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THE IMPACT OF INFLATION TARGETING ON UNEMPLOYMENT IN DEVELOPING AND EMERGING ECONOMIES*

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ABSTRACT

Several countries around the world have adopted the inflation targeting regime for monetary policy. Despite the growing literature on the issue, it is not clear whether developing and emerging countries can improve their economic performance by adopting inflation targeting. This working paper examines the extent to which macroeconomic policies anchored to inflation targeting affect unemployment, economic growth and the output gap. The results show that inflation targeting causes no harm to employment in developing and emerging countries. On the contrary, it might reduce average unemployment and narrow the output gap. Given that the change in regime must be accompanied by institutional and economic reforms to fiscal and exchange rate policies, targeters might be better off than non-targeters. Hence there is no apparent reason to condemn the adoption of the inflation targeting regime by developing and emerging countries.

Key Words: Inflation targeting; Unemployment; Economic growth; Output gap.

1 INTRODUCTION

Several countries around the world have adopted the inflation targeting monetary policy regime. The economic benefits of such a policy have been widely investigated in the recent literature. For developed countries, recent studies have generally reported that adoption of inflation targeting is associated with significant gains in terms of a decline in both average inflation and its volatility, a narrowing of the output gap, an increase in economic growth, and a lessening of the impacts of supply shocks on prices and economic activity. Usually, the studies compare targeting countries to non-targeters countries and offer empirical evidence that the targeters exhibited a better economic performance after the change in monetary policy. The improvements are relative to both the pre-targeting period and to non-targeting countries. Empirical evidence provided by Corbo et al. (2002), Mishkin and Schimidt-Hebbel (2007), Neumann and von Hagen (2001), and Gonçalves and Salles (forthcoming) support this claim. The only exception in the literature might be Ball and Sheridan (2005), who found no convincing evidence of a significant change in economic performance between targeters and non-targeters among developed countries.

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Inspired by the successful experience of developed countries, several developing and emerging countries have also adopted inflation targeting for monetary policy. The reasons usually given to justify adoption of this policy regime include transparency in monetary policy, the reduction of economic uncertainty because of the Central Bank's commitment to the target inflation rate, the credibility of monetary policy over time, and implementation of the institutional and economic reforms required by the new regime. For developing and emerging countries, however, the empirical evidence of the economic benefits of inflation targeting remains unclear. Gonçalves and Salles (forthcoming), for instance, argue that countries on the Emerging Markets Bond Index (EMBI) that adopted inflation targeting were able to reduce the average rate of inflation and its volatility but were not able to improve economic growth relative to EMBI countries that had not adopted inflation targeting. Corbo et al. (2002), on the other hand, claim that the economic performance of targeters was better than that of non-targeters among developed and emerging countries.

An inflation targeting regime uses the nominal interest rate as a policy instrument and the transmission channel is aggregate demand. The general rule is to increase the nominal interest rate more than proportionally to any expected rise in the inflation rate above the target, so that the real interest rate increases. The higher real interest rate reduces aggregate demand and slows economic activity. This forces firms to lower prices in order to avoid excess supply, mitigating inflationary pressures in the economy. It is theoretically and empirically recognised that there is a tradeoff between stabilising inflation and stabilising the output gap, defined as the percentage deviation of effective output from the potential output of the economy. Optimally, the central bank chooses an interest rate that is able to keep inflation as close as possible to the announced target rate without increasing the economy's output gap by much.[1]

On the real side of the economy, the consequences of an inflation targeting regime might be twofold, especially for developing and emerging countries that already face structural deficiencies and that have long sought price stability. Historically, for instance, those countries are characterised by higher unemployment rates than rates in developed countries. In this case, the simple adoption of a monetary policy regime that will explicitly reduce economic activity in order to attain price stability might increase existing distortions and have undesirable consequences in the labour market. Inflation might successfully be brought close to the target rate, but at a high cost in terms of unemployment, the output gap and economic growth. On the other hand, the price stability achieved by a successful inflation targeting regime might lessen uncertainty and create a favourable economic environment for investment, consumption and growth.

This working paper will investigate the extent to which macroeconomic policies anchored to inflation targeting affect unemployment, economic growth and the output gap. If job creation is constrained by supply-side problems, should countries implement a macroeconomic policy that assumes excessive domestic aggregate demand? Will raising interest rates to curb inflation and the tightening of monetary policies increase unemployment? What are the alternative policies? The study will address these issues using a cross-section analysis of developing and emerging countries.

The paper is organised as follows. The next section briefly describes the empirical literature that discusses the consequences of adopting an inflation targeting regime. Section 3 presents the econometric model used in the estimations. Section 4 describes the samples of countries and the period of analysis. The results are presented and analyzed in Section 5. Finally, section 6 offers concluding remarks and policy recommendations.

2 RELATED LITERATURE

The recent literature has made much effort to address the issue of whether inflation targeting affects price stability and economic performance. Mishkin (2004) provides critical arguments for the adoption of inflation targeting by emerging countries. He maintains that the differences between advanced and emerging countries require that the latter take much greater care when adopting an inflation targeting regime. Specifically, emerging countries have weak fiscal institutions, weak financial institutions (including government prudential regulation and supervision), monetary institutions with limited credibility, currency substitution and liability dollarisation, and vulnerability to sudden stops of capital inflows. To have a successful inflation targeting regime, emerging countries should bear in mind that it requires a sequence of measures, including the public announcement of medium-term numerical targets for inflation; an institutional commitment to price stability as the primary goal of monetary policy, to which other goals are subordinated; an information-inclusive strategy in which many variables—not just monetary aggregates or the exchange rate—are used to determine the setting of policy instruments; greater transparency of the monetary policy strategy through communication with the public and the markets about the plans, objectives and decisions of the monetary authorities; and greater accountability on the part of the central bank in attaining its inflation objectives. Failure to meet those requirements might undermine a successful transition to the inflation targeting regime.

There are two crucial issues in implementing the regime. The first is responsible management of fiscal policy, because of all the implications of the fiscal theory of the price level—according to which irresponsible fiscal policy puts pressure on the monetary authority to monetise the debt (Woodford, 1994 and 1995). The second is the "fear of floating" the exchange rate (Calvo and Reinhart, 2002) because of the belief that exchange rate depreciation would increase the prices of imported final goods and raise demand for exports, resulting in higher domestic inflation by means of the exchange rate pass-through. Concerns about exchange rate stability would compromise the credibility of price stability, which should be the main goal of the inflation targeting regime. If adequate attention is paid to those fragilities, however, Mishkin (2004) argues that the inflation targeting regime can help improve the macroeconomic performance of emerging countries because the change in the monetary policy regime does not come unaccompanied. It requires several institutional and economic reforms that positively affect the country as a whole.

Corbo et al. (2002) examine whether inflation targeting makes a difference. They compare targeter countries with non-targeters in terms of success in meeting target values, sacrifice ratios and output volatility. They also analyze whether inflation targeting improves the ability to predict inflation, changes the country's macroeconomic performance in terms of inflation and the output gap, and affects the degree of aversion to inflation relative to non-targeters. The sample includes both developed and emerging countries in the period 1980–1999. They answer these question in the affirmative, finding that inflation targeters were very successful in meeting target values; output sacrifice ratios were lower among targeters than non-targeters; the volatility of industrial production was lower for targeters; forecast errors were smaller for targeters; and inflation aversion was on average not statistically different between targeters and non-targeters. In sum, the empirical evidence suggests that inflation targeting does make a difference to a country's price stability.

For EMBI countries,[2] Gonçalves and Salles (forthcoming) argue that inflation targeting has proven to benefit economic performance: targeters experienced a greater fall in inflation and in the volatility of economic growth than non-targeters. In addition, inflation targeting did not harm economic growth. Thus the authors suggest that the adoption of inflation targeting by EMBI countries did make a positive difference to economic performance.

Mishkin and Schimidt-Hebbel (2007) provide further empirical evidence as to whether inflation targeting makes a difference. Their sample includes eight industrial countries and 13 emerging economies that were inflation targeters in late 2004. The control group consists of 13 industrial non-targeter countries. The empirical evidence is from panel data estimations, panel vector autoregressive models and panel impulse responses. The authors find support for the idea that targeters experienced a better inflation performance, a substantial improvement in the efficiency of monetary policy, and a better observed macroeconomic performance than non-targeters. In addition, emerging economies recorded a much greater improvement following the adoption of inflation targeting than did industrial countries. The authors argue that inflation targeting seems to help countries to achieve lower inflation in the long run, to respond better to oil price and exchange rate shocks, to strengthen monetary policy independence, to improve monetary policy efficiency, and to secure inflation rates that are closer to target levels. They conclude that inflation targeting seems to be the natural monetary regime choice, especially for emerging market economies, where the gains from inflation targeting are found to be the largest.

Neumann and Von Hagen (2001) consider whether inflation targeting matters for developed countries. They analyzed six inflation targeting countries and three non-targeters. The pre-inflation targeting period was 1978–1992 and the post-targeting period was 1993–2001. The empirical evidence considered the volatility of inflation, output gaps and interest rates. They estimated central banks' reaction functions in the form of Taylor rules, unrestricted vector autoregressions (VARs), and policy reactions to large supply shocks generated by the oil price hikes of 1978/79 and 1998/99. They conclude that inflation targeting matters because targeters have reduced inflation to low levels and curbed the volatility of inflation and interest rates. Additionally, targeting has helped previously high-inflation countries to gain monetary policy credibility.

Fraga, Goldfajn and Minella (2003) compare the relative performance of developed and emerging countries that had adopted inflation targeting by the end of 2002. They argue that the volatility of output, inflation, the interest rate and the exchange rate was higher in emerging economies than in developed countries. Among the reasons given for this less favourable tradeoff are the process of building credibility, the need to lower inflation levels, dominance issues (fiscal, monetary or external), and the stronger effect of supply shocks in emerging targeting countries. To improve the performance of the inflation targeting regime, the authors recommend that emerging economies seek high levels of communication and transparency, treat target bands mainly as communication devices, establish a methodology to calculate the convergence path following a shock (adjusted targets), and better International Monetary Fund (IMF) conditionality under inflation targeting.

A contrast to the previous findings is offered by Ball and Sheridan (2005). They investigate whether inflation targeting improves economic performance, as measured by the behaviour of inflation, output and interest rates, for seven countries of the Organisation for Economic

Cooperation and Development (OECD) that adopted inflation targeting in the early 1990s and 13 that did not. Their major finding suggests that, after controlling for regression to the mean, there is no evidence that inflation targeting improves economic performance. That is because after the early 1990s, the economic performance of both groups of countries improved in many dimensions. It might be that average inflation declined more for targeters than non-targeters. But those differences are explained by regression to the mean, given that targeters performed worse than non-targeters in the pre-targeting period. These results, however, should not be taken as an argument against inflation targeting, since the authors did not find that the policy regime caused any harm to the economy. It is just a counter-argument to the panacea that inflation targeting has recently come to be seen in several countries.

This working paper contributes to the previous literature by analyzing the consequences for developing and emerging countries of adopting the inflation targeting regime. Both targeters and non-targeters are developing and emerging countries for which recent data were available. The study examines whether targeters have been able to improve their economic performance in terms of unemployment, economic growth and the output gap relative to non-targeters and to the pre-targeting period.

3 ECONOMETRIC MODEL

The basic econometric model is drawn from Ball and Sheridan (2005). The idea is to use the difference-in-difference approach to compare the performance of targeting and non-targeting countries before and after the adoption of the inflation targeting regime. The focus of interest is to verify whether inflation targeting countries were able to improve their economic performance in terms of reducing the unemployment rate, narrowing the output gap and increasing economic growth. The comparison is made before and after the adoption of the policy regime and in relation to other countries that did not adopt the regime during the period.

Define the variable Y_i as the country *i* average value of a given variable, say the unemployment rate, the output gap or economic growth during some period, and V_i as the volatility of one of those variables during the same period. For each country of the sample, Y_i and V_i are calculated before and after the adoption of the inflation targeting regime. For non-targeting countries, the breaking point is given by the average starting period among countries that adopted the inflation targeting regime.[3]

To compare economic performance across countries in the recent period, taking non-targeters as the control group, Ball and Sheridan (2005) proposed the estimation of the following OLS regressions:[4]

$$Y_{1,i} - Y_{0,i} = \alpha + \beta IT_i + \varepsilon_i \quad (1)$$

$$V_{1,i} - V_{0,i} = \theta + \delta IT_i + \nu_i \quad (2)$$

where $Y_{1,i}$ is country *i* average value of Y_t in the post-inflation targeting period, $Y_{0,i}$ is country *i* average value of Y_t in the pre-inflation targeting period, IT_i is a dummy variable that assumes

value 1 if country *i* is inflation targeting and 0 otherwise. In the same fashion, $V_{1,i}$ is country *i* volatility of Y_t in the post-inflation targeting period, $V_{0,i}$ is country *i* volatility of Y_t in the pre-inflation targeting period. The residuals, ε_i and ν_i are assumed to be homoscedastic.

The major problem with the estimation of (1) and (2) is that they suffer from regression to the mean. The coefficients β and δ, which capture the effects of targeting on the left-hand side variables, are downward biased, leading to the false conclusion that inflation-targeting countries had performed better than non-targeting ones. As argued by Ball and Sheridan (2005), poor performers in the first period tend to improve more in the second period than good performers in the first period. Given that, in general, it is the bad performers that decide to change regime, estimated coefficients β and δ tend to be negative and statistically significant, leading to the erroneous conclusion that a country would be better off by adopting the inflation targeting regime.

To account for the regression to the mean problem, Ball and Sheridan (2005) suggested including the initial value of the left-hand variable as a regressor. In this case, the dummy variable coefficient would measure the relative change in performance for targeting countries, given that the initial performance of all countries is controlled for. Thus, the previous regressions become:

$$Y_{1,i} - Y_{0,i} = \alpha + \beta IT_i + \rho Y_{0,i} + \varepsilon_i \tag{3}$$

$$V_{1,i} - V_{0,i} = \theta + \delta IT_i + \phi V_{0,i} + \nu_i \tag{4}$$

However, regressions (3) and (4) are still missing the potential effect of a poor performance in the first period on the country's decision of choosing to target inflation in the second period. That is, the economic performance in the initial period might be different across targeters and non-targeters and so might not have the same impact across countries on the decision to change regime. To control for this effect, we include a multiplicative dummy variable in regressions (3) and (4). Thus, the estimated regressions are given by:

$$Y_{1,i} - Y_{0,i} = \alpha + \beta IT_i + \rho Y_{0,i} + \lambda(IT_i Y_{0,i}) + \varepsilon_i \tag{5}$$

$$V_{1,i} - V_{0,i} = \theta + \delta IT_i + \phi V_{0,i} + \kappa(IT_i V_{0,i}) + \nu_i \tag{6}$$

where λ and κ are coefficients on the multiplicative dummy variables. If the initial economic performance of targeters and non-targeters is different and affects the country's decision to move toward targeting inflation, they should be statistically significant.

4 DATA AND SAMPLES

We collected annual data for developing and emerging countries on unemployment, economic growth and real GDP, which was used to estimate the output gap, from 1985 to 2005 for the first two variables and from 1985 to 2006 for the latter two. The sources of the data were the Labour Statistics Database (Laborsta) of the International Labour Organisation (for unemployment) and the World Bank (for economic growth, GDP and the consumer price index). The output gap, for all countries, was computed as the percentage deviation of real GDP from potential output, as predicted by a linear trend.

The samples of countries also changed across variables. They are presented in Table 1. Specifically, we were able to acquire data on unemployment for 25 countries, seven of which were inflation targeters by the end of the period. For economic growth and the output gap, our sample consisted of 64 countries, 10 of which were inflation targeters. We also built a third sample including only common countries across all three variables, yielding 16 countries of which six were inflation targeters.

As in Bernanke et al. (1999) and Sheater et al. (2000), we date the beginning of the targeting period as the year when the inflation targeting regime was first announced. As a result, the starting point of the targeting regime ranged from 1990 to 2002. Some countries that moved to inflation targeting in 2005 and 2006 were regarded as non-targeters because of the closeness with the end of the sample.[5] For the non-targeting countries, the post-inflation targeting period started in 1997, defined by the simple mean of starting dates across targeting countries.[6] The results were not sensitive to changes in this breaking point.

For the inflation targeting countries, Table 1 also shows the date when the regime was adopted and the percentage value of the target rate when the regime was first announced. An updated list of current inflation targeting countries is presented in Table 2. It is worth noting that some countries might be classified as non-constant targeters countries, since they allow the targeting rate to change over time. This is the case of Turkey and Indonesia, for instance, which adopted inflation targeting in 2005 and 2006, respectively. For the sake of this study, however, those countries are not distinguished from those that have maintained a constant targeting rate over time.

TABLE 1

Targeting and Non-Targeting Developing and Emerging Countries

SAMPLE 1 (T=7; N=18)

Variable: Unemployment

Targeting countries	Date of adoption	Target value
Brazil	1999	4½%(±2%)
Chile	1990	2-4%
Colombia	1999	2-4%
Israel	1992	1-3%
Korea	2002	4-5%
Philippines	1998	3%(±1%)
Thailand	2000	0-3½%

Non-targeting countries

Albania	Pakistan
Argentina	Panama
China	Puerto Rico
Costa Rica	San Marino
Cyprus	Singapore
Hong Kong	Taiwan
Jamaica	Trinidad and Tobago
Malaysia	Uruguay
Malta	Venezuela

SAMPLE 2 (T=6; N=10)

Variables: Unemployment, Economic Growth, and Output Gap

Targeting countries	Date of adoption	Target value
Brazil	1999	4½%(±2%)
Chile	1990	2-4%
Colombia	1999	2-4%
Israel	1992	1-3%
Philippines	1998	3%(±1%)
Thailand	2000	0-3½%

Non-targeting countries

Argentina	Malaysia
China	Malta
Costa Rica	Panama
Cyprus	Singapore
Jamaica	Trinidad and Tobago

SAMPLE 3 (T=10; N=54)

Variables: Economic Growth and Output Gap

Targeting countries	Date of adoption	Target value
Brazil	1999	4½%(±2%)
Chile	1990	2-4%
Colombia	1999	2-4%
Hungary	2001	3%(±1%)
Israel	1992	1-3%
Mexico	1999	3%
Peru	2002	2%(±1%)
Philippines	2002	4-5%
South Africa	2000	3-6%
Thailand	2000	0-3½%

Non-targeting countries

Algeria	Jordan
Antigua and Barbuda	Kiribati
Argentina	Lesotho
Belize	Macao, China
Bhutan	Malaysia
Bolivia	Malta
Botswana	Marshall Islands
Brunei Darussalam	Mauritius
Bulgaria	Morocco
Cameroon	Namibia
China	Nicaragua
Congo	Panama
Costa Rica	Samoa
Cyprus	Saudi Arabia
Dominica	Seychelles
Dominican Republic	Singapore
Ecuador	Sri Lanka
Egypt	St. Kitts and Nevis
El Salvador	St. Lucia
Gabon	Suriname
Grenada	Swaziland
Guatemala	Syria
Guyana	Tonga
Honduras	Trinidad and Tobago
Hong Kong, China	Tunisia
Indonesia	Turkey
Jamaica	Vanuatu

Source of targeting countries: International Monetary Fund (IMF).

TABLE 2

Inflation Targeting Countries

	Country	Date of adoption	Targeting value
	Developed		
1	Australia	1993	2-3%
2	Canada	1991	1-3%
3	New Zealand	1990	1-3%
4	Norway	2001	2½%
5	Sweden	1993	2% (±1%)
6	Switzerland	2000	0-2%
7	United Kingdom	1992	2%
	Developing/Emerging		
8	Brazil	1999	4½% (±2%)
9	Chile	1990	2-4%
10	Colombia	1999	2-4%
11	Czech Republic	1998	3% (±1%)
12	Ghana	2007	0-10%
13	Hungary	2001	3% (±1%)
14	Iceland	2001	2½% (±1½%)
15	Indonesia	2005	6% (±1%)
16	Israel	1992	1-3%
17	Mexico	1999	3%
18	Peru	2002	2% (±1%)
19	Philippines	2002	4-5%
20	Poland	1998	2½% (±1%)
21	Romania	2005	4% (±1%)
22	Slovakia	2005	0-2%
23	South Africa	2000	3-6%
24	South Korea	1998	3% (±1%)
25	Thailand	2000	0-3½%
26	Turkey	2006	4% (±2%)

Source: IMF, Monetary Bulletin, 2007-2.

5 RESULTS

5.1 MEAN AND VOLATILITY

Before discussing the estimation results, it is informative to look at the differences in mean and volatility of the unemployment, economic growth and output gap variables before and after the adoption of the targeting regime and across targeters and non-targeters. We will start with the mean of those variables. The results are given in Table 3.

TABLE 3

Mean and Percentage Variation of the Variables

	Targeters (T)	Non-targeters (N)	Variation (T-N in %)
Unemployment (I)	7.50	7.98	-6.01
Unemployment (F)	9.40	8.57	9.69
Variation (F-I in %)	25.27	7.33	
Growth rate (I)	3.44	3.15	9.20
Growth rate (F)	4.27	4.11	3.88
Variation (F-I in %)	24.09	30.45	
Output gap (I)	0.17	0.32	-45.18
Output gap (F)	-1.62	-0.42	289.30
Variation (F-I in %)	-1036.93	-231.95	

Note: (I) stands for the pre-targeting period; (F) stands for the post-targeting period.

The percent changes in average unemployment before and after targeting were 25.27 per cent and 7.33 per cent for targeters and non-targeters, respectively. Thus both groups of countries experienced a rise in unemployment between the two periods, but the increase was much more pronounced for targeting countries. Comparing targeters and non-targeters, in the pre-targeting period the average unemployment rate was lower by 6.01 per cent for targeters. In the post-targeting period, however, the difference became positive, meaning a higher average unemployment rate of 9.69 per cent for targeting countries. Thus the average unemployment rate rose for both groups of countries, but it increased relatively more for targeters than for non-targeters.

A similar conclusion arises from the comparison of average economic growth between periods and across countries. For the targeters, there was a 24.09 per cent increase in the average rate of growth after the adoption of inflation targeting. For the non-targeters, the increase was even higher at 30.45 per cent. Comparing the relative performance of the two groups within each period, average economic growth was slightly higher for the targeters. Before the targeting regime, the difference was 9.2 per cent; after the adoption of inflation targeting it fell to 3.88 per cent. Thus the average rate of growth was higher for targeters in both periods, but the positive difference decreased in the latter one.

For the output gap, the scenario is quite different. For both groups of countries, the positive output gap of the first period became negative after the adoption of inflation targeting. However, the fall was considerably higher for targeting countries. Across the groups of countries in the same period, the difference changed from -45.18 per cent to 289.30 per cent in favour of non-targeters. The average output gap became negative after the inflation targeting regime, but more negative for the targeters than for the non-targeters.

Moving to the volatility of unemployment, economic growth and the output gap, the results are given in Table 4. The volatility of the unemployment rate declined between periods for both groups of countries. But the decline was higher for the non-targeters (-62.57 per cent) than for the targeters (-22.61 per cent). Comparing the two groups within a given period, the non-targeters had higher average volatility, by 39.68 per cent, in the pre-targeting period and a lower one, by 24.72 per cent, in the post-targeting period. Thus, combined with the results of Table 3, the unemployment rate had a lower mean and less volatility for the non-targeting countries.

TABLE 4

Volatility and Percentage Variation of the Variables

	Targeters (T)	Non-targeters (N)	Variation (T-N in %)
Unemployment (I)	3.82	6.33	-39.68
Unemployment (F)	2.96	2.37	24.72
Variation (F-I in %)	-22.61	-62.57	
Growth rate (I)	15.07	31.37	-51.95
Growth rate (F)	4.27	13.62	-68.63
Variation (F-I in %)	-71.65	-56.58	
Output gap (I)	58.19	73.83	-21.19
Output gap (F)	47.84	52.02	-8.03
Variation (F-I in %)	-17.78	-29.54	

Note: (I) stands for the pre-targeting period; (F) stands for the post-targeting period.

Looking at the relative performance in terms of economic growth, both groups of countries were able to reduce the volatility of the growth rate between the two periods. Targeters reduced it by 71.65 per cent and non-targeters by 56.58 per cent. In both periods, the average volatility of the growth rate was smaller for the targeting countries. In the pre-targeting period it was smaller by 51.95 per cent and in the post-targeting period by 68.63 per cent. Thus targeting countries succeeded in maintaining a lower volatility of economic growth than non-targeting countries.

An equivalent result, albeit at smaller magnitudes, was observed for relative performance in terms of the output gap. Both groups of countries reduced output gap volatility between periods. Within a given period, volatility was smaller for targeting countries. Nonetheless, the difference decreased substantially after the adoption of the inflation targeting regime.

As a partial conclusion, from Tables 3 and 4 it is not clear whether the adoption of the inflation targeting regime improved the economic performance of targeters in terms of a lower unemployment rate, higher economic growth, and a narrower output gap than non-targeters. In addition to the closeness of the calculated values for the average and volatility of the three variables, there is the potential problem of regression to mean. The estimations of the next section shed new light on the question.

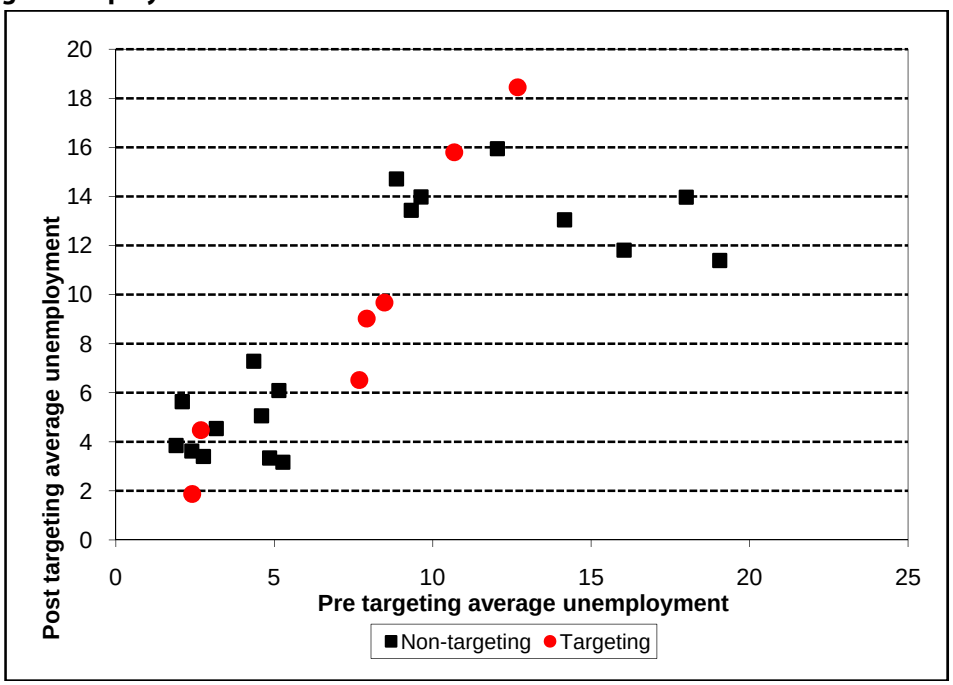
5.2 ESTIMATED INFLATION TARGETING REGRESSIONS

5.2.1 Unemployment

We begin by analyzing the results of regressions for the average unemployment rate. Figure 1 shows averages of the unemployment rate for targeters and non-targeters before and after the adoption of the targeting regime. It is not clear whether countries with a poor performance in terms of high average unemployment have been those that moved to the inflation targeting regime. In fact, there are countries with both low and high initial-period average unemployment that became targeters in the second period, and others that remained as non-targeters. Thus there is no clear evidence of regression to the mean in the estimations of regressions (1) and (2) for unemployment rate differentials. This primary evidence will be confirmed by the estimated regressions that control for potential regression to the mean problem.

FIGURE 1

Average Unemployment Rate



The results of the estimated models for mean unemployment are presented in Table 5. Targeting inflation has no significant effect on average unemployment between periods and across targeters and non-targeters. Neither constant nor inflation targeting dummy variables were statistically significant in the estimated regression for the average unemployment differential.

TABLE 5

Regressions for Average Unemployment Rate

Dependent variable: change in average unemployment rate						
	Sample 1			**Sample 2**		
	eq. 1	**eq. 3**	**eq. 5**	**eq. 1**	**eq. 3**	**eq. 5**
Constant	0.59	2.40*	3.29**	2.30	1.55	2.79*
	(0.78)	*(1.24)*	*(1.17)*	*(1.74)*	*(1.64)*	*(1.34)*
IT dummy	1.31	1.20	-4.98*	-0.39	2.30	-6.55*
	(1.47)	*(1.41)*	*(2.78)*	*(1.06)*	*(1.66)*	*(3.18)*
Initial mean		-0.23*	-0.34**		-0.23	-0.38**
		(0.12)	*(0.12)*		*(0.15)*	*(0.13)*
IT*initial mean			0.82**			1.07**
			(0.33)			*(0.35)*
Heterosc. test	*0.80*	3.29	2.53	0.42	0.28	1.53
[p-value]	*[0.3709]*	*[0.0699]*	*[0.1115]*	*[0.5191]*	*[0.5939]*	*[0.2164]*
R-squared	0.0333	0.1594	0.3521	0.1116	0.2444	0.5744

Note: * indicates statistical significance at the 10% level; ** indicates statistical significance at the 5% level; *** indicates statistical significance at the 1% level. In parenthesis are the standard deviations.
See Table 1 for the countries of each sample.

The same conclusion holds for the unemployment volatility regression, whose results are reported in Table 6. At the standard 5 per cent significance level, neither the constant nor the inflation targeting dummy are statistically significant. As a consequence the R-squared of the estimated regressions are close to zero.

TABLE 6

Regressions for Volatility of the Unemployment Rate

Dependent variable: change in volatility of unemployment rate						
	Sample 1			**Sample 2**		
	eq. 2	**eq. 4**	**eq. 6**	**eq. 2**	**eq. 4**	**eq. 6**
Constant	3.10	1.96**	1.99**	-3.07*	-0.69***	0.51
	(4.33)	*(0.74)*	*(0.76)*	*(1.52)*	*(0.12)*	*(1.13)*
IT dummy	-3.96*	0.75	0.12	1.83	1.20	1.85
	(2.29)	*(1.23)*	*(1.96)*	*(2.49)*	*(1.40)*	*(2.54)*
Initial mean		-0.94***	-0.94**		0.57	-0.67***
		(0.06)	*(0.06)*		*(1.08)*	*(0.13)*
IT*initial mean			0.16			-0.15
			(0.39)			*(0.47)*
Heterosc. test	*3.31*	0.50	0.44	0.15	0.01	0.01
[p-value]	*[0.0687]*	*[0.4813]*	*[0.5051]*	*[0.7023]*	*[0.9095]*	*[0.9144]*
R-squared	0.0217	0.9254	0.9260	0.0374	0.7173	0.7195

Note: * indicates statistical significance at the 10% level; ** indicates statistical significance at the 5% level; *** indicates statistical significance at the 1% level. In parenthesis are the standard deviations.
See Table 1 for the countries of each sample.

In order to avoid the potential regression to the mean problem, equations (3) and (4) were estimated. The results for equation (3) are reported in the third column of Table 5. The statistical significance of the inflation targeting dummy did not improve by including the initial average value of unemployment in the regression. Initial unemployment and the constant were marginally significant at the 10 per cent level. The R-squared coefficient increased to about 16 per cent, reflecting the low explanatory power of the regression.

In the unemployment volatility regression reported in the third column of Table 6, however, the improvements were evident. The constant and initial unemployment volatility became highly significant variables. Nonetheless, the inflation targeting dummy variable retained a negligible level of significance. The R-squared increased to 92.5 per cent, revealing the dominant explanatory power of the initial unemployment volatility in the regression.

Finally, regressions (5) and (6) were estimated under the assumption that initial unemployment might have distinct effects on targeters and non-targeters. The different effects might be captured by including a multiplicative dummy variable for initial unemployment in the regressions. For average unemployment, the multiplicative dummy had a high statistical significance and improved the explanatory power of the model. The initial average unemployment and the constant became statistically significant at the standard 5 per cent level. For non-targeters, initial average unemployment had a negative impact on the average unemployment differential, while for targeters that impact was positive. The inflation

targeting dummy variable was significant only at the 10 per cent level. Its negative coefficient reveals that targeting countries were able to reduce the unemployment differential in the post-targeting period by about 5 per cent relative to non-targeters. The overall significance of the model is given by an R-squared of 35.2 per cent and the residuals are homoscedastic.

In the regression for volatility differential presented in Table 6, the multiplicative dummy variable was not significant and did not improve the model's performance. Only the constant and initial volatility of unemployment were statistically different from zero at the 95 per cent confidence level. The negative coefficient of the latter variable means that inflation targeting countries were able to reduce unemployment volatility in relation to non-targeting ones. Neither the level nor the multiplicative inflation targeting dummy variables were statistically significant. Thus initial unemployment volatility did not differ across targeting and non-targeting developing and emerging countries.

Essentially the same results are obtained by using a reduced sample of just 16 countries, labelled sample 2 in Tables 5 to 10, which are common across the unemployment, economic growth and output gap variables. The inflation targeting dummy variable is not statistically significant in the bivariate regressions for both average and volatility of unemployment regressions given by equations (1) and (2).

When initial unemployment is included in the models, no change is observed in the statistical significance of the estimated coefficients. In particular, the additive inflation targeting dummy and initial unemployment are not statistically significant. However, for the complete regressions, which also include the multiplicative dummy variable, average unemployment is marginally affected by the adoption of the inflation targeting regime. The additive dummy variable is statistically significant at the 10 per cent level and has a negative sign, meaning that targeters were able to reduce average unemployment in the post-targeting period. On average, the fall in unemployment was about 6.5 per cent. The unemployment volatility, however, was not affected by the targeting regime as neither of the dummy variables were statistically significant.

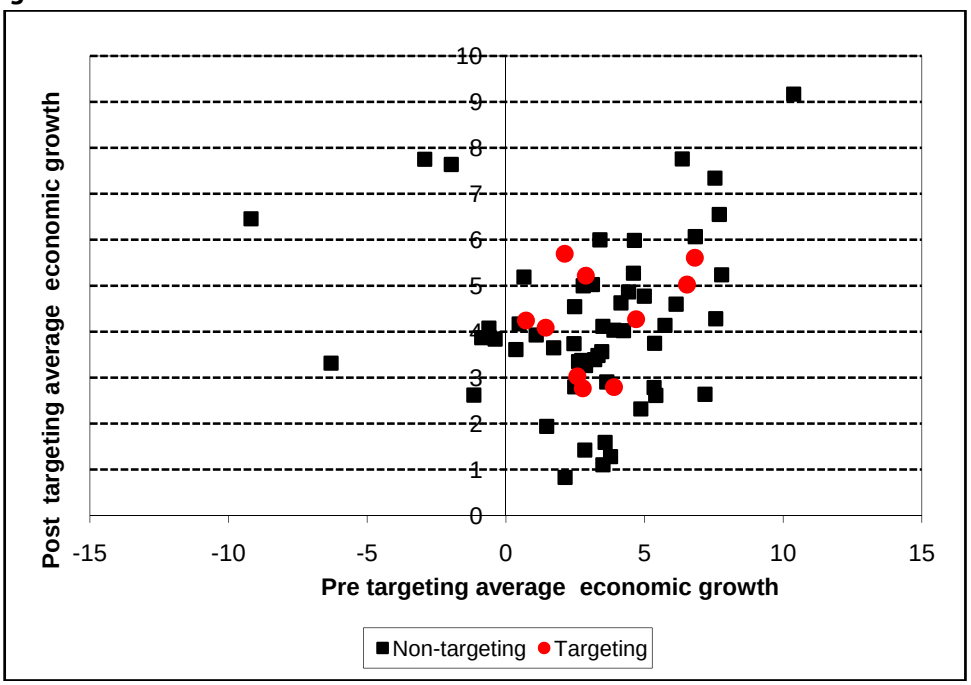
Thus regressions (5) and (6) were able to capture a marginal effect that adoption of the inflation targeting regime had on average unemployment. Targeters reduced average unemployment in the post-targeting period relative to non-targeters. This is the case at the 10 per cent significance level, but not at the 5 per cent level.

5.2.2 Economic Growth

Let us consider first the full sample, which includes data for 64 developing and emerging countries described in Table 1 and labelled sample 3 in Tables 7 and 8 below. Figure 2 plots pre- and post-targeting average unemployment for the full sample. Estimation of equations (1) and (2) reveals that the differentials in average economic growth and in economic growth volatility were not affected by the inflation targeting regime. In both equations, the inflation targeting dummy variable was not statistically significant at the standard 5 per cent significance level. The explanatory power of the models was negligible, as indicated by R-squared coefficients close to zero.

FIGURE 2

Average Economic Growth



When initial economic growth was included in the previous regressions, the basic scenario did not change. The inflation targeting dummy variable was still not statistically significant, confirming that the change in regime did not affect either average economic growth or its volatility. Initial growth, however, was negative and statistically significant in both regressions. This means that a higher initial level of growth is compatible with a smaller differential in average economic growth and its volatility between periods and across countries. The R-squared coefficients rose from close to zero to 59 per cent and the residuals were homoscedastic.

In this case, it is not relevant to control for the effect of initial economic growth across targeters and non-targeters. The multiplicative dummy variable was not statistically significant in either the average or volatility regressions. Thus the adoption of the inflation targeting regime did not play any role in the countries' average growth performance.

Finally, in Tables 7 and 8, regressions (1) to (6) were estimated for the shorter sample 2, which includes only countries that are common across all three variables of the analysis. As described earlier, in this case, there are 16 countries with six inflation targeters. Essentially, the previous conclusions holds in the sense that the adoption of inflation targeting has no clear effect on average economic growth and its volatility for targeters versus non-targeters.

TABLE 7

Regressions for Average Economic Growth

Dependent variable: change in average economic growth						
	Sample 3			Sample 2		
	eq. 1	eq. 3	eq. 5	eq. 1	eq. 3	eq. 5
Constant	0.78	3.03***	3.00***	-0.26	-0.77***	3.71**
	(0.81)	*(0.38)*	*(0.40)*	*(0.90)*	*(0.20)*	*(1.30)*
IT dummy	0.05	0.42	0.70	-0.05	-0.32	-1.39
	(0.32)	*(0.53)*	*(1.07)*	*(1.47)*	*(1.05)*	*(2.91)*
Initial mean		-0.76***	-0.75***		3.54**	-0.80***
		(0.08)	*(0.09)*		*(1.19)*	*(0.23)*
IT*initial mean			-0.08			0.23
			(0.27)			*(0.58)*
Heterosc. test	*0.61*	0.59	0.48	*2.81*	1.46	0.94
[p-value]	*[0.4354]*	*[0.4418]*	*[0.4862]*	*[0.0938]*	*[0.2273]*	*[0.3332]*
R-squared	0.0149	0.5904	0.5910	0.0001	0.5273	0.5334

Note: * indicates statistical significance at the 10% level; ** indicates statistical significance at the 5% level; *** indicates statistical significance at the 1% level. In parenthesis are the standard deviations.
See Table 1 for the countries of each sample.

TABLE 8

Regressions for Volatility of Economic Growth

Dependent variable: change in volatility of economic growth						
	Sample 3			Sample 2		
	eq. 2	eq. 4	eq. 6	eq. 2	eq. 4	eq. 6
Constant	-7.79**	12.01***	11.61***	-3.95	4.34	-0.40
	(3.17)	*(3.40)*	*(3.50)*	*(3.97)*	*(4.83)*	*(4.78)*
IT dummy	-3.01	-8.81	-5.22	-2.62	-4.86	9.00
	(8.01)	*(5.77)*	*(8.97)*	*(6.48)*	*(5.10)*	*(7.58)*
Initial mean		-0.93***	-0.91***		-0.49	-0.21
		(0.12)	*(0.13)*		*(0.38)*	*(0.22)*
IT*initial mean			-0.23			-1.02**
			(0.44)			*(0.42)*
Heterosc. test	2.06	0.90	0.85	0.55	Robust	0.34
[p-value]	*[0.1514]*	*[0.3424]*	*[0.3571]*	*0.4592*		*0.5611*
R-squared	0.0023	0.4999	0.5022	0.0116	0.2840	0.5188

Note: * indicates statistical significance at the 10% level; ** indicates statistical significance at the 5% level; *** indicates statistical significance at the 1% level. In parenthesis are the standard deviations.
See Table 1 for the countries of each sample.

In the basic regressions, the additive inflation targeting dummy variable was not statistically significant. When economic growth in the initial period was added as a regressor, its statistical significance did not change. The initial economic growth itself was statistically

significant only in the average differential regressions. As in the full sample, it had a negative sign, meaning that average economic growth in the initial period and the average growth differential across periods moved in opposite directions.

The inclusion of the multiplicative dummy variable left the previous conclusions unchanged. The additive inflation targeting dummy was still not statistically significant in either model and the multiplicative dummy was statistically significant only in the volatility of economic growth regression.

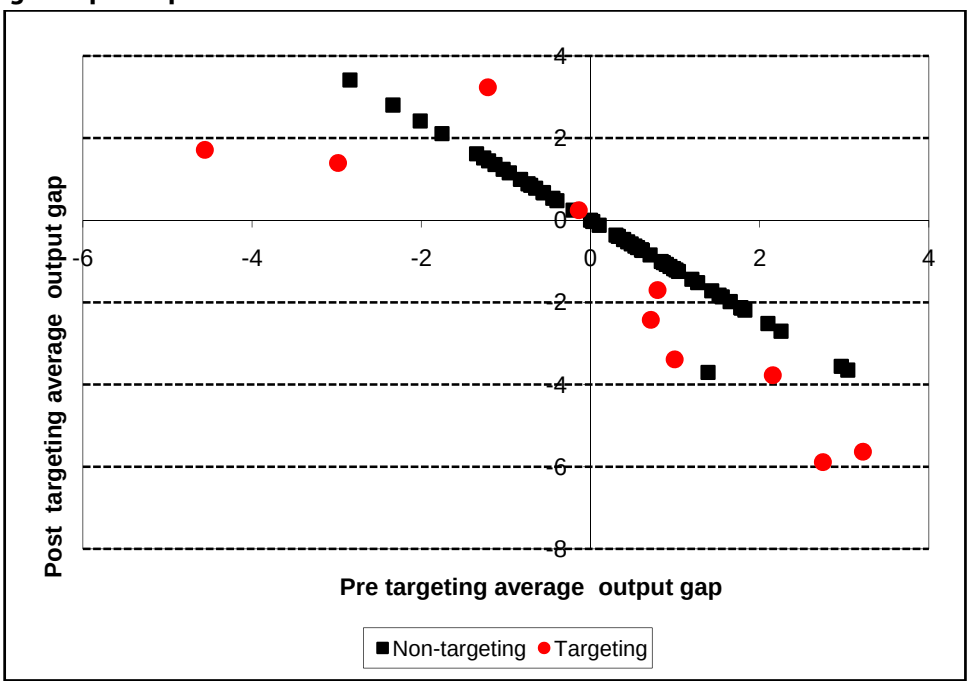
On the basis of the foregoing empirical evidence, therefore, it can be concluded that changing for inflation targeting did not significantly affect developing and emerging countries' economic growth performance. There is no evidence of regression to the mean, and dummy variables that control for the change in regime were not statistically significant. The only variable that seems to matter for the economic growth differential is the countries' average economic growth in the initial period.

5.2.3 Output Gap

In the theoretical models, the output gap emerges as a tradeoff variable when the monetary authority seeks to stabilise inflation. In countries that have adopted an inflation targeting regime, the consequences of a restrictive monetary policy aiming at price stability should be felt in a higher output gap. This claim is investigated here by the estimation of equations (1) to (6). A cross-plot of the pre- and post-targeting period output gap is presented in Figure 3.

FIGURE 3

Average Output Gap



In the full sample, the results reported in Tables 9 and 10 indicate that the additive inflation targeting dummy variable is not statistically significant in the basic regressions.

Neither the average output gap nor its volatility are affected by the change in regime when other control variables are absent from the regressions.

TABLE 9

Regressions for Average Output Gap

Dependent variable: change in average output gap						
	Sample 3			**Sample 2**		
	eq. 1	**eq. 3**	**eq. 5**	**eq. 1**	**eq. 3**	**eq. 5**
Constant	-0.73*	-0.06	-0.03	-1.92	-0.05	0.00
	(0.39)	*(0.13)*	*(0.03)*	*(2.73)*	*(0.14)*	*(0.14)*
IT dummy	-1.16	-1.05***	-1.14	-0.73	-2.16***	-2.22***
	(1.68)	*(0.33)*	*(0.72)*	*(0.82)*	*(0.23)*	*(0.23)*
Initial mean		-2.13***	-2.22***		-2.05***	-2.20***
		(0.08)	*(0.03)*		*(0.06)*	*(0.13)*
IT*initial mean			0.25			0.19
			(0.20)			*(0.14)*
Heterosc. test	Robust	1.89	Robust	Robust	0.00	0.38
[p-value]		*[0.1692]*			*[0.9452]*	*[0.536]*
R-squared	0.0159	0.9211	0.9241	0.0483	0.9908	0.9920

Note: * indicates statistical significance at the 10% level; ** indicates statistical significance at the 5% level; *** indicates statistical significance at the 1% level. In parenthesis are the standard deviations.
See Table 1 for the countries of each sample. Robust means heteroscedaticity consistent standard errors.

TABLE 10

Regressions for Volatility of Output Gap

Dependent variable: change in volatility of output gap						
	Sample 3			**Sample 2**		
	eq. 2	**eq. 4**	**eq. 6**	**eq. 2**	**eq. 4**	**eq. 6**
Constant	-21.81*	30.72***	29.56***	-8.18	-20.30	-46.38**
	(12.31)	*(8.61)*	*(9.07)*	*(17.51)*	*(25.04)*	*(17.60)*
IT dummy	5.15	-6.12	30.16	-14.21	-13.27	97.77**
	(31.14)	*(16.77)*	*(30.54)*	*(28.60)*	*(29.18)*	*(32.50)*
Initial mean		-0.71***	-0.70***		0.18	0.55**
		(0.16)	*(0.17)*		*(0.25)*	*(0.19)*
IT*initial mean			-0.62*			-1.71***
			(0.36)			*(0.40)*
Heterosc. test	1.30	Robust	Robust	0.04	2.92	3.54
[p-value]	*[0.2547]*			*[0.8354]*	*[0.0874]*	*[0.0599]*
R-squared	0.0004	0.5668	0.5775	0.0173	0.0521	0.6203

Note: * indicates statistical significance at the 10% level; ** indicates statistical significance at the 5% level; *** indicates statistical significance at the 1% level. In parenthesis are the standard deviations.
See Table 1 for the countries of each sample. Robust means heteroscedaticity consistent standard errors.

Including the initial unemployment level as a potential control for regression to the mean did not improve the significance of the inflation targeting dummy variable in the volatility regression. In the average output gap regression, however, it became negative and statistically significant. Thus inflation targeting countries experienced a lower average output gap than non-targeting countries after the change in regime. In addition, the initial average output gap is also negative and statistically significant. Thus a higher initial output gap is associated with a smaller output gap differential in the second period.

This evidence, however, does not survive controlling for the initial average output gap of targeting countries. In the estimated equation (5), the inflation targeting variable became statistically not significant, even at the 10 per cent level. The R-squared increased to above 90 per cent but because of the initial average output gap, which is the only variable statistically significant in the estimated regression. In the output gap volatility regression, all variables but the inflation targeting dummy are significant at least at the 10 per cent level.

The results were not changed by moving to sample 2, which considers only common countries across the three variables. In the basic regressions (1) and (2) for the average and volatility differentials of the output gap, the inflation targeting dummy was not statistically significant. Controlling for the initial average and volatility of the output gap in the respective regressions improved statistical significance only in the average output gap regression. Both the inflation targeting dummy and the initial average output gap were significant at the 5 per cent level. This might be interpreted as evidence in favour of the targeters, which were able to reduce the average output gap by adopting the inflation targeting regime.

In this case, as reported in Table 9, the result survives controlling for the initial average output gap of targeting countries. The inflation targeting dummy variable retained its negative sign, estimated value and statistical significance after adding the new control variable to the regression. The initial average output gap has a negative effect on the average output gap differential but the effect is smaller in absolute value for the targeters, because of the positive estimated coefficient of the multiplicative dummy variable.

A similar finding is observed in the regression for the output gap volatility differential, as reported in Table 10. After controlling for the initial volatility of targeters, the inflation targeting dummy variable became statistically significant but with a positive coefficient. This means that, after the adoption of the regime, output gap volatility increased in inflation targeting countries relative to non-targeting countries. The explanation for this might be that targeters tend to adopt a more aggressive monetary policy to bring inflation close to the target level. As a result, the tradeoff between inflation and output gap stabilisation is more pronounced, making the output gap more volatile in targeters than in non-targeters. Thus, while the average output gap seems to be lower for targeters than non-targeters, it is more volatile for the former, compromising the potential benefits of the inflation targeting regime for the productive sector of the economy.

6 CONCLUDING REMARKS AND POLICY RECOMMENDATIONS

This paper has examined whether inflation targeting countries have been able to improve economic performance in terms of the unemployment rate, economic growth and the output gap relative to non-targeting countries and also to the pre-targeting period. The sample consists of developing and emerging countries for which data were available

in the period starting in 1985. The study applied a difference-in-difference approach to address the main question. The estimated models included controls for regression to the mean and for distinct effects that initial-period variables might have on a country's decision to adopt inflation targeting.

Targeting countries, on average, were able to reduce the unemployment rate by about 5 per cent in the post-targeting period relative to non-targeters. This result is not subject to the regression to the mean problem and the effects of initial-period average unemployment are controlled for. However, there is no significant difference in the performance of targeters and non-targeters in terms of the volatility of unemployment between the two periods. The inflation targeting dummy variable was not statistically significant in any of the estimated regressions.

With respect to economic growth, the results are less favourable for the inflation targeting developing and emerging countries. In all the estimated regressions, for both average economic growth and its volatility, the inflation targeting dummy variable was not statistically significant. Thus adoption of the inflation targeting regime did not help improve the countries' performance in terms of achieving higher average economic growth.

For the output gap, however, the results provide some support for inflation targeting. In the full-sample average output gap regressions, the inflation targeting dummy variable was statistically significant and indicated that targeters narrowed the output gap by about 1 per cent relative to non-targeters. In the output gap volatility regressions, however, there is no significant difference between the performances of targeters and non-targeters.

These results concur with the empirical literature's findings for developed countries. As Section 2 describes, there is considerable empirical evidence that inflation targeting improves economic performance. In the case of developing and emerging countries, however, the evidence is less strong. A possible explanation is that several of these countries have moved to purely anti-inflation monetary policies based on interest rate rules, which do not require explicit announcement of a target value for inflation. Thus they are not formally regarded as inflation targeters even though they are acting as such. The main aim of their monetary policy is to stabilise inflation, despite the absence of an explicit inflation targeting regime. This behaviour makes it difficult to identify change in economic performance resulting from the explicit adoption of inflation targeting, because countries regarded as non-targeting are also adopting strict anti-inflation monetary policies.[7]

As the previous results suggested, the inflation targeting regime caused no harm to unemployment in developing and emerging countries. On the contrary, there is some evidence that it might have reduced average unemployment relative to non-targeters. In addition, it might have narrowed the average output gap for targeters and did not negatively affect economic growth. Hence there is no apparent reason to condemn those countries for adopting the inflation targeting regime for monetary policy.

It is important to note that inflation targeting must be accompanied by institutional and economic reforms to fiscal and exchange rate policies. Specifically, it requires responsible management of fiscal policy because of the implications of the fiscal theory of the price level, and a floating exchange rate regime because of the transparency and credibility of the central bank's commitment to keep inflation (and not exchange rate) under control. By paying sufficient attention to these issues, the inflation targeting regime is accompanied by institutional and economic reforms that are positive for the economy as a whole and help improve the country's economic performance in the long run.

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NOTES

1. See Divino (2008) for a formal derivation of an optimal interest rate rule for a small open economy under both aggregate demand and exchange rate channels of transmission for monetary policy.

2. EMBI countries are a subset of emerging countries for which the JP Morgan bank issues its famous risk premium measure, the Emerging Markets Bond Index (EMBI). It consists of 35 countries, 11 of which are classified as targeters.

3. The results were not sensitive to alternative choices of the breaking period for non-targeting countries.

4. As shown by Ball and Sheridan (2005), the method corresponds to a differences-in-differences approach.

5. This was the case of Ghana, Indonesia, Romania, Slovakia and Turkey, which moved to inflation targeting in 2007, 2005, 2005, 2005, and 2006, respectively.

6. Ball and Sheridan (2005) adopted the same criterion to define the breaking data for non-targeters.

7. Divino (2006) shows that there has been a generalisation of anti-inflation monetary policies based on interest rate rules since the successful experience of the US economy during the terms of Paul Volker and Alan Greenspan at the Federal Reserve.

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