

# Has the Adoption of Inflation Targeting Been Effective All over the World?\*

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## Abstract

Inflation targeting has been adopted all over the world since the 1990s. Much attention has been paid to the pros and cons of adopting this policy. Countries that performed inflation targeting received good economic performances. Since the 1990s, central banks have become increasingly concerned with inflation stabilization. However, more focus should be put on output stabilization. This paper has two purposes: (1) To compare the targeting to nontargeting countries in inflation and output. (2) To evaluate the costs of inflation stabilization, in particular reduced sacrifice ratio. This paper shows that countries that target inflation have successfully introduced the policy from the view of reducing inflation rates and reducing macroeconomic shocks empirically. Also, the sacrifice ratio declines for countries during inflation targeting period.

## 1. INTRODUCTION

About 30 countries have adopted inflation targeting. 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 points for central banks re-

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regardless of whether or not inflation targeting is adopted. Inflation targeting has been used recently in many countries. Since the 1990s, policy makers have become increasingly concerned with inflation stabilization.

Section 1 explains recent trends and innovations in inflation targeting. Section 2 analyzes one theoretical view and an empirical method for examining why inflation targeting has been introduced and how it has contributed to inflation. Section 3 performs empirical analyses. Section 4 analyzes whether the introduction of inflation targeting has reduced the costs of inflation stabilization, the accumulated output loss due to a permanent reduction in inflation. Finally, this paper ends with a brief summary.

## 2. ADOPTION OF INFLATION TARGETING

Inflation targeting is a practice in which central banks publicly set the target rate for inflation; monetary policy is then carried out according to this target (Fountas, Karanasos, and Kim, 2002).

The United States has not adopted it yet, although the US Congress discussed it, especially in 2002. The Bank of Japan also does not have a policy of inflation targeting. The ECB does not allow the existence of inflation: however, inflation targeting might be substantially adopted.

In inflation targeting, central banks are responsible for achieving an announced objective for the inflation rate. About 30 central banks adopted this framework for the conduct of monetary policy, and it has shown to be effective in most cases. Svensson and Woodford (2005) mentioned that countries that adopt inflation targeting seem to have attained a significant reduction in both the rate of inflation and inflation expectations.

Many 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. Second, showing central bank's goals and making them more transparent guarantees accountability for the target and independence from the government. Third, this approach gets stability of the expected inflation rate<sup>1</sup>. Finally, inflation in countries that have introduced the policy has been reduced.

On the other hand, many critical thinking have been presented. First, because controlling inflation using money supply growth or exchange rate may be less effective, the trust of 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. Finally, since the 1990s, because market authorities have no effective measures against deflation, introducing inflation targeting may impact the success of other policies. Moreover, there is no previous case in which a central bank introduced inflation targeting during deflation.

As Rotemberg and Woodford (1997) and Svensson (1999) mentioned, the loss function of central banks can be expressed as shown in equation (1):

$$L = (\pi_t - \pi_{new}^*)^2 + \lambda (y^t - y^*)^2 \quad (1)$$

$\pi$  is an inflation rate,  $\pi^*$  is a targeting inflation rate,  $y$  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.  $\pi_{new}^*$  is defined as newly announced inflation targeting and  $\pi_{old}^*$  is the old inflation target.

$\pi_t$  can be expressed as follows:

$$\pi_t = \alpha \pi_{new}^* + (1 - \alpha) \pi_{old}^* + \beta (y^t - y^*) \quad (2)$$

The first-order condition is given by

$$y^t - y^* = - \left( \frac{\beta}{\beta^2 + \lambda} \right) (1 - \alpha) (\pi_{old}^* - \pi_{new}^*) \quad (3)$$

The left side of (3) is the output loss that results from the policy. This loss is determined by the degree of nominal inertia, the weight on the output gap in the loss function and credibility in addition to the size of the reduction in the inflation target.

### 3. SACRIFICE RATIO

The sacrifice ratio has been used to proxy the relative success of policy regimes. Its reduction following a regime change could be a result of good policy credibility for the inflation targeting. An important question of this paper is whether the introduction of inflation targeting has reduced the costs of output.

Early papers of the sacrifice ratio showed the sacrifice by estimating a Phillips curve (Okun, 1978; Gordon and King, 1982). In some later studies, sacrifice ratios have been estimated through of VAR mode. This paper's methodology has most in common with Cecchetti (2000)<sup>2</sup>.

Recently, much attention has been paid to sacrifice ratios because of the recent deflation seen in most developed countries. Cunado (2003) suggested that sacrifice ratio takes higher values in periods of low inflation rates. Zhang (2005) found that there is 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 lost 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 deflations 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 Phillips curve slope and found that sacrifice ratios are weakly negatively related to openness.

This paper's methodology allows us to measure the sacrifice ratio as the costs of a deliberate disinflation policy in contrast to the output costs of a series of negative cost push shocks. To derive our sacrifice ratio estimates, VAR (vector autoregressive) model is employed 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:

$$\text{Sacrifice Ratio} = \sum \delta^{t-t_0} E_{t_0} \frac{Y_{t_0+s} - Y^*_{t_0+s}}{Y^*_{t_0+s}} / p$$

where  $t_0$  is the start point of the disinflation period,  $E_t$  is the expectations operator conditional on information at time  $t$ ,  $\delta$  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.

Keynesian theory in general suggests that prices are set in a staggered manner and fixed. Prices setters are concerned with how prices are expected to rise/fall, and thus with the monetary policy. If rational expectation's formation plays a crucial role in price setting, the degree of policy credibility may influence the sacrifice ratio. Under rational expectations and costly price adjustments, imperfect credibility is an essential ingredient in accounting for a positive sacrifice ratio.

Suppose that monetary policy credibility is brought under inflation targeting. What implications may this have for the conduct of monetary policy? According to the standard credibility arguments presented by Kydland and Prescott (1977) and Barro and Gordon (1983), commitment to a desired policy rule will be welfare-enhancing if the commitment is viewed as credible to the public. Non-credible commitment to a desired rule could reduce welfare even when the actual policy turns of credibility by the public.

The endogenous variables in this paper's models are general economic activity, the logarithm of the seasonally adjusted consumer price inflation, the short-term nominal interest rate, and the change in the nominal effective exchange rate. The length of the endogenous variables was chosen with the few observations available under inflation targeting in mind. For the output gap, we have computed 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. Akaike information criteria (AIC) was computed for length up to six quarters for the two quarters. A constant term is included in all equations. The data series are from IFS (IMF).

VAR (vector autoregressive) models are employed as these impose only a minimum of restrictions for analyzing monetary policy. Fifteen countries in the sample have adopted inflation targeting (date of adoption show in parentheses): Australia (1994:Q4), Canada (1992:Q1), Finland (1994:Q1), Korea (1998:Q1), Norway (2001:Q1), Spain (1994:Q1), Sweden (1993:Q1), Switzerland (2000:Q1), and the United Kingdom (1993:Q1). For each country, we define the beginning of targeting as the first full quarter after the target had been publicly announced 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)<sup>3</sup>.

The sacrifice ratios are estimated for the individual countries of the sample through Monte Carlo simulation of estimated VARs with 1000 replications, drawing each time a new set of coefficients in accordance with their estimated distribution.

#### 4. RESULTS

Estimates for both the pre inflation targeting and the inflation targeting period are reported with standard errors in parentheses. The results are shown in table 1.

The estimates of the sacrifice ratio show that they decline for most countries during inflation targeting period<sup>4</sup>. This tendency is most

Table 1. Sacrifice ratio estimates (mean, per cent)

	Starting period	Pre inflation targeting period	Inflation targeting period
Australia	1994:Q4	1.66 (1.89)	-0.53 (2.99)
Canada	1992:Q1	2.43 (5.78)	0.12 (4.96)
Finland	1994:Q1	-0.05 (0.33)	-0.56 (3.28)
Korea	1998:Q1	1.05 (6.77)	-1.55 (3.53)
Norway	2001:Q1	0.36 (4.98)	0.04 (4.88)
Spain	1994:Q1	0.55 (5.44)	0.28 (3.65)
Sweden	1993:Q1	0.15 (7.08)	-0.22 (10.12)
Switzerland	2000:Q1	-0.44 (9.54)	-0.32 (12.92)
United Kingdom	1993:Q1	0.55 (2.88)	0.68 (5.02)

marked for Canada and Korea, which experienced relatively high sacrifice ratios in the first period. Some countries saw a rise in the sacrifice ratios. These countries experienced relatively low sacrifice ratios.

The properties of this model can be checked by the response of a variable to a shock to the model. Since this paper focuses on the effect of monetary policy in output and inflation, the shock to the short-term interest rate is the interest rate for the purpose of evaluating and providing a compact account of the properties of this model. The responses to the shock indicate the extent to which the models bring the expected effects to changes in monetary policy. The effects on output gaps and CPI inflation of a one standard error interest rate shock are shown for both and whole periods in figure 1-9.

It should be noted 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, 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. However, the results are not far from puzzling than what is common in most VAR studies.

## 5. CONCLUSIONS

The 1990s were amazing in many ways. Not only the Internet and cellular phones came into use, but also economic conditions improved greatly all over the world (except in Japan). Growth was higher, inflation was lower, and both were stable. That situation may have influenced the finding that inflation rate has not affected the deterministic elements of introducing 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. 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. Stock prices, some macroeconomic variables and their variability are sometimes important factors in determining economic performance and welfare. Much further research is needed to investigate the degree of robustness of these findings.

#### Notes

1. King (2002) showed that not only inflation rate but also its standard deviation have been more stable in recent decades in the U.K. See also Bernanke et al. (1999).
2. Durand et al. (2008) used structural VAR and discovered the negative relationship between the level of inflation and the cost of disinflation.
3. ADF test for unit root test was performed for all the variables (rates). They are significant at least 5% level.
4. Hofstetter (2008) suggested large sacrifice ratios were found in the 1970s and 1980s in Latin America and the Caribbean.

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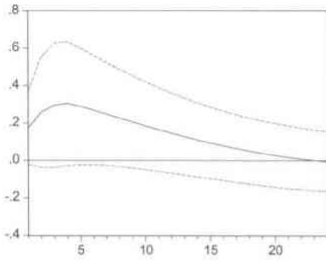
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Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of AUINT to AUGDP



Response of AUINT to AUPRI

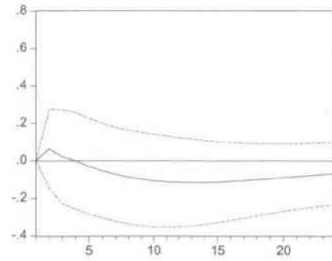
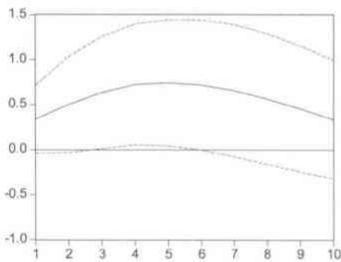


Figure 1a Impulse-response functions: The whole period: Australia

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of AUINT to AUGDP



Response of AUINT to AUPRI

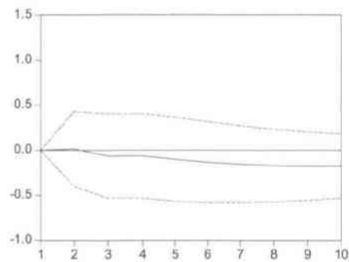
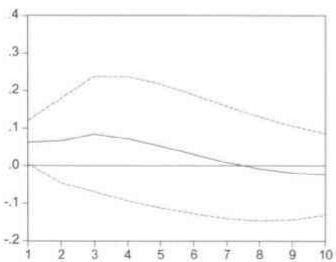


Figure 1b Impulse-response functions: The pre inflation targeting period: Australia

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of AUINT to AUGDP



Response of AUINT to AUPRI

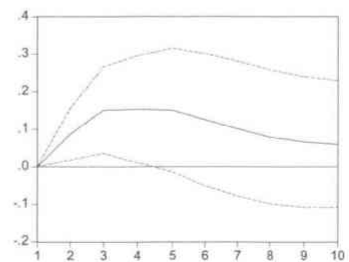
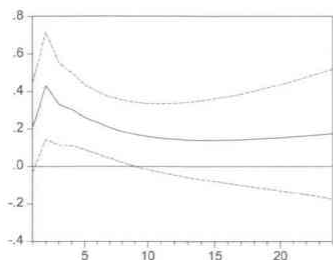


Figure 1c Impulse-response functions: The inflation targeting period: Australia

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of CAINT to CAGDP



Response of CAINT to CAPRI

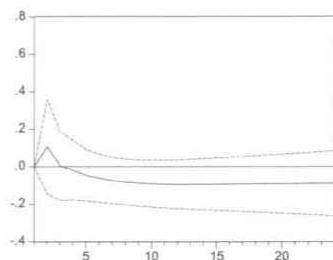
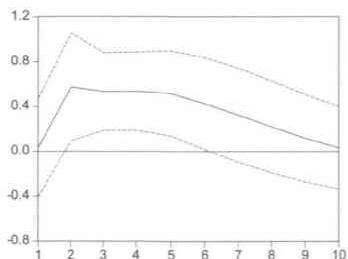


Figure 2a Impulse-response functions: The whole period: Canada

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of CAINT to CAGDP



Response of CAINT to CAPRI

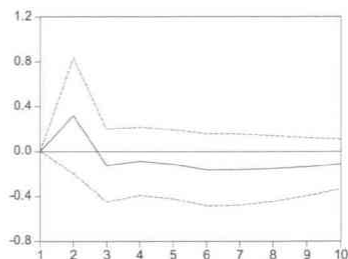
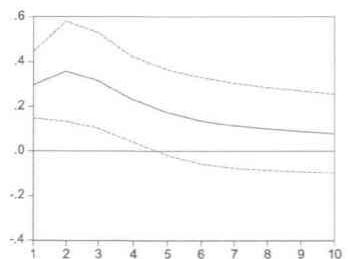


Figure 2b Impulse-response functions: The pre inflation targeting period: Canada

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of CAINT to CAGDP



Response of CAINT to CAPRI

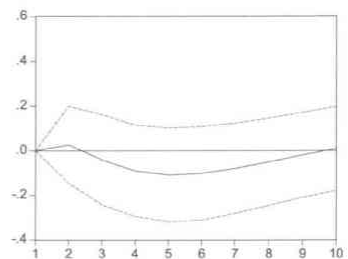


Figure 2c Impulse-response functions: The inflation targeting period: Canada

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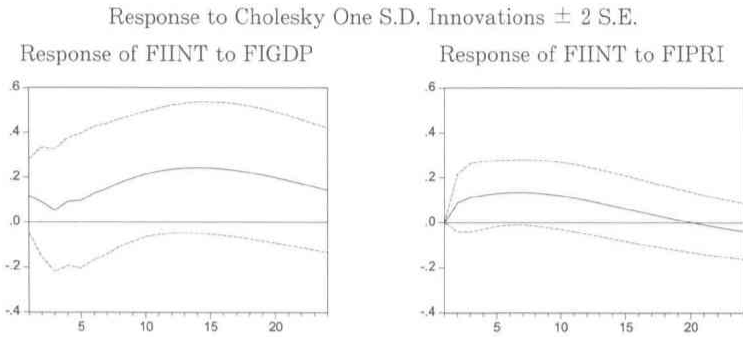


Figure 3a Impulse-response functions: Whole period: Finland

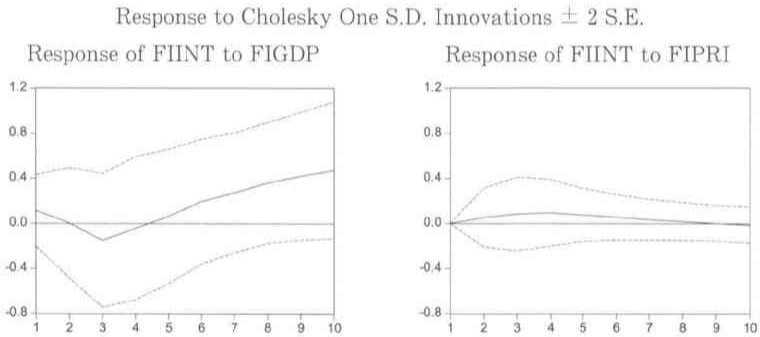


Figure 3b Impulse-response functions: pre inflation targeting period: Finland

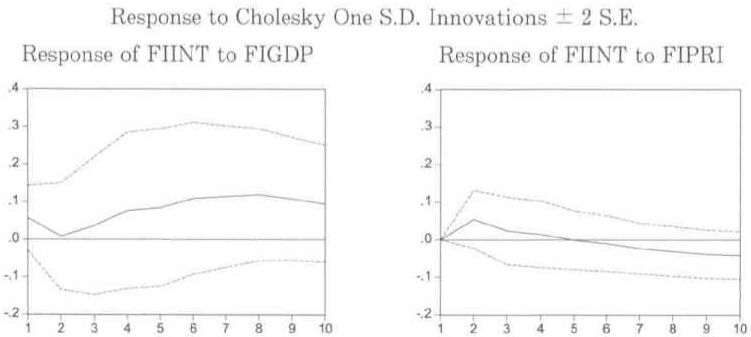
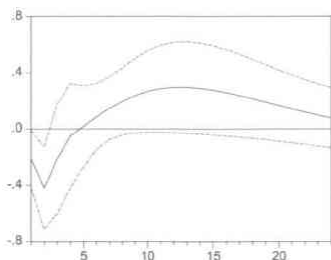


Figure 3c Impulse-response functions: inflation targeting period: Finland

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of KOINT to KOGDP



Response of KOINT to KOPRI

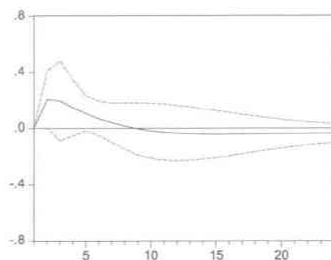
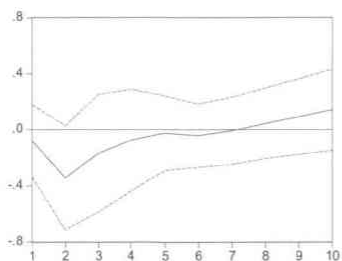


Figure 4a Impulse-response functions: whole period: Korea

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of KOINT to KOGDP



Response of KOINT to KOPRI

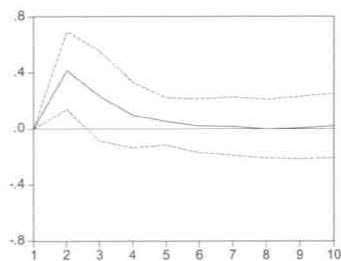
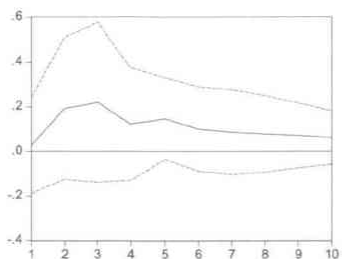


Figure 4b Impulse-response functions: pre inflation targeting period: Korea

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of KOINT to KOGDP



Response of KOINT to KOPRI

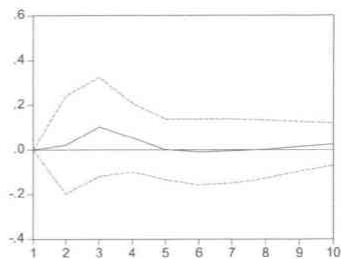


Figure 4c Impulse-response functions: inflation targeting period: Korea

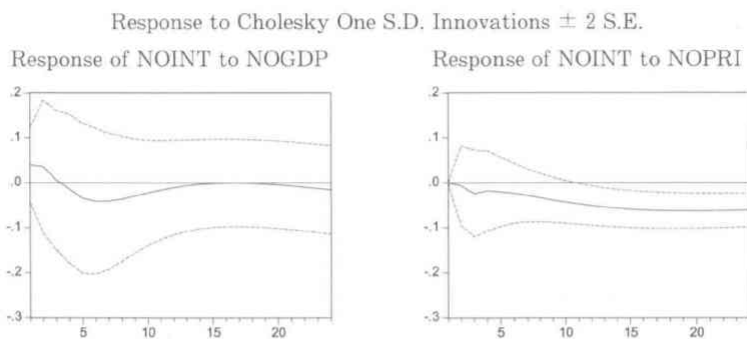


Figure 5a Impulse-response functions: whole period: Norway

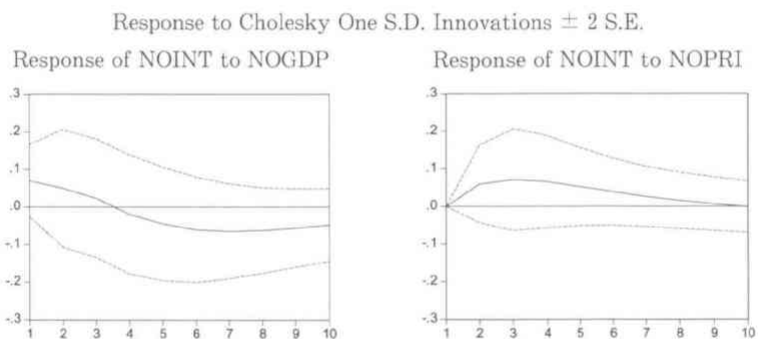


Figure 5b Impulse-response functions: pre inflation targeting period: Norway

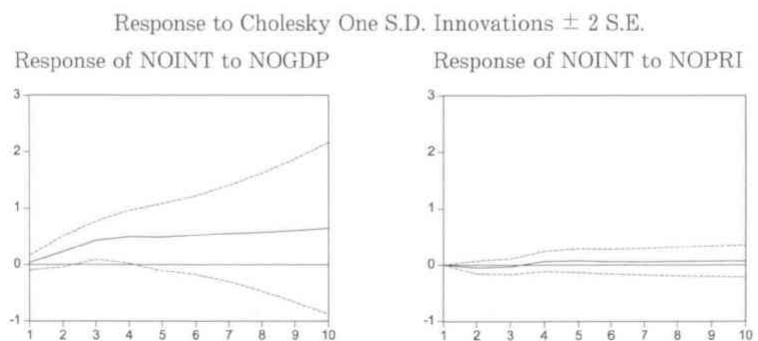


Figure 5c Impulse-response functions: inflation targeting period: Norway

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

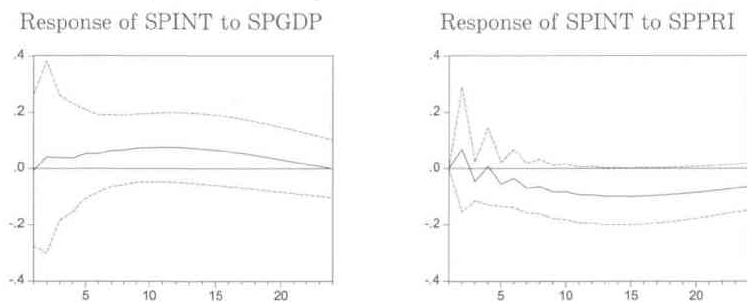


Figure 6a Impulse-response functions: whole period: Spain

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

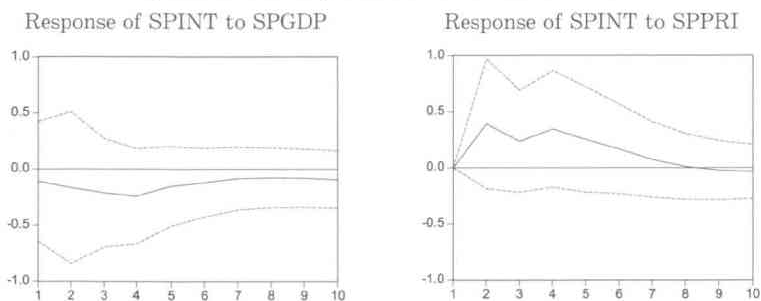


Figure 6b Impulse-response functions: pre targeting period: Spain

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

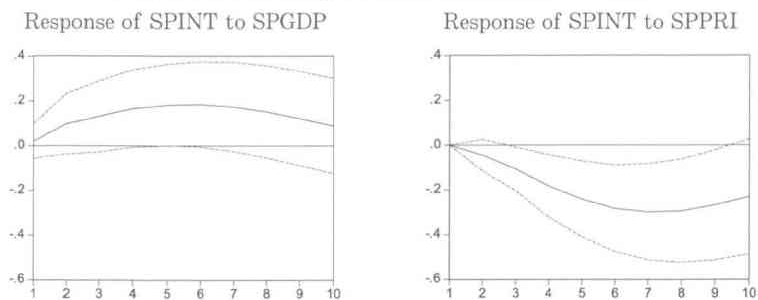


Figure 6c Impulse-response functions: inflation targeting period: Spain



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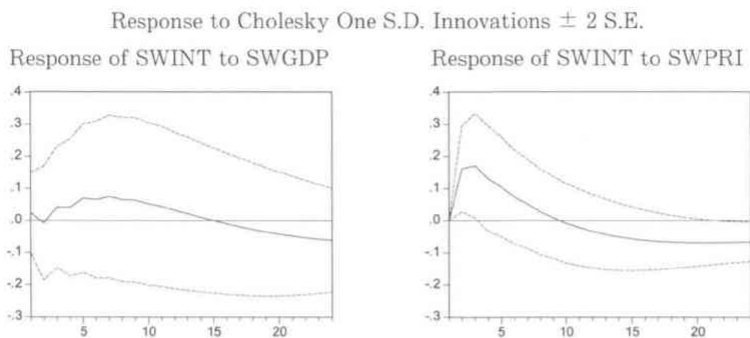


Figure 7a Impulse-response functions: whole period: Sweden

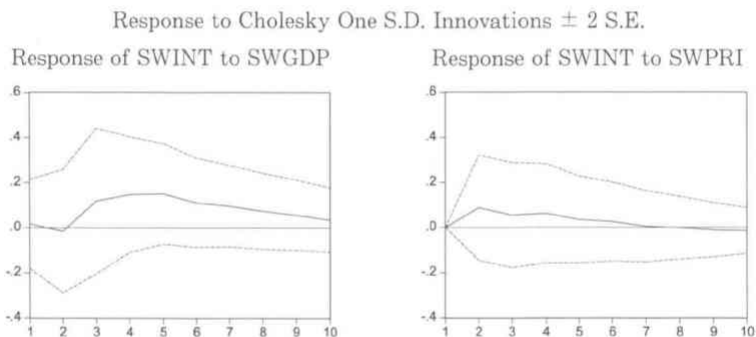


Figure 7b Impulse-response functions: pre inflation targeting period: Sweden

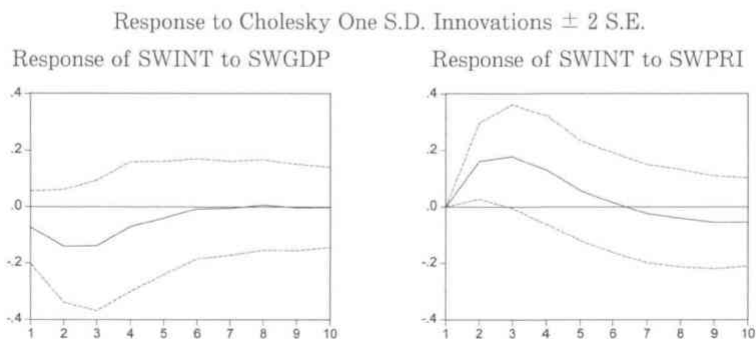
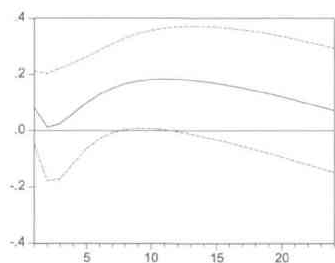


Figure 7c Impulse-response functions: inflation targeting period: Sweden

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of SWINT to SWIGDP



Response of SWINT to SWIPRI

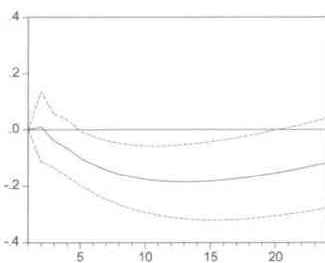
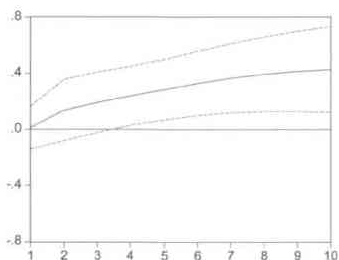


Figure 8a Impulse-response functions: whole period: Switzerland

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of SWINT to SWIGDP



Response of SWINT to SWIPRI

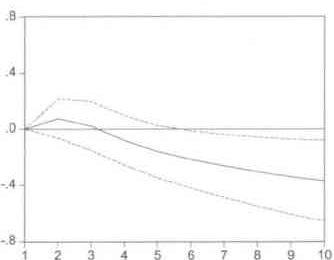
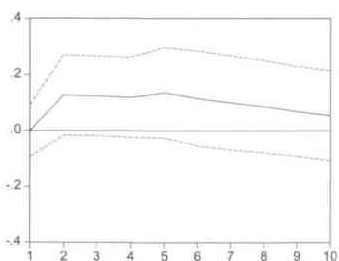


Figure 8b Impulse-response functions: pre inflation targeting period: Switzerland

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.

Response of SWINT to SWIGDP



Response of SWINT to SWIPRI

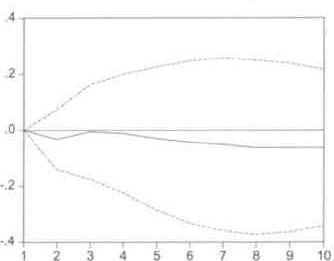


Figure 8c Impulse-response functions: inflation targeting period: Switzerland

Has the Adoption of Inflation Targeting Been Effective All over the World?

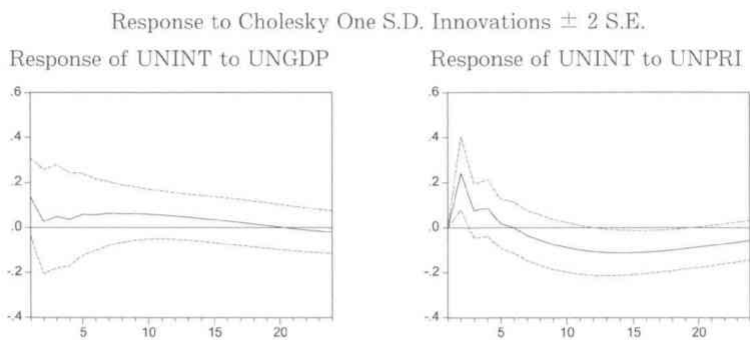


Figure 9a Impulse-response functions: whole period: United Kingdom

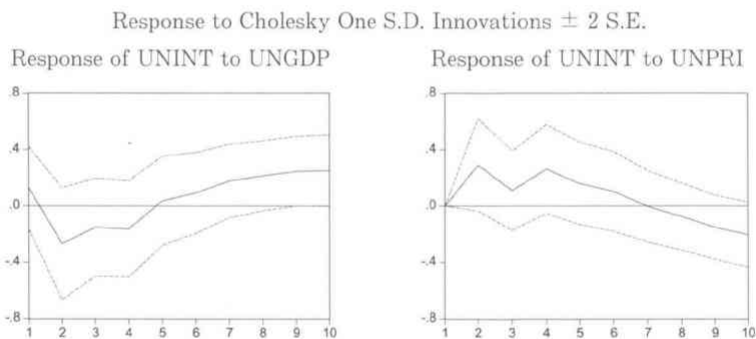


Figure 9b Impulse-response functions: pre inflation targeting period: United Kingdom

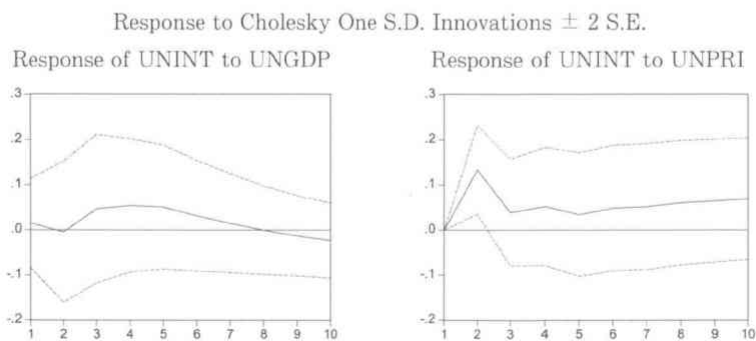


Figure 9c Impulse-response functions: inflation targeting period: United Kingdom

