



ELSEVIER

Journal of Econometrics 100 (2001) 29–32

---

---

JOURNAL OF  
Econometrics

---

---

[www.elsevier.nl/locate/econbase](http://www.elsevier.nl/locate/econbase)

Essays

## Macro-econometrics

James H. Stock\*

*Kennedy School of Government, Harvard University, Cambridge, MA 02138, USA*

Shortly after World War II, many of the leading econometricians collaborated under the aegis of the Cowles Commission and, over the course of a few years, developed a research agenda that structured macroeconometrics for the second half of the 20th century. The central vision of this research program was simple: the development of a mathematical model of the macroeconomy with grounding in economic theory, with parameters estimated using sound statistical methods, tested against and thus consistent with empirical evidence. The resulting macroeconomic model should be useful for testing economic theories, for macroeconomic forecasting, as for advising policymakers.

This vision provides a useful backdrop against which to assess the achievements of macroeconometrics over the past half century and the challenges remaining. Where have we succeeded within this research program? How has the original vision been extended and modified? And what challenges remain? I address these questions in the context of four topics within macroeconomics that have seen significant research efforts which produced durable advances. These remarks should be interpreted as affirming the importance of the research area even as they highlight what I consider to be important weaknesses that need to be resolved by further research.

*IV methods.* An essential part of the Cowles research program was the development of econometric tools for reliable and statistically efficient inference about relationships among economic variables. Central among these tools was the recently invented method of instrumental variables (IV) regression. Steady work by leading macroeconometricians over the subsequent decades have extended these methods far beyond the linear models with i.i.d. Gaussian

---

\* Tel.: + 1-617-4960502.

*E-mail address:* [james\\_stock@harvard.edu](mailto:james_stock@harvard.edu) (J.H. Stock).

disturbances originally analyzed. The modern descendant of IV methods, generalized method of moments (GMM), permits the estimation of nonlinear models with non-Gaussian disturbances with various departures from the classical assumptions. Even in linear settings with serially uncorrelated disturbances, GMM permits relaxing the classic homoscedasticity assumption. The associated methods for estimation of heteroscedasticity and autocorrelation consistent variance–covariance matrices allows applied econometricians to escape the entanglements of generalized least squares. Rapid progress is being made on efficient GMM estimation in increasingly complicated settings, for example with large number of instruments.

Despite these advances, important problems remain unresolved. Exact distribution theory, already difficult in the linear/Gaussian model, is unavailable for GMM under general conditions. Thus most results for GMM rely on first-order asymptotics. However, Monte Carlo studies show that, in many settings, first-order asymptotic theory provides poor approximations to the finite sample distribution, and thus provides a poor basis for inference in applications. These issues are fairly well defined and there are reasons to be optimistic that econometricians can provide improved methods for inference in GMM in typical econometric applications.

*Regression with persistent time series.* Although the early econometricians were also aware that special methods needed to be developed for analyzing time series with strong dependence or trends, the relevant econometric theory largely has been developed relatively recently, over the past two decades. Here, too, econometricians and mathematical statisticians have made great progress. The leading examples are the now well-developed theories of regression with data containing stochastic trends (unit autoregressive roots) and the associated theory of cointegration. Fractional integration provides an alternative approach to strong dependence and is a topic of active theoretical research.

Although we have made tremendous strides, some of the early hopes for reliable inference when time series are persistent have yet to be realized. An obvious problem is the very poor finite sample performance of tests for cointegration (either the null of noncointegration or of cointegration) found in Monte Carlo studies; test with better finite sample size and power are needed. More fundamentally, it is now understood that the theory of efficient inference for cointegrating parameters relies delicately on the assumption of exact unit roots, and that deviations from this assumption that are only detectable with low probability, even asymptotically, can wreck havoc with tests of cointegrating coefficients. Similarly, there are tensions between modeling series as having breaks and/or broken trends (another area of rapid recent development) and having purely stochastic trends. We still need methods which are robust to the particulars of how and why a series is persistent.

*Macroeconomic modeling using a minimum of identifying assumptions.* Perhaps the most notable divergence from the original Cowles vision has been the recognition that the classical simultaneous equations approach to identification often entailed identifying restrictions that were not credible, especially once one recognizes forward looking behavior. This raises the question of whether one can develop policy models using a drastically reduced set of identifying restrictions.

Structural vector autoregressions (VARs) are the leading answer to this question. Whether the vast literature on VARs has generated any useful models is a matter of heated debate. For example, leading contemporary structural VARs, each designed to estimate the effect of monetary policy on output and inflation, produce time series of estimated monetary policy shocks that are essentially uncorrelated with each other. Whether this means that VARs are plagued by intractable identification problems of their own or this is simply an embarrassment, work remains.

*Economic forecasting.* Another useful divergence from the original Cowles vision has been the separation of economic forecasting from structural estimation and economic policy analysis. In addition to the obvious practical advantages, this can be justified theoretically by realizing that the forecasts arising from a structural model are just a function of current and past data; if this function can be estimated consistently without reference to the underlying theoretical model, then the resulting forecasts will have the same forecast error variance, to first-order asymptotically, as if this function were known.

Although economic forecasting is a major activity of nonacademic economists, until recently it has been largely neglected by academic econometricians. One of the more interesting puzzles in this area is the apparent failure of nonlinear models to provide reliable frameworks for macroeconomic forecasting: modern macroeconomic theories emphasize all sorts of fundamental nonlinearities in decision rules and objectives, but simple linear models typically outperform non-linear time-series models, whether parametric or nonparametric, in out of sample forecasting comparisons. A second challenge is forecasting using large data sets: can forecasts be improved by exploiting information in the vast number of time series now available in real time?

This brief review indicates that we have made tremendous strides on many parts of the original Cowles research program. Yet the ultimate objective of those early econometricians – a reliable model of the macroeconomy – seems as distant as it did fifty years ago. By this standard it is hard to escape the conclusion that macroeconometricians have failed. If engineers put a man on the moon in 10 years, should not econometricians have built a credible model of the U.S. economy in 50?

Perhaps not. We now know that the models originally envisioned by the early econometricians were unsatisfactory simplifications in many ways; at least, the NASA engineers knew the equations of motion governing their

rockets. Economic institutions change, investors make decisions in part rationally but in part in ways that still defy formal modeling, union negotiators look to the future when bargaining for wages, and technology evolves relentlessly. Maybe the early econometricians overreached: maybe the workings of the economy are too subtle and evolve too rapidly to be divined statistically.

But if we jettison this vision (as it appears many macroeconometricians already have, of their choice of research topics is an indication), what is left of macroeconometrics? Arguably, much. Economic forecasting, freed of the taint of being atheoretical, can proceed towards its efficiency bound. Economic theories can still be tested (we have learned much about the intertemporal consumption capital asset pricing model). Absent a compelling model, the future of macroeconomic policy advice is less promising. A provocative question is whether it is possible to develop a compelling framework for atheoretical macroeconomic policy analysis; some, myself included, believe that the best of the natural experiments literature holds promise for doing so in the context of microeconomic policy analysis. There have been some attempts to perform macroeconomic policy analysis with minimal theory, for example, the only “theory” being that monetary authorities use all available information when they set monetary policy. Still, however intriguing intellectually, atheoretic macroeconomic policy analysis faces significant conceptual and practical hurdles (e.g. the absence of compelling natural experiments). For policy analysis, at least, it seems premature to abandon the original Cowles Commission quest.