Discussion of *"An Infinite-Dimensional Interest Rates Term Structure Model: Arbitrage-Free, Realistic and Practical"* by Victor Lapshin

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Motivation

Construct a model of yield curve dynamics, such that:

- it is based on no-arbitrage principle
- it is non-parametric
- it produces realistic yield curves
- it works well on illiquid markets
- it takes into account possibility of missing data

Approach

- Based on Heath-Jarrow-Morton (1992) family of models for the forward rate dynamics.
- Applies Filipović (1999) infinite-dimensional extension of HJM (1992).
- Apart from usual stochastic dynamics, the method also takes into account:
  - Limited number of bonds that are actually traded.
    Requires regularization – here, Bayesian approach is used.
  - Limited credibility of information about prices.
    Requires randomness in observed prices.

Results (1)

- No closed-form solution.
  HJM framework plus model complexity.
- The method produces plausible yield curve dynamics.
- A special case is a good static yield curve model.
- The method incorporates illiquidity and sampling issues.
- Under reasonable technical conditions, the finite-dimensional model has desired asymptotics.
- Yield curve estimation may be performed via maximum likelihood method.

Results (2)

- Model is tested on Russian bond market intraday data (3 observations per day).
- Three samples are used: Jan–Apr 2006, Aug–Sep 2007, and Sep–Dec 2008.
- In the normal market conditions the model is not rejected @ 95% confidence level.
- Works reasonably during the crisis.

Comments (1): Contributions

- The main contribution of the paper is methodological, but this is not emphasized.
- There are two major points where the model improves the existing methods:
  - Resolving estimation problems related to missing data or unreliable price quotations (”credibility”).
  - Incorporating effects of low volumes and high bid-ask spreads into yield curve dynamics (illiquidity).
- These two should be separated more clearly: the former issue is merely technical.

Comments (2): The Method

- Are market prices of risk γ^j estimated or treated as free parameters?
  - If estimated, how is the issue of market completeness resolved?
  - If treated as free parameters, which values have been chosen?
- The model aims for non-parametric approach, yet it assumes a normal distribution of prices around the present value of cash flows given the yield curve:

$$p_k \sim N(q_k(r),\ w_k)$$

Is this assumption critical? How do we estimate w_k?

Comments (3): Empirical Part

- Not clear what the dataset actually looks like:
  - How many bonds, which currencies of denomination, maturities, coupons...?
  - Were mid prices or bid/ask prices used?
- Some econometric results should be presented (e.g. parameter estimates, comparisons w.r.t. restricted models not incorporating liquidity/data unreliability issues...).
- If the method performs worse on the crisis data, could it be that it did not resolve the liquidity issues properly?

Comments (4): A Reference to Consider

Dewachter (2009) develops a macro-finance model incorporating:

- A small-scale (semi-) structural New-Keynesian model
- Flexible specification for market price of risk
- Mispricing
- Liquidity premia
- Learning dynamics (e.g. the one related to inflation expectations).