Do we need time series econometrics

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Abstract

Whether or not there is a need for the unit roots and cointegration based time series econometric methods is a methodological issue. An alternative is the econometrics of the London School of Economics (LSE) and Hendry approach based on the simpler classical methods of estimation. This is known as the general to specific method (GETS). Like all other methodological issues it is difficult to resolve which approach is better. However, we think that GETS is conceptually simpler and very useful in applied work.

Keywords: GETS, Cointegration, Box-Jenkins's Equations, Hendry, Granger.

JEL: B40, B41 and B49

1. Introduction

It is unusual to start a short paper with quotations. However, to explain the essence of this paper it is necessary to note the views of two leading econometricians viz., Professor David Hendry and Nobel Laureate Professor Clive Granger. Hendry is a well-known proponent of the econometric methodology of the London School of Economics (LSE) known as the general to specific approach (GETS). He said that " I actually thought cointegration was so blindingly obvious that it was not even worth formalizing it. ….[However,] I still think…. it [cointegration] is completely trivial but it is very, very interesting because….[when] the things that …. are [in] equilibria [imply]….. (a) they are the targets agents are trying to achieve and (b) when they get there they will stay there and when they are not there they will try to move there"; Hendry (2000, p.241). Granger, commenting on GETS, said that "The LSE methodology is a mid-point between the classical econometrics strategy, *with a heavy dependence on economic theory*, and the theoretical pure time series techniques ….. [which] extend the Box-Jenkins approach, such as VAR. Economic theory is used to suggest an initial specification, but then the data are allowed to speak in the process of considering alternative specifications and in the eventual evaluation."; Granger (1990, p.279), my italics.[1]

Given these observations why do economists heavily tilt towards the time series econometric methods and spurn the established and simpler classical methods of estimation? Disregarding trivial merits like an opportunity to decorate papers with impressive mathematical symbols, applied economists do not seem to remember Smith's (2000) three important stages in research, of which the very first one is *purpose*.[2] For our arguments in this paper a distinction between the purpose of testing economic theories and developing models for forecasting is necessary although in practice a mixture of both purposes prevail.

[1] The originals are a longer and the reader is requested to refer to the reference to get the full flavour.

[2] The other two are: summarising observed facts (data analysis) and interpretation.

2. Testing Theories and Generating Forecasts

The atheoretical Box-Jenkins equations are good examples of research where the main purpose or objective is to make forecasts with improved accuracy. Box-Jenkins equations are attractive because forecasting accuracy can be achieved by regressing a variable on its own lagged values. On the other hand testing the quantity theory or the purchasing power parity (PPP) theory or the convergence principle of the Solow model of growth etc., are examples of research with the main objective of testing the validity of theories. The Engle-Granger time series methods can be seen as an intermediate method of extending the Box-Jenkins's atheoretical pure time series methods by adding the theoretical information to further improve the accuracy of forecasts.[3] It is hard to admit that the cointegration methods are superior for testing economic theories than GETS. This is so because in spite of their different starting points, cointegration and GETS are indistinguishable from each other and seem to be observationally equivalent. Therefore, Hendry is justified in saying that "cointegration was so blindingly obvious that it was not even worth formalizing it." Yet, in much of the applied work, the bulk of which is actually on testing theories and not necessarily to generate accurate forecasts, cointegration methods are widely used.

As an example consider this. It can be said that from the medium to long run perspectives, central banks are more interested in understanding by how much the nominal money supply should be increased to maintain stability of economic activity and in particular stability of inflation. They are seldom interested in knowing what should be the increase in money supply every week or month. If they need accuracy in inflation forecasts, they may perhaps use the Box-Jenkins equations and these may do a good job as those based on the cointegration methodology. Therefore, for policy

[3] Although this is the purpose we are not aware of any evidence that equations based on the cointegration methodology, known as VECM (vector error correction models), can forecast better than the simple Box-Jenkins equations.

formulation both accurate forecasts and the validity of the theory underlying policy are equally important.

3. GETS and Cointegration

A drawback of economic theories is that they are essentially equilibrium relationships between variables often in their levels. Theory seldom gives much information about the dynamic adjustments of the variables during the transition period between two equilibrium states and how long is the transition process in the real calendar time. However, the data used to test the theories are hardly generated by an equilibrium world. Therefore, there is a methodological problem with using data generated from a disequilibrium world to test equilibrium theories. And this is the starting point for the development of GETS.

Economists and econometricians at the LSE took a pragmatic view, mostly under the influence of Popper's methodology, that dynamics is an empirical issue to be determined by data and some theoretical insights. They discarded the then popular partial adjustment based dynamics as inadequate and extended the Phillips (Phillips curve fame) error correction model, with its negative feedback effects. A variables changes in the current period due to two main reasons. Firstly, the variable may not have fully adjusted in the previous period to its equilibrium value, which in turn is determined by the theory underling the variable of interest. Therefore, the variables changes in the current period at least partly to close the gap between its actual and equilibrium values. As an example consider the simple theory of the demand for real narrow money (m). Theory says that it depends positively on real income and negatively on the nominal rate of interest. Although theory does not say what equation form should be used to specify this relationship, it is a common practice to use the following:

$$\ln(m^*) = \alpha + \beta \ln(y) - \gamma i \qquad (1)$$

where m = real money, y = real income and i = is the nominal rate of interest, usually the rate of interest paid on time deposits. The superscript asterisk denotes that the variable is the equilibrium value. Therefore, the aforesaid first adjustment can be formulated as:

$$\Delta \ln m_t = -\lambda\left[\ln m_{t-1} - (\alpha + \beta \ln y_{t-1} - \gamma i_{t-1})\right] \qquad (2)$$

Note that if the actual value of money in the previous period exceeds its equilibrium value in the previous period, then it should decrease (in the current period) to move closer to its equilibrium value. That is if the term in the square brackets is positive, the change on the left hand side should be negative. That is why the sign of λ (adjustment coefficient) is negative and this is known as the negative feedback adjustment or simply error correction mechanism (ECM).

Secondly, real demand for money in the current period may also change due to changes in the explanatory variables i.e., y and i in the current and past periods. Therefore, (2) may be specified in a more general form as follows:

$$\Delta \ln m_t = -\lambda\left[\ln m_{t-1} - (\alpha + \beta \ln y_{t-1} - \gamma i_{t-1})\right] + \sum_{i=0}^{n1} \varphi_i \Delta \ln y_{t-i} + \sum_{i=0}^{n2} \varpi_i \Delta i_{t-i} + + \sum_{i=i}^{n3} \psi_i \Delta \ln m_{t-i} \qquad (3)$$

Note that the changes in the lagged dependent variable are added to (3) to give a very general dynamic specification to the adjustment process. This is known as the general unrestricted (dynamic) model (GUM).

Equation (3) can be estimated with the classical methods. The instrumental variables method can be also used to minimize any endogenous variable bias. The insignificant lagged changes in the variables can be deleted. PcGETS and now PcGIVE of Hendry and Krolzig (2001, 2005) have routines to quickly determine the significant lagged changes in the variables. Deleting the insignificant changes in the variables gives a

parsimonious version of the dynamic adjustment equation. It can be used to test the (equilibrium) theory by analysing the estimated parameters of the expression in ECM. It can also be used to make forecasts, but testing theories is its main strength.

So, what is wrong with this approach to test theories and probably also use it for forecasting? Although the time series based cointegration approach is very similar, it has shown that if the variables are non-stationary in their levels their means and variances violate the classical assumptions that they are constant. Therefore, the estimated standard errors with the classical methods are spurious and unreliable. It is necessary to transform such non-stationary variables into stationary variables by differencing and at the same time estimate the models without ignoring the theoretical information on their levels. Time series methods have been developed for this purpose. In the first stage these methods estimate efficiently the coefficients of the variables in the ECM term in (2) and this is the cointegrating equation. The short run dynamic adjustment equation is estimated in the second stage, in the same way as in GETS. In contrast to this approach, the coefficients of the cointegrating equation and the dynamic adjustment are estimated in GETS in one step by estimating (3) in one step.

The above similarities between these two methods have been ignored by many critiques of GETS, who in spite of repeated clarifications by Hendry, argued that the level variables in the ECM are non-stationary and therefore classical methods of estimation are inappropriate. For a long time the fact that GETS can also be made consistent with cointegration has been ignored. Hendry repeatedly stated that if the underlying economic theory is correct, the combination of variables in the ECM must be stationary. Conceptually this is similar to the example of a drunken farmer and his dog to explain the concept of cointegration. In our example of the demand for money, output and the rate of interest are the drunken farmer and demand for money is the dog. If theory is correct they should move closely. Therefore, the order of the variables on both sides of (2) is balanced and consistent with cointegration and the time series methods. Ericsson and McKinnon (2002) have developed a test, perhaps

belatedly, to test for cointegration in GETS. However, by then cointegration and time series econometrics have become enormously popular and GETS did not receive its due recognition.

In much of our applied work at the University of the South Pacific (Fiji) we have extensively used GETS as well as the standard time series and cointegration techniques.[4] Nowhere had we found that GETS performed worse than the time series methods.

4. **Conclusions**

This paper briefly stated the story and methodology behind GETS and the cointegration techniques. We took a methodological view that both these techniques are observationally equivalent but GETS based on the classical methods is simpler to use and well suited for the purpose of testing theories. However, like in all such methodological controversies, it is difficult to assert without any reservations that only one particular methodology is the best. Whether the entirely atheoretical Box-Jenkins equations, or GETS or the cointegration based time series techniques or their variants give the best forecasts is something not yet well explored. This is an area worth examining further with real world data. But we can be fairly confident and claim that if the main purpose of a researcher is testing theories for policy formulation, the simpler GETS seems to be second to none.

[4] At the time of writing this paper the first author was professor of economics at the University of the South Pacific (USP) and he has extensively used GETS in his time series courses. The third author was a graduate student at the USP.

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