

# Just Do IT?

## An Assessment of Inflation Targeting in a Global Comparative Case Study

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*All remaining errors are ours alone. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Dallas or the Federal Reserve System.*

# Motivation

- Inflation Targeting (IT) has become the norm (>40 countries) since its 1990 adoption by the Reserve Bank of New Zealand.
- IT is a monetary policy framework where central banks:
  - Publicly announce an explicit inflation target.
  - Adjust monetary policy tools to steer inflation toward the target.
  - Aim to stabilize inflation expectations, improving policy trade-offs. [▶ Studies](#) [▶ Mechanisms](#)
- The literature on IT's effects is extensive but with mixed results.
- **Balima et al. (2020) meta-analysis:**
  - 45% of estimates show a significant negative effect on inflation.
  - 34% of estimates show no statistically significant effect.
- Some studies attempt to identify causality but face methodological limitations (DPM, DID, PSM, etc.). [▶ Diff-in-Diff](#)

## What We Do

We apply the Synthetic Control Method (SCM; Abadie, JEL 2021) at the country level to assess IT performance:

- Whether IT reduces inflation over different time horizons by shifting the target ( $ATT < 0$ ) (low inflation hypothesis)
- The persistence of disinflation gains during the 2007-09 commodity price shock and Global Financial Crisis (GFC) (resilience or lock-in hypothesis).
- Whether IT reduces the root mean squared (RMS) deviations of inflation from the target (stable inflation hypothesis).

Explore key macroeconomic factors (covariates) influencing IT effectiveness.

# Key Findings

## What We Find:

1. Significant reductions (increases in Japan) in inflation in  $\sim 1$  out of 3 economies.
2. IT allowed lower (but mostly insignificant) inflation during the 2007-09 crisis.
3. Nearly half of the economies kept inflation closer to the target.
4. Exchange rate stability and monetary independence, especially among EMDEs, are linked to IT effectiveness.

## Our Contribution:

- Assess the heterogeneity of IT effectiveness across a broad sample.
- Introduce new metrics to evaluate IT success:
  - Resilience to external shocks.
  - Dispersion around the target.
- Identify key drivers of IT effectiveness.

# Some Intuition: IT in Small Open Economies

## New Keynesian Model:

- Inflation and output dynamics depend on the policy rate gap from neutral, with openness ( $w$ ) affecting trade-offs.
- Core equations:

$$x_t = \mathbb{E}_t(x_{t+1}) - \sigma_w^{-1}(i_t - \mathbb{E}_t\pi_{t+1} - r_t^n)$$

$$\pi_t = \beta\mathbb{E}_t(\pi_{t+1}) + \kappa_w x_t$$

$$r_t^n = i_t^n \quad (\text{zero-inflation frictionless allocation})$$

## Second-Order Expectational Difference Equation on $\pi_t$ :

- Using the Phillips curve to replace the output gap  $x_t$  in the IS curve:

$$\pi_t = ((1 + \beta) + \kappa\sigma^{-1}) \mathbb{E}_t(\pi_{t+1}) - \beta\mathbb{E}_t(\pi_{t+2}) - \kappa\sigma^{-1}(i_t - i_t^n)$$

# Some Intuition: IT in Small Open Economies

## Forward-Looking Solution for Inflation:

$$\pi_t = -\kappa_w \sigma_w^{-1} \sum_{j=0}^{+\infty} \psi_j(\kappa_w, \sigma_w^{-1}) \mathbb{E}_t(i_{t+j} - i_{t+j}^n)$$

## Limiting Condition:

- Requires long-term inflation expectations to remain bounded.
- Must satisfy:

$$\lim_{j \rightarrow \infty} (\psi_j(\kappa_w, \sigma_w^{-1}) \mathbb{E}_t(\pi_{t+j}) - \beta \psi_{j-1}(\kappa_w, \sigma_w^{-1}) \mathbb{E}_t(\pi_{t+j+1})) = 0$$

## Weight Recursion:

$$\begin{aligned} \psi_j(\kappa_w, \sigma_w^{-1}) &= ((1 + \beta) + \kappa_w \sigma_w^{-1}) \psi_{j-1}(\kappa_w, \sigma_w^{-1}) \\ &\quad - \beta \psi_{j-2}(\kappa_w, \sigma_w^{-1}), \quad \forall j \geq 2 \end{aligned}$$

$$\psi_1(\kappa_w, \sigma_w^{-1}) = (1 + \beta) + \kappa_w \sigma_w^{-1}$$

$$\psi_0(\kappa_w, \sigma_w^{-1}) = 1, \quad \psi_{-1}(\kappa_w, \sigma_w^{-1}) = 0$$

# Some Intuition: IT Policy Counterfactuals

## Inflation Counterfactuals: IT vs. non-IT:

$$\pi_t^{IT} - \pi_t^{non-IT} = -\kappa_w \sigma_w^{-1} \sum_{j=0}^{+\infty} \psi_j (\kappa_w, \sigma_w^{-1}) \mathbb{E}_t(i_{t+j}^{IT} - i_{t+j}^{non-IT})$$

## Implications:

- Even under a **credible IT** inflation anchor, multiple policy paths can lead to the same long-run outcome.
- **Credibility of the central bank target alone may not be sufficient**: policy choices and policy trade-offs still shape the performance under alternative frameworks.
- Understanding these policy trade-offs is key for **evaluating the performance of an IT regime**.

# Design and Data

# Design: Intervention

- To classify IT central banks (ITCBs), we focus on: [▶ Conditions](#)
  - Explicit announcement of an IT target and formal acknowledgment of the IT framework.
  - Use of a policy rate as the primary monetary instrument.
  - Some degree of exchange rate flexibility.
- IT adoption periods identified from central bank documents and 58 studies.
- Initial treated sample: 40 IT economies (13 AEs, 27 EMDEs) out of 47 candidates. [▶ Details](#)
- Donor pools: [▶ Details](#)
  - 20 (17 AEs, 3 EMEs) for treated AEs.
  - 50 EMDEs for treated EMDEs.

# Design

- **Pre-Intervention:**
  - Typically starts at the beginning of our sample: 1981:Q1.
  - Requires at least 16 quarters of data.
- **Post-Intervention:**
  - Typically ends in 2018:Q4 (before the pandemic).
  - Requires at least 12 quarters of data.
- **Outcome Variable:** Approximate percent change in seasonally-adjusted CPI:

$$100 (\ln (CPI_t) - \ln (CPI_{t-4}))$$

▶ Summary Treated

# Empirical Strategy

# Empirical Strategy

- We apply the **Synthetic Control Method (SCM)** (Abadie et al., 2010; Abadie et al., 2015). ▶ Method
- To enhance pre-treatment fit, we use the **intercept-shifted SCM** (Ferman and Pinto, 2021).
- **Predictor Variables:** Pre-treatment outcome values (every other quarter of the pre-intervention period).
- **Dynamic Treatment Effect (DTE):** At any time  $t \geq T_0$ , the treatment effect on the treated unit ( $i = 1$ ) is given by:

$$\tau_t = \pi_{1t} - \pi_{1t}^N \qquad \hat{\tau}_{1t} = \pi_{1t} - \sum_{i=2}^{J+1} w_i \pi_{it}$$

where:

- $\pi_{1t}$  is the **demeaned inflation rate** for the treated country.
- $\pi_{1t}^N$  represents the **counterfactual inflation rate** in the absence of IT.
- $w_i$  are the weights assigned to each control unit, constrained by  $0 \leq w_i \leq 1$ .
- $i = 2, 3, \dots, J + 1$  are the **control units**.

# Conventional Measure of IT Effectiveness

- After estimating the **Dynamic Treatment Effect (DTE)**, we compute the **Average Treatment Effect on the Treated (ATT)** for sub-periods of width  $L$ :

$$\widehat{ATT}_L = \frac{1}{L} \sum_{t_1}^{t_2} \widehat{\tau}_{1t}$$

where  $L = t_2 - t_1 + 1$  and  $T_0 \leq t_1 < t_2 \leq T$ .

- **Key Periods of Interest:**

- $L = 12$  quarters,  $t_1 = T_0$  (*Transition phase*).
  - $L = 20$  quarters,  $t_1 = T_0$  (*Extended transition*).
  - $t_1 = T_0, t_2 = T$  (*Full post-treatment period*).
  - $L = 12$  quarters,  $t_1 = 2007Q1$  (*Resilience hypothesis*).
- This measure of effectiveness focuses on the inflation level, but not the volatility around the target

# Findings

## Results: Pre-Treatment Fit

- This analysis presents a **challenging task** due to high volatility and noise in the data.
- **Pre-treatment fit varies:** Some cases exhibit poor pre-T fit.
- **Inclusion Criteria:** An IT country remains in the analysis if:
  - Root Mean Squared Prediction Error (**RMSPE**)  $< 3$ .
  - Mean Absolute Prediction Error divided by Standard Deviation (**MAPE/SD**)  $< 0.5$  (Hollingsworth and Wing, 2020).

▶ Fit Results

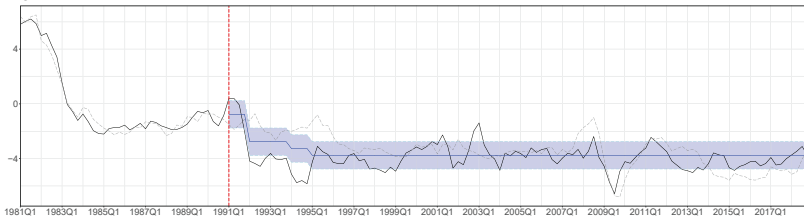
▶ Weights

- **Final sample with good pre-T fit:** 24 economies (10 AEs, 14 EMDEs).

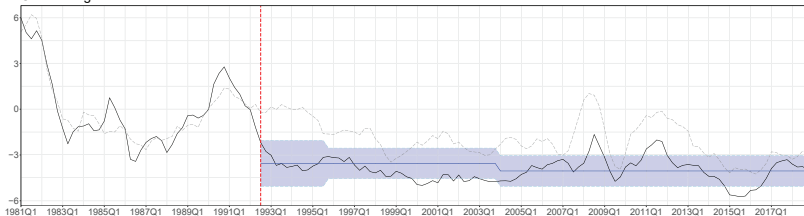
# Results: Some AEs

▶ Aggregate results

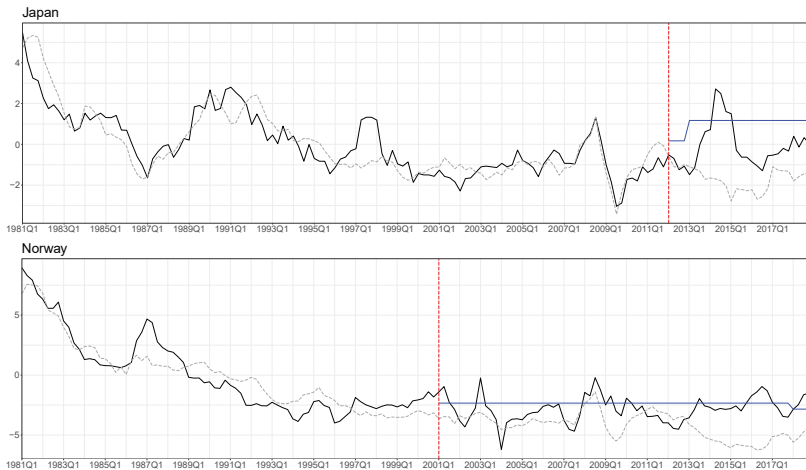
Canada



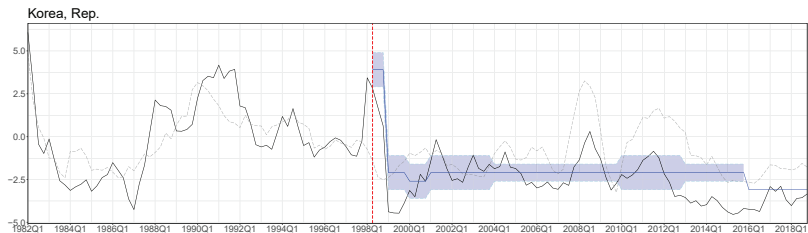
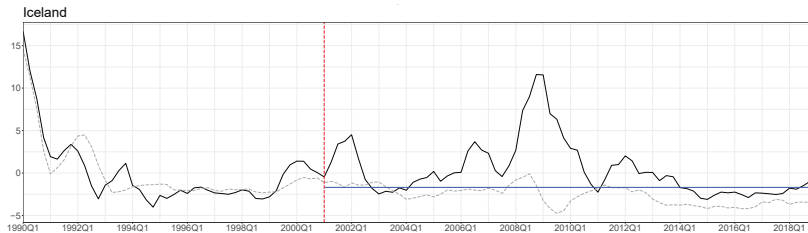
United Kingdom



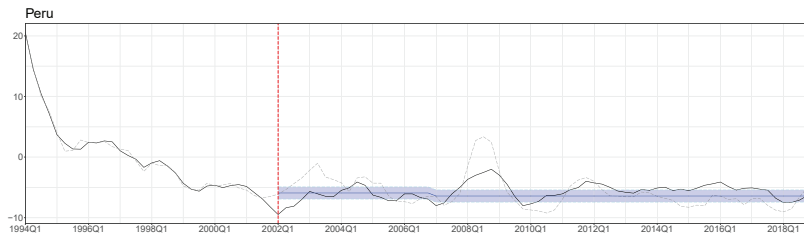
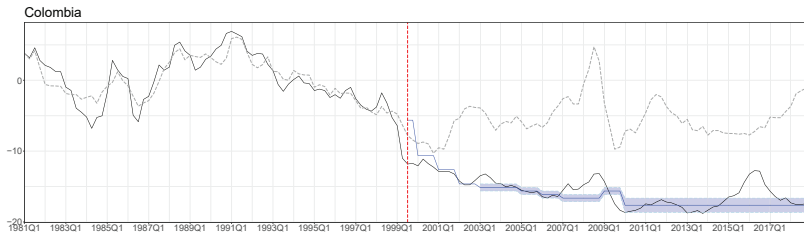
# Results: Some AEs



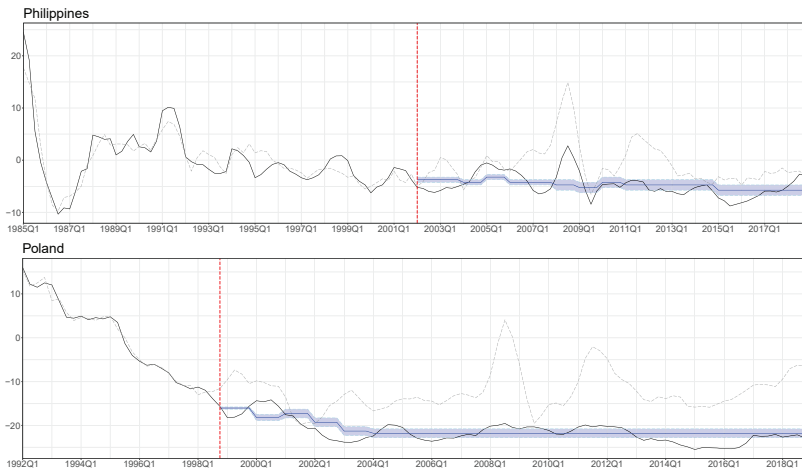
# Results: Some AEs



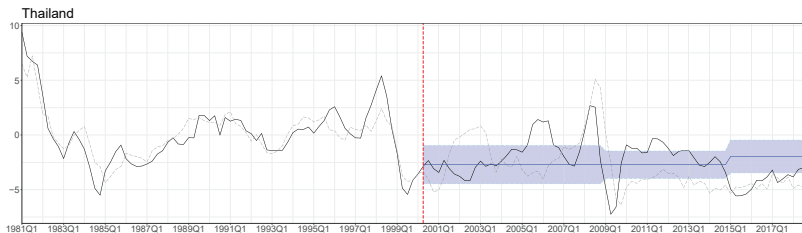
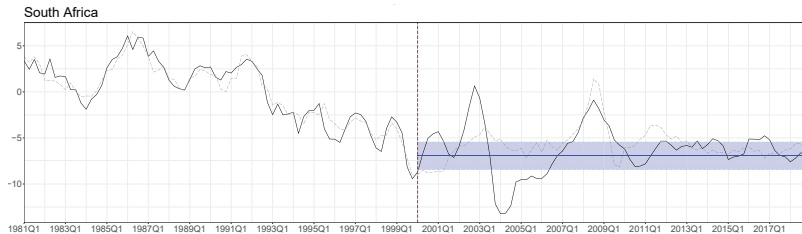
# Results: Some EMDEs



# Results: Some EMDEs



# Results: Some EMDEs



## Exact Inference for $\tau_t$

**Placebo Studies:** We iteratively apply SCM to every unit in the donor pool that did not implement the intervention.

▶ Placebo Tests

▶ Rank

**Significance Evaluation:** We assess the significance of  $\tau_t$  using the **distribution of ratios between post-T RMSPE and pre-T RMSPE** ( $R_i$ ).

$$r_j = \frac{R_j(T_0 + 1, T)}{R_j(1, T_0)}$$

for  $j = 1, \dots, J + 1$ , where  $R_j(\cdot)$  is defined for  $1 \leq t_1 \leq t_2 \leq T$  as:

$$R_j(t_1, t_2) = \left[ \frac{1}{t_2 - t_1 + 1} \sum_{t_1}^{t_2} (\pi_{jt} - \hat{\pi}_{jt}^N)^2 \right]^{\frac{1}{2}}$$

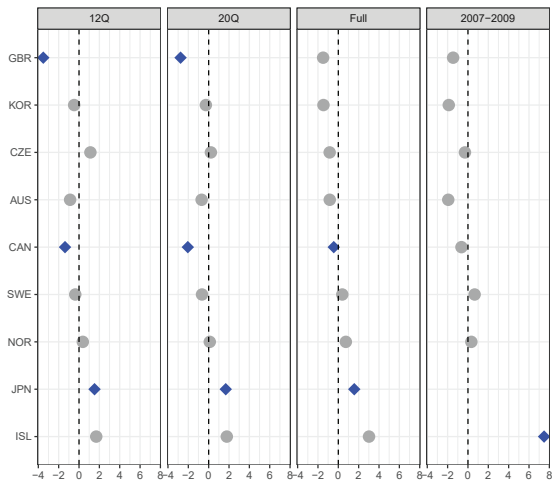
# Results: ATT Estimates and Inference

▶ Robustness checks

	First 12Q Post-T Period	First 20Q Post-T Period	Full Post-T Period	2007-2009 Period
<b>Advanced economies</b>				
Australia	-0.88	-0.69	-0.84	-1.94
Canada	-1.38 *	-2.05 *	-0.45 *	-0.64
Czech Republic	1.12	0.22	-0.85	-0.30
Iceland	1.69	1.78	3.02	7.48 **
Japan	1.52 *	1.68 *	1.57 *	NA
Korea, Rep.	-0.48	-0.28	-1.46	-1.89
Norway	0.37	0.11	0.74	0.33
Sweden	-0.37	-0.65	0.39	0.66
United Kingdom	-3.51 *	-2.76 *	-1.49	-1.46
<b>Emerging market and developing economies</b>				
Albania	3.83	NA	3.28	NA
Chile	-10.32	-21.58	-9.73	-6.83
Colombia	-4.90 **	-6.59 **	-10.21 **	-12.80 **
Guatemala	0.55	-0.36	-1.62	-3.08
Hungary	-0.93	-1.50	-2.29 *	-2.47 **
India	-1.12	NA	-0.94	NA
Indonesia	2.08	1.55	-0.86	0.35
Peru	-2.07 **	-1.43 **	-0.24	-1.77
Philippines	-2.19	-2.04	-4.11 *	-7.25 *
Poland	-4.86 *	-5.61 *	-8.67 *	-10.47 **
Romania	-7.24	-7.50	-8.63	-8.41
Serbia	-2.73	-1.81	-4.67	-2.42
South Africa	2.45 *	0.06	-0.40 **	-0.09
Thailand	-1.35 *	-0.77 *	0.64	-1.72 **

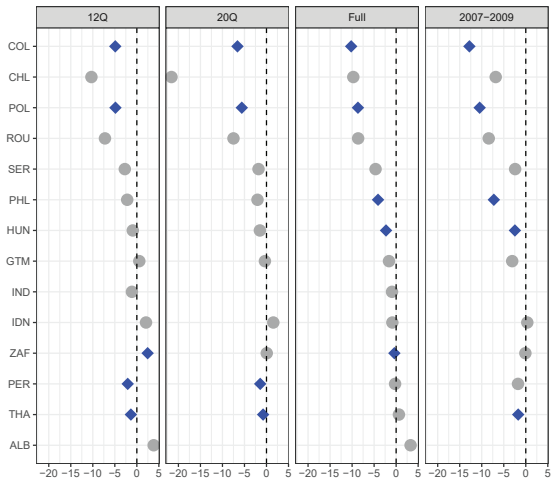
# Results: ATT – AEs

Robustness checks



# Results: ATT – EMDEs

▶ Robustness checks



## A New Measure of IT Effectiveness

We compare the **root mean squared deviations (RMSD)** of observed and synthetic inflation rates from the IT target:

$$DEV_j = \frac{RMSD_j(\pi - \pi^T) - RMSD_j(\hat{\pi}^N - \pi^T)}{R_j(1, T_0)}$$

for  $j = 1, \dots, J + 1$ , where  $T_0 \leq t_1 < t_2 \leq T$ . The numerator components are:

$$RMSD_j(\pi - \pi^T) = \left[ \frac{1}{L} \sum_{t_1}^{t_2} (\pi_{jt} - \pi_{1t}^T)^2 \right]^{\frac{1}{2}},$$

$$RMSD_j(\hat{\pi}^N - \pi^T) = \left[ \frac{1}{L} \sum_{t_1}^{t_2} (\hat{\pi}_{jt}^N - \pi_{1t}^T)^2 \right]^{\frac{1}{2}}.$$

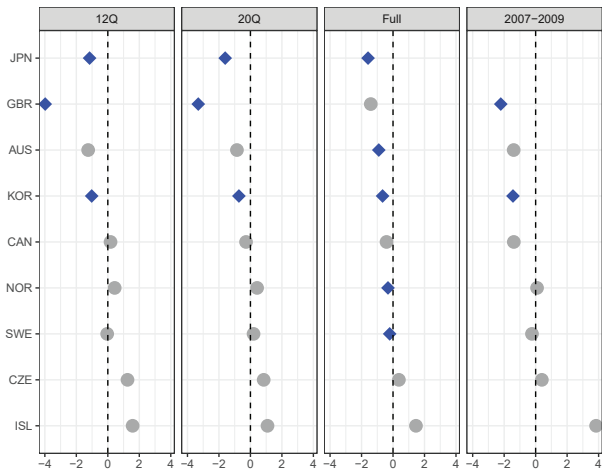
We assess the significance of the negative difference through a **placebo study**.

# Results: DEV

	First 12Q Post-T Period	First 20Q Post-T Period	Full Post-T Period	2007-2009 Period
<b>Advanced economies</b>				
Australia	-1.25	-0.86	-0.90 *	-1.40
Canada	0.17	-0.28	-0.41	-1.39
Czech Republic	1.25	0.84	0.37	0.39
Iceland	1.58	1.09	1.46	3.84
Japan	-1.16 **	-1.60 **	-1.59 **	NA
Korea, Rep.	-1.02 *	-0.73 *	-0.66 **	-1.44 *
Norway	0.44	0.42	-0.32 *	0.09
Sweden	-0.04	0.20	-0.21 **	-0.23
United Kingdom	-3.98 **	-3.31 **	-1.41	-2.21 *
<b>Emerging market and developing economies</b>				
Albania	-4.02 **	NA	-3.65 **	NA
Chile	-4.54 *	-8.64 *	-4.22 **	-1.97 *
Colombia	-1.59 **	-3.28 **	-5.85 **	-7.68 **
Guatemala	0.38	-0.13	-0.35	-0.59
Hungary	-0.51	-0.57 *	-0.67 *	-1.72 **
India	-0.06	NA	-0.09	NA
Indonesia	1.05	0.74	-0.08	0.15
Peru	-1.41 *	-1.43 **	-1.70 **	-3.42 *
Philippines	-0.17	-0.47	-1.52 **	-2.91 **
Poland	-3.85 *	-3.16 *	-7.07 **	-11.52 **
Romania	-3.59 *	-3.79	-3.53 *	-4.22
Serbia	-2.08	-0.77	-5.16	-1.88
South Africa	1.53	2.29	0.54	-0.78 *
Thailand	-1.28 **	-0.93 *	-0.31	-0.75 *

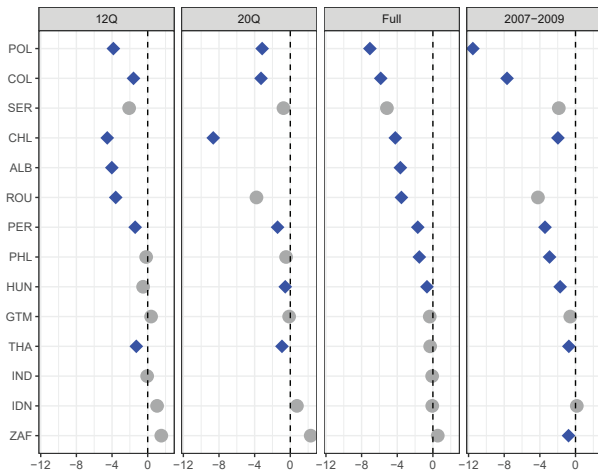
# Results: DEV – AEs

▸ Robustness checks

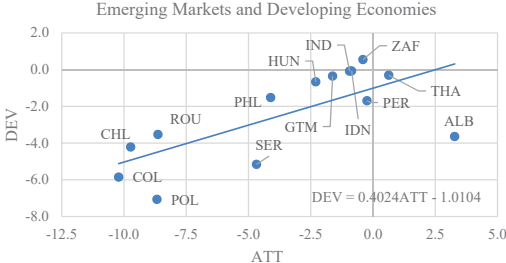
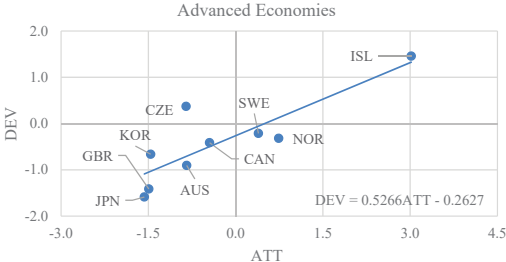


# Results: DEV – EMDEs

Robustness checks



# Correlation Between ATT and DEV



# IT Effectiveness

- **What drives IT effectiveness?** We assess variation using the **Dynamic Treatment Effect (DTE)** in a panel model.

## ▶ Results

- **Key Determinants:**
  - **Monetary independence** and **exchange rate stability** (Aizenman et al., 2010) are crucial, especially in EMDEs.
  - **Central bank independence** enhances stability in AEs, but **governor turnover** better reflects credibility in EMDEs.
  - **Financial openness** increases exposure to external shocks, influencing IT effectiveness.
- **Additional Factors:**
  - **Institutional quality** (corruption controls, CB independence).
  - **Macroeconomic conditions:** Budget balance, IT experience, inflation target.
  - **Financial system depth:** Impacts monetary policy transmission.
- No strong evidence links **financial and fiscal stability** to IT performance, though extreme instability (e.g., Iceland) can undermine success.

# Concluding Remarks

# Conclusions

- **IT is effective in approximately 1 out of 3 countries.**
  - Inflation reduction is **small in AEs** and **moderate in EMDEs**, aligning with prior literature.
  - In some AEs and EMDEs, IT accelerates the transition to lower inflation within the first 5 years.
  - Some EMDEs require more than 3-5 years to observe disinflation gains.
  - Japan stands out as a case of IT facilitating **desired inflation increases**.
- **Causal evidence supports the resilience (lock-in) hypothesis** in 1 out of 3 cases.
- **Significant improvement** in keeping stable inflation close to target, observed in 1 out of 2 cases.
- **Exchange rate stability and monetary independence** are key factors in IT effectiveness.

Thank you!

# Appendix

# Previous findings

← Motivation

- Several studies conclude or argue that ITCBs have been successful because (Balima et al., 2020)
  - reduce inflation and inflation volatility
  - lock in the benefits of previous disinflations (Mishkin and Posen, 1997; Corbo et al., 2002; Bernanke et al., 2018)
  - other benefits: improve GDP growth rate, reduce expected inflation, larger disinflation and lower forecast errors (Johnson, 2002), among others.

# Transmission mechanisms

◀ Motivation

- The IT adoption with a (credible) target below the current inflation rate leads to a lower inflation rate in the short run
- Transmission mechanisms
  - inflation expectations (Ball and Sheridan, 2004; Huang et al., 2019, many others)
  - lower exchange-rate pass-through (Agénor and Pereira da Silva, 2019)
  - output gap (Taylor rule with deviations of inflation from target)

- Issues with DID studies (taken in part from Lee, 2011):
  - conclusions at aggregate level only
  - staggered IT adoption, different pre-/post-treatment periods
  - parallel trends assumption
  - small number of control units
  - same weight for each control unit
  - not individual effects
- Lee (2011) and Barbosa et al. (2018). Similar methods but different
  - samples
  - treatment definition
  - choice of treated and untreated units
  - research questions
  - measures of effectiveness
  - results

Conditions:

1. Explicit acknowledgment of the IT adoption by the monetary authority or its legally-binding incorporation in the CB's statutes
2. Periodic announcement of an explicit numerical inflation-target
3. Use of a policy rate or key interest rate (absence of an explicit monetary aggregate or exchange rate target)
4. The publication of inflation forecasts and use of accountability mechanism.

- We find 47 candidates
- 3 with very short IT experience: < 16 quarters: ARG, CRI, JAM
- 4 show partial implementation: USA, SWI, ESP, URY
- Initial sample: 40 IT economies: 13 AEs, 27 EMDEs
- All have
  - acknowledged IT adoption
  - point target or tolerance band
  - price index (CPI or variant)
  - published forecasts of inflation and other macro indicators
  - some type of accountability mechanism (OL, PH, other).

## Treated and donor pool ◀ Intervention

- Our initial set: 40 economies (13 AEs, 27 EMDEs)
- We use Ilzetzi et al. (2017) coarse classification (2-5) of ERRs
- We discard countries with
  - multilateral and unilateral currency unions
  - currency boards
  - other hard pegs (pre-announced band narrower than or equal to  $\pm 2\%$ , and de facto pegs)
- This criterion restricts some countries: ALB (09Q1-13Q4), FIN (93Q1-98Q4), ROM (05Q3-12Q4), SVK (05Q3-08Q4).

# Data: Outcome variable

◀ Design

	Advanced economies	Emerging market and developing economies
	All IT units	
<hr/>		
Pre-IT regime periods		
Mean	8.54	29.53
Median	4.40	11.67
Standard deviation	17.83	55.64
Coefficient of variation	2.09	1.88
N	893	2267
<hr/>		
Post-IT regime periods		
Mean	2.50	4.97
Median	2.04	4.25
Standard deviation	2.28	3.47
Coefficient of variation	0.91	0.70
N	995	1354
Cross-sectional units	12	26
<hr/>		

## SC method summary ← Empirical strategy

- The weights ( $W$ ) are obtained by matching the treated unit's outcome with the SC over the pre-treatment period
- Define  $X_1$  as a  $(K \times 1)$  vector of pre-treatment features of the treated unit,  $X_0$  denotes a  $(K \times J)$  matrix that contains the same variables for the unaffected units
- The vector  $W^*$  is chosen to minimize  $\|X_1 - X_0W\| = \sqrt{(X_1 - X_0W)'V(X_1 - X_0W)}$  subject to  $w_2 \geq 0, \dots, w_{J+1} \geq 0, w_2 + \dots + w_{J+1} = 1$ , where  $V$  is some  $(K \times K)$  symmetric and positive semi-definite matrix
- $V$  matrix allows different weights to the variables in  $X_0$  and  $X_1$  depending on their predictive power
- $V^*$  is chosen to minimize  $(X_1 - X_0W(V))'(X_1 - X_0W(V))$ .

## SC method summary

← Empirical strategy

- Abadie et al. (2010) show that the SCM estimator is asymptotically unbiased
- This holds if the number of pre-T periods is large relative to the scale of the transitory shocks.
- Ferman and Pinto (2021) show that under imperfect fit the demeaned version of the SCM can significantly reduce bias and variance relative to DID
- The number of post-T periods should be also sufficiently large
- We try to maximize period of analysis, at least 12Q of post-T period and 16Q of pre-T
- Within the final set of treated units, only two of them reach these lower bounds: SRB (16Q pre-T), IND (12Q post-T)
- For the vector of predictors: pre-T values of the outcome variable.

	RMSPE	MAPE	SD	MAPE/SD
<b>Advanced economies</b>				
Australia	1.31	1.09	2.84	0.38
Canada	0.48	0.40	2.76	0.14
Czech Republic	2.15	1.65	3.93	0.42
Iceland	1.67	1.25	4.05	0.31
Israel	1.21	1.03	1.75	0.59
Japan	0.81	0.62	1.50	0.41
Korea, Rep.	1.38	1.06	2.24	0.47
New Zealand	3.11	2.82	4.78	0.59
Norway	1.16	0.89	3.22	0.28
Slovak Republic	2.34	1.58	2.75	0.58
Sweden	1.59	1.28	2.66	0.48
United Kingdom	0.77	0.62	2.35	0.27
<b>Emerging market and developing economies</b>				
Albania	0.77	0.61	1.76	0.35
Armenia	3.80	2.97	7.53	0.39
Brazil	19.37	10.44	39.65	0.26
Chile	2.99	2.38	5.83	0.41
Colombia	1.63	1.27	3.73	0.34
Dominican Republic	4.08	2.70	5.64	0.48
Georgia	4.02	3.01	7.79	0.39
Ghana	3.75	3.04	7.39	0.41
Guatemala	1.68	1.09	3.87	0.28
Hungary	2.02	1.60	7.50	0.21
India	1.80	1.38	3.03	0.46
Indonesia	2.62	1.65	5.22	0.32
Kazakhstan	3.14	2.36	6.86	0.34
Mexico	5.45	4.46	8.39	0.53
Moldova	4.72	4.05	9.09	0.45
Paraguay	3.73	2.78	7.82	0.36
Peru	0.62	0.44	6.27	0.07
Philippines	2.31	1.75	5.67	0.31
Poland	1.04	0.73	9.04	0.08
Romania	1.94	1.63	9.84	0.17
Russian Federation	7.75	4.98	14.09	0.35
Serbia	0.77	0.51	2.57	0.20
South Africa	1.02	0.77	3.49	0.22
Thailand	1.26	0.97	2.76	0.35
Turkey	9.96	8.77	19.53	0.45
Uganda	3.65	2.90	5.23	0.55

# Results: Aggregate ATT ← Gaps

	First 12Q Post-T Period	First 20Q Post-T Period	Full Post-T Period	2007-2009 Period
<b>Advanced economies</b>				
Mean	-0.21	-0.29	0.07	0.28
Weighted mean	-0.57	-0.65	-0.04	-0.12
Median	-0.37	-0.28	-0.45	-0.47
Min	-3.51	-2.76	-1.49	-1.94
Max	1.69	1.78	3.02	7.48
N (ATT<0)	5	5	5	5
N (ATT≥0)	4	4	4	3
N	9	9	9	8
<b>Emerging market and developing economies</b>				
Mean	-2.06	-3.96	-3.46	-4.75
Weighted mean	-1.51	-2.14	-2.68	-3.50
Median	-1.71	-1.66	-1.96	-2.77
Min	-10.32	-21.58	-10.21	-12.80
Max	3.83	1.55	3.28	0.35
N (ATT<0)	10	10	12	11
N (ATT≥0)	4	2	2	1
N	14	12	14	12

# Results: Weights

Control units	Australia	Canada	Czech Rep.	Finland	Iceland	Japan	Korea	Norway	Sweden	UK
Algeria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Austria	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00
Bangladesh	0.98	0.06	0.00	0.13	0.00	0.09	0.00	0.03	0.08	0.06
Belgium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.10
Cyprus	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.11
Denmark	0.00	0.14	0.00	0.23	0.76	0.00	0.00	0.80	0.00	0.00
France	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Germany	0.00	0.24	0.03	0.00	0.00	0.23	0.00	0.00	0.00	0.00
Greece	0.00	0.06	0.86	0.00	0.00	0.04	0.00	0.14	0.22	0.07
Iran	0.00	0.05	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.00
Ireland	0.00	0.20	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00
Italy	0.00	0.02	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00
Luxembourg	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00
Malaysia	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00
Malta	0.00	0.21	0.00	0.18	0.00	0.04	0.27	0.00	0.00	0.23
Netherlands	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.04
Portugal	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.10	0.00
Singapore	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.20	0.34
Slovenia	0.02	0.01	0.10	0.01	0.05	0.01	0.01	0.00	0.01	0.00
Taiwan	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.12	0.00
Descriptive statistics										
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	0.98	0.24	0.86	0.23	0.76	0.23	0.57	0.80	0.28	0.34
#<0.01	18	12	17	12	17	12	17	16	14	12
#>0.01 & <0.1	1	4	1	3	1	4	0	2	2	4
#>0.1	1	4	2	5	2	4	3	2	4	4

**Table 6. Control Unit Weights for each Synthetic Unit - Emerging and Developing Economies**

<b>Control units</b>	<b>Albania</b>	<b>Chile</b>	<b>Colombia</b>	<b>Guatemala</b>	<b>Hungary</b>
Min	0.00	0.00	0.00	0.00	0.00
Max	0.27	0.23	0.16	0.52	0.36
#<0.01	40	42	37	43	39
#>0.01 & <0.1	6	4	9	5	8
#>0.1	4	4	4	2	3
<b>Control units</b>	<b>India</b>	<b>Indonesia</b>	<b>Peru</b>	<b>Philippines</b>	<b>Poland</b>
Min	0.00	0.00	0.00	0.00	0.00
Max	0.39	0.30	0.29	0.27	0.26
#<0.01	39	45	40	42	40
#>0.01 & <0.1	8	0	6	4	7
#>0.1	3	5	4	4	3
<b>Control units</b>	<b>Romania</b>	<b>Serbia</b>	<b>South Africa</b>	<b>Thailand</b>	
Min	0.00	0.00	0.00	0.00	
Max	0.54	0.59	0.18	0.18	
#<0.01	47	43	37	38	
#>0.01 & <0.1	0	5	10	8	
#>0.1	3	2	3	4	

Note: Control units are displayed in rows, treated units are placed in columns. #<0.01 counts the number of weights lower than 0.01; #>0.01 & <0.1 indicates the number of weights between 0.01 and 0.1, and #>0.1 reports the number of weights larger than 0.1.

## Inference: Placebo test ▶ Inference

- We run placebo studies by iteratively applying the SCM to every unit in the donor pool that did not implement the intervention
- In each iteration, we reassign artificially the policy intervention to one of the comparison units
- For each iteration  $\widehat{\pi}_t^N$  is estimated to calculate the ratios  $r_j$ ,  $DEV_j$
- This iterative procedure provides a distribution of  $r_j$ ,  $DEV_j$  where no intervention took place
- For a significant effect, we wish to obtain the largest  $r_1$  and the smallest  $DEV_1$  (i.e., for the treated)
- Low power; we use one-tail tests (Abadie, 2020) at 10%

# Inference: Rank, p-values

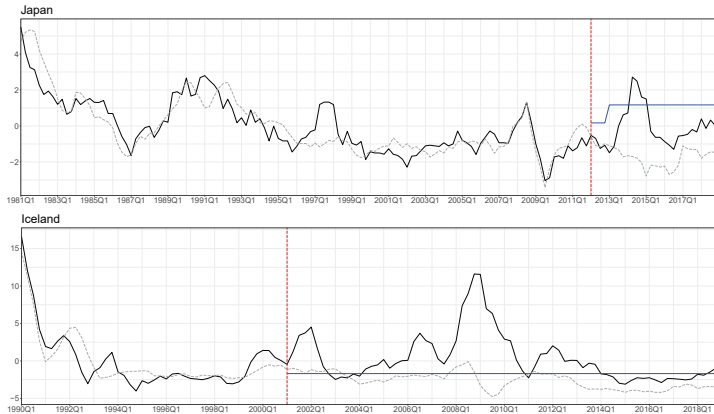
	First 12Q Post-T (H1:ATT>0)	First 12Q Post-T (H1: ATT<0)	First 20Q Post-T (H1: ATT>0)	First 20Q Post-T (H1: ATT<0)	Full Post-T (H1: ATT>0)	Full Post-T (H1: ATT<0)	2007Q1- 2009Q4 (H1: ATT>0)	2007Q1- 2009Q4 (H1: ATT<0)
<b>Australia</b>								
Rank	14	8	16	8	14	11	16	9
P-value	0.737	0.444	0.842	0.421	0.667	0.524	1.000	0.600
<b>Canada</b>								
Rank	3	1	3	1	11	2	9	4
P-value	0.188	0.059	0.167	0.056	0.524	0.095	0.529	0.308
<b>Czech Rep</b>								
Rank	9	14	11	15	18	20	19	20
P-value	0.474	0.700	0.579	0.750	0.857	0.952	1.000	0.952
<b>Iceland</b>								
Rank	3	14	6	18	5	14	1	NA
P-value	0.167	0.778	0.316	0.900	0.238	0.667	0.053	NA
<b>Japan</b>								
Rank	1	14	1	16	2	11	NA	NA
P-value	0.059	0.667	0.059	0.762	0.095	0.524	NA	NA
<b>Korea</b>								
Rank	3	6	5	7	12	5	15	4
P-value	0.188	0.333	0.294	0.389	0.571	0.238	0.882	0.211
<b>Norway</b>								
Rank	7	6	12	11	8	11	14	12
P-value	0.412	0.300	0.667	0.524	0.381	0.524	0.824	0.667
<b>Sweden</b>								
Rank	16	14	17	14	21	19	15	15
P-value	0.889	0.778	0.944	0.700	1.000	0.905	0.882	1.000
<b>UK</b>								
Rank	NA	1	NA	1	20	4	17	4
P-value	NA	0.056	NA	0.056	0.952	0.190	1.000	0.308

# Inference: Rank, p-values

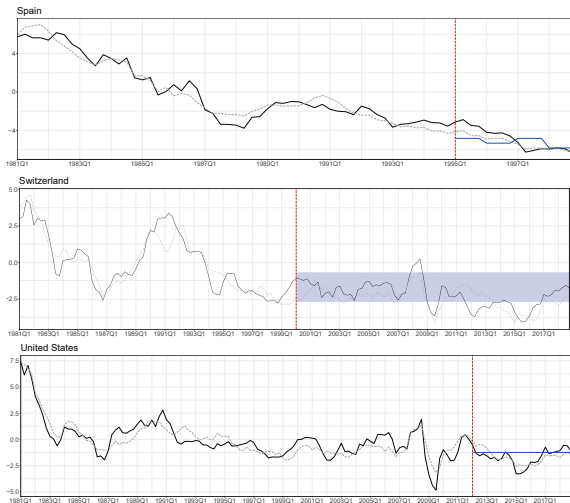
◀ Inference

	First 12Q Post-T (HI:ATT>0)	First 12Q Post-T (HI: ATT<0)	First 20Q Post-T (HI: ATT>0)	First 20Q Post-T (HI: ATT<0)	Full Post-T (HI: ATT>0)	Full Post-T (HI: ATT<0)	2007Q1- 2009Q4 (HI: ATT>0)	2007Q1- 2009Q4 (HI: ATT<0)
<b>Albania</b>								
Rank	5	NA	NA	NA	7	29	NA	NA
P-value	0.106	NA	NA	NA	0.137	0.569	NA	NA
<b>Chile</b>								
Rank	35	7	39	6	46	9	NA	7
P-value	0.833	0.152	0.886	0.128	0.902	0.176	NA	0.194
<b>Colombia</b>								
Rank	NA	2	NA	2	44	1	NA	1
P-value	NA	0.049	NA	0.045	0.863	0.020	NA	0.026
<b>Guatemala</b>								
Rank	39	27	41	13	44	12	NA	10
P-value	0.886	0.659	0.891	0.289	0.863	0.235	NA	0.244
<b>Hungary</b>								
Rank	27	9	31	7	40	5	24	2
P-value	0.600	0.209	0.689	0.163	0.784	0.098	0.571	0.050
<b>India</b>								
Rank	27	10	NA	NA	21	38	NA	NA
P-value	0.659	0.217	NA	NA	0.412	0.745	NA	NA
<b>Indonesia</b>								
Rank	29	44	36	47	38	40	43	42
P-value	0.644	0.957	0.750	1.000	0.760	0.800	0.915	1.000
<b>Peru</b>								
Rank	30	1	26	1	29	7	37	8
P-value	0.698	0.024	0.578	0.024	0.580	0.140	0.881	0.242
<b>Philippines</b>								
Rank	37	8	42	8	44	3	NA	3
P-value	0.925	0.205	0.977	0.190	0.863	0.059	NA	0.088
<b>Poland</b>								
Rank	44	3	47	3	44	3	NA	1
P-value	0.957	0.083	1.000	0.073	0.880	0.060	NA	0.036
<b>Romania</b>								
Rank	NA	17	NA	18	44	14	NA	16
P-value	NA	0.378	NA	0.375	0.880	0.280	NA	0.364
<b>Serbia</b>								
Rank	NA	21	33	19	34	6	NA	24
P-value	NA	0.477	0.702	0.413	0.708	0.125	NA	0.558
<b>South Africa</b>								
Rank	3	30	6	2	19	2	16	7
P-value	0.070	0.714	0.133	0.043	0.373	0.039	0.390	0.175
<b>Thailand</b>								
Rank	20	4	27	4	18	6	16	2
P-value	0.476	0.093	0.600	0.083	0.353	0.118	0.381	0.049

# Results: Japan, Iceland



# Robustness checks



## Quasi-IT Cases

	Average Treatment Effect on the Treated Units						Differences in Root Mean Squared Deviations from Inflation Target (DEV ratio)			
	RMSPE	MAPE/SD	First 12Q Post-T Period	First 20Q Post-T Period	Full Post-T Period	2007-2009 Period	First 12Q Post-T Period	First 20Q Post-T Period	Full Post-T Period	2007-2009 Period
Spain	0.69	0.17	0.43	0.32	0.32	NA	0.66	0.57	0.57	NA
Switzerland	0.80	0.31	0.50	0.52	0.52	0.45	-0.59	-0.62	-0.56	-0.34
United States	0.79	0.37	-0.28	-0.22	-0.01	NA	-0.17	0.13	0.12	NA
Uruguay	10.23	0.36	-3.89	-4.39	-4.41	NA	-0.41	-0.46	-0.46	NA

## Statistics Using All Pre-T Values as Predictors

	Average Treatment Effects on the Treated Units						Differences in Root Mean Squared Deviations from Inflation Target (DEV ratio)			
	RMSPE	MAPE/SD	First 12Q Post-T Period	First 20Q Post-T Period	Full Post-T Period	2007-2009 Period	First 12Q Post-T Period	First 20Q Post-T Period	Full Post-T Period	2007-2009 Period
<b>AEs</b>										
Australia	1.31	0.38	-0.88	-0.69	-0.84	-1.94	-1.25	-0.86	-0.90 **	-1.40
Canada	0.47	0.14	-1.12 *	-1.85 *	-0.37 *	-0.57	0.56	0.00	-0.41	-1.53
Czech Rep.	2.15	0.42	1.24	0.36	-0.72	-0.16	1.20	0.86	0.38	0.42
Iceland	1.67	0.31	1.69	1.78	3.02	7.48 *	1.58	1.09	1.46	3.84
Japan	0.81	0.41	1.53 *	1.68 *	1.57 *	NA	-1.16 **	-1.61 **	-1.59 **	NA
Korea, Rep.	1.40	0.48	-0.54	-0.42	-1.56	-2.06	-1.08 *	-0.80 *	-0.74 **	-1.53 *
Norway	1.16	0.28	0.34	0.13	0.82	0.43	0.45	0.38	-0.38 *	0.05
Sweden	1.65	0.51	0.35	0.22	1.78	1.92	0.33	0.21	-0.94 **	-0.67 *
United Kingdom	0.77	0.27	-3.52 *	-2.75 *	-1.43	-1.42	-3.98 **	-3.31 **	-1.40	-2.23 *
<b>EMDEs</b>										
Albania	0.77	0.34	3.66	NA	3.10	NA	-3.80 **	NA	-3.41 **	NA
Chile	3.07	0.43	-8.88	-20.24	-10.28	-9.82	-4.55 *	-8.25 *	-4.28 **	-3.03 **
Colombia	1.64	0.34	-4.56 **	-6.36 **	-9.91 **	-12.17 **	-1.42 **	-3.17 **	-5.65 **	-7.24 **
Guatemala	1.68	0.28	0.32	-0.66	-1.94	-3.62	0.24	-0.32	-0.57	-1.00 *
Hungary	2.02	0.21	-0.91	-1.49	-2.29 *	-2.43 *	-0.50	-0.56 *	-0.66 *	-1.70 **
India	1.79	0.45	-1.11	NA	-1.02	NA	-0.02	NA	-0.10	NA
Indonesia	2.62	0.32	2.08	1.55	-0.86	0.35	1.05	0.74	-0.08	0.15
Peru	0.49	0.06	-1.20 *	-0.63 *	1.31	-0.19	-0.86	-0.95 **	-2.09 **	-2.64
Philippines	2.37	0.31	-3.03	-2.83	-4.96 **	-8.06 *	-0.44	-0.73	-1.75 **	-3.10 **
Poland	1.03	0.08	-5.09	-5.64	-8.28	-9.88 *	-4.03 *	-3.19 *	-6.69 **	-11.00 *
Romania	1.93	0.17	-6.93	-7.22	-8.33	-8.06	-3.42	-3.65	-3.38	-4.05
Serbia	0.66	0.20	-2.30	-1.72	-5.22	-2.06	-1.50	-0.36	-7.04	-1.23
South Africa	0.99	0.22	2.00 *	-0.35 **	-0.68 **	-0.30	1.68	2.29	0.50	-0.83 *
Thailand	1.26	0.35	-1.33 *	-0.79 *	0.53	-1.78 *	-1.20 **	-0.87 *	-0.25	-0.78 *

## Advanced Economies' Donor Pool without EMEs

	Average Treatment Effects on the Treated Units						Differences in Root Mean Squared Deviations from Inflation Target (DEV ratio)			
	RMSPE	MAPE/SD	First 12Q	First 20Q	Full Post-T Period	2007-2009 Period	First 12Q	First 20Q	Full Post-T Period	2007-2009 Period
			Post-T Period	Post-T Period			Post-T Period	Post-T Period		
<b>AEs</b>										
Australia	1.93	0.55	-0.05	-0.97	-0.39	-0.41	0.38	0.49	0.16	0.00
Canada	0.59	0.17	-1.47 *	-1.96 *	-1.09	-1.41	0.22	0.17	-0.41	-0.85
Czech Republic	2.15	0.42	1.12	0.22	-0.52	-0.30	1.25	0.84	0.24	0.39
Iceland	1.67	0.31	1.69	1.78	3.02	7.48 *	1.58	1.09	1.46	3.84
Japan	0.87	0.45	1.73 *	1.89 *	1.72	NA	-1.43 *	-1.80 *	-1.71 *	NA
Korea, Rep.	1.56	0.54	-0.22	-0.01	-1.61	-2.38	-1.16 *	-0.85 *	-0.87 *	-1.67
Norway	1.18	0.27	0.13	-0.07	0.67	0.32	0.59	0.51	-0.27	0.16
Sweden	1.62	0.49	-0.43	-0.79	0.40	0.58	-0.13	0.14	-0.28	-0.25
United Kingdom	0.85	0.28	-3.40 *	-2.69 *	-1.77	-1.83	-3.47 *	-2.90 *	-1.45 *	-2.32 *

Covariates	ALL		AEs		EMDEs	
	[1]	[2]	[3]	[4]	[5]	[6]
Monetary policy independence	-0.442 ** (0.188)	-0.504 ** (0.223)	-0.295 (0.312)	-0.420 (0.457)	-0.970 *** (0.207)	-1.075 *** (0.312)
Exchange rate stability	-1.305 ** (0.619)	-1.144 * (0.615)	-0.718 (0.670)	-0.057 (0.588)	-1.962 ** (0.891)	-2.230 * (1.047)
Financial openness		0.895 * (0.464)		-0.294 (0.276)		0.966 (0.763)
Central bank independence		0.203 (0.460)		0.373 (0.347)		1.408 (0.806)
Irregular CB governor turnover		0.310 * (0.153)		0.060 (0.100)		0.139 (0.201)
Corruption control		0.023 (0.180)		-0.215 * (0.093)		0.147 (0.331)
Financial development		0.758 (1.033)		1.311 (1.134)		2.292 (1.621)
Budget balance-to-GDP ratio		-0.012 (0.026)		-0.010 (0.016)		0.016 (0.036)
Trade openness		0.001 (0.005)		0.017 (0.009)		-0.002 (0.006)
Number of quarters under IT		-0.043 (0.025)		-0.008 * (0.004)		-0.055 *** (0.011)
Inflation target		-0.035 (0.042)		0.146 (0.106)		0.198 ** (0.081)
Lagged dependent variable	0.909 *** (0.021)	0.905 *** (0.013)	0.860 *** (0.012)	0.835 *** (0.014)	0.882 *** (0.017)	0.850 *** (0.013)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,548	1,458	736	665	812	793
No. of countries	22	20	9	8	13	12
R-squared	0.935	0.913	0.879	0.743	0.954	0.933

Covariates	ALL		AEs		EMDEs	
	[1]	[2]	[3]	[4]	[5]	[6]
Monetary policy independence	-0.284 * (0.160)	-0.309 (0.198)	-0.025 (0.116)	0.102 (0.188)	-0.864 *** (0.216)	-0.709 ** (0.260)
Exchange rate stability	-1.348 ** (0.562)	-1.177 *** (0.407)	-0.930 (0.706)	-0.025 (0.451)	-1.173 ** (0.492)	-1.436 * (0.681)
Financial openness		1.142 * (0.572)		0.057 (0.272)		1.689 ** (0.555)
Central bank independence		0.364 (0.389)		1.142 *** (0.198)		0.430 (1.055)
Irregular CB governor turnover		0.334 ** (0.121)		-0.318 (0.242)		0.322 ** (0.142)
Corruption control		0.097 (0.171)		-0.063 (0.131)		-0.043 (0.303)
Financial development		-0.977 (1.155)		-1.808 (1.708)		0.237 (1.423)
Budget balance-to-GDP ratio		0.008 (0.029)		0.016 (0.010)		0.072 (0.050)
Trade openness		-0.003 (0.004)		-0.003 (0.005)		-0.005 (0.006)
Number of quarters under IT		-0.034 (0.029)		0.011 (0.007)		-0.021 (0.012)
Inflation target		-0.006 (0.058)		0.163 (0.137)		0.413 *** (0.098)
Lagged dependent variable	0.900 *** (0.027)	0.889 *** (0.019)	0.833 *** (0.027)	0.762 *** (0.032)	0.853 *** (0.028)	0.793 *** (0.022)
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,548	1,458	736	665	812	793
No. of countries	22	20	9	8	13	12
R-squared	0.917	0.891	0.791	0.719	0.944	0.925