Have the Sacrifice Ratios Changed under Inflation Targeting? - An Empirical Investigation

by

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Abstract

Disinflation is a painful exercise: it reduces output and increases unemployment at least in the short run. This paper analyses the effects of adopting inflation targeting as a monetary policy framework in order to reduce inflation and maintain it at a low level, on this output or employment sacrifice. Using OECD data for several countries and several empirical methodologies, sacrifice ratios are measured. Several important results emerge: first, adopting of inflation targeting has not been an overnight shift but a gradual process; second, in industrial countries, inflation targeting has resulted in lower inflation as well as lower unemployment; however, the experience of some Eurozone economies as well as emerging market inflation targeters show that maintaining low and stable inflation could lead to adverse unemployment outcomes.

Keywords: Disinflation, Inflation targeting, Inflation-unemployment trade-off

JEL Classification: E24, E31, E52, E58,

1. Introduction

There is a broad consensus that the central focus of monetary policy should be the maintenance of low and stable inflation. This does not, however, mean that central banks need not consider any other economic objectives, a fact recognised by both modern theory and practice of monetary policy. The most accepted theoretical formulations of central bank objective functions and monetary policy reaction functions feature the stabilization of prices/inflation and at least one other (usually output or employment related) economic variable. On the other hand, in practice, even the most respected inflation targeting regimes make an allowance for the policy maker to consider the effects of his/her decisions on other economic variables.

The objective of this paper is to discuss the trade-off arising from pursing multiple objectives in central banking and the costs associated with disinflation arising from this trade-off. To these ends, I start by briefly discussing the historical findings about the trade-off between prices and output/employment, and show that this trade-off is still valid in monetary policy debates. I then discuss the literature on costs of disinflation and sacrifice ratios. Finally, I embark on an empirical analysis to measure the output/employment sacrifice made by central banks in reducing inflation in general and adopting and maintaining an inflation target in particular, and to identify whether the adoption of inflation targeting by central banks has had any impact on this trade-off.

2. The Inflation-unemployment Trade-off

The trade-off between inflation and real variables such as output and employment is a long-discussed topic in monetary economics. According the Mankiw (2000), "[t]he inflation-unemployment trade-off is, at its

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heart, a statement about the effects of monetary policy. It is the claim that changes in monetary policy push these two variables in opposite directions" (p.2). Most influential early work on this trade-off, later to be known as the Phillips curve relationship, was carried out by Phillips (1958), Lipsey (1960), and Samuelson and Solow (1960), who displayed the existence of a trade-off between inflation and unemployment for the UK and the USA. This was followed by the contributions of Friedman (1968) and Phelps (1968) who showed that this trade-off is a short-run relationship which occurs when actual inflation deviates from expected inflation, while in the long run, when actual inflation equals expected inflation, this relationship is vertical at the natural rate of unemployment. As summarised by Taylor (1998), today "there is substantial theoretical support and empirical evidence demonstrating that there is no long-run trade-off between the level of inflation and the level of unused resources in the economy – whether measured by the unemployment rate, the capacity utilization rate, or the deviation of real GDP from potential GDP. Monetary policy is thus neutral in the long run: An increase in money growth will have no long-run impact on the unemployment rate; it will only result in an increase in the inflation rate. The average level of unemployment – or the natural rate – is not a constant, however; it can be affected by government policies, but these are microeconomic rather than monetary in nature" and that "there is also substantial theoretical support and empirical evidence of short-run monetary non-neutrality" (pp.29-30).

The above confirms that although it is a very much accepted fact that a central bank should primarily focus on maintaining price stability, theoretically as well as in practice it is also accepted that a central bank should consider the effects of its policy on other economic variables at least in the short-run.

2.1. The Inflation-Unemployment Trade-off in Theory of Monetary Policy

In theorising monetary policy, a model requires a central bank objective function or a loss function. A modern-day objective/loss function of a central bank involves objectives such as output/unemployment stabilisation in addition to price stability. Walsh (2003) confirms this: "[i]t is standard to assume that the central bank's objective function involves output (or employment) and inflation" (p.366). An example of a standard central bank objective function involving inflation and unemployment can be written down as follows:

$$\max . f(\pi, u) = -\frac{1}{2}\pi^2 - \lambda(u - u_n) \qquad (1)$$

where the objective of the central bank is to maximised the expected value of the function given by equation 1, where π is inflation, u is unemployment, u_n is the natural rate of unemployment, and λ is the policy weight given to deviations of unemployment from its natural rate. As a central bank loss function, this can be equivalently written as

$$\min. \ f(\pi, u) = \frac{1}{2}\pi^2 + \lambda(u - u_n) \qquad (2)$$

where the central bank attempts to minimise the loss arising from deviations from inflation and employment objectives. Another common example of a loss function is

$$\min. \ f(\pi, u) = \frac{1}{2}\pi^2 + \frac{\lambda}{2}(u - u_n + c)^2 \qquad (3)$$

where both the inflation objective as well as the unemployment objective enters the central bank loss function quadratically (i.e., higher the deviation of the objective from its natural rate or the target, the higher is the loss). In this specific example where c is a positive constant, in addition to the inflation objective, the central bank also aims to push unemployment below the natural rate of unemployment by an amount of c.

Some researchers also include interest rate stabilisation and exchange rate stabilisation in central bank objective/loss functions, but some argue that these are instruments or intermediate targets, and therefore, should not be included as an end objective of a central bank (see, for instance, Cecchetti and Ehrmann (1999)). Also, Cecchetti, Flores-Lagunes and Krause (2006), who use a standard loss function as above, state that their assumption that "the fundamental concern of a central bank is domestic macroeconomic performance as measured by output and price stability" (p.419) does not warrant the inclusion of the interest rate or the exchange rate in the loss function.

Svensson (1997), who discusses theorising inflation targeting also utilise a quadratic loss function in the form of

$$\mathcal{L}(\pi_t, \ell_t; \pi^b, \ell^b, \lambda^b) = \frac{1}{2}[(\pi_t - \pi^b)^2 + \lambda(\ell_t - \ell^b)^2] \quad (4)$$

and defines an inflation targeting regime as "with an assigned loss function $\mathcal{L}(\pi_t, \ell_t; \pi^b, \ell^b, \lambda^b)$ with the three parameters: π^b , an explicit announced inflation target; ℓ^b , an implicit but known employment target; and $\lambda^b > 0$, an implicit but known relative weight on employment stabilization" (p.99).

Again, in theory, when modelling central bank reaction functions, one includes central bank reaction to inflation as well as to real variables such as output or unemployment. The most popular example of this type of reaction functions is the Taylor rule, which takes the following form:

$$i_t = i^* + \pi^* + \phi_y y_t + \phi_\pi(\pi_t - \pi^*) \quad (5)$$

where the central bank reacts to deviations of inflation from its target and output gap by changing its policy instrument, the interest rate (i_t). Here i^* is the equilibrium interest rate, π^* is the inflation target, y_t is the output gap, ϕ_y is the policy weight given to output gap stabilisation and ϕ_π is the policy weight given to inflation stabilisation.[1]

2.2. The Inflation-Unemployment Trade-off in Practical Monetary Policymaking

In practice, even the stringent inflation targeting regimes have provisions for flexibility, which are usually incorporated in order to avoid excessive adverse pressure on other macroeconomic variables. Svensson (1997) argues that "[t]he interpretation of inflation-targeting regimes as having a loss function involving both inflation and unemployment targets is supported by several circumstances" (p.100). This is confirmed by Leiderman and Svensson (1995), and Bernanke and Mishkin (1997), among others. According to Bernanke and Mishkin (1997), "[d]espite the language referring to inflation control as the primary objective of monetary policy, […] inflation-targeting central banks always make room for short-run stabilization objectives, particularly with respect to output and exchange rates" (p.101). These authors show several features of inflation targeting regimes to support their argument:

1. According to Svensson (1997), most inflation targeting regimes specify tolerance bands around the inflation target "indicating that some variability of inflation around the target is acceptable" (p.100). This is interpreted as a provision for short-run flexibility in monetary policy decisions. For instance, Bernanke and Mishkin (1997) show that "the use of ranges generally reflect not only uncertainty about the link between policy levers and inflation outcomes but is also intended to allow the central bank some flexibility in the short run" (p.101).
2. Svensson (1997) shows that "[n]o central bank with an explicit inflation target seems to behave as if it wishes to achieve the target at all cost, regardless of the employment consequences.[…] A prominent central banker, Mervyn King (1995), has interpreted inflation-targeting regimes precisely in this way. Thus, an inflation-targeting regime is not interpreted as corresponding to $\lambda = 0$, what King (1995) calls the case of an "inflation nutter"(p.100).
3. Bernanke and Mishkin (1997) also argue that "the price index on which the official inflation targets are based is often defined to exclude or down-weight the effects of "supply shocks;" for example, the officially targeted price index may exclude some combination of food and energy prices, indirect tax changes, terms-of-trade shocks, and the direct effects of interest rate changes on the index" (p.101).
4. According to Bernanke and Mishkin (1997), "short-term inflation targets can and have been

1/ For simplicity, discussions of the importance of expectations and forward or lagged variables, as well as modern-day Phillips curves are avoided.

adjusted to accommodate supply shocks or other exogenous changes in the inflation rate outside the central banks control" (p.101).

5. Bernanke and Mishkin also show that inflation targeting regimes comprise explicit "escape clauses" permitting the government or the central bank to suspend or modify the inflation target "in the face of certain adverse economic developments" (p.101). However, as Svensson (1997) shows "[a]n inflation-targeting regime need not have explicit escape clauses for supply shocks in order to incorporate some preference for employment stabilization (p.100).

The above discussion displays that inflation-output/unemployment trade-off is still an important element in theoretical debates as well as practical aspects of monetary policy and central banking. As Solow (1998) states "monetary policy could afford to go in for a trial-and-error approach to finding a fair balance between the dangers of inflation and the benefits of high output and employment" (pp.4-5). However, as long as the prime objective of a central bank remains the maintenance of price stability, a central bank would want to maintain inflation at a desired low level. In most occasions, central banks have faced the challenge of reducing inflation to that desired low level prior to embarking on the task of maintaining price/inflation stability. The need to reduce inflation, coupled with the existence of a trade-off between inflation and output/ unemployment give rise to the concept "cost of disinflation".

3. Costs of Disinflation and Sacrifice Ratios

According to Mayes and Chapple (1994), "[o]ne of the major concerns of monetary policy is that the cost of bringing inflation down may be high in terms of unemployment and in output foregone. It is obvious why governments wish to reduce inflation in the first place, because inflation itself tends to contribute to a lower rate of economic growth and increase social inequality" (p.9).

The literature on the costs of disinflation is mainly three-fold. First, there is a debate as to whether disinflation should be a gradual process or a quicker change. As Cecchetti and Rich (2001) show "[s]ome discussions, including those of Okun (1978), Gorden and King (1982), Taylor (1983), Sargent (1983), Andersen (1992), and Ball (1994), have focused on the speed of disinflation and whether the monetary authority should adopt a gradualist approach or subject the economy to a "cold turkey" remedy" (p.417). Researchers who favour gradualism with regard to disinflation include Taylor (1983), while Sargent (1983) and Ball (1993) argue that gradualism makes disinflation more expensive.

Second, some researchers attempt to identify factors that help to reduce the cost of disinflation. Cecchetti and Rich (2001) show that Ball, Mankiw, and Romer (1988) analyse the implications of the level of inflation, Grubb, Jackman, and Layard (1983) study the degree of nominal wage rigidity, and Jordan (1999) analyse the extent of central bank independence, as cost-reducing strategies of disinflationary policies. Walsh (2003) observes that "credible policy to reduce inflation should succeed in actually reducing inflation without causing a recession. This implication contrasts sharply with the view that any policy designed to reduce inflation would succeed only by inducing an economic slowdown and temporarily higher unemployment and provides an example from Sargent (1986) who examines the ends of several post World War I hyperinflations in Austria, Germany, Hungary, and Poland and concludes that ""While unemployment did rise during the price stabilization, Sargent concluded that the output cost "was minor compared with the $220 billion GNP that some current analysts estimate would be lost in the United States per one percentage point inflation reduction" (Sargent 1986, p.55)" (p.39).

The third type of related literature focuses on measuring the cost of disinflation. There are several methods of estimating the costs of disinflation, which is commonly known as the "sacrifice ratios". The standard definition for sacrifice ratio is from Okun (1978), which is "[f]or an extra percentage point of unemployment maintained for a year, the estimated reduction in the ultimate inflation rate at equilibrium unemployment ranges between one-sixth and one-half of 1 percentage point, with and average estimate of 0.3" (p.348). According to Andersen and Wascher (1999), Okun's definition implies three features of the sacrifice ratio: "(i) the costs of disinflation refer to a permanent reduction of inflation and not just a temporary one; (ii) the costs are calculated as the cumulative losses during the period of disinflation; and (iii) the losses are usually calculated for a one point reduction in the rate of inflation and can be expressed in terms of either output or

unemployment, with the coefficient from the Okun equation (see Okun (1962)) bridging the two" (p.2). Other definitions include Cecchetti and Rich (2001) ("The sacrifice ratio is the cumulative loss in output, measured as a percent of one year's gross domestic product (GDP), resulting from a one percentage-point permanent reduction in inflation" (p.416)), and Cukierman (2002) ("The sacrifice ratio is the cumulative increase in the yearly rate of unemployment that is due to the disinflation effort divided by the total decrease in the rate of inflation" (p.1)).

Ball (1993) argues that although deriving the [sacrifice] ratio from an estimated Phillips curve as suggested by Okun (1978), or Gordon and King (1982) is common, "[a] limitation of this approach is that it constrains the output-inflation trade-off to be the same during disinflations as during increases in trend inflation or temporary fluctuations in demand" (p.3). The approach of calculating sacrifice ratios as suggested by Anderson (1992), Ball (1993, 1994), and Anderson and Wascher (1999) is to calculate sacrifice ratios from actual developments in inflation, output, and unemployment during individual episodes of disinflation. As Hutchison and Walsh (1998) show, this approach "depends upon assumption about what constitutes a disinflation 'episode' and how to determine equilibrium output levels. Also, it focuses entirely on disinflationary periods rather than on both disinflation and inflation episodes. Equally important, no control is made for other policies or shocks to supply which may simultaneously affect the state of the business cycle and the rate of inflation" (p.711). Also as Mayes and Chapple (1994) show, "the computation of these ratios is no trivial matter. Inflation may fall over a period when output also falls (or at least output growth slows) but it is not clear how much of that change, if any, is due to the policy measures employed to achieve it. They may have been ineffective or even counter-productive and the principal cause of the disinflation may lie elsewhere" (p.12). Cukierman (2002) also concur: "Ideally, one would have liked to obtain a "net" measure of the additional unemployment that is due only to the monetary disinflation policy and to relate it to the additional reduction in inflation because of that policy. Existing measures of sacrifice ratios lump these two components together providing "gross" rather than (more relevant) "net" measures of sacrifice ratios" (p.18).

Other methods of computing the sacrifice ratio also exist. Cecchetti and Rich (1999) and King and Watson (1994) estimate sacrifice rations using structural VAR models, but they find that the ratios obtained are highly sensitive to the size of the model and the identification restrictions used.

Apart from the traditional approach of measuring cost of disinflation in terms of output or employment, several articles starting from Taylor (1979), highlight a trade-off between the variability of inflation and the variability of output. Using this approach, Taylor (1979) shows that "[a]lthough there is no long run trade-off between the level of inflation and the level of output, there does exist a second order Phillips curve trade-off between fluctuations in output and fluctuations in inflation which is not vertical in the long run. This trade-off was estimated for the U.S. economy over the 1953-1975 period and is downward sloping: over the relevant range of this curve business cycle fluctuations can be reduced only by increasing the variability of inflation" (p.1284). As Fuhrer (1997), Cecchetti, Flores-Lagunes and Krause ((2006), among others, show that when the central bank loss function is written similar to equation (4) above, the objective of the central bank is to minimize the deviations from target inflation and target output or employment. Taylor (1998) further describes this trade-off presents yet another choice to policymakers. If the economy is already on the efficiency frontier, "they must choose a policy rule that takes a position on the importance of one measure of stability versus the other" (p.41).

4. Inflation Targeting and Cost of Disinflation

The concepts of the cost of disinflation and sacrifice ratios are particularly important to the current monetary policy debates because several countries have adopted inflation targeting as a viable monetary policy framework to reduce inflation and maintain inflation at a low level, but its impact on output and employment has not been fully tested. As Clifton, Leon, and Wong (2001) note, "the widespread adoption of Inflation targeting (IT) has been partly due to the perception that the IT countries have been successful at reducing inflation with a relatively lower cost of foregone output compared to non-IT countries" (p.3). The existing literature on inflation targeting and the cost of disinflation have still not reached a consensus with this regard. The studies that show that inflation targeting has reduced the cost of disinflation include, Clifton, Leon, and Wong (2001) who investigate seven OECD inflation targeters and nine OECD countries that have not adopted

inflation targeting and conclude that "the adoption of inflation targeting may indeed help to improve the unemployment-inflation trade-off, there is nothing to suggest that inflation targeting is unique in this regard" (p.6), Corbo, Monero and Schmidt-Hebbel (2000) who study 9 inflation targeting countries and 16 other countries and conclude that inflation targeting may have lowered the output costs of inflation stabilization, and Andersen and Wascher (1999) who study 19 industrial countries and observe that in countries that had adopted inflation targeting have smaller sacrifice ratios.

In contrast, studies including Bernanke, Laubach, Mishkin, and Posen (1999), do not find that inflation targeting had a significant impact on the output-inflation trade-off, while Ball and Sheridan (2003), who also compare economic performance in 7 OECD inflation targeters and 13 non targeters find no evidence that inflation targeting improves a country's economic performance with regard to the inflation-output trade-off, which they argue, is possibly because both sets of countries they analyse pursued similar interest rate policies. Lundborg and Sacklen (2006) who use Swedish data show that "heavy anti-inflationary policies might have caused unemployment to persist at high levels" and in the case of Sweden "[r]aising the Swedish inflation target from 2 to 4 percent would bring long-run unemployment down by several percentage points" (p.413).

As shown by Clifton, Leon, and Wong (2001), for developing countries and emerging market countries, the findings may not be similar to those for OECD countries: "An unanswered question is whether inflation targeting would be a successful strategy for countries starting with inflation significantly above OECD levels, even if it is correct that inflation targeting improved the unemployment-inflation trade-off in a group of OECD countries that already had relatively low inflation by emerging market standards. As explored by Khan and Senhadji (2000), the relationship between growth and inflation may be substantially different in developing and industrial countries, i.e., negative effects of inflation on growth may set in at a substantially higher inflation threshold in developing countries" (p.19). Gonçalves and Salles (2008), who use data for 36 developing economies, 13 of which have implemented the inflation targeting framework find that "the choice of the IT regime proved beneficial for emerging economies. In particular, we find that: (i) the greater fall in inflation experienced by emerging market targeters can, to some extent, be attributed to the regime itself and not only to mean reversion; (ii) those choosing to inflation target saw a greater reduction in growth volatility than those opting for alternative monetary policy arrangements (lending some credence to the often asserted "flexibility to cope with shocks" characteristic of the regime). Moreover, the often heard claim that inflation targeting regimes hinder economic growth is clearly not sustained by the empirical evidence. In sum, the data so far suggests that the adoption of IT by emerging economies did contribute towards the attainment of superior outcomes in terms of economic performance" (pp.317-8).

Any favourable change in the inflation-unemployment trade-off under inflation-targeting is said to arise from the credibility of monetary policy generally associated with inflation targeting. Clifton, Leon, and Wong (2001) show that "[s]trengthening the credibility of monetary policy is generally seen in the literature as a development that should improve the unemployment-inflation trade-off since a given change in inflation would be associated with a smaller change in unemployment" and summarise Clarida, Gali, and Gertler's (1999) argument that "if price-setting behavior depends on forward-looking expectations, then a central bank that can credibly commit to an inflation-fighting rule faces an improved short run trade-off between inflation and unemployment. They note that inflation targeting can be viewed as a transparent way for a central bank to put relatively greater weight on fighting inflation in their policy loss function. The simple explanation for this result is that a central bank that agents believe will be an inflation hawk in the future and will not have to contract output by as much today to achieve a given disinflation" (p.4). However, as Clifton, Leon, and Wong (2001) show, the relationship between credibility of monetary policy and the inflation-unemployment trade-off are far from clear due to other complications. Other studies that argue that monetary policy credibility can reduce the inflation-unemployment trade-off include Corbo, Moreno, and Schmidt-Hebbel (2000), Cecchetti and Kim (2003), and Cecchetti, Flores-Lagunes, and Krause (2006).

Having reviewed some recent literature on the existence of the inflation-output/unemployment trade-off, costs associated with disinflation and estimating sacrifice ratios, and the relationship between inflation targeting and the inflation-output/unemployment trade-off, an empirical investigation will be conducted using several developed and emerging market countries to identify any regularities with regard to disinflation under inflation targeting and its impact on unemployment. The choice of countries in the sample is purely based on consistent and historical data availability.

5. Empirical Evidence

The empirical analysis utilizes four sub-samples of countries as shown in Table 1. The first two sub-samples represent countries that have explicitly adopted inflation targeting as the monetary policy framework, while the latter two sub-samples consist of comparator countries. The data are obtained from OECD Key Economic Indicators and generally cover the period from 1980Q1 to 2007Q1. Where there are gaps in data series, data from IMF International Financial Statistics are used. Also, quarterly data are not always readily available. In such instances, annual data series are interpolated using the Goldstein and Khan (1976) method to obtain required quarterly data.

Table 1: Sub-samples used in the Analysis

Sub-sample 1	Sub-sample 2	Sub-sample 3	Sub-sample 4
Inflation Targeters – Industrial Countries	**Inflation Targeters – Emerging Market Countries**	**EURO Zone**	**Other Non- Inflation Targeting Countries**
Australia	Brazil	Austria	Denmark
Canada	Czech Republic	Belgium	Japan
Finland	Hungary	Finland	Russia
Iceland	Republic of Korea	France	Switzerland
Norway	Mexico	Germany	USA
New Zealand	Poland	Greece	
Spain	Slovak Republic	Ireland	
Sweden	Turkey	Italy	
UK		Luxembourg	
		The Netherlands	
		Portugal	
		Spain	

Note: Finland and Spain are considered inflation targeters only up to 1998Q4.

5.1. Sub-Sample 1: Inflation Targeters – Industrial countries

5.1.1. Measuring the trade-off

a. Correlation between Inflation and Unemployment

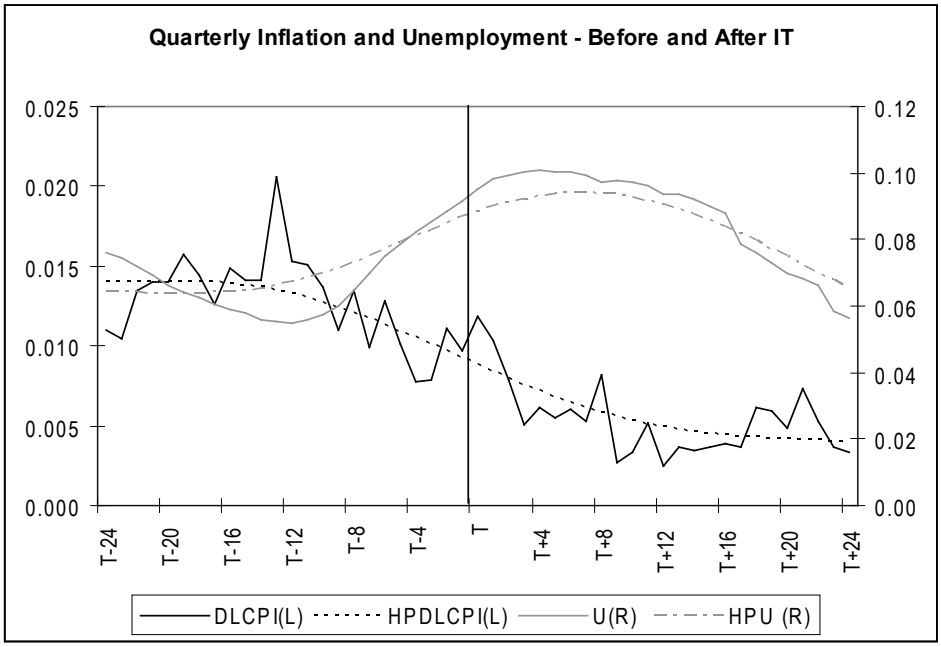
Table 2 provides the coefficients of correlation between inflation and unemployment before and after adopting inflation targeting in countries in sub-sample 1 (i.e., Australia, Canada, Finland, Iceland, Norway, New Zealand, Spain, Sweden, UK). All countries in the sub-sample display a trade-off between inflation and unemployment as shown by negative coefficients of correlation averaging about 0.47. The correlation weakens following the adoption of inflation targeting indicating a possible lessening of the trade-off between inflation and unemployment. In Spain and the UK, the coefficient of correlation become positive following the adoption of inflation targeting, signaling that there is no trade-off between inflation and unemployment. The exception is Australia where the coefficient of correlation remains almost unchanged during the two sub-periods.

Table 2: Coefficients of Correlation : Inflation and Unemployment

Country	Before IT	After IT
Australia	-0.1578	-0.1857
Canada	-0.3300	-0.1224
Finland	-0.3253	-0.1466
Iceland	-0.6029	-0.5455
Norway	-0.6905	-0.0295
New Zealand	-0.5639	-0.2692
Spain	-0.5724	0.6508
Sweden	-0.3803	-0.0979
UK	-0.6017	0.3789
Average	-0.4694	-0.0408

Aggregated inflation and unemployment for the countries in this sub-sample 24 quarters before and after adopting inflation targeting are shown in Figure 1. The methodology used in the aggregation is Similar to Clifton, Leon, and Wong (2001), where T is the quarter in which the country adopted inflation targeting. The two trend series, of inflation (HPDLCPI) and of unemployment (HPU) are obtained using the Hodrick-Prescott filter with a smoothing parameter $\lambda = 1{,}600$.

Figure 1: Aggregated Data – Sub-sample 1



Notes:

1. *DLCPI* (Left axis) is the average inflation for the 9 countries in the sub-sample.

2. *U* (Right axis) is the average unemployment for the same 9 countries.

3. Since Finland and Spain joined EU in 1999Q1, the data for these countries are used only up to 1998Q4; i.e., Finland up to T+22 and Spain up to T+16.

The trade-off between inflation and unemployment is clearly visible during the 24-quarter period prior to adopting inflation targeting by the countries in sub-sample 1. The trade-off continues during the first 8 quarters following the introduction of inflation targeting, before it lessens afterwards with unemployment declining while inflation remaining relatively unchanged.

b. Structural Breaks in Inflation and Unemployment following Inflation Targeting

Table 3 investigates whether average inflation and unemployment have changed during the two sub-periods. In all countries in the sub-sample, mean inflation has declined by around 1.5 percentage points (and around 73 per cent) on average for period following the introduction of inflation targeting. However, with regard to unemployment, the experiences vary; adopting inflation targeting is associated with reduced mean unemployment only in Australia, Canada, Iceland and the UK; in Finland, New Zealand, Spain and Sweden, average unemployment has increased significantly after the introduction of inflation targeting. However, on average, while there is a 73 per cent decline in inflation, there has only been a 20 per cent rise in unemployment.

Table 3: Inflation and Unemployment Rate

Mean

Country	Inflation (Per cent)			Unemployment (Per cent)		
	Before IT	After IT	% Change	Before IT	After IT	% Change
Australia	1.69	0.64	-62.13	7.86	7.03	-10.56
Canada	1.50	0.50	-66.67	9.29	8.52	-8.29
Finland	1.52	0.25	-83.55	5.98	14.46	141.81
Iceland	4.18	1.14	-72.73	2.85	2.24	-21.40
Norway	1.25	0.40	-68.00	3.98	4.03	1.26
New Zealand	2.70	0.54	-80.00	4.26	6.53	53.29
Spain	2.02	0.70	-65.35	14.94	17.11	14.52
Sweden	1.82	0.35	-80.77	2.81	7.36	161.92
UK	1.56	0.45	-71.15	9.21	6.46	-29.86
Average	2.03	0.55	-72.91	6.80	8.19	20.44

A further look at Table 3 shows that countries where the adoption of inflation targeting has resulted in a greater decline in inflation (a higher disinflation under inflation targeting) are the ones that have suffered from a higher increase in unemployment (Finland, Sweden, and New Zealand). This finding supports the arguments that the short-run Phillips curve could be very flat near zero inflation, and lowering inflation is increasingly costly when inflation gets closer to zero. See Stevens and Debelle (1995), Akerlof, Dickens and Perry (2000) and Lundborg and Sacklen (2006).

A series of univariate autoregressive functions are used to test whether there are statistically significant trend breaks at the time of introducing inflation targeting in the 9 countries in the sub-sample 1. Chow Breakpoint tests (with the null hypothesis of no structural break in the quarter given) are carried out to identify possible trend breaks. A summary of findings for inflation processes are given in Table 4.

Table 4: Chow Breakpoint Tests for Inflation Processes

Country	Regression				Chow Breakpoint Test		
	Sample	Lag Length	Constant	Adj. R squared	IT introduced in	F-Statistic [Prob.]	Log Likelihood Ratio [Prob.]
Australia	1980Q4-2007Q1	3	No	0.4882	1993Q2	0.4650 [0.7073]	1.4686 [0.6895]
Canada	1980Q4-2007Q1	3	Yes	0.5958	1991Q1	**6.4824 [0.0005]**	**18.8366 [0.0003]**
Finland	1980Q3-1998Q4	2	No	0.7761	1993Q2	2.3403 [0.1038]	4.7897 [0.0912]
Iceland	1980Q2-2007Q1	1	No	0.8100	2001Q1	0.2398 [0.6254]	0.2440 [0.6213]
Norway	1980Q4-2007Q1	3	No	0.5916	2001Q1	**3.3156 [0.0230]**	**10.0518 [0.0181]**
New Zealand	1980Q3-2007Q1	2	Yes	0.5918	1990Q1	**3.6609 [0.0149]**	**11.0450 [0.0115]**
Spain	1980Q4-1998Q4	3	No	0.7832	1994Q4	0.7001 [0.5553]	2.2533 [0.5215]
Sweden	1980Q4-2007Q1	3	No	0.6323	1993Q1	0.6377 [0.5924]	2.0088 [0.5706]
UK	1980Q3-2007Q1	2	No	0.6521	1992Q4	0.2960 [0.7444]	0.6133 [0.7359]

Results of the Chow Breakpoint tests in Table 4 display that the introduction of inflation targeting marks a trend break in the inflation processes only in Canada, Finland, Norway, and New Zealand. Chow Breakpoint test statistics fail to reject the null hypothesis of no structural break for the other countries.

Table 5: Chow Breakpoint Tests for Unemployment Processes

Country	Regression				Chow Breakpoint Test		
	Sample	Lag Length	Constant	Adj. R squared	IT introduced in	F-Statistic [Prob.]	Log Likelihood Ratio[Prob.]
Australia	1980Q2-2007Q1	2	Yes	0.9744	1993Q2	**2.2724 [0.0846]**	**6.9872 [0.0723]**
Canada	1980Q2-2007Q1	2	Yes	0.9665	1991Q1	**3.0024 [0.0340]**	**9.1394 [0.0275]**
Finland	1980Q2-1998Q4	2	Yes	0.9940	1993Q2	2.1119 [0.1066]	**6.5884 [0.0862]**
Iceland	1988Q3-2007Q1	2	Yes	0.9689	2001Q1	0.4602 [0.7109]	1.4860 [0.6855]
Norway	1980Q2-2007Q1	2	Yes	0.9596	2001Q1	0.8458 [0.4719]	2.6539 [0.4481]
New Zealand	1980Q2-2007Q1	2	Yes	0.9769	1990Q1	0.5195 [0.6698]	1.6377 [0.6509]
Spain	1980Q3-1998Q4	3	Yes	0.9912	1994Q4	0.5412 [0.7060]	2.3884 [0.6647]
Sweden	1980Q2-2007Q1	2	Yes	0.9922	1993Q1	1.0979 [0.3536]	3.4322 [0.3297]
UK	1980Q2-2007Q1	2	Yes	0.9943	1992Q4	**6.8174 [0.0003]**	**19.7369 [0.0002]**

Similarly, Table 5 shows the results of Chow Breakpoint tests for unemployment processes. Introduction of inflation targeting marks trend breaks in unemployment only in Australia, Canada, Finland, and the UK.

The absence of clear trend breaks at the time of the introduction of inflation targeting suggests that most countries have accepted "gradualism" as opposed to the "cold turkey" approach when introducing inflation targeting.

c. Costs of Disinflation

The above results confirm that the introduction of inflation targeting has not occurred overnight but possibly follows a relatively lengthy process. Therefore, the costs and benefits of Inflation targeting, in particular with regard to unemployment (or output), must also be measured using methods that cover a wider time period rather than measuring the instantaneous effects.

One way of analyzing the costs of disinflation is observing the changes to the inflation-unemployment trade-off as measured by slope of the Phillips curve relationship. Inflation-unemployment scatter plots for aggregated data as well as for individual countries indicate that the slope of the inflation-output trade-off has indeed lessened for the second sub-period, confirming a flattening of the Phillips curve.

It is noteworthy that the flattening of the Phillips curve over 1990s has been a general tendency across countries, and a cross-section analysis is required to compare possible differences between Inflation targeting and non-Inflation targeting countries. Bean (2006) attributes the flattening of the Phillips curve in the 1990s to increased specialization, the intensification of product market competition, and the impact of that intensified competition and migration on the behaviour of wages. Roberts (2006), Mishkin (2007), and Razin and Binyamini (2007) also produce similar findings. Cecchetti, Flores-Lagunes and Krause (2006) attribute this improved trade-off to private and public institutional changes as well as more efficient policymaking by central banks.

For each country in this sample, inflation and unemployment are plotted against each other and it is observed that for all countries, the inflation-output trade-off has lessened following the introduction of Inflation targeting. For Spain and the UK, the trade-off seems to have disappeared with inflation and unemployment having a positive relationship. Table 6 summarizes the findings from these Inflation-Unemployment scatter plots. A Before/After ratio is computed for the slope, which displays that flattening of the Phillips curve relationship could be as much as 12 fold with the introduction of Inflation targeting. On average (disregarding Spain and the UK), this improvement is computed to be 5.76 fold.

Table 6: Slope of Linear Regression Line of the Inflation-Unemployment Scatter Plot

Country	Before IT	After IT	Before/After Ratio
Australia	-0.3213	-0.0674	4.7671
Canada	-0.1406	-0.0354	3.9718
Finland	-0.1008	-0.0208	4.8461
Iceland	-0.7722	-0.5278	1.4631
Norway	-0.3856	-0.0393	9.8117
New Zealand	-0.5970	-0.0539	11.0761
Spain	-0.1858	*0.1807*	-
Sweden	-0.3291	*-0.0273*	12.0550
UK	-0.3064	*0.0455*	-
Average	-0.3488	-0.0606	5.7558

The methodology that is adapted in the current study when measuring the possible costs of disinflation associated with the introduction of Inflation targeting primarily follows Anderson (1992), Ball (1993, 1994), and Anderson and Wascher (1999) who calculate sacrifice ratios from actual developments in inflation, output, and unemployment during individual episodes of disinflation. Ball (1993, 1994) uses the peak inflation as the starting point for disinflation. However, since our interest is in the costs and benefits of Inflation targeting, *changes* in unemployment (cost) and *changes* in inflation (benefit) during the period around the adoption of Inflation targeting will be taken into consideration. Therefore, the current method is closer to the one used in Anderson and Wascher (1999) where they consider changes over a longer time period to compute the sacrifice ratio. Also, observing the changes over a longer period addresses the concerns expressed by Mayes and Chapple (1994) who argue that "sacrifice ratios have been traditionally viewed as short-run concepts, just looking at the cost of the period of disinflation. However, the policies are intended to be of net benefit. The appropriate calculation would therefore also take into account the subsequent gains" (p.19).

As said before, the process of disinflation in countries that adopt Inflation targeting could commence several quarters before the actual adoption of Inflation targeting framework. For consistency, it is assumed that this process could commence 12 quarters (3 years) prior to the country adopted Inflation targeting. The cumulative changes in inflation and unemployment during the period from 12 quarters before Inflation targeting to 12 quarters after Inflation targeting are provided in Table 7.

Table 7 shows that inflation has indeed declined during the 3-year period before Inflation targeting. In New Zealand, this disinflation has been as much as by 7.3 percentage points, while for Australia, Finland, Spain, Sweden, and the UK, the decline in inflation has been by 0.5 to 1 percentage point. There has been no disinflation during this period in Canada, Iceland and Norway. All countries in the sub-sample that have experienced disinflation during the three years before the adoption of Inflation targeting have also faced increasing unemployment as well.

Disinflation that occurred following Inflation targeting is also shown in Table 7. All countries expect for the UK, have enjoyed reduced inflation during the 3 years immediately after Inflation targeting. Australia and Spain have experienced declines in unemployment during this period.

The last two columns of Table 7 present the total changes in inflation and unemployment during the 6-year period surrounding the adoption of Inflation targeting. Except for Iceland, disinflation processes have taken place in all other countries and have been associated with increased rates of unemployment.

Table 7: Cumulative Changes in Inflation and Unemployment during the Adoption of Inflation Targeting

Country	IT Introduced in	During the 3 years Before IT		During the 3 years After IT		Total	
		DLCPI	U	DLCPI	U	DLCPI	U
Australia	1993Q2	-0.0084	0.0470	*-0.0052*	*-0.0260*	-0.0136	0.0210
Canada	1991Q1	*0.0079*	*0.0103*	-0.0104	0.0211	-0.0025	0.0314
Finland	1993Q2	-0.0079	0.1190	-0.0034	0.0020	-0.0113	0.1210
Iceland	2001Q1	*0.0063*	*-0.0230*	-0.0020	0.0212	*0.0044*	*-0.0018*
Norway	2001Q1	*0.0002*	*-0.0010*	-0.0054	0.0110	-0.0053	0.0100
New Zealand	1990Q1	-0.0731	0.0298	-0.0079	0.0324	-0.0810	0.0622
Spain	1994Q4	-0.0053	0.0630	*-0.0043*	*-0.0290*	-0.0096	0.0340
Sweden	1993Q1	-0.0098	0.0490	-0.0046	0.0250	-0.0144	0.0740
UK	1992Q4	-0.0081	0.0290	*0.0026*	*-0.0150*	-0.0054	0.0140

Notes: 1. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.
2. Finland and Spain abandoned Inflation targeting in 1999Q1 in favour of the EU.

Table 8 presents the Sacrifice Ratios for each country for the possible periods of disinflation. Sacrifice Ratios are not computed for counter-intuitive episodes. The findings suggest that disinflation associated with Inflation targeting could occur before its implementation, after its implementation or during both periods. During the entire 6-year period surrounding the introduction of Inflation targeting countries have experienced Sacrifice Ratios varying between 0.8 and 12.5.

Table 8: Sacrifice Ratios during the Adoption of Inflation Targeting

Country	IT Introduced in	SR during the 3 years Before IT	SR during the 3 years After IT	Total Sacrifice Ratio
Australia	1993Q2	5.56	*-5.02 (DLCPI↓, U↓)*	1.54
Canada	1991Q1	*-1.30 (DLCPI↑, U↑)*	2.03	12.51
Finland	1993Q2	15.02	0.59	10.69
Iceland	2001Q1	*3.63 (DLCPI↑, U↓)*	10.67	*0.41 (DLCPI↑, U↓)*
Norway	2001Q1	*5.56 (DLCPI↑, U↓)*	2.02	1.90
New Zealand	1990Q1	0.41	4.10	0.77
Spain	1994Q4	11.80	*-6.77 (DLCPI↓, U↓)*	3.53
Sweden	1993Q1	5.00	5.45	5.14
UK	1992Q4	3.60	*5.74 (DLCPI↑, U↓)*	2.57

Notes: 1. Sacrifice ratio is computed as cumulative change in the unemployment rate divided by the cumulative change in inflation (change in CPI) (Signs reversed).
2. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.
3. Finland and Spain abandoned Inflation targeting in 1999Q1 in favour of the EU.

5.1.2. Summary of Findings: Sub-sample 1

In sub-sample 1 (Inflation Targeting Industrial Countries), it was observed that there is a negative correlation between inflation and unemployment suggesting a trade-off, and the trade-off lessens significantly after two years of inflation targeting. Also average inflation has declined considerably after inflation targeting, but experiences with regard to unemployment vary. Countries in which there have been a greater decline in inflation, have experienced higher increases in unemployment rates. Chow breakpoint tests confirm that the introduction of inflation targeting has not happened suddenly but has been preceded by a gradual disinflationary process. The employment sacrifice as measured by the slope of the Phillips curve relationship shows that the slope has lessened following inflation targeting for all countries in the sample. Also, the sacrifice ratio (cumulative change in unemployment rate divided by the cumulative change in inflation during the adoption of inflation targeting) – increased unemployment as a result of lower inflation, and the ratio varies between 0.8 and 12.5 among countries.

5.2. Sub-Sample 2: Inflation Targeters – Emerging Market Countries

5.2.1. Measuring the Trade-off

a. Correlation between Inflation and Unemployment

The second sub-sample includes the emerging market inflation targeters (Brazil, Czech Republic, Hungary, Republic of Korea, Mexico, Poland, Slovak Republic, and Turkey). The coefficients of correlation between inflation and unemployment before and after adopting Inflation targeting in countries in sub-sample 2 are given in Table 9. All countries in the sub-sample apart from Hungary and Mexico, display a trade-off between inflation and unemployment as shown by negative coefficients of correlation between 0.24 and 0.65. However, in Brazil, Republic of Korea, Slovak Republic, and Turkey, the coefficient of correlation become positive following the adoption of Inflation targeting, suggesting that there is no trade-off between inflation and unemployment, while for Poland, the negative coefficient weakens.

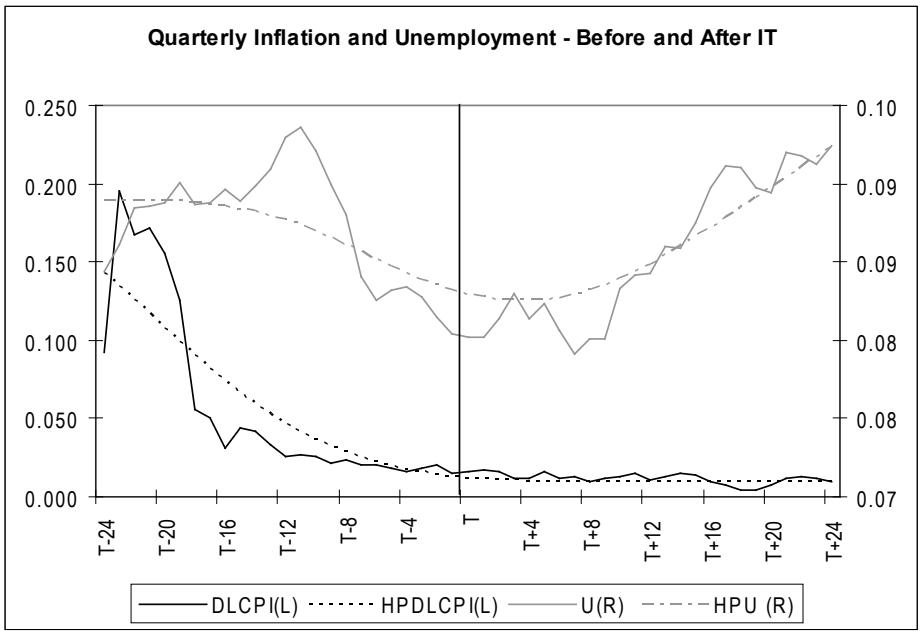
Table 9: Coefficients of Correlation : Inflation and Unemployment

Country	Before IT	After IT
Brazil	-0.2430	0.3060
Czech Republic	-0.3789	-0.5058
Hungary	0.6697	-0.0456
Republic of Korea	-0.4108	0.2519
Mexico	0.3016	-0.1609
Poland	-0.6477	-0.6063
Slovak Republic	-0.3712	0.2476
Turkey	-0.6249	0.2223
Average	-0.2132	-0.0364

Aggregated inflation and unemployment for the countries in this sub-sample 24 quarters before and after adopting Inflation targeting are shown in Figure 2. Similar to Figure 1 with sub-sample 1, T is the quarter in which the country adopted Inflation targeting. The two trend series, of inflation (HPDLCPI) and of Unemployment (HPU) are obtained using the Hodrick-Prescott filter with a smoothing parameter λ=1,600.

Unlike in sub-sample 1, the trade-off between inflation and unemployment is not clear in sub-sample 2. There has been a continuous decline in inflation in the 24-quarter period preceding the adoption of Inflation targeting, while inflation has been remarkably stable in the period following the introduction of Inflation targeting. This indicates that Inflation targeting has been successful in containing the hyper-inflations experienced by some countries in this sub-sample, and that these countries have adopted Inflation targeting only after significant disinflationary processes. However, the low level of inflation in these countries appears to have occurred with rising unemployment levels. Within the first 24 quarters following Inflation targeting, unemployment has risen continuously for this sub-sample.

Figure 2: Aggregated Data – Sub-sample 2



Notes:

1. *DLCPI* (Left axis) is the average inflation for the 8 countries in the sub-sample.

2. *U* (Right axis) is the average unemployment for the same 8 countries.

3. Due to different dates of adopting Inflation targeting, data are available for Turkey only up to T+4, for Slovak Republic only up to T+8, and for Hungary only up to T+23.

b. Structural Breaks in Inflation and Unemployment following Inflation Targeting

As shown in Table 10 average inflation has declined in all countries in the sub-sample following Inflation targeting. The mean inflation has fallen by around 7 percentage points (a decline of 85 per cent). On the other hand, similar to sub-sample 1 there is no common pattern with regard to unemployment. Levels of unemployment have increased in Brazil, Czech Republic, Republic of Korea, Poland and Turkey, while the other countries have experienced falling unemployment. On average, the increase in unemployment is 12.7 per cent compared with the decline in inflation of 85 per cent

Table 10: Inflation and Unemployment Rate

Mean

Country	Inflation (Per cent)			Unemployment (Per cent)		
	Before IT	After IT	% Change	Before IT	After IT	% Change
Brazil	26.32	1.79	-93.20	9.59	11.45	19.40
Czech Republic	2.86	0.72	-74.83	2.85	8.65	203.51
Hungary	3.49	1.32	-62.18	9.22	6.42	-30.37
Rep. of Korea	1.55	0.73	-52.90	3.33	3.60	8.11
Mexico	8.24	1.09	-86.77	3.53	3.40	-3.68
Poland	10.29	0.92	-91.06	12.06	16.23	34.58
Slovak Republic	2.33	0.78	-66.52	13.67	10.75	-21.36
Turkey	10.58	2.37	-77.60	8.17	9.86	20.69
Average	8.21	1.22	-85.20	7.80	8.80	12.72

Similar to sub-sample 1, a series of univariate autoregressive functions are used to test whether there are statistically significant trend breaks at the time of introducing Inflation targeting in the 8 countries in the sub-sample 2. Chow Breakpoint tests (with the null hypothesis of no structural break at the quarter in which Inflation targeting was introduced) are carried out to identify possible trend breaks. A summary of findings for inflation processes are given in Table 11.

Results of the Chow Breakpoint tests in Table 11 display that the introduction of Inflation targeting marks a trend break in the inflation processes only in Czech Republic. Chow Breakpoint test statistics fail to reject the null hypothesis of no structural break for all the other countries.

Table 11: Chow Breakpoint Tests for Inflation Processes

Country	Regression				Chow Breakpoint Test		
	Sample	Lag Length	Constant	Adj. R squared	Test for	F-Statistic [Prob.]	Log Likelihood Ratio [Prob.]
Brazil	1992Q4-2007Q1	1	No	0.7150	1999Q2	0.0004 [0.9835]	0.0004 [0.9831]
Czech Republic	1991Q3-2007Q1	1	Yes	0.2909	1998Q1	**8.2149 [0.0007]**	**15.4770 [0.0004]**
Hungary	1981Q1-2007Q1	3	Yes	0.6326	2001Q2	0.9295 [0.4502]	3.9493 [0.4129]
Republic of Korea	1980Q4-2007Q1	3	Yes	0.5349	2001Q1	0.3006 [0.8769]	1.2924 [0.8627]
Mexico	1980Q2-2007Q1	1	No	0.8243	2001Q1	0.0346 [0.8567]	0.0353 [0.8509]
Poland	1980Q4-2007Q1	2	Yes	0.6900	1998Q4	0.9306 [0.4289]	2.9188 [0.4043]
Slovak Republic	1991Q3-2007Q1	1	Yes	0.1130	2005Q1	1.5629 [0.2181]	3.2523 [0.1967]
Turkey	1980Q4-2007Q1	3	No	0.5767	2006Q1	0.0278 [0.9937]	0.0884 [0.9932]

Table 12: Chow Breakpoint Tests for Unemployment Processes

Country	Regression				Chow Breakpoint Test		
	Sample	Lag Length	Constant	Adj. R squared	Test for	F-Statistic [Prob.]	Log Likelihood Ratio[Prob.]
Brazil	1981Q3-2007Q1	2	Yes	0.9051	1999Q2	0.3678 [0.7764]	1.1650 [0.7614]
Czech Republic	1990Q3-2007Q1	2	Yes	0.9935	1998Q1	**3.6561 [0.0172]**	**11.0787 [0.0113]**
Hungary	1992Q1-2007Q1	2	No	0.9760	2001Q2	0.7449 [0.4795]	1.5770 [0.4545]
Republic of Korea	1989Q4-2007Q1	3	Yes	0.9507	2001Q1	**2.3510 [0.0638]**	**9.8856 [0.0424]**
Mexico	1987Q3-2007Q1	2	Yes	0.9071	2001Q1	1.0142 [0.3914]	3.2259 [0.3581]
Poland	1990Q3-2007Q1	2	Yes	0.9852	1998Q4	1.1093 [0.3523]	3.5590 [0.3132]
Slovak Republic	1990Q3-2007Q1	1	Yes	0.8940	2005Q1	**2.8481 [0.0654]**	**5.7996 [0.0550]**
Turkey	1989Q1-2006Q4	1	No	0.9030	2006Q1	0.8427 [0.3618]	0.8612 [0.3533]

Table 12, which shows the results of Chow Breakpoint tests for unemployment processes, suggests that the introduction of Inflation targeting marks trend breaks in unemployment only in Czech Republic, Republic of Korea and Slovak Republic.

As mentioned earlier, this finding further strengthens that emerging market countries which adopted Inflation targeting also preferred a "gradualist" approach vis-à-vis the "cold turkey" approach, and supports the fact that they have only done so several quarters following successful disinflationary processes.

c. Costs of Disinflation

The Phillips curve relationship for individual countries in the sub-sample is also computed. For Czech Republic and Poland, the inflation-output trade-off has lessened following the introduction of Inflation targeting. For Brazil, Republic of Korea, and Slovak Republic, the trade-off seems to have disappeared with inflation and unemployment having a positive relationship. Table 13 summarizes the findings from these Inflation-Unemployment scatter plots. The Before/After ratio for the slope displays that flattening of the Phillips curve relationship is around 3.8 times for Czech Republic and 10.6 fold for Poland.

Table 13: Slope of Linear Regression Line of the Inflation-Unemployment Scatter Plot

Country	Before IT	After IT	Before/After Ratio
Brazil	-5.0760	*0.1847*	-
Czech Republic	-1.2966	-0.3414	3.7979
Hungary	*0.5760*	-0.0417	-
Republic of Korea	-0.2033	*0.3391*	-
Mexico	*1.7100*	-0.1195	-
Poland	-2.1186	-0.2001	10.5877
Slovak Republic	-0.2582	*0.1302*	-
Turkey	-2.3501	…	-
Average	-1.1271	-0.0070	162.0062

Notes: 1. Scenarios where there is no trade-off are italicized.

2. Turkey's after IT sub-period includes only 4 observations.

As with the sub-sample 1, the sacrifice ratio is calculated using the *changes* in unemployment (cost) and *changes* in inflation (benefit) during the period around the adoption of Inflation targeting.

Cumulative changes in inflation and unemployment during the period from 12 quarters before Inflation targeting to 12 quarters after Inflation targeting are provided in Table 14. Accordingly, inflation has declined during the 3-year period before Inflation targeting in all countries in the sample within a range of 0.2 per cent to 4.5 per cent. Disinflation during this period has accompanies higher unemployment in Brazil, Czech Republic and Republic of Korea. Following Inflation targeting, all countries except for Hungary, Republic of Korea, and Turkey, show further decline in inflation.

The last two columns of Table 14 present the total changes in inflation and unemployment during the 6-year period surrounding the adoption of Inflation targeting. All countries record disinflation during this period, and except for Hungary, Slovak Republic and Turkey, it has been associated with increased rates of unemployment.

Table 14: Cumulative Changes in Inflation and Unemployment during the Adoption of Inflation Targeting

Country	IT Introduced in	During the 3 years Before IT		During the 3 years After IT		Total	
		DLCPI	*U*	*DLCPI*	*U*	*DLCPI*	*U*
Brazil	1999Q2	-0.0224	0.0350	*-0.0024*	*-0.0140*	-0.0248	0.0210
Czech Republic	1998Q1	-0.0076	0.0188	-0.0064	0.0365	-0.0140	0.0553
Hungary	2001Q2	*-0.0174*	*-0.0330*	*0.0088*	*-0.0010*	*-0.0086*	*-0.0340*
Rep. of Korea	2001Q1	-0.0073	0.0140	*0.0060*	*-0.0050*	-0.0013	0.0090
Mexico	2001Q1	*-0.0162*	*-0.0100*	-0.0090	0.0130	-0.0252	0.0030
Poland	1998Q4	*-0.0227*	*-0.0534*	-0.0060	0.0670	-0.0287	0.0136
Slovak Republic	2005Q1	*-0.0028*	*-0.0523*	*-0.0067*	*-0.0439*	*-0.0096*	*-0.0962*
Turkey	2006Q1	*-0.0446*	*-0.0031*	*0.0022*	*-0.0080*	*-0.0424*	*-0.0111*

Notes: 1. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.
2. Slovak Republic's and Turkey's after IT sample has only 9 and 4 observation sets, respectively.

Table 15 presents the Sacrifice Ratios for each country for the possible periods of disinflation. Sacrifice Ratios are not computed for counter-intuitive episodes. The findings suggest that disinflation associated with Inflation targeting could occur before its implementation, after its implementation or during both periods. During the entire 6-year period surrounding the introduction of Inflation targeting countries have experienced Sacrifice Ratios varying between 0.1 and 6.8

Table 15: Sacrifice Ratios during the Adoption of Inflation Targeting

Country	IT Introduced in	SR during the 3 years Before IT	SR during the 3 years After IT	Total Sacrifice Ratio
Brazil	1999Q2	1.56	*-5. 84 (DLCPI↓, U↓)*	0.85
Czech Republic	1998Q1	2.46	5.69	3.94
Hungary	2001Q2	*-1.90 (DLCPI↓, U↓)*	*0.11 (DLCPI↑, U↓)*	*-3.94 (DLCPI↓, U↓)*
Rep. of Korea	2001Q1	1.92	*0.84 (DLCPI↑, U↓)*	6.81
Mexico	2001Q1	*-0.62 (DLCPI↓, U↓)*	1.44	0.12
Poland	1998Q4	*-2.35 (DLCPI↓, U↓)*	11.26	0.47
Slovak Republic	2005Q1	*-18.47(DLCPI↓, U↓)*	*-6.52 (DLCPI↓, U↓)*	*-10.06 (DLCPI↓, U↓)*
Turkey	2006Q1	*-0.07 (DLCPI↓, U↓)*	*3.60 (DLCPI↑, U↓)*	*-0.26 (DLCPI↓, U↓)*

Notes: 1. Sacrifice ratio is computed as cumulative change in the unemployment rate divided by the cumulative change in inflation (change in CPI) (Signs reversed).

2. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.

3. Slovak Republic's and Turkey's after IT sample has only 9 and 4 observation sets, respectively.

5.2.2. Summary of Findings: Sub-sample 2

With regard to the inflation targeting emerging market countries, generally, there has been a negative correlation between inflation and unemployment. This has almost disappeared on average after Inflation targeting. Average inflation has declined significantly after Inflation targeting, but average unemployment has increased. Chow breakpoint tests confirm that disinflation has continued over a reasonable period around adopting Inflation targeting and not overnight. The employment sacrifice as measured by the slope of the Phillips curve relationship has flattened significantly for all countries, while the sacrifice ratio shows that around the time of adopting Inflation targeting, both inflation and unemployment has decreased hindering the computation of sacrifice ratios in most countries. For those countries where sacrifice ratio can be computed, it has been between 0.1 and 6.8.

5.3. Sub-Sample 3: Euro Zone

Sub-sample 3 is a comparator/control sample and includes the countries, which has adopted the Euro as their sole currency. The countries in this sample are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. Of the Euro Zone, the only country that does not appear in the present study is Slovenia, and the reason for its absence is the lack of availability of data.

In order to compare this sub-sample with the first two sub-samples, the creation of Euro in Quarter 1, 1999 is considered as the alternative adopted by the countries in this sample to Inflation targeting. It will be explored whether the experiences of the Euro Zone countries are similar to those experienced by inflation targeters with regard to inflation and unemployment. However, it should be noted that the nature of the previous monetary policy regimes of the countries in sub-sample 3 are ignored (for example, Finland and Spain had Inflation targeting regimes, while Germany had a Monetary Targeting regime).

The pre Euro experience of this sub-sample is also divided into two, in order to analyze whether any change in inflation and unemployment in these countries actually occurred before the creation of the Euro Zone. The break point chosen is Quarter 1, 1993, which is the median quarter that the early inflation targeters (Australia, Canada, Finland, New Zealand, Spain, Sweden, UK) adopted Inflation targeting as their monetary policy framework.

5.3.1. Measuring the Trade-off

a. Correlation between Inflation and Unemployment

Table 16 shows the coefficients of correlation between inflation and unemployment before and after adopting Inflation targeting in countries in sub-sample 1. Apart from Belgium, Ireland, Luxembourg and Portugal show a negative correlation between inflation and unemployment before adopting the Euro. Belgium, Ireland, Luxembourg, the Netherlands and Portugal also display a worsening of the inflation-unemployment trade-off as suggested by negative/increased coefficients of correlation. However, on average, the countries in the sub-sample display lessening of the trade-off between inflation and unemployment as shown by the weakening of the negative coefficient of correlation from 0.375 to 0.126.

Table 16: Coefficients of Correlation : Inflation and Unemployment

Country	Before EURO (1979-1998)	After EURO (1999-2007)
Austria	-0.5186	-0.0852
Belgium	0.0012	-0.1320
Finland	-0.6887	0.0808
France	-0.8495	-0.1618
Germany	-0.4705	0.0017
Greece	-0.8006	-0.0060
Ireland	0.0682	-0.4674
Italy	-0.9115	0.2517
Luxembourg	0.2054	-0.0230
The Netherlands	-0.3158	-0.6699
Portugal	0.3562	-0.2914
Spain	-0.5758	-0.0092
Average	-0.3750	-0.1260

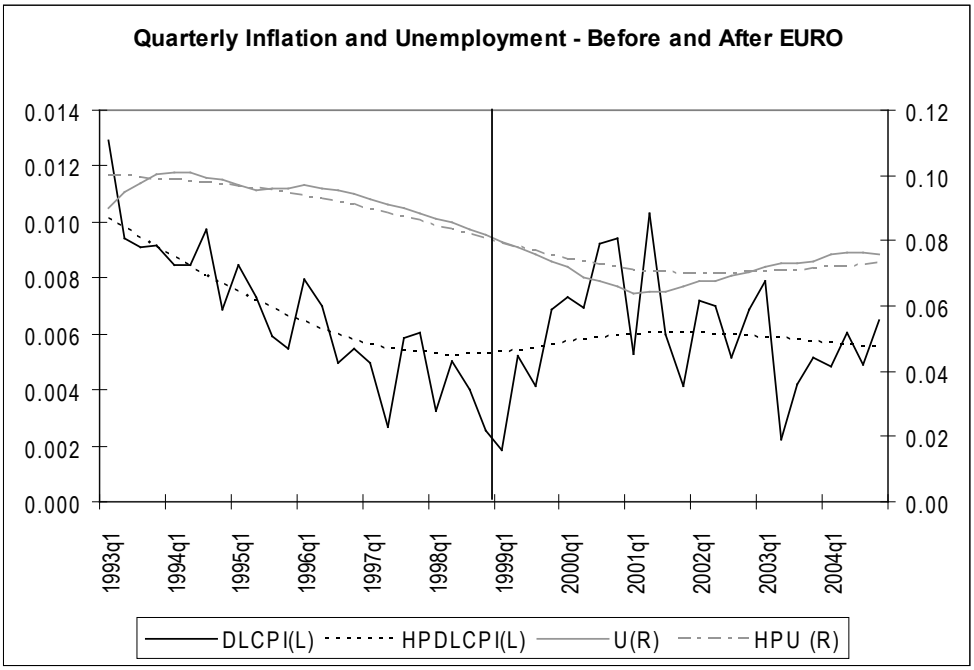
Table 17, which looks at the two sub-periods within the Before Euro period suggests that much of the weakening of the negative correlation between inflation and unemployment has occurred between the period 1993-1998, than in the post Euro period.

Table 17: Coefficients of Correlation : Inflation and Unemployment

Country	Before EURO		After EURO (1999-2007)
	(1979-1992)	(1993-1998)	
Austria	-0.4150	-0.2924	-0.0852
Belgium	0.1312	-0.1737	-0.1320
Finland	-0.3052	-0.1218	0.0808
France	-0.8487	-0.0764	-0.1618
Germany	-0.4710	-0.5444	0.0017
Greece	-0.2207	-0.7499	-0.0060
Ireland	-0.5295	-0.0532	-0.4674
Italy	-0.9233	-0.4079	0.2517
Luxembourg	0.4186	-0.1984	-0.0230
The Netherlands	-0.4598	0.1396	-0.6699
Portugal	0.4801	-0.2545	-0.2914
Spain	-0.4937	0.7134	-0.0092
Average	-0.3031	-0.1683	-0.1260

Aggregated inflation and unemployment for the countries in this sub-sample 24 quarters before and after the introduction of the Euro are shown in Figure 3. Both trend inflation and trend unemployment seem to have declined before Euro while both trend series seem to have stabilized after the introduction of the Euro. There is hardly any evidence of a trade-off.

Figure 3: Aggregated Data – Sub-sample 3



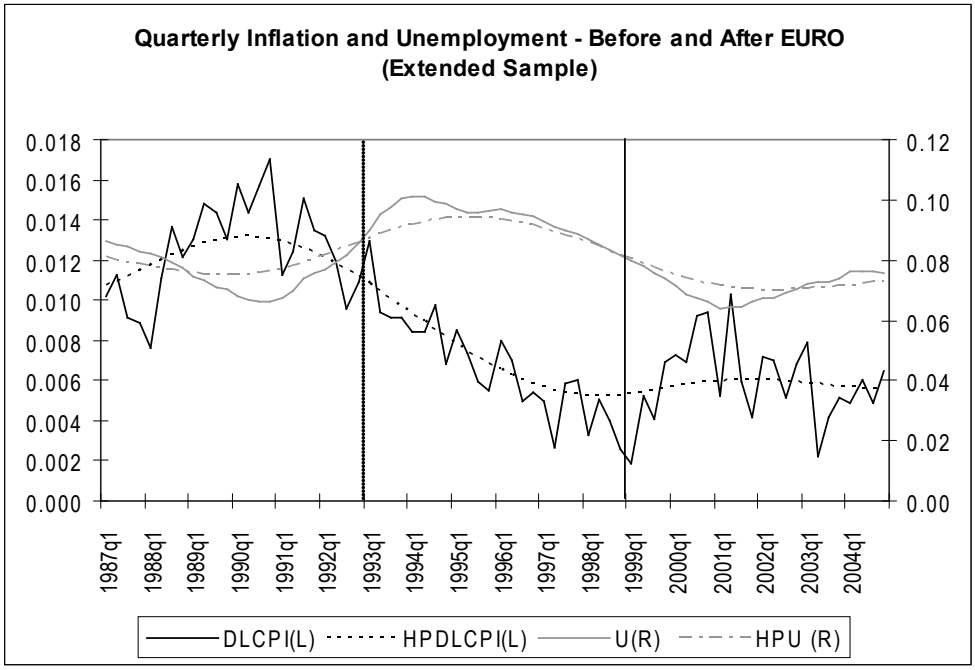
Notes:

1. *DLCPI* (Left axis) is the average inflation for the 12 countries in the sub-sample.

2. *U* (Right axis) is the average unemployment for the same 12 countries.

Figure 4 also considers the period around 1993Q1. A trade-off between inflation and unemployment exists in the 1979-1992 period and the early part of 1993-1998 period before it disappears in the post Euro period.

Figure 4: Aggregated Data (Extended) – Sub-sample 3



b. Structural Breaks in Inflation and Unemployment following Inflation Targeting

Table 18 investigates whether average inflation and unemployment have changed before and after Euro. All countries in the sub-sample show a decline in mean inflation of around 59.2 per cent (but only by around 75 basis points in absolute terms) on average for period following the creation of Euro. The "after Euro" period also shows an increase in mean unemployment in all countries by around 13.8 per cent (or 1.1 percentage points).

Table 18: Inflation and Unemployment Rate

Mean

Country	Inflation (Per cent)			Unemployment (Per cent)		
	Before EURO	After EURO	% Change	Before EURO	After EURO	% Change
Austria	0.77	0.45	-41.56	3.55	4.24	19.44
Belgium	0.87	0.51	-41.38	8.91	7.82	-12.23
Finland	1.14	0.38	-66.67	8.55	8.97	4.91
France	1.11	0.42	-62.16	9.53	9.35	-1.89
Germany	0.68	0.38	-44.12	6.62	8.35	26.13
Greece	3.59	0.78	-78.27	7.92	10.33	30.43
Ireland	1.37	0.93	-32.12	14.02	4.52	-67.76
Italy	1.81	0.56	-69.06	8.92	8.64	-3.14
Luxembourg	0.85	0.59	-30.59	2.55	3.48	36.47
The Netherlands	0.64	0.55	-14.06	6.52	3.48	-46.63
Portugal	2.75	0.73	-73.45	6.59	5.79	-12.14
Spain	1.72	0.78	-54.65	15.43	10.49	-32.02
Average	1.44	0.59	-59.19	8.26	7.12	-13.77

However, as evidenced earlier, much of the decline in inflation has occurred during the 1993-1998 sub-period. As shown in Table 19, inflation has declined by an average of 62.6 per cent from 1979-1992 to 1993-1998 period. In comparison to 1993-1998 period, the decline in inflation following the introduction of the Euro is only 12.3 per cent (or in absolute terms only by 8 basis points). Any disinflation in the countries in the Euro Zone had occurred well before the creation of Euro.

Another key feature in Table 19 is the changes in unemployment during the pre Euro period. In most countries (except for Ireland, the Netherlands, and Portugal), unemployment has increased within the 1979-1992 and 1993-1998 periods corresponding to the significant decline in inflation between these periods. Remarkably, in all countries except for Austria, Greece and Luxembourg, unemployment has declined following the introduction of the Euro compared with the 1993-1998 period. Average unemployment following the Euro is even slightly lower than average unemployment between the 1979-1992 sub-period

Table 19: Inflation and Unemployment Rate

Mean

Country	Inflation (Per cent)					
	Before EURO	**BeforeEURO**	**% Change**	**Before EURO**	**After EURO**	**% Change**
	1979-1992	**1993-1998**		**1993-1998**	**1999-2007**	
Austria	0.91	0.49	-46.51	0.49	0.45	-6.54
Belgium	1.07	0.43	-59.45	0.43	0.51	16.93
Finland	1.54	0.28	-82.09	0.28	0.38	38.02
France	1.45	0.36	-74.97	0.36	0.42	15.51
Germany	0.75	0.50	-32.67	0.50	0.38	-24.61
Greece	4.36	1.91	-56.13	1.91	0.78	-59.11
Ireland	1.77	0.49	-72.40	0.49	0.93	90.04
Italy	2.26	0.85	-62.46	0.85	0.56	-33.49
Luxembourg	1.05	0.42	-60.42	0.42	0.59	41.71
The Netherlands	0.68	0.55	-18.57	0.55	0.55	-1.21
Portugal	3.58	0.94	-73.73	0.94	0.73	-22.64
Spain	2.13	0.83	-61.07	0.83	0.78	-5.72
Average	1.80	0.67	-62.63	0.67	0.59	-12.30
	Unemployment (Per cent)					
	Before EURO	Before EURO	% Change	Before EURO	After EURO	% Change
	1979-1992	1993-1998		1993-1998	1999-2007	
Austria	3.33	4.03	21.12	4.03	4.24	5.11
Belgium	8.71	9.36	7.49	9.36	7.82	-16.43
Finland	5.81	14.48	149.14	14.48	8.97	-38.05
France	8.68	11.35	30.81	11.35	9.35	-17.66
Germany	5.79	8.42	45.44	8.42	8.35	-0.82
Greece	6.90	9.44	36.81	9.44	10.33	9.44
Ireland	15.19	11.88	-21.77	11.88	4.52	-61.95
Italy	8.01	10.89	35.98	10.89	8.64	-20.65
Luxembourg	2.40	2.81	17.19	2.81	3.48	23.91
The Netherlands	6.89	5.73	-16.91	5.73	3.48	-39.18
Portugal	6.65	6.49	-2.38	6.49	5.79	-10.79
Spain	14.41	17.62	22.28	17.62	10.49	-40.48
Average	7.73	9.38	21.28	9.38	7.12	-24.03

The univariate autoregressive functions for inflation and unemployment are carried out to test whether there are statistically significant trend breaks at the time of introducing the Euro in the 12 countries in the sub-sample 3. Chow Breakpoint tests (with the null hypothesis of no structural break at the quarter of the introduction of the Euro) are performed to identify possible trend breaks. A summary of findings for inflation processes are given in Table 20, and Chow Breakpoint test statistics fail to reject the null hypothesis of no structural break for all countries in this sample.

Table 20: Chow Breakpoint Tests for Inflation Processes

Country	Regression				Chow Breakpoint Test		
	Sample	Lag Length	Constant	Adj. R squared	Test for	F-Statistic [Prob.]	Log Likeli-hood Ratio [Prob.]
Austria	1980Q4-2007Q1	3	Yes	0.4233	1999Q1	0.2575 [0.9044]	1.1084 [0.8929]
Belgium	1980Q4-2007Q1	3	No	0.6556	1999Q1	1.5576 [0.2044]	4.8410 [0.1838]
Finland	1980Q3-2007Q1	2	Yes	0.7788	1999Q1	0.9726 [0.4088]	3.0473 [0.3844]
France	1980Q3-2007Q1	2	No	0.8541	1999Q1	1.6210 [0.2027]	3.3161 [0.1905]
Germany	1980Q3-2007Q1	2	Yes	0.3924	1999Q1	1.6791 [0.1763]	5.2077 [0.1572]
Greece	1980Q3-2007Q1	2	No	0.8170	1999Q1	0.8400 [0.4346]	1.7311 [0.4208]
Ireland	1981Q1-2007Q1	4	No	0.7762	1999Q1	1.2526 [0.2940]	5.2883 [0.2590]
Italy	1980Q4-2007Q1	3	No	0.9254	1999Q1	0.3168 [0.8132]	1.0026 [0.8006]
Luxembourg	1980Q4-2007Q1	3	No	0.5814	1999Q1	1.0495 [0.3742]	3.2858 [0.3496]
The Netherlands	1980Q4-2007Q1	3	Yes	0.5368	1999Q1	0.1159 [0.9766]	0.5004 [0.9735]
Portugal	1981Q1-2007Q1	4	No	0.8248	1999Q1	0.1088 [0.9792]	0.4702 [0.9763]
Spain	1980Q4-2007Q1	3	No	0.7795	1999Q1	0.5528 [0.6474]	1.7436 [0.6273]

However, with regard to unemployment, it is noteworthy that 6 out of the 12 countries (Belgium, France, Germany, Greece, Italy, and Spain) in the sample mark structural breaks at the time of introducing the Euro, as shown in Table 21.

Table 21: Chow Breakpoint Tests for Unemployment Processes

Country	Regression				Chow Breakpoint Test		
	Sample	Lag Length	Constant	Adj. R squared	Test for	F-Statistic [Prob.]	Log Likelihood Ratio[Prob.]
Austria	1980Q2-2007Q1	2	Yes	0.8357	1999Q1	0.7040 [0.5518]	2.2133 [0.5293]
Belgium	1980Q2-2007Q1	2	Yes	0.9547	1999Q1	**3.7971 [0.0126]**	**11.4342 [0.0096]**
Finland	1980Q3-2007Q1	3	Yes	0.9938	1999Q1	0.3650 [0.8330]	1.5663 [0.8148]
France	1980Q2-2007Q1	2	Yes	0.9882	1999Q1	**2.3028 [0.0815]**	**7.0776 [0.0695]**
Germany	1980Q4-2007Q1	4	Yes	0.9623	1999Q1	**4.6438 [0.0008]**	**22.9613 [0.0003]**
Greece	1984Q3-2007Q1	2	No	0.9804	1999Q1	**4.9414 [0.0093]**	**9.7911 [0.0075]**
Ireland	1982Q3-2007Q1	2	No	0.9968	1999Q1	0.1508 [0.8602]	0.3138 [0.8548]
Italy	1980Q2-2007Q1	2	Yes	0.9862	1999Q1	**9.3996 [0.0000]**	**26.3616 [0.0000]**
Luxembourg	1982Q3-2007Q1	2	No	0.9511	1999Q1	0.9911 [0.3750]	2.0444 [0.3598]
The Netherlands	1980Q2-2007Q1	2	No	0.9865	1999Q1	0.0376 [0.9632]	0.0780 [0.9618]
Portugal	1983Q3-2007Q1	2	Yes	0.9832	1999Q1	1.1082 [0.3501]	3.4841 [0.3228]
Spain	1980Q3-2007Q1	3	Yes	0.9937	1999Q1	**3.3867 [0.0122]**	**13.7227 [0.0082]**

Table 22 examines whether structural breaks can be identified for 1993Q1, the median date of adopting Inflation targeting by the pioneering countries. However, structural breaks for inflation processes are identified only for Belgium, Finland and Germany and for unemployment processes only for Germany, Ireland and Italy.

Table 22: Chow Breakpoint Tests for Inflation and Unemployment Processes

Country	Test for	For Inflation Process		For Unemployment Process	
		F-Statistic [Prob.]	Log Likelihood Ratio[Prob.]	F-Statistic [Prob.]	Log Likelihood Ratio[Prob.]
Austria	1993Q1	0.7793 [0.5413]	3.3192 [0.5059]	0.7229 [0.5406]	2.2721 [0.5179]
Belgium	1993Q1	**2.8597 [0.0407]**	**8.7247 [0.0332]**	0.3331 [0.8014]	1.0530 [0.7884]
Finland	1993Q1	**3.6252 [0.0156]**	**10.9427 [0.0120]**	1.3946 [0.2414]	5.8653 [0.2094]
France	1993Q1	2.0056 [0.1398]	4.0878 [0.1295]	1.4831 [0.2236]	4.6111 [0.2026]
Germany	1993Q1	**3.0505 [0.0320]**	**9.2807 [0.0258]**	**5.2917 [0.0002]**	**25.8030 [0.0001]**
Greece	1993Q1	1.0108 [0.3675]	2.0797 [0.3535]	1.4152 [0.2484]	2.9133 [0.2330]
Ireland	1993Q1	1.7436 [0.1466]	7.2905 [0.1213]	**6.0839 [0.0033]**	**11.9313 [0.0026]**
Italy	1993Q1	0.8672 [0.4608]	2.7226 [0.4364]	**3.4502 [0.0194]**	**10.4385 [0.0152]**
Luxembourg	1993Q1	1.1402 [0.3366]	3.5652 [0.3124]	0.8624 [0.4254]	1.7813 [0.4104]
The Netherlands	1993Q1	2525 [0.9075]	1.0869 [0.8963]	0.6917 [0.5030]	1.4272 [0.4899]
Portugal	1993Q1	0.4093 [0.8016]	1.7573 [0.7803]	0.4813 [0.6961]	1.5289 [0.6756
Spain	1993Q1	0.0971 [0.9615]	0.3082 [0.9548]	1.6308 [0.1725]	6.8278 [0.1453]

The notion of "gradualism" is again confirmed in this sub-sample. However, the important feature in this sub-sample with regard to structural break is that trends in unemployment has changed following the introduction of the Euro for several large economies in the Euro Zone as shown in Table 21.

c. Costs of Disinflation

The changes to the inflation-unemployment trade-off as measured by slope of the Phillips curve relationship are observed with a view to analyze the costs of disinflation. Table 23 summarizes the findings from the Inflation-Unemployment scatter plots for individual countries, and calculates the Before/After ratio for the slope. On average the slope of the trade-off has declined from 0.19 to 0.07, a decline by around 2.8 per cent.

Table 23: Slope of Linear Regression Line of the Inflation-Unemployment Scatter Plot

Country	Before IT	After IT	Before/After Ratio
Austria	-0.4152	-0.0330	12.5818
Belgium	*0.0006*	-0.0513	-
Finland	-0.1325	*0.0323*	-
France	-0.5164	-0.0623	8.2889
Germany	-0.1508	*0.0005*	-
Greece	-0.8150	-0.0020	407.5000
Ireland	*0.0218*	-0.4084	-
Italy	-0.5996	*0.0269*	-
Luxembourg	*0.2707*	-0.0056	-
The Netherlands	-0.1137	-0.2483	0.4579
Portugal	*0.4037*	-0.0582	-
Spain	-0.2098	-0.0024	87.4167
Average	-0.1880	-0.0677	2.7793

Note: 1. Scenarios where there is no trade-off are italicized.

In order to compute sacrifice ratios from actual developments in inflation and unemployment during possible episodes of disinflation associated with the introduction of the Euro, *changes* in unemployment and *changes* in inflation are considered. Using these changes, cumulative changes in inflation and unemployment during the period from 12 quarters before the introduction of the Euro to 12 quarters after the introduction of the Euro are provided in Table 24. The Table shows that although inflation has generally declined during the 3-year period before Euro, it has increased following the introduction of the Euro. Unemployment has declined in both sub-periods. According, when the 6-year period surrounding the introduction of the Euro is considered it total, inflation shows mixed results while unemployment has generally declined. A trade-off relationship is hard to find in this sub-sample, and is only limited to Germany, Greece, and Italy for the first sub-period, and only to Greece in the total period.

Table 24: Cumulative Changes in Inflation and Unemployment during the Introduction of the Euro

Country	Euro Introduced in	During the 3 years Before EURO		During the 3 years After EURO		Total	
		DLCPI	U	DLCPI	U	DLCPI	U
Austria	1999Q1	*0.0013*	*0.0030*	*0.0003*	*-0.0020*	*0.0016*	*0.0010*
Belgium	1999Q1	*-0.0019*	*-0.0060*	*0.0025*	*-0.0180*	*0.0006*	*-0.0240*
Finland	1999Q1	*0.0042*	*-0.0460*	*-0.0014*	*-0.0180*	*0.0029*	*-0.0640*
France	1999Q1	*-0.0059*	*-0.0010*	*0.0016*	*-0.0260*	*-0.0043*	*-0.0270*
Germany	1999Q1	**-0.0032**	**0.0030**	*0.0018*	*-0.0080*	*-0.0015*	*-0.0050*
Greece	1999Q1	**-0.0151**	**0.0192**	*0.0052*	*-0.0020*	**-0.0099**	**0.0172**
Ireland	1999Q1	*0.0005*	*-0.0530*	*0.0066*	*-0.0260*	*0.0071*	*-0.0790*
Italy	1999Q1	**-0.0075**	**0.0030**	*0.0005*	*-0.0250*	-0.0070	-0.0220
Luxembourg	1999Q1	*-0.0044*	*-0.0040*	*0.0051*	*-0.0030*	*0.0007*	*-0.0070*
The Netherlands	1999Q1	*0.0025*	*-0.0280*	*0.0010*	*-0.0130*	*0.0036*	*-0.0410*
Portugal	1999Q1	*-0.0002*	*-0.0240*	*-0.0007*	*-0.0090*	*-0.0009*	*-0.0330*
Spain	1999Q1	*-0.0054*	*-0.0380*	*-0.0032*	*-0.0400*	*-0.0086*	*-0.0780*

Note: 1. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.

Table 25 presents the Sacrifice Ratios for each country for the possible periods of disinflation. As seen in Table 24, the trade-off relationship is scarce in this sample, and proper sacrifice ratios are not available for most countries. The findings suggest that disinflation has not been a major concern for policymakers during the introduction of the Euro probably with the exception of Greece.

Table 25: Sacrifice Ratios during the Adoption of Inflation Targeting

Country	Euro Introduced in	SR during the 3 years Before IT	SR during the 3 years After IT	Total Sacrifice Ratio
Austria	1999Q1	*-2.28 (DLCPI↑, U↑)*	*6.56 (DLCPI↑, U↓)*	*-0.62 (DLCPI↑, U↑)*
Belgium	1999Q1	*-3.16 (DLCPI↓, U↓)*	*7.11 (DLCPI↑, U↓)*	*37.85 (DLCPI↑, U↓)*
Finland	1999Q1	*10.90 (DLCPI↑, U↓)*	*-13.27 (DLCPI↓, U↓)*	*22.35 (DLCPI↑, U↓)*
France	1999Q1	*-0.17 (DLCPI↓, U↓)*	*15.89 (DLCPI↑, U↓)*	*-6.32 (DLCPI↓, U↓)*
Germany	1999Q1	**0.93**	*4.57 (DLCPI↑, U↓)*	*-3.40 (DLCPI↓, U↓)*
Greece	1999Q1	**1.27**	*0.39 (DLCPI↑, U↓)*	**1.74**
Ireland	1999Q1	*101.34 (DLCPI↑, U↓)*	*3.94 (DLCPI↑, U↓)*	*11.08 (DLCPI↑, U↓)*
Italy	1999Q1	**0.40**	*47.26 (DLCPI↑, U↓)*	*-3.15 (DLCPI↓, U↓)*
Luxembourg	1999Q1	*-0.92 (DLCPI↓, U↓)*	*0.59 (DLCPI↑, U↓)*	*9.92 (DLCPI↑, U↓)*
The Netherlands	1999Q1	*11.15 (DLCPI↑, U↓)*	*12.49 (DLCPI↑, U↓)*	*11.54 (DLCPI↑, U↓)*
Portugal	1999Q1	*-98.36 (DLCPI↓, U↓)*	*-12.93 (DLCPI↓, U↓)*	*-35.11 (DLCPI↓, U↓)*
Spain	1999Q1	*-7.04 (DLCPI↓, U↓)*	*-12.52 (DLCPI↓, U↓)*	*-9.08 (DLCPI↓, U↓)*

Notes: 1. Sacrifice ratio is computed as cumulative change in the unemployment rate divided by the cumulative change in inflation (change in CPI) (Signs reversed).

2. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.

Since the introduction of the Euro itself has not resulted in disinflationary episodes associated with unemployment sacrifice, Quarter 1, 1993 is again considered to identify possible disinflations. Table 26 presents the results. Disinflations had indeed occurred in the 3-year periods surrounding 1993Q1, and when considered the total change, disinflations coupled with unemployment sacrifices have not happened only in Ireland and the Netherlands.

Table 26: Cumulative Changes in Inflation and Unemployment Before and After 1993Q1

Country	During the 3 years Before 1993Q1		During the 3 years After 1993Q1		Total	
	DLCPI	U	DLCPI	U	DLCPI	U
Austria	*0.0016*	*0.0040*	-0.0072	0.0000	-0.0055	0.0040
Belgium	-0.0007	0.0050	-0.0045	0.0230	-0.0051	0.0280
Finland	-0.0080	0.1040	-0.0094	0.0210	-0.0174	0.1250
France	-0.0039	0.0150	*0.0013*	*0.0090*	-0.0026	0.0240
Germany	-0.0015	0.0150	-0.0020	0.0130	-0.0035	0.0280
Greece	*0.0099*	*0.0154*	-0.0258	0.0106	-0.0160	0.0260
Ireland	-0.0056	0.0160	*-0.0027*	*-0.0360*	*-0.0083*	*-0.0200*
Italy	*-0.0033*	*-0.0050*	-0.0008	0.0220	-0.0040	0.0170
Luxembourg	-0.0015	0.0040	-0.0045	0.0070	-0.0060	0.0110
The Netherlands	*0.0018*	*-0.0080*	-0.0017	0.0090	*0.0001*	*0.0010*
Portugal	*-0.0104*	*-0.0040*	-0.0049	0.0260	-0.0153	0.0220
Spain	-0.0041	0.0260	-0.0027	0.0210	-0.0068	0.0470

Note: 1. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.

Using the results in Table 25, sacrifice ratios can be computed for most countries (see Table 27). During the 6-year period surrounding 1993Q1, countries in the Euro Zone have experienced sacrifice ratios within a range from 0.7 to 9.3. There is no evidence of an unemployment sacrifice only in relation to Ireland and the Netherlands.

Table 27: Sacrifice Ratios Before and After 1993Q1

Country	SR during the 3 years Before 1993Q1	SR during the 3 years After 1993Q1	Total Sacrifice Ratio
Austria	*-2.45 (DLCPI↑, U↑)*	0.00	0.72
Belgium	7.69	5.13	5.45
Finland	13.00	2.23	7.17
France	3.86	*-6.86 (DLCPI↑, U↑)*	9.32
Germany	10.32	6.48	8.10
Greece	*-1.56 (DLCPI↑, U↑)*	0.41	1.63
Ireland	2.87	*-13.16 (DLCPI↓, U↓)*	*-2.41 (DLCPI↓, U↓)*
Italy	*-1.53 (DLCPI↓, U↓)*	28.83	4.22
Luxembourg	2.73	1.56	1.85
The Netherlands	*4.37 (DLCPI↑, U↓)*	5.30	*-7.63 (DLCPI↑, U↑)*
Portugal	*-0.38 (DLCPI↓, U↓)*	5.28	1.44
Spain	6.34	7.82	6.93

Notes: 1. Sacrifice ratio is computed as cumulative change in the unemployment rate divided by the cumulative change in inflation (change in CPI) (Signs reversed).

2. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.

Table 28 shows that the standard deviation of inflation has declined in all countries, and on average, the decline is by around 70 per cent. The standard deviation of unemployment has also declined in all countries except for Austria and Luxembourg, by around 48 per cent on average.

Table 28: Inflation and Unemployment Rate

Standard Deviation

Country	Inflation (Per cent)			Unemployment (Per cent)		
	Before EURO	After EURO	% Change	Before EURO	After EURO	% Change
Austria	0.50	0.24	-51.34	0.62	0.63	0.58
Belgium	0.67	0.30	-54.55	1.38	0.78	-43.31
Finland	0.88	0.33	-62.11	4.55	0.83	-81.79
France	0.98	0.24	-75.32	1.62	0.63	-61.06
Germany	0.54	0.24	-55.95	1.69	0.89	-47.48
Greece	1.51	0.32	-78.69	1.39	0.97	-30.65
Ireland	1.45	0.47	-67.86	2.54	0.53	-78.93
Italy	1.24	0.14	-88.49	1.88	1.34	-29.14
Luxembourg	0.77	0.29	-62.55	0.55	1.17	114.22
The Netherlands	0.52	0.31	-39.65	1.44	0.85	-41.37
Portugal	1.89	0.30	-84.06	1.62	1.50	-7.25
Spain	1.00	0.33	-66.74	2.74	1.28	-53.39
Average	1.00	0.29	-70.48	1.84	0.95	-48.30

5.3.2. Summary of Findings: Sub-sample 3

This sub-sample comprising the Eurozone Countries show that the correlation of inflation and unemployment has declined after Euro (after 1999), However, much of the weakening of this correlation has occurred between 1993-1998. Average inflation has declined significantly after Euro while average unemployment has also declined. However, there has been considerable disinflation during 1993-1998 associated with increased unemployment during the same period. Compared with 1993-1998, the post-Euro period marks employment gains which are higher than disinflation gains. Chow breakpoint tests reject trend breaks for inflation processes at the time of introducing the Euro. However, for several countries, introduction of the Euro has resulted in trend breaks in unemployment processes. Gradualism is evident throughout the pre-Euro period as well. Employment sacrifice as shown by the slope of the Phillips curve relationship has flattened significantly for most countries, and the sacrifice ratios show that around the time of introduction of the Euro, both inflation and unemployment have declined for almost all countries suggesting no employment sacrifice has been made. However, significant employment sacrifices have occurred in dinsinflationary episodes between 1990 and 1996, with sacrifice ratios around 0.7 to 9.3.

5.4. Sub-Sample 4: Non-Inflation Targeting Countries

This sample also serves as a comparator/control sample and includes Denmark, Russia, Japan, Switzerland, and the USA. However, it must be noted that the behaviour of inflation and unemployment varies significantly among these five countries, rendering aggregation/averaging probably meaningless. Therefore, whenever possible, individual countries in this sub-sample are analyzed separately. To facilitate comparison, the sample is divided into three time periods as 1979Q4-1992Q4, 1993Q1-1998Q4, and 1999Q1-2007Q1.

5.4.1. Measuring the Trade-off

a. Correlation between Inflation and Unemployment

Coefficients of correlation between inflation and unemployment for the three sub-periods are provided in Table 29. On average, coefficient of correlation has declined over time, but country experiences vary hugely.

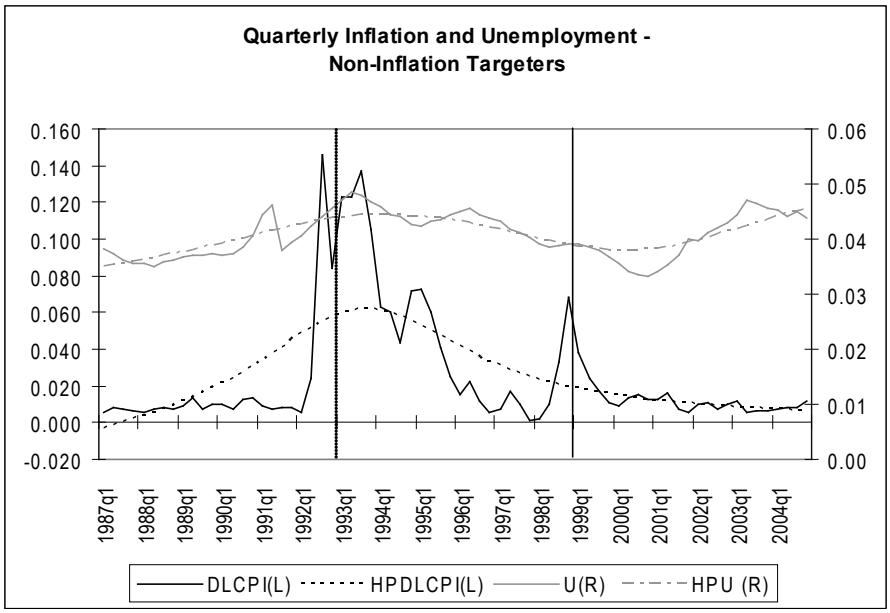
Table 29: Coefficients of Correlation : Inflation and Unemployment

Country	(1979-1992)	(1993-1998)	(1999-2007)
Denmark	0.0468	-0.2027	-0.2087
Japan	-0.5711	-0.0506	-0.1557
Russia	-	-0.8627	-0.0175
Switzerland	-0.0896	-0.1635	-0.1156
USA	-0.1029	0.4501	-0.2220
Average	-0.1792	-0.1659	-0.1439

Note: Russia's inflation Series begins in 1992Q2 and unemployment series in 1991Q3.

Aggregated inflation and unemployment for the countries in this sub-sample during the comparable 1987Q1-2004Q4 period are provided in Figure 5. There is no evidence of a trade-off between inflation and unemployment, but on the contrary the two series show a co-movement especially in the first two sub-periods.

Figure 5: Aggregated Data – Sub-sample 4

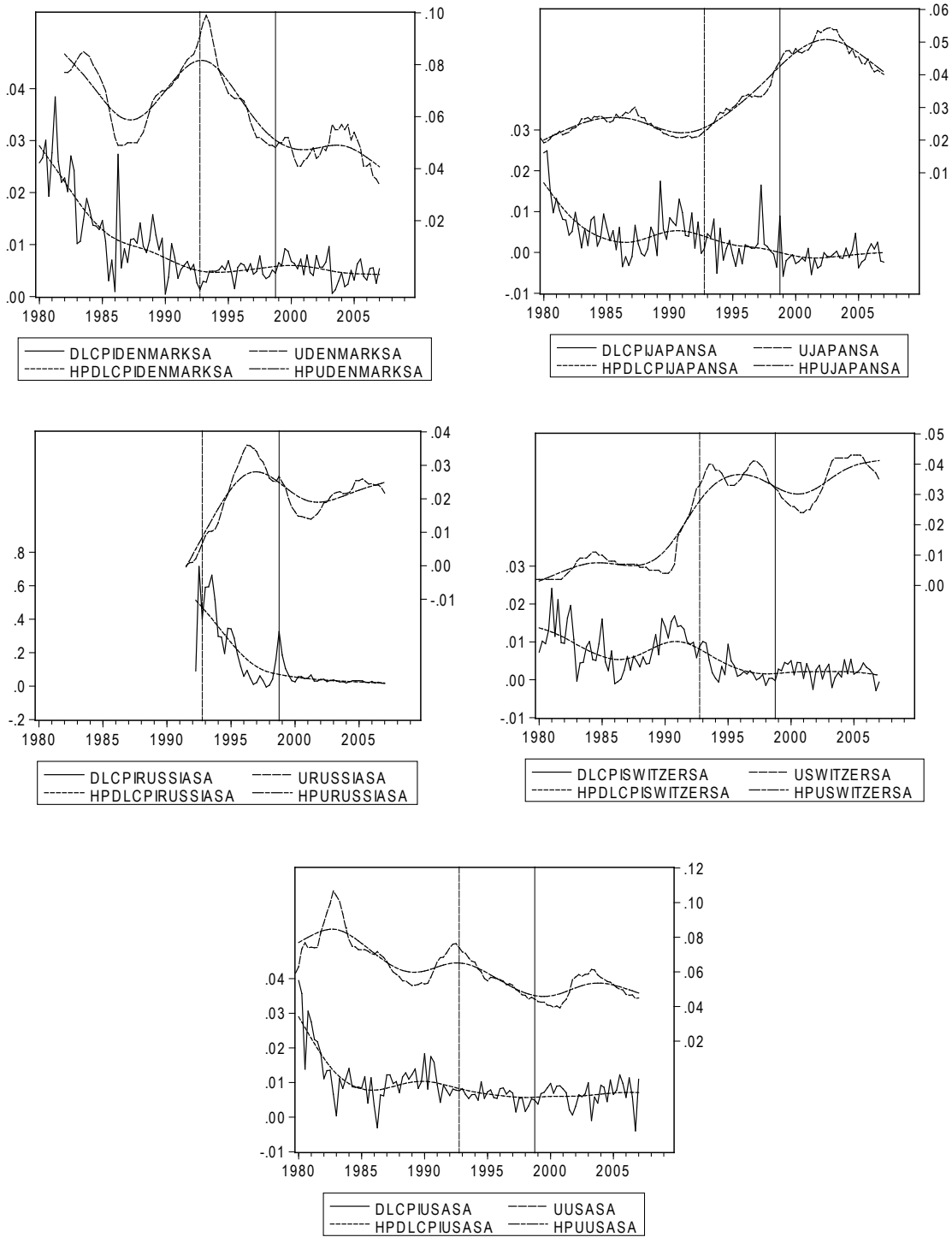


Notes:

1. *DLCPI* (Left axis) is the average inflation for the 5 countries in the sub-sample.
2. *U* (Right axis) is the average unemployment for the same 5 countries.
3. Russia's inflation Series begins in 1992Q2 and unemployment series in 1991Q3.

Since aggregation may result in perverse outcomes when country experiences significantly differ from each other, inflation and unemployment for each country is plotted in Figure 6. There has been a continuous decline in inflation in the first two sub-periods while inflation seems to have stabilized in the third sub-period. In Denmark and the USA, unemployment has declined since 1993, while in Japan, Russia and Switzerland, unemployment has increased during this period. A trade-off between inflation and unemployment is visible in the cases of Russia and Switzerland.

Figure 6: Inflation, Unemployment and their Trends



b. Structural Breaks in Inflation and Unemployment

Table 33 analyzes the changes in average inflation and unemployment in the three sub-periods. On average, inflation has declined by around 61.5 per cent (and around 60 basis points) within the first two sub-periods, while significant declines in inflation during 1999-2007 period have occurred only in Japan and Russia. The evidence on unemployment is not clear, but except for Japan, average unemployment has declined in all countries since 1999.

Table 30: Inflation and Unemployment Rate

Mean

Inflation (Per cent)						
Country	**1979-1992**	**1993-1998**	**% Change**	**1993-1998**	**1999-2007**	**% Change**
Denmark	1.32	0.49	-63.22	0.49	0.53	8.23
Japan	0.59	0.19	-67.55	0.19	-0.11	-158.68
Russia	-	-	-	22.00	4.02	-81.73
Switzerland	0.89	0.25	-71.93	0.25	0.23	-9.61
USA	1.20	0.61	-49.60	0.61	0.66	9.56
Average	1.00	0.39	-61.50	4.71	1.06	-77.38
Unemployment (Per cent)						
	1979-1992	**1993-1998**	**% Change**	**1993-1998**	**1999-2007**	**% Change**
Denmark	6.99	6.75	-3.32	6.75	4.74	-29.83
Japan	2.41	3.23	34.17	3.23	4.77	47.54
Russia	-	-	-	2.47	2.05	-17.02
Switzerland	0.88	3.67	316.78	3.67	3.44	-6.39
USA	7.13	5.57	-21.86	5.57	4.98	-10.68
Average	4.35	4.81	10.40	4.34	3.99	-7.96

Note: Russia's inflation Series begins in 1992Q2 and unemployment series in 1991Q3.

Results of the univariate autoregressive functions and Chow Breakpoint tests are provided below. Table 31 summarizes the findings for Chow Breakpoint tests with the null hypothesis of no structural break in 1993Q1 for the inflation processes. Accordingly, Japan and the USA show evidence of structural breaks in 1993Q1. Chow Breakpoint tests for unemployment processes for 1993Q1 (see Table 32) suggest structural breaks for Denmark and the USA.

Table 31: Chow Breakpoint Tests for Inflation Processes

Country	**Regression**				**Chow Breakpoint Test**		
	Sample	**Lag Length**	**Constant**	**Adj. R squared**	**Test for**	**F-Statistic [Prob.]**	**Log Likelihood Ratio [Prob.]**
Denmark	1980Q4-2007Q1	3	Yes	0.6045	1993Q1	0.4408 [0.7788]	1.8903 [0.7559]
Japan	1980Q3-2007Q1	2	Yes	0.2938	1993Q1	**3.4819 [0.0187]**	**10.5307 [0.0146]**
Russia	1992Q4-2007Q1	2	No	0.8398	1993Q1	-	-
Switzerland	1980Q4-2007Q1	3	No	0.5126	1993Q1	0.4970 [0.6852]	1.5687 [0.6665]
USA	1980Q3-2007Q1	2	Yes	0.3727	1993Q1	**2.4177 [0.0707]**	**7.4207 [0.0596]**

Table 32: Chow Breakpoint Tests for Unemployment Processes

Country	Regression					Chow Breakpoint Test	
	Sample	Lag Length	Constant	Adj. R squared	Test for	F-Statistic [Prob.]	Log Likelihood Ratio [Prob.]
Denmark	1982Q3-2007Q1	2	No	0.9763	1993Q1	**7.9678 [0.0006]**	**15.3522 [0.0005]**
Japan	1980Q2-2007Q1	2	No	0.9892	1993Q1	0.8539 [0.4287]	1.7592 [0.4150]
Russia	1992Q1-2007Q1	2	Yes	0.9851	1993Q1	0.5981 [0.6189]	1.9583 [0.5811]
Switzerland	1980Q3-2007Q1	3	Yes	0.9933	1993Q1	1.4418 [0.2259]	6.0585 [0.1948]
USA	1980Q2-2007Q1	2	Yes	0.9773	1993Q1	**2.6481 [0.0529]**	**8.1002 [0.0440]**

Tables 33 provides the results of Chow Breakpoint tests for the same univariate autoregressive functions with the test date of 1999Q1. The inflation process for Japan indicates a trend break in 1999Q1, while the date marks structural breaks for unemployment processes in Denmark, Japan, and Russia.

Table 33: Chow Breakpoint Tests for Inflation and Unemployment Processes

Country	Test for	For Inflation Process		For Unemployment Process	
		F-Statistic[Prob.]	Log Likelihood Ratio[Prob.]	F-Statistic[Prob.]	Log Likelihood Ratio[Prob.]
Denmark	1999Q1	0.2214 [0.9259]	0.9535 [0.9168]	**13.5634 [0.0007]**	**24.8670 [0.0000]**
Japan	1999Q1	**4.0377 [0.0093]**	**12.1197 [0.0070]**	**2.4582 [0.0905]**	**4.9885 [0.0826]**
Russia	1999Q1	1.4710 [0.2387]	3.0769 [0.2147]	2.0114 [0.1230]	**6.3503 [0.0958]**
Switzerland	1999Q1	0.4440 [0.7220]	1.4027 [0.7049]	0.7323 [0.5720]	3.1201 [0.5379]
USA	1999Q1	1.4559 [0.2311]	4.5299 [0.2096]	0.5894 [0.6233]	1.8562 [0.6028]

c. Costs of Disinflation

Table 34 summarizes the findings from the Inflation-Unemployment scatter plots for tfive countries in the sub-sample. Before/After ratios for the slope are computed for the episodes with a trade-off. The trade-off has lessened from 1979-1992 to 1993-1998 only for Japan, and from 1993-1998 to 1999-2007 only for Russia and Switzerland.

Table 34: Slope of Linear Regression Line of the Inflation-Unemployment Scatter Plot

Country	Before 1993 (1979-1992)	After 1993 (1993-1998)	Before/After Ratio	Before 1999 (1993-1998)	After 1999 (1999-2007)	Before/After Ratio
Denmark	*0.0024*	-0.0173		*-0.0173*	-0.0746	0.23
Japan	-1.1661	-0.0445	26.20	-0.0445	-0.0788	0.56
Russia	-	-19.8060		-19.8060	-0.1398	141.67
Switzerland	-0.0674	-0.1815	0.37	*-0.1815*	-0.0353	5.14
USA	-0.0584	*0.1119*		*0.1119*	-0.1110	

Notes: 1. Scenarios where there is no trade-off are italicized.

Sacrifice ratios for possible episodes of disinflation are computed using changes in inflation and unemployment. Table 35 investigates the changes in inflation and unemployment around 1993Q1, the median quarter of the pioneering inflation targeters adopting Inflation targeting. During the 3-year period prior to 1993Q1, inflation has declined in all countries accompanied by increased unemployment. During the three years after 1993Q1, inflation has declined in all countries except for Denmark. In the USA, the decline in inflation has occurred with declining unemployment. Overall, there appears to be a trade-off between inflation and unemployment around 1993Q1 (except for Denmark).

Table 35: Cumulative Changes in Inflation and Unemployment Around 1993Q1

Country	During the 3 years Before 1993Q1		During the 3 years After 1993Q1		Total	
	DLCPI	U	DLCPI	U	DLCPI	U
Denmark	-0.0099	0.0210	*0.0043*	*-0.0240*	*-0.0056*	*-0.0030*
Japan	-0.0023	0.0009	-0.0037	0.0107	-0.0060	0.0116
Russia			-0.2874	0.0253	-0.2847	0.0253
Switzerland	-0.0073	0.0290	-0.0079	0.0010	-0.0152	0.0300
USA	-0.0026	0.0205	*-0.0022*	*-0.0184*	-0.0048	0.0021

Notes: 1. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.

Table 36 presents the sacrifice ratios for each country for the possible periods of disinflation. During the 6-year period surrounding 1993Q1, the countries in this sub-sample have experienced sacrifice ratios within a range of 0.09 to 7.87.

Table 36: Sacrifice Ratios Around 1993Q1

Country	SR during the 3 years Before 1993Q1	SR during the 3 years After 1993Q1	Total Sacrifice Ratio
Denmark	2.13	*5.63 (DLCPI↑, U↓)*	*-0.53 (DLCPI↓, U↓)*
Japan	0.39	2.90	1.93
Russia	-	0.09	0.09
Switzerland	3.97	0.13	1.98
USA	7.87	*-8.43 (DLCPI↓, U↓)*	0.44

Notes: 1. Sacrifice ratio is computed as cumulative change in the unemployment rate divided by the cumulative change in inflation (change in CPI) (Signs reversed).
2. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.
3. Slovak Republic's and Turkey's after IT sample has only 9 and 4 observation sets, respectively.

Table 37 displays the cumulative changes in inflation and unemployment during the 3-year periods around 1999Q1, the quarter in which the Euro was introduced. Although all countries except for Japan have experienced falling inflation, it has been associated with falling unemployment as well, indicating that there has been no employment sacrifice in these episodes of disinflation. Table 38 computes the sacrifice ratios using the data given in Table 37

Table 37: Cumulative Changes in Inflation and Unemployment around 1999Q1

Country	During the 3 years Before 1999Q1		During the 3 years After 1999Q1		Total	
	DLCPI	U	DLCPI	U	DLCPI	U
Denmark	*-0.0011*	*-0.0190*	-0.0005	0.0000	*-0.0016*	*-0.0190*
Japan	*0.0117*	*0.0107*	-0.0127	0.0094	-0.0011	0.0201
Russia	*0.2074*	*-0.0052*	*-0.2950*	*-0.0112*	*-0.0876*	*-0.0164*
Switzerland	*-0.0012*	*-0.0020*	*-0.0023*	*-0.0050*	*-0.0034*	*-0.0070*
USA	*-0.0005*	*-0.0114*	-0.0043	0.0111	*-0.0048*	*-0.0003*

Notes: 1. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.

Table 38: Sacrifice Ratios around 1999Q1

Country	SR during the 3 years Before 1999Q1	SR during the 3 years After 1999Q1	Total Sacrifice Ratio
Denmark	-17.48 *(DLCPI↓, U↓)*	0.00	-12.21 *(DLCPI↓, U↓)*
Japan	-0.92 *(DLCPI↑, U↓)*	0.74	18.89
Russia	0.03 *(DLCPI↑, U↓)*	-0.04 *(DLCPI↓, U↓)*	-0.19 *(DLCPI↓, U↓)*
Switzerland	-1.73 *(DLCPI↓, U↓)*	-2.20 *(DLCPI↓, U↓)*	-2.04 *(DLCPI↓, U↓)*
USA	-22.89 *(DLCPI↓, U↓)*	2.59	-0.06 *(DLCPI↓, U↓)*

Notes: 1. Sacrifice ratio is computed as cumulative change in the unemployment rate divided by the cumulative change in inflation (change in CPI) (Signs reversed).

2. Counter-intuitive results (episodes where inflation and unemployment both falling, or inflation rising) are italicized.

5.4.2. Summary of Findings: Sub-sample 4

For the non-Inflation targeting, non-Eurozone Countries, the correlation between inflation and unemployment is negative, but has not changed much over time. There have been significant declines in inflation, but lower declines in unemployment. The employment sacrifice, as shown by the inflation-unemployment scatter plots has flattened over time for most countries, indicating lower employment sacrifice. Sacrifice ratios display that there has been substantial employment sacrifices during 1990-1996 period, but not so around 1999.

6. Summary and Conclusions

The preceding analysis attempts to capture any changes to inflation and unemployment processes that have occurred as a result of Inflation targeting. The study uses four sub-samples over the period from 1980 to 2007: two samples of explicit Inflation targeting and the other two being non-Inflation targeting (at least explicitly) samples.

The study conducts time-series analyses within each of the first two sub-samples (inflation targeters – industrial countries and inflation targeters – emerging market countries) to identify changes to the patterns of inflation and unemployment resulting from Inflation targeting. However, since such changes could be common to non-Inflation targeting countries as well, the control/comparator sub-samples are subjected to a similar analysis. The first comparator sub-sample comprises the countries in the Euro Zone. The second comparator sub-sample consists of five diverse non-Inflation targeting countries that do not belong to the Euro Zone. The Euro Zone countries are analysed to see whether the changes following the creation of the Euro (1999Q1) are similar to those experienced by Inflation targeting countries at the time of adopting Inflation targeting. Also, another date, namely 1993Q1 is identified as the median date of which the pioneering Inflation targeting countries adopted Inflation targeting as their monetary policy framework. The Euro Zone countries are then tested to see whether 1993Q1 marks changes in inflation and unemployment similar to the countries in the

first two sub-samples during the time of adopting Inflation targeting. The fourth sub-sample is investigated to identify similar patterns in inflation and unemployment both in 1993Q1 as well as in 1999Q1.

Some general observations are as follows:

1. The negative correlation between inflation and unemployment has generally lessened over time, suggesting a weakening of the inflation-unemployment trade-off. This is probably because of the higher focus on inflation stabilisation and lower emphasis on employment stabilisation by most central banks, which fixes inflation at a certain level with small boundaries, yet employment is allowed to move in a broader range.
2. The introduction of Inflation targeting or the Euro has not resulted in sudden changes to inflation processes in countries. Countries have generally preferred a gradualist approach in changes to monetary policy frameworks. However, there is a significant trend-break in unemployment patterns following the introduction of the Euro in Eurozone countries.
3. Recent declines in inflation have not resulted in significant increases in unemployment in general. However, around the periods of disinflation, there have been employment sacrifices. Also, in emerging market countries, there appears to be an increasing trend in unemployment under inflation targeting, possibly due to the fact that these countries are attempting to maintain a too-low rate of inflation driving unemployment above the natural level.

Although arriving at strict conclusions is difficult, there are indications that employment sacrifices have declined following inflation targeting especially in developed economies. The experience of some Eurozone economies as well as emerging market inflation targeters shows that maintaining low and stable inflation could lead to adverse unemployment outcomes. Whether slightly higher inflation targets might produce more favourable outcomes, needs further investigation.

For those economies that are yet to disinflate and adopt inflation targeting or similar monetary policy strategies that help maintain low and stable inflation, areas of further research include; the choice of the inflation target considering output and employment outcomes; the impact of the speed of disinflation, given that gradualism is the most common trend in monetary policy regimes switches; the importance of credibility of monetary policy as the probable key to reducing employment sacrifices arising from disinflationary efforts; and, quantifying the long-term benefits of disinflation as they may well offset the short-term costs associated with it.

The broader message of this paper is that in the quest for a viable institutional framework to maintain low inflation and stable price levels, there is a need to convince the public that such an exercise is not costless in terms of output and employment losses as evidenced by the experiences of the other countries. Also, authorities should attempt to minimise these costs by considering the impact of gradualism, the effect of greater policy credibility, and the need to identify the appropriate explicit or implicit inflation and employment targets to suit the particular economy.

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