Taylor Rule and Macroeconomic Performance: The Case of Pakistan

by

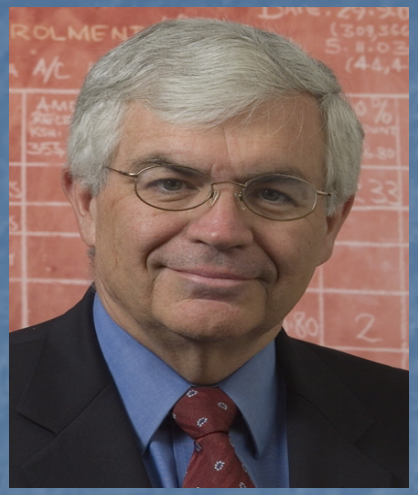
Wasim Shahid Malik (Research Associate PIDE)
and
Ather Maqsood Ahmed (Member (FR&S) CBR)

Rules vs Discretion

If there is anything about which modern macroeconomics is clear however—and on which there is substantial consensus—it is that policy rules have major advantages over discretion in improving economic performance.

John B. Taylor (1993)

Current Debate in Monetary Policy Rules



John B Taylor

Lars E O Svensson

- **Instrument vs targeting rules**
- Proponents of former are Taylor, McCallum and Nelson while of the latter are Svensson, Woodford and Giannoni among others.

Instrument vs Targeting Rules

- **Issues:**
- Simplicity
- Role of judgment
- Robustness
- International practice
- Technical feasibility

Instrument rules

- Monetary policy instrument (e.g. short interest rate) responds to current economic conditions
- State contingent rule
- Meltzer (1987), McCallum (1988), Henderson and McKibbin (1993), Taylor (1993)
- Taylor (1993) rule

$$i_t = r^* + \pi_t + \alpha_1 y_t + \alpha_2 (\pi_t - \pi^*)$$

$$r^* = 2\%, \pi^* = 2\%, \alpha_1 = \alpha_2 = 0.5$$

Characteristics of Instrument Rules

- Very simple
- Need very little amount of information
- Are robust to changes in models
- Easily verifiable so are technically feasible
- No role of judgement------mechanical
- Requires little human capital
- We need only “a clerk armed with a simple formula and a hand calculator”. (McCallum: 2000).

- However, there is often a conspicuous asymmetry in many papers in that central-bank behavior is still often modeled in a mechanical way, as following an ad hoc instrument rule, such as a Taylor rule.
  - Lars E O Svensson (2003)

Targeting Rules

- In 1989 RBNZ and in 1990s some other CBs adopted a framework that, at that time, had less academic support
- **Inflation targeting strategy**
- Inflation forecast as intermediate target.
- Three steps
- central banks announce a numerical inflation target (point target or target range)
- Monetary policy has legislated mandate for achieving that inflation target
- high degree of transparency and accountability
- Constrained Discretion (Svensson 1997)

Two types of targeting rules

- **General Targeting Rule:**
- A general targeting rule specifies an operational loss function, which the monetary policy is committed to minimize.
- **Specific Targeting Rule:**
- specifies first order Euler condition, like marginal rate of transformation and substitution between the target variables is equalized. It gives an implicit reaction function of the monetary authority that needs not be announced.

Characteristics of Developing Countries

- low professionals' capacity
- weak institutions
- small information set
- monetary policy having multiple objectives without clear prioritization
- Calvo and Mishkin (2003) identify five fundamental institutional problems in developing countries
- weak fiscal institutions, weak financial institutions, low credibility of monetary institutions, currency substitution and liability dollarization and finally the vulnerability of the developing countries to sudden stop in capital inflows

Strategy for Developing Countries

- start with simple mechanical rules that do not require more pre-requisites and are easy to follow
- Once the central bank becomes independent and transparent, a system of accountability is set to punish the central bankers in case of acting against social interest and central bankers improve their intellectual and analytical capacity to make good judgment, a developing country can easily switch from simple mechanical rule to more elaborate inflation targeting framework

Objectives of the study

- to estimate the Taylor rule for Pakistan
- to investigate whether the simple monetary policy rules (Taylor rule here) can improve macroeconomic performance given the constraints, mentioned above, faced by the monetary authority
- to verify whether the parameters in original Taylor (1993) rule (the weights on output and inflation stabilization in the rule, real interest rate and target inflation rate) are optimal for Pakistan or they should be changed because the values for these parameters given by Taylor were suggested for the Federal Reserve

Methodology

- Taylor (1993) rule

$$i_t = r^* + \pi_t + \alpha_1 y_t + \alpha_2^* (\pi_t - \pi^*)$$

$$i_t = \alpha_0 + \alpha_1 y_t + \alpha_2 \pi_t$$

$$\alpha_0 = r^* - \alpha_2^* \pi^*$$

$$\alpha_2 = (1 + \alpha_2^*)$$

- Coefficients Restrictions

$$\alpha_0 = 1, \alpha_1 = 0.5, \alpha_2 = 1.5$$

- Estimate by OLS – a requirement of the rule
- Trade-off between estimation efficiency and theory of the rule

Methodology------

- Small macro model by Rudebusch and Svensson (1999).

$$y_t = \beta_1 y_{t-1} + \beta_2 (\bar{i}_{t-1} - \bar{\pi}_{t-1}) + u_t \text{ ———————(AD)}$$

$$\pi_t = \gamma_1 \pi_{t-1} + \gamma_2 y_{t-1} + \varepsilon_t \text{ ———————————(AS)}$$

$$i_t = \alpha_0 + \alpha_1 y_t + \alpha_2 \pi_t \text{ ———————————(CBRF)}$$

$$\beta_1 > 0, \beta_2 < 0, \gamma_1 > 0, \gamma_2 > 0, \beta_1 < 1, \gamma_1 < 1, \alpha_1 > 0, \alpha_2 > 1$$

- Backcasting using estimated parameters and shocks and Taylor rule as monetary policy strategy
- Bootstrap simulation

Finding Optimal Parameter Values for Pakistan

- Minimizing variability in inflation and output
- Minimization of the loss function

$$L_t = \frac{1}{2}\left[\mathrm{var}(y_t) + \mathrm{var}(\pi_t)\right]$$

- One time estimates
- Bootstrap simulation

Results

- Estimation Results

$$i_t = 4.34 - 0.38\, y_t + 0.51\pi_t$$

(4.28) (-2.28) (4.17)

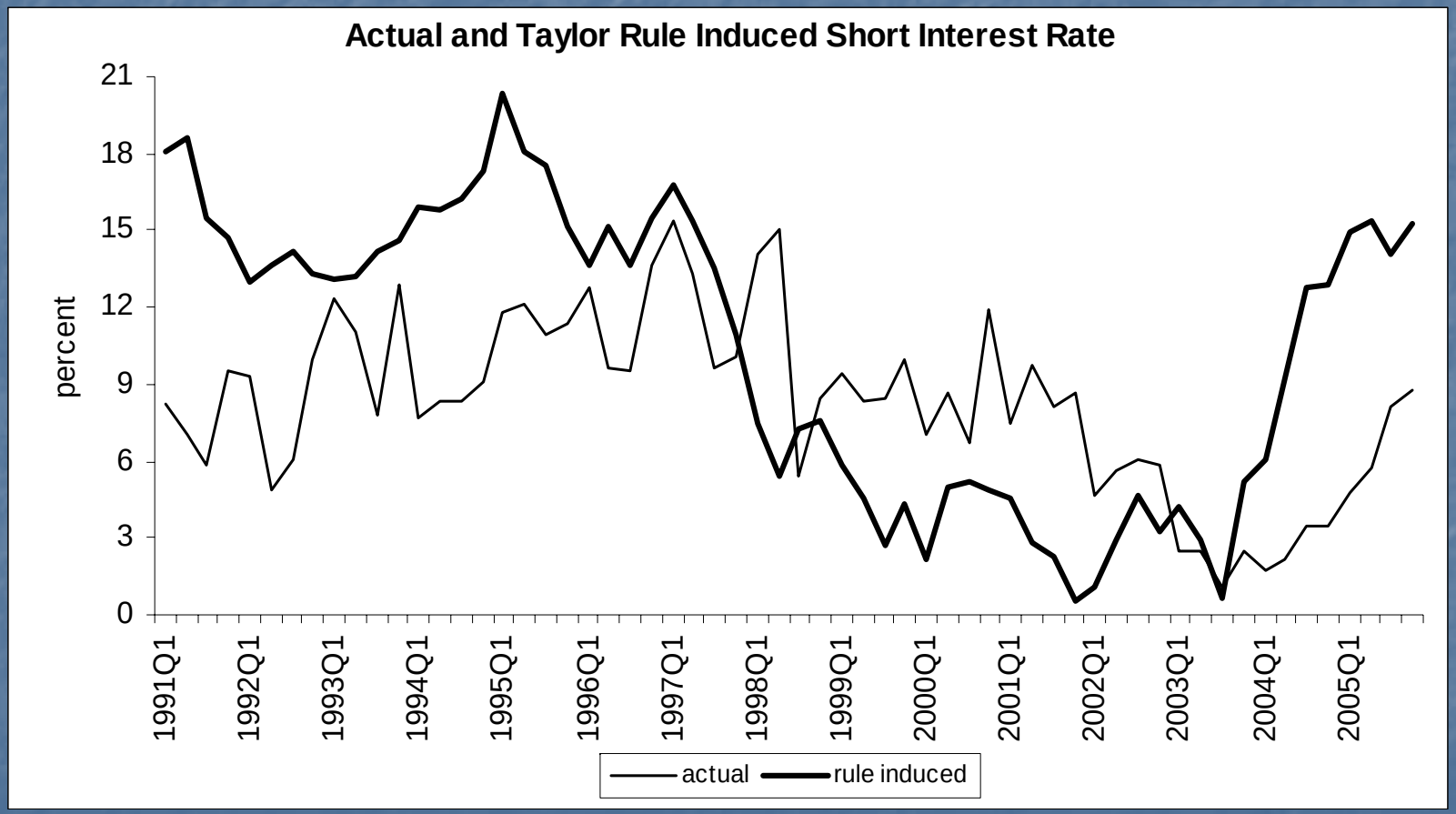
Adjusted R2 = 0.22, DW= 0.89

$$i_t = 17.04 - 0.60\, y_t - 0.78\pi_t$$ (Hanfi's period)

$$i_t = 8.68 - 0.08 y_t + 0.19\pi_t$$ (Yaqub's period)

$$i_t = 5.77 + 0.18 y_t - 0.14\pi_t$$ (Ishrat's period)

Estimation Results-----



Estimation Results-------

Actual and Rule Induced Short Interest Rate		
	Actual	Rule Induced*
Mean	8.24	10.42
Maximum	15.42	20.30
Minimum	1.05	0.51
Range	14.37	19.79
Variance	11.80	32.96
St. Deviation	3.44	5.74
* We used actual data on output gap and inflation to calculate this rate.		

Macroeconomic Performance

Simulation with Taylor Rule and Estimated Model					
		Actual	Rule Based		
			One-time	Bootstrap *	P-value**
Interest rate	Average	8.28	9.24		
	St. Dev	3.53	3.18		
Output gap	Average	-0.24	-0.83		
	St. Dev	2.47	1.72	1.80 (0.21)	0.002
Inflation	Average	7.36	7.00		
	St. Dev	4.31	3.50	3.70 (0.47)	0.10

* Average of 1000 values of standard deviations in bootstrap simulation. Standard errors in parenthesis

** probability of standard deviation with rule being greater than that of actual data

Optimal Parameter Values for Pakistan

$$i_t = 0 + \pi_t + y_t + 0(\pi_t - \pi^*) \text{----------} (rule - I)$$

or

$$i_t = \pi_t + y_t$$

$$i_t = 0 + \pi_t + 0.5y_t + 0.5(\pi_t - 8) \text{-------} (rule - II)$$

or

$$i_t = -4 + 0.5y_t + 1.5\pi_t$$

Comparison of Strategies

Loss Associated with Different Parameter Values for the Rule					
	Variance		Loss to Society		
	Y-Gap	Inflation	One-Time	Bootstrap *	P-values**
Actual	6.10	18.54	12.32		
Rule-I	2.40	13.11	7.76	6.09 (1.40)	0.00
Rule-II	2.80	12.15	7.48	7.82 (1.92)	0.02
Taylor Rule	2.94	12.25	7.60	8.26 (1.72)	0.02

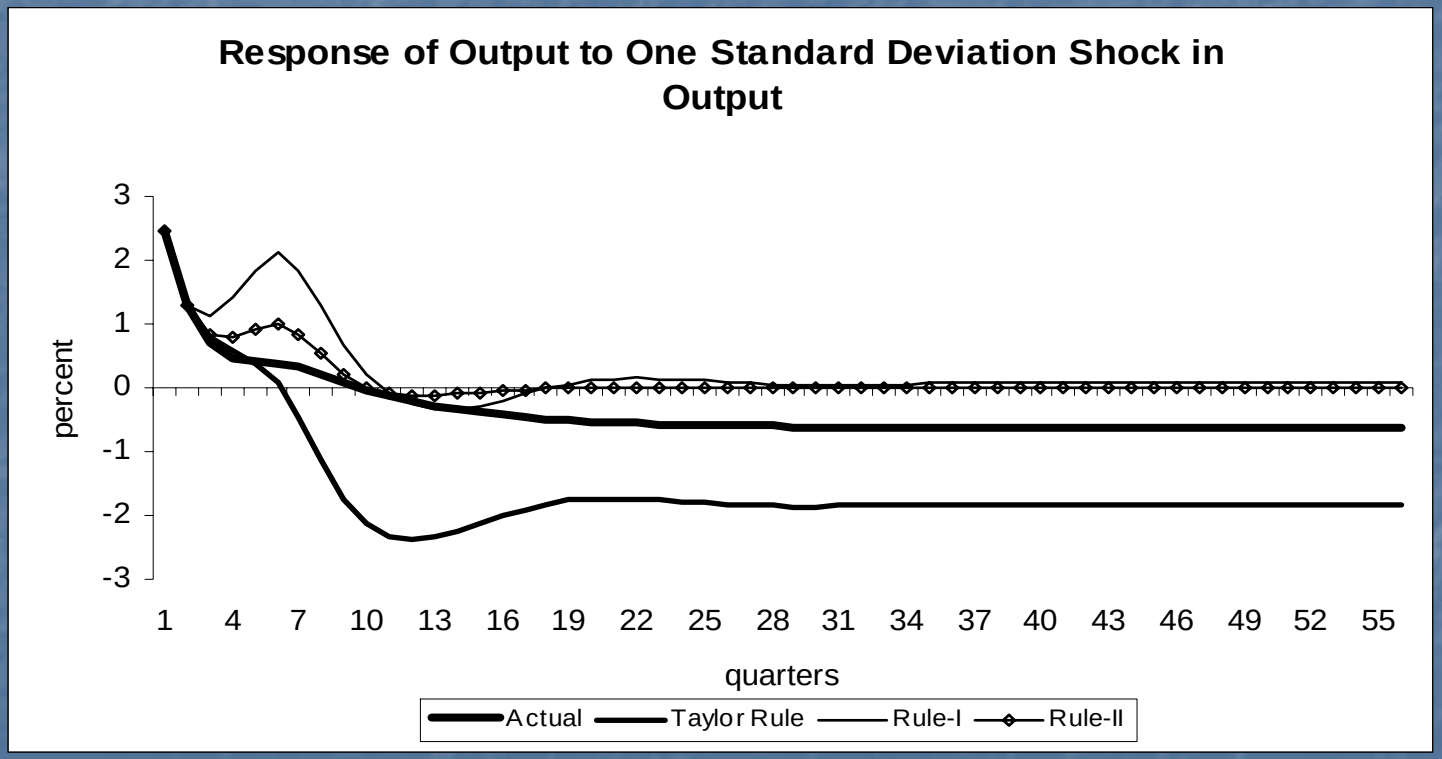
* Standard errors in parenthesis.

** probability of loss associated with rule being greater than that of actual data

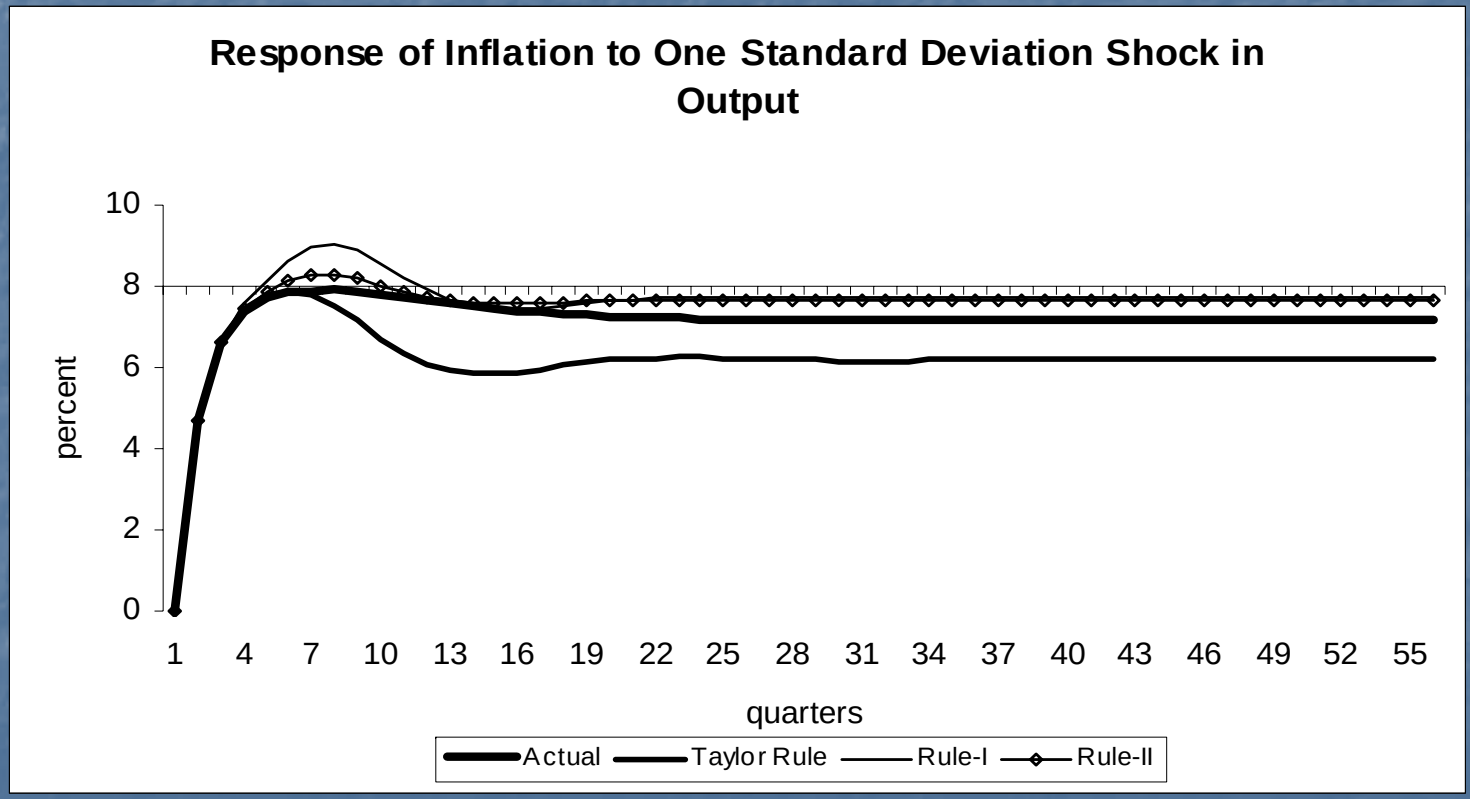
Diagnostic Tests

- **Impulse Response Functions**
  - **Output gap must converge to zero in response to shock**
  - **Inflation must converge to target level in response to shock**
- **Constrained Optimization**
  - **Minimization of the loss function subject to different constraints**

Diagnostic Tests
Impulse Response Functions



Diagnostic Tests
Impulse Response Functions



Constrained Optimization

Loss Minimization subject to Different Constraints				
Constraints	Inflation Target	Coefficients		Loss
		Y-Gap	Inflation	
Case-I	13.74	0.42	0.58	7.42
Case-II	8.11	0.42	0.58	7.47
Case-III	7.96	0.41	0.59	7.47
Case-IV	7.91	0.99	0.01	7.76
Case-V	7.93	0.71	0.29	5.14*
* This value is not comparable to others because it is based on standard deviations while others are based on variances.				

Constraints

- **Two equations in macro model**
- **Case-I**
  - Sum of coefficients of output and inflation equals 1.
- **Case-II**
  - In case of only one period shock output gap converges to a level in the range of -0.1-0.1.
- **Case-III**
  - In case of only one period shock inflation converges to a level in the range of target+-0.25.
- **Case-IV**
  - In case of only one period shock inflation converges to a level in the range -0.50-target-0.50.
- **Case-V**
  - Loss is calculated as the sum of standard deviations of output and inflation.

Thank you for your patience