The Costs of Czech and Swiss Exchange Rate Commitments

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Abstract

As central banks in advanced countries are currently considering launching a new wave of the unconventional monetary policies that were introduced in the aftermath of the Global Financial Crisis of 2008-2009 (GFC), an assessment of impacts of these policies has become major point of interest of numerous empirical studies. This paper aims to investigate the impacts of one such policy, which is often overlooked in academic literature – managed depreciation followed by the introduction of one-sided exchange rate commitment enforced by foreign currency interventions. This policy was introduced by the central banks of the Czech Republic and Switzerland. The accumulation of FX reserves arising due to managed depreciations has also led to fears about the associated balance sheet risks, as this policy may be very costly. Indeed, as a result of their large foreign currency holdings, both the Czech and Swiss National Banks at some points did post significant losses. Therefore, the aim of this paper is to estimate the overall costs of FX interventions of the Czech and Swiss National Banks. We find that for the Czech Republic the overall costs since 2011 were slightly less than 5 % of GDP, while for Switzerland the overall cumulative costs were significantly negative – indicating a profit for the Swiss central bank. Finally, we perform a simple empirical exercise to gauge, whether the costs associated with FX interventions affect negatively the central bank credibility and thus could possibly affect the transmission of monetary policy. Using the FMOLS estimator, our results seem to indicate that the costs of FX interventions did not adversely affect the credibility of the two central banks.

JEL code: E50, E58, F31, G15

Key words: managed depreciation, one-sided exchange rate commitment, costs of foreign exchange interventions, FMOLS estimator, central bank credibility

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1. INTRODUCTION

The contraction of the world economy caused by the GFC and the subsequent slow and prolonged economic recovery led many of the world's central banks to introduce numerous policy measures to facilitate their ultra-loose monetary policies. While some of these measures included new policy instruments, most notably the Quantitative Easing (QE), some central banks reintroduced instruments that had already been used in the past. The use of exchange rate as an instrument of monetary policy can be included into this category – the central bank could then weaken its currency in order to increase the output and/or inflation. In other words, the central bank would perform a managed depreciation.

The possibility of using exchange rate as an instrument of additional easing of monetary conditions, when the policy interest rates have reached zero lower bound (ZLB), had already been discussed in the academic literature in the pre-GFC period. For example, McCallum (2000) concluded that the adjustment of the rate of depreciation of exchange rate might have a stabilizing effect on inflation and output in the case the economy had reached the ZLB – and the standard policy measures can no longer ease the monetary conditions. Subsequently, in the post-crisis era, both the Czech Republic and Switzerland have used the exchange rate of their respective currencies as a policy instrument at ZLB in the form of an asymmetric (or one-sided) exchange rate commitment. In September 2011, the Swiss National Bank (SNB) faced with major appreciation pressures and massive overvaluation of the Swiss franc (CHF), which posed a grave danger for the export-oriented Swiss economy, intervened to weaken Swiss franc and introduced a minimum exchange rate of 1.20 Swiss francs to the Euro. In November 2013, the Czech National Bank (CNB) followed with an announcement that it would intervene in the FX market, if necessary, in order to weaken the Czech koruna (CZK) and maintain its exchange rate to Euro at a level close to 27 CZK/EUR. The CNB introduced its asymmetric exchange rate commitment with a goal of reaching its inflation target and escaping deflation threat.

In both countries, these policy choices sparked debates and the two central banks encountered lot of criticism – the interventions on FX market, which were used to defend these one-sided exchange rate commitments, also came under scrutiny.[2] Especially in Switzerland, the massive accumulation of FX reserves caused by the SNB's FX interventions has led to worries about the long-term credibility of the SNB's exchange rate commitment. Additionally, the possibility of significant losses arising for the central bank from its accumulation of FX reserves was also

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[2] See for example discussion in Franta et al. (2018).

heavily discussed in both countries. Indeed, the SNB acknowledged that the balance sheet risks were the main reason for the eventual abrupt discontinuation of its asymmetric exchange rate commitment in January 2015 (Zurbrügg, 2015).

Obviously, a central bank is not a for-profit institution and its primary objective is to meet its stated policy goal and not making profits. However, very significant losses may reduce the credibility of the central bank or as in the case of SNB, worries about future potential losses may even impact central bank's policy making. Numerous papers were dedicated to analysis of central bank's losses and their impacts. As central bank is a special institution, it is able to cover the current losses by its future profits and as a result remain solvent (Franta et al., 2018). By doing so, current losses reduce its equity, which may even become negative. Indeed, the CNB itself had a negative equity between 1998 and 2013 and then again from 2017 onwards and this did not pose a major constraint for its operations, which serves as a proof that a central bank can easily operate and carry out its monetary policy even with a negative equity. However, Stella (1997) concluded that even though positive central bank equity is not necessary, a weak balance sheet reduces central bank's operational independence and decreases its ability to reach its primary goal of price stability. Significant losses may hitherto require a recapitalization of the central bank by the government, which would have a negative effect on central bank's independence. On a sample of 15 Central and South American countries, Klüh and Stella (2008) found that weak central bank finances might have a negative impact on the ability of the central bank to react effectively to inflation pressures. Benecka et al. (2012) also confirmed, on a wider sample of countries, existence of a weak relationship between inflation and the financial strength of central bank. As a result, it can be argued that significant losses may affect the effectiveness of the central bank's monetary policy transmission. Filardo and Yetman (2012) believed that just reporting large losses could raise concerns about the reputation of the central bank. Another argument put forward by Friedman (1953) is that profit earned by central banks on their operations might indicate that they are conducting right policies. Consequently, the aim of this paper is to first estimate the ex-post costs of exchange rate commitments of the CNB and SNB in order to evaluate and verify the argument that this policy is costly. Second, we also conduct a simple empirical exercise to study, whether these costs affected the credibility of the two central banks.

With regards to the analysis of the costs of Czech and Swiss asymmetric exchange rate commitments, we conclude that these are predominantly related to accumulation of FX reserves through FX interventions – as these were aimed at defending the two central banks'

commitments. Next section of this paper therefore provides theoretical background on measuring the costs of the accumulation of FX reserves, third section then estimates these costs for both the Czech Republic and Switzerland. Fourth section presents a simple empirical exercise to study the effects of these costs on central bank credibility and the fifth section concludes the paper.

2. THE COSTS OF FX RESERVES ACCUMULATION

The introduction of the asymmetric exchange rate commitments in the Czech Republic and in Switzerland has led to a massive buildup of their FX reserves – as the central banks intervened in order to prevent the exchange rate appreciation beyond the commitment level. Figure 1 displays the growth of Czech and Swiss international reserves since 2011. Swiss international reserves (including gold) currently equal almost 120 % of Swiss GDP, and despite a modest decline, the Czech international reserves are still slightly over 60 % of Czech GDP. Additionally, in both countries, the foreign assets constitute more than 95 % of central bank' assets. As a result of these massive FX interventions, adjusting for the size of Czech and Swiss economy, the balance sheets of both the CNB and SNB have grown to levels significantly higher than in most advanced countries. The CNB's and SNB's balance sheets are not only very large, but their assets are also mostly denominated in foreign currencies, which makes them very vulnerable to exchange rate movements. It is this exposure to risks that has fueled concerns about the costs associated with an accumulation of FX reserves.

With regards to the costs of FX reserves accumulation, it is also important to make a distinction between the different types of interventions, which led to this accumulation.[3] In case of a sterilized intervention that is conducted by buying foreign-currency bonds, the central bank would also sell domestic-currency bonds, which would sterilize the impact of intervention. Then, the central bank bears the interest costs of the domestic-currency bonds it sold, and receives interest income from the foreign-currency bonds it purchased. The resulting interest differential is the central bank's profit or loss from sterilization.[4] The academic literature often focuses on these costs. Additionally, the movements of exchange rates lead to valuation changes that impact the domestic-currency value of FX reserves – appreciation of the domestic currency

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[3] We can distinguish between the sterilized intervention – when the central bank offsets the effect of the FX intervention on the monetary base, e.g. the monetary base does not change, and non-sterilized intervention, when the central bank avoids any offsetting operations and as a result, the FX intervention alters the monetary base. When central bank intervenes against the domestic currency, it purchases foreign currency and sells domestic currency, thus a non-sterilized intervention against the domestic currency leads to an increase of monetary base.

[4] These costs may be quite significant for some emerging countries central banks – when the interest rate on domestic-currency bonds is significantly higher than on foreign-currency bonds.

causes a loss for the central bank, while depreciation causes a profit for the central bank – as the foreign-currency assets become more valuable expressed in domestic currency. Consequently, Filardo and Yetman (2012) consider the costs of fully sterilized interventions to equal the sum of interest rate differential and exchange rate movements multiplied by the size of central bank's FX reserves. The costs arising due to the interest differential and valuation changes may be referred to as quasi-fiscal costs.

Figure 1. International Reserves of the Czech Republic and Switzerland
(percent of GDP)
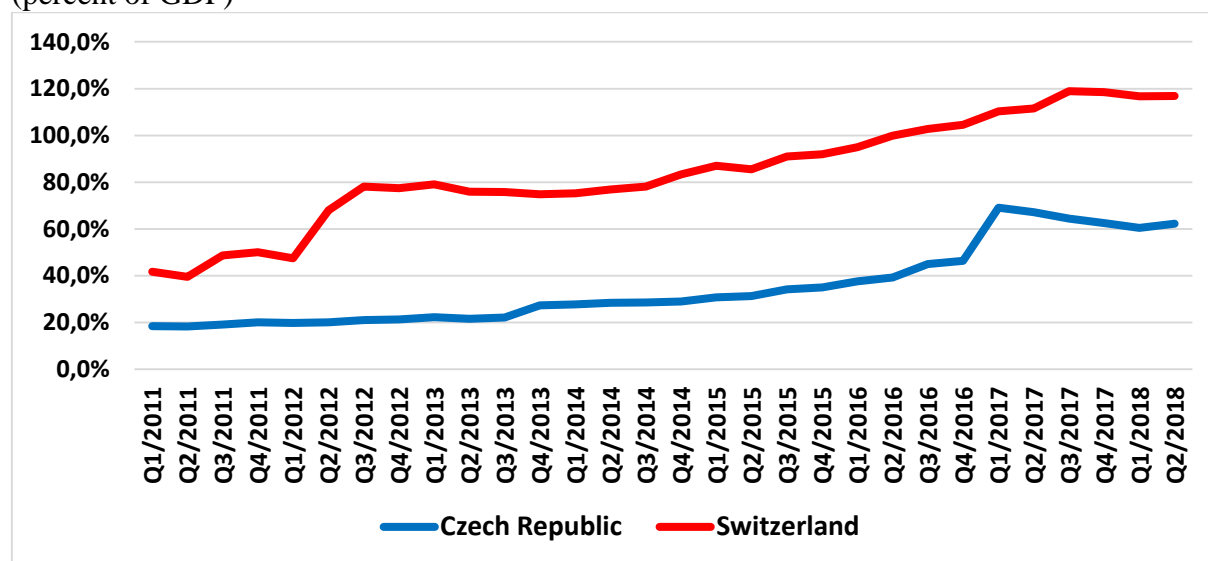
Sources: Czech National Bank and Swiss National Bank

According to a World Bank (2013) study, the costs of sterilized interventions equal the quasi-fiscal costs, while the cost of non-sterilized interventions is inflation. This study found that the costs of sterilized interventions can be quite significant, however, the costs varied significantly across the sampled countries – with some of the analyzed countries even making profits on their interventions. Nonetheless, for the purpose of this paper, we do not consider the inflation to be a cost related to non-sterilized intervention – as both analyzed central banks were trying to achieve higher inflation by weakening their currencies.[5] Adler and Mano (2018) estimated the costs of FX interventions for 73 countries and they found that the costs of FX interventions were not negligible. They distinguish book costs and opportunity costs of FX interventions. With regards to the costs of non-sterilized interventions, they argue that the expansion of monetary base caused by them is associated with opportunity costs, as the expansion of monetary base could have been conducted by purchasing domestic assets instead of foreign assets. Not doing so entails opportunity costs if the returns on domestic assets were higher than

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[5] The goal of CNB's exchange rate commitment was to increase inflation in order to reach its inflation target, while preventing deflation was one of the main reasons SNB used to explain the introduction of minimum exchange rate.

the returns on foreign assets. As a result, they measured the marginal costs of FX interventions as deviations from uncovered interest parity (UIP).

2.1. Methodology

For the purpose of this analysis, we use quarterly data from 2011 until 2018 for the Czech Republic and Switzerland. We estimate the costs of CNB's and SNB's FX interventions based on Adler and Mano's (2018) methodology.[6] We consider the marginal costs of FX intervention to be equal to the costs of holding FX reserves, which are impacted by the interest rate differential between the rate of return on domestic and foreign assets, as well as the changes of the exchange rate of domestic currency. Thus, the marginal costs are estimated based on the below equation:

$$MC_{t+1} = (IR - IR^*) - \frac{SR_{t+1} - SR_t}{SR_t} \qquad (1)$$

where MC_{t+1} represent the marginal costs of FX reserves accumulation in the time t+1, while IR is the domestic rate of return, IR^* is the rate of return on foreign assets and SR is the exchange rate measured as the units of domestic currency per unit of foreign currency. Based on this equation, the marginal costs increase when the domestic rate of return is higher than the foreign rate of return, while the marginal costs also increase when the domestic currency appreciates. The depreciation of domestic currency leads to negative marginal costs of holding the FX reserves (e.g. gains for the central bank). Then, the total costs of FX reserves accumulation can be estimated as per the below equation:

$$TC_{t+1} = MC_{t+1}FX_t \qquad (2)$$

where TC represent the total costs of FX reserves accumulation and FX represents the size of the FX reserves, measured as a percentage of GDP.

3. RESULTS

In line with the literature, we assume that the rate of return on domestic and foreign assets, is equal to the interest rate on short-term instruments – we use 3-month rates in the inter-bank

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[6] The CNB's interventions were mostly sterilized and as a result they entailed the sterilization costs of CNB's domestic liabilities used to sterilize CNB's purchases of foreign assets. SNB's FX interventions were partially sterilized and partially non-sterilized. With regards to the SNB's non-sterilized interventions – this monetary expansion could have been conducted by the SNB through the purchases of domestic assets and as a result, we consider these FX interventions to bear the opportunity costs of not doing so.

market.[7] In order to analyze the costs of CNB's and SNB's FX interventions, we estimate the equation (1) individually for each of the currencies that are included in the respective central bank's FX portfolio and we weigh these results by using the share of these currencies in the respective central bank's FX reserves. We then estimate the equation (2) for both the CNB and the SNB. The data used and their sources are further described in the Appendix A.

Figure 2. The contribution of interest rate differential and exchange rate movements to the overall marginal costs of the Czech Republic's FX interventions
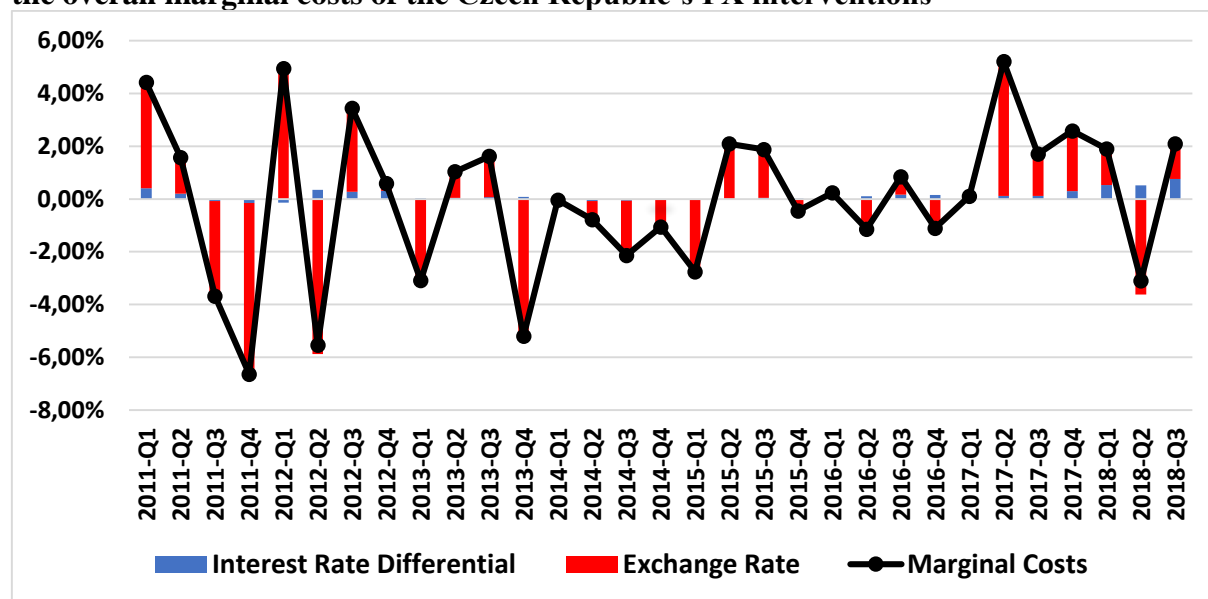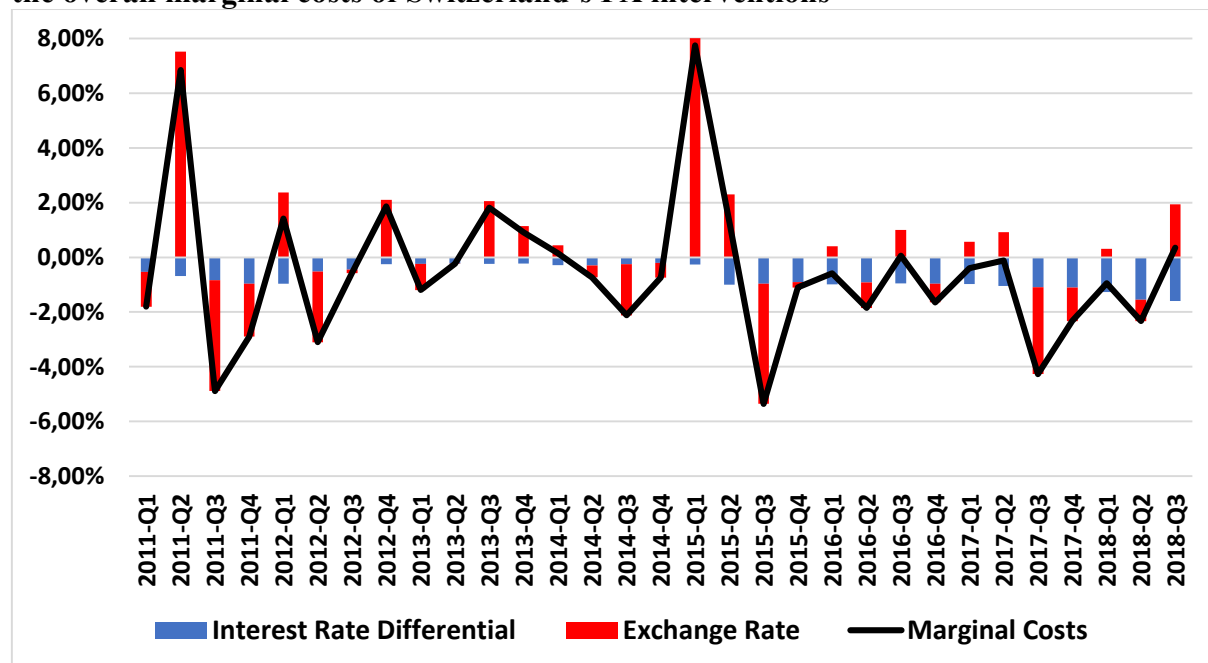

Source: Author's calculations

As evidenced in the Figure 2 and Figure 3, in the case of both central banks, the marginal costs of their FX interventions are mostly determined by the exchange rate movements. The interest rate differential's contribution to the overall marginal costs is significantly lower, and also more stable. In the case of the Czech Republic, the interest rate's contribution to the overall marginal costs has been hovering around 0 % for most of the period preceding the introduction of the exchange rate commitment and also during the period of its application. Only after the CNB's exchange rate commitment was abolished, did the contribution of the interest rate differential to the overall marginal costs started to increase (e.g. the marginal costs of holding the FX position were raising due to increasing interest rate differential between the Czech Republic and other countries). This was caused by the tightening of CNB's monetary policy and raising

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[7] CNB and SNB have both purchased bonds with longer maturities, as a part of their FX interventions, which earn higher returns. However, these higher returns reflect the higher liquidity and risk premiums of long-term bonds – as a result, for the purpose of estimating the differentials between the domestic and foreign rates of return, we can use the short-term interest rates as a proxy. Both the CNB and SNB have also invested parts of their FX portfolios in the stock market. However, for both the CNB and SNB, stocks make up a rather smaller portion of their FX reserves – 8.5 % and 20 % respectively. Due to lack of data availability on the currency composition of these stock portfolios and due to the fact that the higher returns on stock portfolios are mainly associated with the higher risk premiums, we omit the stock portions of the portfolios from our calculations.
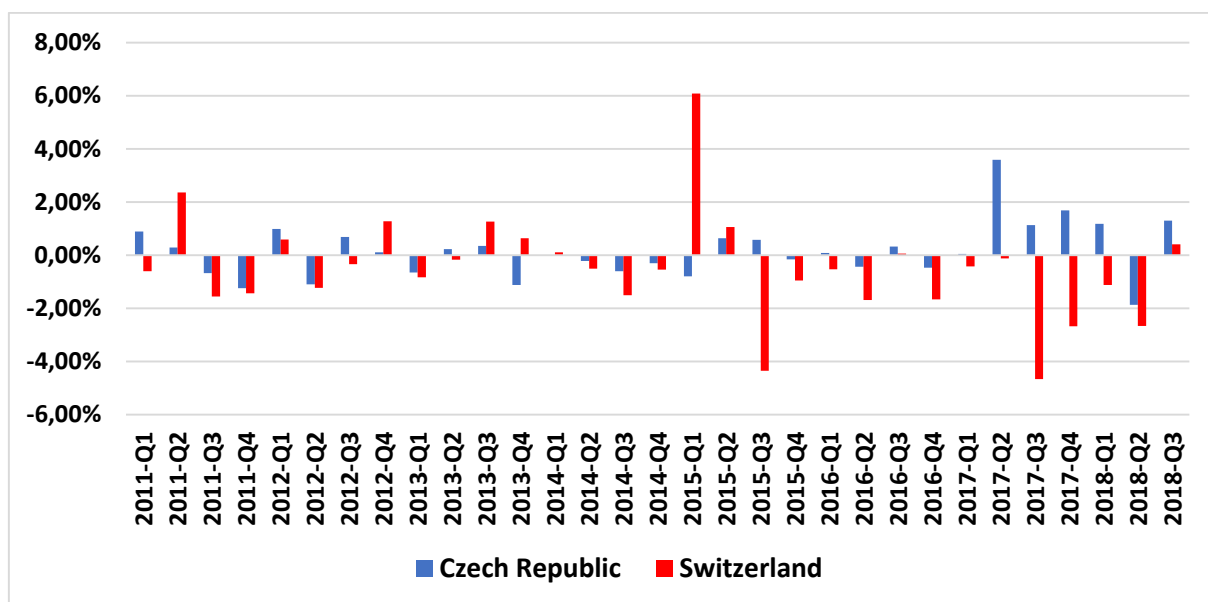
interest rates – as a result, the sterilization costs were growing as the interest rate on CNB's predominantly domestic liabilities was increasing faster than the foreign interest rates that CNB earns on its predominantly foreign assets. On the other hand, in the entire post-GFC era, the contribution of interest rate differential to the overall marginal costs in Switzerland has been negative. In other words, there were no costs associated with SNB's FX positions due to an interest rate differential, because interest rate in Switzerland has been consistently lower than the interest rate in most other developed countries. As a result, SNB earned significantly more on its holdings of FX reserves than it would have earned, had it purchased domestic assets instead (in the case of unsterilized FX interventions). In the case of sterilized FX interventions, SNB's return on its mostly foreign assets was higher than the return it had to pay on its domestic liabilities. This was especially true following the introduction of negative interest rates in the aftermath of the abolition of minimum exchange rate. Over the course of the past three years, the contribution of the interest rate differential to the overall marginal costs, has often even exceeded the contribution of franc's exchange rate changes.

Figure 3. The contribution of interest rate differential and exchange rate movements to the overall marginal costs of Switzerland's FX interventions

Source: Author's calculations

**Figure 4. Total costs of CNB's and SNB's FX interventions**
(percent of GDP)

Figure 4 displays the total costs of Czech and Swiss FX interventions in the post-GFC era. Between 2011 and 2014, the total costs of FX interventions in both countries have often varied between positive and negative values[8] and these values rarely exceeded 2 % of GDP. This changed with the unexpected abolition of the Swiss franc's minimal exchange rate to Euro in January 2015, which saw Swiss franc soar from 1.20 CHF/EUR to approximately 1.05 CHF/EUR. As a result of this massive appreciation, the Swiss franc value of Swiss FX reserves declined leading to massive losses for the SNB. Indeed, according to our calculations, the total costs of Swiss FX interventions amounted to more than 6 % of Swiss GDP in the first quarter of 2015 alone. However, in the following quarters, the massively overvalued Swiss franc started to depreciate closer towards its equilibrium values. This together with negative interest rate differential have caused the total costs of FX interventions to be negative – very negative for some quarters, even declining below 4 % of GDP in some quarters. The CNB's abolition of its asymmetric exchange rate commitment in April 2017 has been much more orderly than SNB's. Nevertheless, significant subsequent appreciation of Czech koruna coupled with increasingly positive interest rate differential led to a significant increase in total costs of Czech FX interventions – slightly less than 4 % of GDP in the second quarter of 2017. In the following quarters, except second quarter of 2018, the total costs of CNB's FX holdings have always exceeded 1 % of GDP.

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[8] Negative values represent negative total costs of FX interventions, i.e. the central bank earned profit on its holdings of foreign assets.

Finally, Figure 5 outlines the cumulative total costs of CNB's and SNB's FX interventions since first quarter of 2011. Based on these figures, we do not find evidence that the introduction of Swiss franc's minimum exchange rate and the related accumulation of FX reserves have been costly for the SNB. On the contrary, with the exception of the brief period after the abandonment of the minimum exchange rate in 2015, the cumulative total costs of Swiss FX interventions have always been negative. In third quarter of 2018, the total cumulative total costs represented just under -15 % of Swiss GDP – so far, the SNB's FX interventions have been profitable. And with the ongoing overvaluation of Swiss franc, we may argue that franc's further depreciation will improve these results. For CNB, prior to abandonment of its asymmetric exchange rate commitment, the conclusion is broadly similar – the cumulative total costs were negative. This changed after April 2017, when the rather undervalued Czech koruna started to appreciate and the total costs of holding the accumulated FX reserves proved to be significant. At the end of the year 2018, the cumulative total costs of Czech FX interventions were slightly lower than 5 % of Czech GDP.

Figure 5. Cumulative total costs of CNB's and SNB's FX interventions
(percentage of GDP)
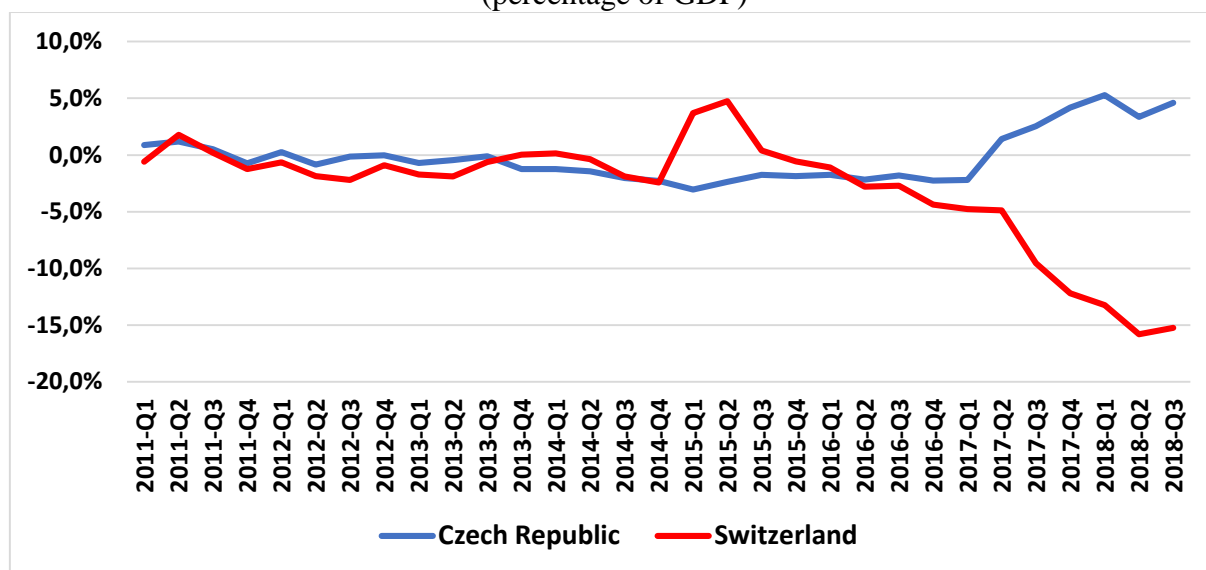
Source: Author's calculations

4. COSTS OF FX INTERVENTIONS AND CENTRAL BANK CREDIBILITY

Finally, in this section we conduct a simple analysis to study the possible consequences of the costs associated with FX interventions. As argued in the introduction, central bank losses arising from the costs of holding large FX positions could affect the reputation of the central bank. In order to verify this argument, we estimate the simple regression in (3), where we regress a measure of central bank credibility on the costs of FX interventions:

$$Credibility_t = \beta_0 + \beta_1 Costs_t + \varepsilon_t \qquad (3)$$

where *Credibility* is our measure of central bank credibility, while *Costs* represent the cumulative costs of FX interventions estimated in the previous section.[9] As our measure of credibility, we follow the approach taken by Levieuge et al. (2015), who proposed a credibility index. This index measures the credibility by deviations of inflation expectations from the inflation target and it is based on following linear exponential (LINEX) function:

$$CRED = \frac{1}{\exp(\tilde{\pi}^e) - \tilde{\pi}^e} \qquad (4)$$

where $\tilde{\pi}^e$ is the deviation between the inflation expectations (π^e) and the inflation target of the central bank ($\bar{\pi}$). This credibility index takes a value between 0 and 1, with value 0 meaning no credibility and the value of 1 meaning full credibility. The index penalizes positive deviations from the inflation target more strongly than negative deviations (i.e. inflation being lower than the target). Figure 6 presents the development of the estimated credibility index of the CNB and SNB.

Figure 6. Estimated Credibility Index for Czech Republic and Switzerland
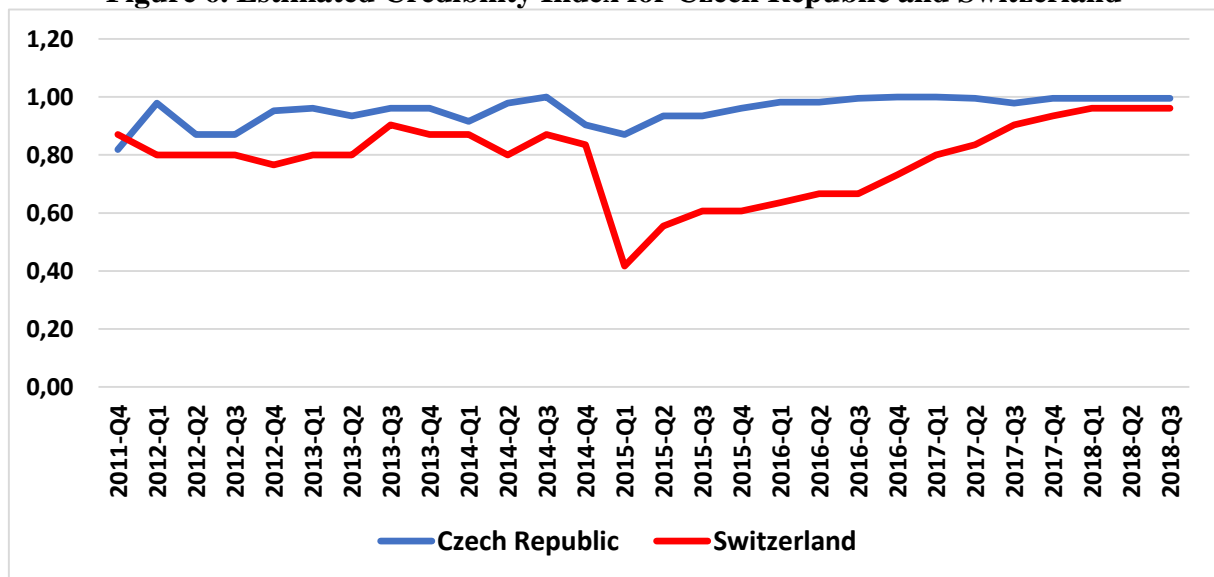
Source: Author's calculations

As we only have a sample of two countries, which conducted the policy of one-sided exchange rate commitments, we estimate the equation (3) separately for the Czech Republic and Switzerland. Since the variables included in the regressions are non-stationary[10], we estimate

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[9] Obviously, this very simple model could be augmented by including some control variables in any future research – however, for the purpose of this paper, we do not include any control variables in the regression due to the limited sample size.

[10] For the sake of brevity, we do not report the results of the ADF Test here. The results are available from author upon request.

the equation (3) using the fully-modified OLS (FMOLS) estimator, which was introduced by Phillips and Hansen (1990), employs a semi-parametric correction to correct for the issues caused by the long-term correlation between the stochastic repressor innovations and the cointegrating equation. Table 1 reports the results of the regressions. These results do not seem to indicate that there was a strong relationship between the costs of FX interventions and the costs of FX interventions. In the case of the CNB, which had to bear larger costs of its FX reserves accumulation than the SNB, we do not find a statistically significant effect of the costs of FX interventions on CNB's credibility. In the case of SNB, we do find a negative and statistically significant effect of FX intervention costs on SNB's credibility – indicating that higher costs had a negative effect on SNB's credibility. However, the SNB's interventions were not associated with very large costs. Instead, this negative relationship seems to be driven by the January 2015 discontinuation of the SNB's minimum exchange rate, which led to both the large losses and a significant drop in SNB's credibility, as well as by the subsequent period, when the SNB was reaping large profits on its reserves (i.e. the costs were decreasing) and at the same time its credibility was improving.

Table 1: The effect of costs of FX interventions on central bank credibility

Variable	(1)	(2)
	Central bank credibility	
FX interventions costs	0.551	-1.823***
	(0.418)	(0.540)
Constant	0.959***	0.727***
	(0.010)	(0.034)
Country	Czech Republic	Switzerland
Observations	27	27
R-Squared	0.128	0.488

*The standard errors are in parentheses. * indicates significance at 10 % level, ** indicates significance at 5 % level, while *** indicates 1 % significance level.*

5. DISCUSSION AND CONCLUSIONS

In this paper we estimated the total costs of FX interventions of CNB and SNB that were aimed at defending these central banks' one-sided exchange rate commitments in the post-GFC era. We find that in the case of the SNB, these interventions and resulting accumulation of FX reserves were not particularly costly – with the exception of few brief episodes. Instead we find that the cumulative total costs were negative in the case of SNB, i.e. the SNB generated profits thanks to its reserve accumulation. The overall cumulative costs of Swiss currency interventions since 2011 were -15.2 % of Swiss GDP. On average, between 2011 and 2018, the costs equaled to approximately -2 % of GDP per year. On the other hand, we find the CNB's interventions to

be moderately costly – especially since the April 2017, when the CNB's exchange rate commitment was abandoned. The cumulative total costs since 2011 equaled 4.6 % of GDP and on average, between the years 2011 and 2018, these costs were equal to approximately 0.6 % of GDP per year. These results deviate to some extent from the results of earlier studies. Moreno (2011) analyzed the costs of FX interventions on a sample of emerging economies and found that in the case of the Czech Republic, the costs caused by the interest differential equaled to 0.1 % of GDP, while a 10 % appreciation of domestic currency would have led to the costs of 1.7 % of GDP and 2.3 % of GDP in June 2008 and September 2010, respectively. A study by the IMF (2011) analyzed the costs of FX interventions in Latin American countries between 2004 and 2010 found the cumulative costs of interventions to vary significantly between -1.5 % of GDP and 5.5 % of GDP. Adler and Mano (2018) found that median annual costs of FX interventions were 0.6 % of GDP for the period between 2002 and 2013. The figures for Switzerland and the Czech Republic were slightly above 1 % and slightly below 1.5 %, respectively. The differences between their results and our results can be explained by different time span of the study – for most of the period analyzed by the Adler and Mano (2018), the interest rate differential was either rather small or negative and hence did not contribute significantly to higher costs. Additionally, between the years 2002 and 2013, there was a significant overall appreciation of both the franc and koruna and this also contributed to higher costs of intervention when compared to our results. Based on our findings we may conclude that the costs of FX interventions may be quite significant, however, in neither the Czech Republic nor in Switzerland do they seem to have had long-term effect on operations of their respective central banks. We also find that the costs of FX interventions can be minimized by reducing the domestic interest rate, so that it is comparable or lower than the prevailing interest rate in the major advanced economies. Exchange rate movements in the case of both analyzed countries were the major driver of intervention costs, hence with regards to the intervention costs only, it seems that keeping the domestic currency stronger than its long-term equilibrium level is a less costly option. This was the case of Switzerland, where the SNB's one-sided exchange rate commitment was set at a level where Swiss franc was still overvalued and so we may speculate that as the franc will eventually depreciate towards its long-term equilibrium, the resulting revaluation of the FX reserves' franc value will eventually lead to significant profits for the SNB. CNB's asymmetric exchange rate commitment was set at a level, where the Czech koruna seems to have been slightly undervalued and so, as the Czech koruna eventually appreciates towards its equilibrium value (and as the equilibrium exchange rate appreciates due to the convergence process of the Czech economy), the costs of CNB's

interventions may rise even further. Finally, a simple empirical exercise that we conducted, does not seem to indicate that the costs associated with the FX interventions had negatively affected the credibility of either the CNB or the SNB.

Acknowledgement

References

ADLER, G. – MANO, R. C. (2018). *The Cost of Foreign Exchange Intervention: Concepts and Measurement.* In Journal of Macroeconomics.

BENECKÁ, S. – HOLUB, T. – KADLČÁKOVÁ, N. L. – KUBICOVÁ, I (2012). *Does Central Bank Financial Strength Matter for Inflation?* CNB Working Paper Series 3/2012, Czech National Bank: Prague.

FILARDO, A. – YETMAN, J. (2012). *The Expansion of Central Bank Balance Sheets in Emerging Asia: What Are the Risks?* BIS Quarterly Review, June, pp. 47-63. Bank for International Settlements: Basel.

FRANTA, M. – HOLUB, T. – SAXA, B. (2018). *Balance Sheet Implications of the Czech National Bank's Exchange Rate Commitment.* Czech National Bank, CNB Working Paper Series 10/2018.

FRIEDMAN, M. (1953). *Essays in Positive Economics*. Chicago: University of Chicago Press.

INTERNATIONAL MONETARY FUND. (2011). *Regional Economic Outlook: Western Hemisphere.* World Economic and Financial Surveys, International Monetary Fund: Washington, D.C.

KLÜH, U. – STELLA, P. (2008). *Central Bank Financial Strength and Policy Performance: An Econometric Evaluation.* IMF Working Paper 08/176, International Monetary Fund: Washington, D.C.

LEVIEUGE, G. – LUCOTTE, Y. – RINGUEDÉ, S. (2015). *Central Bank Credibility and the Expectations Channel: Evidence Based on a New Credibility Index.* NBP Working Paper No. 209, National Bank of Poland: Warsaw.

MCCALLUM, B. T. (2000). *Theoretical Analysis Regarding a Zero Lower Bound on Nominal Interest Rates.* NBER Working Paper 7677, National Bureau of Economic Research: Warsaw.

MORENO, R. (2011). *The Influence of External Factors on Monetary Policy Frameworks and Operations.* BIS Papers No. 57, pp. 65-86. Bank for International Settlements: Basel.

PHILLIPS, P. C. B. – HANSEN, B. E. (1990). *Statistical Inference in Instrumental Variables Regression with I(1) Processes.* In The Review of Economic Studies, Vol. 57, No. 1, pp. 99-125. ISSN 0034-6527.

STELLA, P. (1997). *Do Central Banks Need Capital?* IMF Working Paper 97/83, International Monetary Fund: Washington, D.C.

WORLD BANK (2013). *Latin America's Deceleration and the Exchange Rate Buffer.* Office of Regional Chief Economist, Semiannual Report, World Bank: Washington, D.C.

ZURBRÜGG, F. (2015). *After the Minimum Exchange Rate – New Monetary Policy Challenges.* BIS central bankers' speeches, Zurich, 26. March 2015, Bank for International Settlements: Basel.

Appendix A

Cost of FX interventions data description – interest rates

Country	Indicator	Source
Australia	3-month or 90-day Rates and Yields: Interbank Rates for Canada	Federal Reserve Bank of St. Louis
Canada	3-month or 90-day Rates and Yields: Interbank Rates for Canada	Federal Reserve Bank of St. Louis
Czech Republic	3-month PRIBOR	Czech National Bank
Euro Area	3-month LIBOR based on Euro	Federal Reserve Bank of St. Louis
Japan	3-month LIBOR based on Japanese Yen	Federal Reserve Bank of St. Louis
Sweden	3-month STIBOR	Sveriges Riksbank
Switzerland	3-month LIBOR based on Swiss Franc	Federal Reserve Bank of St. Louis
United Kingdom	3-month LIBOR based on British Pound	Federal Reserve Bank of St. Louis
United States	3-month LIBOR based on U.S. Dollar	Federal Reserve Bank of St. Louis

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