Bank of Japan Working Paper Series

Monetary policy conduct of the Swiss National Bank: the experience from 2001 to 2004

Shinsuke Ohyama*
shinsuke.ooyama@boj.or.jp

Junko Tanigawa**
junko.tanigawa@boj.or.jp

No.06-E-09
May 2006

Bank of Japan
2-1-1 Nihonbashi Hongoku-cho, Chuo-ku, Tokyo 103-8660

* International Department, Bank of Japan
** International Department, Bank of Japan

Monetary policy conduct of the Swiss National Bank: the experience from 2001 to 2004[¶]

Shinsuke Ohyama[†] Junko Tanigawa[‡]
Bank of Japan
International Department

Abstract

The economy of Switzerland experienced a slowdown and disinflation from 2001 to 2003 and the Swiss National Bank (hereafter SNB) aggressively lowered its target range for the three-month Libor rate to the zero lower bound. Owing to the effects of monetary easing and the recovery of the global economy, disinflationary pressures had diminished in the end of 2003 and the SNB started to unwind its expansionary policy in the latter half of 2004.

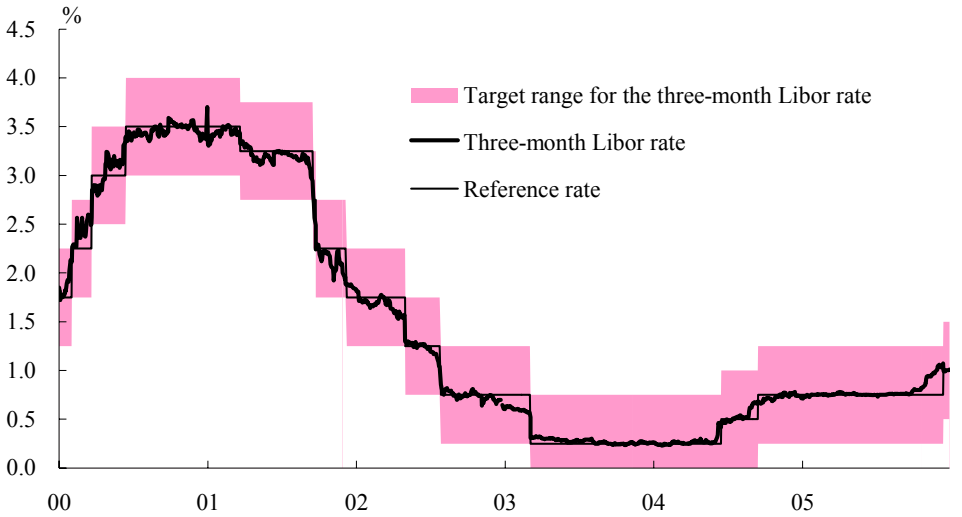
This paper investigates the monetary policy conduct of the SNB during this period and the accompanying financial market reactions, to derive implications for monetary policy conduct. Our main conclusions are twofold. First, estimation of the monetary policy reaction function suggests that the aggressive easing of the SNB from 2001 to 2003 was in line with optimal reaction in the presence of a zero bound on the nominal interest rate. Second, the policy actions taken by the SNB in the easing phase did affect the expectation of market participants on future economic development and monetary policy conducts, while those in the unwinding process of 2004 did not. This fact is consistent with the view that the SNB had taken enough time to have market participants sufficiently expect the near future interest rate hike prior to the actual unwinding process. Such prudent policy conduct was compatible with the robust control in monetary policy, because the SNB judged that the outcome of the low-probability risk of a return to disinflation would be the more serious concern than the possible adverse consequence of a rise in inflation.

¶ We would like to thank many staff members of the Bank of Japan, especially Akinari Horii, Koichiro Kamada, Ryo Kato, Takeshi Kimura, Shigeto Nagai, Nobuyuki Oda, Masato Shizume, Hiroshi Ugai, and Kenichiro Watanabe for their helpful comments on the earlier draft. We are also grateful to Akiko Watanabe for her research assistance. Any remaining errors are the authors' own. The views expressed are those of the authors and do not necessarily reflect those of the Bank of Japan.
[†] Corresponding author, Email: shinsuke.ooyama@boj.or.jp
[‡] Email: junko.tanigawa@boj.or.jp

1. Introduction

Switzerland's economy experienced a slowdown and disinflation from 2001 to 2003 against the backdrop of the large appreciation of the Swiss Franc against major currencies and the slowdown of global economy after the collapse of the "IT bubble." The year-on-year rate of the Consumer Price Index (hereafter CPI and always stated on a year-on-year basis) continued to decline after its peak (+1.9%) on November 2000 and dipped into negative territory twice in 2002 and 2004. To cope with this economic slowdown and the resulting disinflation, the Swiss National Bank (hereafter SNB) aggressively lowered its target range for the three-month Libor rate to the zero lower bound (Chart 1). In this paper, we call this policy operation from March 2003 to September 2004 in which the lower bound of target range was zero as the "practically zero interest rate policy.[1]" Owing to this aggressive monetary easing and the pick-up of the global economy, the economy showed the signs of recovery in the middle of 2003. The CPI hit its bottom (-0.3%) on March 2004 and the SNB started to unwind its expansionary monetary policy from the middle of 2004.

Chart 1: Three-month Libor rate and the target range



Sources: SNB, Bloomberg

Latest: Dec. 05

We investigate the monetary policy conduct of the SNB during this period and the associated reactions of financial markets. The purpose of this paper is to derive the implications for monetary policy under the risk of disinflation. First, we overview economic developments in Switzerland from 2001 to 2004. There are two causes of the economic slowdown and

[1] The expression "practically zero interest rate policy" is based on the statement of Governor Roth on June 2003: "In the course of the last two years we have cut our reference interest rate - the three-month Libor-by 325 bps to practically zero."

disinflation in Switzerland. The first is the large appreciation of the Swiss Franc (hereafter CHF) against major currencies, accompanied by both a realignment of the "strong Euro" expectation and an upsurge in geopolitical risks. The second is the slowdown of the global and especially the Euro-area economy after the collapse of the "IT bubble."

Secondly, we briefly review the conduct of monetary policy by the SNB in that period. From 2001 to 2003, the SNB implemented a considerable monetary easing. It had lowered the target range for the three-month Libor rate more aggressively than in its past. In addition, the SNB had introduced a "commitment" on future policy conduct to hold its ongoing expansionary policy stance for a certain period. In 2004, the SNB prudently began to unwind its "practically zero interest rate policy."

Third, we estimate the monetary policy response function to evaluate the monetary policy conduct of the SNB in that period. The estimation results suggest that the monetary easing from 2001 to 2003 had been largely in line with an optimal response in the presence of a zero bound on the nominal interest rate.

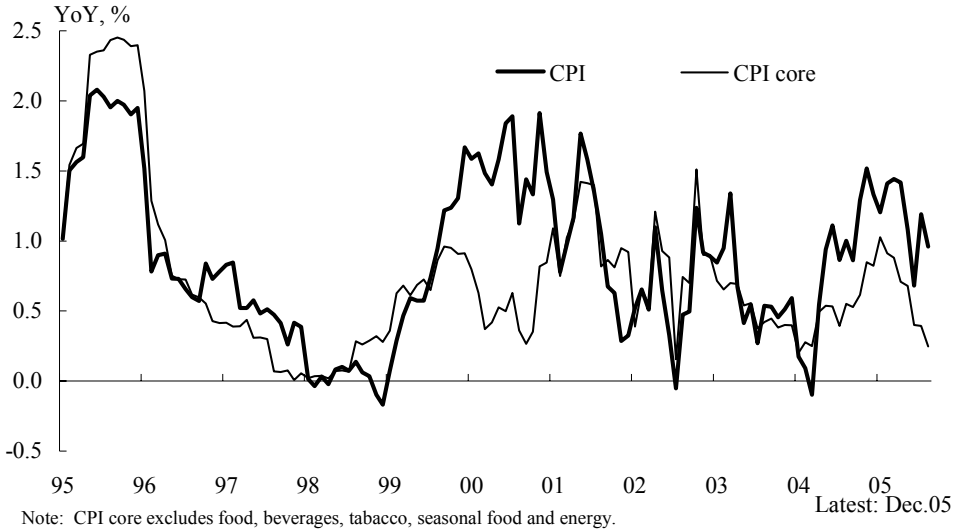
We then examine the reactions of financial markets to these policy actions. One interesting feature is the asymmetry of market responses. In the process of introducing its "practically zero interest rate policy" from 2001 to 2003, the policy actions taken by the SNB had surprised market participants to some extent. To put it another way, the SNB's actions have some influence on the expectations formed by market participants on future economic and financial conditions. By contrast, the SNB started the unwinding process of monetary easing carefully. The financial market had considerably anticipated the exit from the "practically zero interest rate policy" and then in 2004, the SNB accomplished the exit from the "practically zero interest rate policy" without any major market fluctuations. We consider that this prudence in the unwinding process reflects the SNB's judgment that the risk of a return to disinflation was a low-probability risk but its adverse outcome was more severe than that of an increase in inflation. That is, the policy conduct of the SNB was compatible with a robust control strategy under uncertainty of economic structures.

The remainder of this paper is structured as follows. In Section 2, we discuss the causes of the disinflation in Switzerland from 2001 to 2003. In Section 3, we review and characterize the monetary policy conducts of the SNB from 2001 to 2004 based on the Monetary Policy Assessment (hereafter Assessment) and the speeches by the SNB executives. Section 4 estimates the monetary policy response function in Switzerland and compares it with the actual SNB's conduct. In Section 5, we analyze the financial market reactions to the policy actions and communications of the SNB, following with concluding remarks in Section 6.

2. Disinflation of 2001-2003 and its causes

The CPI dropped into negative territory on three occasions from 1998 to 1999 and then accelerated to its recent peak, about +2%, in the middle of 2001 (Chart 2). After that, the inflation rate decelerated and hovered around +0.5% from the latter half of 2001 to early 2004. We call this the "disinflation" period in Switzerland. From early to mid 2004, the inflation rate of CPI started to rise again and has constantly exceeded +1%. In other words, "the threat of deflation has disappeared.[2]"

Chart 2: Consumer price index

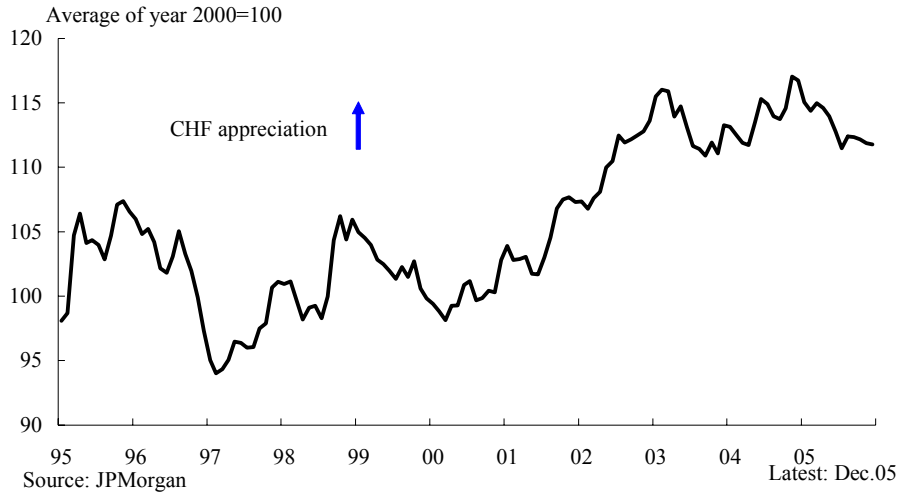


Note: CPI core excludes food, beverages, tabacco, seasonal food and energy.
Source: Datastream

The SNB points out two main causes of disinflation from 2001 to 2003 in its Assessments. One is the appreciation of CHF against major currencies. The nominal effective exchange rate of CHF appreciated largely from mid 2000 to mid 2003 (Chart 3). Two different factors contributed to this appreciation of CHF. From mid 2000 to 2001, the CHF appreciated significantly to the Euro against a backdrop of the adjustment of the previous "strong Euro" expectation that had prevailed before and at the introduction of the Euro in 1999. The CHF also appreciated against the US dollar from mid 2001 to mid 2003. This appreciation resulted from the surge in geopolitical risks after the September 11 attack in 2001, which boosted demand for the CHF as a "safe heaven." The relatively strong demand for the CHF lasted until the end of the war in Iraq in May 2003[3].

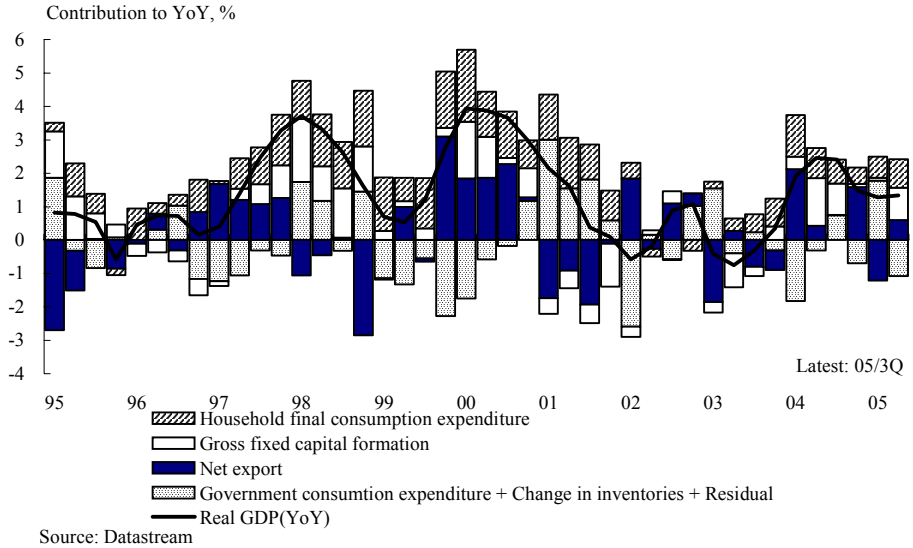
[2] Assessment (June, 2004).
[3] The SNB pointed out in the Assessment on May 2002 that "the rise of the Swiss franc is attributable to special economic and political uncertainty."

Chart 3: Nominal effective exchange rate of CHF



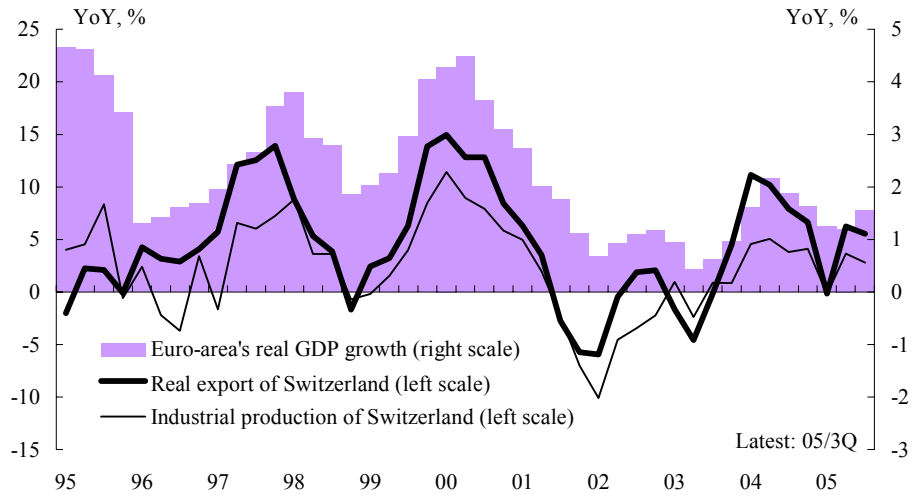
The other cause of disinflation was the economic slowdown in Switzerland. Chart 4 shows that changes in fixed investment and net export were the main components of this economic slowdown. In its own Assessments, the SNB mentioned the factors we have noted above as the causes of the slowdown, namely the appreciation of CHF and the the slowdown of the global and especially Euro-area economy after the "IT bubble" burst. It is intuitive that these two factors are key determinants of business cycles in Switzerland, given that Switzerland is a typical small open economy and that the Euro area is its major trading partner[4]. Chart 5 depicts the stable correlation between the real GDP growth of the Euro area and the Switzerland's real export and industrial production.

Chart 4: Real GDP growth



[4] In 2004, the Euro area accounts for 52.8% in export and 75.4% in import of Switzerland.

Chart 5: Export and production of Switzerland and real GDP of Euro-area



Source: Datastream

3. Overview of the SNB's monetary policy conduct

3.1. Introduction of the "practically zero interest rate policy"

We here briefly overview the SNB's monetary policy conduct from 2001 to 2003. We divide the monetary easing period that began in September 2001 into three stages[5] in order to find the characteristics of this easing. The first stage corresponds to the period of September to December 2001 when the SNB cut its reference interest rate by 150 bps (from 3.25% to 1.75%) to deal with the substantial appreciation of the CHF after the September 11 attack on the US in 2001. The SNB pointed out in its Assessment as of September 17, 2001 that "a recession in the United States or a sustained depreciation of the dollar could have a deflationary impact in Europe and Switzerland. In this case, the National Bank would have to review its monetary policy stance."

The second stage of monetary easing was in the period from mid 2002 to the end of 2002. In this stage, the SNB lowered its target range for the three-month Libor rate by 100 bps (the reference rate: from 1.75% to 0.75%). We consider a "commitment" on future policy conduct as the characteristic of this stage. For example, the Assessment in September 2002 mentioned: "For the time being, it [SNB] will maintain its expansionary monetary course so as to support the economic rebound and to keep Swiss franc investment a fairly unattractive

[5] Prior to the rate cut in September 2001, the SNB lowered its target range for the three-month Libor rate by 25 bps in March 2001, against the ground of the global economic slowdown triggered by the collapse of the "IT bubble."

option." Governor Roth also stated in the press conference after the Governing Council in December 2002 that "we shall adhere to our expansionary monetary policy in the foreseeable future."

The third stage of monetary easing corresponds to the period from March 2003 to September 2004; i.e., the period of the "practically zero interest rate policy." This stage contains two features. The first is of course the introduction of the "practically zero interest rate policy." The SNB lowered its target range for the three-month Libor rate by 50 bps to 0%-0.75% on March 6, 2003, to cope with the persisting global economic uncertainty and the appreciation of CHF against major currencies.

The other is that the SNB hinted that it would apply non-conventional policy measures other than interest rates. Kohli, the Chief Economist of the SNB, stated in his speech in May 2003: "once the zero lower bound has been reached, any increase in the rate of deflation implies an increase in the real rate of interest that cannot be countered by monetary policy. That is, one of the main channels of monetary policy, the one that works through short-run interest rates, becomes out of order. This is not to say that monetary policy becomes incapable of influencing prices and activity. … There are other channels remaining, including those that operate through long-run interest rates, the exchange rate and expectations, as well as quantitative measures."

The exchange rate is the most prominent among those channels. The SNB has an option to employ foreign exchange swaps as a policy instrument to influence the money market as well as the repo operation to manipulate the three-month Libor rate. The Assessment in March 2003 noted "in spite of the fact that money market rates are already very low, the National Bank still has effective instruments at its disposal. In particular, these include intervention on the foreign exchange market." This Assessment also mentioned, to show indomitable resolve, "we shall [therefore] continue to take decisive steps to combat a tightening of the monetary conditions brought about by any significant rise of the Swiss franc against the euro."

3.2. Exit from the "practically zero interest rate policy"

The economy in Switzerland had turned to recovery in the later half of 2003. This turnaround can be attributable to the upswing in global (especially the Euro area) economic activity, the expansionary monetary conditions brought by the SNB, and the consequent depreciation of the CHF against major currencies. At the end of 2003, the SNB assessed that "the signs of an economic recovery in Switzerland are intensifying." Since the economic recovery had developed in line with the expectation of the SNB, after that, the SNB decided to increase the floor of its target range for the three-month Libor by 25 bps from 0.0% to 0.25% at

the Governing Council held in September 2004. In this subsection, we review and characterize this exit process from the "practically zero interest rate policy."

Governor Roth first stated the turnaround in the inflation rate trend. He mentioned in the press conference after the Governing Council on December 12, 2003 that "the threat of negative inflation rates has diminished." He also pointed out "this is the result of an improvement in the global economy and of the less marked decline in inflation abroad, as also of the weaker Swiss franc vis-à-vis the euro." At that Council, however, the SNB decided to leave the target range unchanged at 0% - 0.75%, because not only "the inflation potential is small" but also "the National Bank does not wish to threaten the upswing by increasing interest rate too soon."

In the speech on April 30, 2004, Governor Roth stated that "the long-awaited but oft-delayed upswing finally began to make itself felt" and that "our economic forecasts for the current year are marked by cautious optimism." He explained "the turnaround was facilitated by a marked weakening of the Swiss franc, which was itself triggered by a renewed easing of our monetary policy in March." He also pre-announced the near-future policy action to exit from its "practically zero interest rate policy" with the following words.

- "The debate over deflation, which was so topical barely a year ago, is by and large no longer one of our concerns and has disappeared from the discussion among central bankers. Our interest rate cut in March 2003 was intended to protect us against such development. The goal has been achieved."
- "We know that our interest rates, currently at a historically very low level, will have to be increased if we wish to maintain price stability once the economic situation has been confirmed."

On June 17, 2004, the SNB decided to raise the ceiling of the target range by 25 bps from 0.75% to 1.0% and to maintain the three-month Libor rate in the middle of the target range (0% - 1.0%); i.e., at 0.5%. At the next Governing Council on September 16, the SNB decided to increase the target range by 25 bps to 0.25%-1.25% and completed the exit process from the "practically zero interest rate policy." The Assessment justified its rate hike by the upswing of economic activity in Switzerland in line with its expectations.

In this exit process, the SNB's communication has several features. First, the communications before and on the exit from the "practically zero interest rate policy" were well thought out, in the sense that the SNB clearly explained its evaluation on the economic situation and its future policy direction in its Assessments and speeches. Such prudent communication unquestionably encouraged market participants to share the SNB's views and contributed to the

smoothness of the market reaction in the exit process.

Second, the SNB repeatedly stated that the exit from the "practically zero interest rate policy" was not a major shift of monetary policy conduct in order to avoid unnecessary turbulence in financial markets. Typical expressions are the following. "The monetary policy of the National Bank will remain expansionary and support the upswing." Or, "today's adjustment of our monetary policy should not be seen as a changeover to a restrictive policy. Our interest rate increase is merely to be regarded as an appropriate step toward more neutral monetary conditions following a lengthy period of extraordinary circumstances."

Third, the SNB added various statements in its Assessment to the effect that "should the Swiss Franc appreciate markedly as a result of unexpected developments, the National Bank will react appropriately." This statement gave the SNB the latitude in future policy conduct to react an unexpected appreciation of CHF; i.e., one of the most serious threats to the economic recovery and price stability in Switzerland.

4. Estimation of monetary policy response function

In the previous section, we overviewed monetary policy conducts and communications of the SNB from 2001 to 2004. In the following two sections, we empirically examine the policy conduct of the SNB and the then reactions of financial markets. We here estimate the monetary policy response function for Switzerland and compare it to the actual conduct.

We follow Clarida, Gali and Gertler (1998) to formulate the monetary policy response function. The equation is as follows:

$$i_t = \rho i_{t-1} + (1-\rho)(\beta_0 + \beta_1 gap_{t+1} + \beta_2 \pi_{t+1}) + \varsigma_t \qquad (1)$$

where i, gap, and π are the three-month CHF Libor rate, the output gap in Switzerland, and the inflation rate, respectively. We measure gap by the Hodrick-Prescott (HP) filter (hereafter gap^{HP}) and the band-pass filter (hereafter gap^{BPF}). Since Clarida, Gali and Gertler (2001) stress that openness gives rise to an important distinction between consumer inflation π^{CPI} and domestic inflation π^{DOME}, we employ both inflation rates for π in each estimation. The sample period is from 1980Q1 to 2005Q2. We estimate the above equation by Generalized Method of Moments (GMM) where the instrumental variables are the one-period lags of all variables.

Column (1) in Table 1 summarizes the estimation results. The parameters on inflation rates and output gaps are positive and statistically significant at the 5% level.

Table 1: Estimation results of montery policy response functions

(1) CPI

Output gap	HP filter			Band pass filter		
equation	(1)	(2)	(3)	(1)	(2)	(3)
ρ	0.72	0.65	-	0.70	0.62	-
	(0.08)	(0.09)	-	(0.08)	(0.09)	-
β_0	1.51	2.21	2.09	1.15	1.80	1.85
	(0.53)	(0.50)	(0.44)	(0.43)	(0.35)	(0.31)
β_1	0.85	0.78	0.44	0.72	0.62	0.45
	(0.26)	(0.21)	(0.20)	(0.24)	(0.21)	(0.19)
β_2	1.01	0.87	0.95	1.19	1.05	1.05
	(0.21)	(0.18)	(0.15)	(0.18)	(0.14)	(0.11)
β_3	-	-2.66	-1.51	-	-2.14	-1.04
	-	(0.74)	(0.77)	-	(0.76)	(1.29)
β_4	-	-0.76	-0.01	-	-0.63	-0.08
	-	(0.37)	(0.40)	-	(0.41)	(0.63)
β_5	-	0.31	-0.68	-	0.01	-1.12
	-	(0.49)	(0.63)	-	(0.66)	(1.19)

（2）Domestic goods and service price

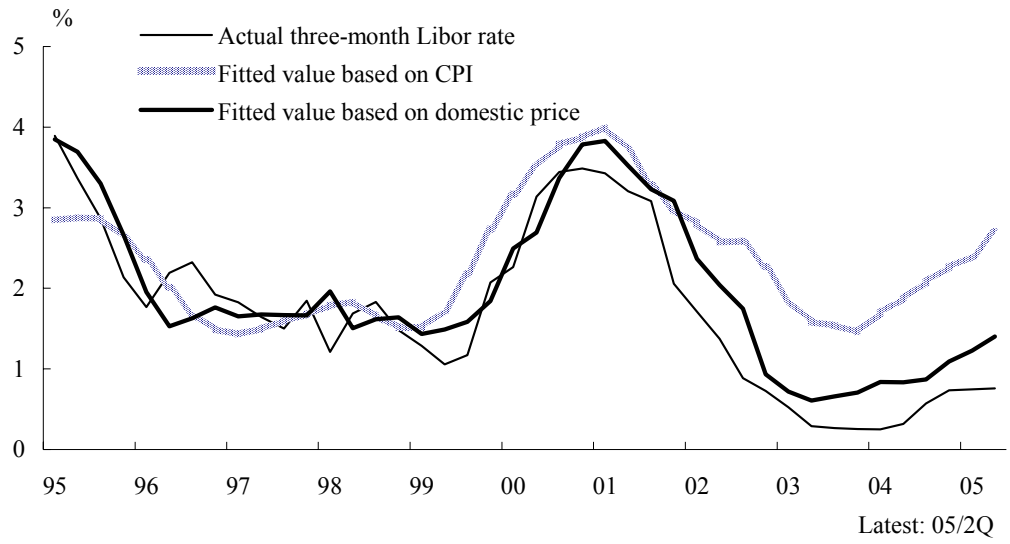
Output gap	HP filter			Band pass filter		
equation	(1)	(2)	(3)	(1)	(2)	(3)
ρ	0.69	0.55	—	0.70	0.53	—
	(0.10)	(0.12)	—	(0.11)	(0.13)	—
β_0	1.44	1.94	1.72	1.05	1.58	1.44
	(0.46)	(0.41)	(0.31)	(0.41)	(0.31)	(0.19)
β_1	0.99	0.82	0.58	0.81	0.67	0.55
	(0.23)	(0.17)	(0.16)	(0.21)	(0.18)	(0.18)
β_2	0.90	0.84	0.93	1.07	0.98	1.04
	(0.17)	(0.14)	(0.11)	(0.15)	(0.11)	(0.07)
β_3	-	-2.12	-2.56	-	-1.97	-2.37
	-	(0.53)	(0.53)	-	(0.44)	(0.38)
β_4	-	-0.53	-0.45	-	-0.33	-0.39
	-	(0.18)	(0.25)	-	(0.24)	(0.25)
β_5	-	0.05	0.73	-	0.13	0.71
	-	(0.43)	(0.35)	-	(0.39)	(0.25)

Note: Paranthesis contain the standard error. Shaded parts incicate statiscially significant at the 5% level.

Chart 6 compares the values calculated by the estimated response functions with either π^{CPI} or π^{DOME} to the actual three-month Libor rate.[6] The fitted values match the actual interest rate closely from 1995 to 2000, while both of them fall below the actual consistently after 2001Q4. This divergence implies that in this easing phase the SNB had lowered interest rates more aggressively than the historical average pattern as shown in the fitted values.

[6] We employ gap^{HP} for the output gap in these calculations.

Chart 6: Actual and fitted values of three-month Libor rates



There are several related literatures. For example, Ahearne et al. (2002) examine Japan's experience in the first half of the 1990s and draw the general lessons that when the risk of deflation is high, the policy accommodation should go beyond the levels conventionally implied by baseline forecasts of future inflation and economic activity. Adam and Billi (2005) indicate that when nominal interest rates are bounded below by zero, "preemptive easing" is optimal because expectations of a possibly binding in the future amplify the effects of adverse shocks. Kato and Nishiyama (2005) verify that the optimal policy reaction function in the presence of a zero lower bound on nominal interest rates is more expansionary and more aggressive than the Taylor rule whose parameters derived without such bound.

We here examine whether the policy conducts of the SNB from 2001 to 2004 were in line with the optimal monetary reaction function under the zero lower bound on nominal interest rates. It is, however, difficult to obtain the closed form expression of the optimal policy reaction function. Therefore, we adopt the "indirect" approach for the examination. We make one important assumption: if the policy conducts of the SNB is in line with the optimal monetary policy function in the presence of the zero bound on interest rates, we can observe the features of the optimal function analytically derived by Kato and Nishiyama (2005) more distinctly when the SNB is more concerned about the liquidity trap than when it is not. That is, the monetary policy of the SNB under the threats of disinflation should be more expansionary and more aggressive than under normal circumstance. In this subsection, we consider the period from 2001Q4 to 2005Q2 as the "unusual" period when the SNB was concerned about the threat of disinflation. Then, we expand Equation (1) to Equation (2) in order to detect the features in the policy during the "unusual" period.

$$i_t = \rho i_{t-1} + (1-\rho)(\beta_0 + \beta_1 gap_{t+1} + \beta_2 \pi_{t+1} + \beta_3 dummy + \beta_4 gap_{t+1} * dummy + \beta_5 \pi_{t+1} * dummy) + \varsigma_t \quad (2)$$

where $dummy$ is a dummy variable that takes 0 from 1980Q1 to 2001Q3 and takes 1 from 2003Q4 to 2005Q2. We also estimate Equation (3), which excludes the gradualism of monetary policy from Equation (2).

$$i_t = \beta_0 + \beta_1 gap_{t+1} + \beta_2 \pi_{t+1} + \beta_3 dummy + \beta_4 gap_{t+1} * dummy + \beta_5 \pi_{t+1} * dummy + \varsigma_t \quad (3)$$

Column (2) and (3) in Table 1 summarize the estimation results. As for the parameter β_3, it is seven cases excluding the one in Equation (3) with π^{CPI} and gap^{BPF} whose values are estimated statistically significant and negative[7]. These results imply that the monetary policy of the SNB during the "unusual" period is more expansionary than in the "usual" period. In other words, we can interpret these results as the SNB's policy conducts had born the first property of the optimal policy reaction under the zero lower bound on nominal interest rates derived by Kato and Nishiyama (2005).

We next focus the estimated parameters of β_4 and β_5. Although we cannot obtain the significantly positive value on β_4, there are two cases of Equation (3) with π^{DOME} whose estimated values of β_5 are statistically significant and positive. These results suggest that the SNB had been partially aggressive in monetary easing during the "unusual" period; i.e., it was aggressive in regard to inflation but not to the output gap.

In summary, we consider the above mentioned results consistent with the view that the monetary policy of the SNB from 2001 to 2004 is by and large in line with the optimal policy reaction function in the presence of a zero lower bound on nominal interest rates, though it might be too early to confirm this outcome.

5. Reactions of financial markets to the SNB's policy conduct

5.1. Anticipated and unanticipated components of policy actions

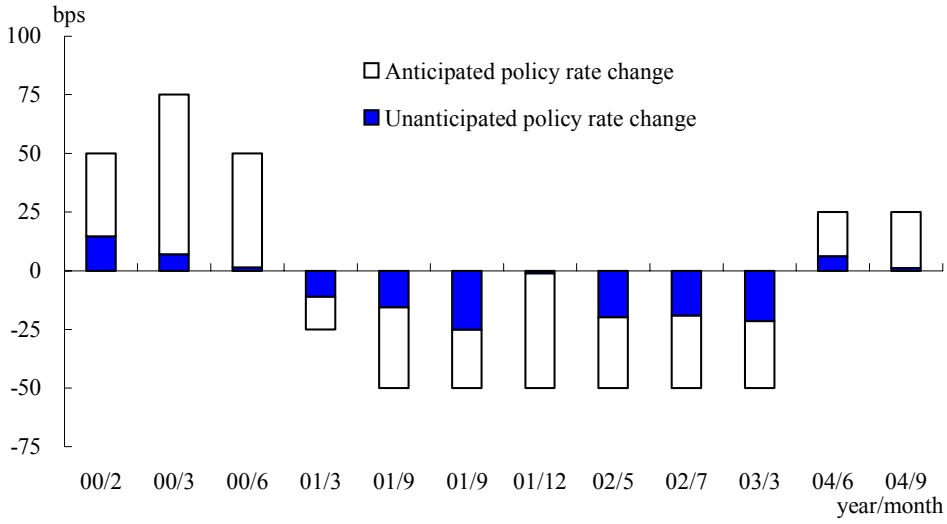
We examine in this section the responses of financial markets to the policy actions of the SNB from 2001 to 2004. We first follow Kuttner (2001) and Hisata et al. (2005) and identify

[7] It is highly possible that β_3 is estimated significantly negative if one obtains the positive values of β_4 and β_5.

the anticipated and unanticipated components of the SNB's policy changes. Specifically, we gauge the unanticipated components of the policy actions; i.e., the "surprises" in financial markets, by the one-day changes of the three-month CHF Libor rate between the days of policy action and the preceding days. The anticipated components of policy actions are computed as the difference between the one-day changes of reference interest rates and the unanticipated components on the policy actions.

Chart 7 displays the anticipated and unanticipated components of twelve-time policy actions from February 2000 to September 2004. We find two interesting observations. First, in general, the unanticipated components are larger in the cases of monetary easing than those in the interest hikes. Second, the market largely anticipated two-time policy changes to exit from the "practically zero interest rate policy" in 2004. Especially, the interest rate hike on September 2004 was almost fully expected the day before the Governing Council.

Chart 7: Anticipated and unanticipated components of policy changes



Since these measurements only focus on the one-day changes between the days of policy actions and the preceding days, we have no information on how the anticipations of financial market evolved. To capture such evolution, we extend this measurement by using the data at one-month, one-week and one-day before the Governing Council. We assume here that the anticipations of financial markets evolve monotonously. We then gauge how much the three-month Libor rate on the day in question anticipates the interest rate change caused by the SNB's action; i.e., the difference between the reference interest rate before the policy action and the actual three-month Libor rate on the day of the Governing Council.

Table 2 summarizes the results. In the cases of the monetary easing excluding that on December 2001, the financial market anticipated about 50% of the interest rate changes in

maximum one-week before the Governing Council. Even at one day before the Governing Council, the financial market expected only 66% in maximum. On the other hand, in the two-time rate hikes in 2004, the financial market expected more than 90% of the interest rate changes even one-week before the Governing Council.

Table 2: Timings and extents of anticipation

%

Date of policy change	Reference rate before the rate change	Three-month Libor rate				Reference rate after the rate change
		1 month before	1 week before	Preceding day	Current day	
Feb. 00	1.75	1.85	1.93	2.12	2.27	2.25
＋50bps		(19%)	(35%)	(72%)		
Mar.00	2.25	2.36	2.56	2.50	2.57	3.00
＋75bps		(35%)	(96%)	(78%)		
Jun. 00	3.00	3.09	3.13	3.39	3.40	3.50
＋50bps		(22%)	(33%)	(97%)		
Mar. 01	3.50	3.50	3.42	3.44	3.33	3.25
▲25bps		(1%)	(45%)	(36%)		
Sep. 01	3.25	3.16	3.08	2.95	2.79	2.75
▲50bps		(19%)	(37%)	(66%)		
Sep. 01	2.75	3.22	2.95	2.49	2.24	2.25
▲50bps		(-92%)	(-38%)	(51%)		
Dec. 01	2.25	1.95	2.00	1.89	1.88	1.75
▲50bps		(81%)	(66%)	(97%)		
May. 02	1.75	1.63	1.54	1.50	1.30	1.25
▲50bps		(27%)	(46%)	(56%)		
Jul. 02	1.25	1.22	1.14	1.04	0.85	0.75
▲50bps		(7%)	(27%)	(52%)		
Mar. 03	0.75	0.60	0.57	0.52	0.31	0.25
▲50bps		(34%)	(41%)	(52%)		
Jun. 04	0.25	0.26	0.46	0.42	0.48	0.50
＋25bps		(4%)	(93%)	(73%)		
Sep. 04	0.50	0.52	0.67	0.67	0.69	0.75
＋25bps		(9%)	(92%)	(94%)		

Note1: Parenthes denote to what extent market participants anticipate the policy rate changes, which is computed as follows.

$$\frac{\text{x (three-month Libor rate; e.g., 1 month before) - target rate level before the rate change}}{\text{three-month Libor rate at date of policy change - target rate level before the rate change}}$$

Note2: Shaded parts indicate the easing phase.

Both of the empirical results mentioned here clearly show that the responses of financial markets are of a different nature between the process of introduction of the "practically zero interest rate policy" from 2001 to 2003 and the process of exit from it in 2004. We will discuss a possible explanation for this asymmetry in market responses. Before that, we add more analysis of the policy actions of the SNB and the market responses.

5.2. Changes in distributions of market participants' expectation

We next examine how the policy actions and communications of the SNB influence the market participants' expectation of future financial conditions. While we focused on the average of market participants' expectations in the previous subsection; i.e., the realized three-month Libor rate, we here analyze the distribution of expectations. Specifically, we investigate how the policy actions and communications of the SNB influenced the implied volatilities (hereafter IVs) of the currency's future options. Since data on the market-based future rate of three-month Libor rate are not available, we use the IVs of the currency's future option as the proxy variables of the expectation distributions among market participants in Switzerland.

We construct three-variable VAR model with daily data on the IVs of three-month currency future options of USD/Euro, CHF/USD and CHF/Euro. Since these three currencies play different roles in the global financial market, we make an assumption on the transmission mechanism of shocks. We assume that USD/Euro is the most exogenous among the three markets, in the sense that a shock in the USD/Euro market can be transmitted to the CHF/USD and CHF/Euro markets simultaneously, but not vice versa. A shock in the CHF/USD market is assumed to influence the CHF/Euro market simultaneously, but not the USD/Euro market. The CHF/Euro market is assumed to be simultaneously influenced by other two markets, but not vice versa. We focus here only on the developments of CHF/Euro, because the SNB pays its attention on CHF/Euro intensively.

We add several exogenous variables to the model, together with the lagged variables of the endogenous variables, in order to capture unexpected shocks on market participants' projection of future CHF/Euro. When an estimated coefficient of an exogenous variable is statistically significant, we consider that it acts to diversify the participants' expectation. Since the IV is an indicator of variation on future price of underlying security, an increase in IV, a positive sign of coefficient, means the corresponding variable works as a shock to increase the distribution of market participants' expectations regarding to CHF/Euro.

We adopt the following exogenous variables: the differences of interest rates and inflation rates between Switzerland and Euro area, the errors of the market expectations on the Switzerland's inflation rates, the dummy variables for the geopolitical risks, those for the day of the Governing Council, and those for the speeches of the SNB executives.

The difference of interest rates between Switzerland and Euro area is the second power of one-day change in the difference between three-month CHF Libor rate and three-month Euribor rate, while that of inflation rate is the second power of the difference in year-on-year

changes in Switzerland's CPI and Euro-area's HICP[8]. The errors of the market expectations on the Switzerland's inflation rates are the second power of difference between the actual values and the market expectations just before the data release (source: Bloomberg)[9]. The dummy variables for the geopolitical risk are two fold. The one is for the September 11 attack in 2001. This variable takes 1 for twenty business days after September 11 attack and 0 for other observations. The other one is for the Iraq War in 2003, being 1 during the war (the period from March 20 to May 2) and 0 otherwise. The dummy variables for the Governing Council are intended to detect the influences of the policy actions and Assessments on the distribution of market participants' expectations. Each variable takes 1 for ten business days on and after the Governing Council and 0 otherwise. The speech dummy variables correspond to the days when three members of Governing Council and Chief Economist of the SNB express their thoughts on the monetary policy conduct through speeches[10]. These variables also take 1 for ten business days on and after the speech and 0 otherwise. The estimation method is Ordinary Least Square (OLS). The sample period is from January 4, 2000 to October 4, 2005. Lag order is 6 periods following the suggestion of AIC (Akaike's Information Criteria).

Table 3 contains the estimation result of the VAR model. Only the parameters on exogenous variables are presented in Table 3, while those on endogenous variables are omitted to save the space. It is intuitive that the differences in interest rates and inflation rates between Switzerland and Euro area have statistically significant and positive impacts on the IV of future CHF/Euro; i.e., the distribution of the market participants' expectations over the future passes of CHF/Euro. The dummy for the September 11 attack also has significantly positive parameter.

[8] We do not include the difference of GDP growth rates between Switzerland and Euro area in the model, because its coefficient was not significant in the preliminary estimation.
[9] We checked the significance of that of the real GDP growth of Switzerland in the preliminary estimation but it turned out to be insignificant.
[10] We pick up the speeches whose drafts are released in English on the Web of SNB and that describe the speaker's thoughts about monetary policy conducts in the abstracts.

Table 3: Estimation result of VAR

		Parameter	S.E.
Difference in interest rates between Switzerland and Euro-area		4.108	0.89
Difference in inflation rates between Switzerland and Euro-area		0.105	0.03
Difference between actual and expected inflation rates		0.110	0.07
9.11 attack dummy		0.102	0.04
Iraq War dummy		0.014	0.03
Governing Council dummy			
	2001/3/22	0.013	0.04
	2001/6/14	-0.025	0.04
	2001/9/17	-0.005	0.11
	2001/9/24	-0.159	0.06
	2001/12/7	-0.010	0.04
	2002/3/21	0.044	0.04
	2002/5/2	-0.095	0.05
	2002/6/14	-0.010	0.04
	2002/7/26	0.006	0.04
	2002/9/19	0.020	0.04
	2002/12/13	0.085	0.04
	2003/3/6	-0.006	0.04
	2003/6/13	0.044	0.05
	2003/9/18	0.011	0.04
	2003/12/12	-0.013	0.04
	2004/3/18	0.006	0.04
	2004/6/17	0.012	0.04
	2004/9/16	-0.046	0.04
	2004/12/16	-0.019	0.04
	2005/3/17	-0.017	0.04
	2005/6/17	-0.028	0.04
Speech dummy	Roth（2000/2/24）	-0.125	0.05
	Gehrig（2000/4/7）	0.060	0.04
	Rich（2000/7/11）	-0.056	0.04
	Roth（2001/9/14）	0.214	0.11
	Rich（2001/11/4）	0.023	0.04
	Kohli（2002/3/7）	0.079	0.04
	Blattner（2002/10/22）	-0.000	0.04
	Kohli（2003/5/21）	0.098	0.04
	Kohli（2003/6/5）	0.081	0.05
	Hildebrand（2003/10/8）	-0.050	0.04
	Roth（2004/4/30）	-0.023	0.04

Note: Shaded parts denote statistically significant at the 5% level.

As for the dummy variables for the Governing Councils and the speeches, the asymmetry in the reactions can be shown to be the same as above mentioned. That is, in the period from 2001 to 2003; i.e., in the phase of monetary easing, we find several dummy variables whose parameters are statistically significant, while there is no such variable in 2004. Though we will discuss this asymmetry later in this Section, we here check a little more deeply how the policy conducts and communications of the SNB affected the expectations among market participants in the period of monetary easing from 2001 to 2003.

The first episode discussed here corresponds to the first stage of monetary easing, namely September 2001. The SNB lowered the target range for three-month Libor rate twice by 50 bps each right after the September 11 attack in 2001, to react the rapid appreciation of CHF. Although the parameter for the Governing Council on September 17 is not statistically significant, that for the Council on September 24 is statistically significant and negative. These results imply that the first action of the SNB after the attack was not sufficient to calm the turbulence in financial markets, but the agile and additional rate cut showed the SNB's strong intension to prevent the CHF to appreciate the more and it contributed to stabilize the market participants' expectations.

It is surprising to us that the speech made by Governor Roth on September 14, 2001 has significantly positive parameter. Since his speech was in line with the market expectations according to the Bloomberg wire news, we do not regard this result as the ground that Roth's speech diversified the market participants' expectations. We rather consider that this dummy variable captured the continued confusion in financial markets after the attack instead of the responses of market participants to his speech.

The second episode is on the Governing Council on May 2, 2002. In the first half of 2002, the Switzerland economy experienced rapid appreciation of CHF against major currencies and the slowdown of economic recovery. Against this backdrop, the SNB decided to lower its reference rate from 1.75% to 1.25% in advance of the regular Council scheduled in June. The negative parameter for the dummy variable on May 2, 2002 implies that this right policy reaction by the SNB worked to reduce uncertainty in the projection of Switzerland economy.

The third episode is on the Governing Council on December 13, 2002 whose parameter is statistically significant and positive. On this Council, the SNB decided to leave the target range for the three-month Libor rate unchanged. This decision itself was in line with the expectation of market participants, but the introductory remarks of Governor Roth at the press conference after the Council surprised the participants in financial markets. As Bloomberg wire news reported at the morning of the Council "a further rate cut may not boost investments much because rates are negative if inflation is taken account, economist said," most market participants did not expect any further action at that time. In his remarks, however, Governor Roth hinted the possibility of further easing as follows: "Should the recovery in the US and in Europe be delayed or should the Swiss franc appreciate markedly, the expected upswing in Switzerland would be threatened. In such case, the National Bank is ready to react by appropriate means." This statement embedded in the expectations of market participants the possibility for the SNB to ease monetary policy further in order to avoid the risk of disinflation.

The fourth and last episode is the speech of Chief Economist Kohli on May 21, 2003.

As we noticed above, Kohli referred to the possibility of the introduction of unconventional measures of monetary policy in the presence of zero lower bound of nominal interest rate. As a positive sign of the estimated parameter for the dummy variable on May 21, 2003 suggests, this speech became a shock to market participants' expectations. In other words, this result suggests that financial market participants did not expect the introduction of unconventional measures before his speech.

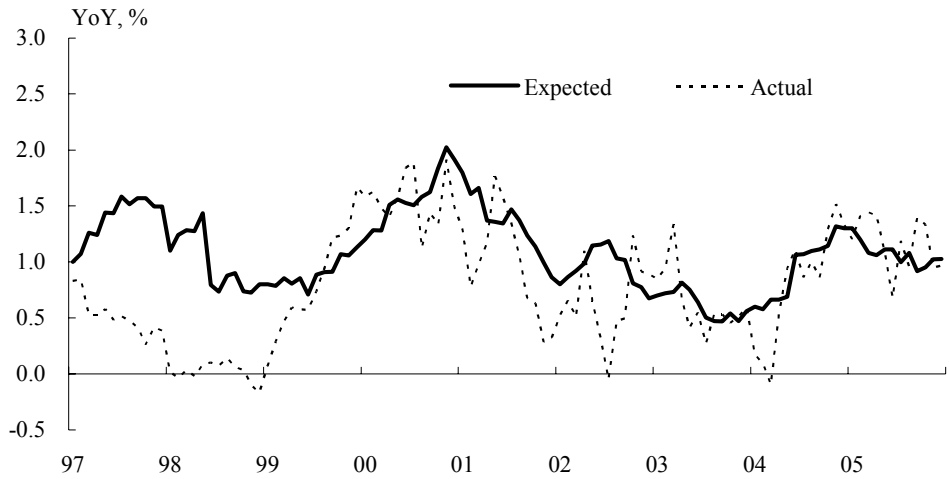
These empirical evidences suggest that the policy actions and communications of the SNB from 2001 to 2003 affected market participants' expectations on several occasions. We consider the realignment of market participants' expectations worked as one of transmission mechanisms of monetary policy.

5.3. Discussion: Why were the market responses asymmetric?

In the previous two subsections, we pointed out two asymmetries in the market responses between the process of introducing the "practically zero interest rate policy" and the process of exiting from it. One convincing explanation is that qualitative differences in policy conduct cause these asymmetries. Specifically, from 2001 to 2003, the SNB lowered its target range for the three-month Libor rate aggressively and called for revisions of market expectation consequently. In contrast, in the process to exit from the "practically zero interest rate policy" in 2004, the SNB took sufficient time for market participants to be almost sure of the near future policy change before its decision. In other words, it is highly possible that the market participants had anticipated the near future rate hike by themselves against the backdrop of the economic recovery in Switzerland and the stabilized foreign exchange markets.

There is some evidence to support this explanation. First, the one-year ahead forecast of inflation by "Consensus Forecasts" had already bottomed out in the autumn of 2003; i.e., more than half a year earlier than the exit from the "practically zero interest rate policy" (Chart 8). Second, the economic recovery in Switzerland had been in progress for one year at the timing of the exit. Third, the fitted value of monetary response functions had already bottomed out well before the actual rate hike as seen in Chart 6.

Chart 8: Expected inflation rate over one-year ahead



Source: Consensus Forecasts Latest: Dec. 05

We consider that such prudent policy conduct on the SNB in the process to remove the extraordinary monetary easing is consistent with the robust control of monetary policy under uncertainty. As we described in Section 3.2., the SNB recognized the risk of the further disinflation relatively small in the first half of 2004. The SNB, however, decided then to provide some "insurance" against the possible emergence of unexpected adverse outcome. Under the several uncertainties, it was more concerned about the low-probability risk that the disinflation might become severe again than the risk of accelerating inflation due to the excess monetary easing, because the adverse outcome of the former risk outsized that of the latter.

6. Concluding remarks

We have examined the monetary policy conduct of the SNB from 2001 to 2004 in this paper. Since we already summarized our main conclusions in the Abstract and the Introduction, we here make some important remarks to assist understanding our analysis.

The first point to note is the difference between Switzerland and Japan. Both countries experienced negative inflation and a "practically zero interest rate policy." The economic situations both countries faced are not the same, however. In Japan, gradual but continuous deflation is apparent over a certain period, while the negative inflation rate was a temporary phenomenon in Switzerland. One of the most important factors that explain this difference is that Switzerland did not experience the boom-and-burst of asset price bubbles and the accompanied non-performing assets problems in financial institutions that hampered economic growth in Japan. In addition, the Switzerland economy is a typical small-open economy that is

relatively sensitive to the dynamics of foreign exchange rates, while the influence of exchange rate fluctuations on inflation dynamics in Japan is not as crucial as in Switzerland. Since it is difficult to neglect these differences between two economies, one cannot simply compare the experiences in Switzerland discussed here to those in Japan.

A second point to note is on the analytical methods of this paper. We use the reduced-form estimations and the event study to examine the monetary policy conducts of the SNB and the market responses to such policy actions. The dynamic general equilibrium approach incorporating the role of "expectation" and "commitment" would generate more fruitful and more robust implications. We will leave this for future research.

References

(In Japanese)

Hisata, Masafumi, Hiroyuki Ando, Junko Tanigawa, and Ryo Kato, "On the "Conundrum" of long-term interest rates in the United States," Bank of Japan Reviews 2005-J-17, May, 2005.

(In English)

Adam, Klaus, and Roberto M. Billi, "Optimal monetary policy under discretion with a zero bound on nominal interest rates." European Central Bank Working Paper Series No. 380, August 2004.

Ahearne, Alan, Joseph Gagnon, Jane Haltmaier, and Steve Kamin and Christopher Erceg, Jon Faust, Luca Guerrieri, Carter Hemphill, Linda Kole, Jennifer Roush, John Rogers, Nathan Sheets, and Jonathan Wright, "Preventing Deflation: Lessons from Japan's Experience in the 1990s." Board of Governors of the Federal Reserve System, International Finance Discussion Papers Number 729, June 2002.

Clarida, Richard, Jordi Gali and Mark Gertler, "Monetary Policy Rules in Practices: Some International Evidence." European Economic Review 42, 1998.

------, ------, and ------, "Optimal Monetary Policy in Open versus Closed Economies: An Integrated Approach." American Economic Review Papers and Proceedings, Vol. 91 No. 2, May 2001.

Kato, Ryo and Shin-Ichi Nishiyama, "Optimal monetary policy when interest rates are bounded at zero." Journal of Economic Dynamics and Control 29, 2005.

Kuttner, Kenneth, "Monetary policy surprises and interest rates: Evidence from the Fed funds futures market." Journal of Monetary Economics 47, 2001.

Swiss National Bank, "Monetary Policy Assessment." Various issues.