



# Who put the holes in the Swiss cheese? Currency crisis under appreciation pressure

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## Abstract

We examine the reasons why the SNB gave up the lower floor of the 1.20 CHF/EUR exchange rate arrangement. Three types of shocks played a role: Exogenous shocks to the autonomous component of money demand, interest rate decreases of the ECB, as well as appreciation expectations. In order to defend these shocks the SNB intervened heavily in the foreign exchange market. This led to an accumulation of reserves of central bank's balance sheet of the size of 80 % of Swiss GDP. Interestingly, the SNB did not lower the interest rate into the negative range during the time period where the peg was in place. Hence, the SNB did not defend the peg *"whatever it takes"*.

Keywords: Foreign exchange market, Swiss crisis, UIP, Currency crisis

JEL Classification: E52, E58, E42

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## **Abstract**

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# 1 Introduction

In the aftermath of the financial crisis, many investors were looking for a *safe haven*.<sup>1</sup> For Switzerland, this led to increased capital imports and thus to a permanent appreciation pressure for the Swiss franc (CHF). In order to counteract this strong appreciation trend, the Swiss National Bank (SNB) introduced in September 2011 a minimum floor at the level of 1.20 CHF/EUR (SNB 2011). One important characteristic is that the peg<sup>2</sup> was a *unilateral* peg. As a consequence, the ECB was not obliged to support it. The whole pressure lied on the shoulders of the SNB. However, in January 2015, the SNB suddenly stopped to defend this peg and switched to a more flexible exchange rate system (SNB 2015). This raises the question of why did the SNB suddenly switch to a floating exchange rate?

Most currency crisis models are designed to explain currency crises of economies which get under devaluation pressures.<sup>3</sup> For example, in a recently published literature review, Glick/Hutchison (2011, p. 2) come up with the following definition: *"A currency crisis may be defined as a speculative attack on the foreign exchange value of a currency that either results in a sharp depreciation or forces the authorities to defend the currency by selling foreign exchange reserves or raising domestic interest rates."* In contrast, not too many models focus on economies which get under appreciation pressure, like the Swiss case.<sup>4</sup> One reason might be that it seems to be easier to defend a peg against appreciation compared to depreciation pressures.

An economy which gets under depreciation pressure has to defend the peg by selling foreign reserves to support the domestic currency. When the central bank runs out of reserves, it has to switch to a floating exchange rate regime

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<sup>1</sup> Baltensperger/Kugler (2016) emphasize the historical origins of the *"safe haven"* status of the Swiss franc.

<sup>2</sup> The SNB implemented a lower floor for the Swiss Franc at the level of 1.20 CHF/EUR. For simplicity, we will use the labels *"lower floor"* and *"peg"* as synonyms.

<sup>3</sup> There have been three different models of generation in order to understand why a currency crisis happens: The first generation, is based on Krugman's model, which explains a sudden speculation on fixed exchange rate system, as a reason for the currency crisis (Krugman 1979). The second generation model, is based on Obstfeld, where by one essential characteristic is that multiple equilibria are possible, but self-fulfilling prophecies lead to attack the peg (Obstfeld 1986). The third generation model provides unfounded exchange rate expectations as a reason for the currency crisis. Furthermore, it shows how problems in the banking and financial system interact with currency crisis (McKinnon/Pill 1996), (Corsetti/Pesenti/Roubini 1999). Further descriptions are provided by: Gärtner/Lutz (2009), Jeanne (2000), Copeland (2014).

<sup>4</sup> One exemption is the recently published study of Amador et al. (2016). They use the label *'Reverse Speculative Attacks'* for currency crises in form of appreciation pressures.

or at least implement a realignment. Furthermore, the peg can be defended by increasing the domestic interest rate which creates a negative stimulus for the real economy.

In contrast, a country which gets under appreciation pressure would accumulate additional foreign reserves and could lower the interest rate vis-a-vis the foreign interest rate. On the first view, this situation seems to be very sustainable.

In this paper, we use a macroeconomic model to highlight some reasons which could lead to a switch from a fixed to a floating exchange rate system in case of a country that is under appreciation pressure. The paper is structured as follows: Section 2 contains a theoretical model. Section 3 includes descriptive statistics and interpretations for the Swiss case. Section 4 concludes.

## 2 Theoretical analysis

The aim of this chapter is to present a theoretical model for the Swiss case. In a first step we outline the basic structure of the model. Afterwards, we analyze three different exogenous shocks which might caused to the currency crisis.

### 2.1 Structure of the model

We use a simple static model of an open economy (Switzerland) which operates at the capacity constraint. The large foreign economy represents the Eurozone (Gärtner 2009, pp. 171). Equation (1) symbolizes the goods market equilibrium condition:

$$\bar{y} = \delta(e + p^* - p) + \gamma\bar{y} + g \quad (1)$$

where the variable  $e$  symbolizes the natural log of the nominal exchange rate as the price for 1 EUR and  $(e + p^* - p)$  represents the natural log of the real exchange rate.

The money market equilibrium condition is given by:

$$\ln(H + F) - p = d_0 + \phi\bar{y} - \lambda R \quad (2)$$

Since Switzerland has implemented a fixed exchange rate system, money supply consists out of a home ( $H$ ) and foreign ( $F$ ) component. Hence,  $m =$

$\ln(H + F)$ . The variable  $d_0$  represents an autonomous component of money demand.

The equilibrium condition for the international capital market is given by the usual uncovered interest rate parity condition (UIP):

$$R = R^* + E(\dot{e}) \quad (3)$$

All Greek letters symbolizes positive parameters. In addition, all variables except interest rates are in natural logs. The endogenous variables of a fixed exchange rate system are the domestic price level ( $p$ ), the foreign component of money supply ( $F$ ), as well as domestic interest rate ( $R$ ).

By substituting (3) into (2) we can derive the equilibrium condition for the financial markets:

$$\ln(H + F) - p = \phi\bar{y} - \lambda(R^* + E(\dot{e})) \quad (4)$$

The slope of the IS-curve in a price–exchange rate–diagram is positive ( $de/dp = +1$ ). The LM-curve is derived in a price–money supply–diagram and also has a positive slope ( $dp/dm = +1$ ). In Figure 1, the initial equilibrium is characterized by the combination ( $m_0 = \ln(H_0 + F_0)$ ,  $p_0$  and  $e_0$ ).

– Insert Figure 1 about here –

## 2.2 Exogenous Shocks

### 2.2.1 Decrease of the foreign interest rate

During the time period where the lower floor was in place [09/2011 – 01/2015], the ECB reduced its key interest rate several times. For example, on September the 4<sup>th</sup>, 2014 the ECB cut its key interest rate from 0.15 % to 0.05 %, so that the level of almost zero was reached (Deutsche Bundesbank 2017). As a consequence, we analyze this exogenous shock in the model outlined above.

A reduction of the foreign interest rate ( $R^* \downarrow$ ) causes a shift of the LM-curve downwards. In a floating exchange rate system, the domestic currency would appreciate to the level  $e_1$  and the goods prices would decrease to  $p_1$  (see Figure 1). However, in a fixed exchange rate system, the central bank intervenes in the foreign exchange market in order to prevent the domestic currency from appreciating. The Swiss central bank has to purchase EUR denominated assets, thus

the reserve component ( $F \uparrow$ ) increases leading to a higher level of money supply. The new equilibrium is characterized by constant goods prices ( $p_0 = p_2$ ) while the nominal exchange rate is also fixed at its initial level ( $e_2 = e_0^{fix}$ ).

In this setting, the decrease of the European interest rate reduces the Swiss interest rate on a 1:1 basis ( $R^* \downarrow = R \downarrow$ ). Since the reduction of the domestic interest rate increases money demand, an increase in money supply closes the money market equilibrium condition. The goods market equilibrium condition is unaffected by a change in the foreign interest rate.

### 2.2.2 Increase of the autonomous money demand component

Another possible exogenous shock could be an increase of the autonomous component in money demand ( $d_0 \uparrow$ ). In the theoretical model outlined above, this shock would also lead to a downward shift of the LM-curve leading to appreciation pressure for the CHF. As a consequence, the SNB would have to defend the peg by buying EUR denominated assets which would result in an increase of the monetary base via the reserve component ( $F \uparrow$ ).

Reasons for an increase of the autonomous money demand component are for example uncertainty in other currency area. In May 2012 to July 2012, the problems within Eurozone escalated. Interest rates spreads for GIIPS<sup>5</sup> countries increased to levels which were regarded to be unsustainable in the long run. This uncertainty led European investors to search for a *safe haven*, thereby increasing the demand for Swiss currency. The increase intervention of the SNB stopped in July 2012. One reason might be the famous speech, "Whatever it takes" of ECB president Mario Draghi.<sup>6</sup> Afterwards, the pressure on the foreign exchange market decreased leading to only modest increases in the reserve component during the time period [08/2012 – 11/2014].

### 2.2.3 Appreciation expectations for the Swiss Franc

The emergence of appreciation expectations for the Swiss currency ( $E[\dot{e}] \downarrow$ ) represents another possible exogenous shock. It is a well known fact that fixed exchange rate systems can break up in case that the tensions become to large.

<sup>5</sup> Greece, Italy, Ireland, Portugal, and Spain.

<sup>6</sup> The speech was delivered during the *Global Investment Conference* in London on 26.07.2012. Literally Mario Draghi said: "Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough." (ECB 2012).

Hence, one could ask the question whether the Swiss lower floor was regarded as a credible exchange rate system, which could enfold the so called *'honey-moon effect'* (Krugman 1991). Studer-Suter/Janssen (2014) argue in this direction and they find evidence that the Swiss franc lower floor helped to stabilize the Swiss currency. In the same direction, Mirkov et al. (2016) argue that the SNB's *verbal interventions*<sup>7</sup> increased the credibility of the peg. They conclude that the markets did not anticipate the discontinuation of the lower floor for the CHF.

In contrast to this, Hertrich/Zimmermann (2015) emphasize that the credibility of the SNB in maintaining the peg was substantially lower than publicly claimed. They use EUR/CHF put options with strike prices below 1.20 EUR/CHF to estimate break-probabilities. They quantify that the break-probabilities increased tremendously after August 2014 and reached levels of almost 50 %.

As a consequence, some financial actors might start to expect that the Swiss central bank will switch to a floating exchange rate system. Since this would result in an appreciation of the Swiss currency, appreciation expectations pop-up ( $E(\dot{e}) = e_1 - e_0^{fix} < 0$ ).

Even mild appreciation expectations lead via the UIP-condition to a scenario, where the domestic interest rate has to be lowered below the level of the foreign interest rate (with  $E(\dot{e}) < 0 \Rightarrow R < R^*$ ). In the theoretical model outlined above, the appreciation expectations would lead to a further shift of the LM-curve downwards, which would lead to more SNB interventions and increases in money supply.

One important detail might even augment the conflict: In case that the foreign central bank lowers the interest rate to the level of zero ( $R^* = 0$ ), the domestic central bank has to – due to the prevailing appreciation expectations – implement a negative interest rate level ( $R < 0$ ). The *'natural lower bound'* might limit the space for negative interest rate levels.

It seems to be that a negative interest rate comes along with some cost for an economy: To some extend central banks have no experience with respect to the potential consequences of a negative interest rate policy. For example,

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<sup>7</sup> Verbal interventions are announcements from a central bank to the public about its intended monetary policies.



it could lower the profitability of commercial banks which could augment the already existing problems within the commercial banking sector. Gros (2016) points out that negative interest rates also invalidate the *'business model'* of central banks. In normal times, central banks issue zero-interest bearing cash as liabilities and earn a return on their assets. When interest rates get negative, seigniorage might also become negative.

### 3 Empirical evidence

#### 3.1 Fx-reserves development

As shown in the previous chapter, all three exogenous shocks lead to an increase in domestic money demand. As a consequence, the central bank has to intervene in the foreign exchange market which increases the foreign component of the money supply. Hence, the domestic central bank has to accumulate foreign assets – denominated in *foreign* currency. The fx-reserves development of the SNB is displayed in Figure 2.

– Insert Figure 2 about here –

As already explained, the intervention volume was relatively low after July 2012. However, suddenly the intervention activity increased again in December 2014. Reasons for this are fundamental changes in the monetary policy within major currency areas.

- Due to the Russian-Ukrainian crisis, the ruble weakened and thus led to more uncertainty (Bernholz 2015, p. 4).
- Since the growing trend that an exit of the US expansionary monetary policy was more likely, the euro has depreciated against the US dollar. (Landmann 2015, p. 14).
- The forthcoming elections in Greece enhanced the risk of a so-called *'Grexit'*. A possible Greek exit from the Eurozone generated even more uncertainty on financial markets (Baake et al. 2016, p. 18).
- The uncertainty increased even more, when the ECB has lowered its deposit rate in negative territory, in June 2014. Furthermore, in consequence of the deflation risk within the Eurozone, the president of the ECB – Mario Draghi – announced another purchasing program, the so called *'quantitative easing'*, which would lead to an even more expansionary monetary policy. In addition, one day before leaving the minimum exchange rate,

the ECB expansionary OMT program was considered as in line with law, according to an Advocate General (Baake et al. 2016, p. 18 – 19).

All these facts increased uncertainty and appreciation pressure and might led to increased autonomous component of money demand. In consequence of these tensions, the market participants expected an appreciation. Furthermore, on November the 30<sup>th</sup>, 2014 the Swiss also held a gold referendum, which increased the appreciation pressure even more. The referendum was rejected, however the appreciation pressure still remained (SNB 2014).

The counter entry of increasing currency reserves are a rise of the monetary base, thus SNB's total balance sheet becomes longer. During the financial crisis all major central banks increased their balance sheets tremendously as it can be seen in Figure 3. In Q1/2015 this ratio took values around 20 % – 40 % for the most industrialized countries. However, this ratio took a value of more than 80 % for Switzerland. Hence, this development was very severe for the Swiss case.

– Insert Figure 3 about here –

This created an enormous risk in the balance sheet of the SNB: In case that the SNB would be forced to terminate the lower floor, the appreciation of the CHF would lead to enormous losses. The equity of the SNB could even become negative.<sup>8</sup> To some extend the SNB tried to diversify the risk, buying not only EUR denominated assets but also USD denominated assets and to a smaller extend even assets denominated in GBP, YEN and other currencies (Figure 2).

To sum up, the SNB faced the following trade-off:

- Should the central bank terminates the peg right now and accept a loss of a seize which is still manageable or
- should the central bank risks that it has to intervene even further, with no guarantee that it will succeed in reducing or eliminating the appreciation pressure.

The president of the Swiss bank UBS – Axel Weber – explained in a discussion round in January 2015 the following saying in the German language,

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<sup>8</sup> The chairman of the SNB Governing Board – Thomas Jordan – elaborated on this issue already in 2011. He stressed that SNB's ability to act is not limited by negative equity, at least in short and medium term. There is, however, in a long run a risk of a loss of credibility against the SNB.

which goes as follows: *"Besser ein Ende mit Schrecken als ein Schrecken ohne Ende (Better an end with terror than terror without an end!)"* (N.N. 2015). The SNB opted for a situation which was still under control.

### 3.2 Interest rate development

As already mentioned, a country which gets under appreciations pressure has not only the option of foreign exchange market interventions, but also the option to decrease the domestic interest rate.

– Insert Figure 4 about here –

An examination of Figure 4 reveals the following developments: The ECB decreased its key interest rate during the time period 2011 – 2014 several times. While in the beginning of 2011, the interest rate was at a level of 1.5%, in the end of 2014 the interest rate was at a level of 0.05 %. In contrast to this, the SNB kept its lower and upper floor constant during almost the whole period where the peg was in place.<sup>9</sup>

This interest rate development is in sharp contrast to the theoretical model outlined above. The theoretical model suggests that a decrease of the foreign interest rate has to be matched by the Swiss central bank on a 1:1 basis.

While during the time period [09/2011 – 05/2014], the European interest rate was larger than the Swiss interest rate  $R^* > R$ , this relationship changed in 06/2014 when the ECB lowered its key interest rate below the SNB upper bound. In September 2014, the ECB decreased its key interest rate even further to the level of 0.05%. Thus the spread  $(R - R^*)$  became even positive. A positive spread  $(R > R^*)$  combined with appreciation expectations of the domestic currency leads to even more capital imports. This can not be sustainable for a long time period.

It becomes very clear, that the Swiss central bank did not use both instruments to defend the peg. The SNB only used central bank intervention and relied on this instrument to a very high degree. However, the SNB refused to mimic the interest rate decisions of the ECB to keep the interest rate spread at a constant level.

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<sup>9</sup> The *Lower Bound* was decreased from 0 % to the level of  $-0.75$  % on December the 18<sup>th</sup>, 2014. The *Upper Bound* was reduced to the level of  $-0.25$ % on January the 15<sup>th</sup>, 2015.

### 3.3 Experience since the abolishment of the peg

According to the impossible trinity, a country can not have a fixed exchange rate, independent monetary policy and complete capital mobility at the same time. Therefore, a switch from a fixed to a floating exchange rate system should increase the space for an independent monetary policy of the SNB.

In contrast to this, we can still observe that after the break-up the SNB is intervening more heavily and is accumulating foreign reserves to a much larger extent as, for example, in the beginning of 2014 – when the fixed exchange rate regime was still in place (see Figure 2). As a consequence, the SNB has not received or – is not using – its full independence with respect to monetary policy.

However, the case that countries still manage their *'floating'* currencies via central bank interventions is a well known fact from the *'fear of float'* or *'fear of appreciation'* literature (Calvo/Reinhart 2002, Levy-Yeyati et al. 2013).<sup>10</sup> The Swiss experience after the abolishment of the lower floor can be regarded as another example for the fear of appreciation.

## 4 Conclusion

In the title of the paper, we raise the question of *'who put the holes in the Swiss cheese'*. Hence, we ask what kind of shocks caused the breakdown of the *'lower bound'* arranged by the SNB. In the theoretical model, we argue that three kinds of shocks played a role:

1. Exogenous shocks which caused increases in the autonomous component of Swiss money demand,
2. the reduction of the interest rate within the Eurozone, as well as
3. appreciation expectations for the Swiss franc.

All three shocks lead to an increase in money demand, causing also changes in money supply via central bank intervention in the foreign exchange market.

Under the assumption of complete capital mobility, decreases of the foreign interest rate as well as appreciation expectations for the domestic currency have

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<sup>10</sup> Also in earlier time periods, the SNB has not adopted a *pure* free float. The SNB also tried to manage the foreign exchange rate development by central bank intervention. See, for example, the following literature: Pierdzioch/Stadtmann (2004), Frenkel/Pierdzioch/Stadtmann (2004), Fischer/Zurlinden (1999), Fischer/Zurlinden (2004).

to be matched by decreases of the domestic interest rate. Since the Swiss interest rate was already at the '*zero lower bound*', the SNB relied solely on central bank intervention. The SNB did not lower its upper bound interest rate into the negative range during the time of the peg.

The interest spread ( $R - R^*$ ) became even positive, in September 2014. The positive spread combined with appreciation expectations led to more capital imports, which caused to higher appreciation pressure. In consequence, the SNB intervened in foreign exchange market, which induced to an increased balance sheet of the size of more than 80 % of Swiss GDP. Finally, the SNB opted to abandon the peg on January the 15<sup>th</sup>, 2015.

Hence, it becomes clear that the SNB was – to some extend – reluctant to defend the peg "*whatever it takes*". By giving up the peg, the SNB did not regain its full monetary independence. The accumulation of reserves after January 2015 is a clear sign of *the fear of appreciation*.

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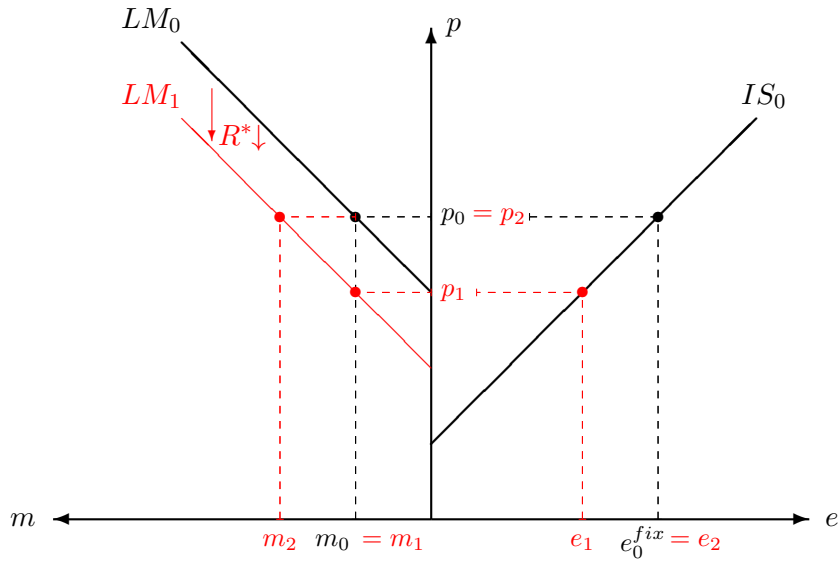
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Figure 1: Exogenous Shock: Decrease of the foreign interest rate



**Note:** In a floating exchange rate system a decrease of foreign interest rate would lead to no central bank intervention  $m_0 = m_1$ , lower goods prices  $p_1 < p_0$  and an appreciation of the domestic currency  $e_1 < e_0$ .

In a fixed exchange rate system, the nominal exchange rate is fixed to  $e_2 = e_0^{fix}$ , goods prices do not react  $p_0 = p_2$ , but central bank interventions lead to a monetary expansion via the foreign reserve component  $m_2 = \ln(H_0 + F_2) > m_0 = \ln(H_0 + F_0)$ .

Figure 2: Development of Foreign Currency Reserves

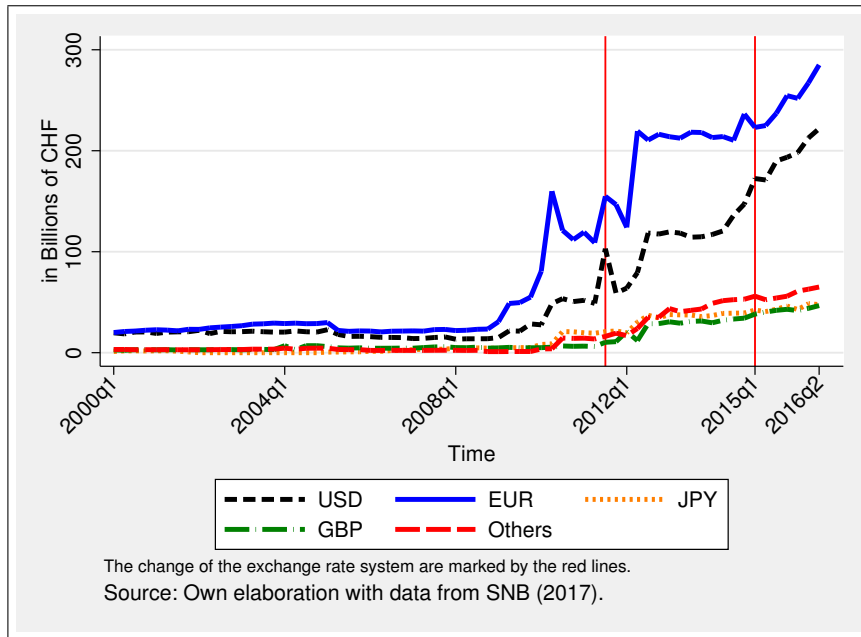


Figure 3: Comparison Balance Sheet of Major Currency Areas

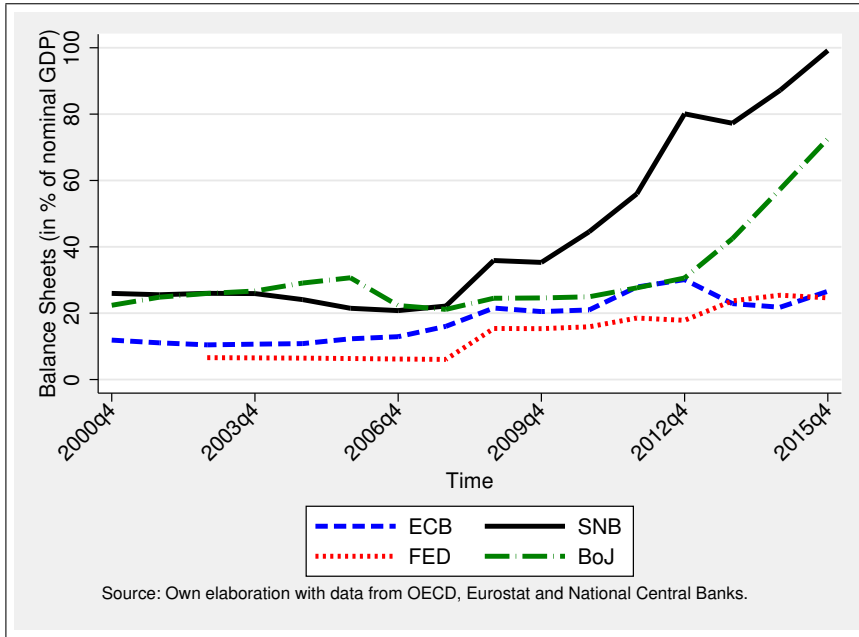


Figure 4: Key interest rate development

