INTRODUCTION

In the Real Business Cycle approach to macroeconomic theory, the business cycle is taken to be driven by exogenous technological shocks. (E.g., see Kydland and Prescott (1982), Prescott (1986).) Solow (1957) showed that an observable measure of exogenous technological shocks is provided by the difference between the rate of growth of output and the share-weighted growth rates of the inputs to production if there are constant returns to scale, all input factors are fully variable, and there is perfect competition in the product and factor markets.

Thus, letting $y_t$ denote aggregate real output, this observable measure of technological shocks – the so-called “Solow residual” – is given by $z_t$ in

$$ y_t = z_t A L_t^\alpha S_t^{1-\alpha} $$

where $L_t$ is aggregate employment and $S_t$ is a measure of the capital services provided by the aggregate capital stock. Thus, the growth rate in the Solow residual is given by

$$ \Delta \ln(z_t) = \Delta \ln(y_t) - \alpha_t \Delta \ln(L_t) - (1 - \alpha_t) \Delta \ln(S_t) $$

where $\alpha_t$ is labor’s share of total income in period $t$.

DATA AND RESULTS

Real output ($y_t$) is measured as gross national product (GNP) in 1987 dollars from the National Income and Product Accounts, Table 1.10. Aggregate employment ($L_t$) is measured as total hours worked, obtained by multiplying CITIBASE variable LHOURS (manhours worked per week for all workers, all industries) by the number of weeks in a quarter. Following Griliches and Jorgenson (1967) and Burnside, Eichenbaum and Rebelo (1995a,b), capital services ($S_t$) are measured by aggregate electricity usage; this measure allows for time variation in capacity utilization rates.\(^2\)
Aggregate electricity usage is measured by three month average of CITIBASE variable IPCOE, a monthly index of electric utility sales to commercial and other users.\(^3\) \(\Delta \ln(z_t), \Delta \ln(y_t), \Delta \ln(L_t),\) and \(\Delta \ln(S_t)\) are plotted versus time in Figures 10-1, 10-2, 10-3, and 10-4 over a 158 quarter sample period running from the second quarter of 1954 to the third quarter of 1993, or 1954:2 to 1993:3.\(^4\) Nonlinearity test results for these four series are given in Table 10-1.

From the first row of Table 10-1 we see that there is no evidence allowing us to reject the null hypothesis of a linear generating mechanism for the Solow residual. Yet the results in the second row, as in Chapter 9 over a slightly longer sample period, indicate that this null hypothesis of a linear generating mechanism can be rejected at the 2% level for real output. Evidently, this nonlinearity in the real output series is not due to nonlinearity in the generating mechanism for the exogenous technological shocks: we conclude that the important nonlinearities are in the macroeconomy itself.

The results given in the remaining rows of Table 10-1 further localize the source of the nonlinearity in real output: it is in the markets for labor. The pattern of the test results for the hours worked growth rate series is quite unlike any observed in our simulations—apparently it is the Hinich bicovariance test that has the highest power against the nonlinear mechanism generating this series. This suggests that asymmetries showing up in the third moments are an important feature of these data and yields a rather specific stylized fact that any putative generating mechanism for hours worked must be able to reproduce.