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## **Foreign Experience with Liftoff from the Effective Lower Bound**

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This note reviews the experiences of foreign central banks in raising their main policy rate after a period of holding the rate close to or at zero (the effective lower bound or ELB). We examine six episodes from five countries since 2000: Canada (2010), Chile (2010), Japan (2000 and 2006), Sweden (2010), and Switzerland (2004).<sup>1</sup> As shown in exhibit 1, all liftoffs followed relatively short periods (less than a year and a half) at the ELB, except for Japan's 2006 liftoff, which came after five years of zero interest rates and quantitative easing.

Key takeaways from this review are: First, there is not much evidence that central banks waited too long to tighten policy and evidence that some tightened too soon. Second, the policy path after liftoff proved to be as important to the achievement of macroeconomic objectives as the timing of the first rate increase. Third, liftoffs did not prove disruptive to financial markets, in large part because they were generally well anticipated by market participants, underscoring the importance of clear communication by central banks. In drawing lessons for the United States, it is important to caveat that, for the most part, these countries had experiences at the ELB that were of shorter duration, had less sizable quantitative easing, and were less important for global markets. In the rest of the memo, we summarize some salient characteristics of these experiences, followed by a more detailed discussion for each country.

### **Summary**

#### **A. Communication before liftoff**

- All central banks provided some kind of guidance during the ELB period that helped the public assess the likely date of and/or economic conditions required for liftoff. The Bank of Canada (BOC) was perhaps the clearest. In April 2009, the BOC stated that policy rates would not rise before the end of the second quarter of 2010, conditional on the outlook for inflation; the BOC removed that guidance one meeting before liftoff in June 2010. The Swedish Riksbank also provided fairly explicit guidance through its quarterly forecast of the policy rate path; at the time of its last

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<sup>1</sup> These were the only episodes that we could find.

rate cut, to 25 basis points in July 2009, the central bank predicted that liftoff would occur in autumn 2010, just a little later than when it actually took place. All the central banks provided broad guidance on the economic conditions necessary for liftoff, generally highlighting how it was important that inflation be expected to move toward target and that there was sufficient momentum in the real economy. (See exhibit 2).

- In the months preceding liftoff, central banks communicated that the first rate increase was near, and thus market participants generally were not surprised when liftoff occurred.
- Each central bank communicated before liftoff that the likely path of rates after liftoff would depend on the evolution of the economy. The Riksbank provided explicit paths of policy rates under its modal outlook going forward 2 to 3 years, as well as a detailed rationale for this forecast. Similarly, the Swiss National Bank (SNB) provided guidance about the likely path of its target range for 3-month Swiss franc LIBOR by making forecasts for inflation that were contingent on the current policy rate being maintained, and which indicated that the SNB would likely need to raise rates further.

#### B. Motivations for liftoff

- Central banks most frequently cited data and forecasts for inflation and economic growth as motivating the first rate hike. By the time of liftoff, economic growth had resumed, albeit against the background of considerable economic slack, with unemployment rates well above pre-recession troughs (see exhibit 3). Headline inflation generally had recovered from negative rates, although it remained below target, and was forecast to rise further over time. However, the difficulty of policymaking in real time was underscored in Japan, where in both episodes subsequent data revisions revealed that economic growth and inflation were weaker than estimated at the time.
- Interest rates indicated by Taylor rules generally turned up by the time of liftoff. Exhibit 4 shows standard Taylor rules using ex-post revised data and estimates for four-quarter core inflation rates and output gaps. In most episodes, narrowing output gaps caused policy rates implied by the Taylor rules to start rising before liftoff. A notable exception is the 2000 liftoff in Japan which occurred while Taylor-rule interest rates were negative and declining. In any case, the foreign experience suggests that simple Taylor rules are probably not a sufficient statistic to time the liftoff and calibrate policy thereafter. In particular, they do not capture the lingering headwinds of the negative shocks which had prompted central banks to earlier adopt zero interest-rate policies. This is most notable in Canada, where downside risks

stemming from the global economy kept the BOC from raising its policy rate beyond 1 percent even as Taylor-rule rates continued to rise.

- Some central banks were motivated by financial stability concerns. The Swedish Riksbank cited rising household debt as a key reason for its liftoff and subsequent rate hikes, even as inflation remained below target. Bank of Japan (BOJ) policymakers saw a policy rate of zero as abnormal and were concerned that it posed risks to the economy in the longer term.
- For Switzerland, liftoff was also motivated by the desire to restore the policy rate corridor to its normal width; the corridor had been compressed during the ELB period, as policymakers avoided taking the lower bound of the corridor (the deposit rate) below zero. Policy rate corridors were also compressed during ELB periods for Canada and Sweden, although this appears not to have been an important consideration in their liftoffs.

### C. Implementation of liftoff

- Liftoff was not difficult to implement, partly because in most of these episodes the policy rate had not been at the ELB for long. Because there had been no large-scale asset purchases and associated balance-sheet expansion, the liquidity adjustment needed to support the increase in rates was not excessive. The exception was the second Japanese episode, in which the policy rate had been zero for five years and the BOJ had implemented its Quantitative Easing Program (QEP). In that case, the first rate hike was preceded by normalization of the BOJ's balance sheet, but this process took only a few months because the BOJ had generally accumulated assets with residual maturities of less than one year.
- During the ELB period, the BOC and Riksbank each employed a narrowed policy rate corridor. At liftoff, both central banks first opted to re-establish the standard operating width of the corridor by increasing the lending rate ceiling of the corridor, while leaving the deposit rate unchanged. In the case of the BOC, this was accompanied by a notable decline in settlement balances in order to raise the overnight rate from near the floor of the corridor to its midpoint.<sup>2</sup> Balances held at the Riksbank also declined substantially before and during the initial period of tightening, reflecting the maturation of several 1-year term liquidity operations that the Riksbank had conducted when financial stresses were high in 2009. After the first rate hike, subsequent increases by both the BOC and Riksbank were accomplished by raising the deposit and lending rates in tandem.

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<sup>2</sup> During 2009-2010, the BOC operated a temporary floor system for the overnight call rate during which it provided excess settlement balances in order to guide the overnight rate toward the floor of the policy rate corridor. See also the April 2013 FOMC note by Bowman, De Pooter, Gagnon, and Leahy for further details.

D. Market reaction

- The liftoffs did not cause sharp reactions in financial markets, largely because central banks had made clear that a rate hike was imminent. The first SNB rate hike in June 2004 did come a quarter earlier than market participants expected, and the initial rate hike in Chile in June 2010 was larger than expected, but in both cases the immediate response of financial markets was relatively muted.
- Financial markets continued to operate without disruptions in the weeks and months following liftoff. That said, periods of zero interest rates may have had some permanent effects on certain markets: Most notably, Japanese uncollateralized money markets in 2000 and 2006 were able to resume functioning smoothly, although activity did not climb back to the levels prevailing before the policy rate had been lowered to zero.

E. Policy after liftoff

- The initial policy rate hike was followed by additional tightening in all episodes except Japan in 2000; excluding that episode, policy rates were never reduced within a year of the liftoff date. However, three of the five countries today are back at the ELB, while Canada's policy rate has paused at just 1 percent for the past four years.
- The BOJ paused after its first rate increase in 2000 and then reversed that hike after six months. In 2006, the BOJ followed its initial 25 basis-point rate hike with another eight months later, then paused for less than two years. During the global financial crisis in 2008, the BOJ once again cut its policy rate to near zero, where it remains.
- The SNB also paused after two rate hikes in 2005, but resumed tightening after about a year, with steady increases ending in late 2007 at 2.75 percent, a rate that could be considered normal for Switzerland. However, the global financial crisis forced the SNB to cut rates sharply to its previous ELB of 0.25 percent by early 2009, to zero in 2011, and to negative in late 2014 (and finally to negative 0.75 percent when it abandoned its exchange rate floor versus the euro on January 15, 2015).
- In Canada, three rate hikes over three months in 2010 took the policy rate to 1 percent, where it has remained for more than four years, even as the BOC has shifted from an initial tightening bias to its current neutral stance.
- In Sweden, liftoff in 2010 was followed by a series of increases that ended in mid-2011 with the policy rate at 2 percent. However, the Riksbank began to gradually reverse those rate hikes within a few months as the euro-area crisis intensified. Amid criticism that its policy was too tight with inflation falling progressively below target and unemployment remaining high, the Riksbank finally cut its policy rate to zero (below the previous ELB of 0.25 percent) in late 2014.

- In Chile, liftoff in 2010 began a series of sharp rate hikes (initially 50 basis points each meeting) as the Central Bank of Chile (CBC) sought to head off inflationary pressures. After about a year, the policy rate reached 5 percent, a normal rate for a fully-recovered Chilean economy. The rate was unchanged for nearly three years before a worsening global outlook prompted cuts to the current rate of 3 percent.

#### F. Conclusions

- Liftoffs and subsequent monetary tightening motivated, in part, by factors other than forecasts of inflation and economic activity appear to have been premature or excessive and were later either paused or reversed. The 2000 BOJ liftoff arguably is the clearest example of a policy mistake: While the hike was very small, Japan needed more stimulus at the time. Indeed, the liftoff was reversed within six months, when QEP was launched with the economy back in recession. Although the BOJ ascribed its liftoff to firming economic conditions, observers at the time argued that the BOJ was uncomfortable keeping interest rates at zero for too long and that the rate hike was actually motivated by a desire to “normalize” policy.
- In Sweden, improving macroeconomic conditions appeared consistent with the initial rate hike. Even though the unemployment rate remained near its peak, GDP had rebounded strongly, and output gaps had narrowed significantly. However, the Riksbank arguably made a mistake in continuing to tighten, motivated in significant part out of concern for high household debt, even as spillovers from the euro-area crisis slowed the Swedish economy and pushed down inflation. The Riksbank compounded this mistake by reversing its rate hikes slowly, again out of concern for high household debt, even as inflation persisted well below target.
- The Canadian experience serves as a contrast to that of Sweden, illustrating how the path of policy after liftoff can be as important to the achievement of macroeconomic objectives as the timing of the first rate increase. Policy rates in Canada and Sweden both lifted off in mid-2010, but the Riksbank’s continued tightening in the face of worsening economic conditions contrasts with the BOC’s decision to pause at 1 percent. Canadian policy was arguably more data-dependent, pausing initially with a tightening bias and then shifting to a neutral stance as external conditions worsened and the housing sector became less heated. In Canada, the inflation rate has remained closer to target and economic growth has been steadier than in Sweden. Moreover, the BOC has kept its policy rate away from the ELB, though not by much, while the Riksbank has had to reverse all of its rate hikes amid criticism that its focus on household debt was misplaced.
- In no case was liftoff obviously too late or subsequent tightening too weak. Inflation rates rarely reached or surpassed target rates, and, similarly, policy rates never surpassed their pre-ELB peaks.

## **Canada (2010)**

In April 2009, the Bank of Canada (BOC) concluded a series of policy rate cuts by lowering its target for the overnight rate to 25 basis points, what it judged to be the ELB. At the same time, it committed to keep the rate unchanged until the end of the second quarter of 2010, conditional on the outlook for inflation. The BOC removed that conditional commitment in April 2010 and at its next meeting, in June, raised the policy rate to 50 basis points. The liftoff was well anticipated by market participants, thanks to clear communication by the central bank, through speeches and post-meeting statements, and did not elicit any significant market moves. The BOC attributed its policy tightening to improvements in the outlook for economic activity and inflation. In addition, the liftoff allowed the BOC to “re-establish the standard operating framework for the implementation of monetary policy,” including by reverting the width of the operating band to 50 basis points. Two additional hikes in July and September brought the policy rate to 1 percent, where it has stayed to this day. First, a strong Canadian dollar, then a tepid global economy, and, more recently, plunging commodity prices exerted significant drag on the Canadian recovery, inducing the BOC to leave in place “considerable monetary stimulus,” even as Taylor-rule implied policy rates rose further (exhibit 4). Following liftoff, the BOC also adjusted its informal guidance, shifting from an initial tightening bias to a more neutral stance as its forecasts for inflation became more subdued.

At the time of liftoff, BOC officials expressed concerns that rapidly rising household debt and house prices posed a substantial risk to the Canadian economy. However, they did not see monetary policy as the best tool for addressing such financial stability concerns, choosing instead to use macroprudential policy in three rounds of measures since 2010. Those measures, which included constraints on loan-to-value and debt-service ratios, contributed to a subsequent slowing in the growth of household debt and house prices, even as monetary policy remained accommodative.

## Chile (2010)

In the aftermath of the global financial crisis, the Central Bank of Chile (CBC) cut its policy rate dramatically to 50 basis points by mid-2009. Toward the end of that year, the Chilean economy was on the road to a sustained recovery. Although the recovery was temporarily interrupted by the devastating earthquake of February 2010, the CBC began to signal in April that better economic conditions and rising inflation expectations favored a normalization of monetary policy.<sup>3</sup> In June 2010, the CBC raised its policy rate 50 basis points to 1 percent, stating that robust internal financial conditions, growing domestic demand, and limited effects from Europe's financial crisis indicated the need to end financial stimulus measures and to normalize monetary policy in order to achieve its 3 percent inflation target. The CBC further stated that normalization would continue “at a pace that will depend on the unfolding of domestic and external macroeconomic conditions.”

Market participants were surprised by the size of the rate increase, as most had expected a 25 basis point hike, but the reaction in financial markets was modest. The CBC raised its policy rate at each of its next six meetings, initially in steps of 50 basis points before shifting to 25 basis point increases. After pausing in January 2011 as it undertook heavy foreign exchange market intervention to weaken the Chilean peso, the CBC continued tightening until the policy rate reached 5.25 percent in June 2011. By then, inflation had stabilized near the target of 3 percent. Overall, liftoff in Chile thus appears to have been implemented quite smoothly. In early 2012, in response to mounting downside risks for the global outlook, the CBC began to lower its policy rate, eventually reaching its current level of 3 percent.

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<sup>3</sup> Six months prior, the CBC had already indicated that a temporary liquidity provision facility would be terminated in May 2010. In the statement following its April 2010 meeting, the CBC replaced language that it would keep its policy rate at 50 basis points until at least the second quarter of 2010 with “The Board considers that macroeconomic conditions and private expectations are consistent with a scenario of normalization of monetary policy.” In this way, the CBC signaled that it was likely to raise rates at the June meeting.

## **Japan (2000 and 2006)**

The Bank of Japan (BOJ) has had two experiences with raising its policy rate from zero, first in August 2000 and then in July 2006. The first episode followed a period of extremely accommodative monetary policy designed to support the economy following the collapse of the 1980s asset bubble and the Asian financial crisis in 1997. With bank lending and inflation falling and with the economy still in recession, the BOJ lowered its policy rate to zero in February 1999, entering a period of zero interest rate policy (ZIRP). At the time, the Bank also promised to continue the easy stance of monetary policy until deflationary concerns abated. However, although deflation remained firmly entrenched, the BOJ raised the policy rate to 25 basis points in August 2000 in response to a seemingly solid economic recovery in economic activity. Speeches by some BOJ officials indicate that other considerations may have been important as well, including concerns that ZIRP was encouraging poor lending and investment decisions, thereby delaying structural reform of the economy.<sup>4</sup> In any case, the liftoff elicited little market reaction as BOJ officials had signaled their intent through speeches in the months preceding the policy change. That said, the move was criticized widely at the time. The liftoff was not uncontroversial even within the BOJ, with two of its nine policy members dissenting from the decision, noting that the cost of waiting was negligible given the trends in inflation.<sup>5</sup> The interest rate hike was small, but it took place in the context of falling exports and equity prices during the collapse of the high-tech boom. As we learned later, the drop in exports (despite a relatively stable yen) helped push the economy back into recession, and deflation continued.

The second episode involved a rate increase in July 2006 following the end of the quantitative easing policy (QEP) in March 2006, which the BOJ had launched five years earlier to support an economy again in recession amid persistent deflation. A key element of QEP was the commitment to maintain the policy until consumer prices had resumed rising and inflation was forecast to remain positive thereafter. After the end of QEP, the BOJ kept the policy rate at

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<sup>4</sup> See Eiko Shinotsuka's speech "Monetary Policy and Structural Reform of the Japanese Economy" on April 25, 2000.

<sup>5</sup> The BOJ proceeded with the liftoff despite an unprecedented request from the Japanese government (under Article 19 of the BOJ's charter) to postpone a vote on raising rates.



zero and started normalizing the size of its balance sheet. The outstanding balance of current accounts (that is, deposits of financial institutions at the BOJ) smoothly decreased from above 30 trillion yen in March 2006 to less than 8 trillion yen in July, in line with the BOJ March statement which indicated that the adjustment process would “be carried out over a period of a few months.” The BOJ had accumulated securities with relatively short residual maturities, which it let mature to achieve its balance sheet adjustment. Following this adjustment, the BOJ raised its policy rate 25 basis points in July and then to 50 basis points in February 2007. This liftoff was widely anticipated by market participants, reflecting clear communication by BOJ officials ahead of the move.<sup>6</sup> At the time of liftoff, the BOJ projected that the economy would continue to “expand for a sustained period” and that inflation was likely to “continue to follow a positive trend,” projecting it would gradually rise “to slightly below 1 percent” by 2008. However, core inflation (excluding food and energy prices) was barely positive. To many observers, this fact appeared at variance with the BOJ’s commitment to maintain QEP in place until inflation had turned positive in a stable manner. As it turned out, the official estimates for inflation were marked down by about ½ percentage point following a methodological statistical change, and deflation persisted.

All told, the BOJ experience with liftoff illustrates the risk of removing policy accommodation too early. In both episodes, even though actual inflation was still subdued, the BOJ judged that faster projected growth would eventually push up inflation. The rate hikes occurred amid an apparent improvement of economic activity, but subsequent data revisions revealed that both growth and inflation were weaker than indicated by real-time estimates. In hindsight, Taylor rules, calculated using revised data for core inflation (excluding energy and food prices) and the output gap, show that the 2000 liftoff was premature; the 2006 liftoff was less obviously premature, but its timing was still questionable (see exhibit 4.) BOJ officials have argued that Taylor rules were not particularly helpful because uncertainties regarding the amount of resource slack and the level of the neutral interest rate resulted in a wide range of rule-based

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<sup>6</sup> BOJ Governor Fukui made the following remarks in a speech on March 16, 2006: “I would now like to touch on the Bank's thinking regarding the future path of monetary policy. There will be a period in which the uncollateralized overnight call rate is at effectively zero percent, followed by a gradual adjustment in light of developments in economic activity and prices.”

policy rates.<sup>7</sup> However, these uncertainties would argue for more caution in raising rates, given asymmetries related to the ELB and the remote chance of a rise in inflation above target. Indeed, the BOJ came under fire for its actions. Many observers noted that the decisions to tighten reflected a view that ZIRP was “not normal” and that a prolonged monetary easing in the 1980s helped fuel a “bubble economy.”<sup>8 9</sup> There is no evidence, however, that either ZIRP or QEP led to excessive risk taking.

### **Sweden (2010)**

During the global financial crisis, as the Swedish economy contracted sharply, the Riksbank lowered the repo rate in a series of steps, reaching 0.25 percent (which it considered to be the ELB) in August 2009. At that time, the Riksbank, which routinely publishes forecasts of its policy rate, said that it expected the rate to remain at that level “until autumn 2010.” At its February 2010 meeting, with the economy beginning to recover, the guidance was changed to “the summer or early autumn 2010.” The Riksbank reiterated that guidance at its April 2010 meeting and hiked the rate at its next meeting in July.

At the July meeting, the Riksbank cited as its primary motivation that the Swedish economy was recovering from its severe downturn and that the rate hike was necessary to meet its inflation target in the medium term. A secondary motivation was concern over rising household debt and housing prices and the belief that interest rates well below their normal level were likely to exacerbate those trends. Thus the Riksbank added to its rate-hike explanation: “Another factor is that household indebtedness has increased significantly in recent years.”

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<sup>7</sup> See speech by Kazuo Ueda, Member of the Policy Board, in September 2000: [http://www.boj.or.jp/en/announcements/press/koen\\_2000/ko0009b.htm/](http://www.boj.or.jp/en/announcements/press/koen_2000/ko0009b.htm/)

<sup>8</sup> [Takahashi \(2013\)](#) reports that “The BOJ Governor, Masaru Hayami, at the time the ZIRP was adopted, described the policy as ‘not normal’” referencing the transcript of the BOJ’s Monetary Policy Meeting on June 28, 2000, which is only available in Japanese. In addition, Paul Krugman wrote in the New York Times in August, 13, 2000 that “Bank of Japan officials began looking for reasons to act in central-bankerly ways. As BOJ-watchers have pointed out, over the past few months the bank has been systematically ‘changing the goal posts,’ finding new reasons to tighten.”

<sup>9</sup> See “[The Asset Price Bubble and Monetary Policy: Japan's Experience in the Late 1980s and the Lessons: Background Paper](#)” by Kunio Okina, Masaaki Shirakawa and Shigenori Shiratsuka, Institute for Monetary and Economic Studies, Bank of Japan, vol. 19(S1), pages 395-450, February 2001.

At the time of liftoff, the Riksbank lowered somewhat its projected path of the repo rate over the next few years, citing its expectation that economic growth in Sweden's key European trading partners would be hurt by fiscal tightening in response to the worsening euro-area crisis. Given its communications before liftoff, the hike in the repo rate was well-anticipated by markets, and the Swedish krone actually depreciated moderately that day versus the euro, as analysts considered the Riksbank's communication about its future rate path to be more dovish than expected.

The decision to hike the repo rate received two dissenting votes from the six-member Executive Board of the Riksbank. One of those dissents belonged to Lars Svensson, who at that time and in subsequent years, has been a vocal critic of the policy tightening and the idea that monetary policy should take on financial-stability objectives such as stemming the rise in household debt. Although the Riksbank motivated its rate hike by its expectation that inflationary pressures would rise as the economy continued to recover, it projected in July 2010 that its preferred measure of inflation (CPIF, holding mortgage rates constant) would fall from its mid-2010 rate of 2 percent, average about 1½ percent over the next two years, and rise to the target only at the end of the forecast period in mid-2013. Moreover, although economic growth had been vigorous in the previous few quarters, the level of Swedish GDP was not projected to reach its pre-crisis level until mid-2011, and the unemployment rate had just begun to turn down following its sharp rise. Indeed, the Riksbank judged at the time that there was "plenty of spare capacity in the economy." In that economic context, and given Riksbank communications highlighting concerns over rising household debt, it appears that such concerns played a significant role in motivating the initial rate hike and subsequent tightening.

The Riksbank also stressed in its communications a desire to "normalize" policy by raising rates back to more normal levels. In addition to the rate hike, the Riksbank sought to return other aspects of its policy to their normal settings. Earlier, as it had cut the repo rate to near zero, the Riksbank had also narrowed its policy rate corridor to 100 basis points from its normal range of 150 basis points; when the repo rate reached 0.25 percent, the deposit rate was negative 0.25 percent and the lending rate was 0.75 percent. Along with the July 2010 rate hike, the Riksbank restored the width of its corridor to 150 basis points.

After raising the repo rate at a steady clip to 2 percent in mid-2011, the Riksbank has had to reverse those increases over the past three years, finally returning the repo rate to the 2010 ELB of 0.25 percent in July 2014 and cutting the rate to zero in October 2014. Analysts saw the Riksbank's statements in 2014 as indicating an increased focus on meeting its inflation target and an acknowledgment that monetary policy was not the best tool to address its concerns about household debt.<sup>10</sup> In hindsight, although the timing of the Riksbank's first rate hike could be justified by improving macroeconomic conditions, the subsequent series of rate hikes, motivated in large part by concerns over household debt, appears to have been excessive given the performance of economic growth and inflation. The Swedish economy ended up suffering collateral damage from the euro-area crisis, and Swedish inflation persisted well below the 2 percent target and the Riksbank's forecasts (with CPIF inflation falling to near zero and headline CPI inflation turning negative). Meanwhile, Sweden's unemployment rate has fallen only modestly from its peak and remains well above pre-crisis levels.

#### **Switzerland (2004)**

In response to the economic downturn of the early 2000s, the Swiss National Bank (SNB) reduced its target range for 3-month Swiss franc LIBOR to 0 – 0.75 percent and guided the rate to near the bottom of the range (to 25 basis points). In March 2004, with the Swiss economy gaining momentum, the SNB discussed the possibility of a rate hike and stated that it would have to adjust its policy stance as soon as the economic upswing was clearly confirmed. In June 2004, the SNB began liftoff by raising the LIBOR target range to 0 – 1 percent. The timing of the move surprised market participants, who had expected liftoff later in the year, as growth at the time of the June meeting was still moderate and inflation remained subdued. Short- and long-term bond yields rose by several basis points on the day of the announcement. The SNB emphasized, however, that the rate hike was a “correction” and “an appropriate step toward more neutral monetary conditions after a long period of exceptional circumstances.” The rate increase brought the LIBOR target range back to its historical width of 1 percentage point, with the goal of once again guiding LIBOR towards the center of the target range. At the September meeting,

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<sup>10</sup> In its October 2014 post-meeting statement, the Riksbank said: “The fact that the repo rate is now being lowered further to get inflation to rise will increase the risks associated with high household indebtedness. It is therefore even more urgent now that these risks are managed. Reducing the risks requires measures aimed directly at household demand for credit. In addition, reforms are needed for a better-functioning housing market.”

as expected by market participants, the SNB raised rates a further 25 basis points, but the SNB attributed the hike to the prospects of above-target inflation.

Despite initial market expectations for a further rate hike, the SNB paused at the December 2004 meeting, amid weak growth and subdued inflation pressures. However, the SNB indicated that the normalization phase that had begun in June 2004 was not yet over, given that inflation was still projected to rise to above the 2 percent target over the medium term.

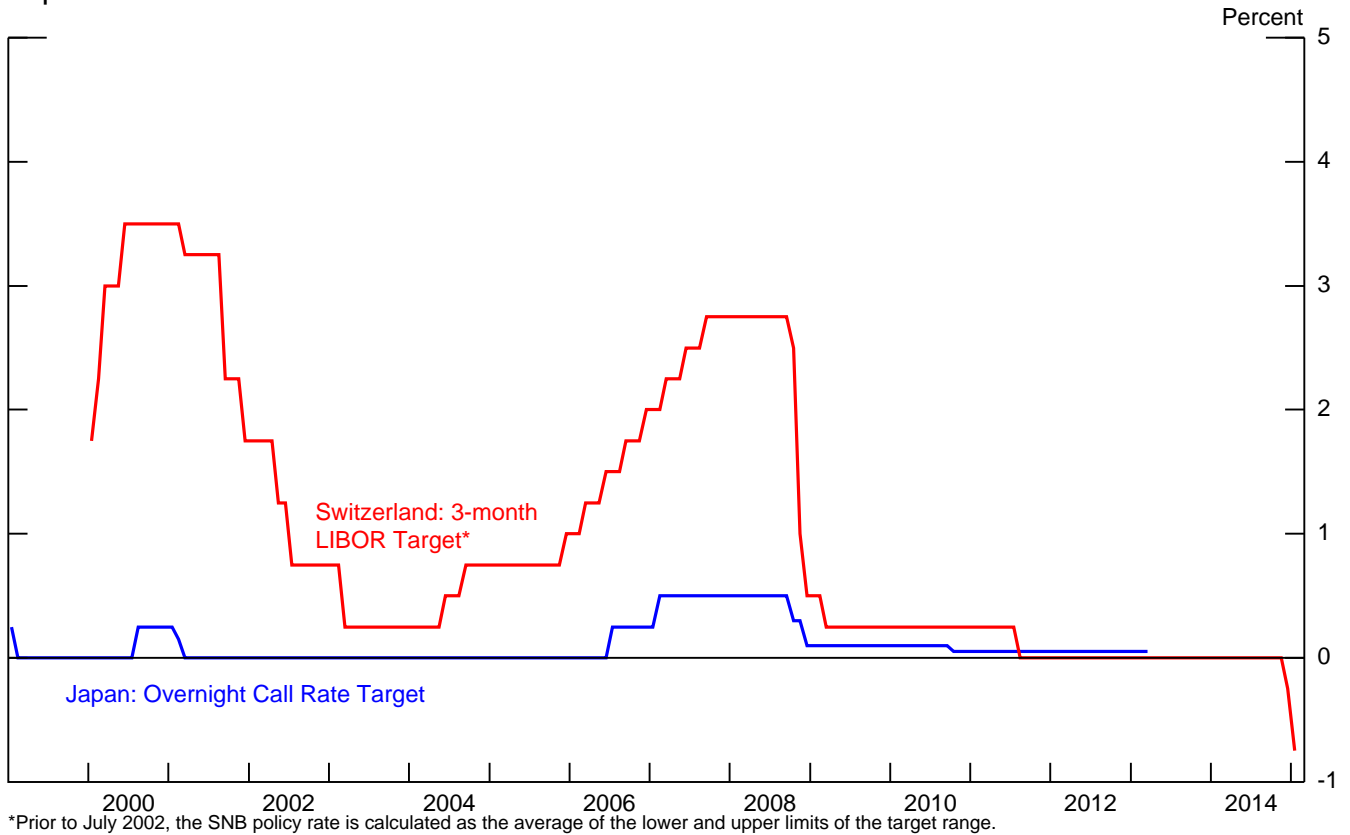
At the end of 2005, the SNB revised up its outlook for growth and inflation, with inflation projected to run almost a full percentage point above the target in the medium term. The SNB judged that a robust and sustained recovery was underway and, as a result, it resumed its gradual normalization of interest rates, raising its target range by 25 basis points at the December meeting. This move was followed by seven more consecutive 25 basis point rate hikes, bringing the target range for LIBOR to 2.25 – 3.25 percent in September 2007, when medium-term inflation expectations stabilized near 2 percent.

The onset of the global financial crisis forced the SNB to ease its policy stance. In March 2009, the SNB brought the target range down to 0 – 0.75 percent. Following a substantial and prolonged appreciation of the Swiss franc, the SNB decided in August 2011 to narrow the range to 0 – 0.25 percent and to maintain a floor for the Swiss franc against the euro at 1.20 francs per euro. In December 2014, the SNB took the LIBOR target range into negative territory, while at the same time widening it again. Most recently, on January 15, 2015, the SNB discontinued the Swiss franc floor and lowered the target another 50 basis points, to a range of negative 1.25 percent to negative 0.25 percent.

Exhibit 1

# Policy Rates

## Japan and Switzerland



## Canada, Chile, and Sweden

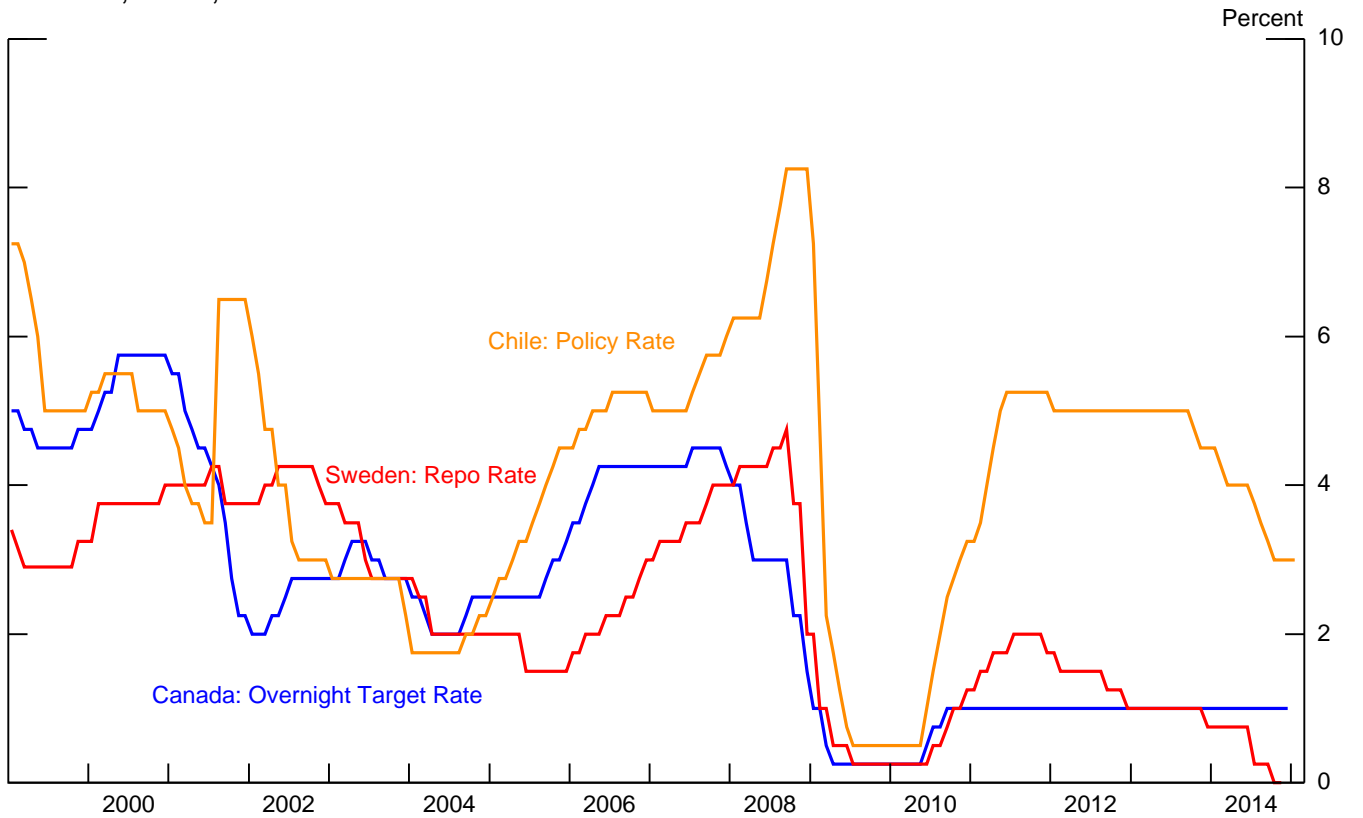
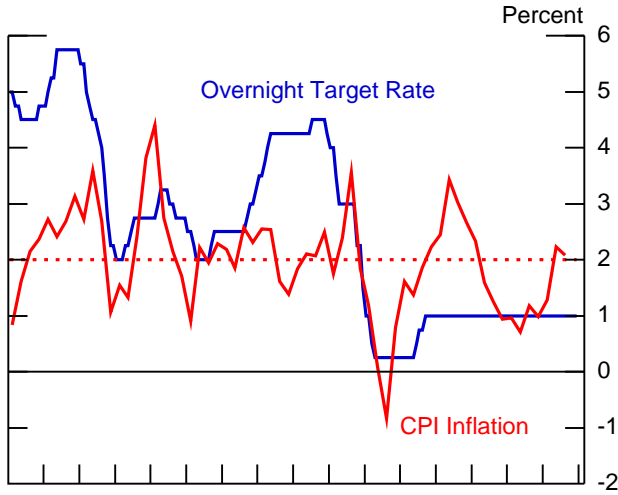


Exhibit 2

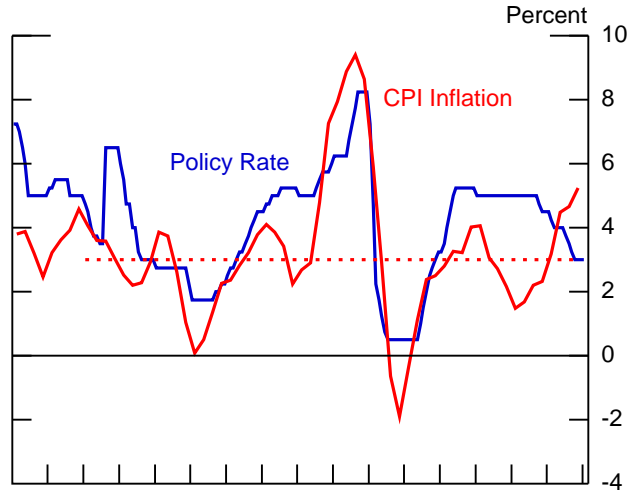
### Policy Rates and Inflation Rates

#### Canada



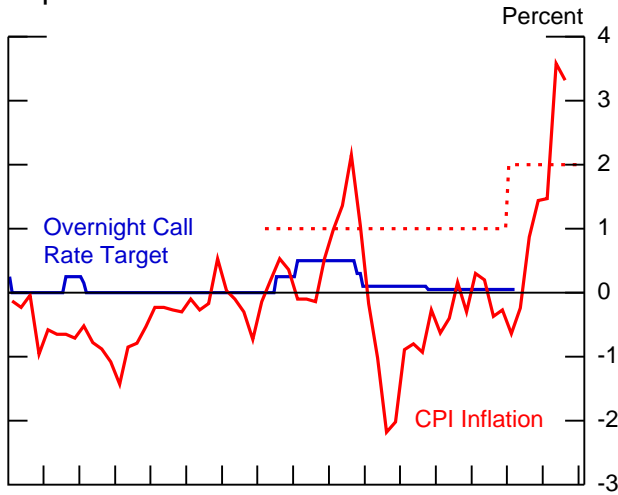
Note: The BOC has a 2 percent inflation target.

#### Chile



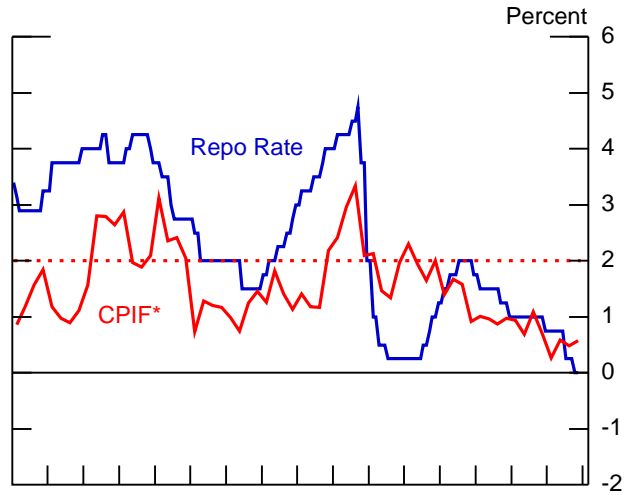
Note: The CBC aimed at a 2-4 percent inflation range between 2001 and 2007 and at a 3 percent target from 2007 onward.

#### Japan



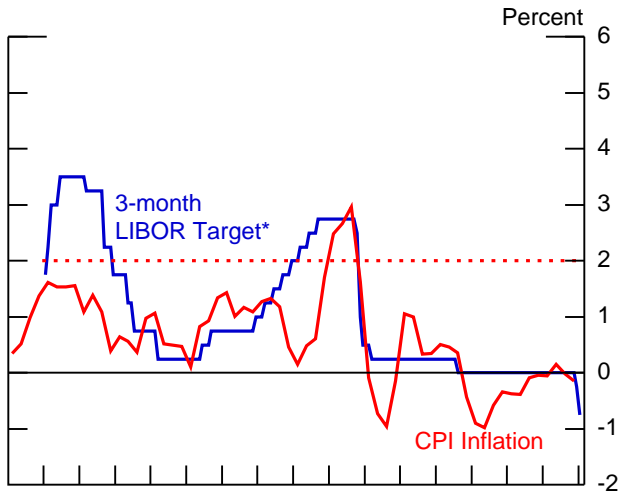
Note: The BOJ introduced an understanding of price stability as a range of 0 to 2 percent in March 2006 and a 2 percent target in January 2013.

#### Sweden



\*Inflation excludes mortgage interest rates.  
Note: The Riksbank has a 2 percent inflation target.

#### Switzerland

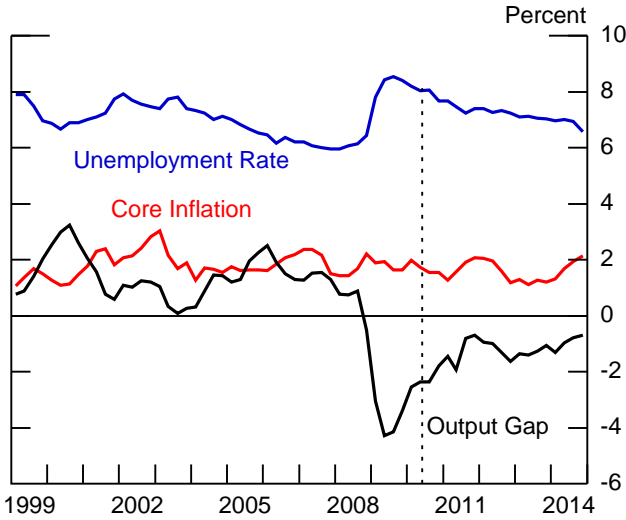


\*Prior to July 2002, the SNB policy rate is calculated as the average of the lower and upper limits of the target range.  
Note: The SNB had a monetary base target until December 1999, when it first introduced its 2 percent inflation target.

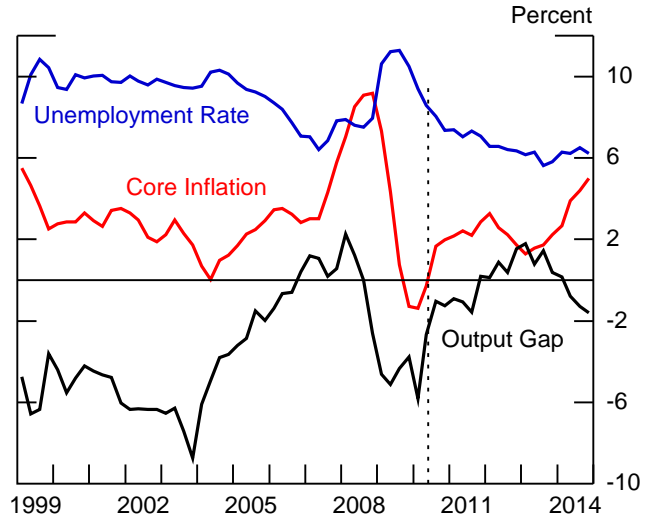
Exhibit 3

**Economic Conditions**

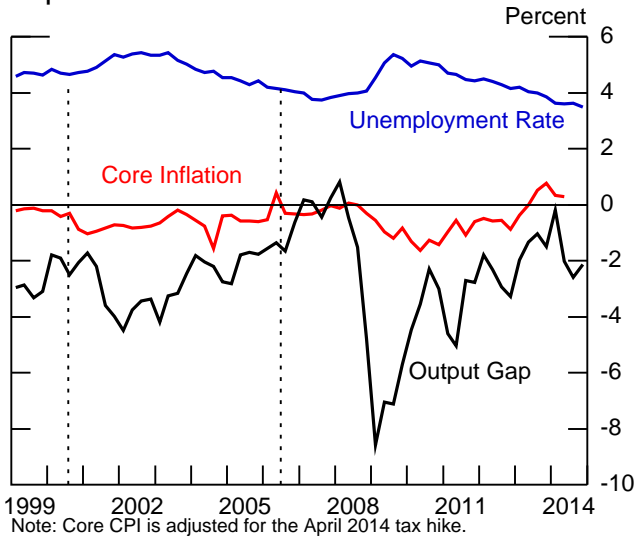
Canada



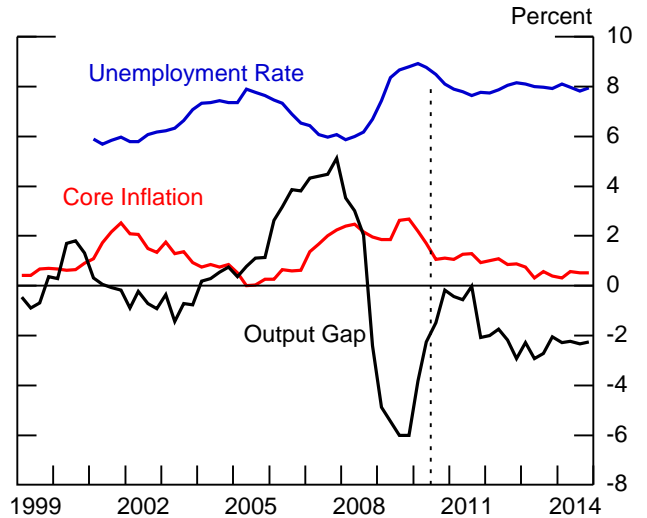
Chile



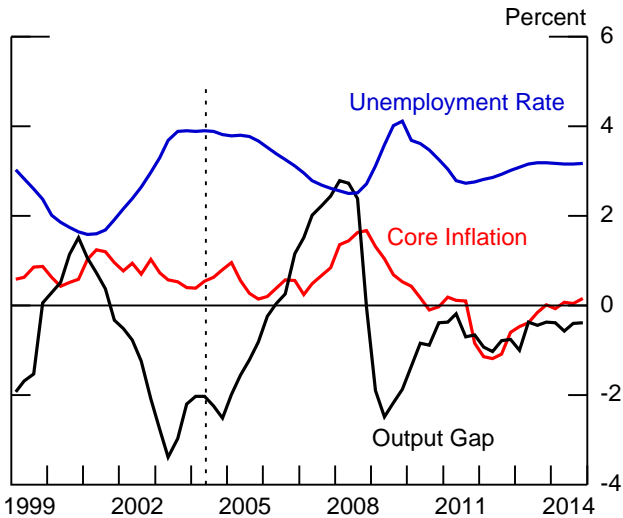
Japan



Sweden



Switzerland



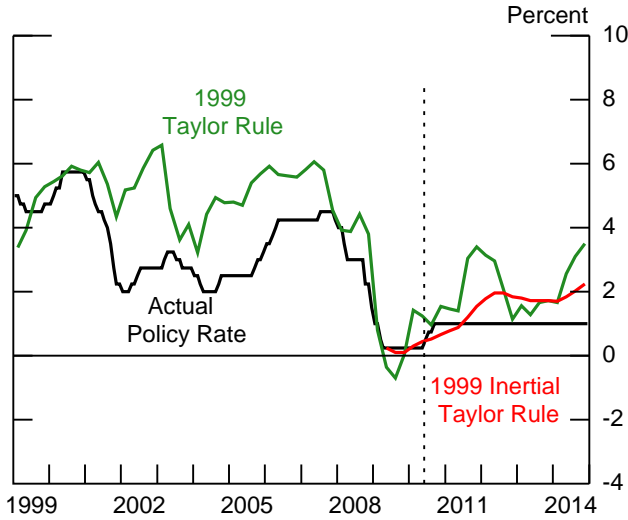
Note: Plotted are four-quarter core inflation rates (excluding energy and food prices) and staff estimates of the output gap. For Switzerland, core inflation also excludes prices of tobacco and seasonal products. Vertical dashed lines identify liftoff episodes.



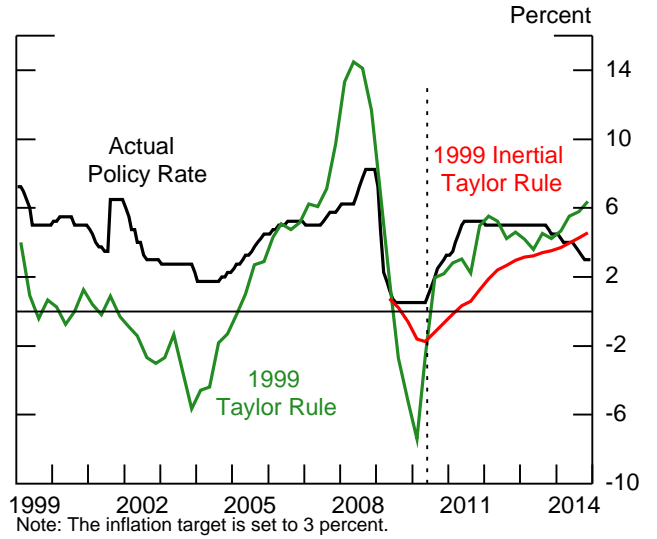
Exhibit 4

# Taylor Rules

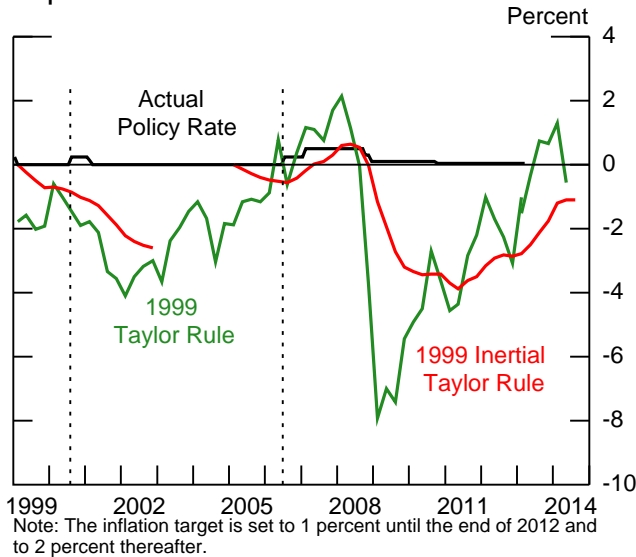
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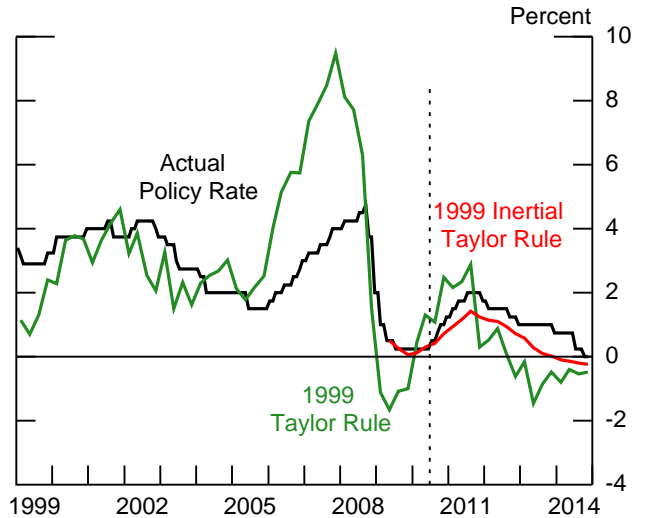
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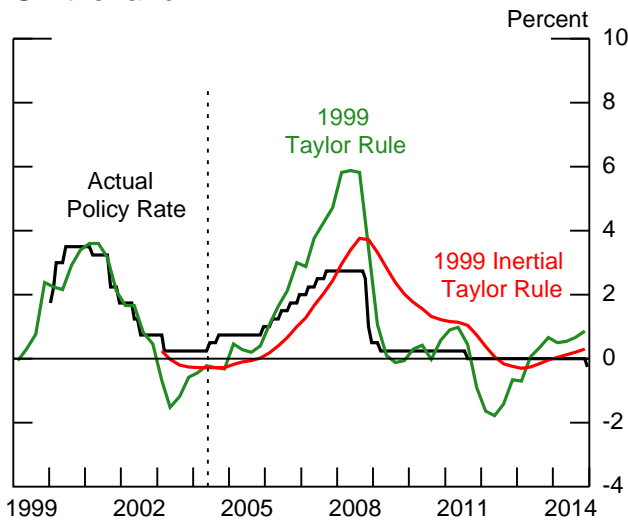
Japan



Sweden



Switzerland



## Taylor Rule Equations

**Taylor 1999 Rule**

$$R_t = 2 + \pi_t + 0.5(\pi_t - \pi_t^*) + gap_t$$

**Taylor 1999 Inertial Rule**

$$R_t = 0.85R_{t-1} + 0.15(2 + \pi_t + 0.5(\pi_t - \pi_t^*) + gap_t)$$

- $\pi_t^* = 2$  for all countries, except Chile and Japan.
- For the Inertial Taylor Rule, the initial value of the prescribed interest rate  $R_t$  is set equal to the actual policy rate when the ELB is reached.

Note: Taylor Rules are calculated using four-quarter core inflation rates (excluding energy and food prices) and staff estimates of the output gap. For Switzerland, core inflation also excludes prices of tobacco and seasonal products. Vertical dashed lines identify liftoff episodes.