

Global and Local stationary modelling in finance: Theory and empirical evidence

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Abstract

To model real data sets using second order stochastic processes imposes that the data sets verify the second order stationarity condition. This stationarity condition concerns the unconditional moments of the process. It is in that context that most of models developed from the sixties' have been studied; We refer to the ARMA processes (Brockwell and Davis, 1988), the ARCH, GARCH and EGARCH models (Engle, 1982, Bollerslev, 1986, Nelson, 1990), the SETAR process (Lim and Tong, 1980 and Tong, 1990), the bilinear model (Granger and Andersen, 1978, Guégan, 1994), the EXPAR model (Haggan and Ozaki, 1980), the long memory process (Granger and Joyeux, 1980, Hosking, 1981, Gray, Zang and Woodward, 1989, Beran, 1994, Giraitis and Leipus, 1995, Guégan, 2000), the switching process (Hamilton, 1988). For all these models, we get an invertible causal solution under specific conditions on the parameters, then the forecast points and the forecast intervals are available.

Thus, the stationarity assumption is the basis for a general asymptotic theory for identification, estimation and forecasting. It guarantees that the increase of the sample size leads to more and more information of the same kind which is basic for an asymptotic theory to make sense.

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Now non-stationarity modelling has also a long tradition in econometrics. This one is based on the conditional moments of the data generating process. It appears mainly in the heteroscedastic and volatility models, like the GARCH and related models, and stochastic volatility processes (Ghysels, Harvey and Renault (1997)). This non stationarity appears also in a different way with structural changes models like the switching models (Hamilton, 1988), the stopbreak model (Diebold and Inoue, 2001, Breidt and Hsu, 2002, Granger and Hyung, 2004) and the SETAR models, for instance. It can also be observed from linear models with time varying coefficients (Nicholls and Quinn, 1982, Tsay, 1987).

Thus, using stationary unconditional moments suggest a global stationarity for the model, but using non-stationary unconditional moments or non-stationary conditional moments or assuming existence of states suggest that this global stationarity fails and that we only observe a local stationary behavior.

The growing evidence of instability in the stochastic behavior of stocks, of exchange rates, of some economic data sets like growth rates for instance, characterized by existence of volatility or existence of jumps in the variance or on the levels of the prices imposes to discuss the assumption of global stationarity and its consequence in modelling, particularly in forecasting. Thus we can address several questions with respect to these remarks.

1. What kinds of non-stationarity affect the major financial and economic data sets? How to detect them?
2. Local and global stationarities: How are they defined?
3. What is the impact of evidence of non stationarity on the statistics computed from the global non stationary data sets?
4. How can we analyze data sets in the non stationary global framework? Does the asymptotic theory work in non-stationary framework?
5. What kind of models create local stationarity instead of global stationarity? How can we use them to develop a modelling and a forecasting strategy?

These questions began to be discussed in some papers in the economic literature. For some of these questions, the answers are known, for others, very few works exist. In this paper we discuss all these problems and we propose

new strategies and modelling to solve them. Several interesting topics in empirical finance awaiting future research are also discussed.