

# Time Series Econometrics: A Critique

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## Abstract

**This is a critical note regarding the currently established econometrics of time series. The criticism involves commonly practiced mechanistic modeling and testing of relationships, taking econometrics away from economics. Among others, modeling economic trends as simple functions of time is extremely naive and testing for cointegration lacks a proper economic foundation.**

## Keywords

**Time Series Econometrics, Trends, Cointegration**

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## 1. Introduction

Estimation and testing of economic models date back to the early days of econometrics, most prominently with the introduction of the famous [1] Cobb-Douglas production function, in 1928. Subsequent development of econometric methods was mostly carried out in the papers and monographs of Cowles Commission in the 1940's and 1950's. The specific nature of dealing with the time series data was taken into account by considering efficient estimation of the coefficients of the model and the serial correlation of the error term [2] (Malinvaud, 1991).

Further extension of time series modeling and estimation came about through a large and influential body of literature in the area of distributed lag analysis. The aim of the distributed lag models was to track the influence of the past on the present. With a few exceptions, none of these methods were derived from economic considerations of moving from one equilibrium to another. With the onset of the "time series revolution" discussed below, distributed lags all but disappeared from the literature.

None of the large number of macro econometric models published following Klein [3] (1950) paid any attention to the dynamics of the essentially static models. The end came with the article by Sims [4] (1980) in which economic theorizing was replaced by current and lagged values of all the variables involved in the so-called VAR modeling.

As well as the VAR models, the simultaneous equation models were also replaced by the “dynamic stochastic general equilibrium” (DSGE) models, in which the dynamic nature of economic systems is better represented. In all of the econometric methodology developed up until then, time series analysis was always done within the context of “econometrics”. The arrival of what has become known as the “time series econometric revolution” led to the subcategorization of econometrics, as such. The revolution was triggered by [5] Engle and Granger’s article (1987) and was “sanctified” by the Nobel prize to the authors in 2003.

The award for time series econometrics is of some importance not only because of its timeliness but also because of its acknowledgement—and approval—of the revolutionary impact of time-series econometrics on macro-econometric research. This revolution is based on the contention—not rejected by statistical tests—that many economic variables have infinite variances, that is, that they grow without limit in time, and that observed relationships among such variables may be purely fictitious. The consoling fact, according to the time-series econometricians, is that while the variables themselves have infinite variances, their linear combination or combinations may well have variances that are finite.

## 2. Discussion

The above-mentioned “discoveries” have had a profound effect on macro-econometric research. On one hand the “growth-without-limit” nature of economic time series has led to modeling the long term movements of these series as simple functions of time plus a random disturbance, and to the concentration of attention on the fluctuations around the time trend. On the other hand, the variables with infinite variances can be transformed to become stationary (integrated) by differencing over time. We can test for the existence of a stable relationship among them. This is known as cointegration. These cointegrated relationships are then to be explained by economic theory. This is in contrast to the traditional deductive approach in which theory comes first and is followed by testing.

The practical and revolutionary impact of the new time series econometrics has been the almost complete abandonment of the simultaneous equation models that describe economies or markets as a system of economic relationships. All that seems to have survived are the vector autoregressive models (VAR) and the method of instrumental variable estimation (IVE). The VAR modeling postulates that the current value of each economic variable is a function of its own lagged values and of the lagged values of all other variables under investigation. The IVE method is a relatively simple method of single-equation estimation when some of the right-hand side explanatory variables are suspected of being endogenously determined.

Judging from the number of citations credited to Engle and Granger, and by the profound influence of their work, the award of the Nobel Prize was well deserved. However, when it comes to the value of the time series econometrics for the advancement of economics, some serious questions arise. It is reasonably clear that the time-series approach to macro-econometric research, with its tendency toward mechanistic modeling, is shifting econometrics away from economics. This betrays the presumably still existing aim of the Econometric Society “to advance economics in relation to mathematics and statistics”.

Another very important aspect of time series econometrics is the modeling of trends as simple functions of time and a stochastic disturbance. It certainly seems very strange that all a professionally trained economist can say about the long run movement of GDP is that it moves with time except for random fluctuations around the time trend. Gone is all that one has learned about the GDP consisting of consumption, investment, and other ingredients for which we have well developed theories. The point is well made by [6] White and Granger 2011, who urge that “(w)henever possible, we recommend attempting to relate apparent trends to appropriate underlying phenomena, whether economic, demographic, political, legal, technological or physical.” And as for the finding that certain economic variables move together in a stable relationship, isn’t it a primary function of an economist to find out not only what is happening, but why it is happening? And not only that, but in the case of more than two variables moving together, there generally exists more than one stable relationship, which then leads to a search for their interpretation. This is in clear contrast with the standard deductive approach in which theories lead to relationships to be tested by observations instead of looking for theories to explain what we happen to observe!

There is also some serious problem in the way that time series analysis is presented in text books and in applied research. The standard approach to teaching time series analysis ignores completely the classical econometrics the basic foundation of which is the regression model. A logical way would be to explain which assumptions of

the classical regression model are likely to be violated when dealing with non stationary economic time series data. This would then be followed by discussion of the undesirable consequences of this on the properties of the least squares estimators and what to do about it. As it is, there is a complete disassociation between classical econometrics and time series econometrics. A lack of connection between time series analysis and economics as such is even more remarkable. The standard explanation of the long-run path of any economic variable as being purely determined by the passage of time plus a stochastic disturbance, with no reference to economic factors, is “primitive beyond words” [7] (Kmenta, 2009).

### 3. Conclusion

The above critique raises the question as to why such movement away from traditional econometrics has been so readily embraced by researchers and sanctified by the Nobel Prize Committee. In my opinion the explanation lies in that while economics has been quite successful in specifying equilibrium relationships among economic variables, there has been little success in—and not much attention given to—explaining the movements from one equilibrium to another. In other words, the dynamics of economic relationships has been given a minor role in the economic research agenda, and it is precisely the dynamics of variables that the time series analysts specialize in. The critique of the time series econometrics is based on its attention to dynamics at the expense of economics! If, however, the Nobel Prize award should serve as a wake-up call to economists to explain dynamic movements by theories of adjustment costs, decision making under uncertainty, etc., then the whole profession will at the end benefit. But this would inevitably mean a merger of economics and econometrics, something that in my opinion has long been overdue!

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