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Assessing McCallum and Taylor rules in a cross-section of emerging market economies

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Structure of presentation

- Motivation for topic
- Research questions
- Models to be estimated
- Empirical evidence
- Conclusion

What the paper does

- We investigate monetary policy behaviour in 20 emerging economies
- McCallum (with monetary base as operating target) and Taylor-type (with interest rates as instrument) policy reaction functions estimated
- Economies under study pursue inflation, monetary and exchange rate targeting

Motivation

- For emerging economies, monetary policy strategies can appear to be intractable for various reasons
- Empirical evidence could help determine the fashion in which they implicitly react to economic developments
- After crises of 1990s, efforts to improve policy institutions, motivating the use of similar reaction functions as in advanced economies

Motivation

- John B. Taylor argued that current financial crisis can at least partly be blamed on loose monetary policy by the FED, comparing it e.g. to the popular Taylor rule
  - ”monetary excesses were the main cause of the boom. The Fed held its target interest rate, especially in 2003-2005, well below known monetary guideleines that say that good policy should be based on historical experience”

    Wall Street Journal, 9 Feb 2009

Motivation

Source: The Economist

Research questions

- Are Taylor-type interest rate feedback rules useful in understanding monetary policy behaviour in emerging markets?
- Can McCallum-type reaction functions be useful in environments of monetary or exchange targeting?
- In economies with a lack of statistics on real economy, could a nominal feedback rule be used in evaluating monetary policy conduct?

Contribution

- Sufficiently long time series allow the estimation of monetary policy rules for periods with consistent policy regimes
- A record of monetary policy institutions (including targets and policy instruments) in 20 emerging economies assembled, and appropriate policy reaction functions are estimated with consideration for the respective environments

Countries in sample

Chile	Peru
Colombia	Philippines
Costa Rica	Poland
Czech Republic	South Africa
Ghana	South Korea
Hungary	Thailand
Israel	Tunisia
Malaysia	Turkey
Mexico	Uruguay
Nigeria	Venezuela

- 15 countries are included in Morgan Stanley's Emerging Market Index; 14 countries are operating inflation targeting regimes

Estimated policy rules – interest rate feedback

- All rules include a lagged policy variable to account for instrument smoothing, and they all feature an exchange rate
- Taylor rule for inflation targeting countries

$$R_t = \alpha + \varphi R_{t-1} + \beta\left(\bar{\pi}_t - \pi^*\right) + \lambda\left(y_t - \tilde{y}\right) + \delta\Delta e_t$$

- Hybrid McCallum-Taylor rule for inflation targeting countries

$$R_t = \alpha + \varphi R_{t-1} + \rho\left(\Delta x_t^* - \Delta x_{t-1}\right) + \delta\Delta e_t$$

- Nominal income target defined by applying an HP-filter to real GDP series, taking growth rates of resulting trend series, and adding the inflation target of central bank
- McCallum and Hargraves (1994) take average growth rates over several decades for G-7 countries

Estimated policy rules – interest rate feedback

- Interest rate feedback rules (Taylor & Hybrid McCallum-Taylor) estimated for inflation targeting countries
- But inflation targeting does not necessitate any strict rule for implementing monetary policy
- Svensson (1999) proposes an implicit rule for inflation targeting that is close to a Taylor rule
- In our Taylor rule, we use contemporaneous values of inflation rate, in contrast to Svensson's implicit rule

Estimated policy rules – monetary base feedback

- McCallum rule for non-inflation targeters:

$$\Delta b_t = \mu \Delta b_{t-1} + \rho(\Delta x_t^* - \Delta x_{t-1}) + \delta \Delta e_t$$

- Rule fully operational, as all variables on right hand side are known to policymaker at time *t*
- During deflation and binding zero lower bound, base money growth can still provide stimulative policy
- Hybrid McCallum-Hall-Mankiw rule for non-inflation targeters:

$$\Delta b_t = \mu \Delta b_{t-1} + \theta(\pi_t - \pi_t^{mave} + \tilde{y}_t) + \delta \Delta e_t$$

- Hybrid target specified as deviation of annual inflation from its moving average and output gap

Estimated policy rules – nominal feedback

- Constructed following Duecker and Fisher (1996) for the Swiss economy
- Nominal feedback rule-implicit inflation target:

$$\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle} = \omega(\Delta m_t - \Delta(m-p)_{\langle t|t-1\rangle})_{t-1} + \beta(\pi_t - \pi_t^{mave}) + \delta\Delta e_t$$

- Real money demand forecast computed by using Kalman filter
- Central bank's reaction in terms of implicit inflation target to movements in inflation gap and exchange rate
- Rule does not depend on real economy variables, which may be beneficial for developing economies

Data

- Quarterly time series data
- Nominal interest rates are policy interest rates of respective central banks; exchange rates measured against the USD
- All variables expressed as annual growth rates in percentage points
- Output gap measures based on HP-filtered data on GDP
- Sources for all data are central bank websites, IFS and CEIC databases

Results – Taylor type reaction functions

Table 3a
Taylor-type reaction functions for inflation targeting economies, GMM
The dependent variable is R (%)

Countries / Coefficients	Chile 99Q2-07Q3	Colombia 00Q1-07Q3	Czech Republic 98Q1-08Q3	Hungary 02Q1-08Q3	Israel 96Q1-08Q4	Mexico 99Q1-07Q3	Peru 02Q1-07Q1
Inflation gap $\overline{\pi}_t - \pi_t^*$ (%): β	0.46*** (0.10)	-0.01 (0.25)	-0.01 (0.05)	0.21 (0.14)	0.12** (0.05)	-0.16 (0.13)	-0.64*** (0.18)
Real output gap $y_t - \tilde{y}_t$ (%): λ	0.38*** (0.05)	0.41** (0.15)	0.04 (0.05)	0.02 (0.16)	0.03 (0.04)	0.20* (0.11)	0.24*** (0.04)
Exchange rate Δe_t (%): δ_T	-0.002 (0.005)	0.03** (0.01)	-0.006 (0.008)	-0.003 (0.029)	0.12*** (0.01)	0.10*** (0.03)	-0.08*** (0.02)
Lagged policy rate R_{t-1} (%): φ_T	0.68*** (0.19)	0.68*** (0.05)	1.00*** (0.05)	0.46** (0.21)	0.83*** (0.03)	0.91*** (0.05)	0.003 (0.14)
R^2	0.81	0.86	0.90	0.38	0.93	0.93	0.68
J-statistic	0.11	0.13	0.09	0.19	0.12	0.10	0.18

- Interest rate smoothing important
- Inflation gap often not statistically significant

Results – Taylor type reaction functions

Table 3a continued…

Countries / Coefficients	Philippines 02Q1-08Q3	Poland 01Q1-08Q3	South Africa 01Q1-07Q3	South Korea 00Q1-08Q3	Thailand 02Q4-08Q3	Turkey 02Q3-07Q4
Inflation gap $\overline{\pi}_t - \pi_t^*$ (%): β	0.19*** (0.02)	0.001 (0.04)	-0.11*** (0.02)	-0.34*** (0.03)	0.39*** (0.10)	0.54*** (0.02)
Real output gap $y_t - \tilde{y}_t$ (%): λ	-0.64*** (0.09)	0.36*** (0.04)	0.84*** (0.24)	0.11*** (0.01)	-0.32*** (0.11)	-1.29*** (0.16)
Exchange rate Δe_t (%): δ_T	0.02*** (0.007)	0.001 (0.008)	0.02*** (0.006)	0.006 (0.004)	-0.02 (0.01)	0.11*** (0.008)
Lagged policy rate R_{t-1} (%): φ_T	0.59*** (0.04)	0.94*** (0.01)	1.14*** (0.02)	0.67*** (0.05)	0.47*** (0.12)	0.39*** (0.03)
R^2	0.61	0.98	0.90	0.90	0.93	0.98
J-statistic	0.17	0.12	0.20	0.13	0.17	0.20

Notes on Table 3a: GMM generalized method of moments. The instruments are lags 2 and 3 of the interest rate, and lags 1 and 2 of the inflation gap, the output gap, the exchange rate, and oil prices. ***, ** and * denote coefficient significance at the 1, 5 and 10 levels, respectively. The J-statistic tests the validity of the over-identifying restrictions for the GMM estimations.

- Interest rate smoothing important
- Inflation gap often not statistically significant

Results – Hybrid McCallum-Taylor rule

Table 4a
Hybrid McCallum-Taylor monetary policy reaction functions for inflation targeting economies, GMM
The dependent variable is R (%)

Coefficients \ Countries	Chile 99Q2-07Q3	Colombia 00Q1-07Q3	Czech Republic 98Q1-08Q3	Hungary 02Q1-08Q3	Israel 96Q1-08Q4	Mexico 99Q1-07Q3	Peru 02Q1-07Q1
Nominal income gap $\Delta x_t^* - \Delta x_{t-1}$ (%): ρ	-0.11** (0.04)	-0.23*** (0.02)	-0.09** (0.03)	-0.18*** (0.03)	-0.07 (0.04)	-0.09 (0.07)	-0.16*** (0.01)
Exchange rate Δe_t (%): δ_{MT}	-0.03 (0.02)	-0.00 (0.00)	0.00 (0.00)	0.02*** (0.00)	0.05*** (0.01)	0.01 (0.47)	0.07*** (0.01)
Lagged policy rate R_{t-1} (%): φ_{MT}	1.01*** (0.07)	0.72*** (0.04)	0.91*** (0.04)	0.69*** (0.04)	0.83*** (0.02)	0.84*** (0.03)	0.29*** (0.08)
R^2	0.61	0.90	0.94	0.68	0.94	0.92	0.40
J-statistic	0.14	0.11	0.13	0.14	0.12	0.09	0.15
Coefficients \ Countries	Philippines 02Q1-08Q3	Poland 01Q1-08Q3	South Africa 01Q1-07Q3	South Korea 00Q1-08Q3	Thailand 00Q4-08Q3	Turkey 02Q3-07Q4	
Nominal income gap $\Delta x_t^* - \Delta x_{t-1}$ (%): ρ	-0.15** (0.06)	-0.23*** (0.04)	-0.16*** (0.03)	0.05** (0.02)	-0.13*** (0.02)	-0.27*** (0.07)	
Exchange rate Δe_t (%): δ_{MT}	0.01** (0.00)	0.01 (0.01)	0.03*** (0.00)	-0.01 (0.00)	0.02*** (0.00)	0.03 (0.02)	
Lagged policy rate R_{t-1} (%): φ_{MT}	0.95*** (0.05)	0.99*** (0.01)	0.91*** (0.02)	-1.15*** (0.09)	0.80*** (0.05)	0.86*** (0.02)	
R^2	0.71	0.98	0.91	0.87	0.93	0.96	
J-statistic	0.14	0.09	0.19	0.16	0.15	0.24	

- Nominal income gap negative and significant in 10/13 cases
- Hybrid rule produces higher or equal R squared values, compared with Taylor rule

Results – McCallum rule

Table 5
McCallum-type reaction functions, OLS and GMM
The dependent variable is the rate of change of the monetary base (Δb) (%)

Countries / Coefficients	Costa Rica 00Q1-07Q2		Malaysia 00Q1-08Q3		Uruguay 01Q1-07Q1		Venezuela 02Q1-07Q4	
	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
Nominal income gap $\Delta x_t^* - \Delta x_{t-1}$ (%): θ	-2.25** (1.09)	-1.97* (1.11)	-0.29* (0.15)	-0.02 (0.20)	0.44* (0.22)	0.63*** (0.14)	0.63** (0.28)	1.03*** (0.24)
Exchange rate Δe_t (%): δ_M	0.72 (0.78)	0.79** (0.32)	-0.57*** (0.19)	0.01 (0.19)	-0.05 (0.16)	-0.02 (0.09)	-0.21 (0.24)	0.17 (0.12)
Lagged policy instrument Δb_{t-1} (%): μ_M	0.57*** (0.11)	1.14*** (0.14)	0.19* (0.10)	1.45*** (0.31)	0.70*** (0.12)	0.49*** (0.09)	0.91*** (0.14)	0.84*** (0.09)
R^2	0.77	0.58	0.50	-0.35	0.63	0.56	0.72	0.51
J-statistic	-	0.13	-	0.09	-	0.17		0.15

- In Uruguay and Venezuela, central bank leaning against the wind
- For Uruguay, feedback parameter estimate close to value (0.5) suggested by McCallum for Japan and US; higher values for Venezuela

Results – McCallum-Hall-Mankiw rule

Table 6
McCallum-Hall-Mankiw reaction functions, OLS and GMM
The dependent variable is the rate of change of the monetary base (Δb) (%)

Countries / Coefficients	Costa Rica 00Q1-07Q2		Malaysia 00Q1-08Q3		Uruguay 01Q1-07Q1		Venezuela 02Q1-07Q4	
	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
Hybrid target Hall-Mankiw $\pi_t - \Delta\bar{p}_t + \tilde{y}_t$ (%): χ	0.72 (1.09)	0.98 (1.10)	1.04** (0.39)	1.39** (0.56)	-0.47 (0.96)	2.28** (0.86)	-1.25* (0.69)	-3.89*** (0.87)
Exchange rate Δe_t (%): δ_{HM}	0.66 (0.83)	-0.37 (0.37)	-0.68*** (0.22)	-0.60** (0.22)	0.06 (0.14)	0.33** (0.13)	-0.27 (0.22)	-0.30 (0.23)
Lagged policy instrument Δb_{t-1} (%): μ_{HM}	0.77*** (0.14)	0.89*** (0.10)	-0.12* (0.07)	-0.07 (0.41)	0.83*** (0.09)	0.64*** (0.12)	0.96*** (0.14)	0.80*** (0.14)
R^2	0.71	0.61	0.37	0.39	0.72	0.21	0.72	0.27
J-statistic	-	0.17	-	0.14	-	0.10	-	0.16

- Reaction of monetary base to exchange rate more important than in McCallum rule with nominal income target
- Only Venezuela consistently leaning against the wind

Results – nominal monetary policy feedback rule

Table 7
McCallum-Dueker-Fischer nominal feedback equations, OLS

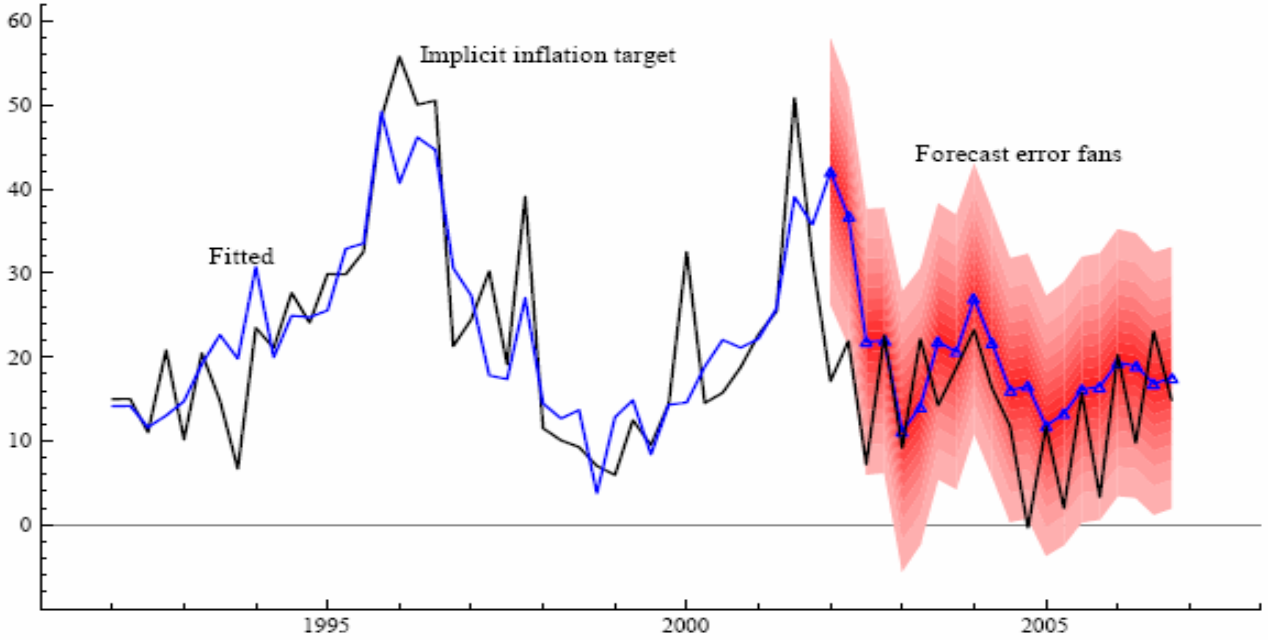
The dependent variable is the implicit inflation target
$\Delta m_t - \Delta(m-p)_{(t|t-1)}$ *(%)*

Countries / Coefficients	Ghana 86Q1-06Q4	Nigeria 86Q1-06Q3	Tunisia 93Q3-07Q1
Inflation gap $\pi_t - \pi_t^*$ (%): β_{DF}	0.62*** (0.09)	1.11*** (0.39)	-7.96*** (1.56)
Exchange rate Δe_t (%): δ_{DF}	0.08 (0.08)	-	-1.23*** (0.22)
Inflation targeting dummy from 2002	-6.55** (2.63)	-	-
R^2	0.63	0.66	0.75

- Ghana and Nigeria have pursued accommodative policies, although for Ghana the introduction of IT in 2002 had negative impact on implicit inflation target variable

Forecasts for Ghana using nominal feedback rule

Figure 3
Forecasting the implicit inflation target in Ghana following inflation targeting adoption
Two forecast error fans shown in the red shaded area



Results – nominal monetary policy feedback rule

Table 7
McCallum-Dueker-Fischer nominal feedback equations, OLS

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Countries / Coefficients	Ghana 86Q1-06Q4	Nigeria 86Q1-06Q3	Tunisia 93Q3-07Q1
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Exchange rate Δe_t (%): δ_{DF}	0.08 (0.08)	-	-1.23*** (0.22)
Inflation targeting dummy from 2002	-6.55** (2.63)	-	-
R^2	0.63	0.66	0.75

- Central bank in Tunisia leaning against the wind; above-trend inflation leads to tighter policy stance

Conclusion

- Monetary policy behaviour examined in 20 emerging economies by estimating a family of policy rules
- For inflation targeters, behaviour seems to be better captured by a hybrid McCallum-Taylor than a simple Taylor rule
- For non-inflation targeters, McCallum-type rules suggest leaning against the wind behaviour for some economies, but results are sensitive to choice of target variable
- Nominal feedback rules mostly show leaning with the wind behaviour, but the introduction of inflation targeting can make a difference