

Modelling Financial Time series using Grammatical Evolution

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Motivation

$$r_t^e = f(x)$$

$$r_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

$$A \leq a, B \geq b, C \neq c$$

- Modelling Issues
 - Functional form of $f(x)$
 - Nature of parameters x
 - Constraints satisfaction

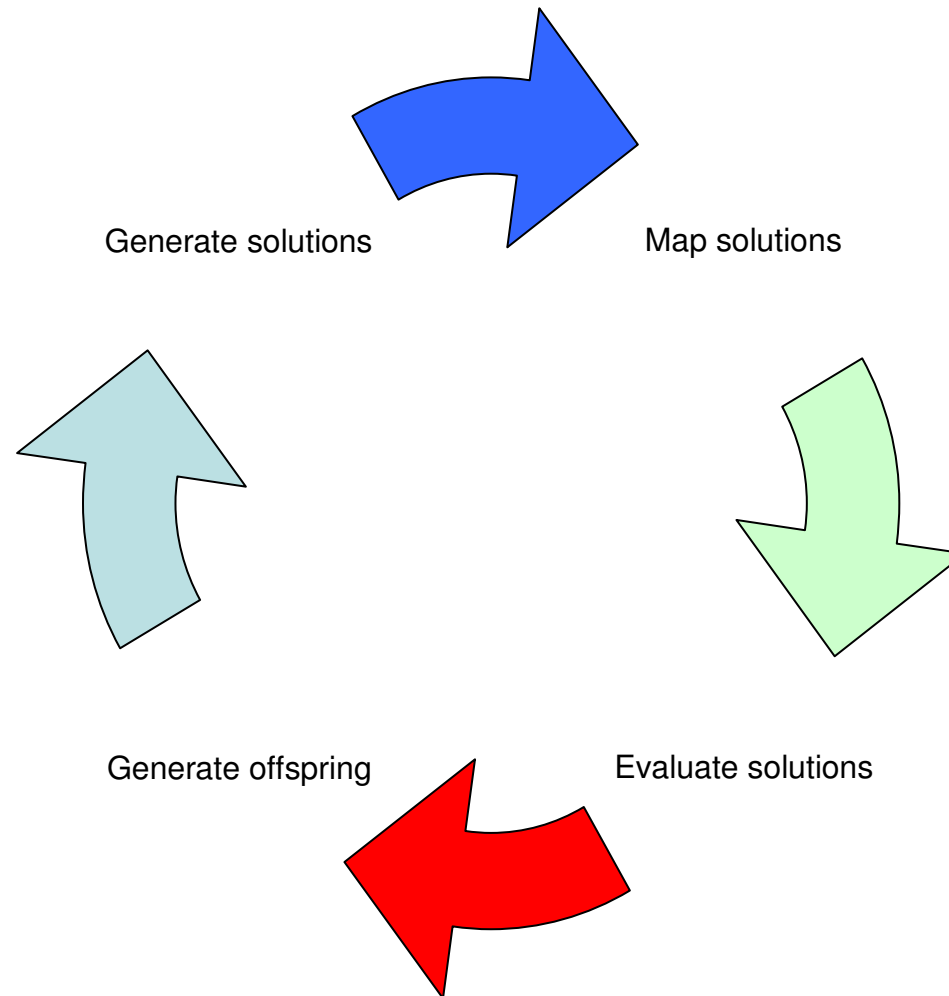
Framework

$$f = \frac{\frac{1}{T} \sum_{t=1}^T r_t \times I_{t-1}}{\sigma}$$

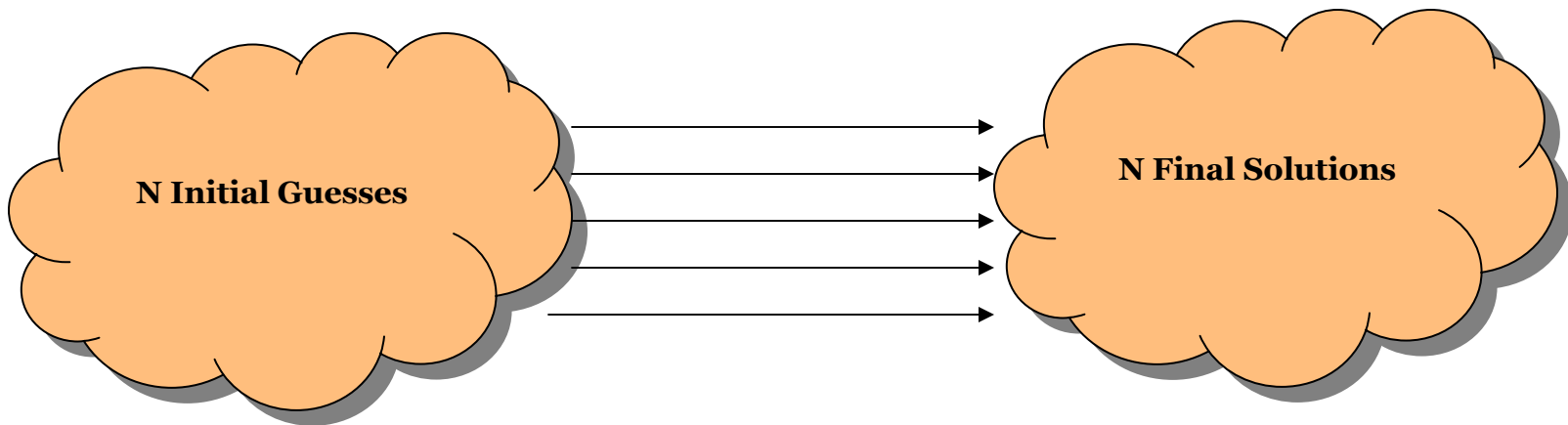
$$I_t \begin{cases} +1 & r_t^e > 0 \\ -1 & r_t^e < 0 \end{cases}$$

- Key problem
 - Infer model for r_t^e from high frequency data
 - Inferred model should be profitable
 - Main Ingredients
 - Past returns
 - Arithmetic operators
 - Moving Average operators
 - Trigonometric functions

Framework

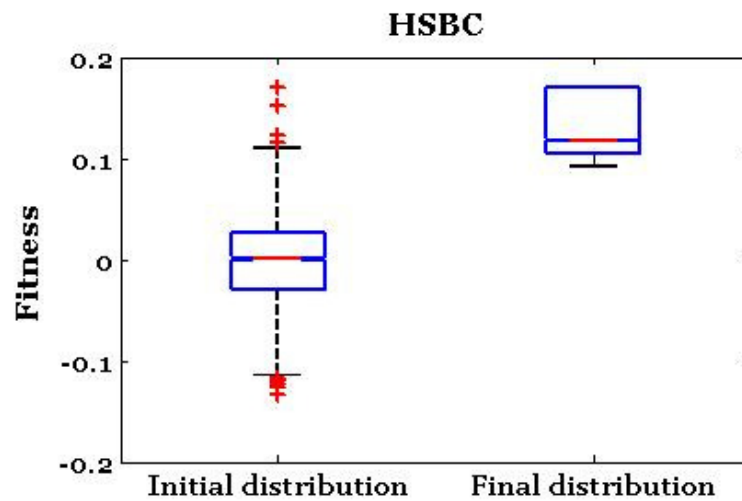
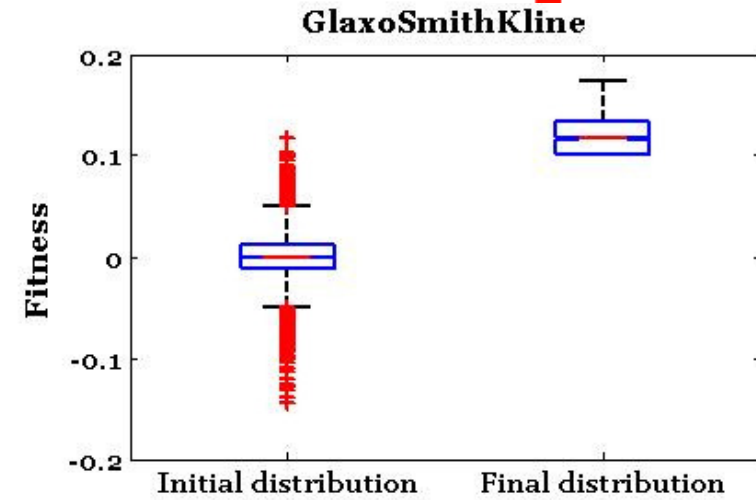
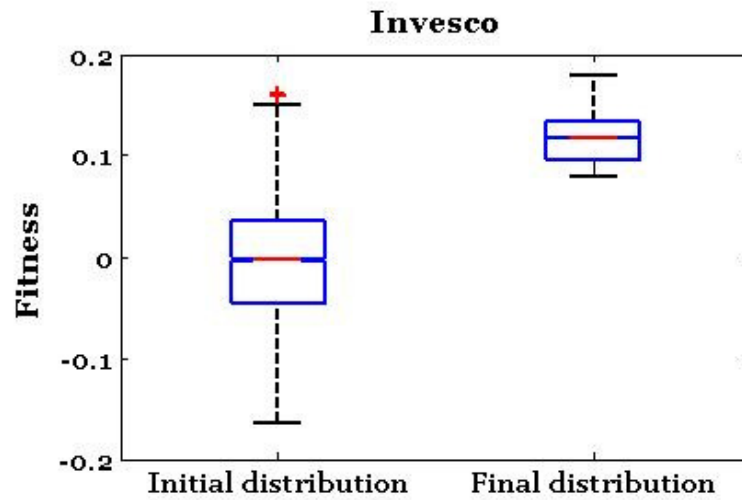


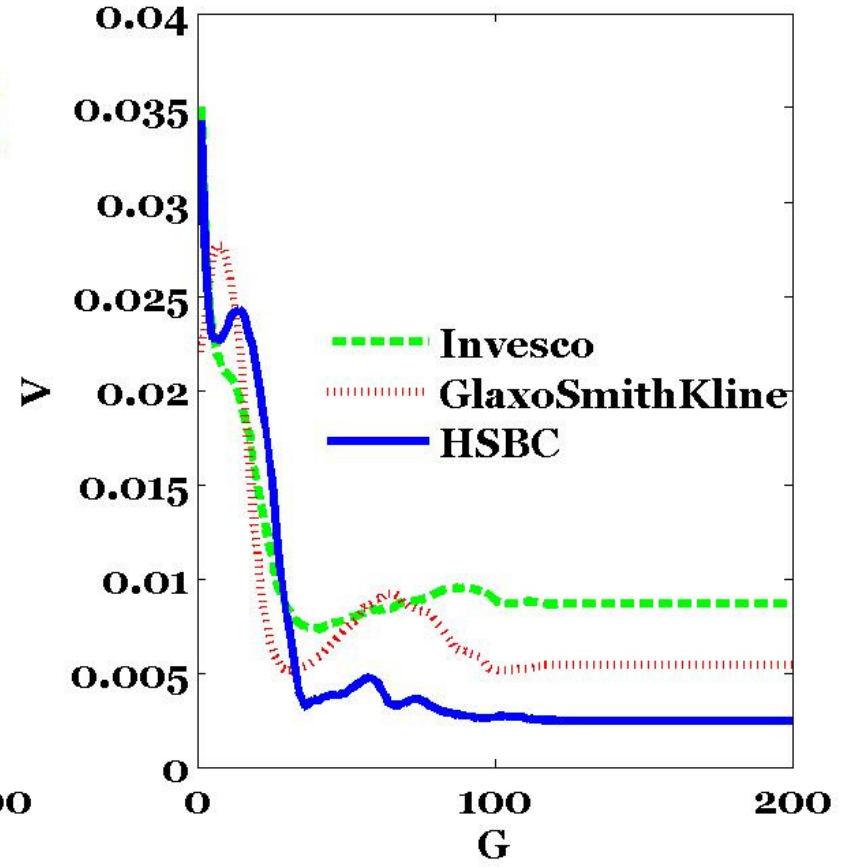
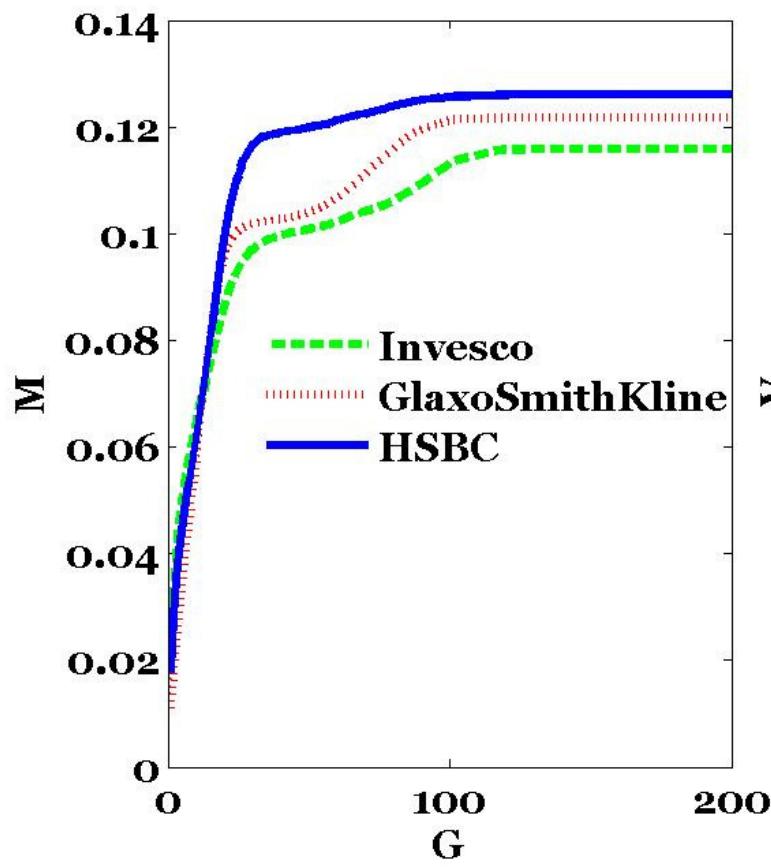
Framework

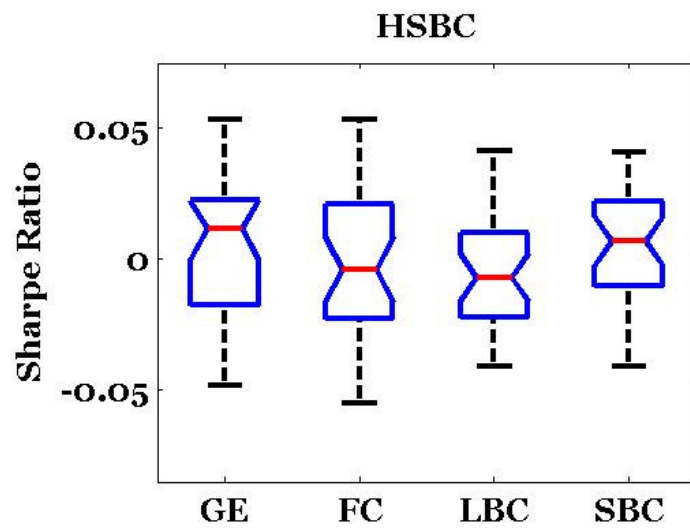
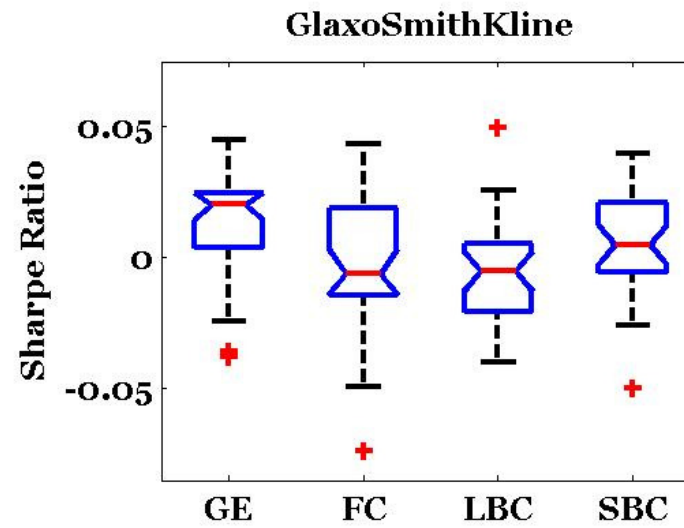
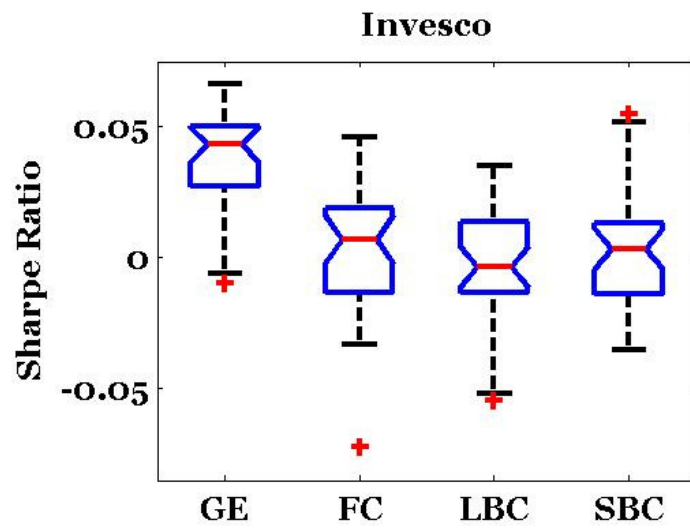


Data

- High frequency data
 - Three FTSE stocks
 - Invesco, GlaxoSmithKline, HSBC (1-30 March 2007)
 - Ljung-Box test of autocorrelation reveals none

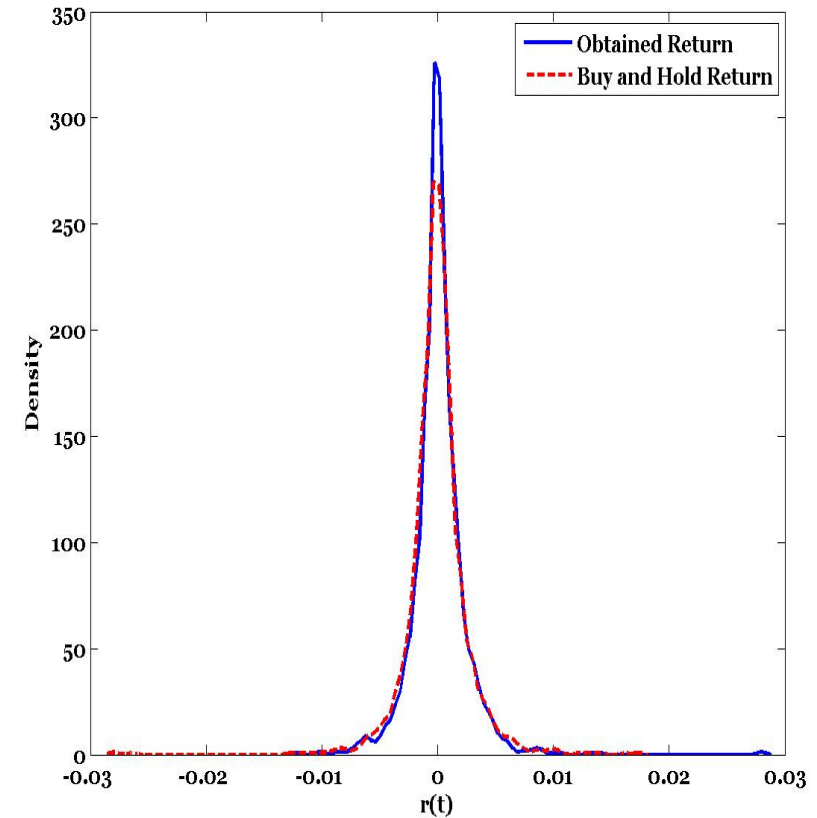




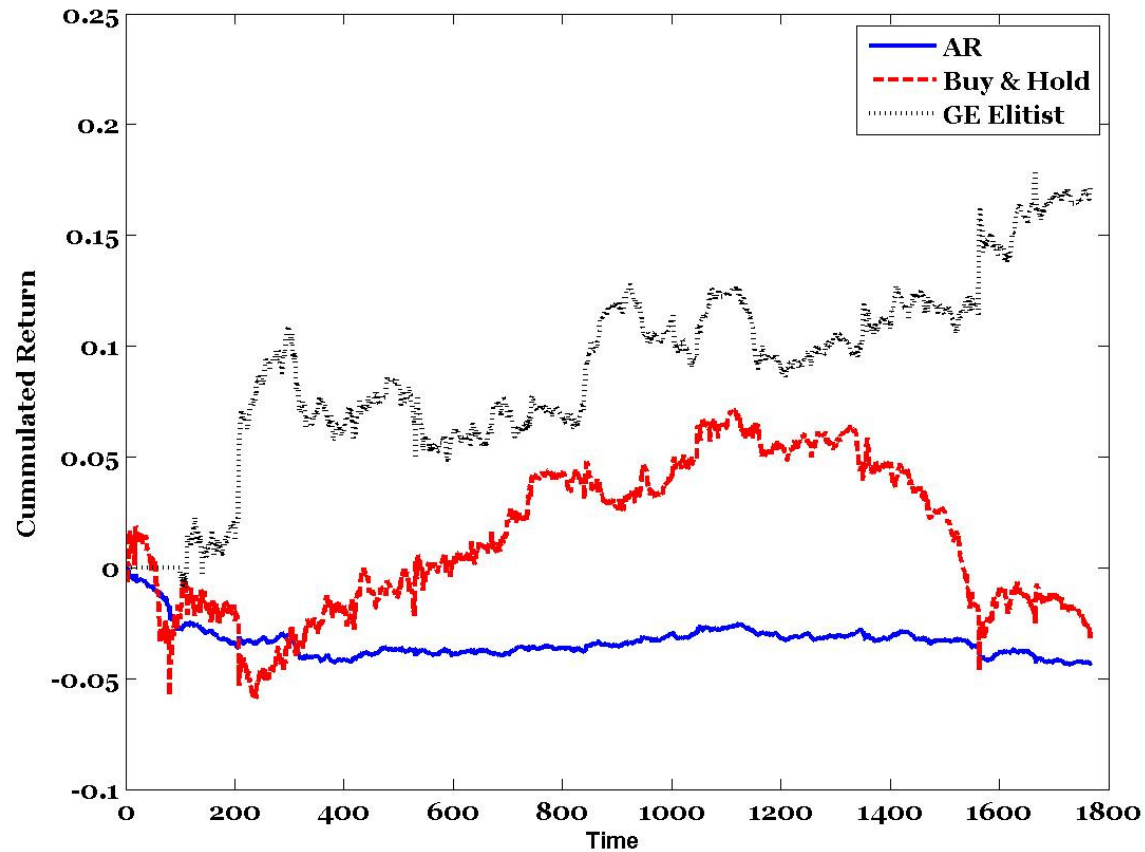


Elitist

$$\left(\frac{1}{T-1} \sum_{i=1}^{T=77} r_{t-i} \right) \times r_{t-35} - \tan(r_{t-88})$$



GE Elitist Vs Buy & Hold, and AR Model



Conclusion & Future Work

- Conclusion
 - GE is able to produce solutions for some stocks that are better than a zero intelligence strategy (coin)
 - GE is able to produce solution that outperforms buy & hold, and an AR model picked using AIC
- Future work
 - Subject decision rule to evolution (coevolve model and decision rule eg. Coevolutionary Grammatical evolution presented at CMS2009)
 - Evolve models of volatility, and maybe higher moments (Possibly coevolve these models)
 - Include some elements of market friction