

Affine term structure models: forecasting the Colombian yield curve

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Research practice II: progress report

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ATSMs

Term structure (TS): relates yields Y with investment horizons τ .

ATSMs: model yields as affine functions of a state vector $X(t)$:

$$Y_{\tau}(t) = A(\tau) + B(\tau)^{\top} X(t) \quad (1)$$

The state vector follows an affine diffusion process:

$$dX(t) = \mu(X)dt + \sigma(X)dW(t) \quad (2)$$

Data

Nelson-Siegel curves published by *Infovalmer*.

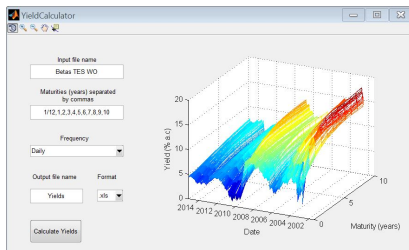


Figure 1: Data interface.

- Time period:
Aug.2002-Mar.2015
- Daily observations.

The log-likelihood function

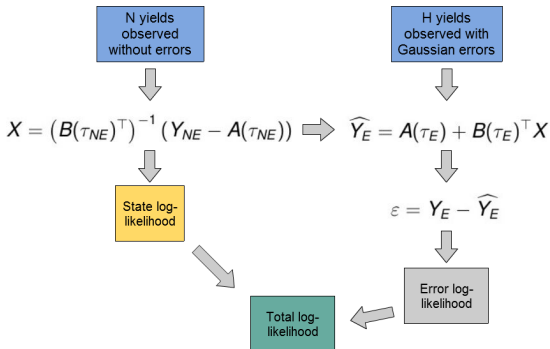


Figure 2: Loglikelihood calculation.

Implemented for 9 models with 1-3 states.

Optimization procedure

- *MATLAB*[®]'s *fminsearch*(...):
 - Solutions vary only $\approx 10\%$ from their initial values.
 - Solutions don't always move into the feasible space.
 - The obtained fit isn't good.
- Differential evolution heuristic:
 - Diversifies well.
 - Solutions are generally feasible.
 - Is time-costly.
 - Parameters must be defined.
 - Stopping criterion must be defined.

Some problems I

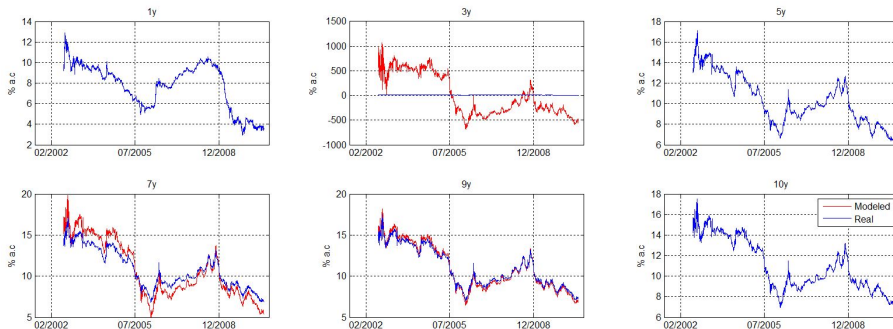


Figure 3: Incomplete fit.

Some problems II

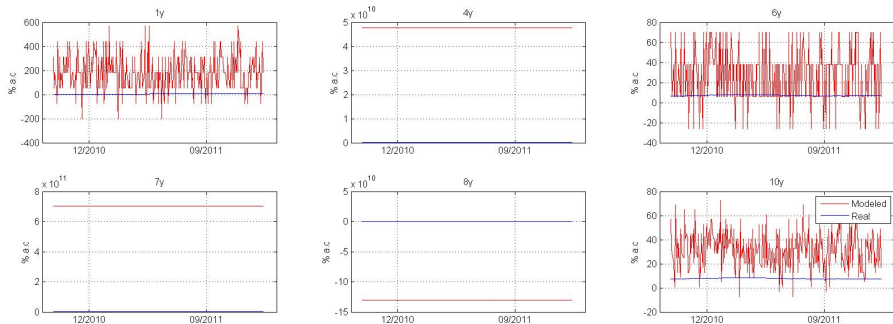


Figure 4: Estimation failure.

Simulation tests

We ran tests using simulated data and found:

- The feasible region is complicated.
- A lot of data must be used for the parameters to converge.
- It is possible to obtain a good fit with "wrong" parameters.

Improvements

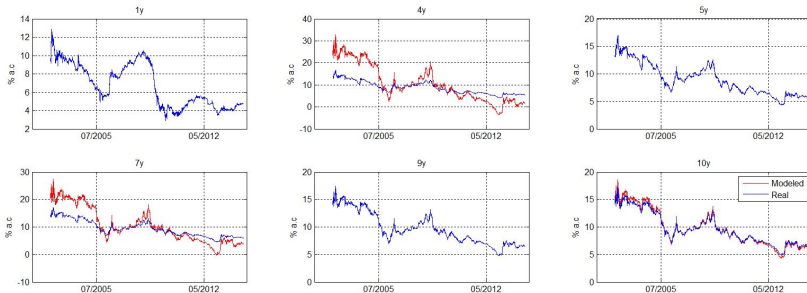


Figure 5: A33 model.

- Whole sample.
- New heuristic parameters.

Current state of the project

- We have a good amount of data.
- The estimation procedure has been implemented for 9 ATSMs.
- Estimation is not consistent.

Schedule


Activity	Time range
Literature review ✓	Jan. 26 - Feb. 28
Implementation. ■	Mar 1 - Mar 31.
Tests of forecast accuracy.	Apr 1 - May 28


Table 1: Project schedule

Report / Presentation	Deadline
Proposal report ✓	Feb. 13th.
Proposal presentation ✓	Feb. 27th.
Progress report ✓	10th week.
Final report	May 29th.
Final presentation	19th week.

Table 2: Course deadlines

References

 Ait-Sahalia, Y. (2008).
Closed-form likelihood expansions for multivariate diffusions.
The Annals of Statistics, 36(2):906–937.

 Chen, R.-R. and Scott, L. (1993).
Maximum likelihood estimation for a multifactor equilibrium model of the term structure of interest rates.
The Journal of Fixed Income, 3(3):14–31.

Thanks for your attention!