# A Bounds Approach to Inference Using the Long Run Multiplier

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# 1 Simulation Results for Figure One

The data used to create Figure 1 were generated from the simulated sampling distribution on the LRM $t$-statistic under the true null hypothesis that there is no long run relationship between $y_t$ and $x_t$ ($\frac{\pi_{yx}}{\pi_{yy}} = 0$). The $x_t$ and $y_t$ series were generated as independent autoregressive processes over a range of degrees of autocorrelation.

$$\begin{aligned} y_t &= \rho_y y_{t-1} + e_{yt} \quad e_{yt} \sim (0,1), \\ x_t &= \rho_x x_{t-1} + e_{xt} \quad e_{xt} \sim (0,1) \end{aligned} \tag{A1}$$

where

$$E(e_{yt}, e_{xt}) = 0 \quad \forall t, s \quad E(e_{yt}, e_{yt-1}) = E(e_{yt}, e_{yt-1}) = 0 \quad \forall s \neq 0.$$

We vary the values of $\rho_X$ and $\rho_Y$ from 0 to 0.90 in increments of 0.10, from 0.90 to 0.99 in increments of 0.01. We also include 0.995, 0.999, and 1.0. We simulated distributions for the LRM $t$-statistic for a single exogenous regressor for sample sizes of $T = \{75, 150, 1000\}$. The sampling distribution was generated using 50,000 replications of the Bewley IV regression where the $t$-statistic on $\psi_0$ gives the LRM.

$$y_t = \phi_0 - \phi_1 \Delta y_t + \psi_0 x_t - \psi_1 \Delta x_t + \mu_t \tag{A2}$$

where $\psi_0 = -\frac{\pi_{yx}}{\pi_{yy}}$, the LRM, $\phi_0 = -\frac{c_0}{\pi_{yy}}$, $\phi_1 = -\frac{\pi_{yy}+1}{\pi_{yy}}$, $\psi_1 = \pi_{yx}$, and $\mu = -\frac{e}{\pi_{yy}}$ in the conditional ECM.

## 2 Univariate Diagnostic Tests: Presidential Success

Table 1: Unit Root and Stationary Tests: Presidential Success, 1953 to 2006 ($T = 54$)

| Test | Presidential Success | President's Party Share | CPG Index | Presidential Approval |
|---|---|---|---|---|
| Dickey-Fuller | | | | |
| $\tau_\tau$ | $-2.39$ | $-3.56^{*}$ | $-2.49$ | $-4.99^{**}$ |
| $\phi_3$ | 3.47 | $6.77^{*}$ | 3.10 | $12.54^{**}$ |
| $\phi_2$ | 2.32 | $4.54^{+}$ | 2.18 | $8.40^{**}$ |
| $\tau_\mu$ | $-2.67^{+}$ | $-3.70^{**}$ | $-2.53$ | $-4.28^{**}$ |
| $\phi_1$ | 3.56 | $6.90^{**}$ | 3.36 | $9.20^{**}$ |
| $\tau$ | $-0.81$ | $-0.41$ | $-2.47^{*}$ | $-0.69$ |
| KPSS | | | | |
| $\tau$, long | $0.12^{+}$ | 0.10 | 0.09 | $0.14^{+}$ |
| $\mu$, long | 0.27 | 0.12 | 0.12 | 0.19 |
| $\tau$, short | $0.14^{+}$ | 0.07 | 0.04 | $0.24^{**}$ |
| $\mu$, short | $0.44^{+}$ | 0.09 | 0.05 | 0.29 |

Note: We present (augmented) Dickey-Fuller (Dickey and Fuller, 1979) test results for the null hypothesis that the series is a unit root ($\tau$) possibly with drift ($\tau_\mu$) and trend ($\tau_\tau$). Also reported are tests of the null hypothesis that the constant, trend, and lagged dependent variable are jointly zero ($\phi_2$), that the trend and lagged dependent variable are jointly zero ($\phi_3$), and that the constant and lagged dependent variable are zero ($\phi_1$). The joint tests can be used to determine the appropriate $\tau$ statistic in a sequential testing framework. The appropriate lag length for the test was selected using the AIC with a maximum of 12 lags. In contrast the KPSS (Kwiatkowski et al., 1992) test is of the null hypothesis that the series is stationary, possibly around a trend ($\tau$) or alternatively a mean ($\mu$). We present test results for both a long and short lag truncation. $** \ p < .01$, $* \ p < .05$, $+ \ p < .10$.

# References


Dickey, D. A. and W. A. Fuller (1979). Distribution of the estimatorsfor autoregressive time series with a unit root. *Journal of the American Statistical Association 74*, 427–431.

Kwiatkowski, D., P. Phillips, P. Schmidt, and Y. Shin (1992, October). Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics 54*, 159–78.