



Is Inflation Targeting Harmful for Economic Growth in Emerging Market and Developing Economies?

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I. Introduction

Inflation targeting is when countries have explicitly adopted an inflation target as their nominal anchor and acknowledge that low and stable inflation is the overriding goal of monetary policy. Inflation targeting is seen as a framework and there are several characteristics that make an inflation targeting regime (Bernanke and Mishkin, 1997). First, the main goal of monetary policy is recognized as price stability; the maintaining of the purchasing power of the country's currency. Second, there is a public announcement of a target for inflation which can be either a specific quantitative point or range. Third, monetary policy is based on a wide set of information. Fourth, increased transparency as there is increased communication with the public about objectives of policy makers. Fifth, there are also increased accountability mechanisms in place for the central bank to attain their inflation objectives (Hammond, 2012).

With the failure of money targeting in the 1980s and the collapse of fixed exchange rate pegs in the 1990s, there was an emergence in inflation targeting (Bernanke and Mishkin, 1997). The Central Bank of New Zealand was the first to adopt inflation targeting in 1990. In 2012, there were 27 fully fledged inflation targeting regimes; 9 advanced economies and 18 emerging market and developing economies (Hammond, 2012). And as of April 2015, there are 36 countries that have an inflation targeting framework; 11 advanced economies and 35 emerging market and developing economies (Schmidt-Hebbel and Carrasco, 2016).

Firstly, let's explore the relationship between inflation, inflation targeting, and economic growth. Most research finds that inflation, a rise in the overall level of prices, does significantly slow growth. High inflation means that the value of money goes down which tends to lead to a decline in purchasing power, therefore eroding savings, discouraging investments, and stimulating capital flight. More specifically, high inflation is detrimental to growth because it creates uncertainty and inhibits economic planning (Jahan, 2012). More specifically, in a study, (Andres and Hernando, 1997) analyzed the correlation between growth and inflation in OECD countries between the years 1960 and 1992. They found that even low and moderate inflation rates can lead to significant and permanent reductions in per capita income.

Monetary theory suggests that the impact of inflation targeting on GDP growth is likely to be positive because by reducing the uncertainty associated with high inflation and "creating an environment in which positive productivity shocks translate more fully into increased investment and production, an inflation target regime increases economic growth" (Hale and Philippov, 2015, p. 2).

The benefits of inflation targeting can be seen as having an explicit and transparent inflation target to help anchor inflation expectations more durably; a temporary price shock does not turn into a persistent increase in inflation. In addition, inflation targeting regimes put greater emphasis on the institutional design of central bank transparency, credibility, and accountability in conducting monetary policy. Inflation targeting grants more flexibility because the target tends to be over a medium term goal so short-term deviations of inflation from the target does not mean a loss of credibility (Hale and Philippov, 2015), (Gemayel, Jahan, and Peter, 2011).

On the other hand, there are arguments that suggest that inflation targeting implies a narrow focus on price stability which can unnecessarily restrain growth. There have been concerns about the lack of focus on output and employment stability especially in the event of supply shocks which can exacerbate fluctuations in output and employment. Thus there appears to be a trade-off between inflation and output stabilization (Gemayel, Jahan, and Peter, 2011).

The purpose of this paper is to study whether the adoption of inflation targeting is harmful for economic growth in emerging market and developing economies. As defined by Robert Solow (1956), economic growth is the increase in the amount of goods and services produced per head of the population over a period of time. In this research paper, I measure economic growth using percent rate of increase in real gross domestic product (GDP).

This is an important question to research because since the late 1990s, there has been a growing debate on whether inflation targeting makes a difference on the real economy. It really depends. While this is an easy question to pose, it is quite a hard question to answer as many prominent researchers in this field, such as Mishkin and Schmidt-Hebbel, note that it critically depends on the sample of countries included in both the control and treatment groups and the methodology in terms of estimation techniques used.

This particular paper will investigate whether the adoption of inflation targeting is harmful for GDP growth in emerging market and developing economies. I use a panel sample of 43 emerging market countries during 27 years between 1989 and 2015. I will look for empirical evidence in a sample of 22 emerging inflation-targeting countries before and after their adoption and I compare their performance to a control group of 21 emerging countries without inflation targeting.

This research paper is organized as follows. Section 2 surveys the literature on the effects of inflation targeting on inflation levels, inflation volatility, growth, and growth volatility and discusses the views of inflation targeting on emerging market and developing economies. Section 3 details the methodology I used. Section 4 presents the results of the data and section 5 discuss the results as well as my analysis of whether inflation targeting is harmful for growth. Section 6 touches upon further discussion and questions. Section 7 is the conclusion.

II. Literature Review

There has been many research conducted on the effects of inflation targeting on inflation, inflation expectations, inflation volatility, and growth in both advanced economies and emerging market and developing economies. Let's briefly explore the effects of inflation targeting on the grander scheme.

3.A. Inflation Levels, and Inflation Volatility

One of the earlier studies in comparing the performance of inflation targeting with non-inflation targeters is Ball and Sheridan (2005). They examined 20 Organization for Economic Cooperation and Development (OECD countries); 7 inflation targeters and 13 non-inflation

Inflation Targeting in Emerging Markets

targeters. They argue that inflation targeting does not make a difference in industrial countries, once one controls for regression to the mean. They used a cross-section difference-in-difference OLS estimation and found no evidence that inflation targeting countries improve performance when looking at inflation, output, and interest rates.

On the other hand, Hyvonen (2004), Vega and Winkelried (2005), IMF (2005), and Batini and Laxton (2007), argue that inflation levels, persistence, and volatility are lower in inflation targeting countries than in non-inflation targeting countries (as cited in Mishkin and Schmidt-Hebbel, 2007). More specifically, the empirical evidence by the IMF (2005) on performance of inflation targeting in emerging market economies suggest that “inflation targeting appears to have been associated with lower inflation, lower inflation expectations, and lower inflation volatility relative to countries that have not adopted it” (IMF, 2005). Furthermore, Hyvonen (2004) follow Ball and Sheridan’s methodology and found that the inflation targeting framework partly contributed to inflation convergence in the 1990s when looking at a larger sample of countries. In addition, Vega and Winkelried (2005) used propensity score matching and found that inflation targeting helped reduced the level and volatility of inflation in inflation targeting countries.

Mishkin and Schmidt-Hebbel (2007) provide evidence that suggests inflation targeting does make a difference using quarterly data from 1989 to 2004. In their study based on 21 inflation-targeting countries and a control group of 13 high-achieving industrial economies that do not target inflation, they note that inflation targeting helps countries achieve lower inflation in the long run. See Table 1 for a full summary of impacts of inflation targeting on inflation and treatment and control group used.

[Table 1 here, see Appendix]

As shown, there are numerous research and evidence on the effects of inflation targeting on inflation and inflation volatility and how the framework can stabilize inflation. Let’s now focus more specifically on the real economy as the answer is very inconclusive for both advanced economies and emerging market developing economies. Below, I sorted the literature for the effects of inflation targeting on growth and output volatility for emerging market and developing economies.

3.B. Growth

Brito and Bystedt (2010) used a panel sample of 46 developing countries between 1989 and 2006, where they controlled for common time and country effects. They are the only study with a significant negative effect of inflation targeting on growth (Schmidt-Hebbel and Carrasco, 2016). Based on their finding, this suggests that lower inflation come at the cost of lower growth as their research also showed that inflation targeting reduced inflation. In contrast, Naqvi and Rizvi (2009) results indicate non-significant effects of inflation targeting on growth, “The estimated effect is -0.5676 but this is not statistically significant (p-value = 0.5683)” (Naqvi and Rizvi, 2009, pg. 12). However, a concern with their research is that their country sample was very small as it was restricted to a sample of ten Asian economies (as cited in Gemayel, Jahan, and Peter, 2011). Another study explored the effects of inflation targeting on both advanced and emerging market developing economies. Hale and Philippov (2015) found that “Advanced economies that

adopted inflation targeting experienced relatively higher growth than those that did not. In contrast, developing countries that adopted an inflation target did not show any substantial gains in growth in the medium term compared with those that did not adopt a target” (Hale and Philippov, 2015, p. 4). And (Gemayel, Jahan, Peter, 2011) report that there was no robust evidence of an adverse impact on output when looking at low-income countries using both difference-in-difference and panel analysis.

3.C. Output Volatility

After surveying the literature further for results on output volatility, it was evident that the effects of inflation targeting on the real economy were less clear. There were different conclusions for both advanced and emerging market and developing economies. “Ball and Sheridan (2005) find no significant effect of inflation targeting on average output growth or output volatility in their sample of 20 OECD countries” (as cited in Svensson, 2010). Goncalves and Salles (2008) use a sample of 36 emerging market and developing economies (13 inflation targeters) from 1980 to 2005. They report a significant negative effect of inflation targeting on output volatility; this means that based on their sample, emerging inflation targeters did contribute to superior outcomes in economic performance. However, Batini and Laxton (2007) and Mishkin and Schmidt-Hebbel (2007) report non-significant effects of inflation targeting on growth volatility (as cited in Schmidt-Hebbel and Carrasco, 2016). Furthermore, there was no significant evidence to conclude that the inflation targeting framework met the goals of stabilizing inflation and growth in emerging market economies (Brito and Bystedt, 2010).

It appears as though, there is no robust evidence that inflation targeting has contributed to changes in growth and output volatility in emerging market and developing economies as there are many conflicting evidence. Pushing the inflation targeting framework further along, let’s put it into focus for emerging market and developing economies. There has been discussion on both sides of the spectrum that inflation targeting is not good for growth and is also good for growth.

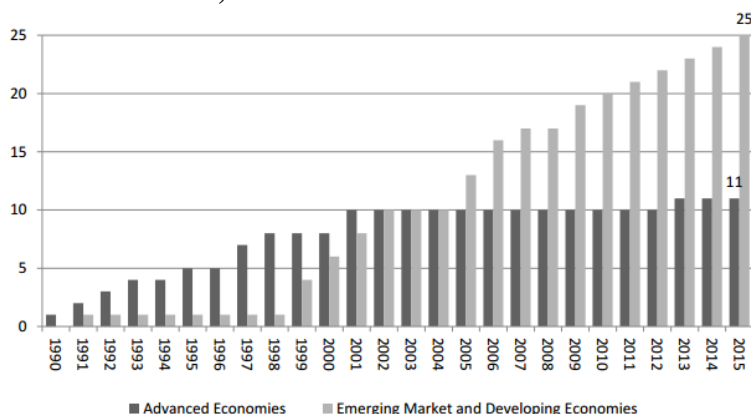
One view is that there are negative results: “Bernanke and Woodford (2005), Cabellero and Krishnamurthy (2005), Mishkin (2000, 2004), and Sims (2005) warn that these economies’ lack of institutional maturity and consistency of macroeconomic fundamentals could undermine credibility and give worse results” (as cited in Brito and Bystedt, 2010). This largely plays into the role of a central bank’s institutional design; do they emphasize transparency, accountability, and communication well?

Another view is that there are positive results: “Bernanke et al. (1999), Mishkin (1999) and Svensson (1997), take the opposite route and claim that since the initial credibility of emerging markets’ central banks is low, practicing official inflation targeting makes their monetary policy more credible, and thus should lead to better macroeconomic outcomes” (as cited in Brito and Bystedt, 2010). This is an interesting dynamic that comes into play when considering emerging market and developing economies. This research paper does not look specifically into a country’s central bank’s institutional design, but readers should be aware that these are possible explanations that could explain why it could be costlier for developing countries to adopt inflation targeting and thus have to wait longer for economic gains from inflation targeting.

Since the late 1990s, the inflation targeting framework has been adopted in a number of emerging market and developing countries as shown in Figure 1; there are now more emerging

market and developing inflation targeters than advanced inflation targeters. Inflation targeting has been around for 27 years now and there is still no clear conclusion about whether it is harmful or effective for economic growth. I found this an interesting area of study and thus motivated my research question, “Is the adoption of inflation targeting harmful for economic growth in emerging market and developing economies?”

Figure 1. Number of IT Countries, 1989-2015



Source: Hammond (2012) and central banks webpages.

III. Methodology

The research conducted by Brito and Bystedt is from 1980 to 2006 with 46 emerging market and developing countries with 13 inflation targeters and 33 non-inflation targeters. Following the approach of one of the more recent studies of inflation targeting in emerging economies, Brito and Bystedt (2010), I based my empirical model on the technique they used. I used panel data regression with ordinary least squares (OLS) estimation looking at 43 countries from 1989 to 2015, 22 inflation targeters and 21 non-inflation targeters. I will talk more about the selection process shortly.

The hypothesis that was tested is stated as follows:

The null hypothesis (H_0): the inflation targeting monetary policy framework does not significantly influence economic growth.

The alternate hypothesis (H_1): The inflation targeting monetary policy framework does significantly influence economic growth.

This research paper works with the following multiple regression equation:

$$y_{n,t} = \alpha \cdot y_{n,t-1} + \beta \cdot IT_{n,t} + \delta_t + \eta_n + E_{n,t} \quad (1)$$

where $y_{n,t}$ is a macroeconomic performance indication of interest (i.e. percent change in real GDP); the subscript $n=1, 2, \dots, N$ is the country; $t=1, 2, \dots, T$ is the period. The lagged value $y_{n,t-1}$ is included to capture persistence and mean-reverting dynamics. Mean reversion is the theory suggesting that prices, returns, or inflation rates eventually move back toward the mean. Thus including a lagged value accounts for the idea that inflation rates generally decline for

inflation targeting countries and for non-inflation targeting countries. The IT dummy variable $IT_{n,t}$ equals to 1 if country n is an inflation targeter in period t and 0 otherwise. Thus, $IT_{n,t}$ is the independent variable, which measures the average effect of inflation targeting across all targeting countries. The term δ_t allows for time effects that capture common shocks to all countries, η_n allows for cross-country fixed effects, and $E_{n,t}$ is the error term. Since the adoption of inflation targeting is an endogenous choice that is chosen by countries at different times with different unobservable characteristics, I control for time and country effects by including those two variables. Furthermore, “countries that adopt inflation targeting did so as part of a wider process of political and economic reform” (Hammond, 2012). I follow Brito and Bystedt in that they also did not include control variables as there is already a country and time effect variable. In another model, I include the control variables: real GDP index, foreign direct investments (net outflow % of GDP), and broad money growth (annual %). Foreign direct investment refers to direct investment equity flows in the report economy and broad money growth is the sum of currency outside banks. These control groups were added in Lin and Ye (2007) as they use propensity-matching score and to account for the idea that inflation targeting should be adopted only after some preconditions are met. Since I have time and country effects and use panel analysis, I do not see a strong reason to use control variables. See appendix, Table 6, for results with control variables, same treatment and control groups are used).

As stated earlier, as of April 2015, there are 36 countries that have an inflation targeting framework across both advanced economies and emerging market and developing economies. I focus on the emerging market and developing economies. I followed Brito and Bystedt’s approach where they had a unified sample of both inflation targeting and non-inflation targeting countries by following two prior studies, Gonclaves and Salles (2008) and Batini and Laxton (2007). I went through and updated the countries by moving the non-inflation targeting countries that are now inflation targeting countries into the inflation targeting group as shown in Table 2. The shaded countries were not inflation targeters at the time of study for Brito and Bystedt (2010).

Table 2. Samples and Dates of Inflation Targeting Adoption

Country	Adoption Year	Country	Adoption Year	Country	Adoption Year
Albania	2009	Hungary	2001	Romania	2005
Brazil	1999	India	2015	Russia	2014
Chile	1991	Indonesia	2005	South Africa	2000
Colombia	1999	Mexico	2001	Thailand	2000
Dominican Republic	2011	Paraguay	2013	Turkey	2006
Georgia	2009	Peru	2002	Uganda	2012
Ghana	2007	Philippines	2002		
Guatemala	2005	Poland	1999		

Sample of non-inflation targeting countries: Argentina, Botswana, Bulgaria, China, Costa Rica, Cote d'Ivoire, Croatia, Ecuador, Egypt, El Salvador, Jordan, Malaysia, Morocco, Nigeria, Pakistan, Panama, Singapore, Tunisia, Ukraine, Uruguay, Venezuela.

I deviate from Brito and Bystedt (2010) in several different ways. First, I decided to take out Czech Republic, Israel, and Korea because these countries are classified as high income countries by the World Bank. Then based on unavailable data and exclusion of hyperinflation periods, I took out Algeria, Armenia, Lebanon, Moldova, Serbia, Taiwan, and Tanzania. I did not decide to explore further to get relevant data because I did not want to have too many countries because of overfitting where my coefficients may become unreliable. I used a combination of data from the World Economic Outlook IMF and World Development Indicators World Bank.

In addition, some of the adoption years I chose are different from Brito and Bystedt (2010). I updated the adoption years according to (Schmidt-Hebbel and Carrasco, 2016) as the information is most up to date.

Furthermore, my time period is 1989 to 2015 rather than 1980 to 2006 for two reasons. Firstly, I did not want to have a large window to prevent overfitting and having unreliable coefficient so I start at 1989 to keep a 27-year window and mostly observe how inflation targeting has progressed since the 2006 observations.

Secondly, I wanted to avoid the problem of high inflation that was in the time prior and control for the 1990s overall trend of falling inflation and macroeconomic volatility. Because my sample starts in 1989, I do not need to include a high inflation dummy variable that equals to 1 if the natural log inflation is greater than 0.40 per year in period t and 0 otherwise as Brito and Bystedt did. For robustness checks, I ran another model where my time period is even later, 1995 to 2015 as I wanted to keep Brazil and Georgia in my sample treatment group as those countries continued to have high inflation into the mid 1990's.

Again, I want to reiterate that the results depend critically on the selection of the empirical model used to address this issue and country composition of treatment and control groups.

IV. Results

Table 3 and Table 4 present various estimates of Eq. (1). *Note: the difference is in the time period.

Table 3. Estimates of the Inflation Targeting Effect on Percent Real GDP (1989-2015)

Estimator:	OLS	C-OLS	TE-OLS	CTE-OLS
	(1)	(2)	(3)	(4)
Inflation targeting dummy	-0.024 (0.943)	0.271 (0.524)	-0.023 (0.949)	0.223 (0.649)
Lagged % Real GDP	0.434 ($<2e^{-16}$)***	0.315 ($<2e^{-16}$)***	0.450 ($<2e^{-16}$)***	0.322 ($<2e^{-16}$)***
Observations	1124	1124	1124	1124
R-squared	0.1918	0.2609	0.2824	0.3485

Source: Author's estimations

Note: *, **, *** respectively denote significance at the 5%, 1%, and 0.1% levels.

p-Values in parentheses. Pooled cross-section (OLS) in column (1), including country-variable effect (C-OLS) in (2), time-variable effect (TE-OLS) in (3), and country and time effects in (CTE-OLS) in (4).

Table 4. Estimates of the Inflation Targeting Effect on Percent Real GDP (1995-2015)

Estimator:	OLS	C-OLS	TE-OLS	CTE-OLS
	(1)	(2)	(3)	(4)
Inflation targeting dummy	-0.235 (0.435)	-0.138 (0.74331)	-0.127 (0.668)	0.080 (0.860)
Lagged % Real GDP	0.362 ($<2e^{-16}$)***	0.237 ($6.63e^{-13}$)***	0.380 ($<2e^{-16}$)***	0.238 ($4.55e^{-13}$)***
Observations	876	876	876	876
R-squared	0.1396	0.2282	0,2908	0.3757

Source: Author's estimations

Note: *, **, *** respectively denote significance at the 5%, 1%, and 0.1% levels.

p-Values in parentheses. Pooled cross-section (OLS) in column (1), including country-variable effect (C-OLS) in (2), time-variable effect (TE-OLS) in (3), and country and time effects in (CTE-OLS) in (4).

V. Data Analysis

The data is analyzed in four ways: column 1 is the pooled cross-section (OLS), column 2 includes country-variable effect (C-OLS), column 3 includes time-variable effect (TE-OLS), and column 4 includes both country and time effects (CTE-OLS). I included all four regressions to better help us understand how the results change with a country and/or time effect. Our main focus is column 4 with time and country fixed effects because adopting the inflation targeting framework is an endogenous choice that could be related to unobservable country characteristics and time trends.

It is important to note the independent variable, IT, is not significantly different from 0 as the p-value is not less than 0.05 in all 4 columns. In addition, there is some unbalanced data but I do not think this alters our result as there are only 37 missing data points.

Looking at column 1, holding the other variables constant, for an inflation targeting country, we would expect to see a 0.024% decrease in percent change in real GDP.

Looking at column 2, holding the other variables constant, for an inflation targeting country, we would expect to see a 0.271% increase in percent change in real GDP. The inclusion of the country effect in column 2 modifies the results. There is now a more positive inflation targeting impact on the percent change in real GDP. However, since the coefficient, IT, is not statistically significant, we cannot reject the null hypothesis.

For column 3, holding the other variables constant, for an inflation targeting country, we expect to see a 0.023% decrease in percent change in real GDP with the inclusion of a time effect.

And for column 4, holding other variables constant, for an inflation targeting country, we expect to see a 0.223% increase in percent change in real GDP.

I was interested in exploring my time window. I decided to shorten my window from 1989 and 2015 to 1995 and 2015 to account for inflation in Brazil and Georgia. After taking into account the country and time effects, my results show that the effect on percent real GDP is positive (Table 4, Column 4) unlike in columns 1, 2, and 3 in Table 4. What is interesting to see is that the magnitude of change in percent change in GDP (column 4) is smaller in Table 4 than in Table 3.

Again, it is important to note the independent variable, IT, is not significantly different from 0 as the p-value is not less than 0.05 in all 4 columns.

My results were similar to Brito and Bystedt (2010) in that columns 1, and 3 for Table 3 and columns 1, 2, and 3 for Table 4 are negative. However, there is a difference when column 4 is considered because I got positive coefficients. In addition, for Brito and Bystedt (2010), the negative effect of inflation targeting on real GDP growth was significant only for column 3. I found no significance. My inference is that this may be due to the different country treatment and control groups.

Comparing my results to another similar study by Gemayel, Jahan, and Peter (2011) who also based their study on Brito and Bystedt (2010), the magnitude of my coefficients were smaller. They have a negative significant effect of inflation targeting on real GDP for time-effect OLS, similar to Brito and Bystedt (2010). My inference is that this may be due to the country selection as Gemayel, Jahan, and Peter (2011) only focused on low income countries.

Due to my treatment group, it is hard to draw conclusions about the effects of inflation targeting because some countries selected only recently adopted the framework. This means that these countries may not be at a stationary-target period, and so we can only discuss the effects of inflation targeting in the short to medium term.

My results were as I expected in getting not statistically significant results because most literature of the effects of inflation targeting on growth did not find significant results.

Comparative descriptive statistics on the percent change in real GDP reflect the trend that emerging market and developing economies have achieved a large reduction in growth volatility as shown in Table 5. The standard deviation pre-inflation targeting is 6.15 and post-inflation targeting is 2.95 for inflation targeting countries.

VI. Further Discussion and Questions

This research was important because it explored the effects of inflation targeting on economic growth in emerging market and developing economies. The control groups were set accordingly

Inflation Targeting in Emerging Markets

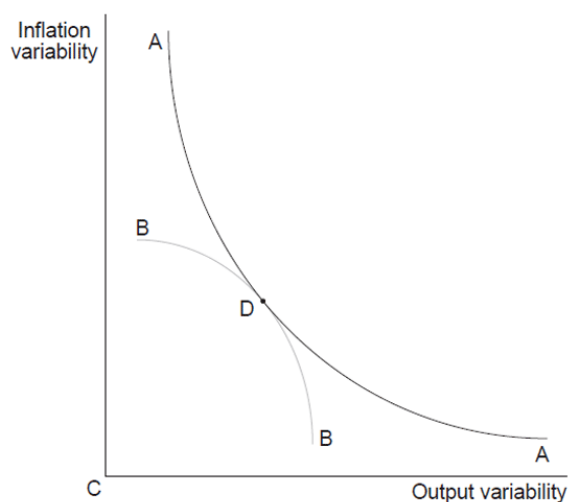
so there was a benchmark to compare emerging targeters and emerging non-targeters. We can then extend the analysis in this paper to address the question, what does this mean for policymakers and the future of inflation targeting? It appears as though it is good to maintain inflation targeting because adopting this framework does not reduce nor increase economic growth. In addition, based on other scholars in this field, it appears as though inflation target levels are reached (IMF, 2005)., (Goncalves and Salles, 2008), (Brito and Bystedt, 2010), and (Gemayel, Jahan, Peter, 2011).

In terms of my model, I want to note that the OLS estimation approach is biased because of omitted variable bias, reverse causation of inflation targeting on inflation. A further exploration to control for this bias would be to use a generalized method of moments (GMM) estimation in the future.

To further explore my model, I want to create “supergroups” and use those for the group effects; for example, I can group countries by region. Similarly, I can also create “three-year time intervals to have a better opportunity to infer information from the time series while constraining the number of instruments” (Gemayel, Jahan, Peter, 2011).

The discussion of inflation targeting is also connected to inflation and output performance as supply shocks move output and inflation in opposite directions and thus create a tradeoff between output and inflation variability as shown in Figure 2 by the AA curve. The BB curve is the indifference curve, and point D is the optimal targeting horizon. It would be interesting to conduct further research by running the same model in seeing whether the adoption of inflation would increase or decrease output volatility.

Figure 2. Trade-off Between Inflation and Output Variability



Source: (Haldane, 1997).

Lastly, I only look at countries broadly; in another paper I can look at a specific country and use a high frequency sample of quarterly data covering the period and sub-periods before inflation targeting and after inflation targeting. This would be interesting to explore as in a broad study, effects of inflation targeting in some countries within the chosen sample can be smoothed out by

other countries. For example, I can see in Figure 3 and Figure 4 that there is an outlier, numbered 1057. I identified that data point and found out that it was Uganda in 1992.

Figure 3. Residuals vs. Fitted Plot (1989-2015)

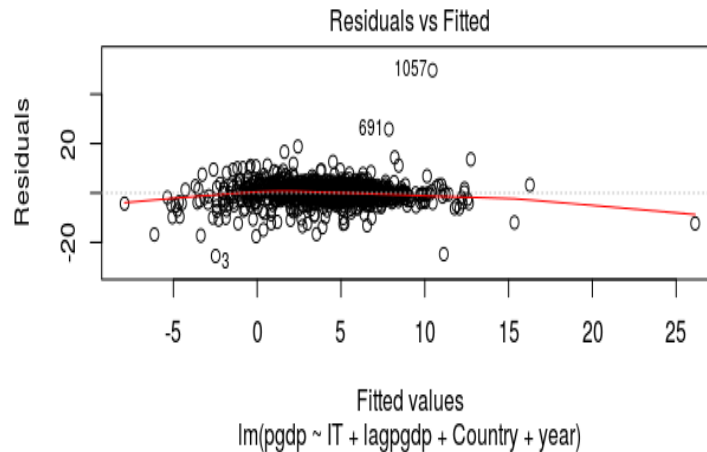
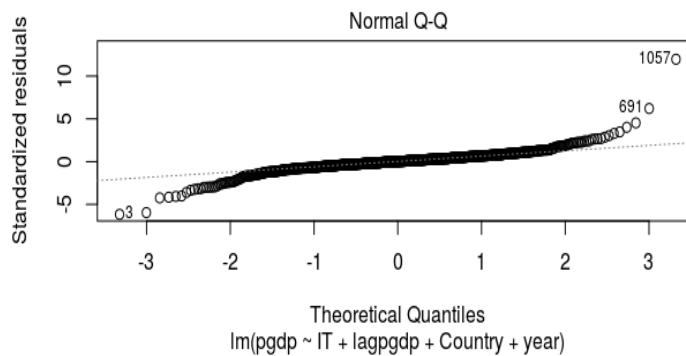


Figure 4. Normal QQ Plot (1989-2015)



VII. Conclusion

There has been ongoing discussion where inflation targeting has been criticized for focusing too much on inflation at the expense of economic growth and output. This paper investigates the impact of inflation targeting on the percent change in economic growth in emerging market and developing economies using panel OLS estimation with time and country effects. The inclusion of a time and country effect, increased the relation between of an IT regime and percent real GDP. For emerging market and developing economies, the main results from this research show that inflation targeting does not have significant negative effects on economic growth. In addition, there is no reason to assume that countries that adopt inflation targeting will have better

macroeconomic performance relative to the control group of other emerging non-inflation targeters. My results were as expected as I followed Brito and Bystedt’s methodology but changed some of my independent variables. Going back to the question asked in the beginning of the paper, “Is inflation targeting harmful for growth in emerging market and developing economies?”, it does not appear to be the case. With a growing number of emerging market and developing economies adopting an inflation targeting framework, it would be interesting to see whether more countries, especially low income countries adopt this framework in the future. There is still a lot to be learned about the effects of inflation targeting on the real economy.

VIII. Appendix

Table 1: Effects of Inflation Targeting on Long-term Inflation Levels in Different Country Groups, 12 Studies

Authors	Sample: Treatment Group; Control Group	Estimation Technique	Difference in Long-Term Inflation Rate
Ball and Sheridan (2005)	AEs:7 IT; 13 NIT	Cross-section OLS	Zero
Hyvonen (2004)*		Cross-section OLS	
Vega and Winkelried (2005)	World: 23 IT; 86 NIT	Propensity score matching	-2.6% to -4.8%
IMF (2005)	EMDEs: 13 IT; 22 NIT	Cross-section OLS	-4.8%
Mishkin and Schmidt-Hebbel (2007)	21 IT; 13 NIT AEs	Cross-section OLS	+1.20%
	21 IT; 13 NIT AEs	IV Panel	Zero
	21 post-IT; 21 pre-IT	IV Panel	-5.0%
	Stationary IT; 13 NIT AEs	IV Panel	Zero
Batini and Laxton (2007)	21 IT; 29 NIT	Cross-section OLS	-4.8%

Lin and Ye (2007)	AEs: 7 IT	Propensity score matching	Zero
Goncalves and Salles (2008)	EMDEs: 13 IT; 23 NIT	Cross-section OLS	
Brito and Bystedt (2010)	EMDEs: 13 IT; 33 NIT	Panel estimation techniques	
Gemayel et al. (2011)	EMDEs: 10 IT; 29 NIT	Cross-section OLS Various panels	-3% -2% to -3%
Calderon and Schmidt-Hebbel (2010)	World: 24 IT; 73 NIT	Multi-variate structural inflation model; Panel Models; Fixed Effects, Random Effects, and System GMM	-3% to -6%
Samarina, Terpstra and de Han (2014)	25 AEs and 59 EMDEs	Propensity score matching	Zero for AEs and negative for EMDEs

*Extended work of Ball and Sheridan's (2003) earlier research.
Source: Schmidt-Hebbel and Carrasco (2016) and I updated with additional references I found.

Table 5. Descriptive Statistics on percent real GDP of Inflation Targeters, 1989-2015.

IT	Min	Q1	Median	Q3	Max	Mean	SD	N	Missing
Pre=0	-28.0	2.120	4.50	6.69	60.220	4.009086	6.153416	365	10
Post=1	-7.1	2.545	4.09	5.71	14.046	3.997896	2.961888	235	11

The following multiple regression equation:

$$y_{n,t} = B_0 y_{n,t-1} + B_1 IT_{n,t} + B_2 gdpindex_{n,t} + B_3 FDI_{n,t} + B_4 broadmgn_{n,t} + \delta_t + \eta_n + E_{n,t} \quad (2)$$

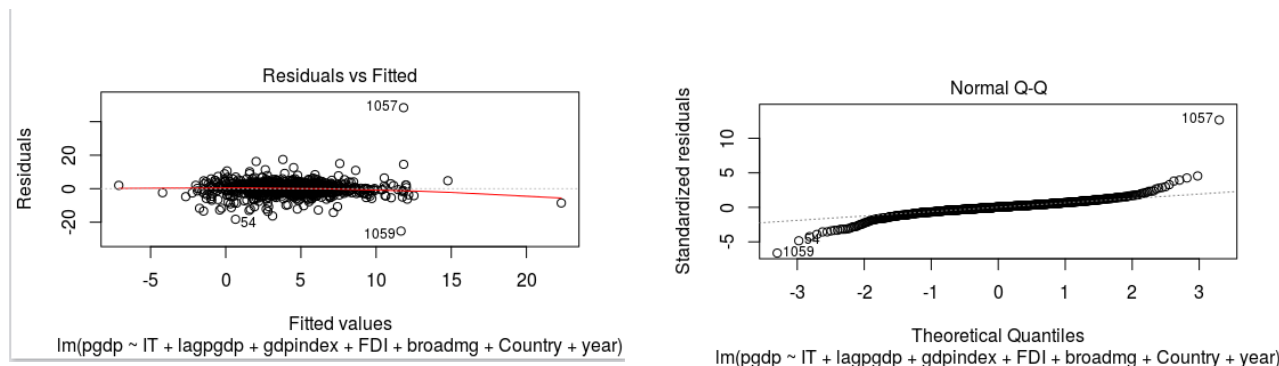
Table 6 present various estimates of Eq. (2).

Table 6. Table 3 Estimates of the inflation targeting effect on percent real GDP (1989-2015).

Estimator:	OLS	C-OLS	TE-OLS	CTE-OLS
	(1)	(2)	(3)	(4)
Inflation targeting dummy	0.129 (0.716)	0.478 (0.335)	-0.075 (0.826)	0.525 (0.283)
Lagged % Real GDP	0.334 ($<2e^{-16}$)***	0.225 ($5.39e^{-13}$)***	0.343 ($<2e^{-16}$)***	0.236 ($5.66e^{-14}$)***
Real GDP Index	-0.022 (0.0003)***	-0.011 (0.130)	-0.057 ($1.29e^{-6}$)***	0.004 (0.822)
Foreign Direct Investment, net outflow (% of GDP)	0.102 (0.002)**	0.124 (0.003)**	0.066 (0.038)*	0.069 (0.106)
Broad Money Growth (annual %)	-0.001 (0.041)*	-0.001 (0.051).	-0.001 (0.087).	-0.001 (0.064).
Observations	1124	1124	1124	1124
R-squared	0.1583	0.2249	0.2695	0.324

My results were as I expected as IT coefficient is not significant, since the p-value is not less than 0.05, we fail to reject the null hypothesis. For this column 1, holding the other variables constant, for an inflation targeting country we would expect to see a 0.129% increase in percent change in real GDP. For column 2, holding the other variables constant, for an inflation targeting country, we would expect to see a 0.478 increase in percent change in real GDP. The inclusion of the country effect in column 2 modifies the results. There is now a more positive inflation targeting impact on the percent change in real GDP. This means that inflation targeting countries grew more. However, again, coefficient is still not statistically significant so we cannot reject the null hypothesis. For column 3, holding the other variables constant, for an inflation targeting country we expect to see a 0.075% decrease in percent change in real GDP. We cannot reject the null hypothesis. And for column 4, holding the other variables constant, for an inflation targeting country, we expect to see a 0.525% increase in percent change in real GDP. The control for common time and country effects in column 4 results in a more positive inflation target impact on economic growth than in column 2 and 3. However, the p-value on the inflation targeting variable is not less than 0.05, there is not enough evidence to reject the null hypothesis. It appears that inflation targeting does not have adverse effects on growth in either direction; thus the data shows that there is no evidence that the inflation targeting regime improves or harms

economic growth as measured by the percent change in real GDP. I will say, what is interesting is that Brito and Bystedt found that IT actually resulted in lower output growth during adoption. (Not significant though, and mine were positive).



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