



Asset model + Reinvestments 1_07

User Guide

for MS Office 2007 or later

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1 INTRODUCTION

The **Asset model + Reinvestments** application calculates projection of monthly future cash flow, market values, amortized values, modified duration, accounting values and yield indicators for the entered portfolio of financial instruments. Further this application calculates reinvestments from existing business and external cash flows.

This application is a complex program usable for different areas, especially for:

- ALM risk management- projection of cash flows, market values, durations, investment returns, etc., risk limits monitoring, stress / sensitivity testing
- Solvency II calculations - esp. standard formula
- Planning - projection of accounting figures (amortized values, accrued interests, unrealized capital gains/losses, P&L and BS impacts, etc.)
- Investment strategy testing

The application of Asset model + Reinvestments is a small and lightweight application with minimal memory consumption in the form of an add-in to Microsoft Excel.

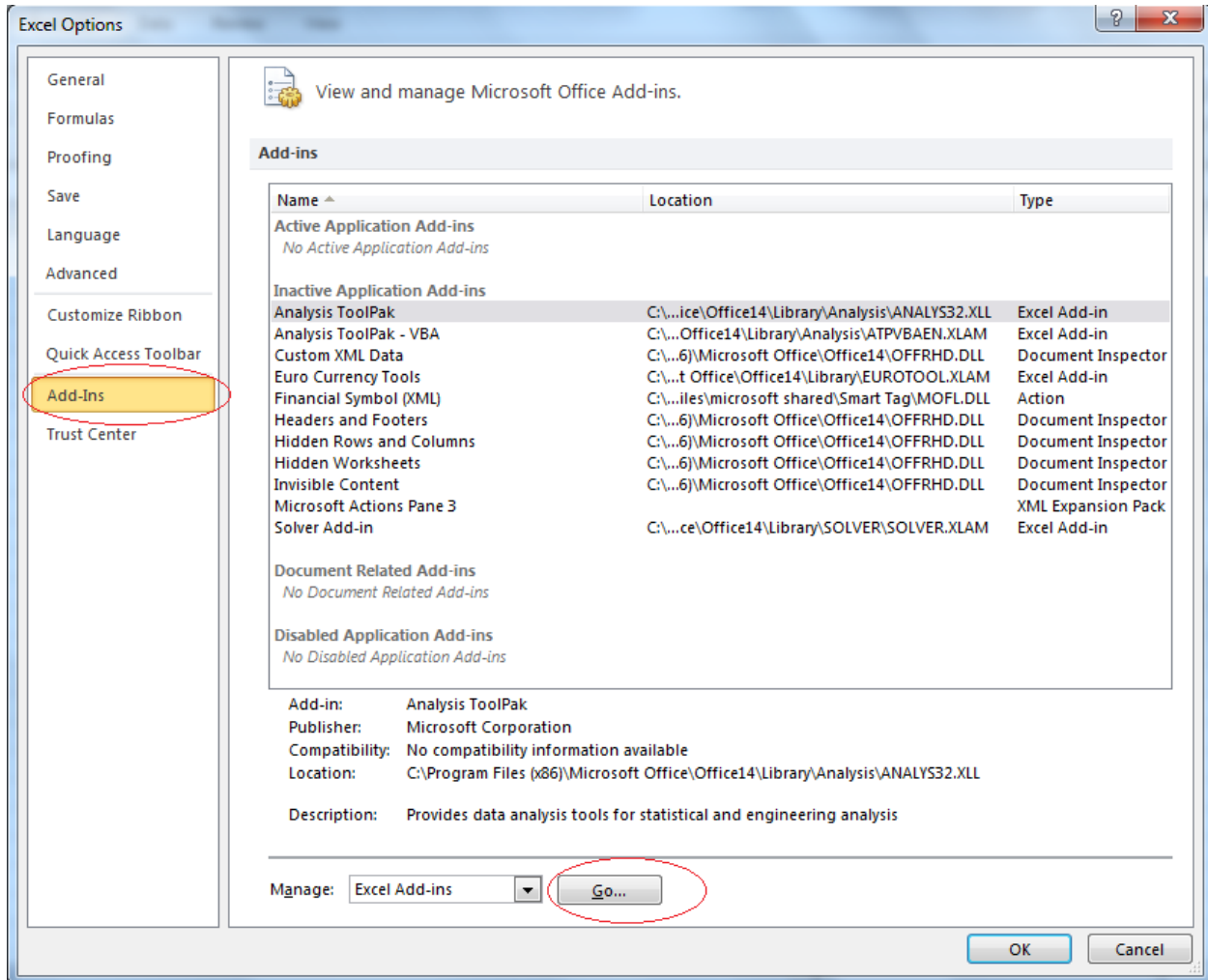
NOTE: Only **Microsoft Excel 2007 or 2010** runs this application successfully.

2 INSTALLATION

To run the application, you need to download the *.xlam file and save it on your disc.

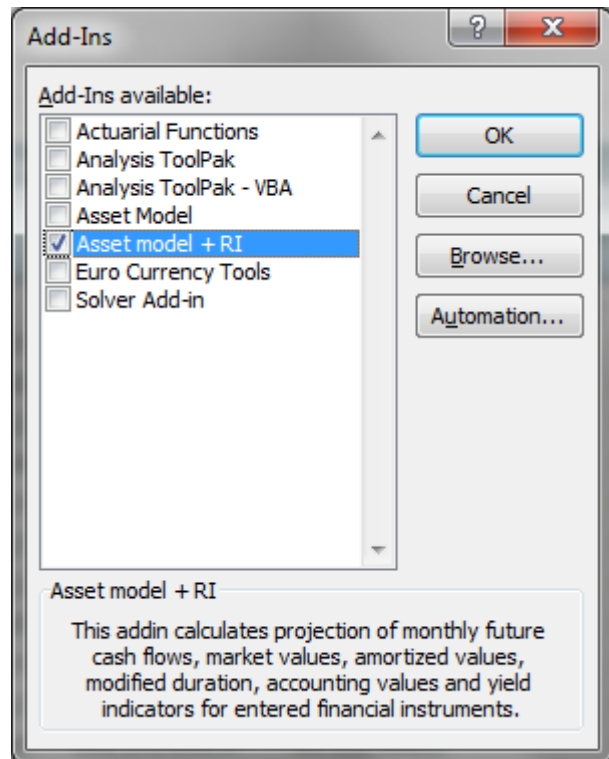
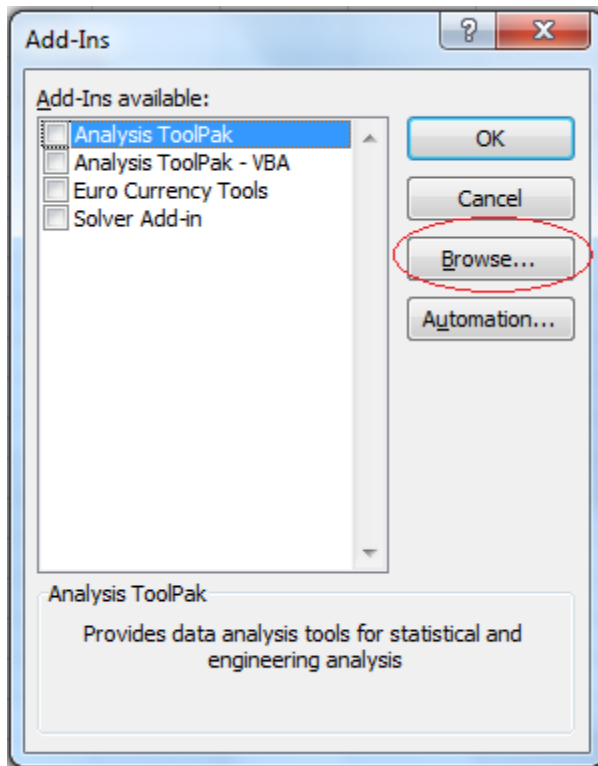
NOTE: *.xlam files do not work without opening through MS Excel. It is necessary to open MS Excel first and through the File → Open find the *.xlam file.

If you want to add Asset model to MS Excel and have these functions available whenever your MS Excel is opened, click on *File -> Option* and choose Add-Ins. Click on the “Go...” button at the bottom of the form shown below.



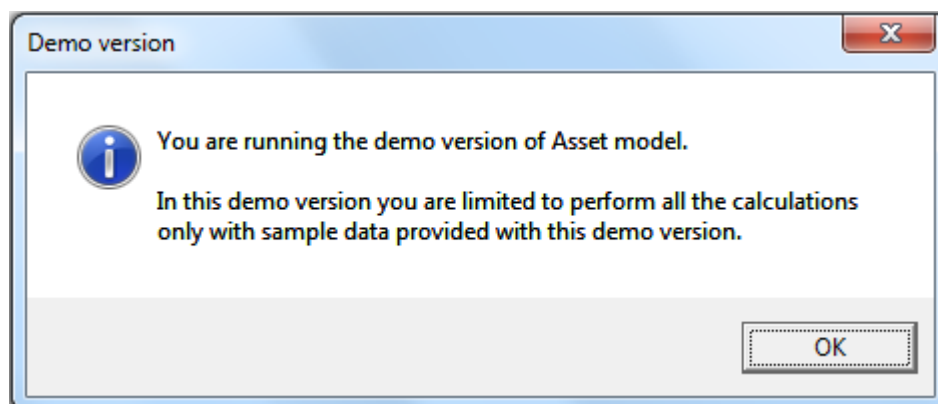
To run the application correctly, click on the “Browse...” button and select the *.xlam file on your disc and click on “OK”. Then the Asset model is available in the list of the Add-Ins. Check the box and click on “OK”.

You only need to take this step once when first opening the application.

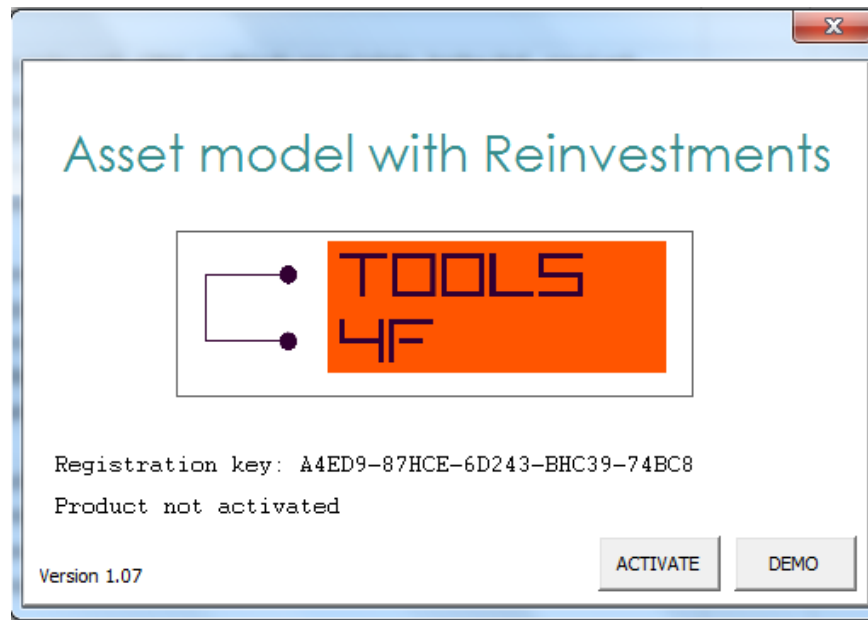


3 DEMO VERSION AND ACTIVATION

After opening the application, you will be informed about the demo version running. Now you can only run the demo version until you insert the valid activation key. In the demo version you can only use the sample data provided within the demo. Click “OK” to continue.

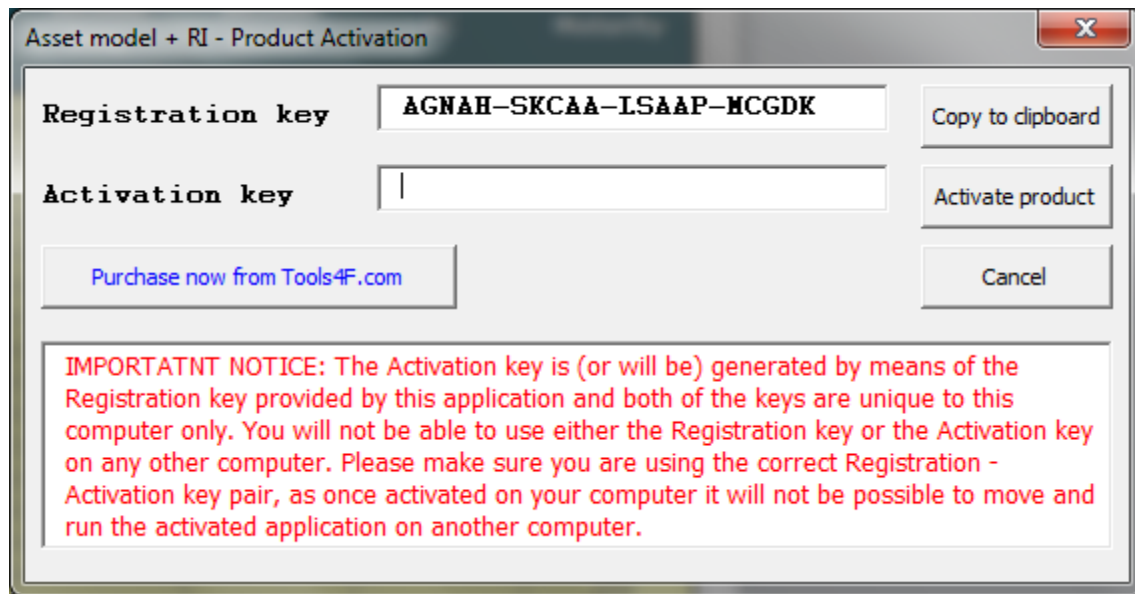


Now only the demo version is active. If you want to run the full version of the application, click on the “Activate” button, otherwise continue in the demo version by clicking on the “Demo” button.



To get the Activation key, go to the www.tools4f.com web site and purchase the application. Once the license is ordered and paid, to your e-mail you will be sent the Activation key. After receiving the Activation key, copy it to the “Activation key” box and you can activate the full version of this application with the “Activate product” button.

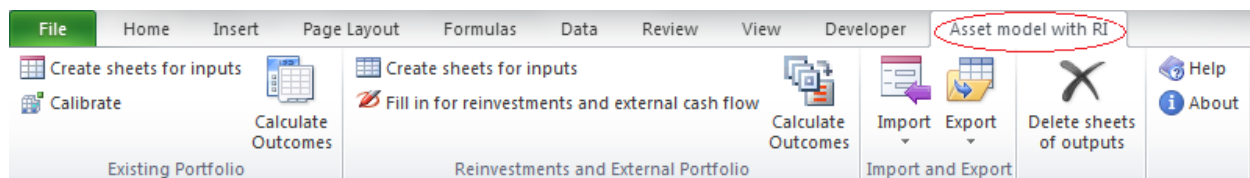
NOTE: The Activation key is generated by means of the Registration key provided by this application and both of the keys are unique to this computer only. You will not be able to use either the Registration key or the Activation key on any other computer. Please make sure you are using the correct Registration - Activation key pair, as once activated on your computer it will not be possible to move and run the activated application on another computer.



From now on, you can use all the functions of the application.

4 USING THE APPLICATION

The Ribbon provides you with the “Asset model with RI” tab that is located after the standard tabs which MS Excel provides. When you click on it, the contextual tabs appear on the Ribbon. It contains tabs for existing portfolio (Create sheets for inputs, Calibrate and Calculate Outcomes. Further it contains tabs for reinvestments and external portfolio (Create sheets for inputs, Fill in reinvestments and external cash flow and Calculate Outcomes). Other tabs are Import some input sheets (from files in txt or csv format) and Export for export of the active sheet to another file (in format xls orxlsx). There are also tabs for Delete sheets of outputs, Help and About (as shown in the picture below).

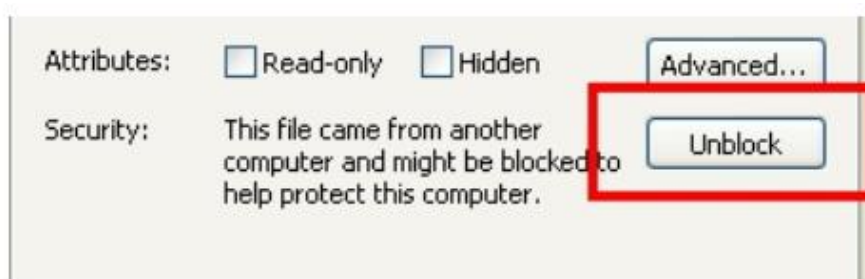


At the beginning, only the *Help*, *About* and *Create sheets for inputs* in Existing Portfolio are available. After clicking on the other contextual tabs, the informative window “Sheets for inputs do not exist!” appears. The Create sheets for inputs allow you to insert a list of financial instruments (current portfolio, yield curves, foreign exchange rates, cash interest, share return and share dividend). These lists are the inputs into the calculation for existing portfolio.

You click on *Create sheets for inputs* in part for Reinvestments and External Portfolio if you want to create sheets for inputs of reinvestments and external portfolio. The mentioned tab inserts three new sheets – *Instruments_Reinvest*, *Reinvestments*, *External_CF*.

4.1 USING THE HELP

Before you start using the Help, you need to unblock the file [help.chm](#). Click on the *.chm file by the right button and choose “Properties”. Click on the “Unblock” button as shown in the figure below. From now on, the Help is fully active.



NOTE: The file *.chm and *.xlam must be saved in the same folder to work with the Help properly.

4.2 INPUT PARAMETERS FOR THE CURRENT PORTFOLIO

The Current_Portfolio sheet is specially designed to fill in the general inputs as easy as possible.

Input data - List of Financial Instruments of Current Portfolio

Valuation Date	30.6.2011	Fill in the last day of month
Basic Currency for the Outcomes	EUR	

LIST OF FINANCIAL INSTRUMENTS - Current portfolio						
1	2	3	4	5	6	7
ID	Name	ISIN	Type of the Instrument	Fix or float for bonds or swaps	Day Count Convention	Face Value (FV)
1	Fix bond GBP	111	Bond	Fix	30E/360	3 400 000
2	Fix bond EUR	112	Bond	Fix	30E/360	4 107 620
3	Float bond USD	113	Bond	Float	30E/360	300 000 000
4	Float bond EUR	114	Bond	Float	30E/360	24 645 718
5	Deposit EUR	115	Deposit		30E/360	1 000 000
6	Savings account EUR	116	Savings account		30E/360	82 152
7	Government T-bills EUR	117	Government T-bills		30E/360	3 000 000
8	Current account USD	118	Current account		30E/360	5 000 000
9	Deposit EUR	119	Deposit		30E/360	246 457
10	Share USD	120	Share		30E/360	10 000 000

Valuation date

The Valuation date means the date to which the values of the Cash Flow should be calculated. It must be the last day of a month. If the date is not filled in, the application automatically fills in the last day of the current month. Also, if the date is not the last day of the month, the program automatically changes it to the last day of the month.

Base currency for the outcomes

This is the currency into which all results are converted. Just before listing of all the results, they are converted into the currency set in the “Base Currency for the Outcomes”. However, during the calculation, all the values are calculated in the currency of the financial instrument set in column 17 (Currency). The values for foreign exchange rates are in the “FXrate” sheet (described below).

List of the allowed currencies of the outcomes:

Currency	State	Currency	State
AUD	Australia	NOK	Norway
CAD	Canada	PLN	Poland
CZK	Czech Republic	RON	Romania
DKK	Denmark	RUB	Russia
EUR	Euro	SEK	Sweden
GBP	Great Britain	TRY	Turkey
HRK	Croatia	USD	U.S.
HUF	Hungary	Other	Other
CHF	Switzerland		

If the currency is not filled in, the program automatically uses Euro as the default currency for outcomes.

List of Financial instruments for the current portfolio

The yellow fields only should be filled in (column 2 – 20). The pink fields (column 21 – 23) are filled in automatically by the running program after clicking on “Calibrate *instruments and calculate spread*” and the white fields (column 24 and 25) are filled in automatically using the Excel formulas.

1. **ID** – is an identification of the financial instrument. The ID is filled in automatically by the application.
2. **Name** – is the name of the financial instrument. It does not need to be filled in.

3. **ISIN** – It does not need to be filled in.
4. **Type of the instrument**-There are these types of financial instruments predefined:
 - a. Bond
 - b. Deposit
 - c. Current account
 - d. Saving account
 - e. Government T-bills
 - f. Share
 - g. IRS Pay leg
 - h. IRS Receive leg

If the Type of the instrument is not filled in, the outputs for the instrument are not calculated.

5. **Fix or float** – It needs to be filled in for bonds and swaps only.
6. **Day count convention** - The type of day count basis to use can be chosen from five types of day count convention:
 - a. 30US/360
 - b. Actual/Actual
 - c. Actual/360
 - d. Actual/365
 - e. 30E/360

If the Day count convention is not filled in, the outputs for the instrument are not calculated.

7. **Face value (Nominal value)** – Face Value = Face Value of 1 piece * number of pieces.
If the Face value is not filled in, the outputs for the instrument are not calculated.
8. **Initial exchange differences** – It has to be filled in only for the instruments which are in the same currency as the outcomes currency.
9. **Income % (p. a.)** – If the Income for Current Account, Savings Account, Government T-Bills, Deposits is not filled in, the value is taken from the Cash Interest sheet. If the Income for Share is not filled in, the value is taken from the Share Dividend sheet. If the Income for other instruments is not set, the outputs for these instruments are not calculated.
10. **Coupon spread % (p. a.) for float** – This column has to be filled in for float instruments only (bonds and swaps).
11. **Income frequency** – It means the number of income payments per year. It attains the values:
 - a. 1 – for annual payments
 - b. 2 – for semi-annual
 - c. 4 – for quarterly

12. **Income month** – This marks the month in which the interest or dividend will be paid. It must be filled in for share and cash (Deposit, Current account, Savings account, Government T-bills)
13. **Maturity** – The maturity date is the date when the security expires. The maturity cannot be filled in for the share and may or may not be filled in for Savings account and Current account. If the Maturity of other instruments is not filled in, the outputs for these instruments are not calculated
14. **Clean market price – on valuation date** - The clean market price is the price of an instrument excluding any interest that has accrued since the issue or the most recent coupon payment. It is in percent of the face value. If clean market price value is not filled in, the outputs for the instrument are not calculated.
15. **Purchased yield to maturity** - Yield to maturity of the security on the purchase date. It must be filled in for Bonds and swaps.
16. **Clean amortized price – on valuation date** - Value of amortized price on the valuation date. It must be filled in for Bonds and swaps.
17. **Currency** – The Currency of the financial instrument can be chosen from these types of currencies: AUD, CAD, CZK, EUR, GBP, HRK, HUF, CHF, NOK, PLN, RON, RUB, SEK, TRY, USD, OTHER. If the Currency is not filled in, the outputs for the instrument are not calculated.
18. **Sector** – It determines the origin of the Instruments. It does not need to be specified.
19. **Portfolio** – Any value can be filled in and it does not need to be specified.
20. **Accounting classification** – There are 6 types of the Accounting classifications predefined:
 - a. FVTPL - Fair Value Through P&L
 - b. AFS - Available for Sale
 - c. HTM - Held to Maturity
 - d. LAR - Loans and Receivables
 - e. HFT – Held for Trading – for IRS
 - f. HEDGE – Hedge Accounting (HA) – for IRSIf the Accounting classification is not filled in, the outputs for the instrument are not calculated!

The values below are filled in automatically by the application.

21. **Type of the spread** – The type of the Spread is calculated for flat or for risk adjustment. It is a method how the spread was calculated.
22. **Spread** – The Spread is calculated for bonds and swaps only, zero is set automatically for the rest of instruments. It is a correction of the yield curve so that the difference

between the calculated market value using this corrected yield curve and the entered market price is less than the entered precision.

23. Clean market price – on valuation date

24. Clean yield to maturity

25. Day count convention index – The value is set according to the value in column 6. It means the Day convention is transformed to that number.

NOTE: **1000** is the maximal number of the Financial instruments.

4.3 INPUT PARAMETERS FOR YIELD CURVE

In the “YC” sheet the application requires information about Yield curve (YC) which is the monthly development of 1Y forward rates.

In the sheet, the application offers 16 types of currency plus one according to your choice. Fill in the table of Yield curves for outcomes currency. Once you click on the currency in the menu at the top of the sheet, you will automatically be directed to the table of the chosen currency.

Input Yield curve

Fill in the Yield Curves for the Currency you need. Fill in the date at which the Yield Curves are valid. All other cells must be empty. You can add up to 20 columns for each sector.

AUD	Australia	NOK	Norway
CAD	Canada	PLN	Poland
CZK	Czech Republic	RON	Romania
DKK	Denmark	RUB	Russia
EUR	Euro	SEK	Sweden
GBP	Great Britain	TRY	Turkey
HRK	Croatia	USD	U.S.
HUF	Hungary	Other	Other
CHF	Switzerland		

Yield curve

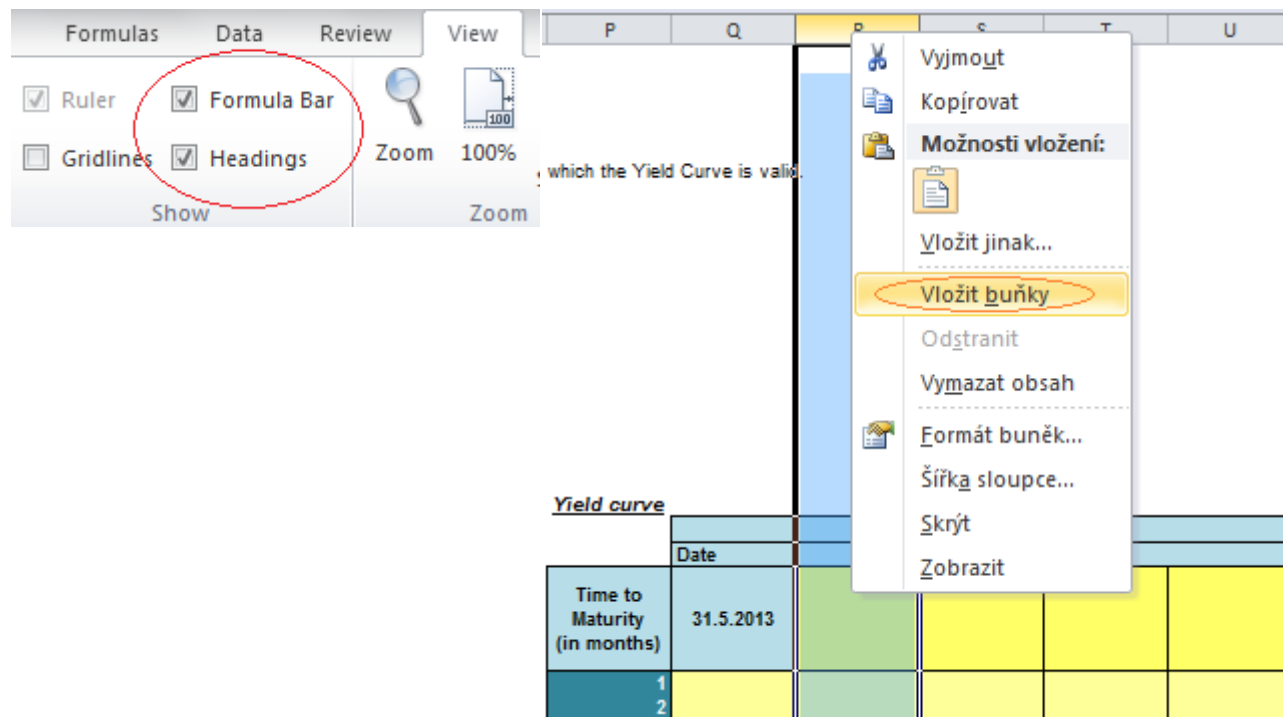
	AUD				
	Date				
Time to Maturity (in months)	31.5.2013				
1					
2					
3					

Yield curve

	Date	
Time to Maturity (in months)	31.5.2013	
1		
2		
3		

Each table has 5 columns in the beginning but it can be expanded up to 20 columns. Once you want to add a column, go to the “View” tab in the Ribbon and check the “Formula Bar” and “Headings” checkboxes. Now select the entire column and choose “Insert”, the new column will

be added. The tables for currencies EUR, GBP, USD and Other are automatically set for 20 columns.



The first yellow cell in the table cannot be changed. It is automatically filled in with the Valuation date from the Current portfolio sheet. The last day of a month must be filled in the other yellow cells. The data about YC have to be valid on the last day of each month.

Yield curve

		EUR									
Date											
Time to Maturity (in months)	31.5.2013	30.6.2014	31.7.2014	31.8.2014	30.9.2014						
1	0,45%	1,37%	1,49%	1,60%	1,70%						
2	0,84%	1,49%	1,60%	1,70%	1,79%						
3	0,81%	1,60%	1,70%	1,79%	1,88%						
4	0,97%	1,70%	1,79%	1,88%	1,96%						
5	1,11%	1,79%	1,88%	1,96%	2,03%						
6	1,25%	1,88%	1,96%	2,03%	2,10%						
7	1,37%	1,96%	2,03%	2,10%	2,17%						

NOTE: You can use our application *Yield curve fitting* to set the parameters in sheet "YC". For more information, see www.tools4f.com.

4.4 INPUT PARAMETERS FOR FOREIGN EXCHANGE RATE

The conversion from different currencies to the base currency (the currency of outcomes specified in the Current Portfolio sheet) is specified in the FX rate sheet.

Monthly development must be filled. In the first row there is a foreign exchange rate valid on the valuation date, in the second row there is a foreign exchange rate valid at the end of the next month, and so on. The application allows you to enter the foreign exchange rate for up to 50 years from the valuation date. The minimum which has to be filled in is till the longest maturity.

Input FX rate									
FX Rate Base currency for the Outcomes: EUR (Currency for the Outcomes from the list "Curr") Fill in all foreign exchange rates in relation to the base currency.									
Date	Currency								
	AUD	CAD	CZK	DKK	EUR	GBP	HRK	HUF	CHF
31.5.2013	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
30.6.2013	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
31.7.2013	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
31.8.2013	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
30.9.2013	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
31.10.2013	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
30.11.2013	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
31.12.2013	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
31.1.2014	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
28.2.2014	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
31.3.2014	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000
30.4.2014	1,000	1,000	0,039	1,000	1,000	1,178	1,000	1,000	1,000

4.5 INPUT PARAMETERS FOR CASH INTEREST

The Cash Interest sheet must be filled in for Current Account, Savings Account, Government T-Bills and Deposit if zero is in column 9 – Income % (p. a.) in the Current Portfolio sheet. It signifies the rate variability and in such a case the values from the Cash Interest sheet are taken as the inputs for the calculation.

The data must also be filled in for the currencies of the instruments mentioned above which are written in column 17 in the Current Portfolio sheet.

Cash Interest

AUD	Australia	NOK	Norway
CAD	Canada	PLN	Poland
CZK	Czech Republ	RON	Romania
DKK	Denmark	RUB	Russia
EUR	Euro	SEK	Sweden
GBP	Great Britain	TRY	Turkey
HRK	Croatia	USD	U.S.
HUF	Hungary	Other	Other
CHF	Switzerland		

AUD		CAD		CZK		DKK		EUR	
Time to Maturity (in months)	Cash Interest %	Time to Maturity (in months)	Cash Interest %	Time to Maturity (in months)	Cash Interest %	Time to Maturity (in months)	Cash Interest %	Time to Maturity (in months)	Cash Interest %
1		1		1		1		1	0,825%
2		2		2		2		2	0,825%
3		3		3		3		3	0,825%
4		4		4		4		4	0,825%
5		5		5		5		5	0,825%
6		6		6		6		6	0,825%
7		7		7		7		7	0,825%
8		8		8		8		8	1,914%

4.6 INPUT PARAMETERS FOR SHARE RETURN

The information about Share Return is written in the Share Return sheet. All the data must be filled in for the currencies of the Shares which are written in column 17 in the Current Portfolio sheet.

Share Return

AUD	Australia	NOK	Norway
CAD	Canada	PLN	Poland
CZK	Czech Republ	RON	Romania
DKK	Denmark	RUB	Russia
EUR	Euro	SEK	Sweden
GBP	Great Britain	TRY	Turkey
HRK	Croatia	USD	U.S.
HUF	Hungary	Other	Other
CHF	Switzerland		

AUD		CAD		CZK		DKK		EUR	
Time to Maturity (in months)	Share Return %	Time to Maturity (in months)	Share Return %	Time to Maturity (in months)	Share Return %	Time to Maturity (in months)	Share Return %	Time to Maturity (in months)	Share Return %
1		1		1		1		1	0,110%
2		2		2		2		2	0,110%
3		3		3		3		3	0,110%
4		4		4		4		4	0,110%
5		5		5		5		5	0,110%
6		6		6		6		6	0,110%

4.7 INPUT PARAMETERS FOR SHARE DIVIDEND

If there is zero in column 9 – Income % (p. a.) for the Share in the Current Portfolio sheet, the values from the Share Dividend sheet are taken as the inputs for the calculation.

The data must be filled in for the currencies of the Shares which are written in column 17 in the Current Portfolio sheet.

Share Dividend

<u>AUD</u>	Australia	<u>NOK</u>	Norway
<u>CAD</u>	Canada	<u>PLN</u>	Poland
<u>CZK</u>	Czech Republ	<u>RON</u>	Romania
<u>DKK</u>	Denmark	<u>RUB</u>	Russia
<u>EUR</u>	Euro	<u>SEK</u>	Sweden
<u>GBP</u>	Great Britain	<u>TRY</u>	Turkey
<u>HRK</u>	Croatia	<u>USD</u>	U.S.
<u>HUF</u>	Hungary	<u>Other</u>	Other
<u>CHF</u>	Switzerland		

AUD		CAD		CZK		DKK		EUR	
Time to Maturity (in months)	Share Dividend %	Time to Maturity (in months)	Share Dividend %	Time to Maturity (in months)	Share Dividend %	Time to Maturity (in months)	Share Dividend %	Time to Maturity (in months)	Share Dividend %
1		1		1		1		1	1,100%
2		2		2		2		2	1,100%
3		3		3		3		3	1,100%
4		4		4		4		4	1,100%
5		5		5		5		5	1,100%
6		6		6		6		6	1,100%

4.8 INPUT PARAMETERS FOR INSTRUMENTS REINVESTMENTS

The “Instruments_Reinvest” sheet is specially designed to fill in the general inputs as easy as possible. This sheet contains the financial instruments (for the purpose of the reinvestments only fix bonds) into which the cash-flows from the existing business and external cash-flow are reinvested.

Input data - List of Bonds for Reinvestments (at valuation date)

Financial instruments behave like fix bonds.

LIST OF FINANCIAL INSTRUMENTS FOR REINVESTMENTS						Grouping parameters			
1	2	3	4	5	6	7	8	10	11
ID	Name	Day Count Convention	Income freq.	Maturity	Currency	Portfolio	Accounting Classification (FVTPL, AFS, HTM, LAR)	Clean Market Price - At Valuation Date <i>don't fill</i>	Day Count Convention index <i>don't fill</i>
1	Test	30E/360	1	1M	CZK	A	AFS	100,00%	4
2	Test	30E/360	1	3M	CZK	B	AFS	100,00%	4
3	Test	30E/360	4	6M	CZK	C	AFS	100,00%	4
4	Test	30E/360	1	1Y	CZK	D	HTM	100,00%	4
5	Test	30E/360	1	3Y	CZK	E	AFS	100,00%	4
6	Test	30E/360	1	5Y	CZK	F	FVTPL	100,00%	4
7	Test	30E/360	2	7Y	CZK	G	AFS	100,00%	4
8	Test	30E/360	2	10Y	CZK	H	FVTPL	100,00%	4
9	Test	30E/360	1	12Y	CZK	I	HTM	100,00%	4
10	Test	30E/360	1	15Y	CZK	J	AFS	100,00%	4
11	Test	30E/360	4	20Y	CZK	K	AFS	100,00%	4
12	Test	30E/360	4	25Y	CZK	L	HTM	100,00%	4
13	Test	30E/360	1	30Y	CZK	M	AFS	100,00%	4

Input parameters in the “Instruments_Reinvest” sheet have the same function as in the “Current_Portfolio” sheet. It is necessary to choose or fill in day count convention, income frequency, maturity, currency, portfolio and accounting classification. Maturity column can contain these values: 3M, 6M, 1Y, 2Y, 3Y, 4Y, 5Y, 6Y, 7Y, 8Y, 9Y, 10Y, 12Y, 15Y, 20Y, 25Y and 30Y.

4.9 INPUT PARAMETERS FOR REINVESTMENTS

In the “Reinvestments” sheet the application requires information about financial instruments.

Firstly, you have to fill in month, year and one of the portfolio and accounting classification or both of these. Option of grouping depends on the choice of portfolio and/or accounting classification.

Secondly, in the header of the table in this sheet is ID of instrument for reinvestment and you have to fill in how many percentages will be reinvested into the particular instrument from “Instruments_Reinvest” sheet. The example on the picture below shows that the financial instruments from the “Current_Portfolio” sheet which the portfolio “B” and the accounting classification “HTM” have and their cash-flows fall into July, 2011 will be reinvested into the instrument ID 2 and ID 3 from “Instruments_Reinvest” sheet. Into each instrument will be reinvested 50 % all cash-flows.

Thirdly, you have to fill in how many cycles (after which cash-flows from reinvestments will be reinvested) you want. If you fill in 0 then the application counts only reinvestments from existing business. If you fill in 1 then the application counts reinvestments from first reinvestments including reinvestments from existing business and so on.

With increasing number of cycles, time demand is increased.

Input Data - Reinvestments for Cash Flow generated by Current Portfolio

For each **type of the instrument, portfolio and accounting classification** of current portfolio and each **month and year**.

Select **ID of the instrument for reinvestment** (from the list "Instruments_Reinvest") and add some percent for selected ID of instrument which you need.

The cash flow will be reinvested at the end of the month to the instrument no. ID

Number of cycles after which cash flows from reinvestments will be reinvested (0 - 600 cycles (integer))

2

ID	Month	Year	Portfolio	Accounting Classification (FVTPL, AFS, HTM, LAR)	ID of instrument for reinvestment				ID of instrument for reinvestment			
					1	2	3	4	5	6	7	8
1	6	2011	B	HTM	100,00%							
2	7	2011	B	HTM		50,00%	50,00%					
3	8	2011	B	HTM			60,00%	40,00%				
4	9	2011	B	HTM				70,00%	30,00%			
5	10	2011	B	HTM					50,00%	50,00%		
6	11	2011	B	HTM				30,00%	70,00%			
7	12	2011	B	HTM				40,00%				
8	1	2012	B	HTM		50,00%	50,00%					
9	2	2012	B	HTM	100,00%							
10	3	2012	B	HTM		50,00%	50,00%					
11	4	2012	B	HTM			60,00%	40,00%				
12	5	2012	B	HTM				70,00%	30,00%			
13	6	2012	B	HTM					50,00%	50,00%		

4.10 INPUT PARAMETERS FOR EXTERNAL CASH-FLOW

In the "External_CF" sheet the application requires information about external cash-flows if you want to calculate reinvestments with external cash-flow. If yes, it is necessary to fill in month, year, cash-flow, one of the portfolio and the accounting classification or both of these. The option of grouping depends on the choice of portfolio and/or accounting classification.

ID of instrument will be selected according to portfolio, accounting classification, month and year from "Reinvestments" sheet.

Input data - Current and Future External Cash Flow

For each **portfolio and accounting classification** and for **month and year** fill **cash flow**.

ID of instrument will be selected according to portfolio, accounting classification, month and year from list "Reinvestments".

The cash flow will be invested at the end of the month to the instrument no. ID

1	2	3	4	5	6	7
ID	Month	Year	Name	Portfolio	Accounting Classification (FVTPL, AFS, HTM, LAR)	Cash Flow in base currency
1	6	2011		B	HTM	1 000 000
2	7	2011		B	HTM	2 000 000
3	8	2011		B	HTM	3 000 000
4	9	2011		B	HTM	4 000 000
5	10	2011		B	HTM	5 000 000
6	11	2011		B	HTM	6 000 000
7	12	2011		B	HTM	7 000 000
8	1	2012		B	HTM	8 000 000
9	2	2012		B	HTM	7 000 000
10	3	2012		B	HTM	6 000 000
11	4	2012		B	HTM	5 000 000

5 IMPORT

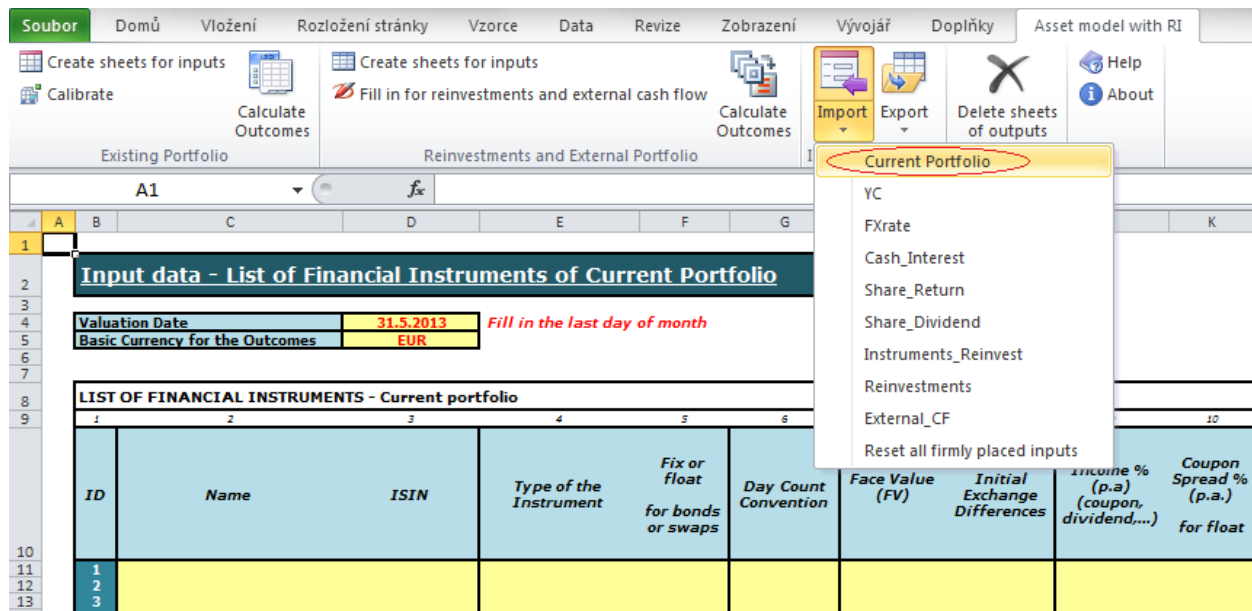
To fill in the data tables you can import the data from a text file (*.csv or *.txt) or fill in the data table directly in MS Excel. If you choose to import the data from a file, firstly, the file browser is opened to let you choose the file. (In this case, the file has to have a structure with the **semicolon** as a separator. Secondly, you are asked to specify the number of the row where the actual data starts. This ensures that only the data are imported, without any header or other information.

5.1 THE CURRENT PORTFOLIO SHEET

You have to respect the pre-specified structure of columns. The complete data table would be comprised of these categories: *Name, ISIN, Type of the Instrument, Fix or Float, Day Count Convention, Face Value, Initial Exchange Differences, Income, Coupon Spread, Income frequency, Income month, Maturity, Clean Market Price, Purchased Yield to Maturity, Clean Amortized Price, Currency, Sector, Portfolio, Accounting Classification:*

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	NAME	ISIN	TYPE	FIX_FLOAT	CONV	FV	EXCHDIFF	INCOME	COUP_SPR	FREQ	INC_MONTH	MATURITY	CMV	YTM_PP	CAP	CURRENCY	SECTOR	PORT	AC
2	Fix bond EUR	111	Bond	Fix	30E/360	16 384 000	0	3,00%		1		2.5.2017	101,76%	2,46%	102,00%	EUR	Govern	A	HTM
3	Fix bond EUR	112	Bond	Fix	30E/360	2 048 000	0	3,00%		1		2.5.2017	101,76%	2,46%	102,00%	EUR	Govern	B	AFS
4	Float bond EUR	113	Bond	Float	30E/360	1 024 000	0	2,50%	3,00%	2		26.9.2016	112,72%	3,46%	97,00%	EUR	Govern	C	FVTPL
5	Deposit EUR	115	Deposit		30E/360	512 000	0	1,70%		1	12	12.1.2015	100,00%			EUR	Govern	D	LAR
6	Savings account EUR	116	Savings account		30E/360	64 000	0	2,30%		1	8	16.2.2017	100,00%			EUR	Govern	E	LAR
7	Government T-bills EUR	117	Government T-bills		30E/360	400 000	0	1,50%		2	2	1.3.2020	100,00%			USD	Govern	F	LAR
8	Current account USD	118	Current account		Act/Act	256 000	-59 000	0,00%		1	11	26.5.2014	100,00%			USD	Govern	G	LAR
9	Deposit EUR	119	Deposit		30E/360	128 000	0	0,00%		2	4	21.6.2013	100,00%			EUR	Govern	H	LAR
10	Share USD	120	Share		30E/360	32 768 000	28 000	1,00%		1	4		100,00%			USD	Govern	I	FVTPL
11	Share EUR	121	Share		Act/365	8 192 000	0	0,00%		4	3		100,00%			EUR	Govern	J	AFS

To import of the data, click on the “Current Portfolio” tab in “Import” tab.



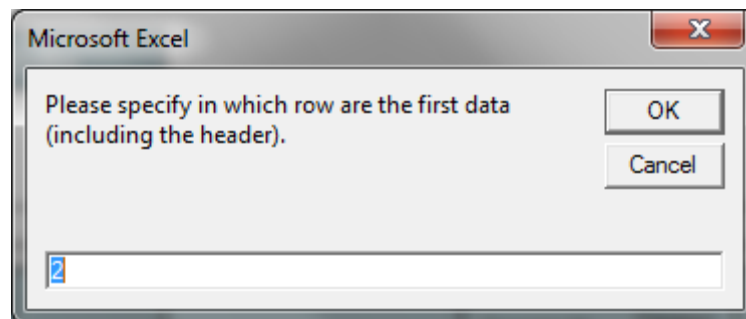
Input data - List of Financial Instruments of Current Portfolio

Valuation Date: 31.5.2013 *Fill in the last day of month*

Basic Currency for the Outcomes: EUR

ID	Name	ISIN	Type of the Instrument	Fix or float for bonds or swaps	Day Count Convention	Face Value (FV)	Initial Exchange Differences	Income % (p.a.) (coupon, dividend,...)	Coupon Spread % (p.a.) for float
1									
2									
3									

You specify the number of the row where the actual data starts.

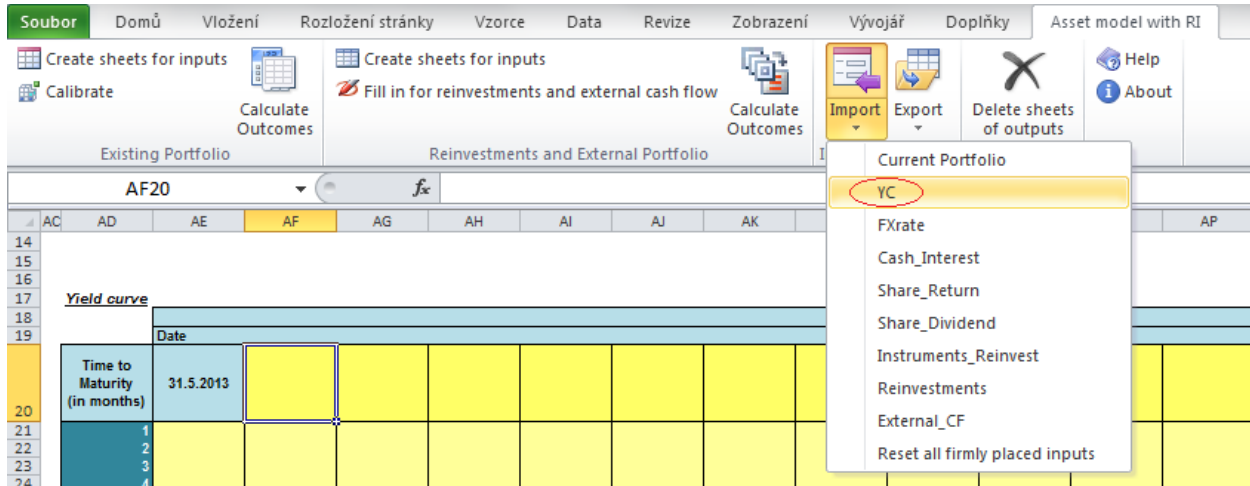


5.2 YIELD CURVE SHEET

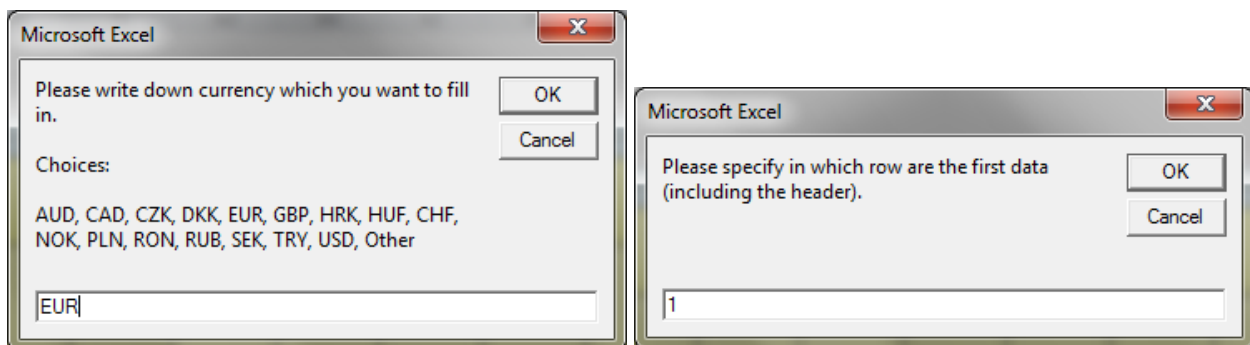
You have to respect the pre-specified structure of columns. The complete data table would be comprised of these categories: *Particular dates*. Date in the first column is the same as the valuation date on the “*Current_Portfolio*” sheet. You can use structure with header (e.g. EUR in first row) or you can use structure without header, it means the first row contains particular dates.

	A	B	C	D	E		A	B	C	D	E
1	31.5.2013	30.6.2013	31.7.2013	31.8.2013	30.9.2013	1	EUR				
2	0,004529	0,006384	0,008097	0,009678	0,011139	2	31.5.2013	30.6.2013	31.7.2013	31.8.2013	30.9.2013
3	0,006384	0,008097	0,009678	0,011139	0,01249	3	0,004529	0,006384	0,008097	0,009678	0,011139
4	0,008097	0,009678	0,011139	0,01249	0,01374	4	0,006384	0,008097	0,009678	0,011139	0,01249
5	0,009678	0,011139	0,01249	0,01374	0,014898	5	0,008097	0,009678	0,011139	0,01249	0,01374
6	0,011139	0,01249	0,01374	0,014898	0,015972	6	0,009678	0,011139	0,01249	0,01374	0,014898
7	0,01249	0,01374	0,014898	0,015972	0,016858	7	0,011139	0,01249	0,01374	0,014898	0,015972

To import of the data, click on the “YC” tab in “Import” tab.



You have to specify the name of the currency which you want to fill in and you specify the number of the row where the actual data starts.



5.3 FOREIGN EXCHANGE RATE SHEET

You have to respect the pre-specified structure of columns. The complete data table would be comprised of these categories: *AUD, CAD, CZK, DKK, EUR, GBP, HRK, HUF, CHF, NOK, PLN, RON, RUB, SEK, TRY, USD, Other:*

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	AUD	CAD	CZK	DKK	EUR	GBP	HRK	HUF	CHF	NOK	PLN	RON	RUB	SEK	TRY	USD	Other
2	1	1	0,039	1	1	1,178	1	1	1	1	1	1	1	1	1	0,753	1
3	1	1	0,039	1	1	1,178	1	1	1	1	1	1	1	1	1	0,753	1
4	1	1	0,039	1	1	1,178	1	1	1	1	1	1	1	1	1	0,753	1
5	1	1	0,039	1	1	1,178	1	1	1	1	1	1	1	1	1	0,753	1
6	1	1	0,039	1	1	1,178	1	1	1	1	1	1	1	1	1	0,753	1

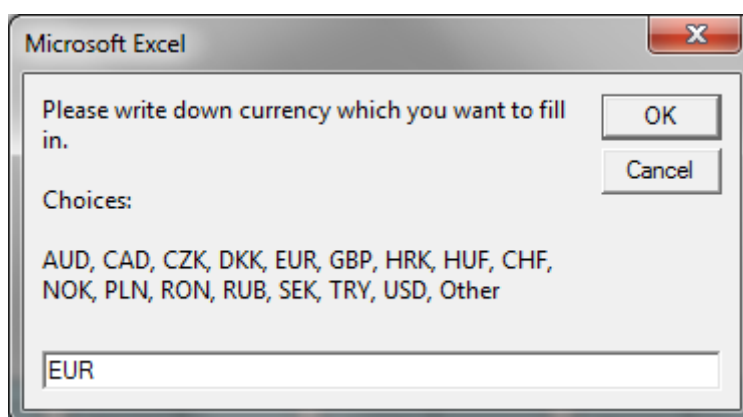
The import of the data is the same as the import of the Current Portfolio sheet.

5.4 CASH INTEREST, SHARE RETURN AND SHARE DIVIDEND SHEETS

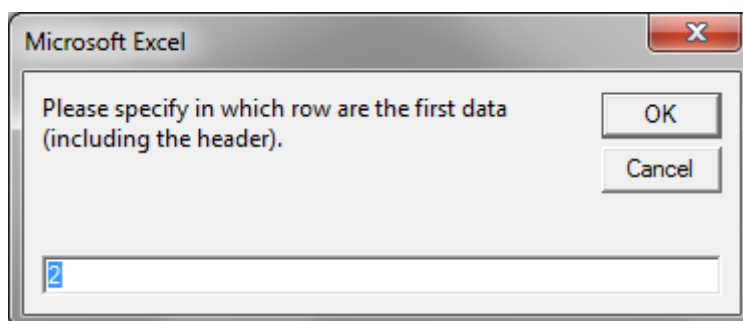
You have to respect the following pre-specified structure of column. The same structure is for Cash Interest, Share Return and Share Dividend sheet.

	A
1	EUR
2	0,83%
3	0,83%
4	0,83%
5	0,83%
6	0,83%

The import of the data is the same as the import of the previous sheets. You have to specify the name of the currency which you want to fill in.



And you specify the number of the row where the actual data starts.



5.5 INSTRUMENTS REINVESTMENTS SHEET

You have to respect the pre-specified structure of columns. The complete data table would be comprised of these categories: *Name, Day Count Convention, Income frequency, Maturity, Currency, Portfolio, Accounting Classification*:

	A	B	C	D	E	F	G
1	NAME	CONV	FREQ	MATURITY	CURRENCY	PORT	AC
2	Test	30E/360	1	1M	EUR	A	AFS
3	Test	30E/360	1	3M	EUR	B	AFS
4	Test	30E/360	4	6M	EUR	C	AFS
5	Test	30E/360	1	1Y	EUR	D	HTM

To import of the data, click on the “*Instruments_Reinvest*” tab in “*Import*” tab.

The screenshot shows the Excel interface with the 'Import' tab selected. The 'Instruments_Reinvest' option is highlighted in the dropdown menu. The main worksheet displays the 'LIST OF FINANCIAL INSTRUMENTS FOR REINVESTMENTS' table.

ID	Name	Day Count Convention	Income freq.	Maturity	Currency	Portfolio	Accounting Classification	Weight	Index
1	Test	30E/360	1	1M	EUR	A	AFS	100,00%	4
2	Test	30E/360	1	3M	EUR	B	AFS	100,00%	4
3	Test	30E/360	4	6M	EUR	C	AFS	100,00%	4

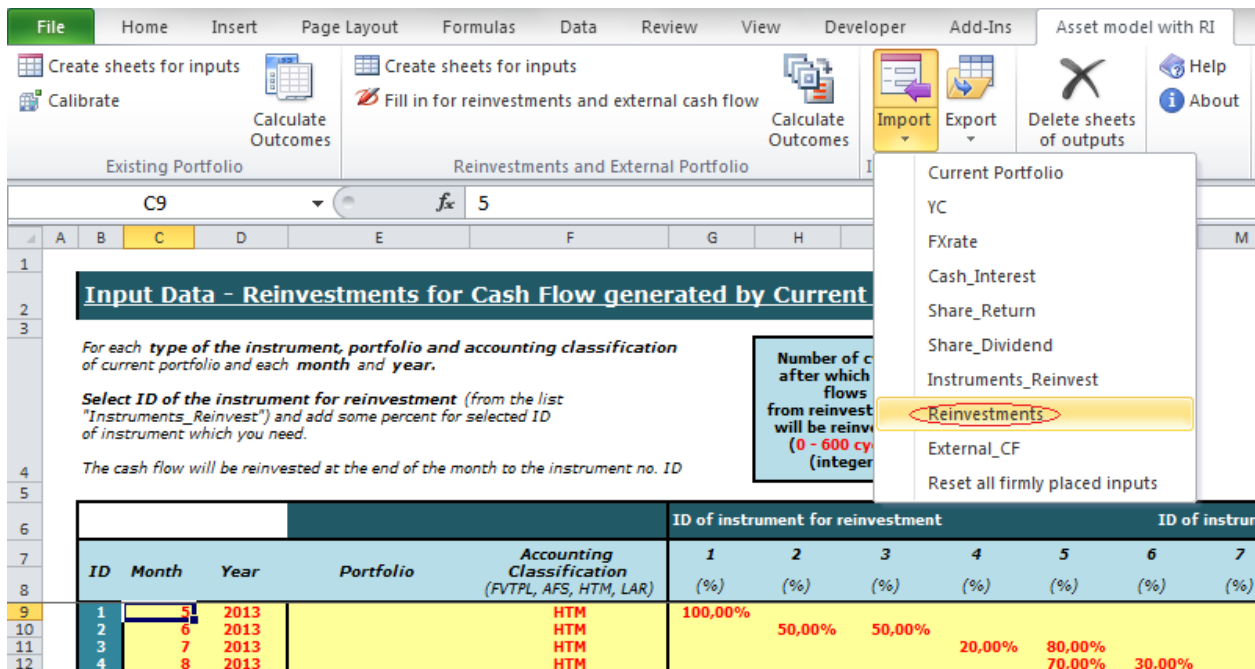
You specify the number of the row where the actual data starts.

5.6 REINVESTMENTS SHEET

You have to respect the pre-specified structure of columns. The complete data table would be comprised of these categories: *Month, Year, Portfolio, Accounting Classification, ID 1, ID 2... and other IDs*:

	A	B	C	D	E	F	G	H	I	J	K
1	MONTH	YEAR	PORT	AC	ID_1	ID_2	ID_3	ID_4	ID_5	ID_6	ID_7
2	5	2013		HTM	100,00%						
3	6	2013		HTM		50,00%	50,00%				
4	7	2013		HTM				20,00%	80,00%		
5	8	2013		HTM					70,00%	30,00%	

To import of the data, click on the “Reinvestments” tab in “Import” tab.



Input Data - Reinvestments for Cash Flow generated by Current

For each **type of the instrument, portfolio and accounting classification** of current portfolio and each **month and year**.

Select **ID of the instrument for reinvestment** (from the list "Instruments_Reinvest") and add some percent for selected ID of instrument which you need.

The cash flow will be reinvested at the end of the month to the instrument no. ID

Number of cycles after which flows from reinvest will be reinvested (0 - 600 cycles) (integer)

ID	Month	Year	Portfolio	Accounting Classification (FVTPL, AFS, HTM, LAR)	ID of instrument for reinvestment							
					1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	
1	5	2013		HTM	100,00%							
2	6	2013		HTM		50,00%	50,00%					
3	7	2013		HTM				20,00%	80,00%			
4	8	2013		HTM					70,00%	30,00%		

You specify the number of the row where the actual data starts.

5.7 EXTERNAL CASH-FLOW SHEET

You have to respect the pre-specified structure of columns. The complete data table would be comprised of these categories: *Month, Year, Name, Portfolio, Accounting Classification, Cash Flow*.

	A	B	C	D	E	F
1	MONTH	YEAR	NAME	PORT	AC	EXT_CF
2	5	2013	Example 1		HTM	1 000 000
3	6	2013	Example 2		HTM	-500 000
4	7	2013			HTM	2 000 000
5	8	2013			HTM	-850 000
6	9	2013			HTM	1 000 000

To import of the data, click on the “External_CF” tab in “Import” tab.

The screenshot shows the Excel ribbon with the 'Import' button highlighted. A dropdown menu is open, showing various options. The 'External_CF' option is circled in red. Below the menu, a table titled 'Input data - Current and Future External Cash Flow' is visible. The table has columns for ID, Month, Year, Name, Portfolio, Accounting Classification, and Cash flow. The data rows show months 5 through 9 for the year 2013, with various accounting classifications and cash flow values.

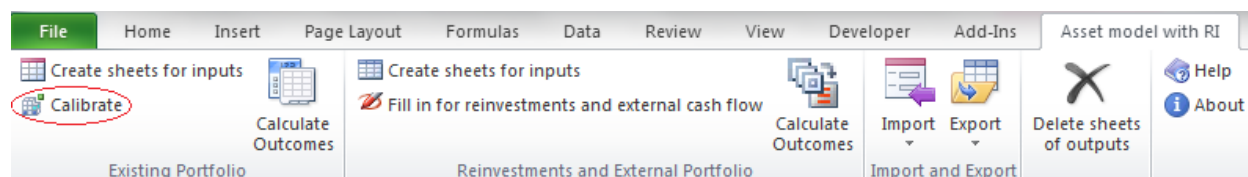
ID	Month	Year	Name	Portfolio	Accounting Classification (FVTPL, AFS, HTM, LAR)	Cash flow in base currency
1	5	2013			FVTPL	5 000
2	6	2013			FVTPL	5 000
3	7	2013			FVTPL	5 000
4	8	2013			FVTPL	5 000
5	9	2013			FVTPL	5 000

You specify the number of the row where the actual data starts.

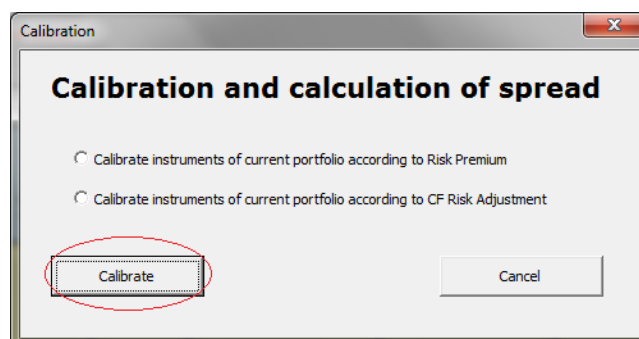
6 CALCULATION ASSET MODEL

6.1 WITHOUT REINVESTMENTS

Before the calculation, you have the option to calibrate the instruments and calculate the spread.



You have two options. First, you can choose “*Calibrate instruments of current portfolio according to Risk Premium*”, it means that yield curves will be shifted up or down and income cash flow will be calculated according to filled in values from Income column in Current Portfolio sheet. Second, you can choose “*Calibrate of current portfolio according to CF Risk Adjustment*” and then yield curves won’t be shifted but income cash flow in outputs will be adjusted by the way that present value of future cash flow is equal filled in clean market value.



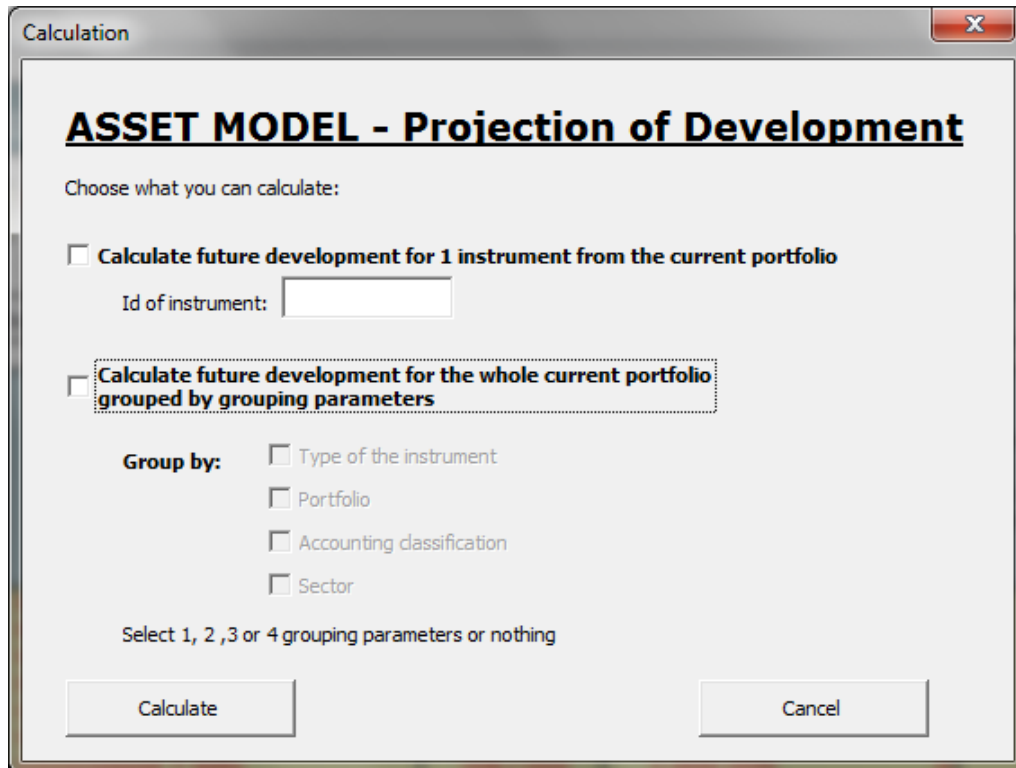
Once the calibration is done, columns 21 – Type of Spread, 22 - Spread and 23 – Clean Market Price – On Valuation Day are filled in automatically.

21	22	23
Type of the Spread	Risk Premium	Clean Market Price - At Valuation Date - calculated
Risk Premium - Flat	0,1975%	101,7581%
Risk Premium - Flat	0,1975%	101,7581%
Risk Premium - Flat	-1,0477%	112,7167%

21	22	23
Type of the Spread	Risk Adjustment	Clean Market Price - At Valuation Date - calculated
CF Risk Adjustment	0,0165%	101,7581%
CF Risk Adjustment	0,0165%	101,7581%
CF Risk Adjustment	-0,0835%	112,7167%

To calculate the Outcomes, click on the “Calculate Outcomes” tab. The application offers two options what to calculate:

1. Calculate future cash flow for 1 instrument from the current portfolio
2. Calculate future cash flow for the whole current portfolio grouped by grouping parameters



Calculation

ASSET MODEL - Projection of Development

Choose what you can calculate:

☐ Calculate future development for 1 instrument from the current portfolio

Id of instrument:

☐ Calculate future development for the whole current portfolio grouped by grouping parameters

Group by:

☐ Type of the instrument

☐ Portfolio

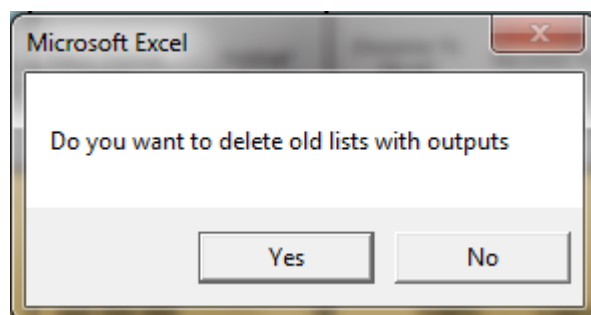
☐ Accounting classification

☐ Sector

Select 1, 2, 3 or 4 grouping parameters or nothing

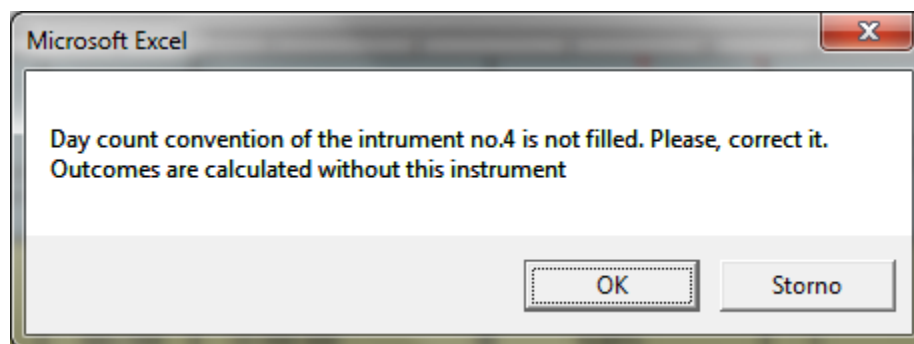
If you want to calculate 1 instrument only, check the checkbox and insert the ID of the instrument and click on the “Calculate” button. The application will ask you if you want to delete old lists with previous outputs. Click on “Yes” or “No” to continue.

In case you want to calculate the whole current portfolio, check the second checkbox and click on the “Calculate” button. Now you have 4 options to group the outcomes. Check the group which you are interested in and click on the “Calculate” button. If you do not check any checkbox, the application will calculate the whole portfolio as one group.

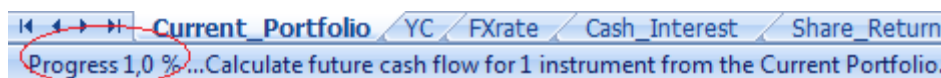


NOTE: You can calculate both variants (one instrument only and the whole portfolio) at the same time. Just check the checkboxes and click on the "Calculate" button.

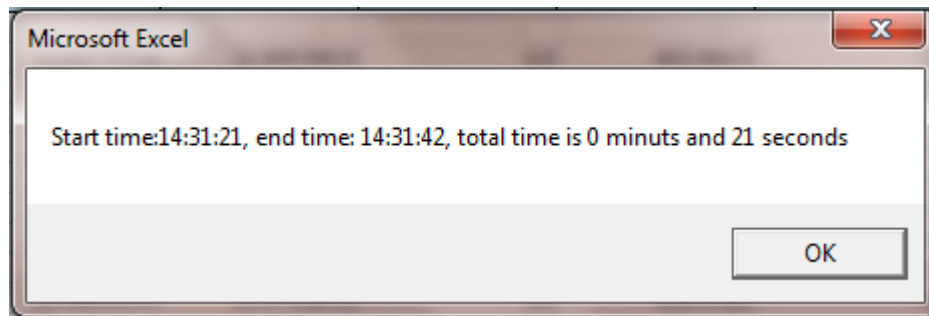
Once entering a wrong value in any cell in the list of instruments, the information window is displayed and you will be informed about the cell which contains the error. In case of a wrong value in the instrument line, the application calculates without this instrument and you will see zeros in the outcome. Click "OK" to continue or click "Storno"/"Cancel" to cancel the calculation and update the information in the list of instruments.



During the calculation, the progress is displayed in the bottom right corner of the screen. Once the calculation is done, the progress bar shows 100 %. The first 3 % usually take longer time to be done, the whole calculation usually takes a few minutes. But please, be aware of the fact that the calculation speed depends on the parameters of your computer.



After the calculation, the application informs you how long the whole process took. The calculation for one instrument takes less time than the calculation for the whole portfolio or for all groups.

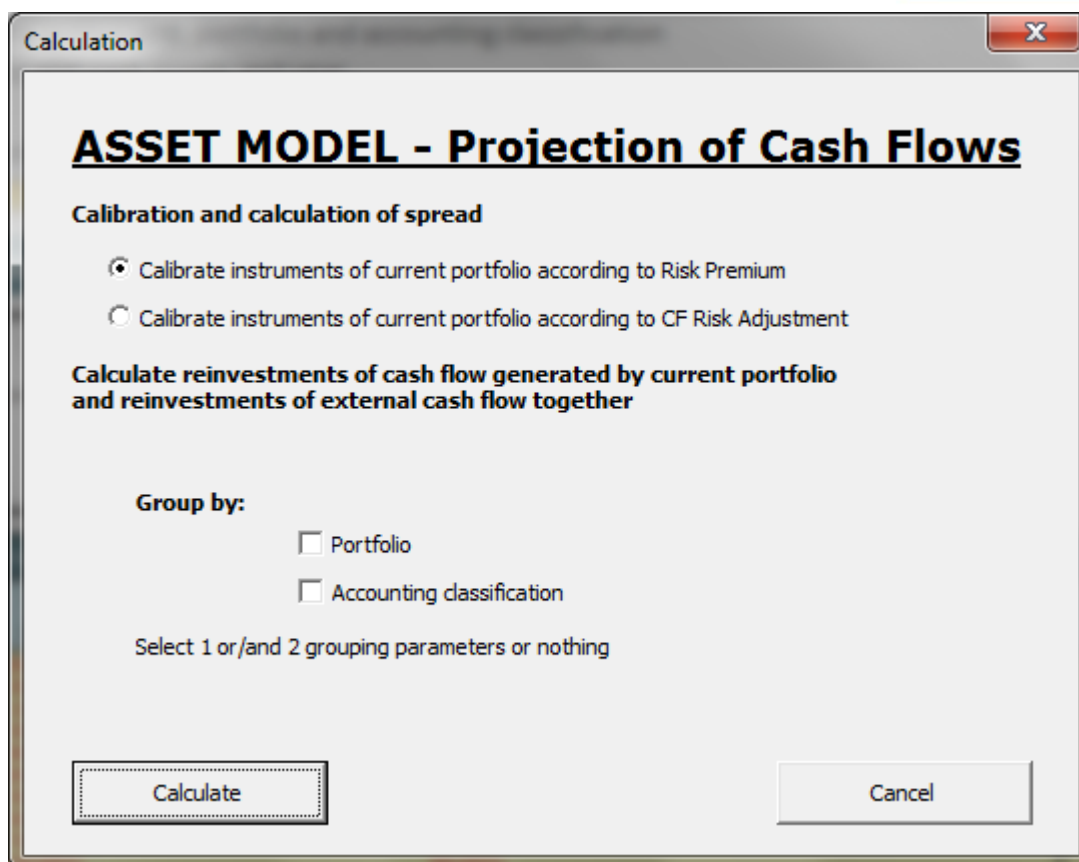


6.2 WITH REINVESTMENTS

To calculate the Outcomes, click on the “Calculate Outcomes” tab. The application offers two options what to calibrate:

1. Calibrate instruments of current portfolio according to Risk Premium
2. Calibrate instruments of current portfolio according to CF Risk Adjustment

Further you can choose group according (not necessary) and click “Calculate”.



7 OUTCOMES

The number of Outcome sheets depends on the setting during the calculation.

Outcomes for one instrument

In case of the calculation just for one instrument, there is only one outcome sheet. The sheet is of the following structure:

1. **At the beginning of the month** – Dirty Market Value, Accrued Interest, Clean Market Value Calculated, Dirty Amortized Price, Clean Amortized Price, FX Differences, Appraisal Differences, Unrealized Capital Gains/Losses Booked, Modified Duration
2. **At the end of the month** – Dirty Market Value, Accrued Interest, Clean Market Value Calculated, Dirty Amortized Price, Clean Amortized Price, FX Differences, Appraisal Differences, Unrealized Capital Gains/Losses Booked, Modified Duration
3. **Cash flow** – Income Cash Flow, Face Value Cash Flow, Realization of FX Differences,
4. **Change** – Change of Dirty Market Value, Change of Accrued Interest, Change of Clean Market Value Calculated, Change of Dirty Amortized Price, Change of Clean Amortized

Price, Change of FX Differences, Change of Appraisal Differences, Change of Unrealized Capital Gains/Losses Booked

5. Other – Interest Income, P&L without FX Differences

Outcomes for the whole portfolio

In case of the calculation for the whole portfolio (none of the checkboxes is checked), there are 3 input sheets.

The sheets “1_Total” and “2_Whole_Portfolio” have the same structure as in the previous case above. These two sheets are identical.

The third sheet “3_Summary” contains cumulative sums. This sheet includes the sums of:

1. Dirty Market Value Calculated
2. Accrued Interest
3. Clean Market Value Calculated
4. Dirty Amortized Price
5. Clean Amortized Price
6. FX Differences
7. Appraisal Differences
8. Unrealized Capital Gains/Losses Booked
9. Modified Duration

Summary at Valuation Date									
Total to 30.6.2011									
Group	Dirty Market Value Calculated	Accrued Interest	Clean Market Value Calculated	Dirty Amortized Price	Clean Amortized Price	FX Differences	Appraisal Differences	Unrealized Capital Gains/Losses Booked	Modified Duration
Whole Portfolio	182 331 400,8	894 979,3	181 436 421,5	165 890 508,5	164 995 529,2	0,0	16 440 892,4	3 828 529,9	3,6
Total	182 331 400,8	894 979,3	181 436 421,5	165 890 508,5	164 995 529,2	0,0	16 440 892,4	3 828 529,9	3,6

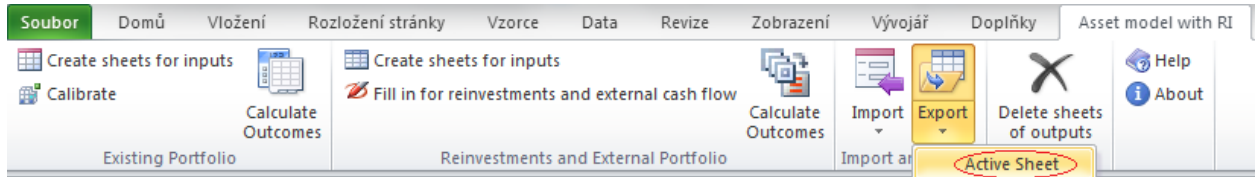
Outcomes for groups

The number of sheets depends on how many groups you want to calculate and how many groups you have in each category (e. g. how many portfolios you have, how many Accounting classifications etc.). The outcome also contains the sheet with the cumulative sums.

Summary at Valuation Date									
Total to 30.6.2011									
Group	Dirty Market Value Calculated	Accrued Interest	Clean Market Value Calculated	Dirty Amortized Price	Clean Amortized Price	FX Differences	Appraisal Differences	Unrealized Capital Gains/Losses Booked	Modified Duration
Whole Portfolio	182 331 400,8	894 979,3	181 436 421,5	165 890 508,5	164 995 529,2	0,0	16 440 892,4	3 828 529,9	3,6
Bond_Govern_B_HTM	420 630,6	2 647,1	417 983,5	421 624,3	418 977,2	0,0	-993,7	0,0	3,5
Bond_Govern_B_FVTPL	21 006 113,3	27 777,8	20 978 335,5	21 627 777,8	21 600 000,0	0,0	-621 664,5	0,0	3,9
Bond_Govern_A_AFS	63 060 583,8	306 386,8	62 754 197,0	58 509 590,7	58 203 203,9	0,0	4 550 993,1	953 196,2	3,6
Bond_Govern_A_HTM	36 924 206,7	168 184,2	36 756 022,5	36 266 239,6	36 098 055,4	0,0	657 967,2	0,0	3,2
Bond_Govern_A_FVTPL	55 945 779,4	386 116,2	55 559 663,2	48 198 808,8	47 812 692,5	0,0	7 746 970,6	0,0	4,0
Deposit_Govern_A_FVTPL	41 425,3	349,1	41 076,2	41 425,3	41 076,2	0,0	0,0	0,0	0,0
Saving account_Govern_A_HTM	83 727,0	1 574,6	82 152,4	83 727,0	82 152,4	0,0	0,0	0,0	0,0
Government T-bills_Govern_C_HTM	123 844,7	616,1	123 228,6	123 844,7	123 228,6	0,0	0,0	0,0	0,0
Deposit_Govern_A_HTM	411 100,8	338,9	410 762,0	411 100,8	410 762,0	0,0	0,0	0,0	0,0
Current account_Govern_A_HTM	206 369,4	988,4	205 381,0	206 369,4	205 381,0	0,0	0,0	0,0	0,0
Share_Govern_A_FVTPL	1 232 285,9	0,0	1 232 285,9	0,0	0,0	0,0	1 232 285,9	0,0	0,0
Share_Govern_A_AFS	2 875 333,7	0,0	2 875 333,7	0,0	0,0	0,0	2 875 333,7	2 875 333,7	0,0

8 EXPORT


The possibility of output export is provided through the “Active Sheet” tab in “Export” tab that you can find next to the “Import” tab.



The screenshot shows the software interface with the 'Export' tab selected. The 'Active Sheet' button is highlighted with a red circle. Below the interface, a table displays the 'Cash Flow of Current Portfolio' data.

At the Begin of the Month								
Date	Dirty Market Value Calculated	Accrued Interest	Clean Market Value Calculated	Dirty Amortized Price	Clean Amortized Price	FX Differences	Unreal Gain	B
5 / 2013	-	-	-	-	-	-	-	-
6 / 2013	16 710 274,2	38 229,3	16 672 044,9	16 749 909,3	16 711 680,0	0,0		
7 / 2013	16 719 303,5	79 189,3	16 640 114,2	16 783 840,4	16 704 651,1	0,0		
8 / 2013	16 730 904,8	120 149,3	16 610 755,5	16 817 840,3	16 697 691,0	0,0		

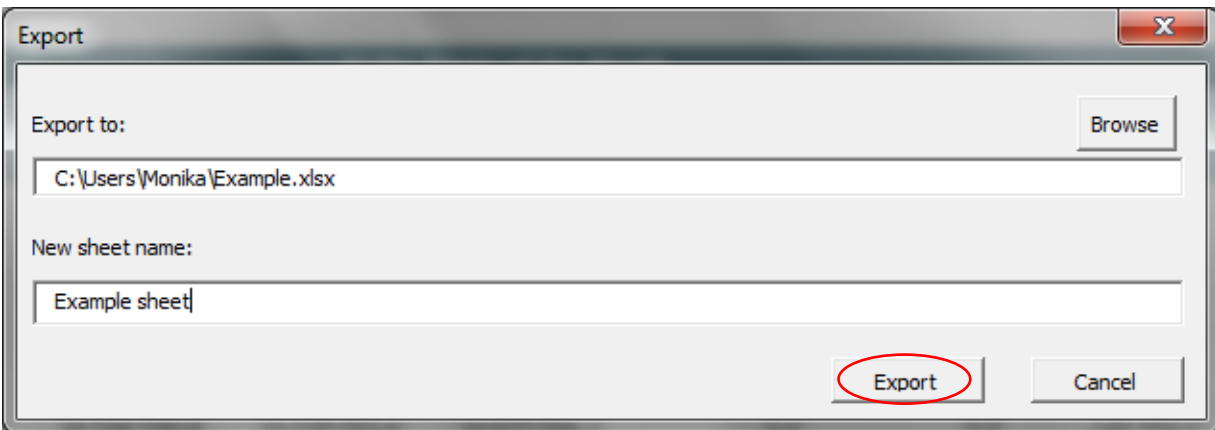
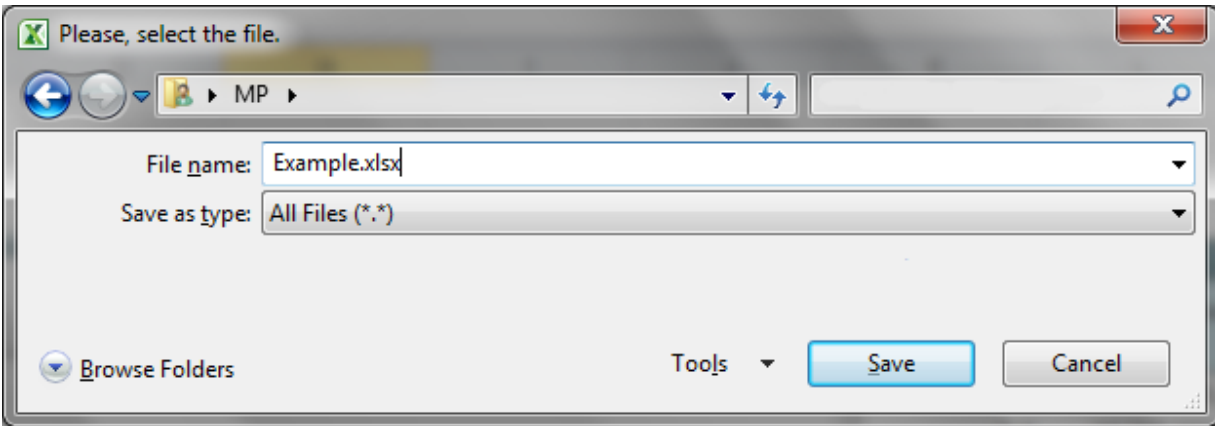
The *output export* setting form is opened after the click on this button. In “New sheet name” field is the name of the active sheet, but it can be overwritten.



The 'Export' dialog box is shown with the following fields and buttons:

- Export to:** A text field with a 'Browse' button next to it.
- New sheet name:** A text field containing the text '6_Whole_Portfolio'.
- Buttons:** 'Export' and 'Cancel' buttons at the bottom right.

Here you can choose the folder, where you want to export the results to format *.xls or *.xlsx. Using the file browser you can either choose the existing file or create a new one.



9 TECHNICAL DOCUMENTATION

Spread

Spread is value of the calculated spread. It is correction of yield curve so that difference between calculated market value using this corrected yield curve and entered market price would be equal. It is filled after running program “Calibrate instruments and calculate spreads”.

Flat spread:

$$YC_t^{modify} = YC_t \pm spread$$

Spread is calculated for bonds and IRS

Spread is not calculated for treasury bills, current account, saving account, deposits and shares.

Clean Yield to Maturity on Valuation Date

The Input is Clean Market Price on Valuation Date from model point (CMP) then YtM is calculated from CMP by the excel formula. The function “YIELD” is used from MS Excel for calculation. YtM in this function is used iteration Newton method for calculation.

Clean Yield to Maturity on Valuation Date is calculated only for instruments with filled in maturity.

Time to maturity (TtM)

The time remaining until a financial contract expires (also called time until expiration). Time to maturity is in years. It depends on day count convention.

30US/360:

$$TtM = \frac{(360 * (Y_{mat} - Y_{val}) + 30 * (M_{mat} - M_{val}) + D_{mat} - D_{val})}{360},$$

where

Y_{mat} is year of maturity date, M_{mat} is month of maturity date, D_{mat} is day of maturity date,
 Y_{val} is year of valuation date, M_{val} is month of valuation date, D_{val} is day of valuation date.

Actual/Actual:

$$TtM = \frac{n_N}{365} + \frac{n_L}{366},$$

where: n_N is number of days between valuation date and maturity in a normal year,
 n_L is number of days between valuation date and maturity in a leap year.

Actual/360:

$$TtM = \frac{n}{360},$$

where: n is number of days between valuation date and maturity.

Actual/365:

$$TtM = \frac{n}{365},$$

where n is number of days between valuation date and maturity.

30E/360:

$$TtM = \frac{(360 * (Y_{mat} - Y_{val}) + 30 * (M_{mat} - M_{val}) + \min(D_{mat}, 30) - \min(D_{val}, 30))}{360},$$

where

Y_{mat} is year of maturity date, M_{mat} is month of maturity date, D_{mat} is day of maturity date,
 Y_{val} is year of valuation date, M_{val} is month of valuation date, D_{val} is day of valuation date.

9.1 FIXED BONDS

Dirty Market Value Calculated (DMV)

The dirty market price of a bond is the present value of all expected future interest and principal payments of the bond discounted at the bond's redemption yield. That relationship defines the redemption yield on the bond, which represents the current market interest rate for bonds plus spread.

$$DMV_t = \sum_{t=1}^n \frac{CF_t}{\prod_{i=1}^t (1 + f_{i,1})^{1/12}}$$

where CF_t is monthly cash flow (coupon + nominal value) in the month t ,
 $f_{t,1}$ is annualized forward rate between term t and $t + 1$,
 n is number of periods,
 t is time.

Accrued Interest (AI)

Accrued Interest is the interest that has accumulated since the principal investment or since the previous interest payment if there has been one already. Accrued income is an income which has been accumulated or accrued irrespective to actual Receipt, which means event occurred but cash not yet received.

The function “ACCRINT” from MS Excel is used for calculation. The formula is:

For coupon rate $C_t > 0$:

$$AI_t = NV \cdot \frac{C}{freq} \cdot \sum_{i=1}^{NC} \frac{A_i}{NL_i}$$

For coupon rate $C_t = 0$:

$$AI_t = 0,$$

where NV is nominal value,
 C is coupon, rate (p.a.),
 $freq$ is frequency,
 A_i is number of accrued days for the i th quasi-coupon period within odd period,
 NC is number of quasi-coupon periods that fit in odd period. If this number contains a fraction, raise it to the next whole number,
 NL_i is normal length in days of the quasi-coupon period within odd period,
 t is time.

Clean Market Value Calculated (CMV)

$$CMV_t = DMV_t - AI_t$$

Dirty Amortized Price (AP)

Present value of future cash flows (coupons and paid the face value) with a purchased Yield to maturity. Purchased YtM is entered in Model Point file.

$$AP_t = AP_t^{clean} + AI_t$$

AP at the end of the month equals to AP at the beginning of the next month.

Clean Amortized Price (AP^{clean})

Amortized price (AP^{clean}) is calculated using function from MS Excel “PRICE”. The formula is:

$$AP_t^{clean} = F * \sum_{t=1}^n \frac{\frac{C_t}{freq}}{\left(1 + \frac{YtMPD}{freq}\right)^{t - \frac{a}{R}}} + \frac{1}{\left(1 + \frac{YtMPD}{freq}\right)^{n - \frac{a}{R}}} - F \cdot \frac{C_t}{freq} \cdot \frac{a}{R}$$

where

C_t is coupon rate (p. a.),
 F is face value,
 YtM_{PD} is annual yield to maturity at purchase date,
 $freq$ is number of coupon payments per year,
 n is number of coupons payable between valuation date and maturity date,
 a is number of days from the beginning of the coupon period to the valuation date,
 R is number of days in coupon period in which the settlement date falls,
 t is time.
 AP^{clean} at the end of the month equals to AP^{clean} at the beginning of the next month.

FX Differences

$$FX\ Differences_t = (FX\ rate_t - FX\ rate_{t-1}) \cdot Face\ Value_t$$

Appraisal Differences

Appraisal differences are calculated as:

$$Appraisal\ differences_t = CMV_t - AP_t^{clean}$$

Unrealized Capital Gains/Losses Booked (UCGL)

Calculation depends on accounting classification:

FVTPL (Fair Value through P&L):	$UCGL_t = 0$
AFS (Available for Sale):	$UCGL_t = Appraisal\ differences_t$
HTM (Held to Maturity):	$UCGL_t = 0$
LAR (Loans and Receivables):	$UCGL_t = 0$
HFT (Held for Trading):	$UCGL_t = 0$
HEDGE (Hedge Accounting (HA)):	$UCGL_t = Appraisal\ differences_t$

Modified Duration (MD)

Modified duration is a formula that expresses the measurable change in the market value of a security in response to a change in interest rates. The definition is:

For coupon rate $C_t > 0$

$$MD_t = -\frac{dDMV}{di} = -\frac{DMV(YC + \Delta i) - DMV(YC - \Delta i)}{DMV(YC)} \cdot \frac{1 + \Delta i}{2\Delta i},$$

where $DMV(YC + \Delta i)$ is dirty market value calculated using yield curve shifted $+\Delta i$,
 $DMV(YC - \Delta i)$ is dirty market value calculated using yield curve shifted $-\Delta i$,
 Δi is equal 0,0001.

For coupon rate $C_t = 0$

$$MD_t = \frac{TtM_t}{1 + \frac{YtM}{freq}}$$

where $freq$ is number of coupon payments per year,
 YtM is the bond's yield to maturity,
 TtM is time to maturity,
 t is time.

Income Cash Flow

Coupon is specified in a model point as an annual rate of investment income. Coupon remains constant throughout the life of the bond.

For zero-coupon bonds the coupon is zero.

Face Value Cash Flow

For each month program calculates value of paid face value during this month. It should be zero for all month except the month when the security expires.

Realization of FX Differences

For each month program calculates value of FX Differences during this month. It should be zero for all month except the month when the security expires.

9.2 FLOATING BONDS

Dirty Market Value Calculated (DMV)

The dirty market price of a bond is the present value of all expected future interest and principal payments of the bond discounted at the bond's redemption yield. That relationship defines the redemption yield on the bond, which represents the current market interest rate for bonds plus spread.

$$DMV_t = \sum_{t=1}^n \frac{CF_t}{\prod_{i=1}^t (1 + f_{i,1})^{1/12}}$$

where CF_t is monthly cash flow (coupon + nominal value) in the month t ,

$f_{t,1}$ is annualized forward rate between term t and $t + 1$,

n is number of periods,

t is time.

Accrued Interest (AI)

Accrued Interest is the interest that has accumulated since the principal investment or since the previous interest payment if there has been one already. Accrued income is an income which has been accumulated or accrued irrespective to actual Receipt, which means event occurred but cash not yet received.

The function "ACCRINT" from MS Excel is used for calculation. The formula is:

For coupon rate $C_t > 0$:

$$AI_t = NV \cdot \frac{C}{freq} \cdot \sum_{i=1}^{NC} \frac{A_i}{NL_i}$$

For coupon rate $C_t = 0$:

$$AI_t = 0,$$

where NV is nominal value,

C is coupon, rate (p.a.),

$freq$ is frequency,
 A_i is number of accrued days for the i th quasi-coupon period within odd period,
 NC is number of quasi-coupon periods that fit in odd period. If this number contains a fraction, raise it to the next whole number,
 NL_i is normal length in days of the i th quasi-coupon period within odd period,
 t is time.

Clean Market Value Calculated (CMV)

$$CMV_t = DMV_t - AI_t$$

Dirty Amortized Price (AP)

Present value of future cash flows (coupons and paid the face value) with a purchased Yield to maturity. Purchased YtM is entered in model point.

$$AP_t = AP_t^{clean} + AI_t$$

AP at the end of the month equals to AP at the beginning of the next month.

Clean Amortized Price (AP^{clean})

Linear amortization of initial amortized value – it is calculated as straight line from initial amortized value to redemption.

AP^{clean} at the end of the month equals to AP^{clean} at the beginning of the next month.

FX Differences

$$FX\ Differences_t = (FX\ rate_t - FX\ rate_{t-1}) \cdot Face\ Value_t$$

Appraisal Differences

Appraisal differences are calculated as:

$$Appraisal\ differences_t = CMV_t - AP_t^{clean}$$

Unrealized Capital Gains/Losses Booked (UCGL)

Calculation depends on accounting classification:

FVTPL (Fair Value Through P&L): $UCGL_t = 0$

AFS (Available for Sale): $UCGL_t = Appraisal\ differences_t$

HTM (Held to Maturity): $UCGL_t = 0$

LAR (Loans and Receivables): $UCGL_t = 0$

HFT (Held for Trading): $UCGL_t = 0$

HEDGE (Hedge Accounting (HA)): $UCGL_t = Appraisal\ differences_t$

Modified Duration (MD)

Modified duration is a formula that expresses the measurable change in the market value of a security in response to a change in interest rates. The definition is:

For coupon rate $C_t > 0$

$$MD_t = -\frac{dDMV}{di} = -\frac{DMV(YC + \Delta i) - DMV(YC - \Delta i)}{DMV(YC)} \cdot \frac{1 + \Delta i}{2 \cdot \Delta i},$$

where $DMV(YC + \Delta i)$ is dirty market value calculated using yield curve shifted $+\Delta i$,

$DMV(YC - \Delta i)$ is dirty market value calculated using yield curve shifted $-\Delta i$,

Δi is equal 0,0001.

For coupon rate $C_t = 0$

$$MD_t = \frac{TtM_t}{1 + \frac{YtM}{freq}}$$

Where $freq$ is number of coupon payments per year,

YtM is the bond's yield to maturity,

TtM is time to maturity,

t is time.

Income Cash Flow

First coupon is specified in a Model Point as an annual rate of investment income.

Amount of the coupon is taken from the forward curve valid at the start date. If coupon frequency is less than 1 year, then the amount is equal to

$$CF_t = \left(\prod_{i=1}^k (1 + f_{i,1}) \right)^{freq/12} - 1 + \text{Coupon spread},$$

where $k = 12/freq$,

Coupon spread is in model point, only float,

$f_{t,1}$ is annualized forward rate between term t and $t+1$,

$freq$ is frequency,

t is time.

Coupons are calculate at the start of the projection before calculation of spread and are the same for all projected months.

Face Value Cash Flow

For each month program calculates value of paid face value during this month. It should be zero for all month except the month when the security expires.

Realization of FX Differences

For each month program calculates value of FX Differences during this month. It should be zero for all month except the month when the security expires.

9.3 CASH (TREASURY BILLS, CURRENT ACCOUNT, SAVING ACCOUNT, DEPOSIT)

Dirty Market Value Calculated (DMV)

$$DMV_t = CMV_t + AI_t$$

Accrued Interest (AI)

Accrued Interest is the interest that has accumulated since the principal investment or since the previous interest payment if there has been one already. Accrued income is an income which

has been accumulated or accrued irrespective to actual receipt, which means event occurred but cash not yet received.

The function “ACCRINT” from MS Excel is used for calculation.

Clean Market Value Calculated (CMV)

Initial Clean Market Value (*Clean Market Price on Valuation Date*) entered at the model point.

For Current account, Saving account and deposit:

$$CMV_t = CMV_{t-1} + CF_t.$$

For Treasury bills:

$$CMV_t = CMV_{t-1},$$

where CMV_0 is Clean Market Price on Valuation Date (from model point).

Dirty Amortized Price (AP)

$$AP_t = DMV_t$$

Clean Amortized Price (AP^{clean})

$$AP_t^{clean} = AP_t - AI_t$$

FX Differences

$$FX\ Differences_t = (FX\ rate_t - FX\ rate_{t-1}) \cdot Face\ Value_t$$

Appraisal Differences

Appraisal differences are calculated as:

$$Appraisal\ differences_t = CMV_t - AP_t^{clean}$$

Unrealized Capital Gains/Losses Booked (UCGL)

Calculation depends on accounting classification:

FVTPL (Fair Value Through P&L): $UCGL_t = 0$

AFS (Available for Sale): $UCGL_t = Appraisal\ differences_t$

HTM (Held to Maturity): $UCGL_t = 0$

LAR (Loans and Receivables): $UCGL_t = 0$

HFT (Held for Trading): $UCGL_t = 0$

HEDGE (Hedge Accounting (HA)): $UCGL_t = Appraisal\ differences_t$

Modified Duration (MD)

Modified duration is not calculated.

Income Cash Flow

There are two possibilities to enter investment income. There is identifier that decides if investment income is fixed rate (and is defined in model point) or variable rate (and sourced from special table). In the case of variable rate, investment income is specified by month in the model point

Face Value Cash Flow

For each month program calculates value of paid face value during this month. It should be zero for all month except the month when the security expires.

Realization of FX Differences

For each month program calculates value of FX Differences during this month. It should be zero for all month except the month when the security expires.

9.4 INTEREST RATE SWAPS (IRS)

IRS is modelled so that receive leg and pay leg are modelled separately. Each leg is modelled like a fixed or float bond (according to the character of the leg). Pay leg is with negative sign. Outputs for the whole IRS are obtained by adding both legs.

9.5 EQUITY

Market Value (variable Dirty Market Value (DMV) = Clean Market Value (CMV))

$$DMV_t = MV_{t-1} \cdot (1 + growth_t)^{\frac{1}{12}},$$

where

$$growth_t = \frac{1 + return_t}{1 + dividend_t} - 1,$$

MV_0 = Clean Market Price on Valuation Date (from input)

Accrued Interest (AI)

$$AI_t = 0$$

Dirty Amortized Price (AP)

$$AP_t = 0$$

Clean Amortized Price (AP^{clean})

$$AP_t^{clean} = 0$$

FX Differences

$$FX\ Differences_t = (FX\ rate_t - FX\ rate_{t-1}) \cdot Face\ Value_t$$

Appraisal Differences

Appraisal differences are calculated as:

$$Appraisal\ differences_t = CMV_t - AP_t^{clean}$$

Unrealized Capital Gains/Losses Booked (UCGL)

Calculation depends on accounting classification:

FVTPL (Fair Value Through P&L): $UCGL_t = 0$

AFS (Available for Sale): $UCGL_t = Appraisal\ differences_t$

HTM (Held to Maturity): $UCGL_t = 0$

LAR (Loans and Receivables): $UCGL_t = 0$

HFT (Held for Trading): $UCGL_t = 0$

HEDGE (Hedge Accounting (HA)): $UCGL_t = Appraisal\ differences_t$

Modified Duration (MD)

Modified duration is not calculated.

Income Cash Flow

There are two possibilities to enter investment income. There is identifier that decides if investment income is fixed rate (and is defined in model point) or variable rate (and sourced from special table). In the case of variable rate, investment income is specified by month in the model point

Face Value Cash Flow

For each month program calculates value of paid face value during this month. It should be zero for all month except the month when the security expires.

Realization of FX Differences

For each month program calculates value of FX Differences during this month. It should be zero for all month except the month when the security expires.

9.6 VARIABLE – CHANGE AND OTHER

Change of Dirty Market Value (ΔDMV)

Change of DMV (ΔDMV) is calculated as:

$$\Delta DMV_t = DMV_t - DMV_{t-1},$$

where DMV_t is dirty market value valid at the end of the month m ,
 DMV_{t-1} is dirty market value valid at the end of the previous month.

Change of Accrued Interest (ΔAI)

Change of AI (ΔAI) is calculated as:

$$\Delta AI = AI_t - AI_{t-1},$$

where AI_t is accrued interest valid at the end of the month m ,
 AI_{t-1} is accrued interest valid at the end of the previous month.

Change of Clean Market Value (ΔCMV)

Change of CMV (ΔCMV) is calculated as:

$$\Delta CMV_t = CMV_t - CMV_{t-1},$$

where CMV_t is clean market value valid at the end of the month m ,
 CMV_{t-1} is clean market value valid at the end of the previous month.

Change of Dirty Amortized Price (ΔAP)

Change of AP (ΔAP) is calculated as:

$$\Delta AP_t = AP_t - AP_{t-1},$$

where AP_t is dirty amortized price valid at the end of the month m ,
 AP_{t-1} is dirty amortized price valid at the end of the previous month.

Change of Clean Amortized Price (ΔAP^{clean})

Change of AP (ΔAP^{clean}) is calculated as:

$$\Delta AP_t^{clean} = AP_t^{clean} - AP_{t-1}^{clean},$$

where AP_t^{clean} is clean amortized price valid at the end of the month m ,
 AP_{t-1}^{clean} is clean amortized price valid at the end of the previous month.

Change of FX Differences

Change of *FX Diff* ($\Delta FX Diff$) is calculated as:

$$\Delta FX Diff_t = FX Diff_t - FX Diff_{t-1},$$

where $FX Diff_t$ is FX differences valid at the end of the month m ,
 $FX Diff_{t-1}$ is FX differences valid at the end of the previous month.

Change of Appraisal Differences

Change of *App Diff* ($\Delta App Diff$) is calculated as:

$$\Delta App Diff_t = App Diff_t - App Diff_{t-1},$$

where $App Diff_t$ is appraisal differences valid at the end of the month m ,
 $App Diff_{t-1}$ is appraisal differences valid at the end of the previous month.

Change of Unrealized Capital Gains/Losses Booked

Change of *UCGL Booked* ($\Delta UCGL Booked$) is calculated as:

$$\Delta UCGL Booked_t = UCGL Booked_t - UCGL Booked_{t-1},$$

where $UCGL Booked_t$ is UCGL booked valid at the end of the month m ,
 $UCGL Booked_{t-1}$ is UCGL booked valid at the end of the previous month.

Interest income without FX Differences

$$Interest\ income_t = \Delta AI_t + CF_t - \Delta AP_t^{clean}$$

P&L without FX Differences

Calculation depends on accounting classification:

FVTPL (Fair Value Through P&L):	$P\&L_t = \Delta CMV_t + CF_t$
AFS (Available for Sale):	$P\&L_t = Interest\ income_t$
HTM (Held to Maturity):	$P\&L_t = Interest\ income_t$
LAR (Loans and Receivables):	$P\&L_t = Interest\ income_t$
HFT (Held for Trading):	$P\&L_t = \Delta CMV_t + CF_t$
HEDGE (Hedge Accounting (HA)):	$P\&L_t = Interest\ income_t$

10 LITERATURE

- [1] CIPRA, Tomáš. *Finanční a pojistné vzorce*. Praha: Grada Publishing, a. s., 2006. ISBN 80-247-1633-X.