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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 in the 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 do "whatever it takes" to defend the peg.

Key words: Foreign exchange market, Swiss crisis, UIP, Currency crisis

JEL classification number: E52, E58, E42

1 Introduction

In the aftermath of the financial crisis, many investors were looking for a *safe* haven.¹ 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, in September 2011, the Swiss National Bank (SNB)

¹ Baltensperger & Kugler (2016) emphasize the historical origins of the "safe haven" status of the Swiss franc.

introduced the minimum floor at the level of 1.20 CHF/EUR (SNB, 2011). One important characteristic is that the peg² 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 begs 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.³ For example, in a recently published literature review, Glick & Hutchison (2011, p. 2) came 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.⁴ 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 or at least implement 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. At first glance, this situation seems to be very sustainable.

² 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.

³ There have been three different models of generation in order to understand why a currency crisis happens: The first generation is based on the 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 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).

⁴ One exemption is the recently published study of Amador, Bianchi, Bocola & Perri (2016). They use the label 'Reverse Speculative Attacks' for currency crises in the form of appreciation pressures.

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 provides conclusions.

2 Theoretical Analysis

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

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

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:

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

Since Switzerland has implemented a fixed exchange rate system, money supply consists of 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):

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

All Greek letters symbolize positive parameters. In addition, all variables except interest rates are in natural logs. The endogenous variables of a fixed exchange

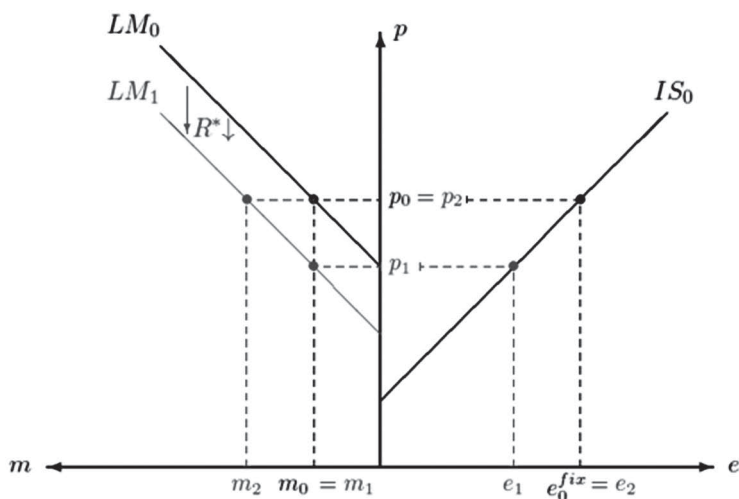
rate system are the domestic price level (p), the foreign component of money supply (F), as well as domestic interest rate (R).

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

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

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).

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 $m_2 = \ln(H_0 + F_2) > m_0 = \ln(H_0 + F_0)$.

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 4th, 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 areas. In May 2012 to July 2012, the problems within the Eurozone escalated. Interest rates spreads for the GIIPS⁵

⁵ Greece, Italy, Ireland, Portugal, and Spain.

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" by the ECB president Mario Draghi.⁶ 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 ($E[e] \downarrow$) represents another possible exogenous shock. It is a well-known fact that fixed exchange rate systems can break up in case that tensions become too large.

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 'honeymoon effect' (Krugman, 1991). Studer-Suter & Janssen (2014) argue in this direction and they find evidence that the Swiss franc lower floor helped stabilize the Swiss currency. In the same direction, Mirkov, Pozdeev & Söderlind (2016) argue that the SNB's *verbal interventions*⁷ 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 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 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 in-

⁶ The speech was delivered during the Global Investment Conference in London on 26 July 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)

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

terest 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.

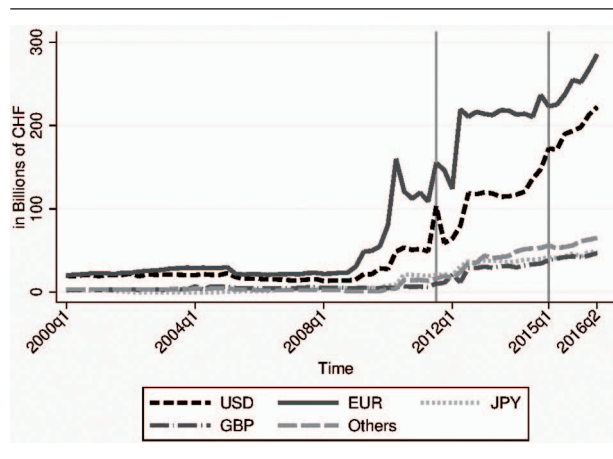
It seems that a negative interest rate comes along with some cost for an economy: To some extent, central banks have no experience with respect to potential consequences of a negative interest rate policy. For example, it could lower the profitability of commercial banks which could augment the already 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 non-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.

Figure 2: Development of Foreign Currency Reserves



The change of the exchange rate system are marked by the gray lines

Source: Own elaboration with data from SNB (2017).

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 were 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 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, Hüning, Straubhaar, & Vöpel 2016, p. 18).
- The uncertainty increased even more, when the ECB 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's expansionary OMT program was considered to be 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 30 November 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 the SNB's total balance sheet becomes longer. During the financial crisis, all major central banks increased their balance sheets tremendously, as 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.

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 nega-

tive.⁸ To some extent, the SNB tried to diversify the risk, buying not only EUR denominated assets but also USD denominated assets and, to a smaller extent, 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 terminate the peg right now and accept a loss of a seize which is still manageable or
- should the central bank risk that it has to intervene even further, with no guarantee that it will succeed in reducing or eliminating the appreciation pressure.

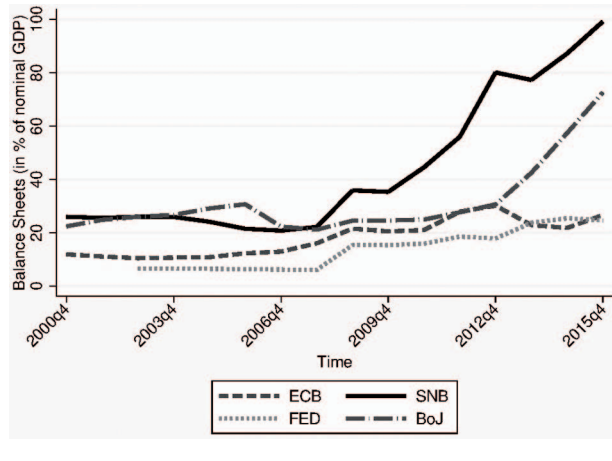
The president of the Swiss bank UBS, Axel Weber, explained in a discussion round in January 2015 the following saying in the German language, which goes as follows: "Besser ein Ende mit Schrecken als ein Schrecken ohne Ende (Better an end with terror than terror without an end!)" (N.N., 2015). The SNB opted for a situation which was still under control.

3.2 Interest rate development

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

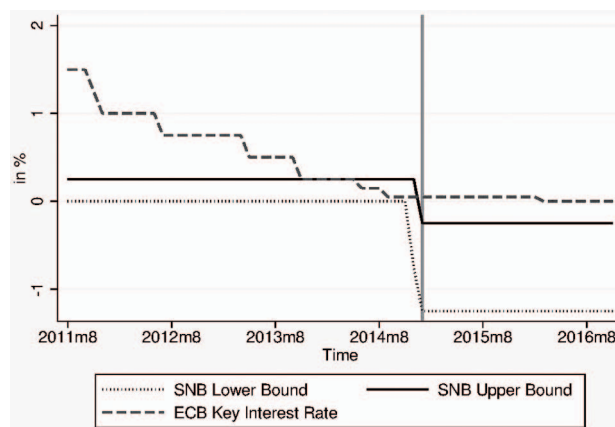
An examination of Figure 4 reveals the following developments: the ECB decreased its key interest rate several times during the time period 2011 – 2014.

Figure 3: Comparison Balance Sheet of Major Currency Areas



Source: Own elaboration with data from OECD, Eurostat and National Central Banks.

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

Figure 4: Key interest rate development

The change of the exchange rate system are marked by the vertical gray line

Source: Own elaboration with data from SNB (2017).

While the interest rate was at the level of 1.5 % in early 2011, at the end of 2014 it was at a level of 0.05 %. In contrast to this, the SNB kept its lower and upper floor constant during almost the entire period when the peg was in place.⁹

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 cannot be sustainable for a long time period.

It became 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.

⁹ The Lower Bound was decreased from 0% to the level of -0.75% on 18 December 2014. The Upper Bound was reduced to the level of -0.25 % on 15 January 2015.

3.3 Experience since the abolishment of the peg

According to the impossible trinity, a country cannot 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, has been intervening more heavily and has been 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, Sturzenegger, & Gluzmann, 2013).¹⁰ The Swiss experience after the abolishment of the lower floor can be regarded as another example of 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 the money supply via central bank intervention in the foreign exchange market.

¹⁰ Also in earlier time periods, the SNB did not adopt 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 by Pierdzioch & Stadtmann (2004), Frenkel, Pierdzioch & Stadtmann (2004), Fischer & Zurlinden (1999), Fischer & Zurlinden (2004).

Under the assumption of complete capital mobility, decreases of the foreign interest rate as well as appreciation expectations for the domestic currency have 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 higher appreciation pressure. In consequence, the SNB intervened in the foreign exchange market, which induced an increased balance sheet of the size of more than 80% of the Swiss GDP. Finally, the SNB opted to abandon the peg on 15 January 2015.

Hence, it becomes clear that the SNB was, to some extent, reluctant to do "whatever it takes" to defend the peg. 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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