Structural breaks and structural change in financial and other series

(Abbreviated Title: Structural change)

NES Research Project Proposal for 2005-2006

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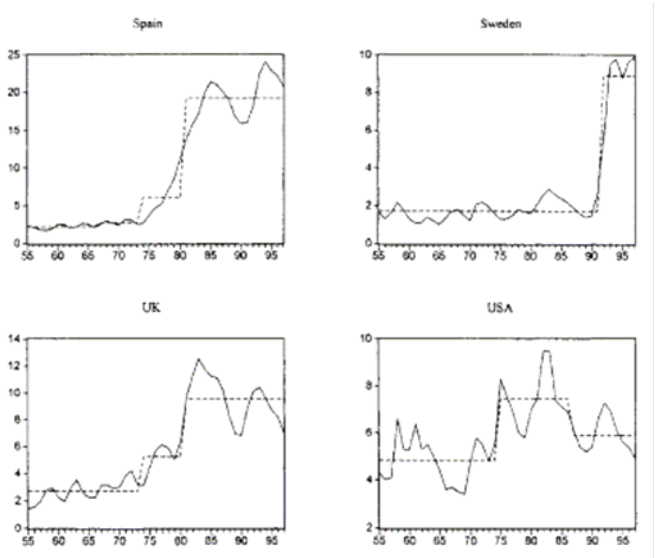
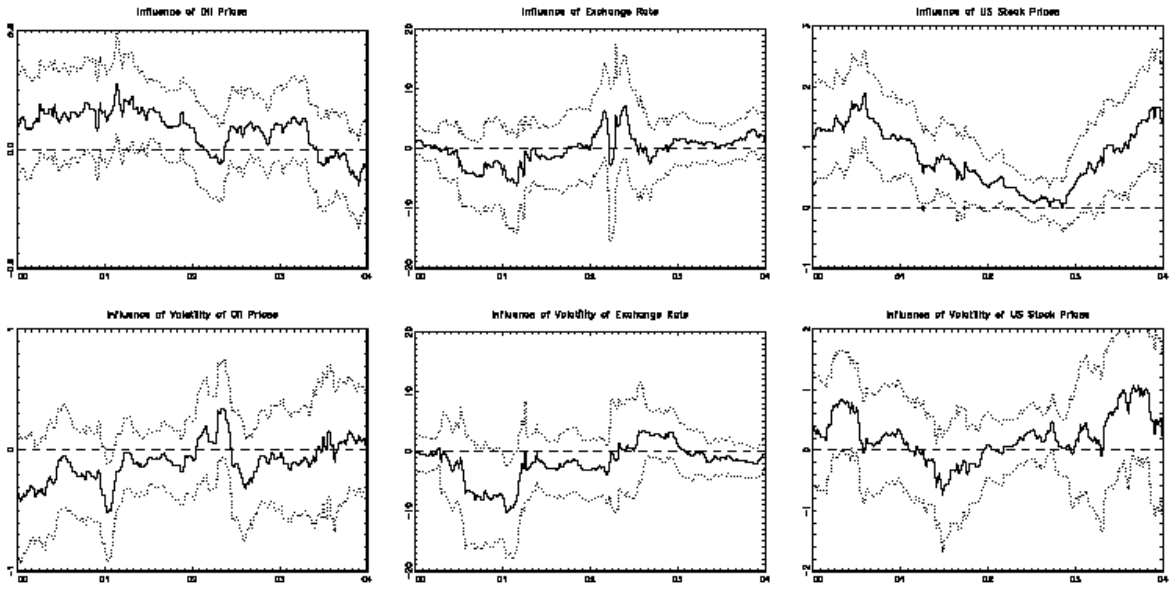
Economists have been getting more and more concerned with possible structural instabilities in economic relationships which may invalidate conclusions obtained using conventional econometric tools. Most models of time series are experiencing structural instability when applied to real life data, and estimation and inference without acknowledging this fact leads to unreliable results. Old Chow-type tests for structural breaks are now considered unacceptable as they presume knowledge of the timing of structural breaks. Since then, a great deal of progress has been achieved in the theory of identifying, estimation and testing of structural breaks when a number of breaks and their timing are unknown (e.g., Bai and Perron, 1998; 2003). The applied economists eagerly brought these theories into practice (e.g., Papell, Murray and Ghiblawi, 2000; Rapach and Wohar, 2004, among others). For example, below are the pictures of application of the Bai and Perron methodology to unemployment series in four countries (taken from Papell, Murray and Ghiblawi, 2000).



One can see that the (least squares) procedure identifies 2 structural breaks in unemployment series of the UK, US and Spain, and only one break in Sweden.

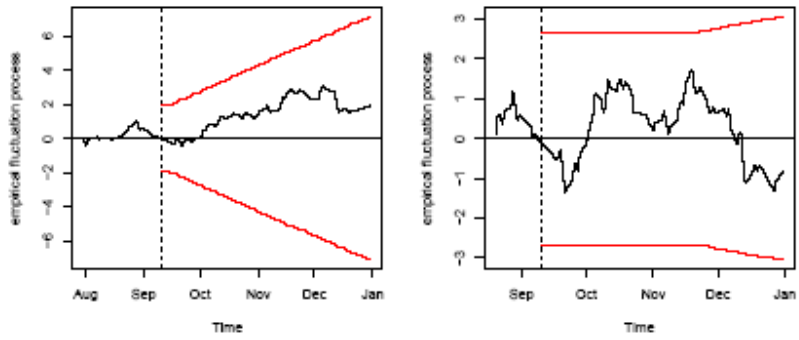
Now, the mentioned methods for identification of structural changes presume that these changes are abrupt, and that between successive breaks there are periods of full structural stability. This may not be true in reality even in mature markets, to say nothing of developing ones, like financial markets in post-communist countries. The variables there presumably undergo continuous structural changes. Hence, the tools for analyzing such changes should be different. Users of the *Econometric Views* are familiar with CUSUM-type graphs where some measures, like regression coefficients, are tracked in time. For example, below are the pictures of application of regression analysis inside a rolling one-year window made for Russian stock returns taken from Anatolyev (2005b).



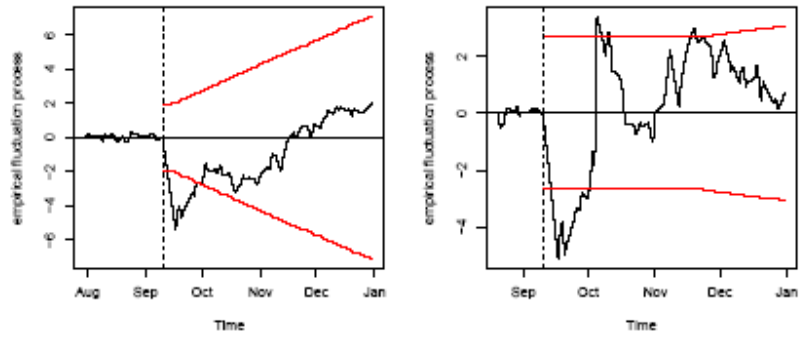
The varying character of regression coefficients is apparent.

More than a decade ago, econometricians revived old CUSUM-type fluctuation tests that allowed one to track structural shifts in model parameters in time in order to detect deviations from constancy (e.g., Ploberger, Krämer and Kontrus, 1989). More recently, there has been a new burst of interest to developing sequential tools for practitioners who make decisions in real time. These tools are called *monitoring*; see Chu, Stinchcombe, and White (1996) for coefficient constancy, and Inoue and Rossi (2005) and Anatolyev (2005a) for hypothesis

testing. These tools allow a researcher to see if the new data that have come, say, today, obey the same relationship as before. For example, below are the pictures of application of monitoring tools to two American stock returns after the 9/11 terrorist attack taken from Zeileis, Leisch, Kleiber, and Hornik (2004).



This stock (Lucent Technologies) does not exhibit structural change



This stock (Delta Air Lines) does exhibit structural change

Whether there has been a structural change or not is judged by whether the empirical trajectory went outside the confidence band or stayed inside. *Retrospection* refers to similar tools applied to a historical sample, without additional data coming.

Students with an interest in applied time series econometrics are invited to participate in this project. Those who would like to work on empirical research with real financial data are especially welcome, but there is also place for those who are more interested in econometric theory. The target is producing a high-quality research publishable in good western economic journals (several articles authored by the leader and students in previous years' projects have been already published).

Below are some possible topics for students' work. Each topic may be more applied or more theoretical, to a student's taste.

(1) The paper by Anatolyev (2005b) contains an analysis of stability of the Russian stock market during 1995-2004. Other financial markets call for similar investigation, both in Russia (e.g., Russian exchange rate market) and abroad (e.g., Chinese stock market).

(2) We have a database of transactions data at the Moscow Interbank Curency Exchange for the period from the year 1999 to the year 2002, as well as some data on tradings of IBM and Alcatel stocks. Other data (e.g., for the Russian trading Syetem) may also be obtained. There has appeared literature on parametric analysis of such ultra-high frequency data (e.g., Engle, 2000). There are applications of testing for structural breaks in this context, but it is interesting to also apply the monitoring methodology

(3) Most of empirical finance literature is developed under the presumption of the symmetric quadratic loss function even though it is acknowledged that this loss function is rarely relevant in the world of finance (e.g., see Christoffersen and Diebold 1997). It is interesting to think of the testing for structural breaks and modifying the monitoring methodology in the context of asymmetric (e.g., linear exponential) loss.

(4) It is interesting to investigate the power of tests for structural breaks when the structural changes are occurring gradually rather than being abrupt, which is more realistic. There is some literature on the power when the data are generated by various regime switching models (Carrasco, 2002), but not by gradual structural changes.

(5) An example of retrospective and monitoring nonparametric tests for time-series predictability is given in Anatolyev (2005a), but it represents a special class of nonparametric tests. It is also interesting to look at nonparametric estimation and adapt the retrospective and monitoring tools for nonparametric models. The spheres of application may be various financial series.

(6) Developing monitoring tools panel data models, when a panel is long. The spheres of application may be various micro and financial series.

Of course, a student may approach the project leader with own ideas.

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