ON THE SOURCES OF THE GREAT MODERATION

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MAIN POINTS

1. Volatility of output, hours, and labor productivity declined dramatically since mid 80s
   - volatility of hours and labor productivity has risen *relative* to volatility of output
2. Significant change in correlation structure.
   - Correlation of hours and productivity from 0 to (-)
   - Correlation of output and labor productivity (+) to 0
3. Sharp fall in contribution of non-technology shocks to variance of output.
4. Structural Answers:
   - Interest-rate rule favoring inflation stabilization
   - End of short-run increasing returns to labor (SRIRL)

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Table 3. Changes in Cross-Correlations

First-Difference	*pre-84*	*post-84*	*change*
Output, Hours	0.78	0.57	-0.20^{**} (0.08)
Hours, Productivity	0.18	-0.41	-0.59^{**} (0.10)
Output, Productivity	0.75	0.50	-0.24^{**} (0.11)
BP-Filter	*pre-84*	*post-84*	*change*
Output, Hours	0.87	0.84	-0.03 (NA)
Hours, Productivity	0.16	-0.42	-0.59^{**} (0.14)
Output, Productivity	0.62	0.12	-0.49^{**} (0.16)

Evidence Against “Strong Form” of Good Luck Hypothesis

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$$X_t = D(L)\epsilon_t, \qquad Y_t = F(L)\epsilon_t$$

where $D(L) = d_0 + d_1 L + d_2 L^2 + \cdots$

$$\text{Cov}(X_t, Y_t) = \frac{\sigma_\epsilon^2}{2\pi i} \oint F(z) D(z^{-1}) \frac{dz}{z}$$

$$\text{Var}(X_t) = \frac{\sigma_\epsilon^2}{2\pi i} \oint D(z) D(z^{-1}) \frac{dz}{z}$$

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THEORETICAL EXPLANATIONS

1. Monetary Policy [Clarida et al. (2000)]

2. Inventory Management [Kahn et al. (2002)]

3. Financial Innovation [Dynan et al. (2006)]

4. Gali and Gambetti focus on monetary policy and returns to labor.

STYLIZED MODEL

"Suggestive" and "Simple" New Keynesian Model

$$y_t = E_t(y_{t+1}) - (i_t - E_t(\pi_{t+1})) + d_t \quad (4)$$
$$\pi_t = \beta E_t(\pi_{t+1}) + \kappa(y_t - a_t) \quad (5)$$
$$i_t = \phi_\pi \pi_t + \phi_y \Delta y_t \quad (6)$$
$$y_t = a_t + \gamma n_t \quad (7)$$

y_t is log output
n_t is log hours
i_t is short-term nominal rate
π_t is inflation
d_t is exogenous demand shock
a_t is exogenous technology shock

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(7) Reduced form aggregate production ($\gamma > 1$ implies SRIRL)
Δa_t and d_t assumed to be AR(1)

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To what extent can the (relatively small) changes in the three structural parameters (γ, ϕ_π, ϕ_y) account for the variation in estimated second moments between the pre-1984 and post-1984 periods?

Simple Sensitivity Analysis

1. **Can pure good luck account for almost all of the reduction in volatility of output?**

2.

3.

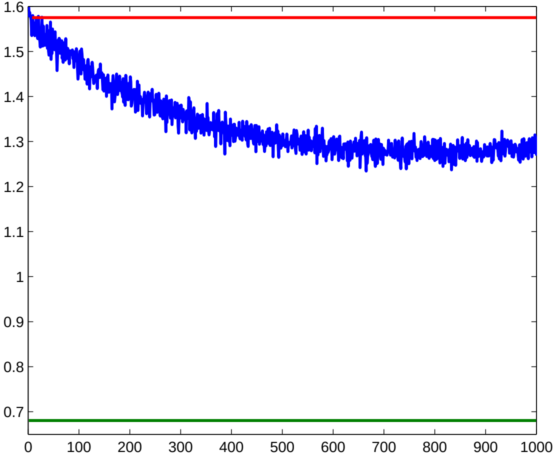
GOOD-POLICY CALIBRATION

Permanent Parameters
$\beta = 0.99$, $\kappa = 0.34$, $\rho_a = 0.1$, $\rho_d = 0.5$

Varying Parameters
Pre-84 $\gamma = 1.1$, $\phi_\pi = 1.01$, $\phi_y = 0.25$
Post-84 $\gamma = 0.9$, $\phi_\pi = 2.0$, $\phi_y = 0.1$

Calibration
Find σ_a, σ_d to match
1. Pre-84 Unconditional Volatility of Output Growth (1.57)
2. Pre-84 Conditional Volatilities of Output Growth (1.14 / 0.52)

Fig 1: Standard Deviation of Output



$\gamma = 1.1$, ϕ_y = linspace(0.25, 0.1), ϕ_π = linspace(1.01, 2)

GOOD-LUCK CALIBRATION

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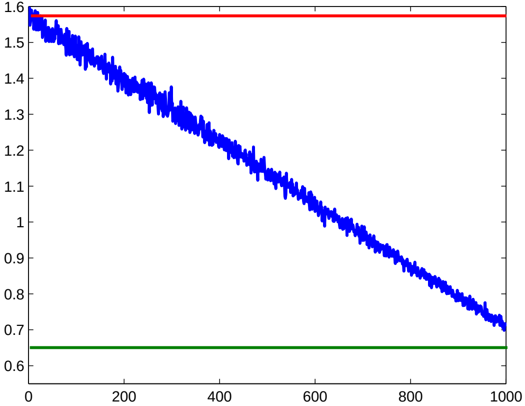
Calibration

Find σ_a, σ_d to match

1a. Pre-84 Unconditional Volatility of Output Growth (1.57)
2a. Pre-84 Conditional Volatilities of Output Growth (1.14 / 0.52)
1b. Post-84 Unconditional Volatility of Output Growth (1.10)
2b. Post-84 Conditional Volatilities of Output Growth (0.62/ 0.54)

Vary σ_a and σ_d but keep pre-84 policy parameters.

Fig 2: Standard Deviation of Output



σ_a = linspace(1.81, 0.73), σ_d = linspace(0.77, 0.48)

Assume Pre-84 Policy Rule

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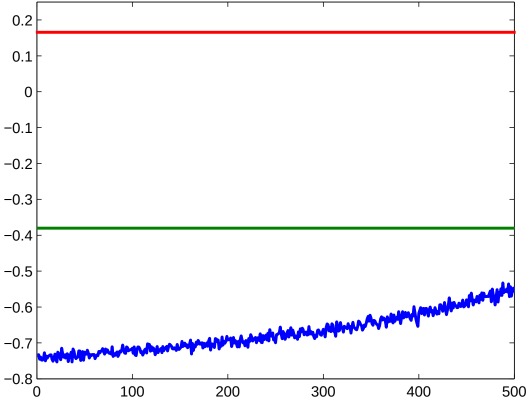
Fig 3: Cross-Correlation of Hours and Productivity



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Simple Sensitivity Analysis

1. Can pure good luck account for almost all of the reduction in volatility of output?

   Yes, but what about other moments?

2.

3.

Simple Sensitivity Analysis

1. Can pure good luck account for almost all of the reduction in volatility of output?

2. **How to interpret change in SRIRL?**

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CALIBRATION

Permanent Parameters

$\beta = 0.99$, $\kappa = 0.34$, $\rho_a = 0.1$, $\rho_d = 0.5$

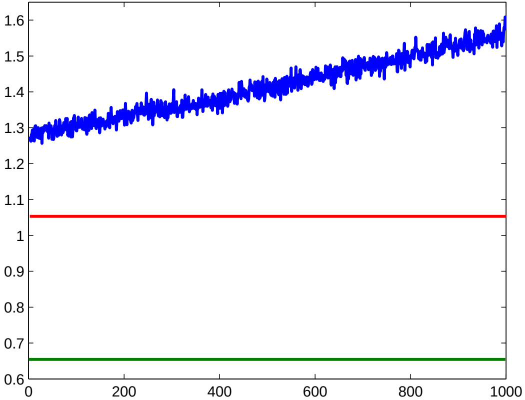
Calibration

Pre-84 Policy Rules $\phi_\pi = 1.01$, $\phi_y = 0.25$

Find σ_a, σ_d to match

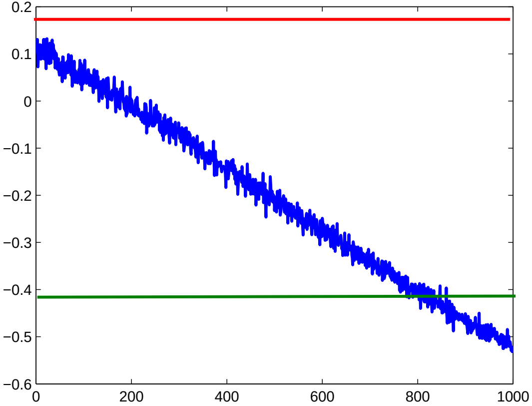
1. Pre-84 Unconditional Volatility of Output Growth (1.57)
2. Pre-84 Conditional Volatilities of Output Growth (1.14 / 0.52)
3. Must match Table 6: Volatility of Pre-84 Hours (1.3)

Fig 4: Standard Deviation of Hours



γ = linspace(1.1, 0.9), Assume Pre-84 Policy Rule

Fig 5: Correlation of Hours and Productivity



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SIMPLE SENSITIVITY ANALYSIS

1. Can pure good luck account for almost all of the reduction in volatility of output?

2. **How to interpret change in SRIRL?**
   Without SRIRL, (-) correlation between hours and productivity

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Simple Sensitivity Analysis

1. Can pure good luck account for almost all of the reduction in volatility of output?
2. How to interpret change in SRIRL?
3. **If time variation in parameters is important, how should model be constructed?**

REGIME SWITCHING

- Won't rational agents take regime change seriously and form probabilistic distributions over regimes?

- Davig-Leeper (2007) show policy can deviate from Taylor rule in short-run if deviations are small or not prolonged.

- Assume switching in structural parameters is driven by two-state Markov chain $\gamma(s_t), \phi_\pi(s_t), \phi_y(s_t)$ with
  $p_{11} = \mathbf{0.75}, p_{22} = 0.95, p_{ij} = 1 - p_{ii}$ where $i \neq j$.
  State 1: $\gamma_1 = 1.1, \phi_{1,\pi} = \mathbf{0.95}, \phi_{1,y} = 0.25$
  State 2: $\gamma_2 = 0.9, \phi_{2,\pi} = 2, \phi_{2,y} = 0.1$

- Calibrate to hit post-84 volatilities in regime 2:
  Standard Deviation of Output in Regime 1 is 1.25 (Data 1.57)

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OTHER ISSUES

- Why not include policy variables or inflation in VAR? (long-run restrictions, and increase in number of parameters to estimate) Why not report percentiles of posterior?

- Identification: Strong dynamic restrictions must be placed on the VAR to impose long-run identifying restrictions [Faust-Leeper (1997), Roberds (1996)]. How does this change with time-dependent parameters?

$$X_t = F(L)u_t$$

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$$\epsilon_t = A_0^{-1}u_t$$

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$$[F_t(1)A_{t0}]_{i,j} = 0?$$

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- Good Luck or Good Policy? Yes. As with most any economic question, answer is probably somewhere in the middle.
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