Inflation Targeting and Fiscal Rules:

Do Interactions and Sequencing Matter?

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Introduction

IT: framework for monetary policy; five main criteria (Svensson, 1997, Mishkin, 2000)
(i) public announcement of a medium-term inflation target
(ii) institutional commitment to price stability as the primary goal of monetary policy
(iii) forward-looking strategy for inflation forecasts
(iv) enhanced transparency
(v) greater accountability of central bank in achieving its inflation target

IT: successful in decreasing inflation (Batini & Laxton, 2007; Gonçalves & Salles, 2008; Lin & Ye, 2009; or de Mendonça & de Guimarães e Souza, 2011)

FR: "*a permanent constraint on fiscal policy, expressed in terms of a summary indicator of fiscal performance, such as government budget, borrowing, debt, or a major component thereof*" (Kopits & Symansky, 1998, page 2).

FR: effective in providing fiscal discipline (FD; Alesina et *al*., 1999; Debrun et *al*., 2007; Hallerberg et *al*., 2009; Dabla-Norris et *al*., 2010; or Gollwitzer, 2011)

Existing literature: IT & FR considered in isolation

Empirical perspective

Monetary (Fiscal) regime no effect on F (M) outcomes: omitted-variables bias

Theoretical perspective:

Improving incentives of M/F policymakers affects outcome of strategic interaction

cross effects M/F outcomes + interactions M/F reforms

(Beetsma and Bovenberg, 1997a, b; 1998; Debrun, 2000; Beetsma, Debrun, and Klaassen, 2001 Dixit and Lambertini, 2003; and Castellani and Debrun, 2005).

This paper: interactions IT & FR have First-Order Implications

First: joint effect of IT & FR (Inflation and FD)
Second: sequencing of IT & FR adoption

Method: System-GMM
- multilevel endogeneity (adoption of IT & FR, interactions & sequencing)
- accounts for inertia in inflation dynamics and in the budget process

Result 1: adopting both IT & FR *vs.* IT only / FR only
- improves primary (and overall) fiscal balances
- decreases average inflation

Result 2: sequencing (or timing) of IT and FR matters
- FR before IT better primary fiscal balances & inflation (than reverse sequence)

Plan of the presentation:

II. Additional Motivation and Gaps in the Literature

III. Data and Stylized Facts

IV. Methodology

V. Results and Robustness

VI. Conclusion

II. Additional Motivation and Gaps in the Literature

Overall view:

- considerable literature: improving M/F institutions impacts overall Policy Mix
- theory:
  - IT in strategic interaction M/F authorities = affects conduct of FP
  - Explicit constraints on fiscal discretion = affects conduct of MP

Goal of the section:

- derive lessons in terms of our testable propositions

Two strands of literature:

- Optimal Macroeconomic Institutions
- Other Relevant Literature

A. Optimal Macroeconomic Institutions

Dominance

- strategic interactions M/FP: unpleasant monetarist arithmetic (SW 1981)
- modern SW: fiscal theory of price level (Leeper 91, Sims 94, Woodford 95,98)

Optimal Central Bank Design and Fiscal Policy

- highly stylized environments to determine Inflation & FP (Barro, Gordon 1983)
- M/F policy are linked through different channels
  - Distortionary taxes: increase M authorities' temptation to boost output
  - Inflation tax: positive impact on inflation on budget financing
  - Both M/F can affect aggregate demand
- two features
  - time inconsistency: Inflation too high / FP too expansionary (short-run)
  - partial instit. reforms (i.e. IT) on only 1 player: aggravates coordin. fail.
- notable examples of side effects:
  - effect IT on Inflation contingent on Fiscal Rules (Beetsma & Bovenbert 97)
  - common "culture of stability" with joint reforms (Dixit & Lambertini 2003)
  - Fiscal Rule for IT to deliver optimal Inflation (Castellani & Debrun 2005)

B. Other Relevant Literature

Beyond game-theory: cross effects of IT & FR on M/F policy mix

- Independent CB under IT = agency to restrain FP, since insulated from pressure to monetize (Mishkin 2004, Roger 2009, Freedman & Ötker-Robe 2010)
- IT delivers FD notably in developing countries (Minea & Tapsoba 2014)
- FD prerequisite for IT to achieve price stability (Masson et *al.*, 1997; Sims, 2004; or Bernanke & Woodford, 2004)

Both IT & FR = similar class of reforms of policymaking process

(i) rule-based policy frameworks, increasing popularity in the early 90s

(ii) same ultimate goal: credibility Kopits (2001)

(iii) similarities in their nature:

- numerical targets on macroeconomic aggregates (constrain the discretion of monetary and fiscal authorities respectively)
- comparable transparency and accountability mechanisms

B. Testable Hypotheses

Stylized facts: institutional reforms in which IT & FR not conceived independently
(i) FR to support the IT framework (Brazil, Norway, New Zealand or Sweden)
(ii) legislation, in the form of FR, provide debt monetization (Brazil, Chile, Israel, Norway, Poland, Romania or United Kingdom)
(iii) the inflation target is jointly defined by the CB and the Government (Australia, Canada, Czech Republic, Ghana, Indonesia, New Zealand, Philippines, South Africa or Turkey)

Hypotheses:
H1: reject the nulls: IT does not affect F Perfs // FR does not affect Inflation
H2: reject the null: IT & FR interaction does not influence F Perfs & Inflation
H3: derived from rich IT & FR interactions: compare their sequencing

III. Data and Stylized Facts

152 developed and developing countries, 1990-2009
(limitations: data availability, i.e. reliable fiscal data exist only from 1990)

A. Main Variables

Inflation Targeting (IT)

- binary variable, 1 if IT (at a give year), 0 otherwise
- IT starting dates Rose (2007) and Roger (2009)
- *default* starting years and *conservative* starting years (Vega & Winkelried, 2005)
- 152 countries: 29 IT by the end of 2009
- mitigate outliers from hyperinflation episodes (Mishkin & Schmidt-Hebbel, 2002): normalized Inflation/(1+Inflation)

Fiscal Rules (FR)

- binary variable, 1 if FR (at a give year), 0 otherwise
- new Fiscal Rules Database (IMF's Fiscal Affairs Department, Fiscal Policy and Surveillance Division, 2009)
- 152 countries: 51 FR by the end of 2009

B. Interaction between IT & FR + Sequence of Adoption

We build 5 dummy variables:

(i) IT_only, 1 after IT if not FR
South Africa (IT 2000 + no FR): 0 for 1990-1999, 1 for 2000-2009

(ii) FR_only, 1 after FR if not IT
India (FR 2004 + no IT): 0 for 1990-2003, 1 for 2004-2009

(iii) IT_&_FR, 1 after FR or IT (complementaries / substituabilities)
Australia (IT 1993 + FR 1998): 0 for 1990-1992, 1 for 1993-2009
Poland (FR 1997 + IT 1998): 0 for 1990-1996, 1 for 1997-2009

(iv) IT_after_FR, 1 after IT if both FR and IT (sequence of adoption)
Poland (FR 1997 + IT 1998): 0 for 1990-1997, 1 for 1998-2009

(v) FR_after_IT, 1 after FR if both IT and FR (sequence of adoption)
Australia (IT 1993 + FR 1998): 0 for 1990-1997, 1 for 1998-2009

C. Outcome variables

Three outcome measures:

- two for fiscal authorities:
  - Primary Fiscal Balance (PFB): Revenue-Expenditure (no interest payments)
  - Overall Fiscal Balance (FB): Revenue-Expenditure (+interest payments)
- one for monetary authorities: Inflation (annual growth rate of CPI)

D. Stylized Facts

152 countries:

- 92 (60.53%) neither IT nor FR
- 29 ITers: 9 (31.03%) IT only; 51 FRers: 31 (60.78%) FRonly
- 60 IT or FR: 20 (33.33%) both IT and FR

First charts: complementarity / substitutability
Second charts: sequence of adoption

Figure 1. PFB: IT_&_FR vs. FR_only

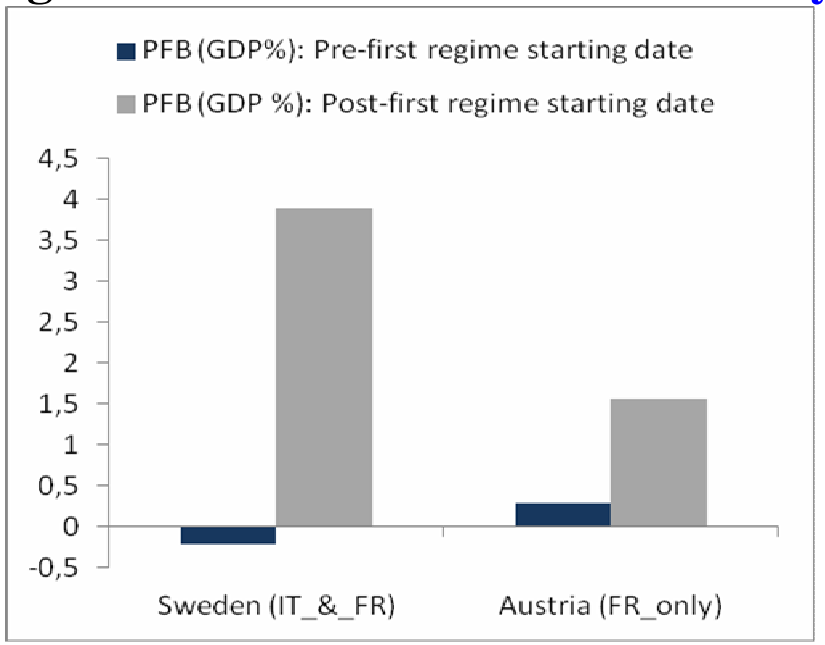

Figure 2. Inflation: IT_&_FR vs. IT_only

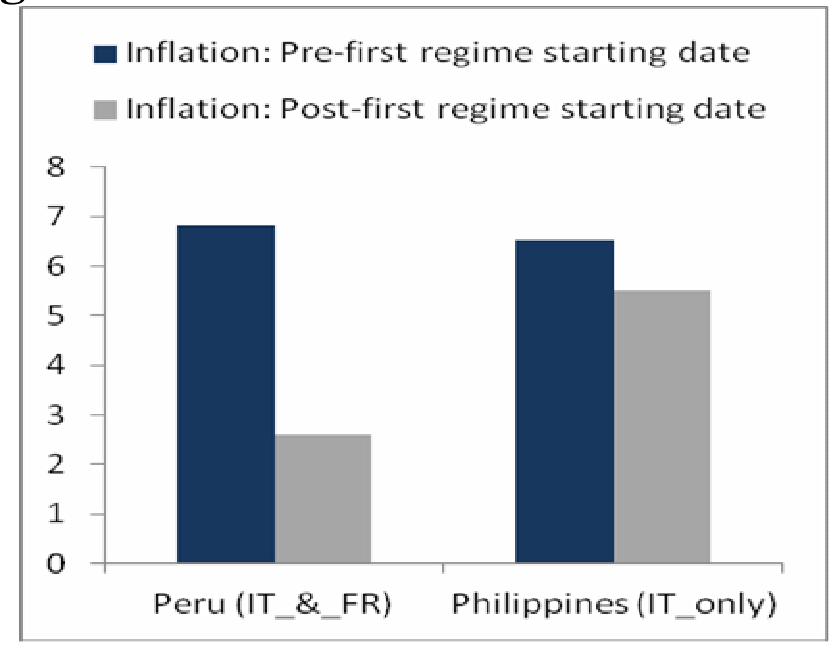

Figure 1:

- Sweden, IT 1993, FR 1996; Austria, FR only 1999
- Sweden: larger PFB (+4.12 pp) *vs*. Austria (+1.27pp)

Figure 2:

- Peru, FR 2000, IT 2002; Philippines, IT only 2002
- Peru: lower Inflation (-4.23 pp) *vs*. Philippines (-1.04 pp)

Complementarity between IT and FR in shaping FD and Inflation

Fig.3. PFB: IT_after_FR vs. FR_after_IT

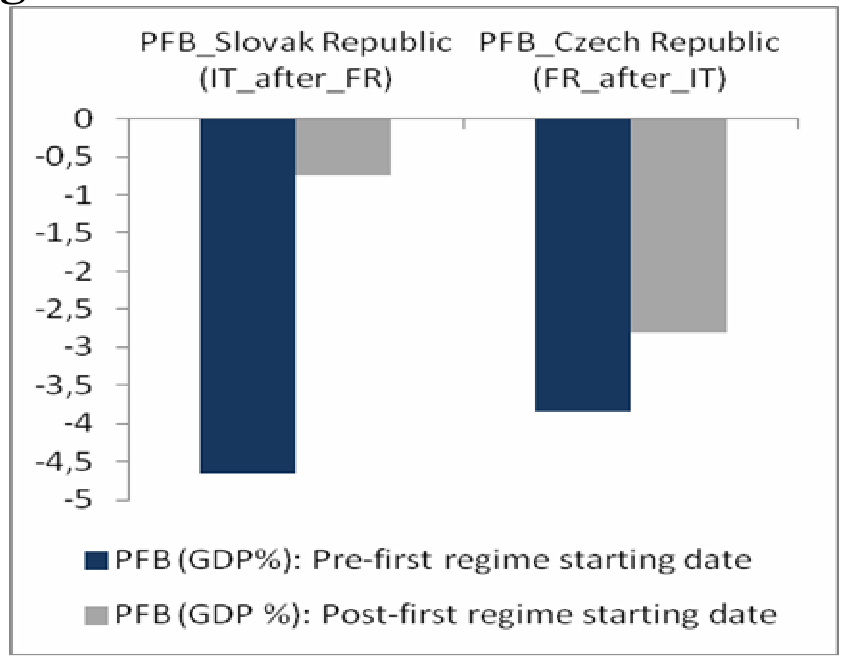

Fig4. Inflation: IT_after_FR vs. FR_after_IT

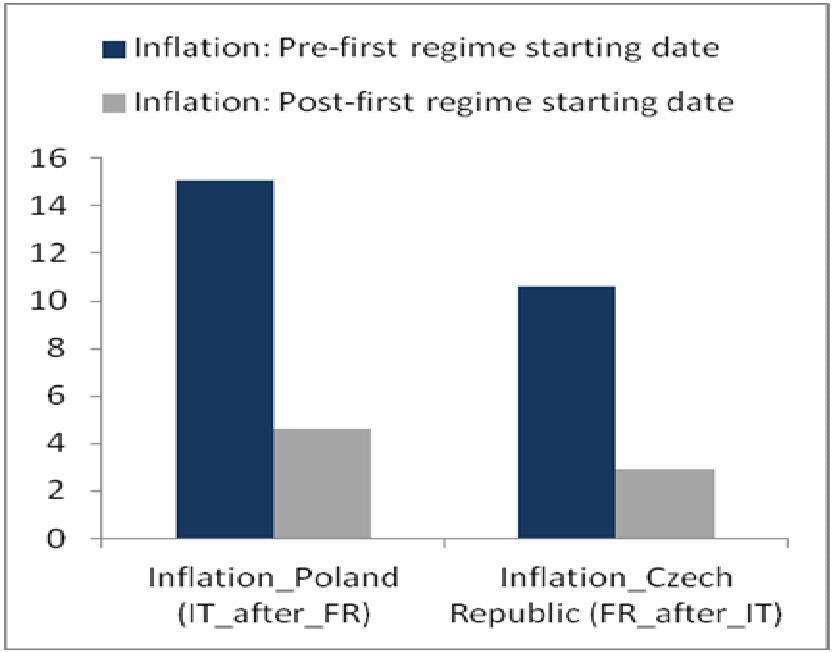

Figure 3:

- Slovak Republic, FR 2002, IT 2005; Czech Republic, IT 1998, FR 2005
- Slovak Republic: larger PFB (+3.91 pp) *vs*. Czech Republic (+1.05pp)

Figure 4:

- Poland, FR 1997, IT 1998; Czech Republic, IT 1998, FR 2005
- Poland: lower Inflation (-10.46 pp) *vs*. Philippines (-7.71 pp)

Potential role of the sequencing of adoption of IT & FR

IV. Methodology

A. Specification

Goal: IT & FR interaction + sequence of IT & FR adoption on FD and Inflation

$$PFB_{it} = \alpha + \beta\, PFB_{it-1} + \lambda_1 IT_{it} (\text{or } \lambda_1 FR_{it}) + \delta_1 Debt_{it-1} + \phi X_{it} + v_i + n_t + \varepsilon_{it}\,, \quad (1a)$$

$$Inflation_{it} = \alpha + \beta\, Inflation_{it-1} + \lambda_1 IT_{it} (\text{or } \lambda_1 FR_{it}) + \phi X_{it} + v_i + n_t + \varepsilon_{it}\,, \quad (1b)$$

Controls:

- lagged PFB (persistency in the budget process)
- lagged government debt (sensitivity of PFB to past debt, i.e. fiscal solvency)
- output gap (business cycle fluctuations)
- government stability (politico-institutional context)
- trade openness & the growth rate of terms of trade (external shocks)
- logarithm of real per capita GDP (status of development)

Expected interest coefficients:

λ_1 positive if (1a) on PFB (FB) + negative if (1b) on Inflation

Sequencing of adoption:

$$PFB_{it} = \alpha + \beta\, PFB_{it-1} + \lambda_1 IT\_only_{it} + \lambda_2 FR\_only_{it} + \lambda_3 IT\_\&\_FR_{it} + \lambda_4^1 IT\_after\_FR_{it} + \lambda_4^2 FR\_after\_IT_{it} + \delta_1 Debt_{it-1} + \phi X_{it} + v_i + n_t + \varepsilon_{it} \quad (2a)$$

$$Inflation_{it} = \alpha + \beta\, Inflation_{it-1} + \lambda_1 IT\_only_{it} + \lambda_2 FR\_only_{it} + \lambda_3 IT\_\&\_FR_{it} + \lambda_4^1 IT\_after\_FR_{it} + \lambda_4^2 FR\_after\_IT_{it} + \phi X_{it} + v_i + n_t + \varepsilon_{it} \quad (2b)$$

(2a-b): the isolate effect of IT/FR + their joint effects:

Level 1: IT only or FR only

λ_1 IT only; λ_2 FR only

Level 2: complementarity / substitutability

λ_1 IT only *vs.* $\lambda_3 + \lambda_4^1$ or $\lambda_3 + \lambda_4^2$

λ_2 FR only *vs.* $\lambda_3 + \lambda_4^1$ or $\lambda_3 + \lambda_4^2$

Level 3: sequence of adoption

λ_4^1 IT after FR; λ_4^2 FR after IT

B. Identification

Key issue in estimation: endogeneity in IT, FR and 5 interaction-sequence variables

Standard estimator: DID (Ashenfelter & Card, 1985)
Criticism (Bertrand, Duflo & Mullainathan, 2004): if serial dependence

- in dependent variables: PFB and Inflation are persistent (coefs of lagged variables significant in (1) (2))
- in the treatment variable (no country abandoned IT yet due to economic duress pattern, for example)

Misleading standard errors

Alternative: IV, difficult time-varying valid instruments institutions (Acemoglu 2005)

Consequently: Blundell & Bond (1998) GMM, with Windmeijer (2005) small sample robust correction: appropriate for tackling endogeneity + dynamic panel
1990-2009, 5 non-overlapping four-year periods (to avoid an over-fit of the instruments, since a large number of periods relative to the number of countries)

V. Results and Robustness

Table 1: Effects of IT, FR, and their interactions, on the PFB

Dependent Variable: PFB Balance	**[1]**	**[2]**	**[3]**	**[4][a]**	**[5]**
Lagged Primary fiscal balance	0.246***	0.293***	0.371***	0.389***	0.347***
	(0.079)	(0.056)	(0.074)	(0.059)	(0.060)
Lagged Debt/GDP	0.013*	0.015*	0.026***	0.020**	0.020**
	(0.007)	(0.009)	(0.010)	(0.008)	(0.009)
Inflation Targeting (IT) Dummy	**2.420*** **				
	(0.856)				
Fiscal Rule (FR) Dummy		**1.349****			
		(0.682)			
IT_only			**3.005*** **	**1.996*** **	**2.025****
			(1.086)	**(0.744)**	**(1.044)**
FR_only			**1.609*** **	**1.569*** **	**1.179***
			(0.569)	**(0.436)**	**(0.633)**
IT_&_FR			**2.993***	**4.260****	**1.999***
			(1.623)	**(1.891)**	**(1.052)**
IT_after_FR			**6.558****	**3.444***	**4.824***
			(3.106)	**(1.812)**	**(2.696)**
FR_after_IT			**-1.417**	**-2.553**	**-0.160**
			(1.836)	**(2.145)**	**(2.461)**

IT only: PFB +3 pp; FR only: PFB +1.6 pp
Both IT & FR:

- IT after FR: PFB +9.5 pp (IT_&_FR + IT_after_FR)
- FR after IT: PFB +3 pp (IT_&_FR + FR_after_IT, latter not significant)

Result 1: interaction sometimes matters

- IT & FR interactions on PFB: +8 pp *vs.* FR only (IT additional effect)
- FR after IT on PFB: not statistically different *vs.* IT only

Result 2: timing matters

- IT after FR on PFB: +6.5 pp *vs.* FR after IT

Robustness

Time length between IT (FR) and FR (IT)					-0.213
					(0.137)
Output Gap	16.758	8.699	-9.791	-8.847	-7.578
	(14.864)	(7.807)	(8.485)	(7.600)	(8.705)
Trade Openness	-0.014	-0.010	-0.006	-0.006	-0.012*
	(0.014)	(0.008)	(0.008)	(0.006)	(0.007)
Growth Rate of Terms of Trade	9.721**	7.487**	5.949	2.571	6.596*
	(4.972)	(3.624)	(3.884)	(3.687)	(3.611)
Government Stability	0.480	0.468**	1.109***	1.044***	1.054***
	(0.400)	(0.239)	(0.218)	(0.227)	(0.268)
Logarithm of real per capita GDP	0.179	0.170	0.879	0.623	0.921
	(0.701)	(0.630)	(0.763)	(0.522)	(0.748)
Time Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	341	341	341	341	341
Arellano-Bond test for AR(2): p-value	0.147	0.299	0.427	0.459	0.550
Hansen over-identification: p-value	0.581	0.179	0.443	0.358	0.126

Robustness 1: [4] conservative starting IT dates ([3] default):

Comp./Subst.: PFB +4.260 (FR after IT); +7.704 (IT after FR)

Timing: only the sequenced IT after FR has a significant effect on PFB

Robustness 2: Overall Fiscal Balance FB (instead of the PFB) as measure of FD

No qualitative change in our results (reported in the Appendix)

Robustness 3: Control for Time Length elapsed between the adoptions of IT and FR

- Idea: joint effect depends whether or not the adoption of the second regime was announced, hence anticipated by the private agents, at the beginning of the first regime
- Proxy for the second regime implementation: the time length between the adoptions of the two regimes (time to embed the announcement in behaviour)
- Tested hypothesis: the influence of the sequence of adoption, and **not** of the time length between the adoptions of the two regimes
- Expected result: not statistically significant of the variable Time Length

[5]: Time Length is not significant; main coefficients: no qualitative changes

Table 2: Effects of IT, FR, and their interactions, on Inflation

Dependent Variable: Inflation Rate	**[6]**	**[7]**	**[8]**	**[9][a]**	**[10]**
Lagged Inflation Rate	0.450***	0.456***	0.465***	0.361***	0.512***
	(0.149)	(0.145)	(0.057)	(0.049)	(0.065)
Inflation Targeting (IT) Dummy	**-0.042****				
	(0.019)				
Fiscal Rule (FR) Dummy		**-0.031***			
		(0.016)			
IT_only			**-0.022****	**-0.032***	**-0.017***
			(0.009)	**(0.020)**	**(0.010)**
FR_only			**-0.012**	**-0.018**	**-0.012**
			(0.008)	**(0.013)**	**(0.011)**
IT_&_FR			**-0.026****	**-0.040***	**-0.029***
			(0.013)	**(0.023)**	**(0.016)**
IT_after_FR			**-0.013***	**-0.029***	**-0.021***
			(0.008)	**(0.017)**	**(0.012)**
FR_after_IT			**0.013**	**0.036**	**0.026**
			(0.011)	**(0.024)**	**(0.018)**

IT only: Inflation -2.2 pp; FR only: Inflation not significant

Result: interaction & timing

- FR after IT on Inflation *vs.* IT only: no significant difference
- IT after FR on Inflation -3.9 pp *vs.* IT only -2.2 pp

Robustness

Time length between IT (FR) and FR (IT)					0.0003
					(0.0014)
Output Gap	0.602*	0.751**	0.214*	0.016	0.125
	(0.359)	(0.354)	(0.117)	(0.120)	(0.141)
Trade Openness	-0.00003	-0.00008	-0.00004	0.0002	0.00008
	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
Terms of Trade Growth Rate	-0.042	-0.030	-0.101	-0.084	-0.063
	(0.108)	(0.108)	(0.070)	(0.067)	(0.086)
Government Stability	-0.018**	-0.018**	-0.011***	-0.016***	-0.013**
	(0.008)	(0.008)	(0.003)	(0.004)	(0.005)
Logarithm of Real per capita GDP	-0.004	-0.008	-0.008*	-0.010	-0.007
	(0.011)	(0.012)	(0.005)	(0.007)	(0.007)
Time Effects	Yes	Yes	Yes	Yes	Yes

[9]: conservative IT dates: better for IT only, better IT and FR interaction & timing

[10]: use of Time Length: no qualitative changes of our results

VI. Conclusion

First empirical study on IT-FR interaction (152 countries, 1990-2009)

Results

(i) IT-FR interaction matters (Sargent & Wallace, 1981, Woodford, 1994)

(ii) timing of adoption of IT and FR is not neutral on PFB and Inflation

Policy implications

- Theoretical perspective
  - first FR (political power) then IT (delegation unelected) is preferable
  - new perspective of Barro & Gordon (1983) game Government/Central Bank: incentives for setting policies cooperative basis
- Practical perspective
  - prioritize fiscal reforms (at least not consider FP *after* MP reforms)

Developments:

- effects of imposing formal restraints in highly uncertain environments
- study the impact of macroeconomic reforms on macroeconomic volatility