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# **Inflation Targeting: Monetary Policy, Growth and Inflation**

**Manmohan Agarwal  
and  
Ammu Lavanya**

Discussion Paper # 260



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विकासशील देशों की अनुसंधान एवं सूचना प्रणाली



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# Inflation Targeting: Monetary Policy, Growth and Inflation

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**Abstract:** Monetary policy has evolved over the years until in recent years more and more central banks are adopting inflation targeting. India followed suit in 2014. Monetary policy evolved towards inflation targeting in order to prevent the use of monetary policy using the Phillips curve to suit short term political objectives, the political business cycle. Inflation targeting is expected to anchor inflation and provide a better basis for decisions leading to higher growth. It is argued that targeting has resulted in lower inflation and higher growth. We find that inflation abatement occurred before the adoption of targeting and in countries that did not adopt targeting as those that did. Though the long run Phillips curve is not vertical the adoption of targeting results does not result in higher unemployment but in a more favourable Phillips curve. We do not find that inflation targeting leads to breaks in either the inflation rate or the growth of per capita GDP. We then analyse the relation between growth, inflation and the external balance in developing countries during prolonged periods of growth. We find that for the group of countries and periods considered GDP growth Granger causes inflation but not the other way round. Overall we find little evidence to support that targeting leads to lower inflation or higher growth.

**Keywords:** Inflation, Inflation targeting, Monetary policy, Growth.

**JEL Codes:** E31, E52, E58, O11JEL codes: H75, I18, I28, O15

## Introduction

Monetary policy has evolved over the years to a state where more and more countries are adopting inflation targeting. Section I discusses how monetary policy has changed in its objectives over the past century and a half. We note that it has come full circle and today it is geared

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towards managing inflation as it was under the pre First World War gold standard. In particular, we discuss the issues raised by inflation targeting. One of the reasons for stressing the control of inflation was the rejection of the Phillips curve that there is a trade-off between inflation and unemployment. In section II we discuss the nature of the Phillips curve. We also discuss whether inflation targeting did result in lowering inflation. In section III we analyse whether adoption of targeting resulted in breaks in the inflation and GDP per capita growth series. There have been a number of high growth periods in developing countries and in section IV we examine the relation between growth and inflation during these periods, particularly to see whether higher rates of inflation resulted for a higher growth rate as it encouraged factor mobility, as some analysts have argued. In section V we undertake a time series analysis of the relation between growth and inflation in a panel of countries. In particular we see whether inflation Granger causes higher growth or whether growth Granger causes higher inflation. We end with some conclusions in section VI.

## **I.A: Monetary Policy Under the Gold Standard**

A country adopting the gold standard (GS) had to maintain the value of its currency and this implied that it could not afford any lengthy period of inflation. Though under the pre first world war gold standard the government or the monetary authorities did not consider that they had the responsibility to manage the economy<sup>1</sup> they were aware that excessive money creation would fuel inflation which would make their goods non-competitive in world markets and lead to balance of payments deficits that would make maintenance of the exchange rate difficult. Monetary policy was geared to control the external account in order to maintain equilibrium in the balance of payments (BOP). This was easier for the key currency countries such as England and France who were creditor countries than for the smaller periphery countries particularly in Southern Europe and Latin America which were debtor countries.<sup>2</sup>

If England had a BOP of payments deficit the Bank of England (BE) would raise the interest rate. This would lower capital outflows,

England was a net lender, and encourage inflows, thereby improving the capital account of the BOP. The fall in capital outflows and increase in inflows were a reflection of the belief that the exchange rate would be maintained and this resulted in stabilizing speculation. The higher interest rate would also lower the level of economic activity and so imports and improve the current account. Consequently, the overall BOP would improve. For debtor countries a higher rate of interest may not lead to an improved capital account as the cost of servicing their debt would rise and investors would expect a worsening of the current account. The main effect in debtor countries was that the higher interest rate would lead to lower economic activity and so lower imports. But the lower level of economic activity particularly of imports would reduce the government's revenue which depended considerably on trade taxes and raise the budget deficit. Domestic sources of funding were limited unless the money supply was increased putting downward pressure on the value of the currency. Doubts about the viability of the fiscal position made foreign lender reluctant to lend. Fears that the exchange rate would be abandoned resulted in destabilizing speculation. Countries often abandoned the gold standard and depreciated their currencies. Debtor countries, particularly those on the periphery in Latin America and Southern Europe, were able to remain on the GS for only very limited periods of time.<sup>3</sup>

The major adjustment mechanism under the gold standard (GS) was variation in the level of absorption and economic activity.<sup>4</sup>

In the aftermath of the First World War (FWW), the GS mechanism which had worked relatively satisfactorily in the pre-FWW period failed to do so and countries experienced prolonged periods of high unemployment which created political instability and so policy makers could no longer ignore the level of economic activity.

A second issue became evident in the period after the FWW, the extent of interdependence between the major countries and how this affected policy and the state of the economy. Before the FWW England usually had a BOP surplus as its earnings from its foreign investments were greater than its trade deficit and its new FDI outflows. Higher

interest rates to tackle a BOP deficit turned the deficit into a surplus and so rectified the original problem and the higher interest rate was only a temporary expedient. But England had to sell many of its foreign investments to pay for the war and after the FWW its earnings on foreign investments did not usually cover the deficit and its new foreign investments. Long term investments were financed by short term borrowings. So it had to maintain a high rate of interest to prevent capital outflows which it would not have been able to tolerate given the situation of the rest of the BOP and its low levels of gold holdings (Agarwal, 2017). The high rate of interest resulted in lower levels of economic activity and high levels of unemployment throughout the inter war period. This higher rate of interest was not merely in relation to the level of economic activity but relatively to the US to prevent capital outflow to the US.

What was brought into prominence was the need for the four major powers, the US, the UK, France, and Germany, to coordinate their policies. Meetings of the heads of the central banks were held periodically to exchange information and to try to coordinate policy. Benjamin Strong, the Governor of the New York Federal Reserve Bank played a prominent role in these meetings (Ahamed, 2009). However, it soon became obvious that the interests of the surplus countries, the US and France, clashed with those of the deficit countries, the UK and Germany, as predicted by Keynes. Furthermore, Strong often came under intense pressure from other participants in the formation of US monetary policy. Strong resisted the attempts of the others to raise interest rates in the US when inflation increased in the US or to stem the credit fuelled bull run on the stock exchange as a higher interest rate would put pressure on the pound. But ultimately in 1928 he was forced to increase the interest rate (Ahamed, 2009).

The inter war period pointed to the need for monetary policy coordination among the major currencies. The need for coordination followed from the well known impossible trinity or the trilemma. A country could not have a fixed exchange rate, free capital movement and an independent monetary policy (Aizenman, 2013).

## **I.B: Monetary Policy and Bretton Woods System**

The Bretton Woods System (BWS) sought to shift the centre of policy making from managing the BOP to achieving full employment. The objective of monetary policy was to reach full employment and each country would run an independent monetary policy. Therefore, in terms of the trilemma, there could not be free capital flows.<sup>5</sup> Both White and Keynes considered it necessary to restrict capital flows. Bankers wanted free capital flows. The initial attempt to force free capital flows as a condition of the 1947 loan to England ended in a crisis that forced the US to countenance postponement of adoption of exchange rate convertibility but not its abandonment (Helleiner, 1994, Agarwal, 2020). Monetary policy, in the initial post Second World War (SWW) year, was geared to maintaining low interest rates to facilitate servicing of the large public debt inherited from the war.

The challenge for policy makers under the BWS was whether both internal and external objectives, namely full employment and equilibrium in the BOP, could be achieved even though the exchange rate was fixed. Proper deployment of fiscal and monetary policy would ensure the achievement of both full employment and BOP equilibrium (Fleming, 1962, Mundell, 1963). Under this scheme of things monetary policy would be used to manage the BOP. If the deficit became too large the rate of interest rate should be raised so that capital inflows would reduce the deficit and if the deficit was too small or the surplus too large the rate of interest should be raised. It, however, soon became clear that changes in interest rates resulted in a portfolio switch. Capital flows occurred while the portfolio adjustment was occurring. This implied that if the deficit continued the interest rate would need to be also continually increased. At some point even a higher interest rate would not lead to large capital flows from risk averse investors.<sup>6</sup> Furthermore, as rates of inflation rose in the 1950s rates of interest were raised to control inflation. Monetary policy was used to control inflation and not to achieve full employment. However, since rates of inflation varied among countries, exchange rates became misaligned, namely the interest parity equation

did not hold. The BWS collapsed in the early 1970s and the developed countries adopted flexible exchange rates. Developing countries shifted to flexible exchange rates considerably later after a number of countries experienced BOP crises.

### **I.C: Monetary Policy after the Collapse of the BWS**

The collapse of the BWS coincided with a sharp increase in the rate of inflation in many countries. The higher overall rate of inflation in the 1970s was accompanied by more variable rates of inflation. It was believed that uncertainty about the future rate of inflation acted as a disincentive to investment leading to lower rates of investment and levels of economic activity. A flexible exchange rate nullified the harmful effects of inflation on competitiveness and the BOP. However, it adversely affected the level of economic activity and resulted in stagflation, a new phenomenon in the 1970s. It, therefore, became imperative to control inflation. Consequently, whereas earlier central banks conducted monetary policy taking account of a number of factors such as the rate of inflation, the state of economic activity, the rate of unemployment, the state of the BOP etc. now central banks gave primacy to controlling the rate of inflation. For instance, Volcker raised the federal funds rate which had averaged 11.2 per cent in 1979, to a peak of 20 per cent in June 1981. The prime rate rose to 21.5 per cent in 1981 as well, which helped lead to the 1980-82 recession.

The episode of high inflation resulted in the belief that central banks should be independent of the political authorities and its mandate should be control of inflation. This belief resulted from a number of factors. The Phillips curve had suggested that there could be a trade off between inflation and unemployment. Some policy makers in the 1970s wanted to maintain levels of economic activity in the face of the deflationary effect of the oil price rise.<sup>7</sup> But the inflation augmented Phillips curve showed such a trade off might only be a short term one while expectations adjusted. With a inflation adjusted Philips curve there was no long term trade off (Phelps, 1967).<sup>8</sup> So there was no need to tolerate inflation. In addition it became clear that economic conditions

at the time of an election influenced the result of the election. So the political authorities would have a temptation to manipulate policies to increase the level of economic activity before an election.<sup>9</sup> There was development of the notion of a political business cycle (Nordhaus, 1975). Later research has shown that the notion of a PBC is both theoretically and empirically doubtful.<sup>10</sup>

It was believed that controlling the rate of inflation would lead to a number of benefits (Bernanke and Mishkin, 1997). By reducing uncertainty it would raise investment levels and the level of economic activity, so scourge of stagflation would be avoided. Also, economic decision makers need to take account of the future when they make decisions. Therefore, expectations of the future are important. A part of the responsibility of central bankers namely of monetary policy is to manage expectations (Woodford, 2003). The purpose of inflation targeting is not merely to reduce the rate of inflation. Inflation targeting includes central banks explain what they expect to happen and what they are trying to achieve (Woodford, 2003).<sup>11</sup> This means that central banks cannot spring surprises (Bernanke and Mishkin, 1997) and so would avoid the political business cycle. Inflation targeting, however, is not a rule such as Friedman's rule of having a constant rate of growth for the money supply. It is more a framework for analysing the performance of the economy (Bernanke and Mishkin, 1997).

Adoption of inflation targeting followed from reduced belief in the efficacy of an active monetary policy, lack of a long term trade off between inflation and unemployment, and the value of pre-commitment and credibility (Kydland and Prescott, 1977) and benefit of low inflation for growth and efficiency. If all countries reduced rates of inflation exchange rates would become more stable and the uncertainties associated with very unstable exchange rates would be avoided; instability of exchange rates were a feature of the 1980s and 1990s. Furthermore, when a central bank had multiple objectives it would normally fulfill some and fail in others and it was difficult to evaluate the performance of a central bank. With a single objective it was easier to evaluate the central bank's performance.

A number of countries did introduce formal systems of evaluation. Increasingly countries had their central banks adopt inflation targeting where the sole goal of the central bank was to control inflation so that monetary policy was geared towards controlling inflation. Our survey above had shown that controlling inflation has always been an important goal of a central bank, but under inflation targeting it is the sole goal. So monetary policy seems to have come full circle towards what its goal was under the GS. India adopted in 2014 inflation targeting as the goal of monetary policy.

### **I.D: Inflation Targeting: Some Issues**

Research by many economists shows that adoption of inflation targeting has had favourable effects. Countries that have adopted inflation targeting not only have lower rates of inflation but also experience faster growth, as predicted by many economists. But a number of questions arise in evaluating this claim.

And sometimes the claims are confusing. For instance, while Ball and Sheridan (2004) claim that inflation targeting countries seem to have significantly reduced both the rate of inflation and inflation expectations beyond that which would likely have occurred in the absence of inflation targets. But they also conclude after examining the performance of twenty organization for Economic Cooperation and Development countries that there is no evidence that inflation targeting improves performance as measured by the behaviour of inflation, output, or interest rates.

Inflation targeting may seem simple to implement-tighten monetary policy if the rate of inflation is above target and loosen it if inflation is below the target rate. But one has to remember that monetary policy is going to affect future inflation. The relevant rate of inflation for economic decisions and therefore for policy formulation is the future rate of inflation, namely the expected rate of inflation. A successful policy would require an inflation model that correctly predicts the path of the economy including the inflation. Countries that lack such models may not be successful in inflation targeting. This can be a challenge. Past large

scale models have not necessarily been good at predicting the future path of the economy<sup>12</sup>; they are particularly poor at predicting turning points and a successful monetary policy should iron out these turning points. The difficulty of predicting inflation makes implementation of inflation targeting difficult (Cechetti, 1995, Bernanke and Mishkin, 1997). There is no evidence that inflation targeting has affected inflation expectations or that it has reduced the cost of reducing inflation in terms of increased unemployment (Bernanke and Mishkin, 1997). The other fear is that exclusive concentration on the rate of inflation might affect the rate of growth particularly in developing countries. As they grow rapidly significant structural changes and resource reallocations are required. It is feared that these require substantial price changes which a policy of inflation targeting might prevent.

An analysis of inflation targeting in developing countries shows that deviations from both central targets and upper bounds are larger and more common (Fraga et. al. 2004). Inflation targeting in these countries is a more challenging task than in developed one, as the macroeconomic environment is more volatile and they tend to have weaker institutions and more problems with credibility of the policy authorities. Furthermore, they are less likely to have reliable macro models.

## **II: Inflation Targeting and the Phillips Curve: Implications of Inflation Targeting for Unemployment**

We now examine the operation of inflation targeting. We first look at the nature of the Phillips curve. The rationale for inflation targeting is partly that there is no trade off between inflation and employment so no benefit is derived at least over the long term by having a higher rate of inflation. Many countries which have adopted inflation targeting have set their inflation targets to 2 per cent or lower. However, from a historical perspective inflation rates of 2 per cent are very low as no OECD country has experienced inflation below 2 per cent for an extended period of time between the Second World War and the 1990s. The widespread adoption of low inflation targets reflects the underlying idea of a vertical long run Phillips curve. According to this view, inflation has no long

run effects on unemployment which means that low unemployment could exist alongside low rates of inflation. However, for the OECD countries, sustained periods of low unemployment have always been accompanied by high inflation rates and periods of low inflation are characterised by high rates of unemployment thus leading to a questioning of the idea of a vertical Phillips curve and the presence of a long run unemployment inflation trade off. The existence of a trade off would mean that targeting inflation at low levels would lead to the persistence of high unemployment.

Svensson (2013) shows that if inflation expectations are anchored at the inflation target in the sense that the average inflation expectations equal the target even though the average inflation deviates from the target, the long run expectations augmented Phillips curve is no longer vertical but becomes downward sloping. A downward sloping long run Phillips curve would mean that there is a long run tradeoff between inflation and unemployment. When the average inflation expectations equal the inflation target, average inflation below the target will imply average unemployment above the natural rate. For the case of Sweden, Svensson (2013) estimates the slope of the long run Phillips curve to be equal to 0.75. (This implies that a 1 percent point lower average inflation is associated with  $1/0.75 = 1.33$  percentage points higher average unemployment.) For Sweden, the average inflation rate for 1997-2011 was 1.4 percent which is 0.6 percent below the inflation target of 2 percent. This means that unemployment rates in Sweden were  $0.6/0.75 = 0.8$  percent higher than the average unemployment. Thus, the unemployment cost of inflation lower than the target inflation by 0.6 percent was 0.8 percent. For the United States, the Federal Reserve announced a target of 2 percent for PCE inflation in June 2012. However, it is perceived that even prior to this, the Federal Reserve targeted a core inflation level of 2 percent. Fuhrer (2011) shows that inflation expectations in the USA have stabilised around 2 percent which implies that there is no long run vertical Phillips curve for the USA. Svensson (2013) estimates the slope of the Phillips curve in the USA for the period 2000-2011 and finds it

to be equal to 0.23. (This would imply that if average inflation in the USA was 1 per cent below the target level of inflation, the average cost in terms of unemployment would be  $1/0.23 = 4.35$  per cent.) However, for the United States, average inflation has stayed at the target level of 2 per cent and thus there is no unemployment cost of average inflation below the perceived target. Canada has had an inflation target of 2 per cent for CPI inflation since 1991. Svensson (2015) finds the existence of a downward sloping long run Phillips curve for Canada for the period 1997-2012. The slope of the Phillips curve is estimated to be equal to 0.42. (This would imply that the unemployment cost of a 1 percent deviation of inflation below the target inflation equals  $1/0.42 = 2.38$  percent.) However, in Canada too, average inflation has been exactly equal to the target level and thus there is no unemployment cost of average inflation below the target levels. Most of the advanced countries that have adopted inflation targeting have managed to achieve their inflation targets except for Sweden where inflation levels are below target levels and the United Kingdom where inflation levels overshoot the target inflation levels during the global financial crisis years.

Akerlof et al. (2000) set up a model for a near rational Phillips curve where agents' behaviour changes as the economy shifts between high and low inflation regimes. Near rational behaviour means that when inflation doesn't deviate too much from zero, a significant fraction of the private sector neglects inflation as if it were zero. When inflation rises sufficiently above zero, an increasing fraction of the private sector becomes rational and has rational expectations. The long run Phillips curve under this hypothesis is vertical and equal to the long run natural rate of unemployment for high inflation levels and has a hump to the left and is downward sloping for low and positive inflation rates and equals the natural rate of unemployment for zero inflation. If inflation is disregarded at low rates, the private sector sets a lower wage and a lower price relative to nominal aggregate demand. As a result, unemployment is sustained at lower levels than it would be if inflation was fully

accounted for. The Phillips curve that is implied by this model shows that there exists an inflation rate that minimises long run unemployment. Departures from this rate could potentially lead to large costs in terms of unemployment. In the context of inflation targeting, near rational behaviour would mean that when average inflation doesn't deviate too much from the target, a significant fraction of the private sector neglects that deviation and behaves as if average inflation were equal to the target inflation. A major consequence of this is that the target rate of inflation is important. Targeting low levels of inflation would thus result in high unemployment levels. Lundborg and Sacklen (2006) use this model and find that for the case of Sweden (which has an inflation target of 2 per cent) doubling the targeted rate of inflation from 2 to 4 per cent could restrict long run unemployment to 1.5 – 3.5 per cent.

Wong et al.(2001) examine the impact of adoption of inflation targeting on the unemployment inflation tradeoff for seven OECD countries by estimating Phillips curve models for combined country averages. Their results suggest that on average the unemployment-inflation trade off improved in OECD countries subsequent to the adoption of inflation targeting. This means that disinflations after inflation targeting was adopted were associated with smaller increases in unemployment. They attribute the improvement in the unemployment inflation trade off to the enhanced credibility of the central banks to fight inflation after the adoption of inflation targeting.

In brief, while the long run Phillips curve may not be vertical, adoption of inflation targeting makes the Phillips curve more favourable to maintaining a low level of unemployment.

### **Did Inflation Targeting control a spiraling inflation**

We now discuss whether rates of inflation were really spiraling out of control. We see that rates of inflation increased substantially in the 1970s and 1980s (Table 1). Four countries, New Zealand, Canada, England and Sweden adopted inflation targeting in the late 1980s and early 1990s. Inflation did decrease in subsequent decades. But as we can see rates

of inflation were decreasing in general after the 1980s even before the adoption of targeting. And in some countries the rates of inflation did not increase much, Germany and Switzerland, and in many countries they came down in the 1980s, Germany, Switzerland, Japan and even England before they adopted inflation targeting. In general, inflation rates have been much lower since the 1990s.

**Table 1: Rates of Inflation**

Year Average Rates of Inflation							
	Targeting	1960s	1971-79	1980-90	1991-2000	2001-08	2009-19
New Zealand	1989	3.8	12.0	11.3	1.8	2.8	1.6
Canada	1991	2.7	7.8	6.3	2.0	2.3	2.6
England	1992	4.1	13.8	7.2	2.9	2.0	2.1
Sweden	1993	4.1	8.7	8.2	2.3	1.8	1.0
Average		3.7	10.6	8.2	2.2	2.2	1.8
Australia		2.5	10.5	8.3	2.2	3.2	2.1
France		4.0	9.2	7.0	1.7	1.9	1.0
Germany		2.6	5.0	2.9	2.4	1.8	1.2
Italy		4.0	13.1	10.8	3.8	2.4	1.1
Japan		5.6	9.2	2.6	0.8	-0.1	0.3
Norway		4.5	8.1	8.0	2.3	1.9	2.1
Switzerland		3.3	5.1	3.5	2.0	1.1	0
US		2.8	7.2	5.5	2.8	2.8	1.6
Average		3.7	8.4	6.1	2.2	1.9	1.2

*Source:* Authors' calculations from data in World Bank World Development Indicators.

### **III: Relation between Inflation targeting and Inflation: Structural Breaks**

As noted above, high rates of inflation in the 1970s resulted in the adoption of inflation targeting. Inflation targeting was expected to break inflation expectations and that this would result in lower rates of inflation

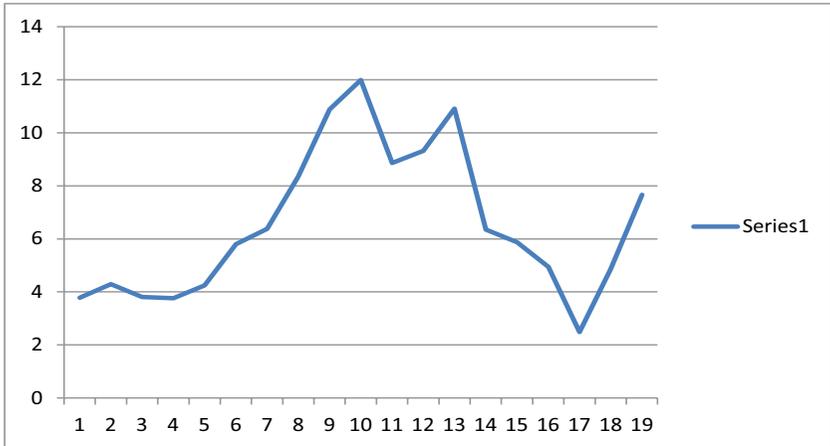
and higher rates of growth. To analyse whether inflation targeting has had these effects on inflation and gross domestic product per capita (GDPPC), we undertook a structural break test (Bai Perron test) on the series of consumer price index (CPI) and GDPPC for 28 advanced and developing countries. The results are shown in the table 1.

The results of the test show that adoption of inflation targeting by a country has not lead to a break in either the CPI series or the GDPPC in the year in which inflation targeting was adopted. Further, breaks in the CPI series for a few countries occur in the same year irrespective of whether the country has adopted inflation targeting or not. There were few breaks in GDPPC in the developed countries and few were related to either inflation targeting or to the breaks in inflation. For example, Canada, France and Germany witness a break in the CPI series in 2002 and 2011 even though Canada is an inflation targeting country whereas France and Germany are not. Thus, breaks in the CPI and GDPPC series are not influenced by whether a country has adopted inflation targeting or not.

Among the developing countries the breaks in growth of GDPPC were related either to the debt crisis of 1982, Brazil in 1981 and Mexico in 1982, or the Asian crisis, Korea in 1997, or to the substantial liberalisation in 1991, India in 1994. The only cases where a break in the CPI series may be related to adoption of inflation targeting are the break for South Africa in 2001 after adoption of targeting in 2000, in Philippines in 2000 after adoption of targeting in 2000. But it should be noted that a number of developing countries, Brazil, Colombia, India, Indonesia, and Sri Lanka, experienced a structural break in 2002 independently of adoption of targeting.

We now examine whether the adoption of inflation targeting in India in 2014 has affected the rate of annual inflation and the rate of growth of per capita GDP.

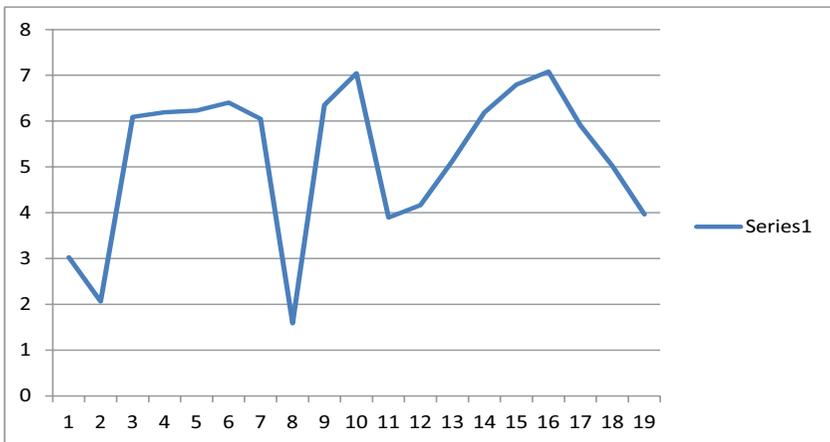
**Figure 1a: Rate of Annual Inflation, 2000-2019**



*Source:* World Bank World Development Indicators.

Clearly the rate of inflation has declined (Figure 1a). However, the decline started in 2010, despite a small increase in 2012 and 2013. Also the rate of growth of per capita increased between 2011 and 2017 (Figure 1b) while the rate of inflation was decreasing,

**Figure 1b: Rate of Annual Growth of Per capita GDP**



*Source:* World Bank World Development Indicators.

The correlation between the rate of inflation and the rate of growth is almost zero for the period 2001 to 2019 and for 2009 to 2019. However, one has to recognise that the period since adoption of inflation targeting in India is too short for serious statistical analysis. In brief, it is difficult to relate the adoption of inflation targeting to breaks in either the series for growth of per capita GDP or the inflation rate.

**Table 2: Structural Breaks in Inflation and Growth**

<b>Australia</b>	<b>1993</b>	<b>1979,1988,2001,2010</b>	
Canada	1991	1972,1981,1990,2002,2011	
France		1973,1982,1991,2002,2011	1975
Germany		1973,1982,1992,2002,2011	
Italy		1974,1983,1992,2001,2010	1990
Japan	2013	1974,1983,1992	1970,1992
New Zealand	1989	1978,1987,1996,2008	1998
Norway	2001	1972,1981,1990,2000,2010	
Switzerland		1973,1982,1991,2002	
Sweden	1993	1973,1982,1991,2007	
United Kingdom	1992	1972,1981,1990,1999,2010	
United States	2012	1972,1981,1990,1999,2008	
Brazil	1999	1995,2002,2008,2014	1981
Colombia	1999	1993,2002,2011	
India	2014	1991,2002,2011	1994
Indonesia	2005	1993,2002,2011	
S. Korea	2001	1980,1991,2000,2009	1997
Mexico	2001	1990,1999,2010	1982
Saudi Arabia		1976,1995,2010	1977
South Africa	2000	1990,2001,2011	
Malaysia		1974,1983,1993,2002,2011	
Philippines	2002	1984,1993,2002,2011	
Turkey	2006	2002,2011	
Uganda		2003,2008,2012,2016	1988
Tunisia		1991,1999,2008,2015	
Thailand	2000	1979,1989,1998,2008	
Tanzania		1995,2004,2012	1999
Sri Lanka		1992,2002,2011	1990

*Source:* Authors' calculations

## IV: Growth Accelerations in Developing Countries and Inflation

Policy makers and analysts in developing countries often argue that higher rates of inflation help in reallocation of factors which is otherwise hindered by sluggish markets. Hausmann et al. identify instances of rapid accelerations in sustained economic growth and find more than 80 such episodes across countries between the 1950s and 1990s. We use these growth episodes to look at the trends in indicators of macroeconomic stability before and during growth acceleration episodes to understand the underlying causes and effects of growth accelerations. In particular, was the period of growth acceleration related to a period of price stability and also whether the growth acceleration resulted in higher inflation. Growth and inflation might also affect the external account. We, therefore, study the trends in three indicators of macroeconomic stability: inflation, external balance and exchange rate to understand what are the correlates of growth at the start and during a growth transition and to see if these indicators differ significantly prior to and post the start of a growth acceleration.

We compare the average value of a variable around the start of a growth transition, i.e. years  $t-1$ ,  $t$  and  $t+1$  (where  $t$  is the year of the start of growth acceleration) and the average value of the variable for the prior seven years to see if there is any significant difference between the two groups. A statistically significant difference would imply that the start of a growth transition was accompanied by a change in these indicators of macroeconomic stability. The results are presented below.

**Table 3: Analysis of Macro indicators at Time of Indicators**

	<b>Group 0:[t-7,t-1], Group 1: [t-1, t+1]</b> <b>diff= mean(0)-mean(1)</b> <b><math>H_0</math> : diff =0</b>		
	<b><math>H_a</math> : diff &lt; 0</b>	<b><math>H_a</math> : diff = 0</b>	<b><math>H_a</math> : diff &gt; 0</b>
Inflation (GDP Deflator)	$\Pr(T < t) = 0.0755$	$\Pr( T  >  t ) = 0.1510$	$\Pr(T > t) = 0.9245$

*Table 3 continued...*

Table 3 continued...

External Balance (on goods and services as % of GDP)	$\Pr(T < t) = 0.4568$	$\Pr( T  >  t ) = 0.9136$	$\Pr(T > t) = 0.5432$
Exchange Rate (national currency per USD)	$\Pr(T < t) = 0.0568$	$\Pr( T  >  t ) = 0.1136$	$\Pr(T > t) = 0.9432$

**Source:** Authors' Calculations.

The results do not show any statistically significant difference in the indicators of macroeconomic stability at the start of a growth transition, namely there was no sharp difference.

Further, to understand the nature of the growth acceleration we compare the average values of the variables for the periods between the years  $t$  and  $t+7$  and  $t-4$  and  $t-1$ . The results are presented below.

**Table 4: Difference in Macro Indicators before and after Growth Acceleration**

	<b>Group 0: [t-4, t-1], Group 1: [t, t+7]</b> <b>diff = mean(0) - mean(1)</b> <b><math>H_0 : \text{diff} = 0</math></b>		
	<b><math>H_a : \text{diff} &lt; 0</math></b>	<b><math>H_a : \text{diff} \neq 0</math></b>	<b><math>H_a : \text{diff} &gt; 0</math></b>
Inflation (GDP Deflator)	$\Pr(T < t) = 0.9555$	$\Pr( T  >  t ) = 0.0890$	$\Pr(T > t) = 0.0445$
External Balance (on goods and services as % of GDP)	$\Pr(T < t) = 0.8380$	$\Pr( T  >  t ) = 0.3240$	$\Pr(T > t) = 0.1620$
Exchange Rate (national currency per USD)	$\Pr(T < t) = 0.0269$	$\Pr( T  >  t ) = 0.0538$	$\Pr(T > t) = 0.9731$

**Source:** Authors' Calculations.

The results show a significant difference in the behavior of the inflation and exchange rates. We find a significant decline in the inflation levels and a depreciation of the currency during the acceleration period compared to the years before the start of the growth acceleration. On the other hand, the external balance does not show any significant change during the period of growth acceleration. Since there was no change in inflation and the exchange rate during the transition period we infer that the change in these variables is gradual during the period of acceleration. The rate of inflation declines implying that there is no support for the hypothesis that growth acceleration requires factor movements that would be facilitated by higher inflation. The lower inflation occurs despite that the higher exchange rate (i.e. depreciation of the currency) that would lead to higher prices of traded goods. The decline in inflation post the start of the growth acceleration could possibly be attributed to an increase in productive capacity because of growth which in turn increases output and lowers prices.

On the other hand, prior to the start of the growth acceleration, the exchange rate was lower as compared to after. This implies that there was a depreciation of the exchange rate post the year in which the growth acceleration started. While this means that the start in growth acceleration may not have been caused by a depreciation of the currency, it is possible that the lower exchange rate before period  $t$  reflects inflow of capital which in turn may have had a positive impact on growth. A depreciation of the currency after the start of the period of growth acceleration could have played a role in sustaining the growth acceleration for a longer period of time. We get similar results when we repeat the exercise for different periods before and after the growth acceleration.

Periods of sustained and rapid economic growth were accompanied by a lower rate of inflation, a depreciation of the currency and no significant change in the current account. Higher levels of growth help in increasing productive capacity which leads to lower levels of inflation. At the same time, a depreciation of the currency might be expected to increase inflation by making imports more expensive. However, since

the current account balance has remained unchanged, it implies that exports have increased at the time of the growth acceleration. If exports did indeed increase during the period of growth acceleration, it could mean that the growth acceleration was fueled more by foreign demand as compared to domestic demand. The following table shows the trend in the export share of countries prior to and post the year (t) in which the growth acceleration started.

**Table 5: Behaviour of Exports at Time of Growth Acceleration**

	Group 0:[t-5,t-1], Group 1: [t+1, t+5] diff= mean(0)-mean(1) $H_0 : \text{diff} = 0$		
	$H_a : \text{diff} < 0$	$H_a : \text{diff} \neq 0$	$H_a : \text{diff} > 0$
Export share (Export as a percent of GDP)	$\Pr(T < t) = 0.0519$	$\Pr( T  >  t ) = 0.1037$	$\Pr(T > t) = 0.9481$

*Source:* authors' Calculations.

The results show that the share of exports increased significantly in the years in which the rapid and sustained growth acceleration was taking place as compared to the years prior to the start of the growth acceleration. This could be indicative of the fact that the growth accelerations were export led and not due to an increase in domestic demand.

While significant differences in macroeconomic indicators prior to and post a growth acceleration may not imply causality, it is interesting to note that accelerations in growth across countries is associated with changes in macroeconomic indicators especially inflation and exchange rate.

## V: Relation between Growth and Inflation

To further understand the relationship between inflation and economic growth, a panel vector auto regression (PVAR) analysis has been carried out for 24 advanced and developing economies<sup>13</sup> for the period 1971 to 2018.

A PVAR model for a series with two variables, T years and i units

can be written as:

$$Y_{i,t} = a_{1i0} + \sum_{l=1}^m a_{1i,l} Y_{i,t-l} + \sum_{l=1}^m b_{1i,l} X_{i,t-l} + f_i + u_{1i,t}$$

$$X_{i,t} = a_{2i0} + \sum_{l=1}^m a_{2i,l} X_{i,t-l} + \sum_{l=1}^m b_{2i,l} Y_{i,t-l} + f_i + u_{2i,t}$$

where  $a$  and  $b$  are the coefficients of linear projection of  $Y(X)$  on the past values of  $Y(X)$  and  $X(Y)$ ,  $m$  is the maximum number of lag terms of each variable,  $i$  denotes the country,  $f_i$  is used to control for country specific fixed effects and  $u$  denotes the error term which follows a white noise process.

The variables used in the analysis are growth rate of CPI as a measure of the inflation rate and the growth of GDP per capita as a measure of economic growth. The unit root tests for the variables as shown below indicate that the two variables are stationary.

**Table 6: Unit Root Tests**

Unit root tests		
Variable	Levin Lin Chu	ImPesaran Shin
GDPPC growth	-14.8382 (0.00)	-15.2219 (0.00)
Inflation rate	-5.8123 (0.00)	-4.9859 (0.00)

*Note:* The figures in brackets indicate p-values.

*Source:* Authors' Calculations.

A generalised method of moments (GMM) estimation is used to estimate the model and the first four lags of the endogenous variables are taken as instruments. Using the model and moment selection criteria (MMSC) for GMM models based on Hansen's J statistic of over identifying restrictions, a lag length of three was selected as this had the smallest MAIC value.

The results of the PVAR analysis are given below.

**Table 7: Results of VAR Analysis**

<b>Results of Panel VAR analysis (first four lags of the variables taken as instruments)</b>		
	<b>GDPPC</b>	<b>Inflation</b>
GDPPC lag1	0.24 (0.001)***	0.17 (0.028)*
GDPPC lag2	0.08 (0.134)	0.19 (0.026)*
GDPPC lag3	0.09 (0.181)	0.06 (0.503)
Inflation lag1	-0.04 (0.024)*	0.83 (0.000)***
Inflation lag2	0.02 (0.293)	-0.07 (0.568)
Inflation lag3	0.009(0.599)	0.17 (0.050)
Hansen's J chi2(4) = 3.3755449 (p = 0.497)		

*Note:* \* p<.05; \*\* p<.01; \*\*\* p<.001.

*Source:* Authors' Calculations.

**Table 8: Granger Causality Results**

<b>Panel VAR-Granger causality Wald test:</b>		
<b>Ho: Excluded variable does not Granger-cause Equation variable</b>		
<b>Ha: Excluded variable Granger-causes Equation variable</b>		
<b>ExcludedEquation</b>	<b>GDPPC</b>	<b>Inflation</b>
GDPPC	...	12.453(0.006)***
Inflation	5.511(0.138)	...
All	5.511(0.138)	12.453(0.006)***

*Source:* Authors' Calculations.

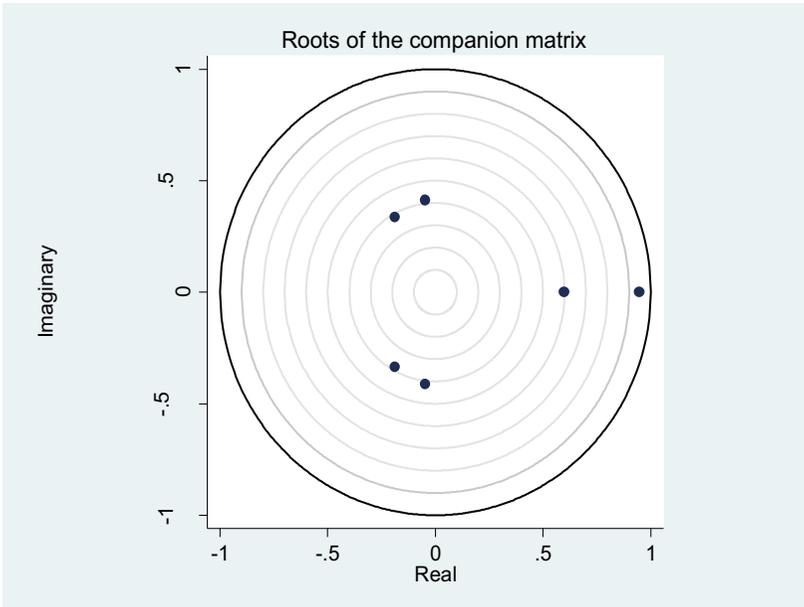
The results of the PVAR analysis show that growth rate of GDP per capita granger causes inflation while inflation does not granger cause GDP per capita. This means that the past values of GDP per capita help in predicting the current inflation rates whereas past values of inflation play no role in explaining the growth rate of GDP per capita. This clearly indicates a unilateral causal direction from GDP per capita growth to inflation. Therefore, one of the expectations of targeting that lower inflation would lead to higher growth is not borne by the analysis.

**Table 9: Eigenvalues**

Eigenvalue stability condition		
Eigenvalues		
Real	Imaginary	Modulus
.9458424	0	.9458424
.5976546	0	.5976546
-.0480975	-.4126871	.4154804
-.0480975	.4126871	.4154804
-.1881658	-.335927	.3850368
-.1881658	.335927	.3850368

*Source:* Authors' Calculations

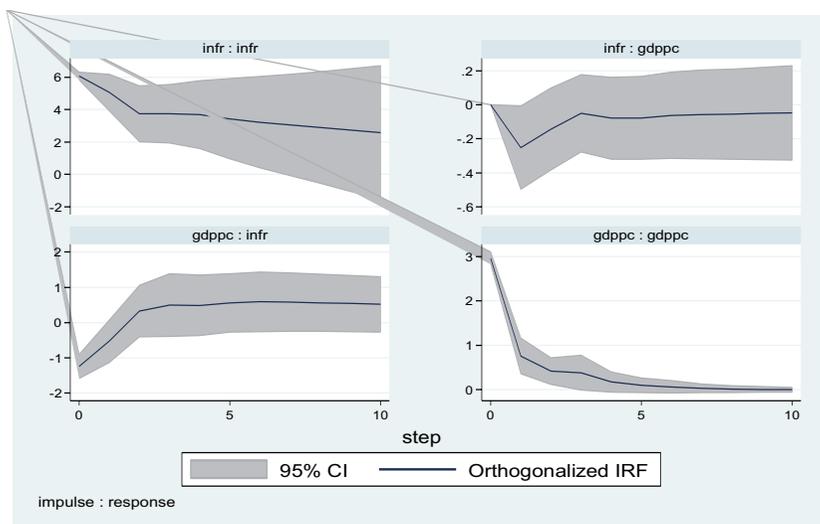
**Figure 2: Roots of the Matrix**



The stability condition of PVAR calculates the modulus of each eigenvalue of the estimated model and requires all moduli to be strictly less than one for the estimated model to be stable. Because the modulus

of each eigenvalue is strictly less than 1 and the eigenvalues lie inside the unit circle, the stability condition is satisfied (Figure 2).

**Figure 3: Impulse Response Functions**



The orthogonalised impulse response functions (IRF) based on Cholesky decomposition are now shown. The IRF confidence intervals are computed using 200 Monte Carlo draws based on the estimated model. The IRF plot shows that a positive shock to growth rate of GDP per capita leads to an increase in the rate of inflation in the near future, but not over the medium or long term (Figure 3). On the other hand the confidence interval for the response of GDP per capita to a shock in inflation includes zero which means that the change in inflation rates do not affect GDP per capita growth significantly in the short term or the long term.

**Table 10: Forecast Error Variance Decomposition**

<b>Forecast Error Variance Decomposition</b>		
<b>Response Variable and Forecast Horizon</b>	<b>Impulse Variable GDPPC</b>	<b>Impulse Variable Inflation</b>
GDPPC		
0	0	0
1	1	0
2	.9932708	.0067292
3	.9913077	.0086923
4	.9911781	.0088219
5	.9905846	.0094154
6	.9900001	.0099999
7	.9896271	.0103729
8	.9893006	.0106993
9	.9890029	.0109971
10	.9887456	.0112544
Inflation		
0	0	0
1	.0401944	.9598057
2	.0284522	.9715479
3	.0246872	.9753128
4	.0234955	.9765045
5	.0226634	.9773366
6	.022956	.977044
7	.0237276	.9762723
8	.0244676	.9755325
9	.025147	.9748531
10	.0257669	.9742331

*Source:* Authors' Calculations.

The forecast error variance decomposition (FEVD) of the residual covariance matrix of the estimated PVAR model is shown above. Based on Cholesky decomposition, the FEVD estimates show that around 3

percent of the variance in inflation can be explained by the growth rate of GDP per capita. On the other hand, inflation explains only 1 percent of the variation in the future GDP per capita growth. Thus, a panel VAR analysis to understand the relationship between rate of inflation and economic growth shows that growth rate of GDP per capita can cause an increase in the rate of inflation but the opposite relationship does not hold.

## **VI: Conclusions**

The upsurge of inflation in the 1970s along with lower rates of growth, namely stagflation, raised concerns that the high and variable rates of inflation would have adverse effects on investment and so growth. Also there were fears of political business cycles as authorities raised economic activity around election time to increase probability of winning the election and reducing economic activity later. Thus it was recommended that central banks be made autonomous and also be given the mandate of just managing the rate of inflation, have a target rate of inflation. Central banks have been increasingly adopting inflation targeting and the Indian central bank did so in 2014. Rates of inflation have fallen in the developed countries since their heyday in the 1970s. But we find that the decline in inflation predated the adoption of targeting and occurred in countries both those that adopted targeting and those that did not. We also did not find any breaks in the rate of inflation or the rate of growth of per capita GDP around the year of adoption of targeting. We next analysed high growth episodes in developing countries. We find that the transition to a period of higher growth was not accompanied by higher inflation or depreciation of the exchange rate or a worse current account balance. But we find that in the longer run the higher growth period is accompanied by lower inflation and a depreciated exchange rate. There seems no support for the hypothesis that higher growth in developing countries required higher inflation to encourage the factor shifts that necessarily accompany higher growth. A VAR analysis shows that rate of inflation does not Granger cause the rate of growth but the rate of growth does Granger cause inflation.

## Endnotes

- <sup>1</sup> (Bloomfield, 1959) reports that the Macmillan Committee set up after the Great Depression noted that no central bank would consider before the first world war that it should concern itself with the price level or that policy should be aimed towards maintaining it.
- <sup>2</sup> See Keynes (1971) for this distinction between debtor and creditor countries. Difference between debtor and corridor countries persists to this day.
- <sup>3</sup> For a discussion of the working of the GS in the periphery see Acerna, Reis and Rodriguez.(2000). Also see Bordo and Flandreau . 2001.
- <sup>4</sup> See Agarwal (2017) for a detailed discussion of the working of the pre FWW GS.
- <sup>5</sup> The trilemma is that a country cannot simultaneously have free capital movements, a fixed exchange rate and an independent monetary policy.
- <sup>6</sup> The fears of losses from a devaluation would outweigh the gains from a higher interest rate.
- <sup>7</sup> It was generally believed that Keynesians were prone to tolerate higher levels of inflation. But it should be remembered that Keynes was against inflation. He wrote in *The Economic Consequences of Peace*, p 235-288, There is no subtler, no surer means of overturning the existing basis of Society than to debauch the currency. The process engages all the hidden forces of economic law on the side of destruction, and does it in a manner which not one man in a million is able to diagnose.
- <sup>8</sup> The new classical macroeconomists showed that there was no trade even in the short run.
- <sup>9</sup> For instance it is believed that President Nixon persuaded the Fed president Burns to adopt a looser monetary policy so that the level of economic policy was higher (Abrams and Butkiewicz2012).
- <sup>10</sup> For detailed survey see Dubois, 2016.
- <sup>11</sup> This also increases the accountability of central banks as they would have to explain where they went wrong if they miss the target.
- <sup>12</sup> See Fair (1974) for a detailed discussion.
- <sup>13</sup> The countries included in the analysis are Australia, Canada, France, Germany, Italy, Japan, New Zealand, Norway, Switzerland, Sweden, United Kingdom, United States, Colombia, India, Indonesia, S.Korea, Mexico, Saudi Arabia, South Africa, Malaysia, Philippines, Turkey, Thailand and Sri Lanka

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