

Asset-Liability Management 2018

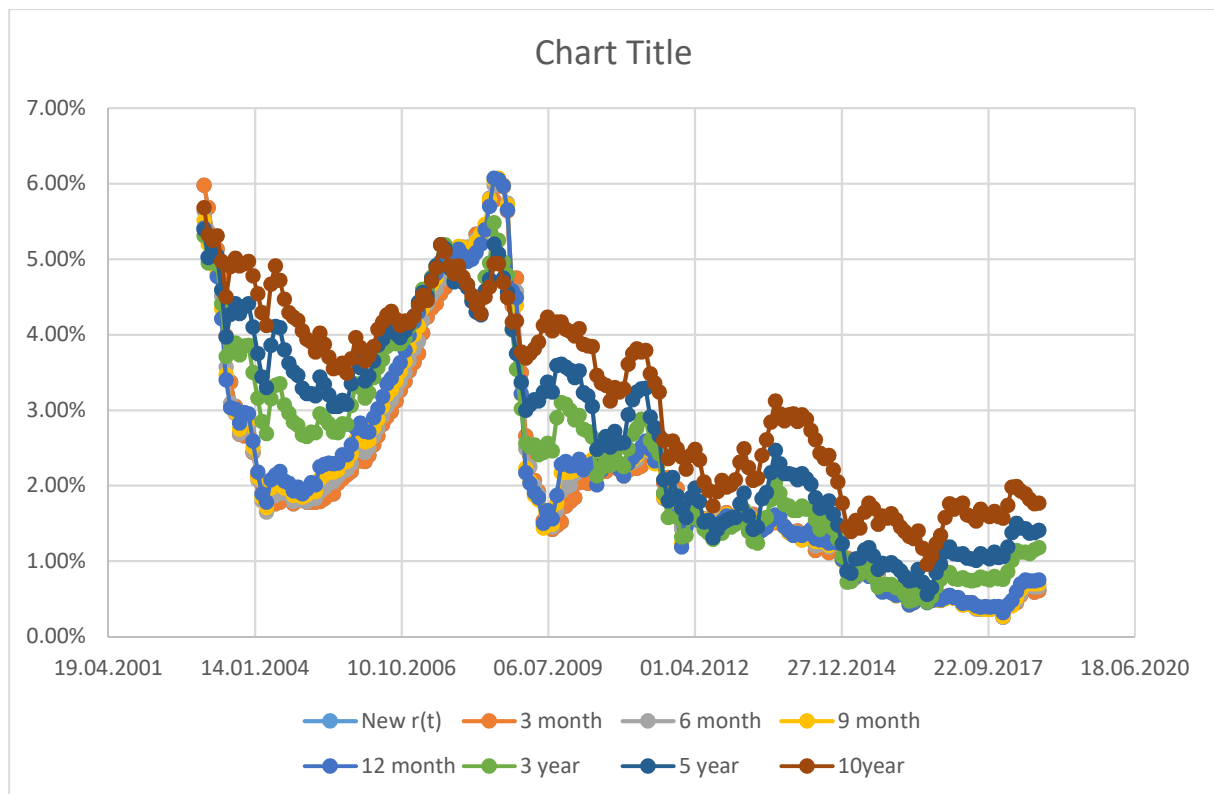
Project – some hints

As I said in the project description, this is a new project with new data, and I could not guarantee that the numbers selected would “behave well” in the sense of giving reasonable results. Indeed, the numbers have turned out to be a bit troublesome.

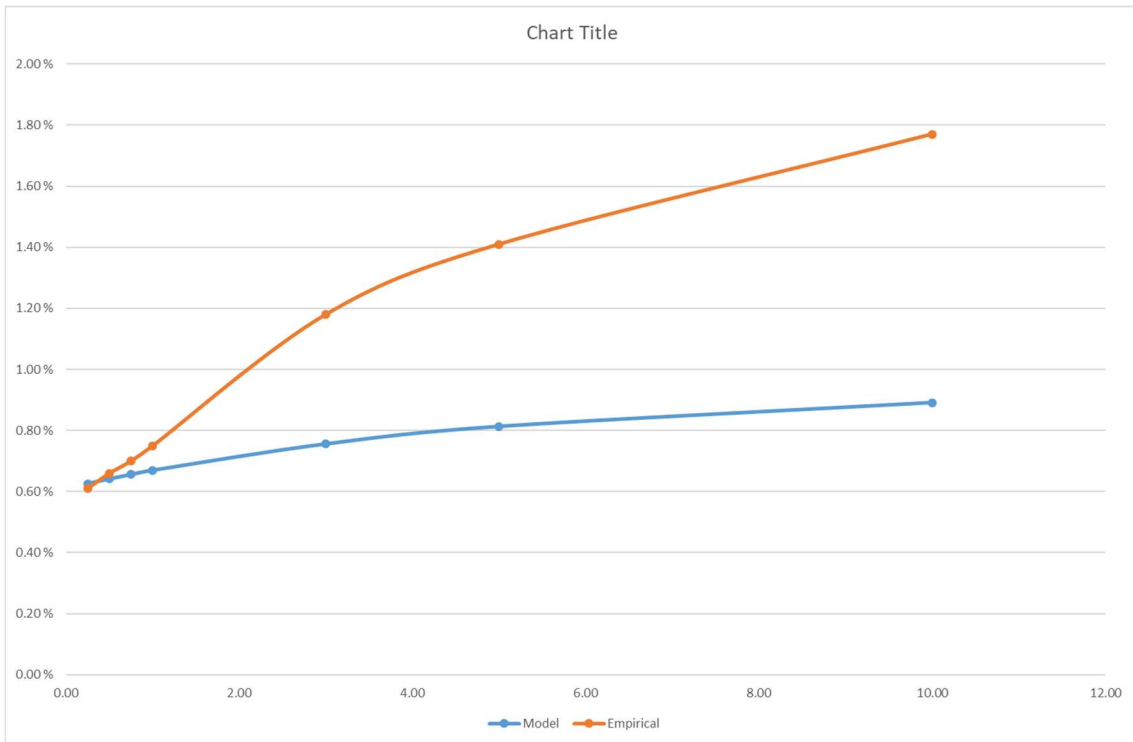
Here are some hints regarding the results.

1. Term structure modelling

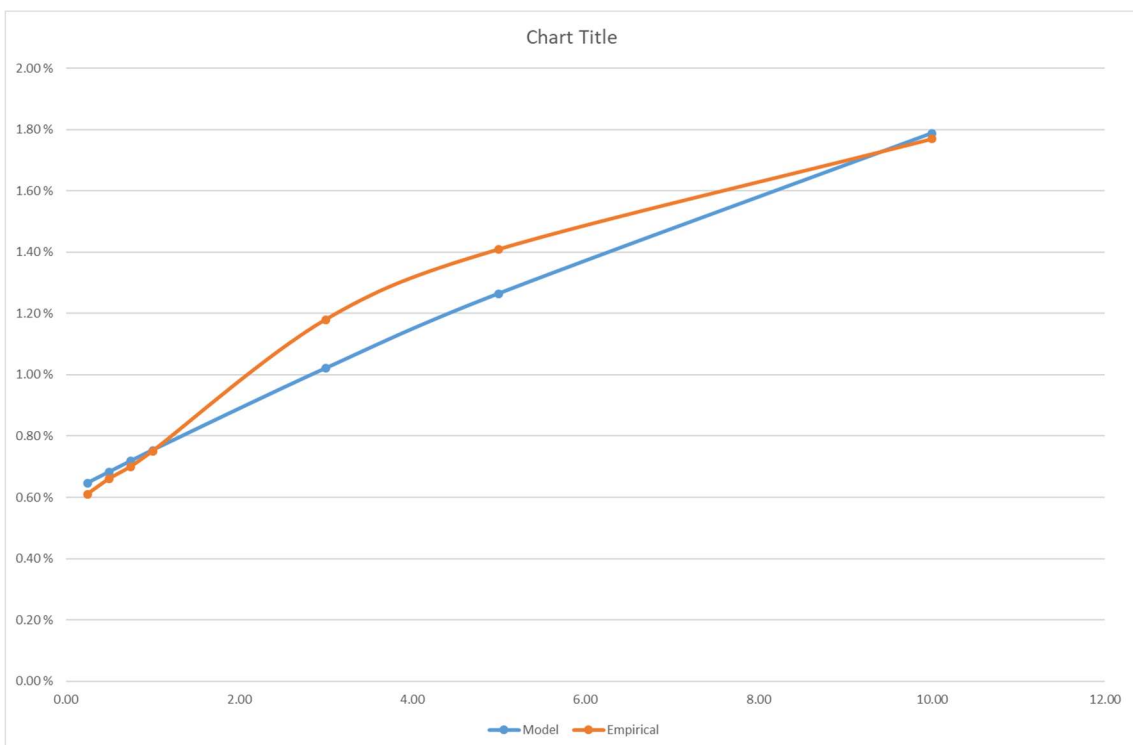
The regression method for estimating the model parameters for Vasicek / CIR does not perform well. On the other hand, you probably also noticed that the yield curves over the estimation period were very unstable. Expecting a purely statistical model to make sense of the mess the financiers and politicians created, is asking too much.



Just using the regression method, I get this in question 1 (c), obviously quite unsatisfactory:



In an attempt to address the problem, I forced $b=6\%$ and $a = \alpha/(b\Delta)$. A long-term rate of 6% may be “about right” for NOK under normal economic conditions. In that case the fit looks like this:



It's still a poor fit, but at least the curves meet.

In your project you could discuss the fitting issue briefly. You're free to look for a better fit by adjusting the parameters, but I don't know if the Vasicek / CIR models are able to provide a better fit.

2. Exchange rate modelling and MVA

There seems to be some confusion on how to calculate the covariance matrix. It is, indeed, spelt out in the project. The underlying (simplistic) assumption is that the month-to-month differences of the 10 currency rates are i.i.d. over time, and that there are correlations across the set of currencies for any monthly change. That there must be correlations is really obvious: if the NOK drops/rises in value from one month to the next under otherwise stable conditions, all of the 10 currencies are likely to rise/drop to some extent. I also assume that the expected monthly change is zero, and force that assumption into the estimation formula. Because of the independence assumption you can just multiply the monthly variances by 12 to get annual variances. So please, don't just run a "Corr" function on the raw exchange rates.

To allow you to check your results, here are μ , Σ and the portfolios.

Question 1 (b)

	mu	one								
Australia	1.8910 %	1								
Canada	2.0570 %	1								
Switzerland	-0.7460 %	1								
Denmark	-0.3570 %	1								
Euro	-0.3470 %	1								
United Kingdom	0.8780 %	1								
Japan	-0.0650 %	1								
Poland	1.2650 %	1								
Sweden	-0.4110 %	1								
United States	2.5180 %	1								
Sigma	Australia	Canada	Switzerland	Denmark	Euro	United Kingdom	Japan	Poland	Sweden	United States
Australia	0.1716614	0.1025506	0.0536457	0.0084125	0.062471	0.1100509	0.0006578	0.021518	0.0086996	0.0813717
Canada	0.1025506	0.1743418	0.0624204	0.0103224	0.0759231	0.1675834	0.001168	0.0143404	0.007572	0.162829
Switzerland	0.0536457	0.0624204	0.2253393	0.0206562	0.1538199	0.1971268	0.001874	0.025546	0.0102227	0.1557803
Denmark	0.0084125	0.0103224	0.0206562	0.0043108	0.0321512	0.0331334	0.0002331	0.0056598	0.0021711	0.021198
Euro	0.062471	0.0759231	0.1538199	0.0321512	0.2400187	0.2472601	0.0017286	0.0424945	0.0161793	0.1574015
United Kingdom	0.1100509	0.1675834	0.1971268	0.0331334	0.2472601	0.7173998	0.0022358	0.0470987	0.0205899	0.3053748
Japan	0.0006578	0.001168	0.001874	0.0002331	0.0017286	0.0022358	4.912E-05	9.046E-05	0.0001009	0.0028802
Poland	0.021518	0.0143404	0.025546	0.0056598	0.0424945	0.0470987	9.046E-05	0.0263811	0.0044282	0.0115222
Sweden	0.0086996	0.007572	0.0102227	0.0021711	0.0161793	0.0205899	0.0001009	0.0044282	0.0024687	0.0094107
United States	0.0813717	0.162829	0.1557803	0.021198	0.1574015	0.3053748	0.0028802	0.0115222	0.0094107	0.374436

Question 1 (c)

	w_min	w_ref	w_tan
Australia	0.0253 %	0.0229 %	0.0248 %
Canada	-0.1317 %	-0.1627 %	-0.1384 %
Switzerland	-0.1008 %	-0.0383 %	-0.0873 %
Denmark	96.4131 %	113.4862 %	100.1025 %
Euro	-12.9616 %	-15.1863 %	-13.4423 %
United Kingdom	0.0354 %	0.0245 %	0.0331 %
Japan	16.6548 %	1.6457 %	13.4115 %
Poland	0.2983 %	0.0874 %	0.2527 %
Sweden	-0.1559 %	0.1277 %	-0.0946 %
United States	-0.0770 %	-0.0071 %	-0.0619 %

Question 1 (d)

Assume that

Required return	2.20 %
Funding ratio	100.00 %

I assumed quite simply, that the liability behaves like SEK but with a different expected return.

Liability-Asset Correlation	Sweden
Australia	42.2602 %
Canada	36.4988 %
Switzerland	43.3429 %
Denmark	66.5541 %
Euro	66.4673 %
United Kingdom	48.9265 %
Japan	28.9873 %
Poland	54.8723 %
Sweden	100.0000 %
United States	30.9532 %

	w_gamma
Australia	0.0000 %
Canada	0.0000 %
Switzerland	0.0000 %
Denmark	0.0000 %
Euro	0.0000 %
United Kingdom	0.0000 %
Japan	0.0000 %
Poland	0.0000 %
Sweden	100.0000 %
United States	0.0000 %

Optimal portfolio that includes a liability hedge and risk-free NOK and gives an expected asset return of 2.2%:

nu	100.0000 %
1-w_0	-81.46 %
w_0	181.46 %

In your project, please give me evidence that you've actually done the calculations.