Has Inflation Targeting Been Effective?

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ABSTRACT

Inflation targeting has been conducted in many countries, with the number increasing rapidly since the beginning of the 1990s. The pros and cons of adopting this policy have received much attention. Generally, countries that have conducted inflation targeting have experienced good economic performance. Policymakers have become increasingly concerned with inflation stabilization. The increased focus on inflation stabilization has contributed to lowering inflation rates from the high rates experienced in the 1970s and 1980s. This paper has two purposes. First, it will analyze why countries adopt inflation targeting. This paper shows that the openness of the economy, the fiscal surplus, and the central bank's independence correlate negatively with the adoption of inflation targeting. Past inflation is not a motive for the introduction of inflation targeting. It will also evaluate the costs of inflation stabilization between targeting and nontargeting cases, in particular to determine the sacrifice ratio, which declines during inflation targeting periods.

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I.   INTRODUCTION

Since the 1990s, about 30 countries have adopted inflation targeting as their framework for the conduct of monetary policy. Countries that have adopted inflation targeting have generally shown good economic performance, including low inflation and stable economic growth.

Price stability is one of the most important assignments for policymakers, especially those in central banks, regardless of whether or not inflation targeting is adopted. Several instruments, including inflation targeting, monetary targeting, and exchange rate targeting, are employed to achieve price stability in many countries worldwide. Among these tools, inflation targeting has been used recently. Since the 1990s, policymakers have become increasingly concerned with inflation stabilization. The increased focus on inflation stabilization has contributed to the reduction of inflation rates from the high rates experienced in the 1970s and 1980s. This paper discusses why countries adopt inflation targeting and how they have attained economic performance by introducing inflation targeting.

Section II explains recent trends and innovations in inflation targeting. Section III presents a theoretical view and an empirical method for the examination of why inflation targeting has been introduced. Section IV shows the empirical results and analyzes them. Section V analyzes whether the introduction of inflation targeting has reduced the costs of inflation stabilization, the accumulated output loss due to a reduction in inflation. Finally, this paper ends with a brief summary.

II.   WHAT IS INFLATION TARGETING?

In general, inflation targeting is a policy by which central banks publicly set the target rate for inflation; monetary policy is then carried out according to this target (Fountas et al., 2002; Kurihara, 2003).

It has not been long since inflation targeting was first adopted as a monetary strategy. The United States has not yet adopted inflation targeting, although the US Congress has considered it, especially in 2002. The Bank of Japan also does not have a policy of inflation targeting. The ECB does not admit the existence of inflation. However, inflation targeting might be substantially adopted.

With inflation targeting, central banks are responsible for achieving a publicly announced objective for the inflation rate. Recently, about 30 central banks all over the world adopted this framework for the conduct of monetary policy, which has proven effective in most cases (Svensson et al., 2005). Mishkin (2001) noted that countries that practice inflation targeting have attained a significant reduction in both the rate of inflation and inflation expectations beyond that which would likely have occurred in the absence of inflation targeting.

Many other benefits can be obtained from the introduction of inflation targeting. First, the realization of the central bank's goal of price stability might not be judged accurately in the absence of clear standards. By introducing targeting, markets can accurately judge the performance of central banks. Second, clarification and increased transparency of central banks' goals guarantees accountability for the target and independence from the government. Third, this approach confers stability of the expected inflation rate. Targeting locks in expectations of low inflation, which reduces

the inflationary impact of macroeconomic shocks (Svensson, 1997).[1] Finally, inflation in countries that have introduced the policy has been reduced as mentioned before.

On the other hand, many critical perspectives have been presented. First, because controlling inflation using money supply growth or exchange rate may be less effective, trust in a commitment to inflation targeting may be unstable. Second, if market participants believe and credit the target, there is some possibility of increases in long-term interest rates, for example. Third, targeting may be attained at the sacrifice of other important economic factors. Fourth, suitable inflation (CPI or PPI, for example) cannot be easily decided. Finally, since the 1990s, because market authorities have no effective measures against deflation, the introduction of inflation targeting may impact the success of other policies. Moreover, there are few previous cases in which a central bank introduced inflation targeting during deflation.

III.   THEORETICAL BACKGROUND AND EMPIRICAL METHOD

A.   Theoretical Background

It is important to investigate whether structural differences exist between countries that employ inflation targeting and those that pursue other policy frameworks. To explore these potential differences, this paper uses a probit model in which the dependent variable is a dummy that uses the value of one for those countries that use inflation targeting and zero for those that do not. This analysis uses four variables, shown below, to judge which factors affect the probability that inflation targeting policies are adopted.

- *Past inflation:* Past inflation may have positive correlation with adoption of inflation targeting and seems to be one of the incentives to introduce inflation targeting.
- *Openness of the economy:* Inflation is affected by many factors both from abroad and domestically. Countries that are affected by external factors may not see any merit in the adoption of inflation targeting. Also, if the real exchange rate depreciates, for example, the economy becomes more open, the depreciation as an effect of rising import prices becomes more harmful. In such a case, policymakers have a disincentive to allow inflation. For policymakers, it would be better if the inflation rate were more flexible. Making the rate of inflation flexible allows the exchange rate to change in a desirable direction. However, when the inflation rate is high, it is unclear whether or not this concept is applicable. The answer depends on the econometric analysis in this paper.
- *Central bank independence*: Price stability is the ultimate goal of almost all central banks. If inflation targeting is conducted under such circumstances, other strategies often arise because of political reasons. In such cases, the independence of central banks may be compromised. In fact, this threat to independence is the reason that measures other than inflation targeting are used. The central bank independence variable functions as a negative coefficient for inflation targeting.
- *Fiscal surplus*: Inflation targeting is effective in maintaining fiscal discipline, which is considered important for sound economic growth. It is therefore assumed that a negative influence affects inflation targeting.

The equation is estimated is as follows:

$$\text{Inflation Targeting} = \alpha \text{ Past inflation} + \beta \text{ Openness of the economy} \\ + \gamma \text{ Independence} + \eta \text{ Fiscal surplus} \qquad (1)$$

B.   Data and Empirical Method

This study uses the consumer price index (CPI) for inflation rate. The ratio of the amount of trade volume (export plus import) to the GDP is used for openness of the economy in equation (1). Also in the equation, the central bank's independence index is from Cukierman et al. (2002).

The sample includes all members of the OECD as of 1985 except Luxembourg. Fifteen of the OECD countries in the sample have adopted inflation targeting (date of adoption shown in parentheses): Australia (1994:Q4), Canada (1992:Q1), Finland (1994:Q1), Hungary (2002:Q1), Iceland (2001:Q1), Korea (1998:Q1), Mexico (1999:Q1), New Zealand (1990:Q3), Norway (2001:Q1), Poland (1998:Q1), Spain (1994:Q1), Sweden (1993:Q1),[2] Switzerland (2000:Q1), Turkey (2003:Q1), and the United Kingdom (1993:Q1).[3] For each country, we define the beginning of targeting as the first full quarter after the target was publicly announced and in which a specific inflation target or target range was in effect and compare inflation "targeters" to the other "nontargeters." The sample period ends with the recent 2007: Q4. Finally, all of the dates are I (0).[4]

IV.   RESULTS AND IMPLICATIONS

A.   Deterministic Elements of Inflation Targeting

The result is almost as expected. The result of equation (1) is as follows:

Inflation Targeting = - 19.43 +   1.40Past inflation - 0.08Openness - 0.42Independence
                      (-28.62)   (1.00)   (-18.73)   (-10.50)
                        - 2.84Fiscal surplus
                        (-6.28)
adj. R2: 0.77; F-statistic: 145.51

The results show that the openness of the economy, the central bank's independence, and the fiscal surplus correlate negatively with adoption of inflation targeting.

The coefficient of past inflation is positive as expected; however, it is not significant. Recently, because the inflation rate all over the world has not been high, there may be little incentive to introduce inflation targeting, especially for OECD countries. The coefficient of openness of the economy against inflation targeting is negative and significant. Economic activity has been globalizing and its effect appears in the result. The independence of central banks exerts a negative influence on the adoption of inflation targeting. The coefficient of fiscal surplus is also negative, as expected.

B.   Outcome of Adopting Inflation Targeting

Is inflation targeting effective? The results are interesting and contain some important information. We estimate this by the equation (2):

$$\text{Inflation} - \text{Inflation average} = \alpha + \beta \text{ Targeting} + \gamma \text{ Inflation average} \qquad (2)$$

where inflation average is an average for the whole period. The result is as follows:

Inflation – Inflation average = 0.33   - 1.08 Targeting + 0.10 Inflation average
                                     (1.24) (-7.95)   (3.46)
adj. R2: 0.63; F-statistic: 120.74

     The result is clear. The regression shows that the inflation targeting effect is negative and statistically significant, which is a positive finding. Inflation targeting has not been introduced as a result of past inflation rates; however, it reduces the inflation rate, which indicates that not only the inflation rate itself but also other factors should be considered.

     Finally, standard deviations are shown in Table 1, which shows that the estimates in the inflation targeting period are smaller than the ones in the pre-targeting period. Also, targeting countries' rates are smaller than those in non-targeting countries.

Table 1
Standard deviation of inflation rate

	Before	After
Inflation-targeting Countries	3.34	1.72
Non-inflation Targeting Countries	2.33	

V.   MEASURING THE SACRIFICE RATIO

A.   Model Properties

The sacrifice ratio can be used as a proxy of the relative success of economic policies. A reduction of the sacrifice ratio could be a result of improved policy credibility for inflation targeting. An important question of this paper is whether the introduction of inflation targeting has reduced the costs of inflation stabilization.

     Traditional studies of the sacrifice ratio proceeded by estimating a Phillips curve (Okun, 1978; Gordon, 1982). In later studies, sacrifice ratios have been estimates by using VAR models. Our method has most in common with Cecchetti and Rich (2001).[5]

     Sacrifice ratios have received much attention because of deflation in most developed countries. Andersen and Wascher (1999) showed that the empirical evidence suggested that inflation for the 19 countries has fallen 8% to 3.5% and the average sacrifice ratio has increased from about 1.5% to about 2.5%. Cunado (2003) suggested that the sacrifice ratio takes higher values in periods of low inflation rates. Zhang

(2005) found a negative relationship between sacrifice ratios and initial inflation rates, and the cost of reducing inflation is generally lower when the speed of disinflation is faster. Christopher and Christopher (1997) showed that the loss of output from a disinflation-induced recession typically will be recouped in 10 to 15 years. Goncalves and Carvalho (2009) showed that inflation targeters suffered smaller output losses during deflation when compared to nontargeters. Chortareas et al. (2003) found that a higher degree of central bank transparency is associated with lower sacrifice ratios. Down (2004) showed that central bank independence affects both output and the unemployment costs of disinflation. Hetzel (2007) and Bowdler (2009) investigated the Phillips curve slope and found that sacrifice ratios are weakly and negatively related to openness. Daniels (2005) suggested that greater openness raises the sacrifice ratio but reduces inflation bias.

As mentioned in the theoretical analysis, the loss function of central banks can be expressed in equation (3):

$$L = \left(\pi_t - \pi_{nt}{}^*\right)^2 + \lambda\left(y^t - y^*\right)^2 \tag{3}$$

where π is an inflation rate. $\pi_{nt}{}^*$ is a newly announced inflation targeting rate. It is assumed that agents believe that inflation will equal the newly announced inflation target with probability α and the old inflation target $\pi_{Ot}{}^*$ with probability $(1-\alpha)$.[6] α is thought to be a credibility parameter. y is an output (log of GDP), y^* is a potential output (log of its value), and $y^t - y^*$ means GDP gap. Central banks would like to minimize this loss function. The expectations-augmented Phillips curve is given by equation (4):

$$\pi_t = \alpha\pi_{nt}{}^* + \left(1-\alpha\right)\pi_{Ot}{}^* + \gamma\left(y^t - y^*\right) \tag{4}$$

The first-order condition is given by (5):

$$\left(y^t - y^*\right) = -\gamma\left(1-\alpha\right)\left(\pi_{Ot}{}^* - \pi_{nt}{}^*\right)\left(\gamma^2 + \lambda\right) \tag{5}$$

The left side of (5) measures the output loss. The loss is determined by the degree of nominal inertia and the weight on the output gap in the loss function and credibility, in addition to the size of the reduction in the inflation target. The higher the credibility achieved by the new inflation target, the lower the output loss. With perfect credibility, the output loss is zero. The output loss declines in weight with output gap stabilization.

This paper's empirical method allows us to measure the sacrifice ratio as the costs of a deliberate disinflation policy in contrast to, for example, the output costs of a series of negative cost push shocks. To derive our sacrifice ratio estimates, we employ VAR (vector autoregressive) model for both mentioned time periods. VAR models can identify the interest rate reaction function that has been pursued over the periods.

The sacrifice ratio measures the cumulative output loss under disinflation for each percentage point reduction in the inflation rate, formally as in equation (6):

$$\text{Sacrifice Ratio} = \sum \delta^{s-to} E_{to} \frac{Y_{t0+s} - Y^*_{t0+s}}{Y^*_{t0+s}} / p \qquad (6)$$

where to is the start point of the disinflation period, Et is the expectations operator conditional on information at time t, δ is the discount actor, Y is the actual production, Y^* is the potential production, and p is the change in the inflation rate over the period. The ratio is calculated by taking the cost of lost production and dividing it by the percentage change in inflation; the quotient gives the loss of output per 1% change in inflation.

Keynesian theory tells us that prices are determined in a staggered manner and fixed for a certain period. Price-setters are concerned with how prices are expected to rise and fall and thus with future monetary policy. If the formation of rational expectation plays an important role in price-setting, the degree of policy credibility may influence the sacrifice ratio. Under rational expectations and costly price adjustments, imperfect credibility is a crucial element in accounting for a positive sacrifice ratio.

Note that monetary policy credibility is enhanced under inflation targeting. What implications might this have for the conduct of monetary policy? According to the standard credibility arguments, commitment to a desired policy rule will enhance welfare if the public views the commitment as credible. Non-credible commitment to a desired rule could reduce welfare even when the actual policy loses public credibility.

B.   Sacrifice Ratio Estimates

The endogenous variables in this paper's models are aggregate economic activity, the logarithm of seasonally adjusted CPI, the short-term nominal interest rate, and the change in the nominal effective exchange rate. For the output gap, we calculate the Hodrick-Prescott detrended series of the logarithm of real GDP. The length of the endogenous variables was chosen with the few observations available under inflation targeting period. Akaike information criteria (AIC) were computed for a length up to six quarters for the two quarters. We allow for a constant term in all equations. All data are from IFS (IMF).

VAR models are employed as these impose only a minimum of restrictions on the analysis of monetary policy. The starting point is 1980:Q1. Then the sacrifice ratios are estimated for the individual countries by Monte Carlo simulation of estimated VARs with 1000 replications. Estimates for both pre-inflation targeting and the inflation targeting period are reported with standard errors in parentheses. The results are shown in Table 2.

Estimates of the sacrifice ratio decline for most countries during inflation targeting periods.[7] This tendency is most marked for Canada and Norway. Some countries saw a rise in the sacrifice ratios. These countries experienced relatively low sacrifice ratios.

Table 2
Sacrifice ratio estimates (mean percentage)

	Starting period	Pre-inflation Targeting Period	Inflation Targeting Period
Australia	1994:Q4	2.43	0.12
		(5.78)	(4.99)
Canada	1992:Q1	1.66	-0.55
		(1.89)	(2.99)
Finland	1994:Q1	-0.05	-0.56
		(0.33)	(3.28)
Korea	1998:Q1	1.05	-1.55
		(6.77)	(3.53)
Norway	2001:Q1	0.36	0.04
		(4.98)	(4.88)
Spain	1994:Q1	5.33	1.98
		(8.24)	(4.67)
Sweden	1993:Q1	-0.44	-0.32
		(9.54)	(12.92)
Switzerland	2000:Q1	0.15	-0.22
		(7.08)	(10.12)
United Kingdom	1993:Q1	0.55	0.68
		(2.88)	(5.02)

C.   Impulse Response to Interest Rates

The properties of this model may be studied by examining the response of a variable to a particular shock to the model.[8] As this analysis focuses on the effect of monetary policy in inflation, the shock to the short-term interest rate is of interest for the purpose of evaluating and providing an explanation of the properties of this model. The responses to this shock will indicate the extent to which the models produce the expected effects, in view of economic theory, to changes in monetary policy. The effects on CPI inflation and output gaps of a one standard error interest rate shock are shown for both periods in Figure 1-3.[9] The figures included are compiled from Australia, Canada, and Finland. Other countries figures are omitted due to page restrictions. However they resemble the figures of the fore- mentioned three countries.

The effects of interest rate on inflation and output gap are less clear; however, the results correspond with those from Table 2. The results do not appear puzzling.

Table 3 shows the standard deviation of annual growth rate. The table shows that targeting countries have enjoyed good performance.

Table 3
Standard deviation of annual growth rate

	Before	After
Inflation-targeting countries	2.04	1.44
Non-inflation targeting countries	1.62	

Figure 1(a)

Impulse-response functions: the pre inflation targeting period: Australia

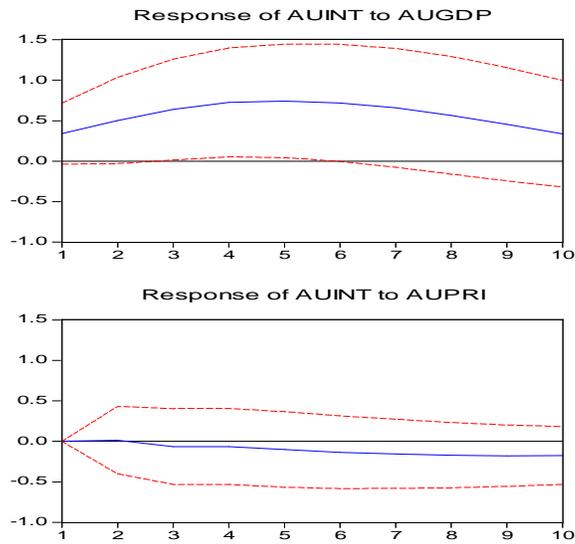Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of AUINT to AUGDP

Response of AUINT to AUPRI

Figure 1(b)

Impulse-response functions: the inflation targeting period: Australia
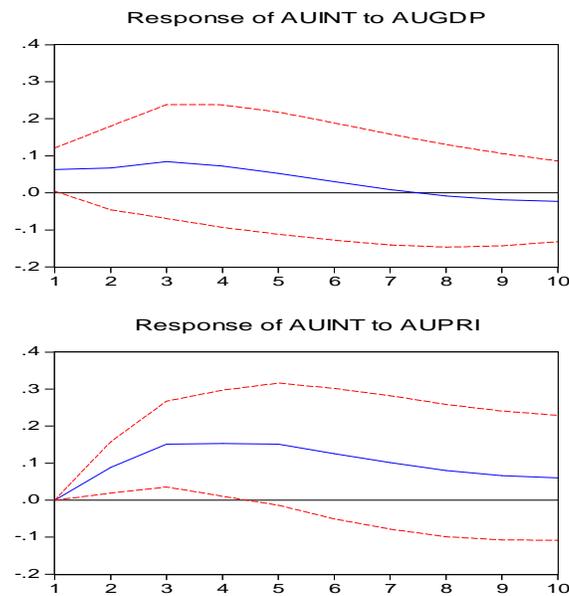
Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of AUINT to AUGDP

Response of AUINT to AUPRI

Figure 2(a)
Impulse-response functions: the pre inflation targeting period: Canada

Response to Cholesky One S.D. Innovations ± 2 S.E.
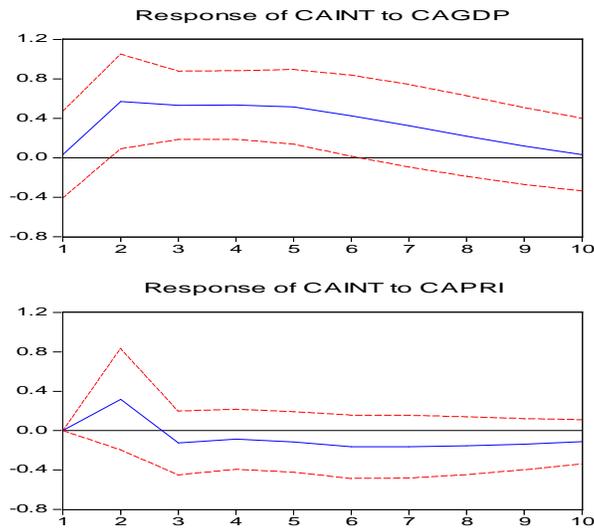
Response of CAINT to CAGDP

Response of CAINT to CAPRI

Figure 2(b)
Impulse-response functions: the inflation targeting period: Canada

Response to Cholesky One S.D. Innovations ± 2 S.E.
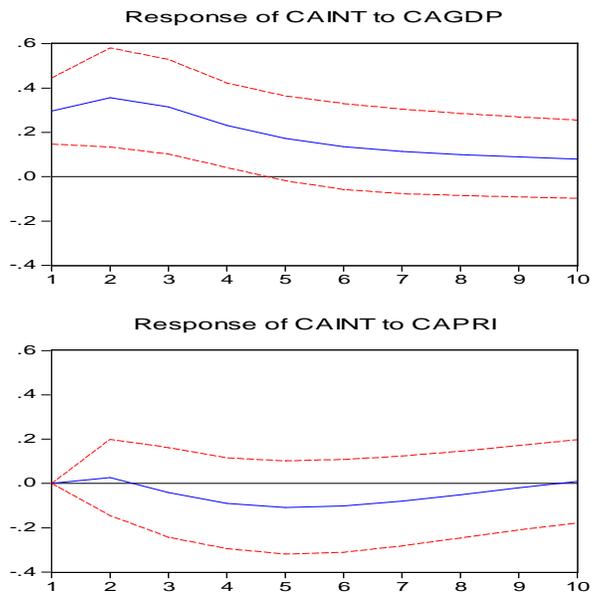
Response of CAINT to CAGDP

Response of CAINT to CAPRI

Figure 3(a)
Impulse-response functions: pre inflation targeting period: Finland
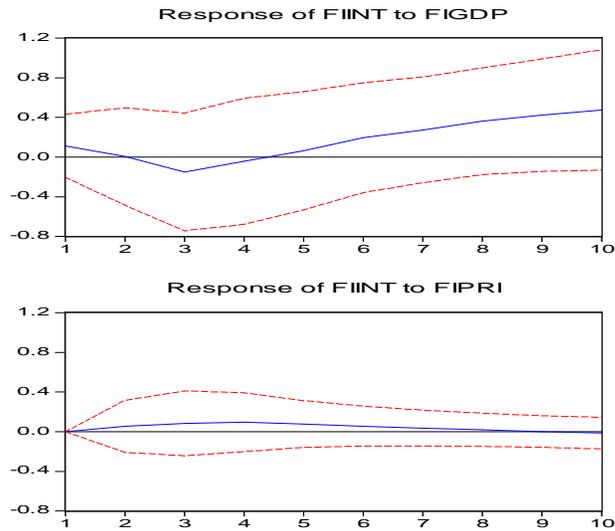

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of FIINT to FIGDP

Response of FIINT to FIPRI

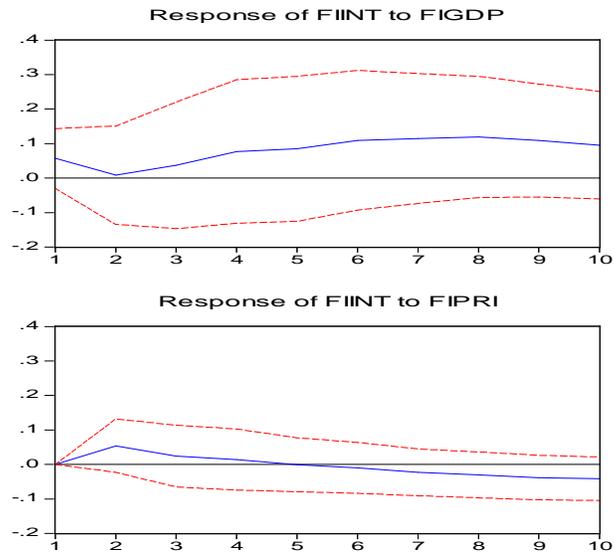**Figure 3(b)**
Impulse-response functions: inflation targeting period: Finland

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of FIINT to FIGDP

Response of FIINT to FIPRI

One should keep in mind that the sacrifice ratios are imprecisely estimated. The uncertainty is in part due to the use of only a minimum of exclusion restrictions from economic theory in the models. Also, although the sample of countries is small and the time series are short, we nevertheless interpret our findings as supportive of a credibility-enhancing effect of inflation targeting.

IV.   CONCLUSIONS

This analysis confirms that the openness of the economy, independence of the central bank, and fiscal surplus are negative factors in inflation targeting. However, past inflation is not a factor in the introduction of inflation targeting.

The 1990s were amazing in many ways. Growth was higher, inflation was lower, and both were stable. That situation may have influenced the finding that inflation rates have not affected the deterministic elements of the introduction of inflation targeting.

This paper also showed that targeting countries have successfully introduced inflation targeting in terms of reducing inflation rates and reducing economic shocks. This paper provides some evidence in favor of an affirmative answer to this question. The sacrifice ratio has declined for the inflation-targeting countries. However, whether or not targeting improves a country's economic performance as a whole is a different issue. Growth, for example, is a typical case. Interest rates, exchange rates, and stock prices and their variability are sometimes important factors in determining economic performance and welfare. The relationship between central bank independence and sacrifice ratio, and between openness of the economy and sacrifice ratio leaves discussion (Cukierman, 2002). The sample of countries is small and the time span is short. Much further research is needed to investigate the degree of robustness of these findings.

ENDNOTES

1. Bernanke et al. (1999) showed that not only inflation rate but also its standard deviation have been more stable in recent decades in the U.K.
2. Sweden announced in January 1993 that it aimed to limit the annual increase in the CPI beginning in 1995 to 2%.
3. Most countries in Europe were part of the European Monetary System (EMS), and their monetary policies focused on meeting convergence criteria, including inflation rates and fixing exchange rates. However, some countries followed policies based on money supply targets.
4. The ADF test for unit root test was performed for all the variables (rates). They are significant at least 5% level.
5. Durand et al. (2008) used structural VAR and found that it displayed a negative relationship between the level of inflation and the cost of disinflation.
6. See Roste (2008) for an example.
7. Jordan (1997), Corbo et al. (2001), and Johnson and Gerlich (2002) produced similar results. The estimates of Norway are low. Centinkaya et al. (2002) showed that disinflation in Turkey is not characterized by huge losses in output and affected by positive supply shocks. Hofstetter (2008) found large sacrifice ratios for the 1970s and 1980s in Latin America and the Caribbean.

8. Ball (1994) and Jordan (1997) analyzed sacrifice ratios emphasizing on-demand management policies.
9. The other countries figures can be sent on request (kurihara@vega.aichi-u.ac.jp).

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