This Week's Citation Classic

Economists traditionally modeled the long-term growth path of the economy as a deterministic exponential trend. This paper introduced evidence that the trend is stochastic, and more importantly that trend shocks are large. This implies that monetary and fiscal shocks cannot fully account for variation in the economy and that real factors which have a permanent impact must play an important role. [The *SSCl®* and the *SCl®* indicate that this paper has been cited in more than 425 publications, making it the most-cited paper published in this journal.]

The Two-Charlies Paper: Is GNP a Random Walk?

Charles R. Nelson
Department of Economics
University of Washington
Seattle, WA 98195

My interest in trends and their misinterpretation goes back to my observation as an adolescent that people are quick to see trends where none exist. Later, economics taught me that long-term growth is determined by highly predictable factors such as population, so GNP can be modeled as a deterministic trend line with deviations from trend interpreted as a "business cycle." If monetary and fiscal policy were appropriately marshaled, they could virtually eliminate these fluctuations.

In statistics I learned about random walks and related processes with unit roots that can exhibit growth but will wander away from any deterministic trend. If economic time series are of this type, then the trend is a stochastic process and a source of variation.[1] when Charles Plosser and I investigated testing for a deterministic vs. stochastic trend we soon found that the distribution theory was nonstandard. Fortunately, Plosser noticed that D.A. Dickey and W.A. Fuller[2] had developed a test for a unit root. Applying it to

historical US GNP, employment, prices, and interest rates, we found that the data were entirely consistent with the hypothesis that the economy is akin to a random walk.

Analysis of the models we obtained implied that shocks to the stochastic trend are at least as large as the shocks to the cycle, a dramatic reversal of the traditional view that trend variations are negligible. Evidently, a recession is not Just a temporary decline in the economy but also signals a downward adjustment of the trend. "Real" factors such as labor supply and technological innovation which determine the long run path of the economy must therefore also be important sources of shocks to the economy. Thus, the Fed cannot hope to eliminate fluctuations in the economy simply by eliminating monetary or "nominal" shocks.

Plosser and I were convinced that our work was important, but it was not easy to convince editors and referees. The editor of the *Journal of Political Economy* described the paper "as methodological rather than substantive" in his rejection letter, which was supported by a scathingly negative referee's report. The late Karl Brunner was willing to accept what he called "the two-Charlies paper." To my knowledge the first to cite us were R.M. Stulz and W. Wasserfallen,[3] who showed that the empirical finding was robust across economies and suggested what would now be called a "real business cycle model" to account for it. Certainly our paper added impetus to the developing real business cycle literature.[4] More surprising, at least to me, it stimulated a seemingly endless series of papers on the statistical theory of testing for unit roots.[5] Cointegration is clearly the most important econometric development to be influenced by it.[6] In my mind, the most important impact of the paper is that macroeconomists have started to think more about the long-run impact of technology and other real shocks to the economy.

1. **Beveridge S & Nelson C.** A new approach to decomposition of economic time series into pennanent and transitory components with particular attention to measurement of the business cycle. J. *Monetary Econ.* 7:151-74, 1981. (Cited 105 times.)
2. **Dickey D A & Fuller W** A. Distribution of the estimators for autoregressive time series with a unit root. *J. Amer. Statist. Assn.* 74:427-31, 1979. (Cited 420 times.)
3. **Stulz R M & Wasserfallen** W. Macroeconomic time-series, business cycles and macroeconomic policies. *Carnegie-Rochester Conf. Ser. Pub. Pot.* 22:9-54, 1985. (Cited 35 times.)
4. **Plosser** C. Understanding real business cycles. *J. Econ. Perspect.* 3:55-77, 1989.
5. **Campbell J Y & Perron P.** Pitfalls and opportunities: what macroeconomists should know about unit roots. (Blanchard O J & Fischer S. eds.) *NBER macroeconomics annual 1991.* Cambridge. MA: MIT Press, 1991. p. 141-219.
6. **Engle R F & Granger C W J.** Co-integration and error correction: representation, estimation, and testing. *Econometrics* 55:251-76. 1987. (Cited 630 times.) [Sec also: **Engle** R F & **Granger** C W J. Cointegration—the early days.
Citation Classic*. *Current Contents®/Arts &. Humanities* I5(2):22. 18 January 1993. and *Current Contents/Social & Behavioral Sciences* 25(2):8. 11 January 1993.]
Received March 15. 1993