Foreign Exchange Interventions as an (Un)conventional Monetary Policy Tool: Mid-Term Evaluation

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Abstract

The zero level of interest rates constitutes a limit of this standard monetary policy instrument. On the example of the Czech Republic we argue that in such a situation foreign exchange interventions represent a meaningful monetary policy tool for small open economies not facing serious liquidity problems. Existing studies also suggest that potential financial losses of central banks stemming from the buildup of international reserves do not necessarily compromise credibility and the ability to pursue monetary policy objectives. We provide an overview of the evidence of the functioning of FX interventions and the exchange rate pass-through to consumer prices. Using simulations which take into account the existence of the zero lower bound we argue that in such a situation the pass-through can be much larger than the existing evidence suggests. Finally we provide an evaluation of the Czech Republic experience with the use of exchange rate tool in 2013.

Introduction

The latest, but lasting, economic difficulties have prompted a prolonged period of monetary easing. A significant number of (important) central banks have lowered their rates in response to the crisis in order to mitigate its consequences and meet their monetary (and other) goals and have announced that they expect rates to be at low levels for a significant period of time. The dismal status of the financial sector has also prompted the use of other, unconventional tools in order to boost the liquidity and maintain the stability of particular segments of the financial sector.

The long-lasting economic stagnation has thus left a number of central banks facing the limits of the standard monetary policy instrument – policy interest rates are often approaching the zero level. Depending on the particular situation of their economy and financial sector, central banks have turned their attention to various unconventional monetary policy measures, such as a negative interest rate on deposits (as used, for example, by the National Bank of Denmark and the Swedish Riksbank), various forms of liquidity provision through quantitative or qualitative easing, and foreign exchange interventions.

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[1] Czech National Bank

The Czech National Bank (CNB), an inflation-targeting central bank, has also approached the zero level. However, the position of the CNB and the situation of the Czech financial system are rather dissimilar to those faced by the Fed, the BoE, or the ECB. The major difference determining the choice of another monetary instrument in the Czech Republic is neither the size of the economy nor the magnitude of the economic downturn. Whereas most economies have been hit by a severe liquidity crisis and a subsequent credit crunch as a result of the global financial crisis, the Czech financial system is characterized by an abundance of liquidity. Its source was and is the inflow of foreign exchange into both the private and the public sector. Not only is the ratio of deposits to loans well above the EU average (see Figure 1), but total deposits exceed total loans. The significant excess liquidity is absorbed by the CNB using repo tenders.
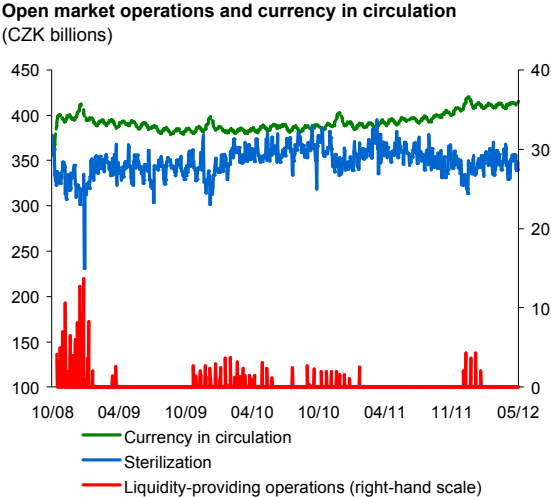
In 2008, on the eve of the crisis, the CNB even introduced liquidity-providing repo operations, but they were used only very rarely (Figure 2) despite having an important psychological effect. However, due to the excess of liquidity, the introduction of a liquidity-providing program along Fed, BoE, or ECB lines cannot be expected to have a significant, if any, impact in the Czech economic situation.

Figure 1: Ratio of deposits to loans

Ratio of deposits to loans granted in selected EU countries
(%; end of 2011; deposits/loans to residents)
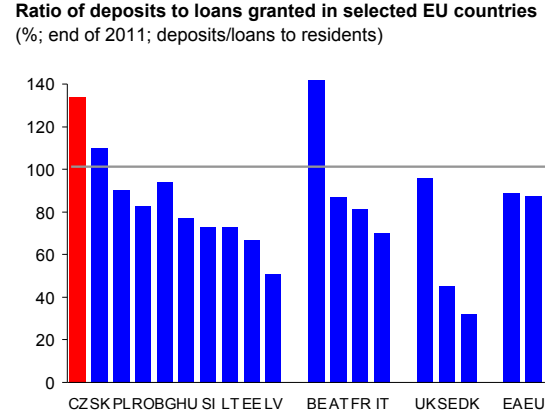
Source: ECB

Figure 2: Open market operations

Open market operations and currency in circulation
(CZK billions)

Source: CNB

Experience with negative deposit interest rates is very limited and the economic consequences are in general very unclear. Moreover, in some pieces of legislation in the Czech Republic, penalty interest is bound in a multiplicative manner to the discount rate. This may lead to severe legal complications if the rate is lowered below zero. In addition, the general legislation forbids negative interest rates in certain types of contracts.

As a consequence, foreign exchange (FX) interventions have been selected as the most appropriate monetary policy tool when interest rates hit the zero bound and cannot be lowered any further. Moreover, given that the Czech economy is very open and FX interventions are among the standard instruments of monetary policy, it seems only logical to choose them over the alternatives.

On November 1, 2012, the CNB lowered the two-week repo rate – its key monetary policy rate – to "technical zero" (0.05%). Following an internal debate about the other monetary policy instruments usable for further monetary easing outlined above, the Bank Board decided that FX interventions would be used where necessary to lower the value of the Czech koruna

and decided to publicly communicate the choice of this instrument well in advance in order to transparently reduce the market uncertainty about the looming zero-rate threshold and to avoid a loss of ability to influence monetary-policy relevant inflation and inflation expectations in the event of a prolonged recession and a need for further monetary easing.

Today, many central banks use inflation targeting (IT) as their means of achieving and maintaining price stability. The CNB switched to inflation targeting in 1998 and has earned a high level of credibility since then. In recent times, the CNB has been highly ranked for its transparency.

Under inflation targeting, the monetary policy tool is the interest rate. The exchange rate is not a tool, but an endogenous variable affecting future inflation expectations. The crucial general issue when dealing with FX interventions is therefore the question of their compatibility with inflation targeting. Is influencing FX contradictory to IT? Leaving aside technical and procedural compatibilities, does it compromise the credibility and goals of the central bank? The theory also states that FX interventions can have an impact only through expectations about depreciation/appreciation of the currency or the risk premium of the country.

The IT theory gives very little, if any, guidance on FX interventions. On the contrary, it assumes and usually recommends pure floating with no role for exchange rate management, because in this framework monetary policy affects the exchange rate through the interest rate. The only way in which the exchange rate enters the whole process is through the future inflation forecast influencing the interest rate.

And it is exactly this implicit reaction of monetary policy to exchange rate shocks that leads one to question FX interventions under standard conditions. Why intervene in the FX market if we have another monetary variable, the interest rate, at hand? Such behavior cannot be credible, as it contradicts the fundamentals of IT.
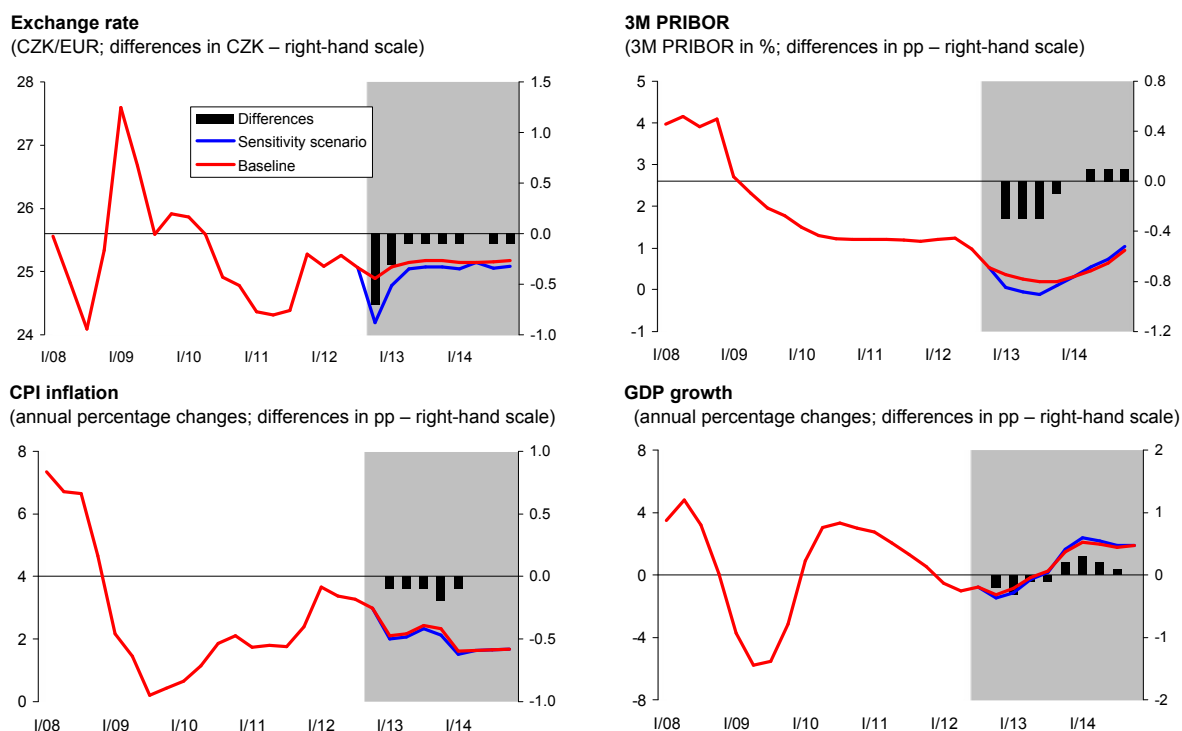
Under standard conditions, an unexpected depreciation shock eases the monetary conditions. However, in such a situation the interest rate is increased in order both to prompt appreciation of the currency and to tighten the easier monetary conditions directly. The important consequences are that

1) the implicit reaction of the monetary policy instrument strongly affects our ability to estimate the true effects that FX interventions have on macroeconomic variables, and

2) in the situation of a zero lower bound, appreciation shocks cannot be accommodated by a standard interest rate cut to ease the tighter monetary conditions caused by the exchange rate shock.

Figure 3 shows an example of the effects of a 3% exchange rate shock under the standard situation (with no zero bound and hence with an accommodating monetary policy tool) on the Czech economy. This exercise is commonly used as a sensitivity scenario by the CNB in its inflation reports. The graphs reveal only a very modest reaction of both CPI inflation and GDP growth to the exchange rate shock.

The crucial question is to what extent do the results of the exchange rate fluctuations shown hold for the effects of FX interventions on the Czech economy if the need arises to use them to further ease monetary policy. In addition, what is the international and Czech experience with FX interventions? Can we build on that experience, or does everything change as we hit the zero lower bound on nominal interest rates? In the following sections we will try to shed some light on the issues inevitably brought up by such questions in line with the argument outlined above.

Figure 3: The CNB's exchange rate sensitivity scenario (a 3% appreciation shock)
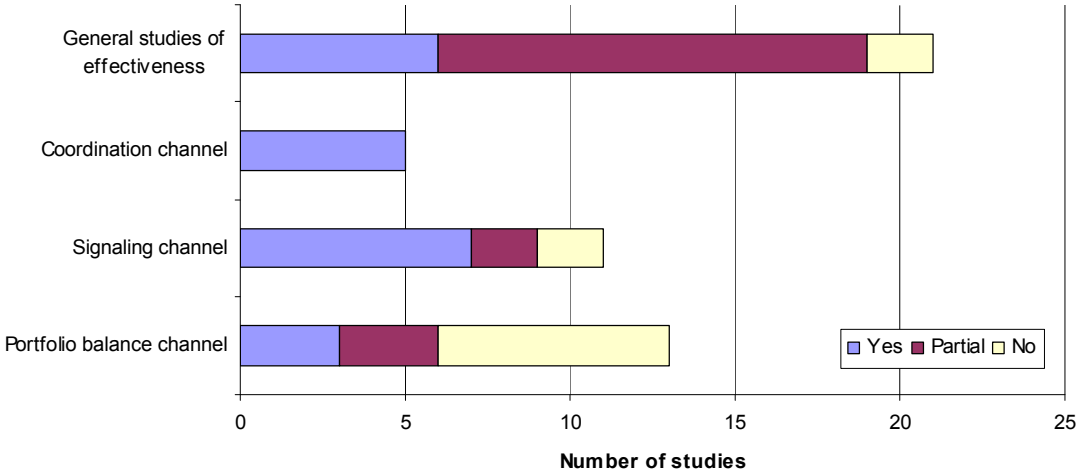
Exchange rate
(CZK/EUR; differences in CZK – right-hand scale)

3M PRIBOR
(3M PRIBOR in %; differences in pp – right-hand scale)

CPI inflation
(annual percentage changes; differences in pp – right-hand scale)

GDP growth
(annual percentage changes; differences in pp – right-hand scale)

Source: CNB Inflation Report IV/2012

International Experience with FX Interventions

First, let us focus on the case of known interventions under the standard situation in actual practice. The number of official floaters is steadily increasing, but we still observe a "fear of floating" (Calvo and Reinhart, 2002), as many central banks in open economies do intervene regardless of their official position. According to the IMF's classification, independent floating dominates among IT countries (with 19 countries as of April 2008), but managed floating coexists with this regime, too (10 countries). Moreover, many independent floaters do actually intervene at least occasionally, with interventions having been more common during the recent crisis: Brazil in October 2008, Chile in January 2011, Indonesia in October/November 2008, Israel in 2008–09, Mexico in 2009, New Zealand in 2007, Poland in April 2010 and from September 2011 to December 2011, South Korea in 2008–09, Switzerland since 2009.

Numerous proposals for managed floating regimes had already been put forward before the 2008 crisis (e.g., Bofinger and Wollmershaeuser, 2003; Goldstein, 2002). The core of the idea is that if the central bank was able to reduce exchange rate volatility, it could achieve a better trade-off between inflation and output variability. However, two important questions remain unanswered: Can the theoretically meaningful outcome really be achieved in practice? And can it be achieved without harming central bank credibility, the cornerstone of the inflation-targeting monetary policy regime? Cavusoglu (2010), reviewing studies which investigate the effectiveness of interventions, found that interventions have a significant short-lasting effect on exchange rates mainly through the signaling and coordination channels. But only a few studies have provided evidence that interventions have been effective in the longer term. Studies focused on the general effectiveness of interventions, not on any particular pass-through channels, give a very mixed picture. The findings are summarized in Figure 4.
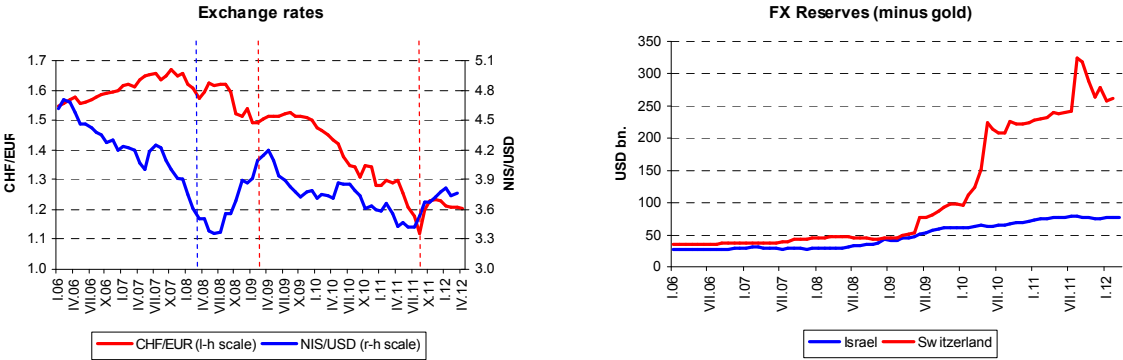
Figure 4: Do interventions work?

General studies of effectiveness · Coordination channel · Signaling channel · Portfolio balance channel — Number of studies (0–25). Legend: Yes / Partial / No

When we limit ourselves to cases where interest rates are close to zero, only two countries have experience with interventions – Switzerland and Japan. Both are, however, very specific cases (safe haven currencies and reserve currencies) where the central banks struggled to keep their currencies from further appreciating during periods of flight to safe assets. The Swiss National Bank (SNB) announced in March 2009 that it would ease the monetary conditions in order to prevent any further appreciation of the CHF against the euro. Apart from directly purchasing foreign currency on the FX markets, the SNB started in August 2011 to perform indirect interventions by narrowing the key interest rate range from 0–0.75 pp to 0–0.25 pp, sharply raising the supply of liquidity, and using FX swaps. On September 6, 2011 the SNB set a minimum exchange rate of 1.20 CHF/EUR, stating that it would buy foreign currency in unlimited quantities if the rate fell below this level. As a consequence, by September 2012 its balance sheet had tripled in size and the monetary base had grown six times in comparison with 2008 as a result of liquidity operations and FX interventions. The FX reserves rose by 450%, with 60% of them denominated in the euro. In July 2012 the reserves reached $417 bn, which is almost 70% of GDP, whereas the average for 1999–2007 was 13%. To sum up the Swiss experience, we can say that such a commitment is an effective tool if the bank is ready to purchase an unlimited quantity of assets (see Figure 5).

Figure 5: FX interventions by Switzerland and Israel

Exchange rates — CHF/EUR (l-h scale) / NIS/USD (r-h scale)

FX Reserves (minus gold) — USD bn. — Israel / Switzerland

Probably the best example of a country comparable to the Czech Republic with recent experience of large-scale interventions is Israel. Israel, like the Czech Republic, is a small open economy, the Bank of Israel targets inflation, and the Israeli spot FX market is similar in size to the Czech one. However, the purpose of the interventions was different and hence has limited relevance from such a perspective: Israel's interventions were motivated by exchange rate policy considerations rather than by FX being a monetary policy tool. The first round of interventions took place in March 2008 with the primary goal of increasing Israel's FX reserves. At the end of March, the BoI started buying about $25 million a day, and in July 2008 the average daily rate of purchases was increased to $100 million. In August 2009 the BoI abandoned regular unidirectional interventions and introduced the possibility of ad-hoc bidirectional interventions, i.e., of buying and selling shekel at any time in the event of large movements in its exchange rate not only in the case of market failure in the FX markets, but also in situations where the development of the exchange rate was inconsistent with economic conditions. Between March 2008 and July 2012 the reserves of the BoI increased from $29.4 bn to $75.4 bn. During the period of interventions the FX reserves grew by 164% to more than 30% of GDP by the end of 2011. We can conclude that in the case of Israel a large volume of purchases was needed, but their impact on the exchange rate was not very clear, as numerous currencies depreciated during the observed period. Also, the fact that the BoI never officially terminated the interventions points to possible exit strategy difficulties.

Czech Experience

The Czech exchange rate regime shifted from a fixed to a floating one in 1997 (see Figure 6 for the evolution of exchange rate policy). Since then, the CNB has intervened in the FX market in three distinct periods, almost always against appreciation of the koruna. The first intervention period took place between February and July 1998, the second between October 1999 and March 2000, and the third between October 2001 and September 2002. But the evidence on the effectiveness of these interventions, summarized in Figures 7 and 8, is mixed. Sometimes there was a visible immediate impact which lasted up to 3 months. In other cases the effect was less clear, was weak, or was transient. Of course, without knowing the counterfactual this evidence cannot be used to convincingly address the impact of the interventions in question. However, there are several studies that address the effect of the CNB's FX operations on the FX market.

Disyatat and Galati (2007) found that the interventions of 2001–2002 had some (weakly) statistically significant impact on the spot rate and risk reversal, but that this impact was small. They did not find evidence that the interventions had had an influence on short-term exchange rate volatility. Geršl and Holub (2006) found the interventions had probably played a minor role in influencing the exchange rate in the short run at best. According to them, the interventions contributed to increased volatility of the exchange rate, but only to a limited extent. According to Geršl (2006), the interventions had only a small short-term effect on the exchange rate level and to a certain extent contributed to increased conditional and implied volatility. And finally, Égert and Komárek (2006) conclude that from mid-1998 to 2002 koruna sales were effective in smoothing the path of the exchange rate for up to 60 days. This was not the case from 1997 to mid-1998.

Figure 6: Czech exchange rate policy
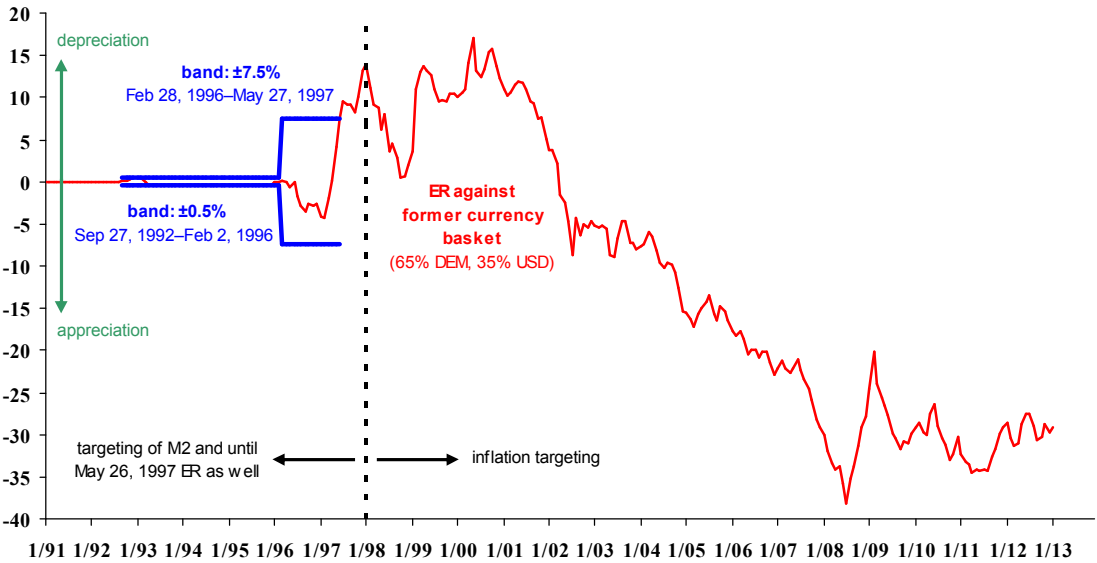
Source: CNB

Figure 7: Interventions and other operations on the Czech FX market
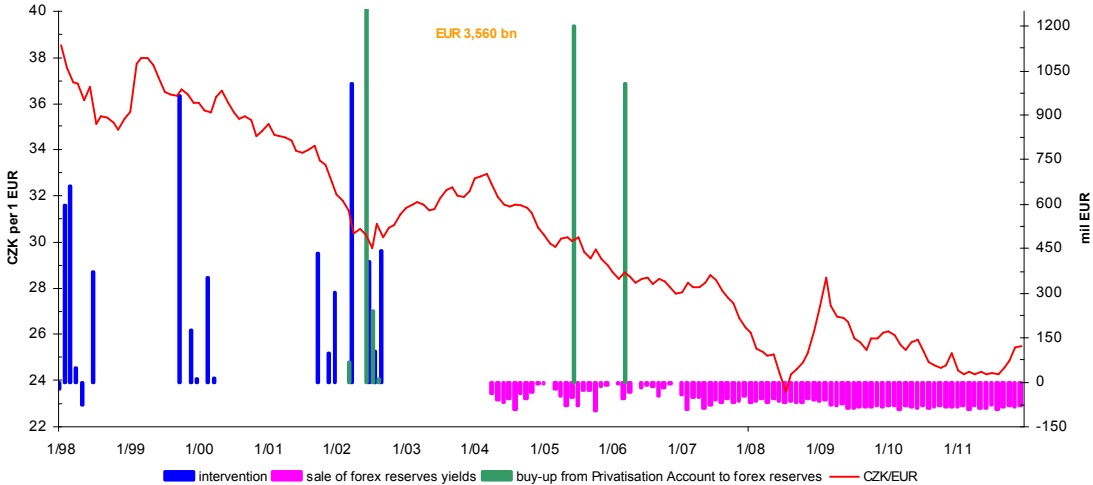
Source: CNB

In 2004 the CNB started selling a part of its yields on FX reserves (these sales were recently discontinued). Starting in June 2007, the previously discretionary approach to reserve sales, with the timing and size of sales not pre-announced, was changed to a regime of daily sales. Dominguez, Fatum, and Vacek (2010) analyze whether the euro-denominated reserve sales influenced the CZK/EUR rate and reach an interesting and slightly counterintuitive conclusion: over the period of the discretionary regime, there is little evidence that the sales influenced the koruna. However, starting in 2007, when the CNB sold euros every business day, the decumulation of reserves led to statistically significant appreciation of the koruna against the euro. One possible explanation is that in the ad-hoc regime the traders intentionally go against the market in order to minimize volatility, and the market trend dominates the effects of the sales.

Figure 8: Effectiveness of Czech interventions

Starting month	Final month	Overall volume	CZK/EUR (ECU prior to 1999)						
(t)	(T)	EUR million	t-3M average	t-1M average	Start of t	Low of [t;T]	End of T	T+1M average	T+3M average
02/1998	04/1998	1285	37,87	38,50	38,37	36,30	36,46	36,11	35,11
06/1998	07/1998	508	36,95	36,11	36,49	34,35	34,35	35,47	35,17
10/1999	10/1999	966	36,52	36,36	35,72	35,68	36,62	36,40	36,03
12/1999	12/1999	229	36,36	36,40	36,08	35,83	36,13	36,03	35,60
03/2000	03/2000	394	36,05	35,71	35,65	35,53	35,63	36,31	36,02
10/2001	01/2002	643	33,86	34,19	33,91	31,46	31,92	31,79	30,36
04/2002	04/2002	1 009	32,08	31,39	30,62	30,06	30,63	30,56	29,75
07/2002	09/2002	954	30,36	30,3	29,25	28,97	30,30	30,65	31,19

Source: CNB

Exchange Rate Pass-through to Consumer Price Inflation

The existing international and Czech empirical evidence suggests that FX interventions have the ability to influence the exchange rate, even though this may not always be the case in the long term. Fatum and Pedersen (2009) made an interesting observation in this context when studying the effects of sterilized FX interventions of the Danish central bank. They found that interventions exert a significant influence on exchange rate returns only when the direction of intervention is consistent with the monetary policy stance. This is exactly the case when an FX shock is NOT accommodated, but rather fueled, by monetary policy inactivity. This also justifies FX interventions being used as a tool of monetary policy when the interest rate has reached the zero limit and further easing is necessary to meet the inflation target. When the interest rate can no longer be used or is insufficient to influence inflation expectations and achieve price stability, FX interventions become a viable option.

Knowing that FX interventions have the ability to influence the exchange rate and are not in contradiction with IT under the zero-level limit is only the first step toward their practical use as a tool for achieving the inflation target.

The next, practical step is to quantitatively assess the exchange rate tool. The question we need to address first is how exchange rate changes affect prices in the Czech Republic. In other words, we need to address the relevance of existing simulations of exchange rate pass-through.

The results of existing empirical analyses of the transmission of an exchange rate shock to Czech inflation lie in a relatively wide band of 0% to almost 80% (see Figure 9) and are hard to compare due to substantial differences in the methods, empirical specifications, and time series spans used. Also, a slight decreasing tendency in exchange rate shock pass-through over the last decade is apparent. One of the most recent estimates – an impulse response based on a vector autoregression (VAR) model estimated on quarterly data for 1998Q1–2012Q3 (depicted in Figure 10) – suggests pass-through of nearly 8%. We do not have any evidence on whether the decreasing trend in the pass-through is due to the methodology used, to better monetary policy adjustment fully compensating the exchange rate shocks, or indeed to a change in the characteristics of the underlying transfer channels.

Figure 9: Exchange rate pass-through to Czech inflation based on a literature review
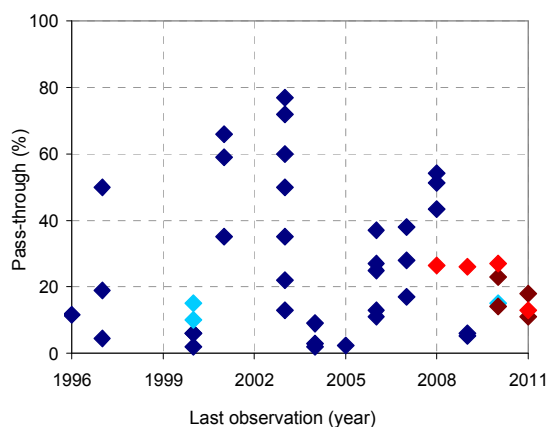
Note: The figure shows the reaction of consumer prices to an exchange rate shock of 1%. It summarizes 43 ERPT estimates for the Czech Republic collected from 22 papers and articles published in 2001–2012. Dark blue points represent time-invariant estimates. Light blue points are medians of time-varying estimates. Results based on Babecká Kucharčuková et al. (2013) are in dark red (VAR) or red (BVAR median and TVP-VAR for 2008Q1, 2009Q1 and 2010Q1).
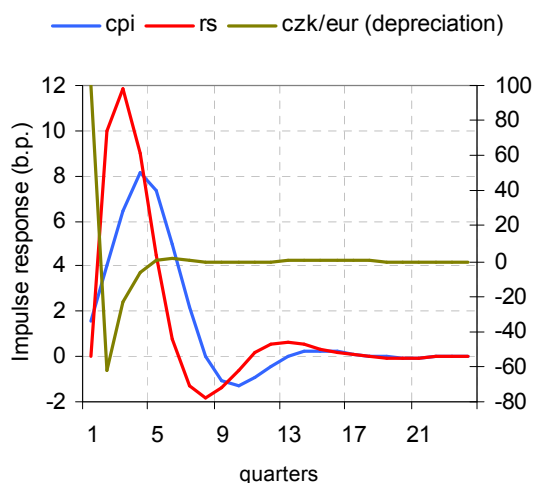
Source: CNB

Figure 10: Impulse response of the CPI and the short-term interest rate to a Czech koruna depreciation of 1% (VAR model)
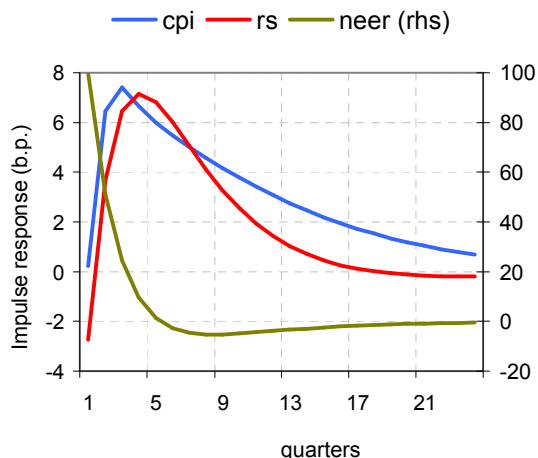
Note: The generalized impulse response is based on a VAR model estimated on quarterly data for 1998Q1–2012Q3. The vector of endogenous variables contains Czech GDP, the consumer price index (cpi), 3M PRIBOR (rs), the nominal effective exchange rate (neer), and monetary aggregate M2. The exogenous variables are the IFS All Primary Commodities price index, euro area GDP, and 3M EONIA.

Source: CNB

Figure 11: Impulse response of the CPI and the short-term interest rate to a Czech koruna depreciation of 1% (g3 model)

Note: The impulse response is based on the CNB's core DSGE forecasting model, called g3. The notation is: consumer price index (cpi), 3M PRIBOR (rs), nominal exchange rate (czk/eur).

Source: CNB

In the standard inflation-targeting regime, an exchange rate shock transmits through both a direct channel (import prices) and an indirect channel (economic activity), taking into account the endogenous reaction of all other variables, including interest rates. Through the direct channel of import prices the exchange rate change passes through to consumer prices almost immediately. However, exchange rate changes influence not only prices, but also, with some lag, real volumes of imports and exports, which consequently cause changes in the rate of growth of wages and employment. The labor market is thus the means of indirect pass-through of the exchange rate shock to consumer prices. This pass-through, however, is moderated by the reaction of interest rates. The movement of interest rates not only causes a correction in the nominal exchange rate, but also, by changing real interest rates, influences investment and private consumption.

Other estimates, based on Bayesian vector autoregression model (BVAR) and vector autoregression model with time-varying parameters (TVP-VAR),[2] published in Babecká Kucharčuková et al. (2013) lie in the interval of 13–26% (see the red points in Figure 9). The reaction of consumer prices to a shock is rather quick, peaking after about four quarters. Figure 11 depicts the impulse response based on the CNB's core dynamic stochastic general equilibrium (DSGE) forecasting model,[3] which is very similar to the empirical evidence in both the strength and the timing of the pass-through. Analyses conducted in the CNB indicate that the strength of the response to an exchange rate shock gradually decreases along the distribution chain. The largest pass-through (over 50%) is observed for import prices; the transmission of the shock to industrial producer prices and to consumer inflation is an order of magnitude lower.

Influence of the Zero Lower Bound on Pass-through

As rates approach the zero lower bound (ZLB), the transmission of shocks to the economy may change, as we document using various instances of similar phenomena (one parameter fixed, decreased degrees of freedom). Take, for instance, Bayesian fan charts, which are used to predict the future development of an economy as it reacts to various exogenous shocks. Nowadays, central banks do not explicitly address the issue of the ZLB on the nominal interest rate when constructing fan charts. However, there are several possible approaches to forecasting at the ZLB.

First, forecasts can be conditioned on shocks that lead to a non-negative nominal interest rate. Second, forecasts can be conditioned on the interest rate itself, regardless of the shocks hitting the economy. And finally, the ZLB can be ignored completely.

Franta et al. (2013) show on Czech data that, depending on which types of shock we exclude from the construction of the simulated density forecasts, we can introduce different types of bias. In the first approach, all shocks which directly or indirectly imply a decreasing interest rate are filtered out. For example, a negative demand shock, which usually leads to fall in output, inflation, and the interest rate, is also discarded by this approach when the economy reaches the ZLB. As a consequence, negative demand shocks are less likely to be included in the simulated density forecast than positive demand shocks.
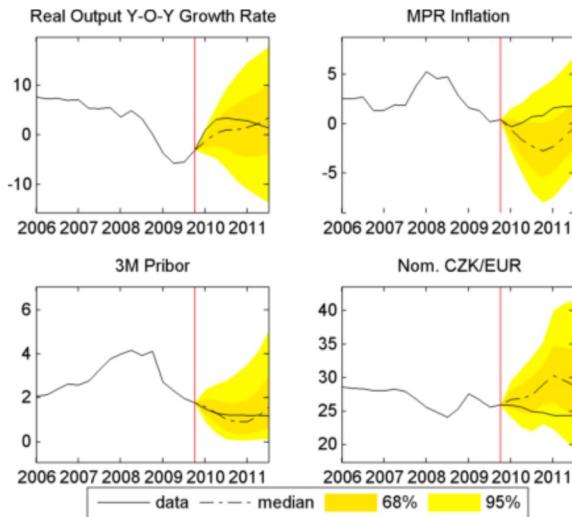
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[2] Compared to standard VAR model, which is used to capture interdependencies among multiple time series, Bayesian VAR allows to impose *a priori* information on the model parameters and mitigate the over-parameterization problem. VAR with time-varying parameters enables to capture changes in underlying structure of the economy.

[3] The DSGE methodology focuses on explaining economic phenomena using macroeconomic models based on microeconomic foundations. Therefore, DSGE models should not be vulnerable to the Lucas critique.

The second approach imposes zero on all negative parts of the interest rate path, but constructs the density forecast using all draws of shocks. For example, a negative monetary policy shock, which is not possible at the ZLB, gets into the sample of forecasts from which the density is sampled. Even though such a shock does not have any impact on the nominal interest rate, it immediately affects the exchange rate and thus other variables in the following periods.

Figure 12: Shocks filtered (ZLB active)   **Figure 13: ZLB ignored**
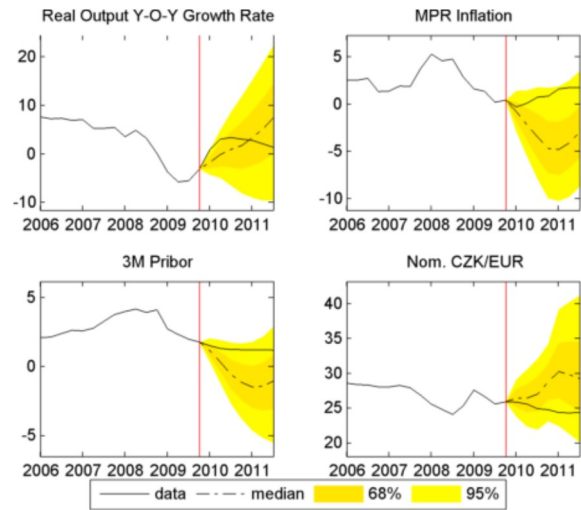
Note: Fan charts starting in 2010Q1. The vertical line denotes the period of the last observed values used for the estimation. The density forecasts are characterized by the centered 95% (light yellow), centered 68% (dark yellow), and median of the marginalized joint distribution.

Source: Franta et al. (2013)

In the last case, not only all draws of shocks, but also possible negative lagged values of the nominal interest rate are used to construct the density forecast. We do not intend to discuss the question of the accuracy or usefulness of the individual approaches, but they do allow us to demonstrate the difference in forecasts, i.e., the theoretical responses of the economy to shocks when the zero interest rate limit is binding. As Figures 12 and 13 demonstrate, the differences in the forecasts can be sizable (note the differences in the vertical scales). Not accounting for the ZLB at all (Figure 13) leads to ex-post observed monetary-policy-relevant inflation being on the edge of the centered 95% of the distribution forecast. A similar result is observed if a zero nominal interest rate is imposed following the second approach mentioned above. Ignoring the ZLB also leads to an over-optimistic outlook for real output growth. These results highlight one important finding: the models we use in normal times will not necessarily work correctly as the economy approaches and hits the zero lower bound on nominal interest rates.

As shown by many authors (e.g., Portes, 1969), fixing one input or binding constraint in effect leads in general to higher responsiveness (or volatility) of the remaining variables, ceteris paribus. This is also true for the exchange rate pass-through with the ZLB binding. When monetary policy acts to stabilize the economy and reacts transparently to an exchange rate shock, the exchange rate pass-through to inflation is relatively small, as the above-mentioned empirical evidence suggests. But the transmission of an exchange rate shock changes as the central bank approaches the ZLB and interest rates cannot counteract the shock. Depending on how long economic agents expect monetary policy to operate in the ZLB regime, the pass-through of the exchange rate to inflation increases sizably. The first channel is import prices,

which directly cause higher inflation without a stabilizing reaction of interest rates. The second channel is real interest rates: longer-term fixed nominal interest rates due to the ZLB and gradually increasing inflation push down real interest rates and thereby stimulate real economic activity, for instance private consumption. The two channels therefore work in the same direction.

It is not only monetary policy that is sensitive to the existence of the ZLB. Analogously, in a meta-analysis of fiscal multipliers Gerchert and Will (2012) show that the fiscal multipliers are significantly higher in a ZLB regime regardless of the subsample of models chosen. We can therefore conclude that the existing studies estimating the size of pass-through are not all applicable in a situation of zero rates, and that the pass-through at the ZLB can be several times larger than past estimates.

Costs of FX interventions

A major impediment to conducting FX interventions might be their adverse effect on central banks' balance sheets. However, one has to keep in mind that when intervening with the goal of easing monetary conditions, no costly sterilization is necessary because in such a situation the monetary consequences of intervention are in line with the monetary policy objective. But that does not mean that FX interventions are costless. Long-lasting interventions against one's own currency usually lead to a sizable buildup of international reserves. With the local currency appreciating due to the economic convergence of the country, assets denominated in foreign currencies have to be revalued. And if the central bank holds more foreign currency assets than foreign currency liabilities, such revaluation creates financial losses.

As, for example, Stella (2008) and Stella and Lönnberg (2008) point out, the accumulation of losses may have a negative impact on the financial strength of the central bank and undermine the credibility of monetary policy. However, in order to correctly understand the degree of credibility risk, the central bank's balance sheet situation has to be put in the relevant macroeconomic context that the bank faces. Cincibuch et al. (2009) develop a formal framework for assessing the sustainability of the central bank's balance sheet. Taking the long-run trends from the CNB's forecasts and simulating the long-term development of the CNB's balance sheet, they show that the CNB should eventually get into a profit-making situation as economic convergence progresses, and the risk premium, as well as the real exchange rate appreciation trend, is likely to disappear. They conclude that the CNB will be able to repay its current accumulated loss out of future profits.

The long-term sustainability of the balance sheet and the central bank's credibility, therefore, will not necessarily be compromised even in situations of negative own capital if the losses stem from the economic convergence of the country. On the other hand, theoretical expectations are one thing, but the actual ability to pursue monetary policy objectives, such as stabilizing inflation expectations, may be harmed when the central bank becomes financially weak. To analyze the issue, Benecká et. al (2012) empirically address the link between central bank financial strength and inflation. On a panel of more than 100 countries between 2002 and 2009 they find that in a few cases there is indeed a statistically significant negative relationship between financial strength and inflation. But the results lack robustness with respect to the choice of alternative measures of financial strength and econometric technique. Also, there is some evidence that the relationship is non-linear, with only substantial financial weakness being associated with higher inflation, and the link exists only for countries with the lowest level of central bank legal independence and/or relatively high inflation rates.

In general, according to Benecká et al. (2012), the explanatory power of central banks' financial strength indicators is rather weak, while other inflation determinants seem to play a more important and robust role.

## *Situation of the Czech Economy in Late 2013*

As mentioned earlier, the Czech economy experienced a sharp slowdown in 2008 in reaction to the global financial and economic crisis. After one year in deep recession, a gradual recovery in 2010 and 2011 took place while public finances reform was started. The credibility of the public finance reform manifested in low interest rates; the Czech government enjoys lower premium than Euro counterparts, e.g., France. However, in 2012 and 2013 the economy witnessed mild, however protracted, recession again. At this time the economy also started to lag behind its major trading partners as the roots of the slowdown were not imported from abroad, but stemmed from weak domestic demand, too. The EU also experienced period of amebic improvements, various new financial problems and many deep uncertainties. As a consequence, the domestic inflation was decreasing and hit the lower boundary of the tolerance band around the CNB's target by the end of 2013, in spite of VAT and other tax increases taking place in that year (see Figure 14). Monetary-policy relevant inflation was already around zero and also showed a decreasing tendency.

In addition, the so-called adjusted inflation excluding fuel prices, i.e. the indicator of core inflation, had been negative since 2009 due to deep decline in prices of tradable goods and services. Moreover, as Figure 15 reveals, in 2013, for the first time in Czech modern history, the growth of prices of non-tradables, i.e., the index that is the most closely related with domestic situation only, reflects prices of domestic services and gives hints about future wage pressures, got to zero level as well. As this index was historically the highest one, it has signaled very unusual circumstances, especially for a converging economy, and mainly reflected weak domestic demand, no wage growth and even expected wage decline. Together with still-falling prices of properties it was the edge of deflationary spiral forming in the economy.

Figure 14: Czech inflation – actual vs. targets
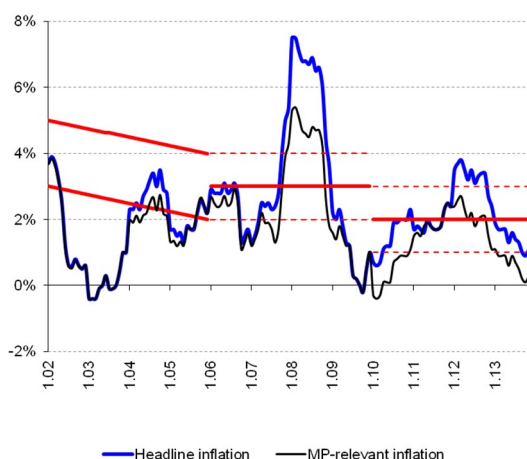
**Figure 15: Core inflation – tradables and non-tradables**
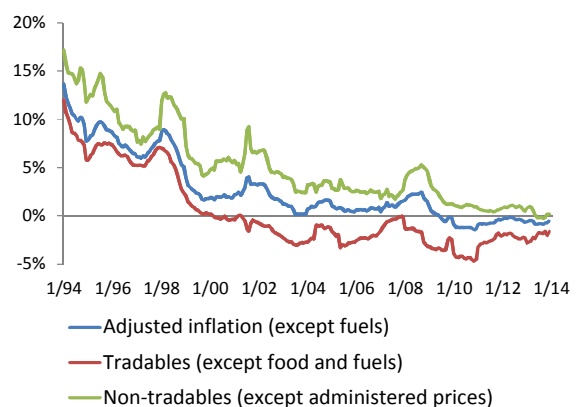
Source: CNB

The CNB responded to this development by gradually lowering interest rates to "technical zero" (0.05% for the two-week repo rate and the discount rate, and 0.25% for the Lombard

rate) on November 1, 2012. In order to further ease monetary conditions, the CNB communicated that it is prepared to use the exchange rate as an additional instrument if a need arises. Finally, the forecast published in the Inflation Report IV/2013 pointed to a need for clearly negative levels of market interest rate, followed by a rise in rates only at the end of 2014 (see Figure 16). Given the ZLB on interest rates, this pointed to a significant need to ease monetary policy using other instruments.

Figure 16: Inflation Report IV/2013: Interest rate forecast

(3M PRIBOR in %)

■ 90%   ■ 70%   ■ 50%   ■ 30% confidence interval
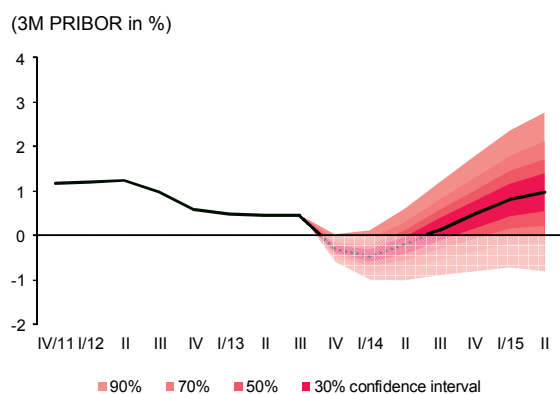
Source: CNB

The baseline forecasting model showed that ignoring this need would have dire consequences for the Czech economy (see Franta et. al, 2014, for detailed assessment of costs, risks and uncertainties). Moreover, Cook and Devereux (2013) show that the optimal reaction of foreign policy rates to home rates at the ZLB is an increase. Otherwise, the home currency starts to appreciate uncontrollably. However, the situation was complicated by the fact that, according to our reading of the economic development in the euro area, ECB has been expected to significantly ease the monetary policy in the (near) future as well. Therefore, the deadly appreciation spiral was not likely but almost certain to come.[4]

As historical note we add that the ECB indeed decreased its rates just 45 minutes after the Czech FX commitment was eventually announced. Without it, there would be further appreciation spree on the CZK, and consequent unsustainable tightening of monetary policy stance with deflation spiral further propelled by the appreciation.

Exchange Rate Commitment of November 2013

On November 7, 2013, the CNB Bank Board decided to start using the exchange rate as an additional instrument for easing the monetary conditions. An alternative scenario constructed using the CNB core prediction model revealed that the optimal amount of monetary easing would be delivered by weakening the koruna so that the exchange rate is close to CZK 27/EUR. The exchange rate level was chosen to avoid deflation or long-term undershooting of the inflation target and to speed up the return to the situation in which the CNB will be able to use its standard instrument, i.e. interest rates. The exchange rate commitment was constructed as one-sided. This means that the CNB committed to prevent excessive appreciation of the

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[4] The trading department of CNB, after long period of relative normal trading, indeed signaled development that was revealing of forming speculative positions on currency appreciation.

koruna exchange rate below CZK 27/EUR. On the weaker side of the CZK 27/EUR level, the CNB allowed the exchange rate to move according to supply and demand on the FX market.

Using the exchange rate as an additional instrument at the ZLB was proposed mainly by McCallum (2000) and Svensson (2001), who proposes a "foolproof way" of escaping from a liquidity trap in an open economy. Svensson argues that such safe way consists of announcing a price-level target path corresponding to a positive long-run inflation target, a devaluation of the currency and a temporary exchange rate peg, which is later abandoned in favor of standard inflation targeting once the price-level target path has been reached. He further argues that "this will jump-start the economy by (1) a real depreciation of the domestic currency relative to a long-run equilibrium level; (2) a lower long real interest rate (since there must eventually be a real appreciation of the domestic currency, and expected real appreciation of the currency is associated with relatively low short and long domestic real interest rates); and (3) increased inflation expectations (since, with the exchange-rate peg, expected real appreciation is associated with expected domestic inflation)." (Svensson, 2001, 280–1)

Note, that Svensson's (2001) proposal emphasizes the role of inflation expectations as well as the effect of decrease of real interest rate and does not rely on the portfolio-balance channel of foreign exchange interventions as previous authors. The exchange rate peg serves to handle the credibility problem in his approach, as it allows the central bank immediately and credibly demonstrate its commitment to higher inflation rate by means the exchange rate peg. The price-level target makes the temporary peg consistent with long-run inflation target and allows inflation to deviate in short run from its standard target.

Figure 17: Comparison of scenarios constructed using the CNB core prediction model
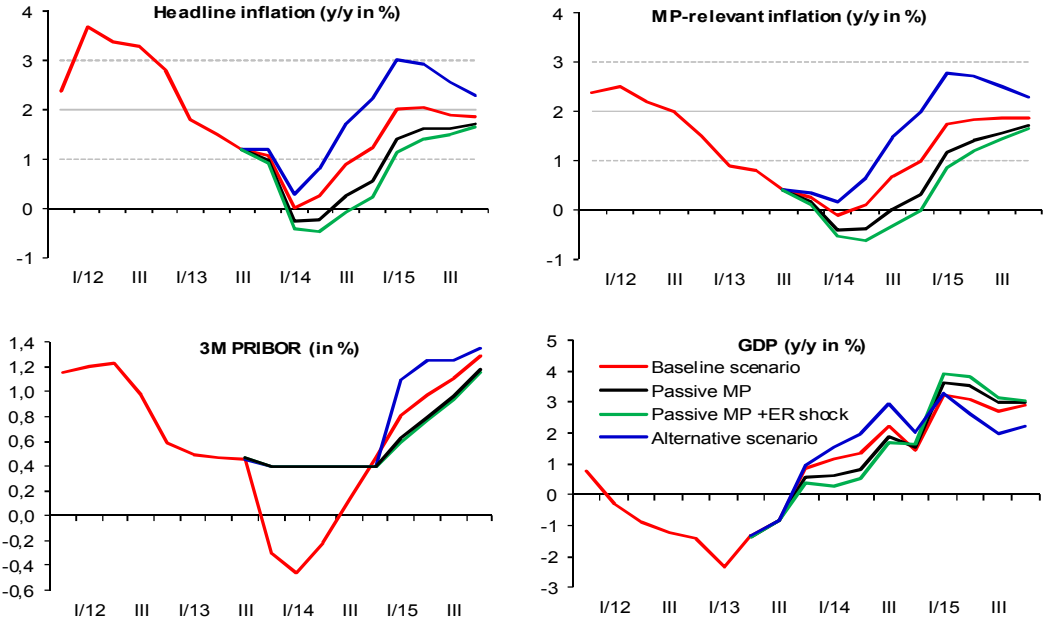
Note: Baseline scenario = CNB baseline prediction with no limits on interest rate; Passive MP = Active ZLB and no reaction of additional monetary policy tools; Alternative scenario = Active ZLB and FX interventions used as an additional monetary policy tool.
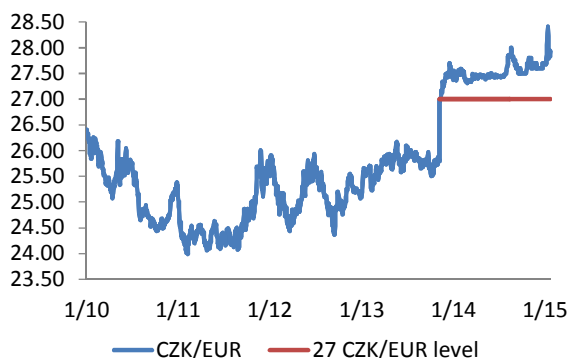
Source: CNB

Although the practical implementation of the CNB commitment is different from Svensson's model, it has all the necessary features. In a similar manner, the inflation predicted to follow

the CNB's November 2013 FX commitment (see Alternative scenario line in Figure 17) was expected to overshoot the inflation target in order to offset the significant undershooting in 2014. That is, the chosen approach implicitly contained an element of temporary price-level targeting recommended by Svensson (2001).

The commitment to offset past deviations from the inflation target by future developments increases inflation expectations and through a decrease in ex ante real interest rates speeds up exit from the ZLB. However, this element of price-level targeting was implemented without an explicit regime change as assumed in Svensson. As Franta et al. (2014) argue, the implemented approach is equivalent only from an ex ante perspective – but this was actually needed, the ex ante effectivity. The CNB also weakened the exchange rate as a one-off action and did not introduce a crawl, and announced that a future change of the exchange rate to a weaker level was possible in case of strong anti-inflationary pressures. In these technical aspects, the CNB's approach differed from Svensson's (2001) recommendations.

Figure 18: CZK/EUR exchange rate

Figure 19: Open market operations and currency in circulation
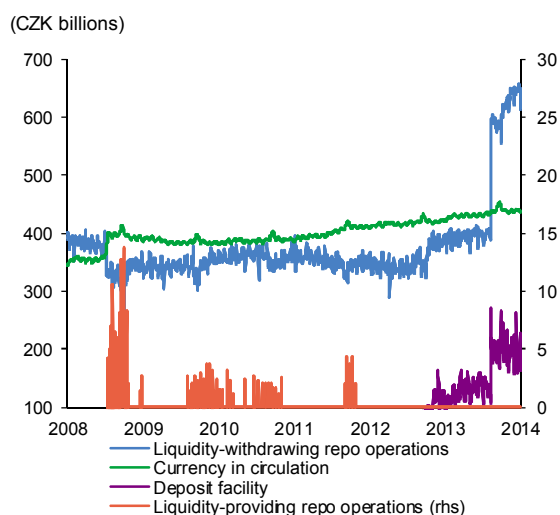
Source: CNB

Actual interventions were quite massive (EUR 7,499 bn.) and resulted in increase in foreign exchange reserves in about 8% of GDP (in terms of the reserves they grew by one third), but took place only for a few days after the policy decision of the CNB. After the CNB's policy announcement, koruna reached CZK 27/EUR quickly, and had been moving at somewhat weaker levels since then (see Figure 18). The exchange rate volatility decreased significantly (both the actual one, and implied by futures prices) in 2014.

Mid-Term Evaluation of the Effects

For a long period of time, there was not enough data from the real economy to demonstrate how the FX commitment did help the Czech economy and what were the effects and their channels. Communication of the step and its consequences proved to be very complicated because model predictions were not sufficient to persuade the public. Only by the end of 2014, that is a year after announcing the FX commitment, we finally started to gather real statistical evidence of its longer term effects. Even now with the real economy data the communication is a daunted task.

Table 1: Development since November 2013

	Annual percentage changes			
	Available on 7.11.2013		Available on 11.3.2015	
Gross domestic product (s.a.)	II/13	-1.3	2014	2.0
Consumer price index	9/13	1.0	1/15	0.1
General unemployment rate (in %, s.a.)	9/13	7.1	1/15	5.9
Average nominal wage	II/13	1.2	IV/14	2.3
Number of vacancies	9/13	39,040	2/15	69,000
Gross operating surplus of nonfinancial corporations	II/13	1.3	III/14	17.5
Insufficient demand as a limit of production in industry (in %)	IV/13	52.0	1/15	40.3
Composite confidence indicator (index)	10/13	88.9	2/15	95.5

Table 1 reveals that the development of majority of macroeconomic indicators between November 2013 and March 2015 was changed in a positive way, i.e., in accordance with CNB's predictions. However, one needs to distinguish between the effects of FX commitment from the other sources of changes, e.g., general economic improvement in the euro area.

The first assessment naturally uses the change in GDP development but all the factors mentioned in Table 1 provide complex picture. The post-crisis slowdown of the Czech economy had been exceptionally strong compared to other countries in the region. The Czech Republic had been consistently among the 10 worst-performing countries of the EU up to 2013. In the second quarter of 2013, the Czech economy fell by 1.3% vis-a-vis the same period of 2012. In 2014, the Czech economy already grew by 2% and the Czech Republic moved among the top 10 EU members.

Figure 20: GDP change decomposition
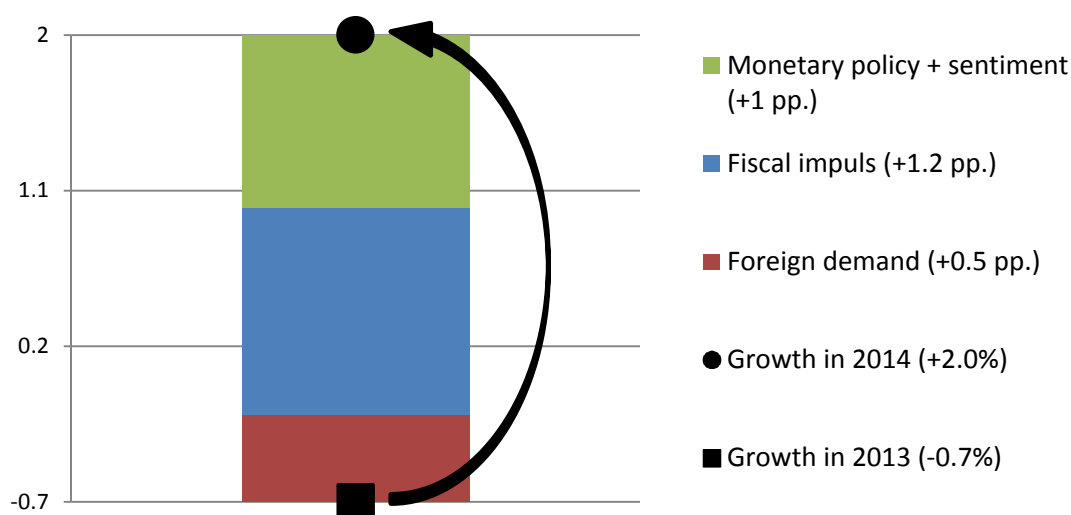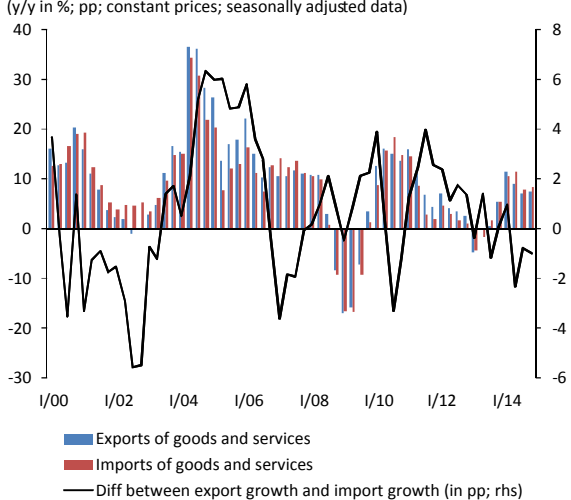

Source: CNB

Figure 20 shows simple decomposition of the GDP change with respect to the main factors identified by the CNB's analyses. The change in dynamics of the Czech GDP reached 2.7 percentage points in 2014 (from -0.7% in 2013 to 2.0% in 2014). As we can see, the least important in effect had been the development of foreign demand which is often quoted as the most important factor. However, as the euro area witnessed only moderate recovery, the direct contribution of foreign demand to Czech economic growth was only about 0.5 percentage points, assuming unchanged linkages from the past. Actually more important has been the change in fiscal policy. Its total contribution is estimated at 1.2 percentage points. Note that fiscal policy changed from significantly restrictive in 2013 to slightly growth-enhancing one, mostly via recovered government investments that have been seriously limited during the earlier fiscal consolidation years. The remaining 1 percentage point can be attributed to the monetary policy action (FX commitment) combined with improved sentiment of businesses and households (as these effects could not be directly separated without further assumptions or usage the main CNB model).

In a similar fashion, unemployment went down by more than 1 percentage point in 2014, the growth of nominal wages accelerated, the number of vacancies almost doubled, and the financial situation of nonfinancial corporations improved notably. These changes are in line with the GDP change, although the wage development has been slower, most likely due to lower inflation, which we will discuss later.

Figure 21: Trade balance surplus and investment
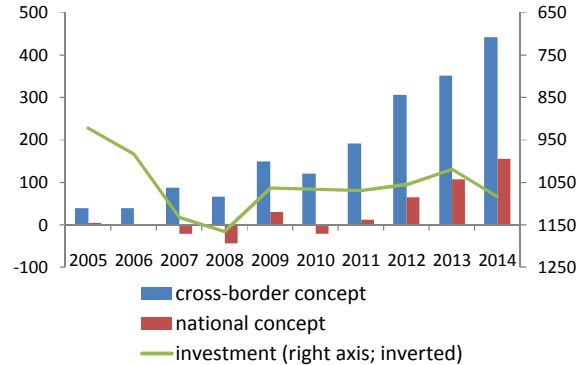
Figure 22: Exports and imports

(y/y in %; pp; constant prices; seasonally adjusted data)
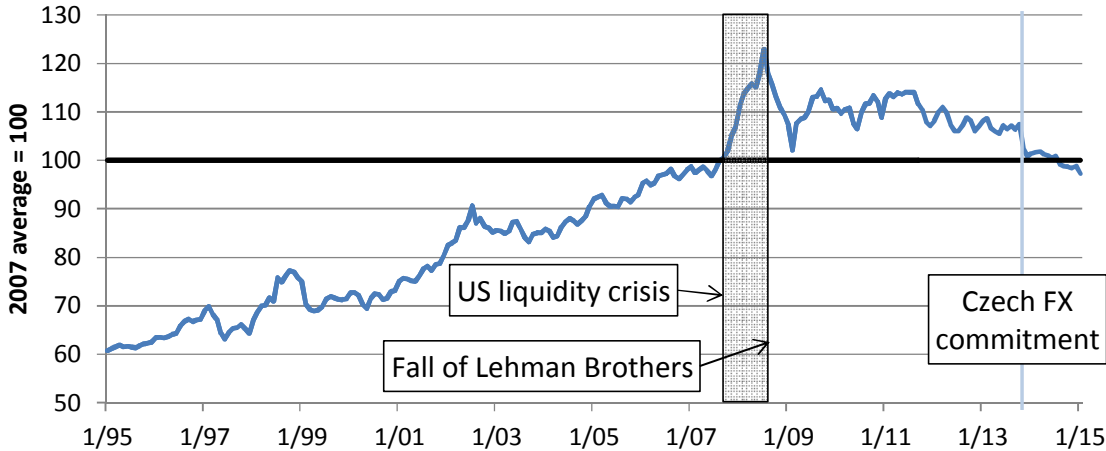

Source: CNB

Error! Reference source not found. and **Error! Reference source not found.** document the existing link between investments and foreign trade. As we see from the former figure, the investment was in period 2008-2013 severally reduced. As the investment is the most import-intensive activity, the decline has also affected the trade balance, which surplus has started to grow (the correlation of trade surplus and investment is high, about -0.9). Also when using the assumed import intensity of investment from DSGE (of 80%), we can explain almost all the newly generated trade surplus with the decline of investment. The perceived good results of trade surplus generated additional appreciation pressures, however, as the results of surplus were not caused by higher grow export activities but rather disinvestment, it lead to unsustainable appreciation – there is no economic reason why economy that does not invest into its future should witness long term appreciation tends due to "better prospects." The

appreciation is also visible in REER development as shown in Figure 23. That vicious linkage has been broken with the FX commitment.

In order to address the influence of FX commitment more rigorously and directly, a sensitivity scenario has been constructed using the CNB's prediction model which compares the forecast from November 2013 with reality and a hypothetical counterfactual scenario had the koruna not weakened. The sensitivity scenario reveals two interesting facts (see Figure 24). First, both GDP growth and inflation would have been significantly lower had the CNB not decided to use FX interventions as an additional monetary policy tool. The difference in growth between reality and this no-intervention counterfactual is, indeed, close to 1 percentage point, as the simple decomposition provided above suggests.

Figure 23: Real effective exchange rate of the Czech koruna

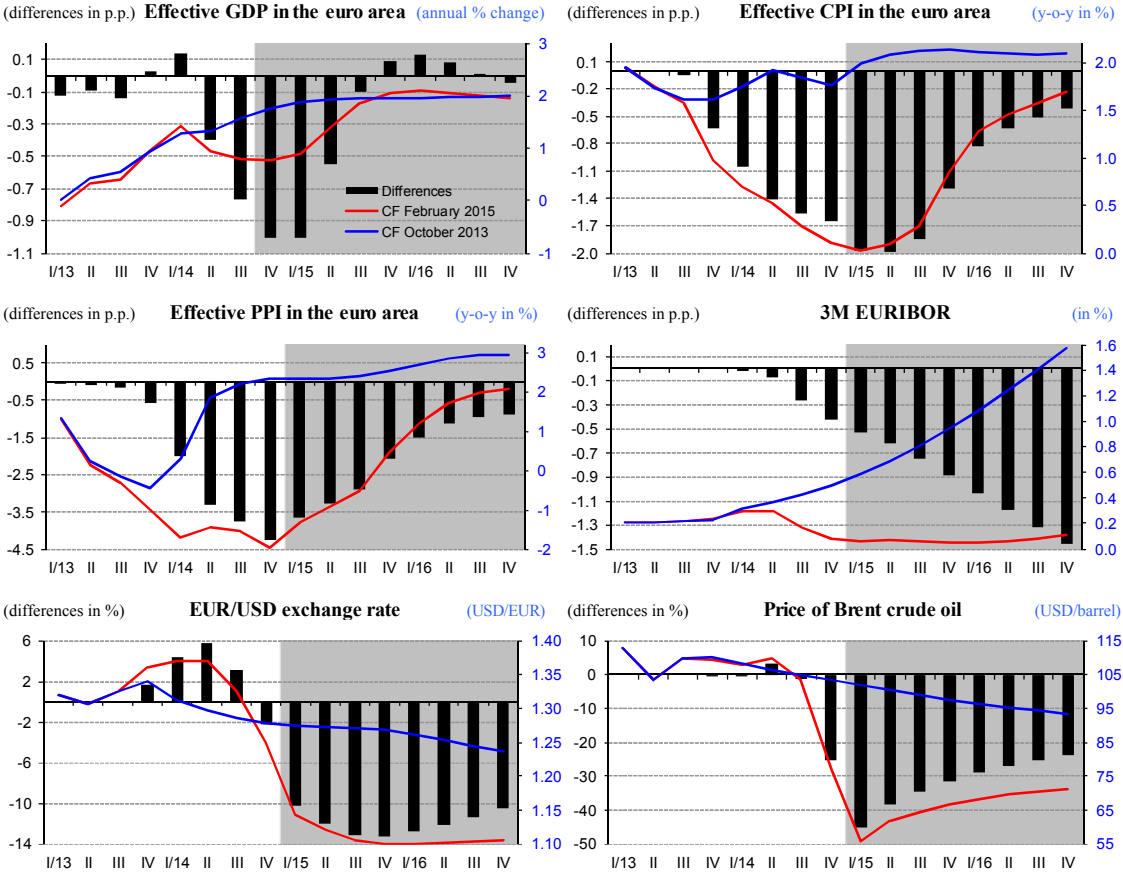**Figure 24: Sensitivity scenario: No interventions**
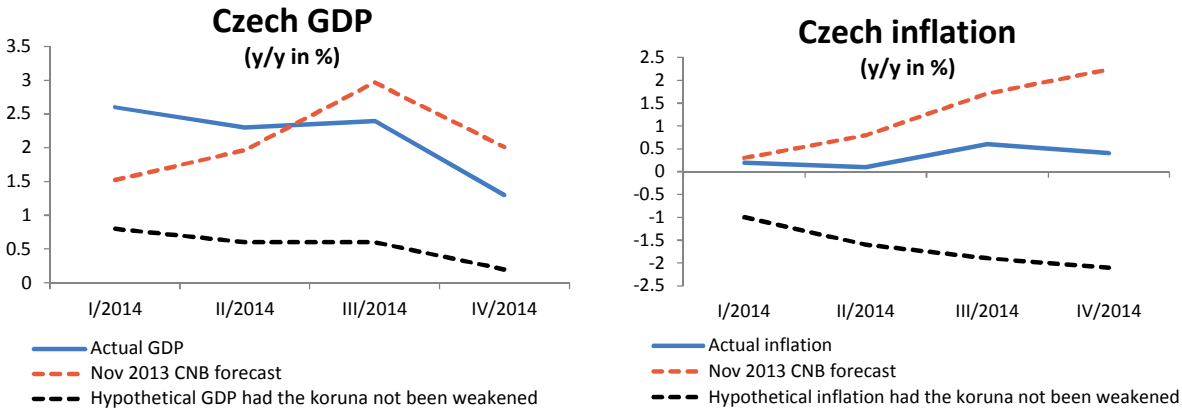
Source: CNB

As the general economic development has been in line with the model predictions, why is the inflation path so different? Inflation seems not to react to the weaker koruna as strongly, as expected in the models. We show that the driver of the difference is indeed the external development. The major reason for inflation staying far from predicted levels and the inflation target are strong disinflationary pressures which the Czech Republic imports from the euro area. Figure 25 illustrates the differences between euro area consensus forecasts for main macroeconomic variables in November 2013, the actual path till February 2015 and forecast

since then. Not only was the effective euro area (euro area members weighted by their share on foreign trade vis-a-vis the Czech Republic) GDP growth significantly lower than expected in 2013, but consumer prices growth practically stopped at the beginning of 2015, and producer prices growth was, instead of recovering its growth, further deeper in negative figures.

To assess the impact of lower oil prices on Czech inflation, the CNB constructed a sensitivity scenario with oil price fixed at the 2014 level. Figure 26 shows that with oil price around 100 USD/barrel, inflation would be on average 1 percentage point higher in 2015. But, predictably, the GDP growth and household consumption would suffer significantly.

Hence we conclude that the difference in inflation development from the predicted path can be attributed almost solely to factors outside the Czech economy that monetary policy has no effect on. The future development of inflation depends whether the firms that experience the windfall profit due low oil prices will pass part of it to wages and investment. Should the behavioral pattern not change, the secondary effects of low oil price should not lead to new deflationary dangers.

Figure 25: Euro area consensus forecast in November 2013 and February 2015

Source: Consensus Forecast, CNB

Figure 26: Sensitivity scenario: Higher Brent price
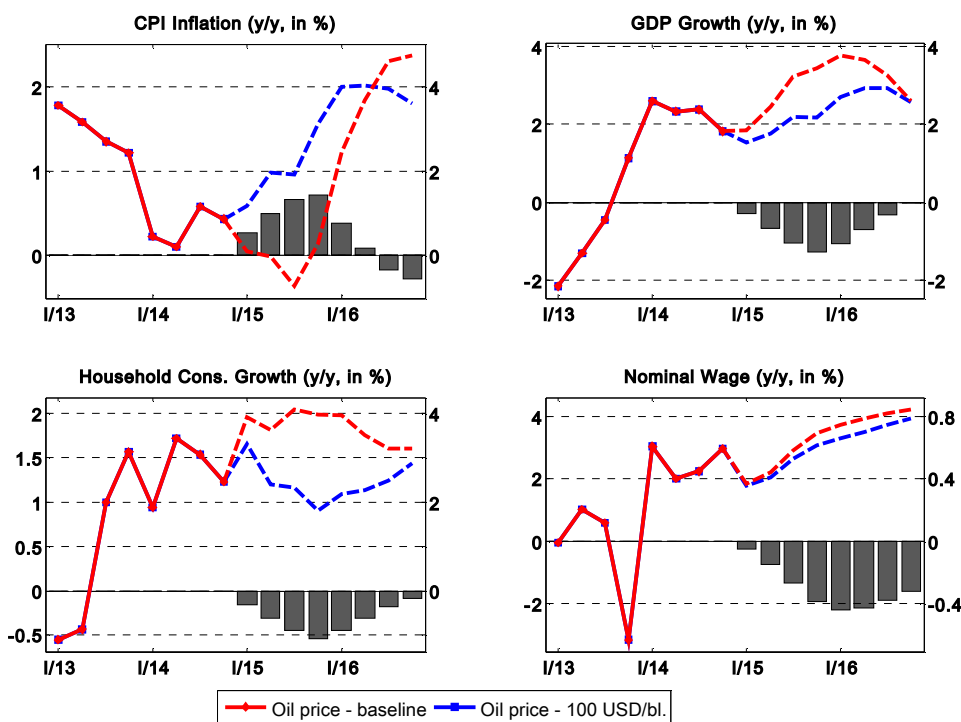
Note: Left-hand scale = Annual change in %; Right-hand scale = Difference in percentage points

Source: CNB

Concluding Remarks

The use of foreign exchange interventions to ease the monetary conditions in an open economy is a rational choice. First, this monetary instrument is used only when interest rates are at a zero level, i.e., when the standard natural tool is no longer available. Second, the power of the central bank when intervening against its own currency is not limited by the size of the reserves. Third, the depreciation helps net exports, which is a good side-effect stimulating the economy. In essence, in an economy with abundant liquidity in the banking sector, such as the Czech Republic, FX interventions are the only efficient way to implement monetary easing.

As far as the practical implementation is concerned, we firstly note that the implementation can indeed differ from the theoretical models in the literature but has to comprise all the necessary elements. Second, the FX commitment serves well even if the economic development changes, i.e., it showed to be both an efficient tool of monetary easing when needed as well as an anchor to inflation expectations in case the surrounding development would lead to unwanted monetary tightening.

Finally, we would argue that in such a situation FX interventions did not reduce the transparency and credibility of inflation targeting. The inflation target – including the tolerance band around it – remains unchanged and is publicly known in advance. On the contrary, if further easing is necessary the zero interest rate bound prompts questions of credibility due to the primary tool having been exhausted. The prediction of the market interest rate path, despite reflecting the zero level, remains publicly announced. However, the

exchange rate itself is still not the target, but rather a new tool for achieving the target. Consequently, it is not meaningful to specify a "target exchange rate." The desired policy exchange rate changes dynamically over time and is determined by the evolution of the forecasted economic conditions and the targeted inflation rate.

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