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Master Thesis

Theory in Practice - The Implementation of The Foolproof Way in Switzerland and The Czech Republic

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# Abstract

*We analyse the similarities between the Svensson's (2000) "The zero bound in an open economy: A foolproof way of escaping from a liquidity trap" and the exchange rate target commitment implemented in Switzerland and the Czech Republic following the European sovereign debt crisis. We observe that the foolproof way did not work in Switzerland, mainly due to failure to establish the peg's credibility. This is linked to the existence of incomplete pass-through, a feature not contemplated in Svensson's model. On the other hand, we conclude that the foolproof way succeed in the Czech Republic, allowing the economy to escape the liquidity trap.*

**Introduction**

The economist John Maynard Keynes first introduced the notion of liquidity trap
in 1930s. It can be defined as the central bank's failure to reduce long term real
interest rates necessary for the stimulation of investment and consumption. The
relationship between nominal interest rate, real interest rate and inflation is given
by the Fischer equation. If the nominal interest rate hits the zero lower bound
(ZLB) and inflation is close to zero, or negative, while real interest rates are
positive, the central bank must look for alternative measures to reduce real interest
rates. Although, the concept has been around for some time, it did not occur as an
issue until the late 1990's. The Japanese economy's struggle with the liquidity
trap initiated a discussion around alternative monetary policy measures that can
assist in escaping the liquidity trap. The literature on measures against the
liquidity trap is controversial and many policies have been suggested to cope with
the issue. Examples of suggested policies include announcing higher inflation
target, influencing long nominal interest rates, fiscal stimulation, manipulating
expectations, currency depreciation and etc. However, most of these theories have
weaknesses that obstruct its application.

Svensson (2000) presented a combination of policies to escape the liquidity trap in
his paper 'The Zero Bound in an Open Economy: A Foolproof Way of Escaping
from a Liquidity Trap'. The framework suggests the central bank to commit to a
higher future price-level, undertake a real depreciation of the domestic currency
and commit to the peg until the economy has hit the designated price-level target,
and lastly, announce an exit strategy once the economy is back to the normal
situation. We augment the framework to include discussion regarding exchange
rate pass-through, and the implications associated with incomplete pass-through.
Since the Japanese case, many advanced economies have been caught in the
liquidity trap, especially after the 2008 Financial Crisis. Switzerland and the
Czech Republic were caught in the liquidity trap after and implemented monetary
policies similar to the foolproof way. The Swiss National Bank introduced an
exchange rate floor of 1.20 Swiss franc per euro in 2011, while the Czech
Republic introduced a similar floor of 27 koruna per euro in 2013.

The thesis is an in-depth study of the foolproof way followed by analyses of the implementation of the framework by both countries. The Czech and the Swiss economy have many similarities. Both are advanced European economies with high dependence on the EU. Although, Switzerland, unlike the Czech Republic, is not member of the EU, its economy is highly dependent on the EU. For instance, nearly two-thirds of its exports are to the EU. Moreover, the unconventional monetary policy was implemented in the same period. However, the results of the policy were different. The Czech central bank was successful in escaping the liquidity trap, but the Swiss National Bank had to abandon the peg before the desired results were achieved. Therefore, we study their implementation of the framework, and try to comprehend why one country failed, while the other was successful.

We find that the degree of exchange rate pass-through is vital for the success of the foolproof way. Switzerland failure was linked to low degree of pass-through to consumer prices and safe haven characteristic displayed by the Swiss franc. Meanwhile, the Czech Republic was successful due to the private sector belief of the koruna pegging to be credible.

The first section of the paper is an in-depth study of the foolproof way and discussion regarding the implication of the degree of pass-through. Afterwards, we analyse the Swiss case of the foolproof way and the reason behind its failure. Lastly, we look at the Czech case.

**A Model of a Small, Open Economy**

In this section we provide a comprehensive explanation of 'The Foolproof Way'. Svensson (2000) illustrates a model for an open economy that has reached the zero lower bound and has entered deflation. This is a typical liquidity trap. For a better understanding, we start by presenting the model derived in Svensson (2000) and the monetary policy transmission mechanisms associated to it.

The aggregate supply curve is a given by the following modified Phillips curve

(1) $\pi_{t+1} = \alpha_\pi \pi_t + (1 - \alpha_\pi) E_t \pi_{t+2} + \alpha_y E_t y_{t+1} + \alpha_q (E_t q_{t+1} - q) + \varepsilon_{t+1}$

Where $\pi$ denotes the rate of inflation and the subscript expresses the time period. $E_t$ is the expectation operator given information available in period t. y and q denote the output gap and the real exchange rate, respectively. $\varepsilon_{t+1}$ is a cost-push shock and the $\alpha's$ are constant and positive being $\alpha_\pi$ smaller than unity. Prices are set one period in advance since the inflation rate in period t+1 is determined by information available in period t. The inflation in period t+1 depends on the inflation in period t as well as the expected inflation in period t+2. The expected output gap in period t+1 also plays a role since an expectation of increase in the real activity leads to price-setters setting higher prices for period t+1. The expected real exchange rate depreciation relative to steady state shows the effect of expected costs of intermediate inputs on inflation.

A standard definition of inflation is the increase in the prices of domestically produced goods and services over a period of time. Specifically, inflation is the change in prices relative to the previous period. Hence, inflation can be written as follows

(2) $\pi_t = p_t - p_{t-1}$

Where $p_t$ denotes the log prices of domestically produces goods and services in period t.

Output gap is defined as the deviation between actual production of goods and services in an economy and the maximum output of the economy that is sustainable in the long term, also called the potential output. Hence, the output gap can be written as follows

$$(3) \quad y_t = y_t^d - y_t^n$$

Where $y_t^d$ denotes log aggregate demand and $y_t^n$ denotes potential output in period t.

The real exchange rate expresses the purchasing power of the domestic currency relative to a foreign currency. It is the price-level of foreign produced goods and services relative to the domestic price-level of goods and services. In order to compare both foreign and domestic goods in the same currency, we multiply with the nominal exchange rate. Hence, the log of real exchange rate can be written as follows

$$(4) \quad q_t \equiv s_t + p_t^* - p_t$$

Where $p_t^*$ denotes the log foreign price-level, and $s_t$ is the log nominal exchange rate in units of domestic currency per unit of foreign currency.

Inflation measured by consumer price index (CPI) is the change in the prices of a basket of goods that a household typically consumes (OECD DATA, 2017). In a small, open economy, it is reasonable to assume that households consume both domestic goods and imported goods. Therefore, the CPI inflation is given by the sum of domestic inflation and imported inflation in terms of domestic currency, weighted for imported goods

$$(5) \quad \pi_t^c = (1-\omega)\pi_t + \omega\pi_t^f$$

Where $\omega$ denotes the share of imported goods in the consumer basket, and $\pi_t^f$ is

the imported inflation. The model assumes perfect pass-through, implying that log prices of imported goods in domestic currency are given by

$$(6)\quad p_t^f = p_t^* + s_t$$

Combining equation (2) and (6), we get

$$(7)\quad \pi_t^f = \pi_t^* + s_t - s_{t-1} \implies \pi_t^f = \pi_t + q_t - q_{t-1}$$

Inserting equation (7) into the CPI-inflation function yields

$$(8)\quad \pi_t^c = \pi_t + \omega(q_t - q_{t-1})$$

The result rests on the critical assumption of perfect pass-through, which we shall discuss later on.

The following IS-curve expresses the aggregate demand for domestically produced goods in terms of the output gap.

$$(9)\quad y_{t+1} = \beta_y y_t - \beta_\rho E_t \rho_{t+1} + \beta_y^* E_t y_{t+1}^* + \beta_q (E_t q_{t+1} - q) - (\gamma_y^n - \beta_y) y_t^n + \eta_{t+1}^d - \eta_{t+1}^n$$

Where the coefficients are non-negative. $y^*$ denotes the log foreign output gap while $\eta_{t+1}^d$ denotes a serially uncorrelated zero-mean demand shock. The aggregate demand in period t+1 is determined one period in advance since all the variables, except the shocks, are determined by information available in period t. Furthermore, the variable $\rho_t$ in the IS-curve above is defined as follows

$$(10)\quad \rho_t = \sum_{\tau=0}^{\infty} (E_t r_{t+\tau} - r)$$

$$(11)\quad r_t = i_t - E_t \pi_{t+1}$$

$$(12)\quad i_t \geq 0$$

Where $r_t$ is the real interest rate while r is its constant steady state level. Hence, $\rho_t$ denotes the sum of current and expected deviations of the real interest rate from its steady state. Equation (11) determines the real interest rate following the Fischer equation. Lastly, equation (12) takes into consideration a binding zero lower bound. Let us consider the long real interest rate with maturity T, $r_t^T$. The expectation hypothesis implies that the relationship between long real interest rates and short interest rates is given by $r_t^T = \frac{1}{T}\sum_{\tau=0}^{T} E_t r_{t+\tau}$. Given the expectation hypothesis, $\rho_t$ can be written as $\rho_t \approx T(r_t^T - r)$, implying that $\rho_t$ is approximately the product of the deviation of from the steady state level of a long real rate and its maturity (Svensson, 2000). The uncovered interest parity condition (UIP) holds for the exchange rate if

$$(13) \quad i_t - i_t^* = E_t s_{t+1} - s_t + \varphi_t$$

Where $i_t^*$ denotes the foreign nominal interest rate and $\varphi_t$ is the foreign-exchange risk premium. We rewrite the above equation using equations (4) and (2)

$$(14) \quad i_t - i_t^* = E_t q_{t+1} - p_{t+1}^* - p_{t+1} - (q - p_t^* + p_t) + \varphi_t = E_t q_{t+1} - E_t \pi_{t+1}^* - E_t \pi_{t+1} - q_t + \varphi_t$$

Re-arranging and applying the Fischer equation yields the real interest parity condition in terms of the stationary real exchange rate (Svensson, 2000)

$$(15) \quad E_t q_{t+1} = q_t + r_t - r^* - \varphi_t$$

Let us now use the fact that the difference between the steady state levels of domestic and foreign real interest rate equals the steady state level of the foreign exchange risk premium, $r - r^* = \varphi$. Furthermore, we have that the real exchange rate moves towards its steady state in the long run, $\lim_{T \to \infty} q_T = q$. Hence, solving equation (15) forward yields

$$q_t - q = -\sum_{\tau=0}^{\infty}(E_t r_{t+\tau} - r) + \sum_{\tau=0}^{\infty}(E_t r_{t+\tau}^* - r^*) + \sum_{\tau=0}^{\infty}(E_t \varphi_{t+\tau} - \varphi)$$

$$(16) \quad q_t - q \equiv -(\rho_t - \rho_t^*) + \frac{1}{1-\gamma_\varphi}(\varphi_t - \varphi)$$

The variables of interest here are the real exchange rate and $\rho_t$. The real exchange

rate is negatively related to the difference between the domestic and foreign $\rho_t$.

To simplify the model, the following univariate AR (1) processes are assumed

$$(17) \quad \pi_{t+1}^* = \pi^* - \gamma_\pi^*(\pi_t^* - \pi^*) + \varepsilon_{t+1}^*$$
$$(18) \quad y_{t+1}^* = \gamma_y^* y_t^* + \eta_{t+1}^*$$
$$(19) \quad \varphi_{t+1} = \varphi + \gamma_\varphi(\varphi_t - \varphi) + \xi_{\varphi,t+1}$$

The coefficients of the above equations are non-negative and less than unity while

the shocks are serially uncorrelated and have a zero-mean. $\pi^*$ is the steady state

level of foreign inflation, which is assumed constant. $\varphi$ denotes the constant

steady state level of foreign exchange risk premium. Furthermore, the ensuing

Taylor-type instrument rule assumes that foreign interest rate is a linear function

of its inflation and output:

$$(20) \quad i_t^* = i^* + f_\pi^*(\pi_t^* - \pi^*) + f_y^* y_t^* + \xi_{it}^*$$

Svensson (2000) assumes that the government's fiscal policy does not affect the

price-level in the economy, and therefore, this is not depicted in the model.

**Transmission Mechanisms of Expansionary Monetary Policy in a Small,**
**Open Economy**

In the above model, we have defined the aggregate supply equation (1), the CPI

inflation equation (8) and the demand equation (9). The sum of current and

expected future real interest rate (10) and the real interest rate (11) have been

determined as well. Furthermore, we have derived the real interest parity

condition (15) and assumed equations for the exogenous variables in the foreign country (17)-(20). These equations are sufficient to discuss the monetary policy transmission mechanisms present in a small, open economy. We disregard the zero lower bound to simplify our discussion. The discussion assumes perfect pass-through. We shall, however, comment on the implications of incomplete pass-through for the monetary policy transmission mechanism later on.

Suppose that the central bank conducts expansionary monetary policy and decreases the short nominal interest rate in period t. As discussed above, current output gap and domestic inflation are predetermined. Both domestic inflation in period t+1 and expectations regarding inflation in period t+1 will be sticky. Note that expected domestic inflation is endogenous in our model, and the real interest rate is increasing in the nominal interest rate as an equilibrium property (Svensson, 2000). Thus, the decrease in nominal interest rate leads to a fall in the short real interest rate. $\rho_t$ and $q_t$ are forward-looking variables, and therefore, are affected by current and expected future real interest rates. Hence, expectations regarding the future path of the real interest rate matter.

Consider equations (10) and (16). It is evident that $\rho_t$ decreases while $q_t$ rises given that the assumed fall in the real interest rate is persistent in such a way that the *expected* real interest rates decrease as well. In this framework, an increase in the real exchange rate corresponds to a real depreciation of the domestic currency. It is evident from equation (8) that a real depreciation of the domestic currency increases the CPI inflation with the share of imported goods in the standard consumer basket of domestic households, $\omega$ . To summarise, an expansionary monetary policy will decrease the real interest rate and a real depreciation of the domestic currency leading to an increase in the CPI inflation. The above mechanism is defined as *the direct exchange rate channel to the CPI inflation.*

Next, we take the demand side of the model, defined by the IS-equation (9), into consideration. The two variables of interest are the expected future long real rates, $E_t\rho_{t+1}$ , and the expected future real exchange rate. The fall in the expected future real rates will lead to a fall in the expected future *long* real rates as well. One can

see from equation (9) that such a fall in $\mathrm{E}_t \rho_{t+1}$ will lead to an increase in the output gap. Since the aggregate demand is an endogenous part of the output gap, demand will increase as well (Svensson, 2000). The effect of the real interest rate on demand is defined as *the real interest rate channel to aggregate demand.* Similarly, the expected future depreciation implies that $\mathrm{E}_t q_{t+1}$ rises due to an increase in the current real exchange rate contributing to an increase in the output gap and increasing aggregate demand endogenously. The mechanism explained is called *the exchange rate channel to aggregate demand*

Hereunder, we look at the transmission mechanisms on the supply side. Consider the Phillips-curve denoted by equation (1). As shown under the discussion about the transmission mechanisms on the demand side, output gap and the real exchange rate will increase when the real rates fall. Thus, expected increases in the output gap and the real exchange rate will cause a rise in inflation one period ahead, $\pi_{t+1}$ . These are called *the aggregate demand channel to domestic inflation* and *the exchange rate channel to domestic inflation.* In addition, the Phillips-curve above shows that expectations regarding inflation in period t+2, $\mathrm{E}_t \pi_{t+2}$ , have an effect on the inflation in period t+1. A persistent increase in inflation in period t+1 will lead to a rise in expectations regarding inflation in period t+2, which again contributes to an increase in $\pi_{t+1}$ . It is called *the direct expectations channel to domestic inflation* in period t+2. There are other transmission channels, such as the credit channel and the direct money channel, but we restrict ourselves to the above mentioned transmission channels.

**Incomplete Pass-through**

Perfect pass-through implies that the Law of One Price holds. That is, the price of a good or an asset is the same in different countries when taking into account the nominal exchange rate. Any change in the exchange rate or the price of the goods in the foreign country will immediately affect the price of the imported goods in the domestic country. As Monacelli (2003) argues, there is well-established empirical evidence that there are large and pervasive deviations from the Law of One Price for traded goods. Therefore, it is reasonable to question Svensson's

(2000) assumption of perfect pass-through. The difference between incomplete and perfect pass-through might bear important implications for the design of optimal monetary policy (Monacelli, 2003). Since this might be one of the reasons behind the foolproof way being controversial, we shall spend some time deliberating on implications of the degree of pass-through. Our point of reference will be the working paper of Monacelli (2003).

Consider equation (5) above. Let us now introduce the terms of trade, which is the average domestic currency price of exports relative to the average domestic currency price of imports. Hence, the log of terms of trade is given by the equation $\phi_t = p_t^f - p_t$. Moreover, the terms of trade in terms of relative inflation rates is given by $\Delta\phi_t = \pi_t^f - \pi_t$. Using terms of trade, equation (5) can be written as:

$$(21) \quad \pi_t^c = \pi_t + \omega\Delta\phi_t$$

If we compare equation (8) to equation (21), the latter looks at the difference between inflation of imported goods and domestically produced goods instead of the difference in the real exchange rate of two periods. Hence, equation (21) implies that a real depreciation of the domestic currency does not necessarily mean that the CPI inflation increases. In an environment of low pass-through, fluctuations in the real exchange rate will have lesser impact than that assumed by Svensson (2000). Therefore, equation (21) looks at the increase in the inflation of imported goods, and not just the real depreciation of the currency. The violation of the Law of One Price has implications for the output gap as well. In case of perfect pass-through, a real depreciation of domestic currency would lead to a betterment of terms of trade and subsequently manifest into an increase in the output gap. Hence, we see an increase in the output gap due to a real depreciation as equation (9) implies. However, the violation of the Law of One Price implies a difference between the real exchange rate and terms of trade. A real depreciation will lead to a weaker improvement in terms of trade than under perfect pass-through, and as a consequence may lead to a weaker effect on the output gap. Thus, in case of incomplete pass-through, the effect of exchange rate on real activity will be weak, or insignificant in the extreme case.

The basis of our analysis is a small, open economy. Goods produced in a small economy represent an insignificant part of the world's consumption basket, and we treat rest of the world as a closed economy, implying equivalence between domestic and CPI inflation in the world economy. In the case of incomplete pass-through, the Law of One Price does not hold. The deviation has implications for the relationship between the real exchange rate and terms of trade. The real exchange rate is defined as above: $q_t \equiv s_t + p_t^* - p_t$ . Let the log price-level of imported goods relative to domestically produced goods be given by: $\delta_t = p_t^f - p_t$ , and the measure for deviations from the Law of One price be defined as: $\psi_t = s_t + p_t^* - p_t^f$ . Then,

(22)  $q_t = \psi_t + p_t^f - p_t = \psi_t + \delta_t$

Hence, equation (22) implies two main sources behind deviations from aggregate purchasing power parity. Firstly, differences in the consumption baskets of the domestic economy and rest of the world. If the two consumption baskets coincide, there are no relative price variations in the equilibrium and $\delta_t$ is therefore zero. The second source of deviation is the departure from the Law of One Price, $\psi_t$ . If there is incomplete pass-through, $\psi_t$ contributes to volatility in the real exchange rate. Hence, its role is vital for the determination of dynamics of imported inflation.

Campa and Goldberg (2002) estimate the elasticity of pass-through for a number of OECD countries. Their main finding is that there is only a partial pass-through of exchange rate in the short run, while the results show near-perfect pass-through in the long run. Hence, incomplete pass-through should be modelled in such a manner that it is allowed for large, gradual and persistent deviations from the Law of One Price. Assume that local retailers import differentiated goods for which the Law of One Price holds at the time of importation. The importers solve for an optimal mark-up on imported goods that allows for deviations from The Law of One Price in the short run, but the pass-through is complete in the long run. We

allow the degree of stickiness of imported goods $(\theta_F)$ to vary from the stickiness of domestically produced goods $(\theta_H)$. Combining the solution of the optimal price with the aggregate import price yields the ensuing aggregate supply curve for imported goods

$$(23) \quad \pi_t^f = \beta E_t \pi_{t+1}^f + \lambda_F \psi_t, \ \lambda_F \equiv \frac{(1-\theta_F)(1-\beta\theta_F)}{\theta_F}$$

Equation (23) implies that imported inflation rises as the world price of the imported good exceeds the local currency price of the good (Monacelli, 2003). Parameter $\theta_F$ is the degree of pass-through. Equation (23) can be solved forward to yield the following result:

$$(24) \quad \pi_t^f = E_t \left\{ \sum_{k=0}^{\infty} \beta^k \lambda_F \psi_{t+k} \right\}$$

Hence, imported inflation is a forward-looking variable. Its current behaviour depends on the current and expected future deviations from the Law of One Price.

This is an important result for our analysis. Equation (7) defines imported inflation as a function of domestic inflation and the real exchange rate. However, the result above implies that imported inflation depends on the degree of pass-through in the economy. A low degree of pass-through implies higher degree of stickiness in the prices of imported goods. Thus, prices that the consumers face remain stable even though the exchange rate is volatile. Thus, deviations from the Law of One Price (partial pass-through) imply that imported-inflation is less affected than Svensson (2000) suggests. Hence, incomplete pass-through has the implication that a real depreciation of domestic currency does not affect CPI inflation as much as in equation (8). Therefore, incomplete pass-through implies that the economy will not be as reactive to a real depreciation of domestic currency as suggested by Svensson (2000).

**Implications of Incomplete Pass-Through on Monetary Policy Transmission Mechanisms**

In case of low pass-through, the CPI inflation will not be as reactive to the real depreciation of domestic currency as under the environment of perfect pass-through. The degree of stickiness of prices of imported goods will be higher. The increase in consumer prices will not be proportional to the increase in the import prices implying that CPI inflation will not increase as much as above. Hence, the *direct exchange rate channel to CPI inflation* will be weaker than under perfect pass-through environment. The stickiness in consumer prices implies that the increase in the price of imported intermediates will not be proportional to increase in the consumer prices. Hence, domestic inflation will not increase as much as under perfect pass-through environment, downplaying the *exchange rate channel to domestic inflation. The exchange rate channel to aggregate demand* will also be weaker since demand will not shift as much to domestic goods as under perfect pass-through due to weaker improvement of terms of trade.

Expectations regarding inflation play an important role for current inflation. The stickiness of prices under incomplete pass-through implies that importers will be forward-looking when setting prices. Therefore, not only current, but also expectations regarding future exchange rate will contribute to determining prices and subsequently inflation today. If a depreciation of domestic currency is expected, or expected to persist, then price-setters will take into account the expected increase in cost of importation in the future when setting prices today. Hence, the *direct expectations channel to inflation* may, in fact, be stronger under incomplete pass-through than under perfect pass-through.

The abovementioned transmissions channels are four vital mechanisms for the foolproof way. Thus, the impact of the real depreciation will not be as immense as Svensson suggests. Incomplete pass-through is a realistic assumption, and may have an impact on the results of implementing the foolproof way, such as a delay in reaching the price-level target.

**Policy Alternatives under a Binding Zero Bound**

The zero bound denoted by equation (12) is a critical assumption of the framework. Therefore, we dedicate this section to explaining the transmission mechanism of alternative policy options in the presence of such a bound. Assume that the economy has reached the zero lower bound, and there is need for expansionary monetary policies that can be set without incurring a negative nominal interest rate.

First, we study how a credible commitment of continuing low interest rate regime by the central bank can affect private sector expectations. Suppose the private sector expects an increase in the nominal interest rate in the future. A policy option for the central bank is a commitment to maintain the nominal interest rate at zero for a longer period than expected by the private sector. If the policy is successful, expectations of nominal interest rates will go down, which, by the Fischer equation, will lead to a reduction in the expected future real rates given that inflation expectations remain unchanged. By equations (9) and (10), $\rho_t$ will fall and consequently contribute positively to the output gap. However, the policy relies on making the private sector believe that the commitment is credible and lack of such a commitment mechanism may lead to insignificant effect on the real interest rates.

A second policy option is manipulation of the supply and demand of domestic currency in the exchange market. Suppose that the nominal interest rates are zero in the infinite future, and cannot be further affected. In case of an exogenous foreign exchange risk premium, the real exchange rate can only be affected if $\rho_t$ is affected. Thus, if the nominal interest rate and inflation expectation cannot be further moved by the central bank, it cannot affect $\rho_t$ and consequently the real exchange rate is unaffected as well. However, if $\varphi_t$ is partly endogenous and the relative holdings of domestic and foreign currency assets can affect the foreign exchange risk premium, foreign exchange interventions may change relative holdings of domestic and foreign currency denominated assets leading to changes in the nominal and real exchange rates. Hence, a partly endogenous $\varphi_t$ that can

manipulated by relative holding of domestic and foreign currency assets will affect the real exchange rate, $q_t$.

A third option is the manipulation of private sector's expectations regarding future inflation. If the central bank is successful in increasing inflation expectations, it will lead to reduction in future real interest rates, depreciate current and future exchange rates, and increase future output and actual future inflation. It should be noted that the policy relies heavily on success of anchoring inflation expectations to, say, central bank's inflation target. Svensson (2000) suggests a price-level target path corresponding to a positive long-run inflation. The advantage of such a path is that some deflation today implies higher inflation expectations in the future (we shall discuss price-level targeting in detail later), and cause reduction in real rates and real depreciation of the domestic currency without changes in the nominal interest rate.

Lastly, we discuss the policy of expanding the monetary base when the economy has hit the zero lower bound. An option is open-market operations in long government bonds rather than short bonds. The argument is that since short government bonds will be near perfect substitutes for money reserves on the zero lower bound, the private sector holding larger amounts of money reserves will have minimal effect on the prices of other assets (Meltzer, 1999). However, the central bank can manipulate the long nominal and real interest rate by reducing expectations about future nominal rates via the risk premium. Another possibility is that such open-market operations lead to increase in inflation expectations and consequently a reduction in $\rho_t$.

There are other available options as well, such as open-market operations in corporate bonds. However, we refrain ourselves to the above discussion.

**The Foolproof Way of Escaping From a Liquidity Trap**

Svensson (2000) proposes a framework to escape the liquidity trap that we shall explain hereunder.

Firstly, it is suggested announcing a price-level target path with a positive drift

$\left\{\hat{p}_t\right\}_{t=t_0}^{\infty}$ for the domestic price-level.

(25) $\hat{p}_t = \hat{p}_{t_0} + \pi(t-t_0), \ t>t_0$

The price-level target path should have two main characteristics. Firstly, the announced price-level target path should exceed current price-level, $\hat{p}_{t_0} > p_{t_0}$. Secondly, it should take into account a small positive long-run inflation target, $\hat{\pi} > 0$, such as 2%, which is the norm for central banks in industrialized nations. Another feature of the price-level is that it presents an exit strategy. The path exhibits the price-level target path that the bank aims to pursue before unpegging the currency. Svensson suggests price-level targeting instead of typical inflation targeting conducted by advanced economies. Both methods establish targets for a price index such as the CPI. However, the difference is that inflation targeting only takes the future into account while price-level targeting takes previous periods into account as well. For instance, if the CPI rises by 2% in the past year, the central bank will look to drop the price-level the next year to keep it on its target. In the case of too low inflation, the central bank will conduct more rigorous open-market operations if the price-level target is not reached within the prescribed period. Hence, price-level targeting is more vigorous than inflation targeting, and may cause more volatility in inflation in the short term. The price-level target path may pose a credibility problem as well if the private sector expects the central bank to abandon the path as soon as inflation hits its target.

Secondly, the framework recommends announcing a devaluation of the currency and pegging the exchange rate target to an *upwards-crawling* exchange rate target path.

(26) $s_t = \bar{s}_t, \ t \geq t_0$

Where $\bar{s}_t$ is the exchange rate target, and is given by

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$$(27) \quad \overline{s}_t = \overline{s}_{t_0} + (\hat{\pi} - \pi^*)(t - t_0), \, t \geq t_0$$

Here, $\overline{s}_{t_0}$ denotes the initial exchange-rate target after depreciation and $\hat{\pi} - \pi^*$ is the difference between the domestic inflation target and average foreign inflation between periods t and $t_0$. The central bank exhibits a commitment to maintain the exchange rate target by buying and selling unlimited amounts of foreign exchange. The choice of the initial nominal exchange rate target in equation (27) must be such that it allows for a real depreciation of the domestic currency relative to its steady state.

$$(28) \quad q_{t_0} \equiv p^*_{t_0} + \overline{s}_{t_0} - \overline{p}_{t_0} > q$$

Hence, the exchange rate target is a nominal depreciation of the domestic currency at the rate of $\hat{\pi} - \pi^*$. The reason behind allowing drift in the nominal devaluation is to avoid a *real* appreciation of the currency due to differences in the development of prices between the home and foreign country. Thus, the model also allows for a fixed peg if the price development is similar in both countries, $\hat{\pi} = \pi^*$.

Thirdly, announce abandoning the peg when the price-level target path is reached, and that the central bank will switch over to flexible price-level targeting with the same target path, or flexible inflation target.

Finally, the abovementioned framework should be executed.

**Why Should the Foolproof Way Work?**

This section explains the dynamics of the framework, and how the abovementioned foolproof way will lead to a reduction in the long-term real interest rate, or a real depreciation that increases the output gap. In the first part, we will explain what is expected to happen, and why this is feasible, when we

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implement the steps of the previous section. Later, we explain the algebraic derivations to prove why the suggested is expected to happen. We still use Svensson (2000) as our reference point.

1) The devaluation and pegging of the currency that causes a real depreciation is a viable policy for the central bank. The depreciation causes an appreciation pressure, and the central bank can cope with such pressures by printing unlimited amount of domestic currency that is used to buy foreign exchange. Hence, the peg protection of the peg is feasible.

2) The private sector will believe the peg to be credible if the central bank exhibits its willingness to defend the peg.

$$(29) \quad \mathrm{E}_t s_{t+\tau} = \overline{s}_{t+\tau}, \ \tau > 0$$

3) After establishing the credibility of the peg, the central bank shall raise the short nominal interest rate according to UIP. The economy has escaped the liquidity trap, and long real interest rates shall decrease despite the raise in nominal interest rate (we shall explain this later). The combination of equations (27) and (29) yields

$$(30) \quad \overline{s}_{t+1} = s_t + \hat{\pi} - \pi^*$$

Consider the UIP given by equation (13). Substituting the expected nominal exchange rate into equation (30), the UIP can be written as follows

$$(31) \quad i_t = i_t^* + \hat{\pi} - \pi^* + \varphi_t$$

The equilibrium interest rate will no longer be zero. It will rise to fulfil equation (31). Equation (31) expresses the credibility of the new policy. Hence, if the peg has become credible, the central bank should set the nominal interest rate to equation (31) implying that foreign investors will be indifferent between foreign and domestic currency. Thus, the central

bank does not need to intervene in the foreign exchange market to defend the peg anymore. Furthermore, as discussed above, the economy is out of the liquidity trap since the zero lower bound is no longer binding as the nominal interest rate has been raised. However, a rise in the nominal interest rate does not correspond to contractionary monetary policy since the increase in inflation expectation outweighs the rise in the nominal interest rate. This is proven by the arguments in step 4) and 5).

4) As discussed under the analogy of equation (28), the initial exchange rate target must cause a depreciation of the domestic currency relative to its steady state. The real depreciation implies that the private sector will expect domestic currency to return to its steady state level, and therefore, it expects an eventual real appreciation.

5) Consider the real interest parity condition denoted by equations (15) and (16). An expectation regarding real appreciation will lead to lowering the long real interest rates. Hence, a real depreciation implies a lower $\rho_t$ relative to $\rho_t^*$. The IS-equation (9) implies a positive boost to the real activity due to lowering of the long real interest rate. However, such a decrease in the real interest is not necessary for stimulation of the output gap. The output gap may also be increased due to the real depreciation of the domestic currency, which in turn leads to a rise in future inflation. Thus, the economy is still successful in escaping the liquidity trap.

6) Next, let us consider the upward-crawling peg denoted by equation (27). Only in the case of domestic inflation target exceeding the foreign average inflation will lead to a real appreciation. Therefore, an increase in the inflation must be expected by the private sector. The proof is provided hereunder. By combining equations (4), (26) and (27), we can derive

$$q_{t+1} - q_t = s_{t+1} - s_t + \pi_{t+1}^* - \pi_{t+1}$$
$$= s_{t_0} + (\hat{\pi} - \pi^*)(t+1-t_0) + (\hat{\pi} - \pi^*)(t-t_0)\pi_{t+1}^* - \pi_{t+1}$$
$$(32) \quad q_{t+1} - q_t = -(\pi_{t+1} - \hat{\pi}) + (\pi_{t+1}^* - \pi^*)$$

Furthermore, we assume for simplicity that foreign inflation is deterministic and constant, $\pi_{t+1}^{*} = \pi^{*}$,

(33)  $q_{t+1} - q_t = -(\pi_{t+1} - \hat{\pi})$

Equation (33) implies that if domestic inflation exceeds its target, the domestic currency will appreciate. Hence, given that the peg's credibility is manifested, there will be an appreciation pressure and the private sector expects inflation to exceed its target,

(34)  $E_t \pi_{t+\tau} - \hat{\pi} = -(E_t q_{t+\tau} - E_t q_{t+\tau-1}) > 0$   .

7)  The discussion above implies that monetary policy is expansionary, and the economy is stimulated by: a) a real depreciation of the domestic currency, b) a lower long real interest rate and c) increased inflation expectation (Svensson, 2000). Points a) and b) will lead to a rise in the output gap. Inflation, on the other hand, will increase due to the arguments a) and c), and the above-mentioned increase in the output gap. Thus, a real appreciation of the domestic currency will occur.

8)  Since actual inflation has surpassed its target, the price-level will start to climb towards the price-level target path. We, hereby, prove that the price-level will reach the price-level target path in finite time. Assume that the peg is sustained for an infinite period of time. Next, let us consider the steady state domestic price level path, given by the following equation

(35)  $\bar{p}_t \equiv p_t^{*} + \bar{s}_t - q$

Where $\bar{p}_t$ denotes the steady state price-level path. Using equations $\pi_t^{*} = p_t^{*} - p_{t-1}^{*}$, $\pi_{t+1}^{*} = \pi^{*}$, (25) and (27), we can derive

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$$\overline{p}_t = \pi_t^* + p_{t-1}^* + s_t - q$$
$$= \pi_t^* + p_{t_0}^* + \overline{s}_{t_0} + (\hat{\pi} - \pi^*)(t - t_0) - q$$
$$= \pi^* + p_{t_0}^* + \overline{s}_{t_0} + \hat{\pi}(t - t_0) - \pi^* - q$$

(36) $\quad \overline{p}_t = p_{t_0}^* + \overline{s}_{t_0} - q + \hat{\pi}(t - t_0)$

Note that the above steady state price-level path is consistent with the exchange rate peg. If the steady state price-level path is above the price-level *target* path, we have

(37) $\quad \overline{p}_t > \hat{p}_t$

The implication of equation (37) is that the price-level target path is hit in finite time. Combination of equations (25) and (36) yields

$$\overline{p}_t - \hat{p}_t = p_{t_0}^* + \overline{s}_{t_0} + \pi(t - t_0) - q - \hat{p}_{t_0} - \hat{\pi}(t - t_0)$$

(38) $\quad \overline{p}_t - \hat{p}_t = (q_{t_0} - q) - (\hat{p}_{t_0} - p_{t_0})$

Equation (38) implies that $q_{t_0} - q > \hat{p}_{t_0} - p_{t_0} > 0$ for equation (37) to be fulfilled.

Hence, the result above implies that the initial nominal devaluation must be such that the difference between the initial real depreciation and the real exchange rate's steady state is larger than the difference between initial price-level target path and the initial price-level. The real depreciation relative to steady state serves as a measure of initial expansion of the monetary policy while $\hat{p}_{t_0} - p_{t_0}$ measures how much the economy inflates and extends before the price-level target is reached. Thus, the size of $\hat{p}_{t_0} - p_{t_0}$ determines how much of past several years of zero or negative inflation the central bank is willing to undo. For a given initial exchange rate depreciation, the price-level target will be hit sooner the smaller the difference $\hat{p}_{t_0} - p_{t_0}$ is. Meanwhile, for a given $\hat{p}_{t_0} - p_{t_0}$, the price-level target will be hit sooner as well as with higher activity and inflation, the

larger the initial depreciation is (Svensson, 2000). It should be noted, though, that a too fast recovery the liquidity trap runs the risk of overheating the economy before the price-level target path is reached.

9) Finally, when the price-level target path has been reached, the peg will be abandoned and the monetary policy shifts to flexible price-level target or flexible inflation target.

Lastly, we shall comment on the consequences of the abovementioned framework if executed in a low pass-through environment. If the inflation forecasts do not take incomplete pass-through into account, the forecasts will overestimate the effects of a real depreciation of the currency on inflation. Hence, the price-level will not be as reactive as Svensson predicts and will not catch up with the price-level target path that the central bank sets. Moreover, under perfect pass-through a depreciation of the currency will make foreign goods expensive relative to domestic goods, increasing the demand of foreign goods. However, in the case of incomplete pass-through, the change in the relative price of foreign and domestic goods will be smaller and so will be the resulting effect on the demand for domestic goods since the incentive for consumers to switch expenditure from foreign to domestic goods is weakening (Bailliu & Bouakez, 2004).

Incomplete pass-through has implications for the credibility of the peg as well. As discussed above, the weaker improvement in terms of trade under incomplete pass-through delay the instant increase in inflation and demand. The pass-through of exchange rate fluctuations to consumers takes time and if price-setters do not believe that the devaluation of the domestic currency will persist, they will not increase prices. Thus, the establishing of the credibility of the peg under perfect pass-through will play a bigger role than portrayed by Svensson (2000). Thus, the 'indirect' upward pressure on domestic inflation will be smaller because of the weaker output response. Conclusively, empirical evidence shows that sizable depreciations of domestic currency exerts fairly small effects on consumer prices for industrialised countries (Mishkin, 2008). Hence, exchange rate depreciations that Svensson's (2000) model relies so heavily on are likely to have less effect on inflation than that predicted by the framework.

**Switzerland - Overview**

The Swiss National Bank (SNB) is an independent central bank with the mandate of ensuring price stability. By price stability, the SNB conveys a rise in the Swiss consumer price index of less than 2% per annum. Deflation is also considered a violation of the objective of price stability. The SNB's monetary policy strategy consists of the definition of price stability, a medium-term conditional inflation forecast and a target range for the three-month Swiss franc Libor (London Interbank Offered Rate). The conditional inflation forecast is a key element in SNB's communication as it shows how the SNB expects consumer prices to move if the interest rate remains unchanged over the next three years. In order to ensure price stability, the SNB defines a target range for the three-month Swiss franc Libor and it aims to keep the Libor in the middle of this range. From 6th September 2011 to 15th January 2015 a minimum exchange rate of 1.20 CHF per euro was also implemented. The unconventional measures adopted in the 2011-2015 period are particularly relevant in light of Svensson's paper. As such, we hereby present them as well as the events that led to and put an end to such the unconventional monetary policy.

The Swiss franc had been appreciating significantly since 2008 (and until the pegging in 2011). 2008 was a year of weak global growth, with Switzerland also feeling the effects of the financial downturn. In that year, the decline in equity prices and the return of risk aversion caused increased volatility in real and nominal exchange rates, highlighting the traditional role of the Swiss franc as a safe haven currency. Swiss inflation, which peaked at 3.1% in July, started falling rapidly as a result of the collapse in the oil prices and the deteriorating economic situation. As a result, central banks around the world initiated expansionary monetary polices, and the SNB followed suit. The SNB implemented quantitative easing and unsterilized foreign exchange intervention aimed at limiting the excessive appreciation of the Swiss franc and combating the deflationary pressures. In the last two months of 2008, the SNB relaxed the monetary policy stance by 225 basis points, reaching a three-month Libor target range of 0.0–1.0%. The economic contraction continued in 2009, but was not as significant as in most industrial countries and in 2010 Swiss output was already growing,

increasing by 2.6% (SNB Annual Report, 2010). The appreciation of the Swiss franc continued during this period, reflecting trade surpluses, improving growth prospects for Switzerland and safe haven effects. Inflation remained low mostly due to the strong Swiss franc. The SNB left its target range for the three-month Libor unchanged at 0.0–0.75% from January 2009 to August 2011. Moreover, between March 2009 and June 2010, the SNB conducted foreign exchange interventions in order to prevent the appreciation of the Swiss franc against the euro. In 2011, global economic growth slowed down. Fiscal stimuli came to an end and rising commodity prices negatively affected real wages in major advanced economies.

Later in 2011, uncertainty rose as the European sovereign debt crisis started to develop. Growth divergences widened between not only advanced and emerging economies but also among advanced economies. Inflation, which was increasing at the beginning of the year driven by energy and raw material prices, decreased at the end of the year due to the weaker economy. The major central banks continued expansionary monetary policies, announcing measures to provide liquidity to the financial system. In Switzerland, GDP increased by 1.9% in 2011 (International Monetary Fund, 2012b). This result was mainly due to favourable economic conditions in the first half of the year. Swiss technical capacity utilisation rose further, unemployment fell and business expectations suggested a positive economic trend (SNB Annual Report, 2011). However, the surge of the European sovereign debt crisis and the environment of increased risk aversion that followed caused a sharp appreciation of the Swiss franc. The increased strength of the currency and the subsequent downside risks to price stability led to several interventions by the central bank. In August 2011, the SNB narrowed the target range for the Libor to 0.0-0.25% and increased the liquidity supply several times by expanding banks' sight deposits.

On 6th September, the SNB regarded the Swiss franc to be massively overvalued against currencies of Switzerland's major trading partners, and decided to enforce a minimum exchange rate of CHF 1.20 per euro to defer deflationary risks associated with the overvaluation (Swiss National Bank, 2011). Since inflation remained low and the risk of safe haven inflows persisted, SNB maintained the CHF 1.20 per euro floor. However, at the end of 2014, anticipation of the

European Central Bank's quantitative easing program and geopolitical turmoil in Europe triggered increased capital inflows. Consequently, the SNB had to intervene heavily to defend the floor and in December 2014 announced a cut in the interest rate on SNB deposits from 0 to -0.25%. At the same time, the franc had been depreciating against the US dollar and Indian rupee (which are major trading partners of Switzerland) since mid-2014, reducing the likelihood of the currency overvaluation. The SNB's balance sheet was approaching an amount equivalent to 90% of the GDP and given the circumstances, further intervention could result in losses on the SNB's balance sheet. Furthermore, the SNB was concerned about possible speculation around the timing of exiting the floor, once the size of its interventions became public. Therefore, on 15th January 2015, the SNB abandoned the CHF 1.20 per euro floor. Concurrently, the Libor target range was lowered to between -1.25% and -0.25%. Following the exit of the floor, the franc substantially appreciated against the euro, starting to weaken towards the end of January and hovering in the range of CHF 1.08 – 1.10 per euro from mid-August until the end of December 2015.

**Switzerland and the Foolproof Way**

The unconventional policy put in practice in the period from 2011 to 2015 follows a similar framework to the foolproof way model proposed by Svensson. We hereby analyse to what extent this policy fits the model.

The foolproof way model is meant to be implemented in a liquidity trap and a deflation situation. In August 2011, the SNB established a target range for the Libor of 0-0.25% and expanded several times the banks' sight deposits reaching CHF 200 billion. Moreover, inflation as measured by the CPI, stood at 0.2%. Inflation expectations exhibited a downward trend as the Swiss franc appreciated further and global economic outlook dampened. According to the September 2011 monthly Credit Suisse ZEW Financial Market Report, in August, only 14% of all participants believed that CPI inflation rates would rise in the coming six months. As such, it is safe to assume that the Swiss economy was indeed facing a liquidity trap and deflationary pressures. In the foolproof way, Svensson (2000) analyses the case when the nominal interest rate of the home country is lower than in the rest of the world. In 2011, all the major central banks were following an

expansionary monetary policy; as such interest rates were generally low. Moreover, Switzerland had to cope with immense appreciation pressures on its currency. We, hereby, analyse whether Switzerland's unconventional monetary policy fits Svensson's (2000) model.

Svensson (2000) suggests that the central bank announces a price-level target path given by equation (25). However, the SNB did not announce such an upward-sloping price-level target path. We identify two main reasons behind SNB's decision not to announce a price-level target path. First, price-level targeting may cause volatility in inflation and unemployment in the short-term, and thus, there is a political cost associated with switching to price-level targeting, such as comprehensive negative media coverage. Second, price-level target also provides, as discussed above, an exit strategy from the peg. If the financial markets do not believe that the central bank will be able to reach the price-level target path due to persisting appreciation pressures on the Swiss franc and global insecurity, the credibility of the peg is weakened. The reason being that the private sector will not expect the central bank to keep the peg in the long term if it is not serving its purpose. The SNB may have expected this, and therefore, did not announce a price-level target path.

The next step is to devalue the currency and peg it to an upwards-crawling exchange rate target given by equation (27). The target corresponds to a nominal depreciation of the domestic currency at the rate of difference between domestic inflation target and average foreign inflation (Svensson, 2000). In line with this argument, Svensson suggests to have a fixed a peg if the domestic inflation target and foreign average inflation are equal. Nearly 75% of Switzerland's exports are to the EU and USA, which had an inflation rate (GDP deflator) of 1.9% and 2.1%, respectively (World Bank Data, 2017). Thus, the average foreign inflation in 2011 equalled 2%, which is also the inflation target of Switzerland. Hence, it is more suitable for SNB to choose a fixed peg than an upward-crawling peg. Therefore, it is reasonable to conclude that the devaluation and pegging of the Swiss franc was according to Svensson's proposal. However, the Swiss franc was still considered overvalued and the SNB was expecting it to weaken out in time. This does not correspond to Svensson's proposal of a real depreciation of the currency relative to the steady state. Lastly, the foolproof way prescribes the

announcement of an exit strategy. The SNB did not announce an exit strategy, or that the intention of the pegging was to reach the inflation target. It announced that the pegging was to stop the appreciation of the Swiss franc, and support the export sector that the Swiss economy relies heavily on.

The first and second steps refer to the central bank's ability to devaluate the currency and establish the credibility of the peg. In principle, there are no major problems associated with currency devaluation within the context under study, however establishing the credibility of the peg may pose some difficulty. Under normal circumstances, the credibility is established through an extensive communication of the central bank's intentions to the public and by the central bank's intervention in the exchange market. On 6th September 2011, the SNB successfully devalued the Swiss franc. As evident by figure 1, the increase in the balance sheet of SNB demonstrated the banks willingness to defend the peg by printing large amounts of Swiss francs and purchasing foreign exchange.

**Figure 1 The SNB Balance Sheet**



(OECD, 2015)
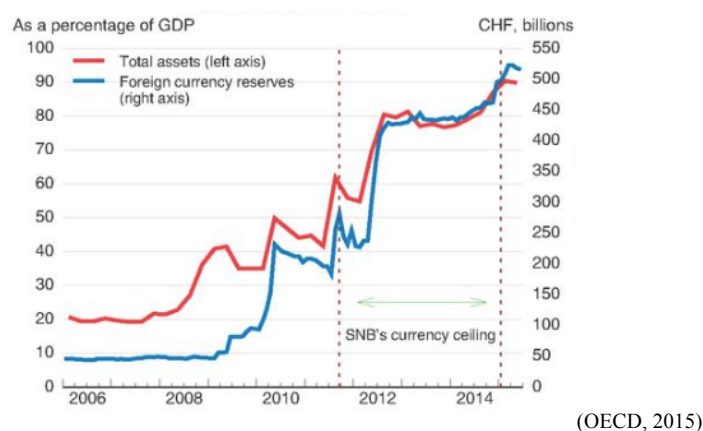
During that year, the franc stabilised at around CHF1.23/EUR. However, in the years that followed 2011, there were episodes of increased global uncertainty, and appreciation pressures on the franc returned once again, leading to massive interventions from the SNB. The SNB managed to maintain its exchange rate target commitment throughout the whole period, but the existence of such strong pressures on the currency may rise questions about the ability of the central bank to maintain the peg and hence its credibility. Although one of the advantages of the foolproof way lies in the fact that the central bank should be able to intervene in the exchange market indefinitely, as it would only have to print domestic

currency, the SNB interventions gained too large proportions for the bank's balance sheet. Furthermore, there is a political cost related to printing unlimited amount of domestic currency. The mass printing of money in Germany after the First World War and the ensuing hyperinflation is still remembered in large parts of Europe. Therefore, such an idea makes the population uneasy even though there are no such risks when inflation is extremely low or there are deflationary pressures. We shall dedicate the next section to deliberate extensively on the credibility of the SNB exchange rate commitment, both in light of Svensson's definition of a credible peg and in light of financial markets beliefs on the CHF/EUR exchange rate level.

Under the assumption that the credibility of the peg has been established, the framework suggests to the central bank to increase the interest rates following equation (31). As one can see from the figure 2, the interest rate remained unchanged for most of the period of the pegging and even turned negative at the end of the exchange rate peg.

**Figure 2 Swiss Nominal Interest Rates**



(OECD, 2015)
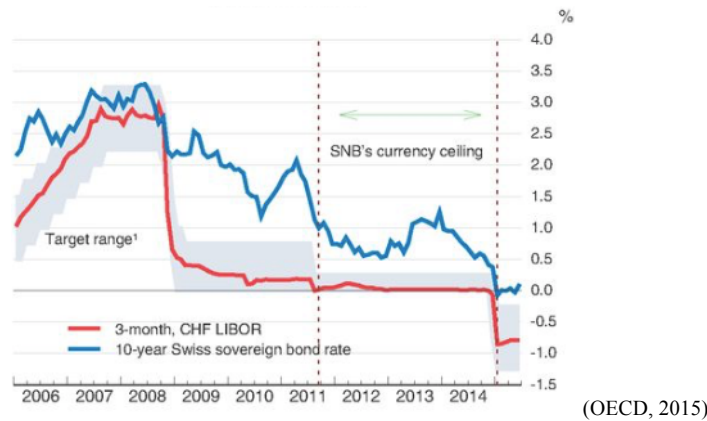
The reason is as follows, consider equation (31) that we re-write here

$$(31) \quad i_t = i_t^* + \hat{\pi} - \pi^* + \varphi_t$$

As stated above, the difference between domestic inflation target and average foreign inflation equals zero, while Grisse and Nitschka (2015) find the average foreign exchange risk premium of Swiss franc to be persistently large and negative against other major currencies. Therefore, the Swiss nominal interest rate

should, in fact, be lower than the nominal interest rate of the Eurozone. The average nominal interest rate in the Eurozone equalled 1.0% in 2011 while the average Swiss nominal interest rate was 0.1% in the same year (Swiss National Bank). Thus, the nominal interest rate was in accordance to the framework, and should not have been increased until the foreign exchange risk premium, or the Eurozone nominal interest rate increased.

Following Svensson's (2000) framework, the real depreciation should create expectations of a real appreciation, which would imply a lower real interest rate. In Switzerland, as previously mentioned, the real exchange rate was still under its steady state level after the devaluation and the eventual depreciation over the steady state level that the SNB expected, did not occur. Nevertheless, the real exchange rate depreciated from its level in 2011, and therefore, it is still possible to observe the effects of exchange rate expectations on real interest rates. As the figure X depicts, the real interest rates increased during the periods with insignificant appreciation pressures on the franc, the first half of 2012 and 2013.

**Figure 3 The Swiss Real Interest Rate (%): Ex-Post**



(The World Bank)
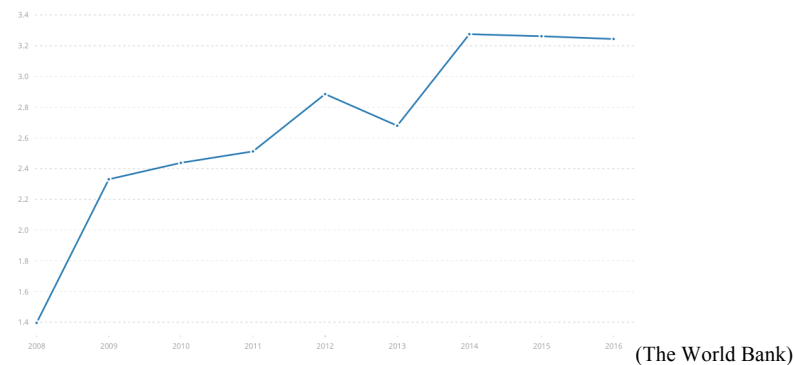
Finally, the foolproof way predicts a rise in inflation expectations due to the chosen crawling peg. As previously mentioned, the SNB opted for a fixed peg. In principle, this should not be a problem, as according to the transmission channels described at the beginning of this paper, a real depreciation should imply an increase in inflation.

**Table 1 Swiss Observed Inflation**

| | 2011 | | | | 2012 | | | | 2013 | | | | 2014 | | | | 2012 | 2013 | 2014 |
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inflation | 0.6 | 0.4 | 0.4 | −0.5 | −0.9 | −1.0 | −0.5 | −0.3 | −0.4 | −0.4 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | −0.1 | −0.7 | −0.2 | 0.0 |

(Swiss National Bank, 2015)

However, as it is possible to observe in table 1, the increase in inflation did not occur. In fact, deflation pressures aggravated after the implementation of the peg. A possible reason behind inflation not reacting as the model predicts is the incomplete pass through of the exchange rate to inflation. We discuss whether there is incomplete pass-through in Switzerland, and the eventual implication of it in the later.

Overall, according to Svensson (2000), the Foolproof way should work since the economy is jumpstarted by a real depreciation, low real interest rates and increased inflation expectations. From 2011 to 2015, Switzerland's output gap remained negative or close to zero percent, as depicted in figure 4.

**Figure 4 Swiss Output Gap**



(Swiss National Bank, 2015)
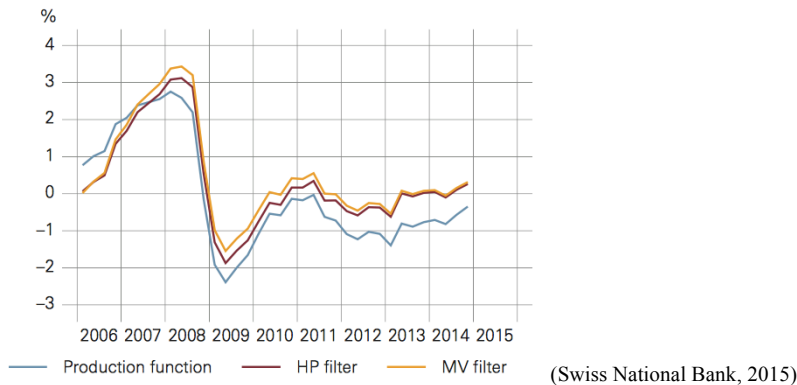
Although, not relative to steady state, there was a real depreciation of the Swiss franc, but real interest rates in Switzerland increased and inflation remained low.

Two factors can be outlined as the most important contributors to the failure of the foolproof way. First, the role of the Swiss franc as a safe haven currency, which influenced the credibility of the peg, greatly determined the degree of the central bank intervention and prevented the franc depreciation back to its steady-state

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over time. Second, the imperfect pass-through extended the effects of the Swiss franc sharp appreciation through time and harmed inflation and GDP.

**The credibility of the Swiss franc peg**

The Swiss franc exhibits safe haven characteristics. A safe haven currency is likely to be affected mainly by global factors in times of turmoil, which could have a significant impact for the monetary policy of the domestic country. A study by Hoffmann and Suter (2010) plots the impact of currency return shocks on the level of exchange rate. In the figure below, the difference between the two lines gives an impression to what extent global factors explain movements in the nominal exchange rate of the Swiss franc. If the movements were driven by domestic components only, the two lines would follow an identical path. However, as figure 5 shows, global factors persistently increase the valuation of the franc, especially since the late 1990s.

**Figure 5 Multilateral Swiss Franc Exchange Rate versus Domestic Component**



(Hoffmann & Suter, 2010)
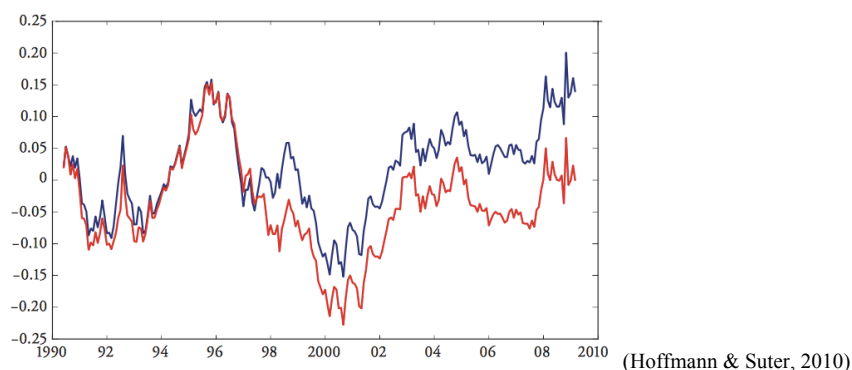
In the figure 6, Hoffmann and Suter (2010) plot the global factor $HML^{FX}$ (difference between the highest and lowest interest rate differential portfolios) on the return of a portfolio that goes short on Swiss franc and long in all other major currencies. The dashed vertical lines mark global events such as natural disasters, geopolitical events and economic crises. As one can see, the franc appreciates more in case of economic crises than geopolitical. Hence, the Swiss franc does indeed play a role as a safe haven in times of economic crises.

**Figure 6 Average Global Return Component and Global Events**
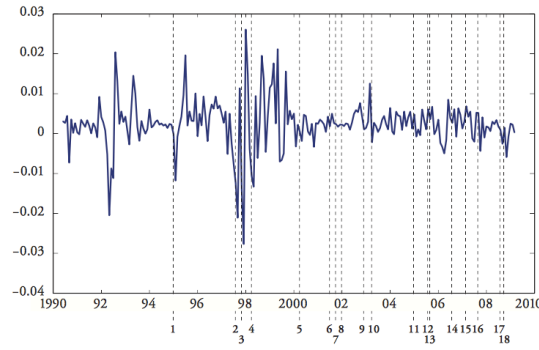


(Hoffmann & Suter, 2010)

This safe haven characteristic of the Swiss franc implied, during the period of enforcement of the peg, great appreciation pressures on the currency which led to massive interventions from the central bank. The safe haven status could, therefore, be a source of instability, undermining the credibility of the peg. In its explanation on how the peg is credibly established, Svensson makes use of the uncovered interest parity given by equation (31). In order to provide a better understanding of the Swiss case we start by presenting some conclusions of Grisse and Nitschka (2015). In their paper, the authors conduct a regression analysis to investigate whether the uncovered interest parity holds for the Swiss franc and shows safe haven characteristics. Their regression equation goes as follows

$$(39) \quad \Delta s_{t+1}^{*} = \sigma + \Omega_{0}^{*}(F_{t}, s_{t}^{*}) + \varepsilon_{t+1}^{*}$$

where $\Delta s_{t+1}^{*}$ is the change in the log spot exchange rate of the foreign country relative to the home currency and $F_{t}$ is log forward exchange rate. Note that Grisse and Nitschka (2015) are presenting a simpler version of the uncovered interest parity, than the one that Svensson covers, as they do not consider the existence of risk premium. In order for the uncovered interest rate parity condition without risk premium to hold, $\sigma$ would have to be zero and the coefficient $\Omega_{0}^{*}$ to equal unity. Their results show that the coefficient $\Omega_{0}^{*}$ is significantly different from unity. In most cases, the point estimates are negative, but not always significantly different from zero, which can reflect risk premium on foreign currency investment. Subsequently, Grisse and Nitschka (2015) augment the above general regression to include two risk factors in order to assess if potential currency risk factors help to better understand exchange rate dynamics. The

average Swiss franc exchange rate and the VIX index (index for global risk in currency market) are included in the regression. Hence, the augmented regression equation is as follows

$$(40) \quad \Delta s_{t+1}^{*} = \sigma + \Omega_{0}^{*}(F_{t},s_{t}^{*}) + \Omega_{1}^{*}AFX_{t+1} + \Omega_{2}^{*}\Delta VIX_{t+1} + \varepsilon_{t+1}^{*}$$

where AFX is the average Swiss franc exchange rate and $\Delta VIX$ denotes change in the VIX index. Grisse and Nitschka (2015) have three main findings on the above regression. Firstly, most coefficients on the forward discount are not statistically significant. Secondly, there is noticeable variation in the sensitivity to franc specific currency risk factor. Thirdly, covariation of Swiss franc exchange rates with VIX returns shows that the franc exhibits safe haven characteristics. $\Omega_{2}^{*}$ reflects both Swiss francs position as a safe haven and franc's role in currency carry trades. The negative coefficient estimates indicate that the franc appreciates when global risk (VIX) increases. However, there are some significant positive coefficients against certain currencies as well such as the Japanese yen, British pound and US dollar. A potential explanation is that these currencies provide a better hedge against global risk than franc. By augmenting the regression, Grisse and Nitschka (2015) present a similar approach to the uncovered interest parity as the one described by Svensson (2000). The augmented regression provides a good fit for the data in general, with an $R^2$ between 20 and 70. Nevertheless, it is worth to note that the $R^2$ for the euro was one of the lowest. Therefore, according to Svensson's (2000) definition of uncovered interest parity and its relationship with the establishment of the peg credibility, the SNB should have not faced any problems regarding this matter.

However, looking at financial markets it is possible to observe that there were certain doubts regarding the peg. Hertrich and Zimmermann (2017) study the credibility of the SNB exchange rate commitment by observing the behaviour of EUR/CHF put options prices. The authors point out the fact that during the commitment, there were EUR/CHF put options with strike prices below the EUR/CHF 1.20 floor trading at positive prices. This signals that financial market participants had doubts about the ability of the central bank to maintain the peg. As such, Hertrich and Zimmermann (2015) estimate the implied risk-neutral

probabilities that the exchange rate appreciates beyond the peg within 1, 3, and 12 months. In their model, they consider the possibility of a readjustment of the peg to a lower level, i.e. the authors assume that there is a credible barrier (referred to as implied floor) with a value below the peg level and below option exercise prices for which there are positive put option prices observed in the market. As a result, the spread between the implied floor and the central bank's floor is used as a measure of the credibility of the peg.

**Figure 7 Implied EUR/CHF Exchange Rate Barrier**
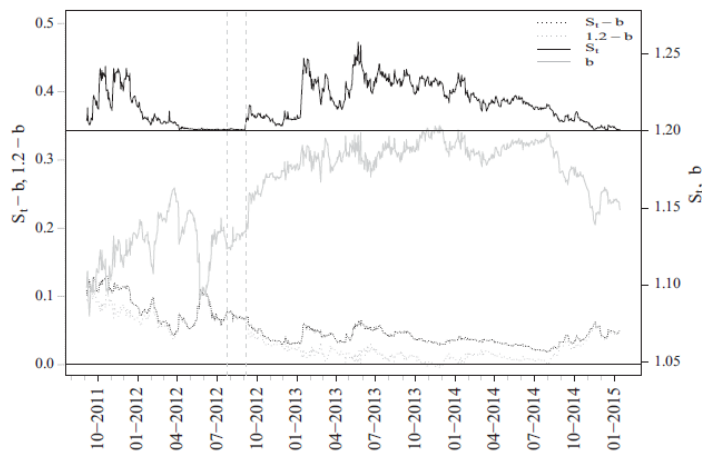


(Hertrich & Zimmermann, 2017)

In figure 7, $S_t$ corresponds to the spot EUR/CHF exchange rate and b to the Hertrich and Zimmermann (2015) estimated implied floor. As it is possible to observe, there is some variation of the implied floor, however with a positive trend until August 2014. This suggests that the peg is gaining credibility with time. The period from May to August 2012 was characterised by the escalation in the European debt crisis and risen doubts about the survival of the monetary union. Observing figure 7, this period corresponds to one with the lowest implied floor. On the other hand, two events that very much contributed to the establishment of credibility of the peg were the announcement, on 6th September 2012, of the unlimited bond buying program by the ECB and the revaluation of the euro with respect to the Swiss franc in January 2013. However, the implied floor fell again in the second half of 2014, following ECB communications regarding further monetary easing, and increasing demand in financial markets for safe investments. Overall, from a financial market perspective, the peg credibility was significantly lower than perceived at first sight.

**Incomplete Pass-through in Switzerland**

Stulz (2007) quantifies the effects of pass-through in the Swiss economy by using a recursively identified Vector Auto Regression (VAR). The data set stretches from 1976 to 2004 and the study finds a substantial, but incomplete pass-through of exchange rate to import prices, while the exchange rate pass-through to consumer prices is weaker. An interesting result is the decrease in the degree of pass-through in the 1990s. The transmission of import price shocks to consumer prices is virtually zero. The decrease coincides with the era of lower and stable inflation rate in Switzerland. The reason being that the inflation targeting policy initiated in the late 1990s led to a significant decrease in inflation, which had a downturn effect on the exchange rate pass-through since such pass-through is lower in a low inflation than high inflation environment.

Bearing this in mind, we now return to the events during the exchange rate commitment and their relationship with the pass-through. As figure X shows, the Swiss franc sharply appreciated *before* the enforcement of the peg, but the effects of the appreciation did not influence inflation until the second quarter of 2012.

**Figure 8 The Swiss Real Effective Exchange Rate Index (2010=100)**



(The World Bank)
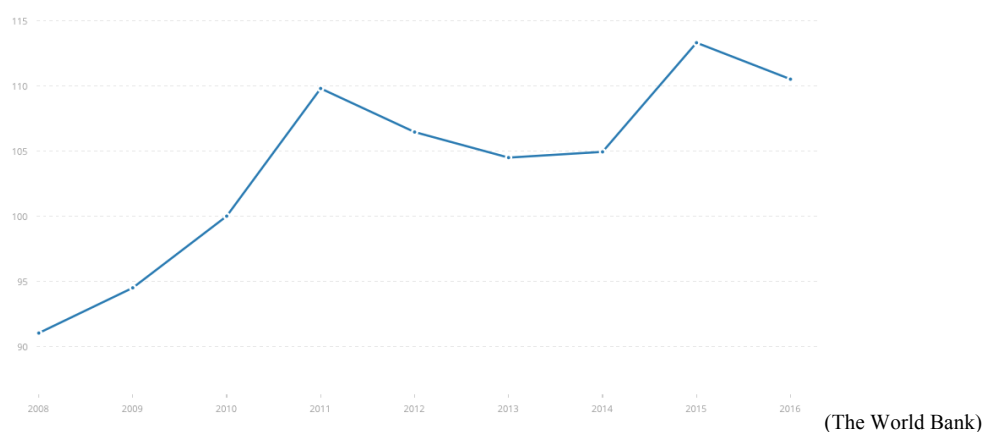
Similarly, improvements in the inflation rate due to the exchange rate commitment did not occur until the third quarter of 2012, especially in the prices of imported goods and services. The price of imported goods and services exhibited an average drop of 4.2% in 2012, 1.8% in 2013 and 1% in 2014, implying that it takes time for the currency depreciation to have the desired

outcome of increasing imported inflation. Thus, there is indication of incomplete pass-through in Switzerland. (SNB Annual Report, 2014).

The analogy above indicates that the depreciation of the domestic currency had a delayed effect on consumer prices of imported goods and services due to stickiness in the consumer prices of imported goods and services. Thus, the direct exchange rate channel to CPI inflation seems to be weaker than the prediction of the foolproof way. As figure 9 depicts, the fall in domestic consumer prices due to the sharp appreciation of the Swiss franc before the introduction of the peg did not halt until the beginning of 2012. Similarly, the increase in domestic consumer prices due to the currency depreciation occurred towards the end of 2012. Hence, there was a delay in the pass-through of increased cost of imported intermediates to domestic goods and services. Therefore, the exchange rate channel to domestic inflation is weaker than Svensson (2000) suggests.

**Figure 9 Switzerland Consumer Prices**
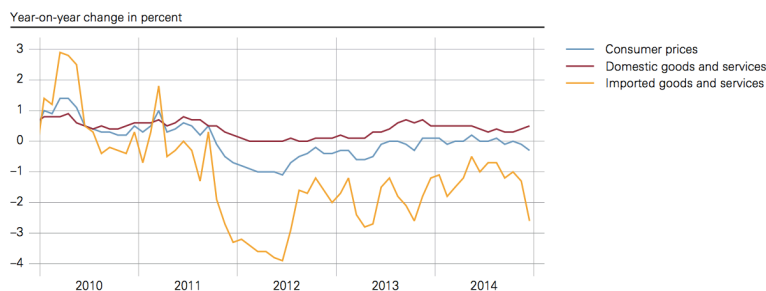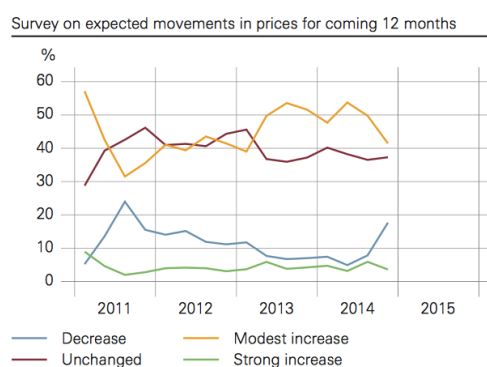


(Swiss National Bank, 2014)

Table 2 shows that the terms of trade ratio for Switzerland did not improve in the period of 2011 until 2015. In fact, the terms of trade ratio decreased slightly from 2011 to 2012 and remained somewhat stable around 98.8% throughout 2014 before increasing in 2015. Compared to the OECD total, Switzerland's terms of trade ratio was close to the OECD average. Hence, price of imported goods and services does not seem to increase relative to domestic goods, and the shift in demand from imported to domestic goods and services, was missing. Thus, the increase in aggregate demand due to the exchange rate channel to aggregate demand is low.

**Table 2 Terms of Trade Ratio**

|      | Switzerland | OECD  |
|------|-------------|-------|
| 2011 | 99.5        | 97.9  |
| 2012 | 98.9        | 97.5  |
| 2013 | 98.8        | 98.2  |
| 2014 | 98.8        | 98.8  |
| 2015 | 101.4       | 100.4 |

(OECD, 2017)

As discussed under the section about implications of low pass-through on monetary transmission, the expectations channel to inflation may be stronger under incomplete pass-through due to the price-setters' forward-looking nature. The Quarterly Bulletins of the SNB consist of a survey about inflation expectations of the domestic households for the next 12 months and financial markets' expectations for the next 6 months. Table 3 describes the inflation expectations of the private sector in detail. The period of interest starts from the 3$^{rd}$ quarter of 2011 until the 4$^{th}$ quarter of 2014. We find that majority of financial analysts expected inflation to remain unchanged in all the surveys. Moreover, percentage of analysts expecting inflation to remain unchanged increased consistently from 2011 to 2014. Meanwhile, financial analysts expecting increase in inflation, increased from 3$^{rd}$ quarter of 2011 to 1$^{st}$ quarter of 2013 (peaking at 33%) before stabilising around 25% for the rest of the period. Similarly, households expecting no changes in the prices remained somewhat stable around 40% for the whole period (see figure 10). However, it should be noted that there was a marked increase in the number of households expecting modest increase in inflation in 2013 (around 10% increase).

**Figure 10 Household's Inflation Expectations**



(Swiss National Bank, 2015)

**Table 3 Financial Markets Inflation Expectations for Switzerland**

|       | Increase (%) | No changes (%) | Decrease (%) |
|-------|--------------|----------------|--------------|
| 3Q11  | 14           | 49             | 37           |
| 4Q11  | 17           | 49             | 34           |
| 1Q12  | 14.5         | 69             | 14.5         |
| 2Q12  | 18           | 70             | 12           |
| 3Q12  | 30           | 67             | 3            |
| 4Q12  | 33           | 61             | 5            |
| 1Q13  | 40           | 60             | 0            |
| 2Q13  | 21           | 78             | 1            |
| 3Q13  | 26           | 71             | 3            |
| 4Q13  | 25           | 71             | 4            |
| 1Q14  | 24           | 73             | 3            |
| 2Q14  | 20           | 80             | 0            |
| 3Q14  | 25           | 75             | 0            |
| 4Q14  | 25           | 75             | 0            |

(Swiss National Bank)

Nonetheless, a majority of financial analysts and a substantial number of households expected inflation to remain unchanged in all the surveys. Hence, the expectation channel had subdued, if any, effect on inflation. A weak expectation channel to inflation contradicts our discussion above that stated that the expectation channel would, in fact, be stronger. A possible explanation behind the result might be the credibility of the peg. The private sector may have expected the peg to not withstand the increasing global turmoil and the appreciation pressures on the Swiss franc. Therefore, the private sector did not take into account that the depreciation will persist while setting prices. Hence, subdued inflation expectations indicate that price-setters did not expect the devaluation to last leading to the weak expectation channel to inflation.

**Czech Republic – Overview**

The Czech National Bank (CNB) is an independent central bank with the primary objective of maintaining price stability. In order to achieve its goal, the CNB follows an inflation target of 2% with a tolerance band of one percentage point in each direction. The CNB also supports the general economic policies of the government in order to attain sustainable economic growth. The CNB uses the interest rate as its main instrument for monetary policy. The CNB's key policy rate is the two-week repo rate. The Lombard rate is also of importance, applied in

marginal lending facilities and the discount rate used in deposit facilities. The CNB decided to intervene in the foreign exchange rate market for the period 7th November 2013 to 6th April, aiming for an exchange rate close to CZK27/EUR. The foreign exchange market intervention carried out by the CNB bears some resemblance to the framework of the foolproof way. In order to be able to do the comparison, we first provide some macroeconomic context of the Czech Republic in the period before, during and after the intervention.

In the second half of 2011, the Czech Republic's economy gave the first signs of contraction. The country had been expanding since 2009 mostly driven by exports. From 2009 to 2011, unemployment declined and consumer and business confidence improved. Following a temporary negative headline CPI inflation in late 2009, inflation had remained just below the 2 percent target since the second quarter of 2010. Growth in regulated prices, indirect tax hikes, and rise in global commodity prices were the main contributors to the inflation increase. The policy rate, which was cut sharply during the 2009 crisis, remained at 0.75% from May 2010. However, in 2012, amidst the European sovereign debt crisis, the Czech economy contracted by 1.2% (International Monetary Fund, 2013) mainly due to weaker domestic consumption and investment. As in some other European countries, the recession in the Czech Republic came along as a result of the correction of previous fiscal imbalances. Inflation averaged 3.3% (Czech National Bank, 2012) mainly driven by increases in the VAT rates and positive contributions from foods and fuel, but demand driven inflationary pressures disappeared from the economy as external and domestic demand weakened. As a result, the CNB made several cuts to its policy rate and the two-week repo rate hit 0.05% in 2012. In 2013, headline inflation continued declining in tandem with inflation in the euro area and regional trade partners. The decrease contributed a sizeable negative output gap, a low wage growth in private companies, rise in unemployment, deferred household consumption and corporate investment, and low inflation expectations. Constrained by the zero lower bound and facing deepening disinflationary tendencies, the CNB decided to pursue foreign exchange interventions. As such, on 7th November 2013, the CNB announced that it would intervene in the foreign exchange market in order to keep the exchange rate of the koruna close to CZK27/EUR. The floor by the CNB implied a koruna depreciation of around 6% (International Monetary Fund European Dept, 2014a).

During 2014 and 2015 the economy grew strongly driven by improving domestic demand, robust exports, supportive macroeconomic policies and favourable external environment. Inflation, however, remained well below target. In December 2016, inflation finally picked up and reached the 2% target continuing to increase into the upper half of the tolerance band at the beginning of 2017, on account of a faster growth in prices of non-tradable goods (Czech National Bank, 2016a). By April 2017, the CNB inflation forecast was consistent with a sustainable fulfilment of the target at the monetary policy horizon, and inflation expectations were well anchored. As such, on 6th April 2017, the CNB announced the koruna-euro floor removal. Following the exit from the exchange rate commitment, the koruna only appreciated slightly and inflation remained in the upper half of the tolerance band. Moreover, the Czech economy showed robust growth, leading the Central Bank to raise its key policy rate to 0.25% on 3rd August 2017.

**The Czech Republic and the Foolproof Way**

The foreign exchange intervention from 2013 to 2017 was an unconventional policy put in practice in a situation where few other options appeared to be available for the CNB to stop deflationary pressures. By November 2013, the CNB assessed two scenarios: a baseline scenario in which it would have to use negative interest rates and an alternative scenario, in which it would recur to the exchange rate intervention. Given the zero lower bound, negative rates cannot occur as such the CNB chose to intervene in the foreign exchange market. We hereby analyse the CNB intervention and to what extent this policy follows the foolproof way framework above.

Svensson (2000) analyses an economy in a liquidity trap, with negative output gap and negative expected domestic inflation. By November 2013, the Czech policy rate stood at 0.05% and monetary-policy relevant inflation, averaged 0.4% (Czech National Bank, 2013a). According to the CNB forecast (Czech National Bank, 2013b) both headline and monetary-policy relevant inflation would drop to zero or be slightly negative at the beginning of 2014. Moreover, inflation expectations were low and growth had remained negative throughout the year. Given the

economic situation, the foolproof way could be the solution for the Czech economy as prescribed by Svensson (2000).

The first step to implement the foolproof way consists of the announcement of an upward-sloping price level target path. Under the price level target path, past deviations from the target are offset by subsequent developments in inflation. When deciding the level for the currency devaluation, the CNB allowed, in its forecast scenario, an undershooting of inflation in 2014 and an overshooting in 2015, leading to an average inflation close to the target. This strategy implicitly incorporated an element of price level targeting without the CNB having to change its regime of inflation targeting (Franta et al., 2014). However, this strategy is equivalent to price level targeting only from an ex ante perspective, since ex post the economy operating with the given nominal exchange rate level may present a different domestic price level than forecasted.

In the second step of Svensson's (2000) model, the currency should be devalued and pegged to a crawling exchange rate target. This way of pegging is de facto equivalent to price-level targeting (Franta et al., 2014). Thus, if there is an undershooting of the long-term inflation target, then there must occur an overshooting of the target in the future, which implies a rise in inflation expectations. This is given by equation (27) above, where an upwards-sloping exchange rate target will be in place if the domestic inflation target is different from the foreign inflation and a fixed peg will arise if both the domestic inflation target and foreign inflation are equal. However, pegging the nominal exchange rate in such a way and targeting the price level stops being equivalent when the foreign central bank itself does not target the price level and/or there are shocks to the equilibrium real exchange rate. When those events happen, it may be impossible for a Central Bank to fulfil simultaneously the commitments of price level targeting and crawling exchange rate targeting. Later in this paper we give an example that provides further clarification on this matter. In 2013, Eurozone inflation averaged 1.4% (European Central Bank, 2013), while the CNB's inflation target was 2%. In contrast to Svensson's (2000) recommendation, the CNB devalued the koruna as a one-off action, advising that a movement to an even weaker level would only occur in the presence of very strong anti-inflationary risks.

The last step consists on the announcement that when the price-level target path has been reached, the peg will be abandoned and substituted by either price-level targeting or inflation targeting. In the announcement of the peg introduction, the CNB's Governor outlined that the CNB would "intervene in the volume and for the duration needed in order to achieve the exchange rate we have specified and thereby hit the inflation target in the future", thus, presenting an exit strategy. According to the CNB forecast scenario in the moment of the peg introduction, the exchange rate intervention was only intended until the beginning of 2015 (Czech National Bank, 2013b)

According to Svensson (2000), the above strategy should be able to jumpstart the economy, while increasing nominal interest and inflation rates. The Czech economy did expand, escaped the liquidity trap and reached an inflation rate closer to its target after implementing the exchange rate floor. Although the CNB policy implementation did not completely follow Svensson's (2000) framework, the Czech Republic is an example that the foolproof way can be successful. We hereby analyse why the foolproof way worked in the Czech Republic and compare it with Svensson's (2000) theoretical proposal.

After announcing the peg, the central bank must to be able to implement it. As previously discussed, this should not a problem, since it implies currency depreciation. The CNB successfully implemented the peg, intervening in the foreign exchange market only in the first few days following the decision. However, before the exchange rate commitment was reached, financial institution clients were buying koruna over concerns that the CNB would be unable to uphold the exchange rate target. Furthermore, comments were being made in the media regarding the inability of the CNB to maintain such level of intervention. And on 7th November 2013, the CNB experienced some difficulties in its intervention following the ECB's announcement of a cut in interest rates.

Overall, the CNB purchases totalled a massive CZK200 billion, but afterwards the exchange rate stabilized at a slightly weaker level than CZK27/EUR into 2014 where there were no interventions from the CNB. This suggests that the credibility of the peg was established.

According to Svensson (2000), once the peg is credible, the central bank should increase the short nominal interest rates to a level corresponding to the uncovered interest parity condition. Throughout 2014 and 2015 the interest rate differential of the Czech Republic vis-à-vis the Eurozone, as such there was no pressure for the CNB to increase interest rates (see, Figure 11). The CNB intervened on foreign exchange over the course of 2015 due to upward pressures on the koruna caused by the unexpected abandonment of the peg by the Swiss Central Bank, the ECB quantitative easing program and the favourable evolution of the domestic economy. In 2016, the ECB introduced negative interest rates, increasing the interest rate differential of the Czech Republic vis-à-vis the Eurozone. This combined with a stronger domestic economy and expectations of the CNB's exit of the peg generated appreciation pressures on the koruna. The CNB discussed the possibility of cutting interest rates below zero, but opted only to intervene in the exchange market.

**Figure 11 Interest Rate Differential Czech vs Euro**
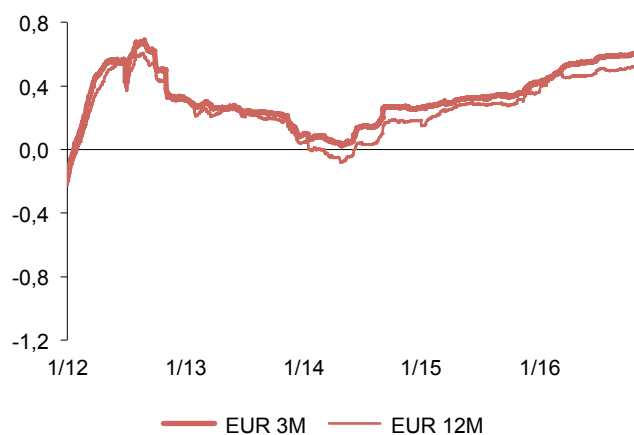


(Czech National Bank, 2016c)

As we can see, the CNB did not have to increase interest rates. Here it should be noted that the period under study is characterized by generally low inflation, low interest rates and poor economic conditions globally, resulting in a different outcome than the one described in the foolproof way, where the foreign interest is assumed higher than the domestic interest rate.

Continuing the analysis, the foolproof way argues that long real interest rates will be lower following the real depreciation. This is given by the real interest parity

condition, which holds in the Czech Republic since the uncovered interest parity also holds. In figure 12, it is possible to observe lower real interest rates in 2014 and 2016. However, in 2015, there is an increase in real interest rates. The increase is due to a decline of inflation expectations and as previously mentioned, in 2015 there was a positive interest rate differential vis-à-vis the Eurozone.

**Figure 12 Ex ante Czech Real Interest Rates**
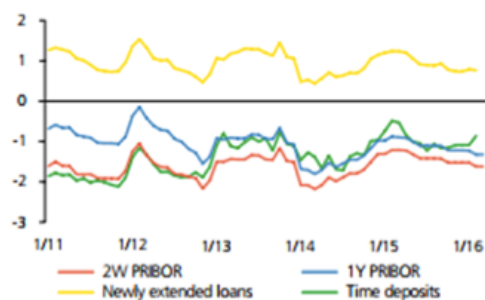


(Czech National Bank, 2016b)

Next, the model states that once the peg is credible, the private sector will expect an increase in inflation, a feature that comes from the crawling peg and its equivalence with price-level targeting. However, as we previously mentioned, this equivalence does not always work. An example of it can be found one year right after the implementation of the Czech koruna peg. During 2014, headline inflation dropped sharply. Deflationary tendencies in the euro area deepened causing a negative effect on growth in import prices, global oil prices declined significantly and food prices also began to fall due to a previous decrease in global prices of agricultural commodities. As a result, and as depicted in the figure 13, in that year, the large deflationary tendencies surpassed the ones predicted when the floor was introduced. Therefore, if the CNB had adopted both the exchange rate floor and the price-level targeting, it would be facing the dilemma of which of these two commitments it should uphold to.

**Figure 13 Observed and Forecasted Inflation (Czech Republic)**
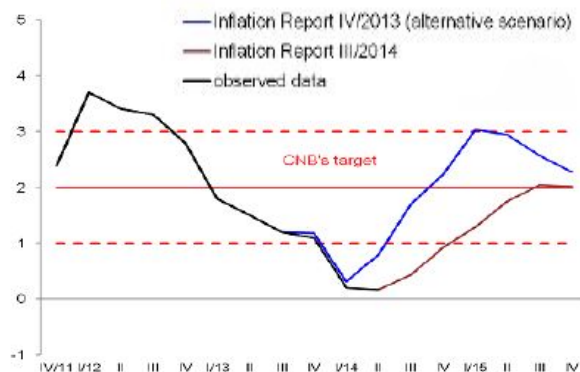


(Franta et al., 2014)

In contrast to the foolproof way, a lower path of the domestic price level can be consistent with a fixed peg. The question now lies on the ability of the CNB fixed peg to steer inflation without the inflation expectations coming from the price-level targeting, as suggested by Svensson (2000). Following the negative developments of inflation, the CNB was left with two options regarding the exchange level commitment: either further devaluate the koruna or/and extend the duration of the peg. A further devaluation of the koruna was regarded by the CNB as an "emergency" measure. Therefore, the CNB established that in the presence of a long-term increase in deflation pressures, which would have the ability of causing a substantial fall in domestic demand, renewed risks of deflation in the economy and a systematic decrease in inflation expectations, the level of the peg would be changed. During the period the exchange rate commitment was in force the CNB did not make use of this emergency measure, however it had the need to announce an extension of the duration of the peg several times. As depicted in figure 14, adjusted inflation started increasing after the weakening of the currency, mainly driven by a rise in non-tradable goods. This signals the positive effect of the depreciation of the koruna on the fading out of anti-inflationary pressures.
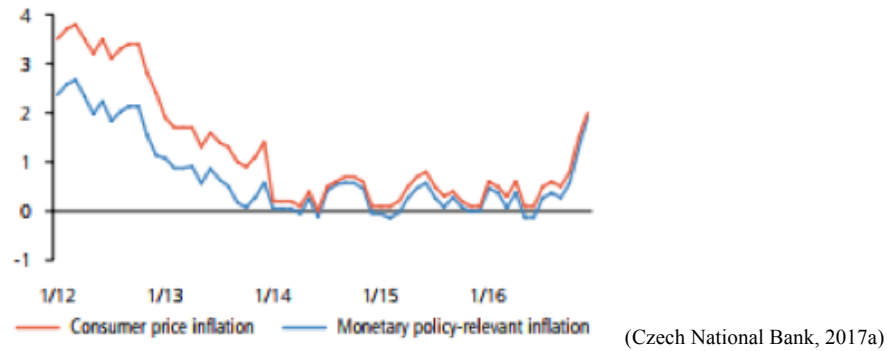
**Figure 14 Adjusted Inflation Excluding Fuels**
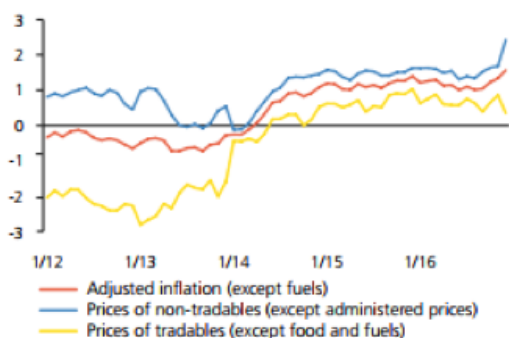


(Czech National Bank, 2017a)

Moreover, although there were deflationary pressures coming mostly from the outside, which kept inflation low until 2016, they were not enough to justify a further devaluation of the koruna (figure 15).

**Figure 15 Czech Republic Inflation**
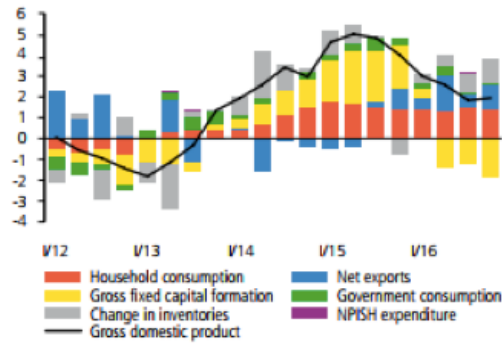


(Czech National Bank, 2017a)

Expectations remained well anchored, thanks to the credibility of the peg, the transparency of the CNB communications and the rise in adjusted inflation (See Figure 16).

**Figure 16 Actual and Expected Inflation**



(Czech National Bank, 2017a)
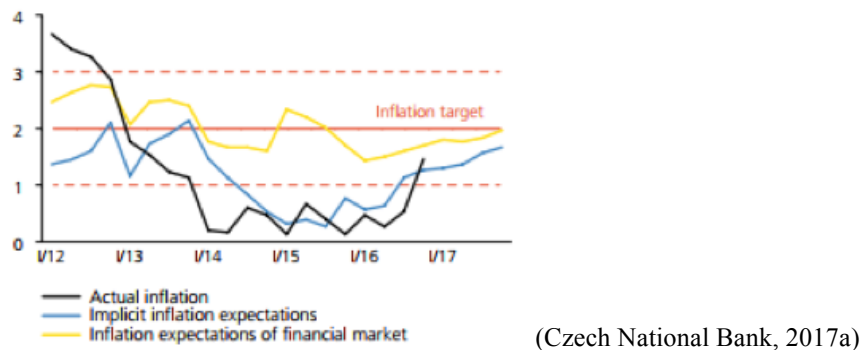
According to Svensson (2000), the Foolproof way should be able to jumpstart the economy, due to a real depreciation, lower real interest rates and increased inflation expectations. Even though the CNB intervention does not comply with every features of the foolproof way, the three above-mentioned factors were achieved and the Czech Republic showed positive GDP growth throughout the period of the peg (figure 17), where the deceleration of the economy in 2016 was mainly due to a slower absorption of EU funds.

**Figure 17 Czech Republic Gross Domestic Product**



(Czech National Bank, 2017b)

Continuing following the Foolproof way, actual inflation should hit a level higher than the target, reaching the price-level target path and allowing the central bank to abandon the peg. As previously mentioned the CNB used inflation targeting and opted for a fixed peg. Its exit strategy consisted on the removal of the exchange rate floor conditional on the sustainable fulfilment of the inflation target. At the September 2016 meeting, the Bank Board stated that the CNB would not discontinue the peg before the second quarter of 2017. In the last quarter of 2016 inflation increased sharply, reaching the 2% target in December for the first time in four years. This reflected a marked recovery in food prices, a rebound in euro area producer prices and an increase in adjusted inflation excluding fuels, with growth in non-tradable prices in particular. With higher inflation, market expectations started building up around an exit of the exchange rate floor in the second quarter (figure 18) of 2017.

**Figure 18 Market Expectations Towards The Floor Removal**



(Chamonikolas, 2017)

By December 2016, investors betting the near end of the currency cap made increasing koruna purchases (Spezzati, 2016).

However, the CNB managed to keep expectations under control through extensive communication and sizeable exchange rate interventions. The CNB reiterated that on-target price growth is not an automatic condition to exit the floor and warned that after the peg removal, the CNB will not allow the koruna to appreciate beyond what the bank saw justified by the economy's fundamentals. Speculation resurged before the 30th March monetary policy meeting in expectation that the announcement of the peg removal was made in that meeting. Overall, during the first quarter of 2017, the interventions of the CNB amounted to around CZK 1.1 trillion. In April 2017, the CNB called an extraordinary session to assess the need to continue the exchange rate commitment. The central bank board agreed that the conditions for sustainable fulfilment of the inflation target had been met and that the Czech Republic's macroeconomic situation was much more favourable than in 2012–2013. Furthermore, the koruna market was heavily overbought due to the behaviour of financial speculators and exchange rate risk hedging by domestic exporters, which had been expecting an early peg removal. This would prevent the koruna from appreciating sharply, allowing a smooth exit from the peg. Therefore, in that meeting, the CNB announced the removal of the exchange rate commitment. As a result, on that day, the koruna appreciated by 1.5% (See Figure 19).

**Figure 19 CHF/EUR Spot Exchange Rate**



(Markets, 2017)

Since then, the koruna has been appreciating gradually, reflecting the difference between economic growth and monetary policy between the Czech Republic and the Euro area. Despite a slight decrease in inflation in the second quarter of 2017,

inflation remained in the upper half of the tolerance band around the CNB's target. Furthermore, the economy has been above its potential output level, there has been solid growth in household consumption and employment, and persisting consumer optimism. Therefore, the CNB decided to increase its policy rate to 0.25% in its 3rd August meeting. In line with the results obtained so far, the CNB has been successful in implementing, and exiting, its exchange rate commitment, proving that the foolproof way can indeed work.

**Conclusion**

Svensson (2000) presents a practical way of escaping the liquidity trap based on three steps: announcement of a price-level target path, devaluation of the domestic currency that causes a real depreciation relative to its steady state and an exit strategy once the price-level has reached the desired path. We do an in-depth study of the theoretical framework, and augment it with the discussion of exchange rate pass-through. The foolproof way is based on the assumption of perfect pass-through. However, we discuss that the assumption might not correspond with the reality and has implication for the result of the foolproof way. A low degree of pass-through may lead to weaker monetary policy transmission channels, delaying the decrease in the real interest rate and increase in inflation expectations. We find that incomplete pass-through may also have implications for the credibility of the peg.

The theoretical framework's practicality is then analysed by studying the recent cases of Switzerland and the Czech Republic. In a context of general low inflation, low interest rates and global uncertainty, the economies under study chose to peg its exchange rate in order to escape the liquidity trap. We find that the failure of the foolproof way in Switzerland is driven by persistently large and negative risk premium, associated with safe haven characteristics of the Swiss franc. Secondly, a low degree of exchange-rate pass-through may have led to subdued effects of the exchange rate channel to CPI inflation, domestic inflation and aggregate demand. We also find that the expectation channel to inflation was insignificant, and linked it to the possibility of the peg not being credible. The Czech central bank, on the other hand, was successful in the implementation of the framework. Although, it did not follow every feature of the model, the

similarities between the Czech central bank's policy and the foolproof way are remarkable.


The private sector's inflation expectations are pivotal for the foolproof way to succeed. Therefore, the foolproof may provide a viable solution to the liquidity trap given that the credibility of the peg is established. Our analysis has shown that the credibility of the peg is more crucial than portrayed by Svensson.

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