Discussion of:

"Endogenous risk in a DSGE model

with capital-constrained financial intermediaries",

by Hans Dewachter and Raf Wouters

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Brussels, 12 October 2012

Summary

- DSGE models with financial frictions contain interesting non-linearities

- Interesting trade-off between continuous and discrete time models: accuracy vs. size (# states)

- Larger linear-nonlinear models tend to produce more realistic features on both price and quantities (but what if "all" non-linearities were introduced?)

Discussion

- Why He and Krishnamurthy (and not CSV, or "credit constraints")?

- Is there a better approximation to the reputation constraint?

- Why third (and not second) order?

Why He and Krishnamurthy

- Objective: build a model with appropriate cyclicality of leverage and asset prices and where risk is endogenous and plays a role on allocations

- He and Krishnamurthy has good properties:

  - because of the specific financial constraint?

  - or because of nonlinear effects are given a chance?

Why He and Krishnamurthy

- Why not CSV framework (BGG):
  - explicit information friction (but restrictions on lending/borrowing – only deposits, no equity, no direct financing)
  - fares well on cyclicality; additionally has explicit default risk and actual defaults
  - risk neutrality in lending relationships $\rightarrow$ no natural role nonlinearities and changes in price of risk

Why He and Krishnamurthy

- Why not Gertler and Karadi (2011):

  – banker can run away with a fraction λ of bank assets; incentive constraint:

  $$q_t K_{t+1} \leq \phi_t N_t$$

  (for given N, there is a max value of assets banker can hold; the higher N, the less binding constr.)

– Accumulation of net worth

$$\frac{N_{t+1}}{N_t} = \left(R_{kt+1} - R_{t+1}\right)\phi_t + R_t$$

(accumulation depends on excess return on equity)

– Constraint assumed as binding and linearised $\rightarrow$ nonlinearities are ruled out

Why He and Krishnamurthy

- He and Krishnamurthy (2012):
  - reputation constraint: intermediary's (leveraged) share of risky assets is either constant $1/\alpha^*$, or constrained from below by its reputation

$$\alpha_t^{FI} = \max\left(\frac{1}{\alpha^*}, \frac{q_t K_t}{\varepsilon_t}\right)$$

  - Accumulation of reputation

$$\frac{\varepsilon_{t+1}}{\varepsilon_t} = m\alpha_t^{FI}\left(R_{kt+1} - R_{t+1}\right) + mR_{t+1} - \eta$$

– Account explicitly for nonlinearities

Why He and Krishnamurthy

- HK vs GK
  - Binding

$$\begin{array}{cc} HK & GK \\ \alpha_t^{FI} = \frac{q_t K_t}{N_t} & \phi_t = \frac{q_t K_{t+1}}{N_t} \end{array}$$

  - "Non-binding"

$$\begin{array}{cc} HK & GK \\ \alpha_t^{FI} = \frac{1}{\alpha^*} & \phi_t = \frac{1}{\alpha^*}\text{?} \end{array}$$

Why He and Krishnamurthy

- Why not! It provides a nice benchmark where nonlinearities work in the "right" direction

- Not clear if peculiar type of financial friction is key

- Dewachter and Wouters' results may be very general

A better approximation of the constraint?

- Well known that kinks are smoothed in the solution of stochastic problems (option pricing): smooth nonlinear approximation to occasionally binding constraint is sensible

- Perturbation methods become feasible, thus applicable to larger models

- Is there a better smoothing function?

A better approximation of the constraint?

- The approximation of the constraint

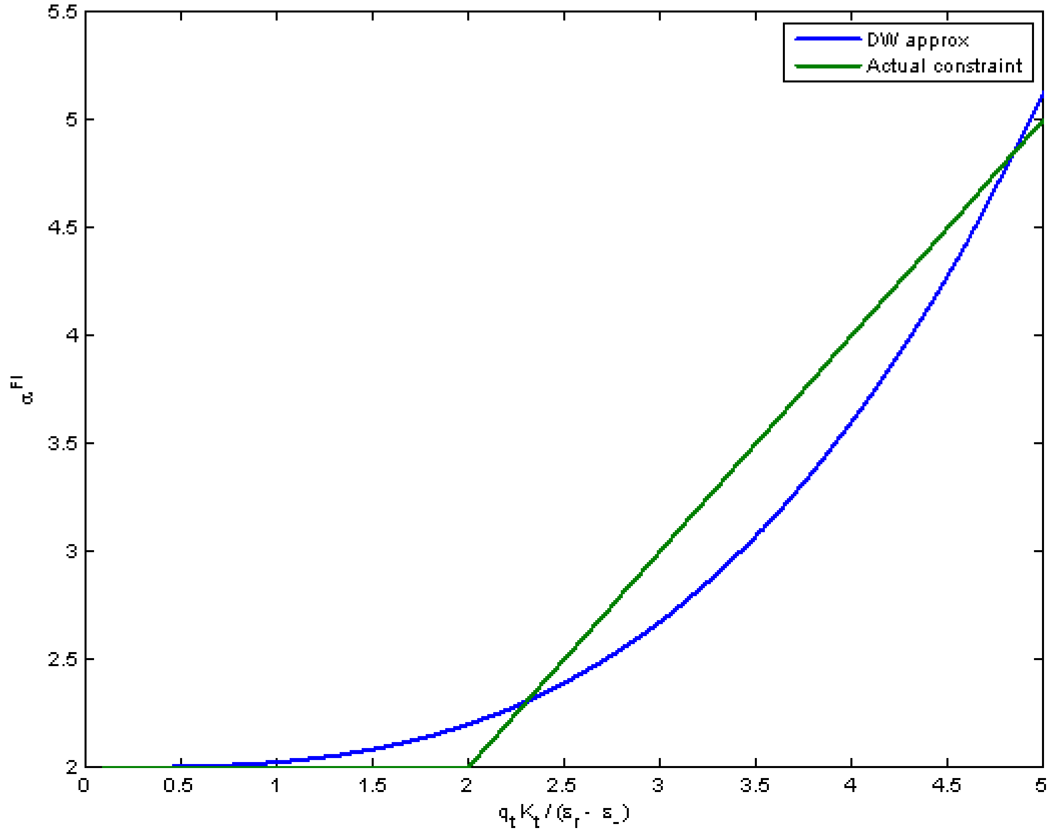
$$\alpha_t^{FI} = \max\left(\frac{1}{1-\lambda}, Q^{\varepsilon}\right)$$

is

$$\alpha^{FI} = \frac{1}{1-\lambda} + 0.1\,(1-\lambda)^2\,(Q^{\varepsilon})^3$$

for $Q^{\varepsilon} \equiv \frac{q_t K_t}{\varepsilon_t}$

A better approximation of the constraint?



A better approximation of the constraint?

- Based on option theory, try solution to

$$\alpha^{FI} = 2 + \max\left(Q^{\varepsilon} - 2, 0\right)$$

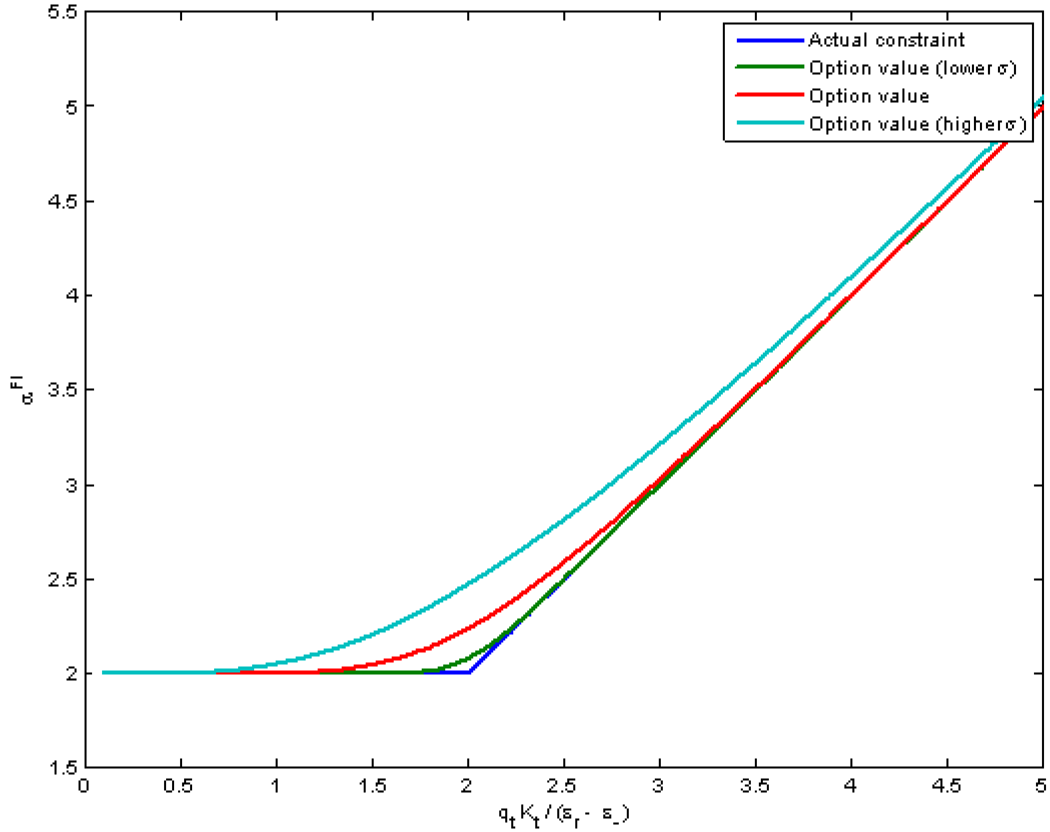
ie

$$\alpha^{FI} = 2 + N\left(d_1\right) Q^{\varepsilon} - 2N\left(d_2\right)$$

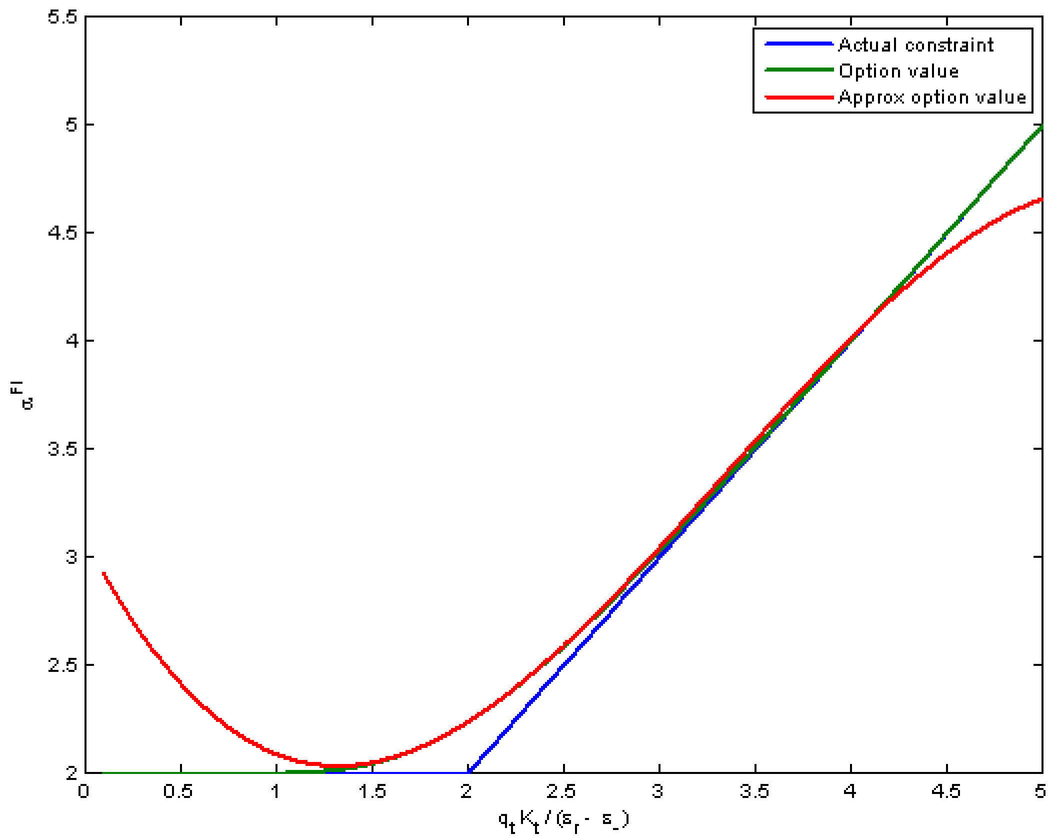
for

$$d_1 = \frac{\ln \frac{Q^{\varepsilon}}{2} + \frac{\sigma^2}{2}}{\sigma}, \qquad d_2 = d_1 - \sigma$$

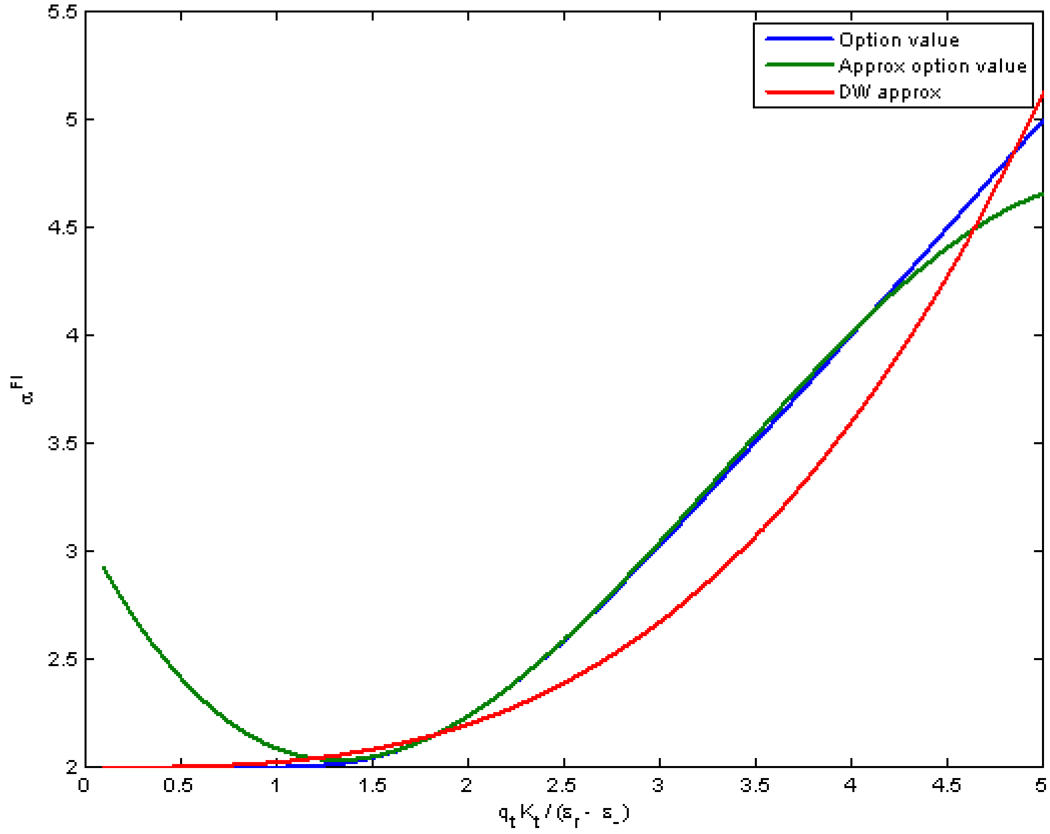
A better approximation of the constraint?



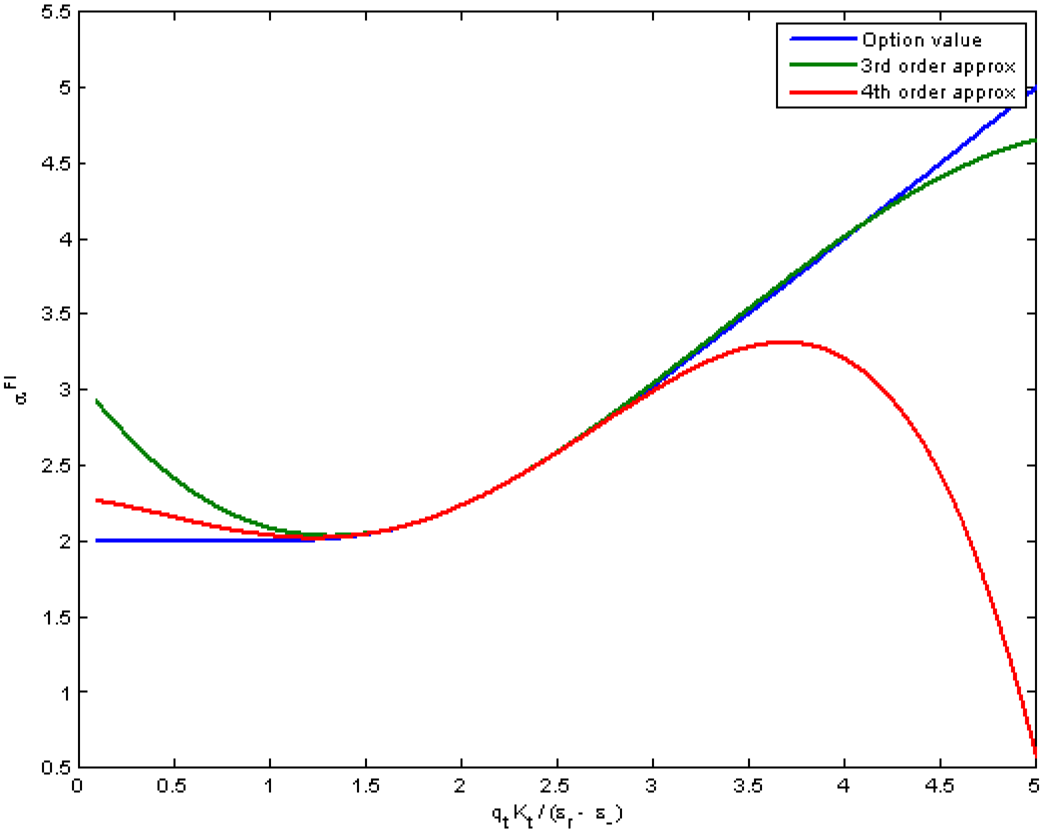
A better approximation of the constraint?



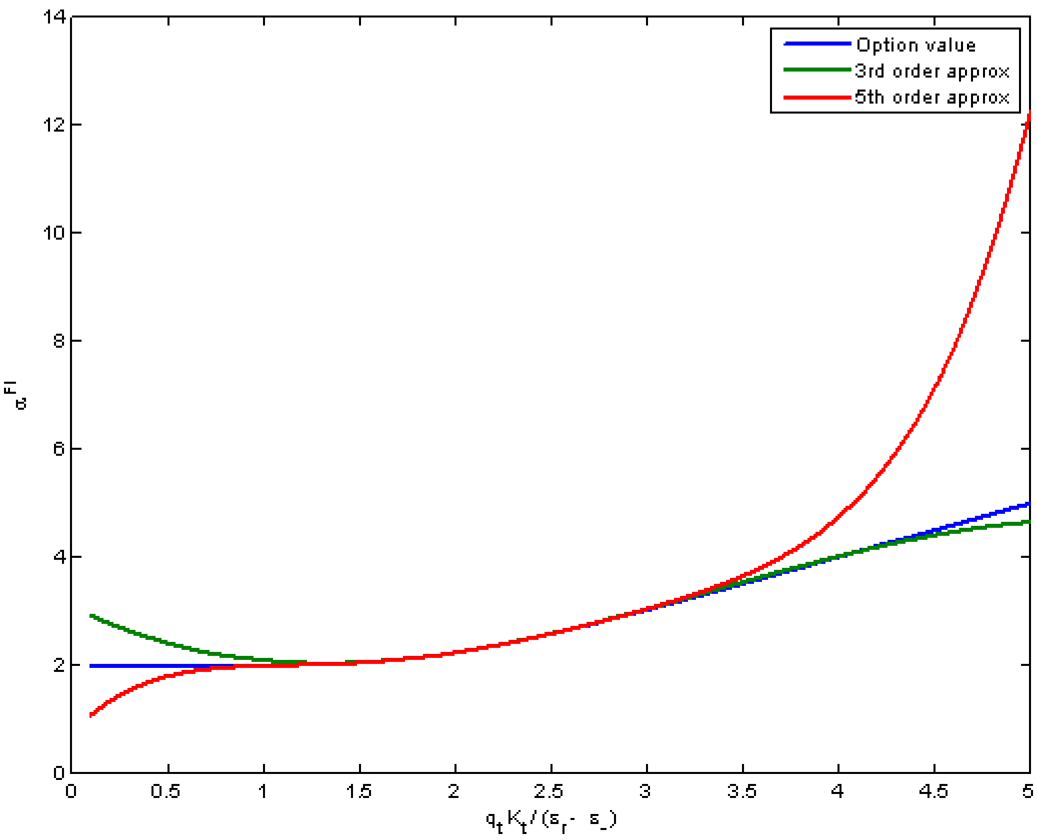
A better approximation of the constraint?



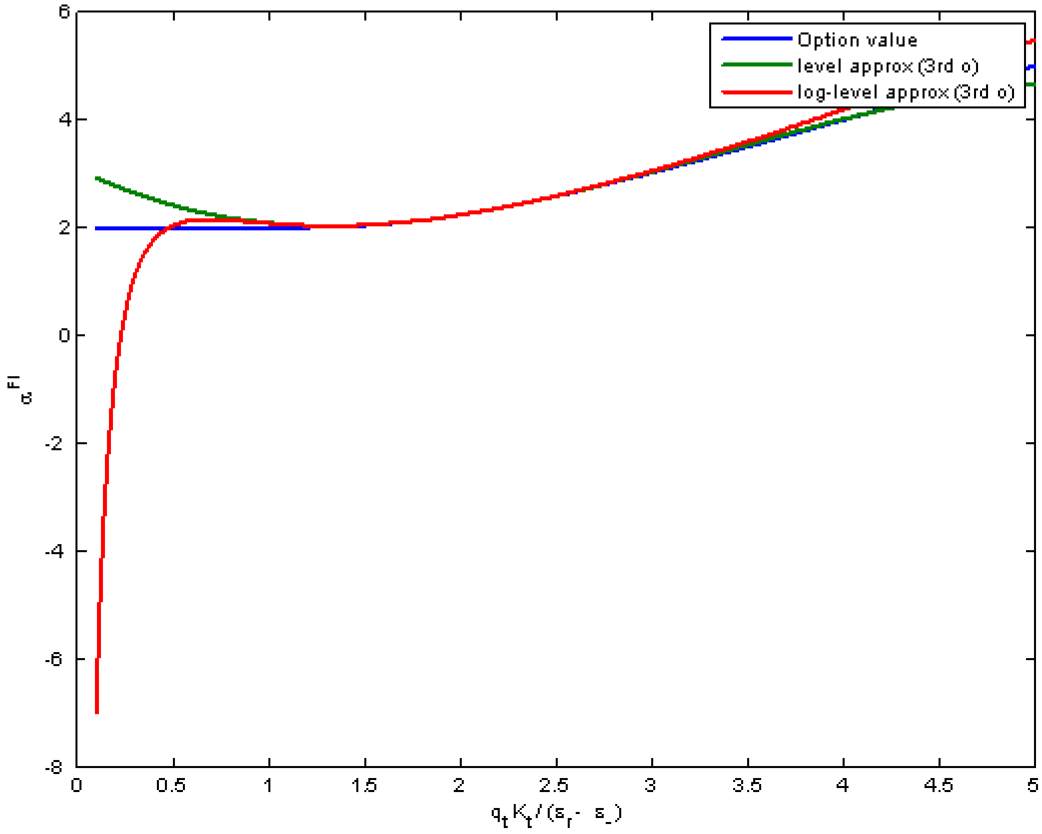
A better approximation of the constraint?



A better approximation of the constraint?



A better approximation of the constraint?



A better approximation of the constraint?

- Try a more flexible functional approximation with tuning parameter?

- It should work also when the functional form is approximated to third order

- but higher order perturbation may give wild results away from the approximation point

Why third order

- Why not start from a second order approximation?

- "Closer" to Ito calculus

- Enough to capture risk (conditional variances and covariances)

Why third order

- It has to do with the constraint

$$\varepsilon_t = \varepsilon_{t-1}\left(m\widetilde{R}_t - \eta\right)$$

- Note: ε is indeterminate in non stochastic steady state

$$m\widetilde{R} = \eta$$

Why third order

- To first order

$$\widehat{\varepsilon}_t = \widehat{\varepsilon}_{t-1} + (1+\eta)\,\widehat{\widetilde{r}}_t$$

- $\widehat{\varepsilon}_t$ behaves like a random walk

Why third order

- Second order

$$\widehat{\varepsilon}_t = \widehat{\varepsilon}_{t-1} + (1+\eta)\,\widehat{\widetilde{r}}_t - \frac{1}{2}\eta\,(1+\eta)\,\widehat{\widetilde{r}}_t^2$$

- $\widehat{\varepsilon}_t$ is still a random walk

Why third order

- Third order

$$\widehat{\varepsilon}_t = \widehat{\varepsilon}_{t-1} + ... - \frac{1}{6}\eta\left(1+\eta\right)\left(\eta+2\right)\widehat{\widehat{r}}_t^3 - \frac{1}{2}\eta\left(1+\eta\right)\widehat{\widehat{r}}_t^2\widehat{\varepsilon}_{t-1}$$

- Minimum approximation order to ensure that the distribution of $\widehat{\varepsilon}_t$ is well defined

Conclusion

- Really interesting paper

- It opens the way for many other possible applications