Universität
Basel

Wirtschaftswissenschaftliche
Fakultät

WWZ

February 2020

The Short-Run Impact of SNB Sight Deposits on Exchange Rates: Results from Weekly Data 2015 – 2018

WWZ Working Paper 2020/04

Prof. em. Dr. Peter Kugler

Universität Basel
Peter Merian-Weg 6
4052 Basel, Switzerland
wwz.unibas.ch

Corresponding Author:
Prof. em. Dr. Peter Kugler
Tel. +41 61 207 33 44
peter.kugler@unibas.ch

The Short-Run Impact of SNB Sight Deposits on Exchange Rates: Results from Weekly Data 2015 – 2018

Peter Kugler

University of Basel, Faculty of Business and Economics

Abstract: This paper provides an econometric analysis of the short-run impact of SNB sight deposits mainly created by intervention on the Swiss franc exchange rate covering the period January 2015 to June 2018 using weekly data. Our model includes both the exchange rate of the Swiss franc against euro and dollar and uses the plausible assumption that foreign interest rates and the euro-dollar exchange rate are exogenous. Besides sight, deposits we include interest rate differentials for 2- and 10-year government bonds, and some exogenous exchange rate determinants. GMM estimation indicates that a one percent increase in the sight deposits leads leads to a 0.41 percent appreciation of the Swiss franc against euro and dollar.

JEL classification
E43, E52, E58, F31, C32

Keywords

SNB sight deposits, bond returns, exchange rates, GMM-estimation

First draft January 2020 revised February 2020

Helpful comments by Petra Gerlach are gratefully acknowledged.

1. Introduction

The balance sheet of the SNB increased from a level of 193 billion Swiss Francs in January 2009 to 817 billion Swiss Francs in December 2018. This led to an increase in sight deposits of domestic bank and foreign institutions with the SNB from 36 to 574 billion Swiss Franc in this period. This more than quadrupling of the balance sheet was mainly caused by the SNB's attempt to dampen the tremendous real appreciation of the Swiss Franc (in particular against the Euro) over the last ten years by massive foreign exchange market interventions. There are three strongly different sub-periods during these years, which are separated by the introduction of the exchange rate floor against the Euro in September 2011 and its abolishment in January 2015. In the first sub period, we have a highly volatile growth of path of sight deposits from 39 to 93 billion up to mid-2010 mainly caused by changing liquidity provision for banks. Up to July 2011, the SNB kept sight deposits on a relatively low level between 23 and 30 billion during a period of strong appreciation of the Swiss Franc against the euro. The interventions in the foreign exchange market were sterilized by a massive issue of SNB bills, which increased from a level of ca. 30 billion in spring 2010 to ca. 115 billion in summer 2011. In August, we have again a change in policy with first a tremendous growth of sight deposits created by massive foreign exchange market interventions, which was later supported by the exchange rate floor in September 2011. In the second sub period, we had nearly a fixed exchange rate with only marginal deviations from the exchange rate floor of 1.20 SFr/Euro. After the abolishment of the floor in January 2015 the SNB, policy turned to a more stable framework of monetary and exchange rate policy. The Swiss Franc became again a flexible exchange rate but the SNB frequently intervened in the foreign exchange market in order to prevent very strong appreciation of the Swiss Franc. Moreover, the operational target band of the SNB for the 3MLibor rate did not change during this period.

This paper tries to assess the effect of the massive foreign exchange market intervention on the Swiss franc exchange rate indirectly by using the change in sight deposits as an indicator for unsterilized foreign exchange market intervention of the SNB. There are weekly data published by the SNB on the average stock of sight deposits and they appear as the best publicly available substitute for the publicly unknown details on the SNB's foreign exchange market interventions.[1] According to the short outline of the SNB policy given above and the VAR results reported by Kugler (2017) the last period appears to be most promising for estimating the impact of SNB sight deposits on the franc exchange rate. Other authors did not use this data source so far. Recent papers on the effect of SNB's foreign exchange market intervention used adjusted or unadjusted changes in foreign exchange reserves as proxy for interventions. In this context, we may mention the Swiss specific results of Abbuy (2018, quarterly, 1980-2014) and those for Switzerland as a member of a large panel (Adler et al, 2019, monthly 1996-2013 as well as Fratscher et all, daily, 1995-2001). All these papers arrived at the conclusion that (even sterilized) interventions have a statistically significant effect on the exchange rate.

Our model includes both the exchange rate of the Swiss franc against the euro and the US dollar and uses the plausible assumption that changes in Swiss monetary policy have no influence on the exchange rate between euro and dollar. Besides sight deposits we account for interest differentials for two and 10-year government bond yields and a couple of exogenous determinants of the exchange rates. We estimate the model by GMM under the assumption that there is a simultaneous relation between the SNB sight deposits and Swiss interest and exchange rates. We consider foreign interest rates like foreign monetary policy as exogenous. The simultaneity problem arises by the policy reaction to exchange rates changes, which is a characteristic of monetary policy in the highly open Swiss economy. The model is similar to that used by Kugler (2020) in order to estimate the influences of Swiss Franc 3MLibor on the Swiss Franc exchange rate replacing the target policy rate by the SNB sight deposits.

The paper is organized as follows. Section 2 has a look at the data. Section 3 displays the exchange rate model estimates and section 4 concludes.

2. Data

We start with a look at the data. In general, our figures cover the period 2009-2018. The extension of the sample beyond the period used in estimation of the exchange rate model allows us to highlight the changes over the three sub periods. The financial and euro-government-finance crisis has triggered a very expansionary monetary policy since then. The

[1] The SNB publishes the amount of foreign exchange interventions for each calendar year in ist annual accountability report.

zero lower bound for the target of the policy rate (LIBORSF3M) is essentially reached in August 2011, and in January 2015, we have the move of the SNB to a negative interest rate operating target.

The graph suggests that there is a long run level relationship between the two years government bond return (ChGovBond2y) and the Libor rate. By contrast, this seems not be the case for the ten years government bond (ChGovBond10y). This conjecture is confirmed cointegration test reported by Kugler (2020). Moreover, both bond returns are considerably more variable then the Libor rate.

Figure 1: CH government bond returns and 3M Libor, January 2009 – December 2018

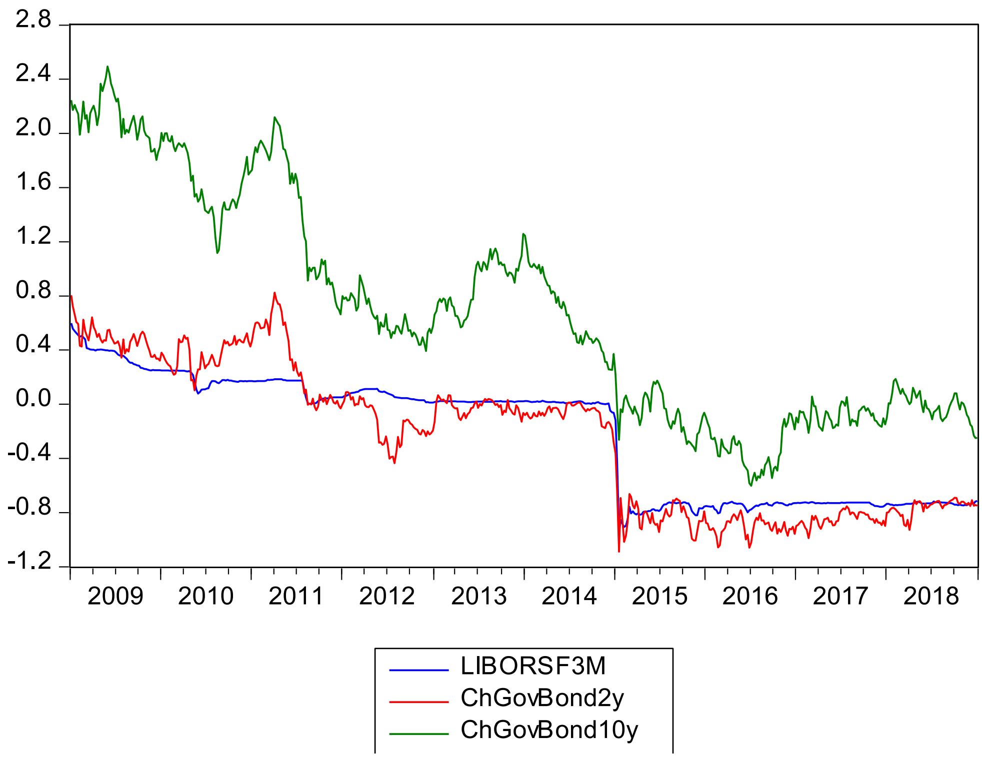


Figure 2 plots the two exchange rate series. Against the euro, we note a slight depreciation of the franc in 2009. Thereafter, we see a sharp appreciation of the Swiss franc, which led then to the introduction of the 1.20 floor against the euro in September 2011, which in turn created a quasi-fixed exchange rate for the euro until the abolishment of the floor in January 2015. Since then we note a slight appreciation tendency of the euro. The franc-dollar exchange rate displays a sharp appreciation until the fall 2011, which turns then into a slight depreciation tendency.

Figure 2: Swiss franc exchange rates, euro and USD, January 2001 – December 2018

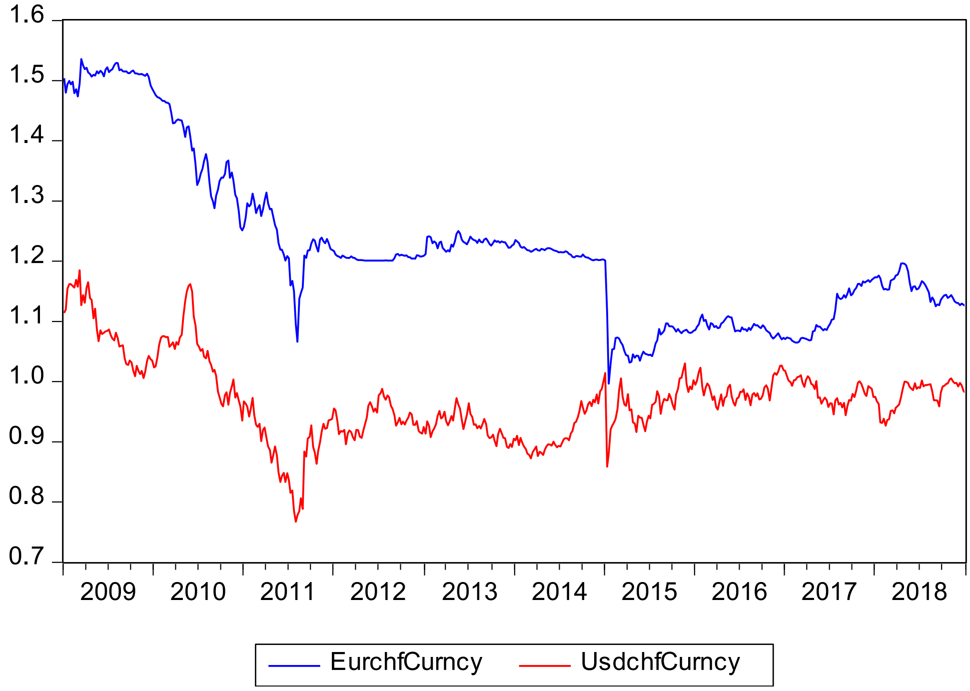


Figure 3 displays the development of sight deposits at SNB. We see a rather volatile development at a low level until summer 2011. Then SNB policy switches to unsterilized interventions and the introduction of the 1.20 floor led to an unprecedented level of sight deposits in 2012. The turmoil surrounding the abolishment of the 1.20 floor with tremendous appreciations of the Swiss franc again led to a jump in the level of sight deposits in January 2015, which was followed by a more or less steady growth which leveled off in summer 2017.

Figure 3: Total Sight deposits at the SNB (before August 2011 only domestic banks)

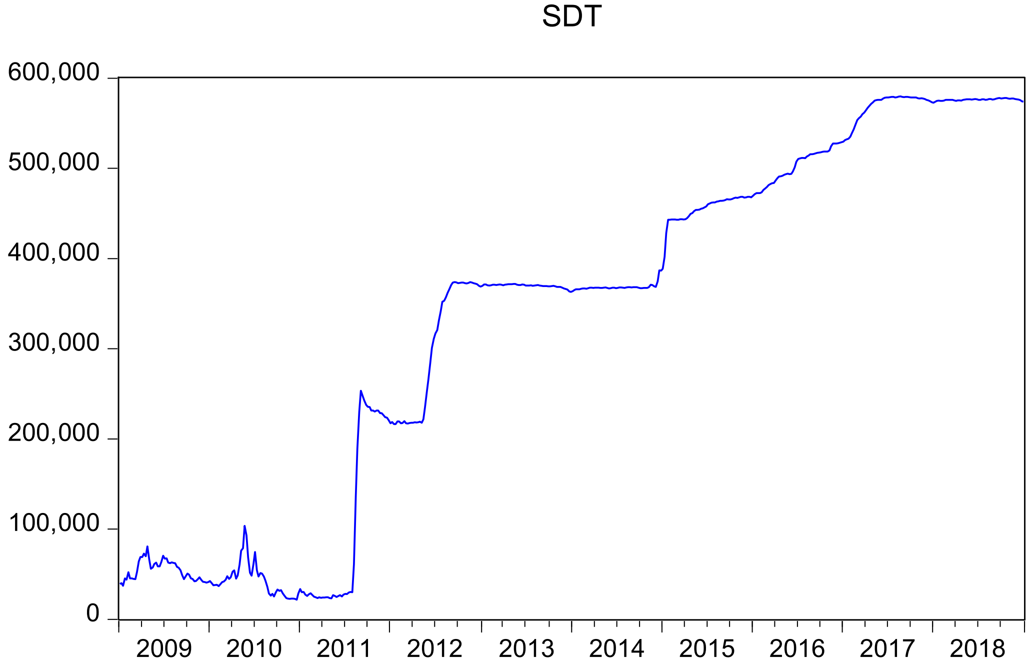
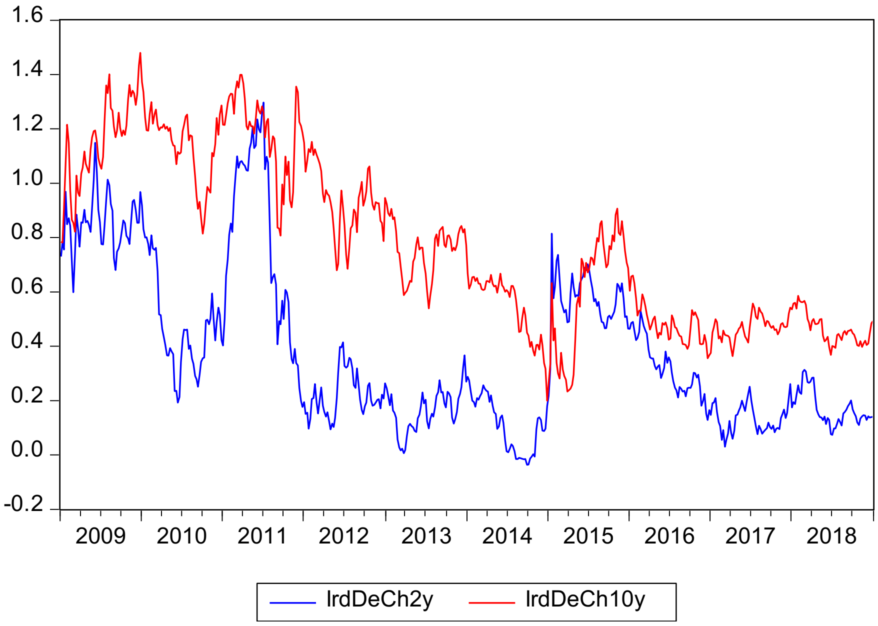
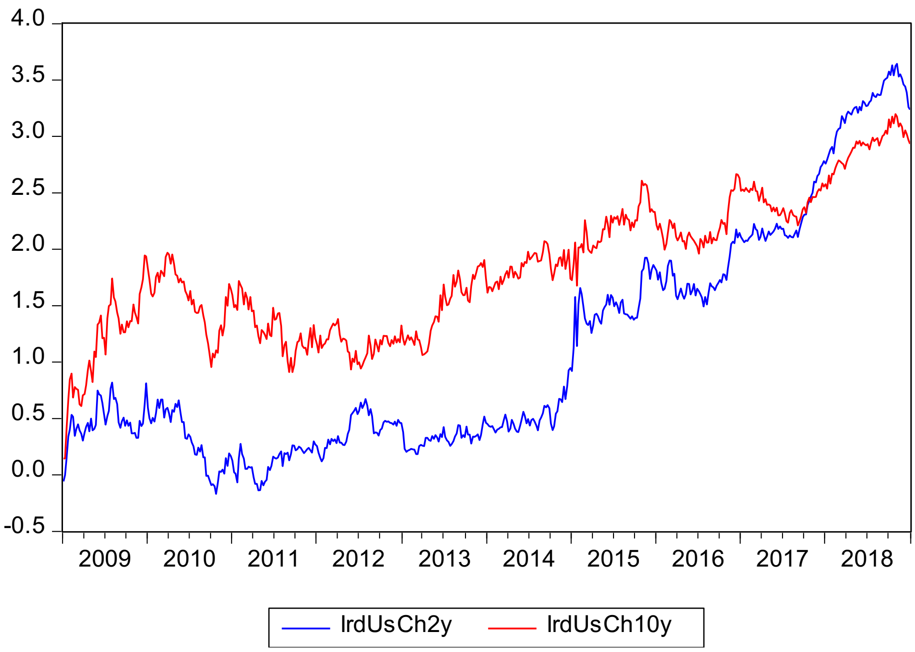


Figure 4 provides the plots of the government bond interest rate differentials for the Swiss franc against the euro (Germany) and the US Dollar. For both currency pairs we see rather volatile differentials, which vary between 0 and 1.4 % for Germany and 0 and 3.5 for the US, respectively. In general, the 2-year differential is more volatile than the 10-year differential. Moreover we not we note a tendency of shrinking differentials against Germany, whereas for the US we note an opposite long run movement.

Figure 4: Interest rate differentials (bond returns) Euro-Franc and Dollar-Franc 2009-2018





3. The model for the exchange rates

In this section, we estimate a model relating the changes of the Swiss franc euro and dollar exchange rates to those of the SNB sight deposits and in government bond return differentials. Because of the SNB's policy response to exchange rate movements, we consider SNB sight deposits and Swiss bond returns as endogenous. By contrast, foreign interest rates are assumed exogenous, as Swiss monetary policy has plausibly no influence on Euro area and US monetary policy. Besides, we add some other exogenous variables. These controls turned out as important determinants of the Swiss franc exchanges rates in the empirical analysis of Fink, Frei and Gloede (2019).

Firstly, let us briefly define the variables involved in our empirical analysis. Table 1 presents the variables and the respective transformations. The data source is Bloomberg L.P. and we sample the variables at the end of the trading day, except the SNB sight deposits (SDT), which are from the SNB (https://www.snb.ch/de/system/search?q=giroguthaben) and are weekly averages. The daily observations were converted to weekly values by taking the last observation of the week. The endogenous variables are the Swiss exchange rates EURCHF and USDCHF as well as Swiss government bond yields. Furthermore, as control variables we follow the selection of financial drivers similar to Fink, Frei and Gloede (2019): for capturing currency-specific dynamics we use the euro and US dollar factor, which is the mean of the rate of change of the euro or dollar against 26 currencies (excluding the Swiss franc). To capture the risk environment, we include several risk variables: the EU-periphery to Germany government bond spread (10Y), the VIX risk appetite index and the Gold spot price.

Table 1: Overview financial variables

Name	Description	Transformation	Unit
		Endogenous Variables	
DLEUR	EURCHF exchange rate	ΔLog	Percent
DLUSD	USDCHF exchange rate	ΔLog	Percent
DLSDT	SNB sight deposits	ΔLog	Percent
ChGovBond2y	Swiss government bond yield (2Y)	-	Percent
ChGovBond10y	Swiss government bond yield (10Y)	-	Percent
		Exogenous Variables	
DEURF	Euro factor: Mean across 26 daily FX log returns, excluding Swiss franc	ΔLog	Percent
DLUSD	US dollar factor: Mean across 26 daily FX log returns, excluding Swiss franc	ΔLog	Percent
DIDPER	Interest rate differential EU periphery vs. Germany (10Y)	First difference	Percentage points
DVIX	US volatility index	First difference	Percentage points
DLPG	Gold price (dollar)	ΔLog	Percent
DEGovBond2y	German government bond yield (2Y)	-	Percent
DEGovBond10y	German government bond yield (10Y)	-	Percent
USGovBond2y	US government bond yield (2Y)	-	Percent
USGovBond10y	US government bond yield (2Y)	-	Percent

Our model relates the rate of change in the two exchange rates (100 times difference of log) to sight deposits (100 times difference of log) and the two corresponding interest rate differentials as well as the listed exogenous variables. Alternatively, we looked for a relationship in levels, but cointegration analysis provided, as in the earlier study (Kugler, 2017), no evidence for a relationship between the level series.

We allow for a simultaneous relation between the changes in exchange rates and changes in the sight deposits and Swiss interest rates. This implies that the interest rate differentials become endogenous. However, we use the plausible assumption that changes in foreign interest rates are exogenous. Besides these two equations, we complement the system by two equations relating the changes of the Swiss government bond rates to the changes in the SNB sight deposits and the foreign (US) bond yield[2]. Finally, we have an autoregressive distributed lag equation for the change in sight deposits depending on the change in the euro exchange rate. This equation captures the policy reaction of the SNB to changes in the franc euro exchange rate: decreases in the exchange rate (appreciation of the Swiss franc) lead to intervention resulting in increased sight deposits. This increase is distributed over time according to an autoregressive distributed lag model. Note that a test of this model against the alternative of a static model with autoregressive error term confirmed the distributed lag formulation.

We use the Generalized Methods of Moments taking into account heteroscedasticity using the White covariance matrix in the moment conditions. The equations are estimated jointly and we have three cross equations restrictions: the regression coefficients of sight deposits and interest rate differentials should be the same in the euro and in the dollar equation. A violation of this restriction implies that changes in the SNB sight deposits and Swiss interest rates have an influence on the exchange rate between euro and dollar, which appears highly implausible.

We use one lag of all endogenous variables and all exogenous variables as instruments. The equations are over-identified and we can test the model's appropriateness by a large number the over-identifying restrictions, namely 60.

[2] We used US bond returns as these are from the internationally dominant bond market. However, replacing it by the German bond return does hardly effects our results.

Table 1 shows the estimation results obtained for the sample March 2015 to December 2018. We start in March as the abolishment of the 1.20 floor was accompanied by tremendous initial appreciation of the Swiss franc and correspondingly outlying observations. Moreover, we had sometimes very heavy interventions from summer 2016 to summer 2017, which were triggered by foreign exchange market turbulences induced by Brexit and the French presidential elections. Therefore, we skipped observations with changes in sight deposits over 0.6 percent. This reduces the sample size from 201 to 190 observations[3]. The Table displays the restricted estimates with the same interest rate differential coefficient in both exchange rate equations. Moreover, the over-identifying restrictions cannot be rejected at all reasonable significance level.

According to our estimates, a 1 percent change in sight deposits leads to a contemporaneous 0.38 percent increase in the exchange rate (depreciation). This effect has the expected sign and is statistically highly significant. The bond return differential coefficients have the expected positive sign: an increase in the return differential in favor of the foreign currency leads to a depreciation of the Swiss franc. This impact is particularly strong for the 10-year bond differential. The estimated coefficient is 0.6 and statistically highly significant. All statistically significant effect of the exogenous determinants have the expected sign. In particular, we see that the last three "crisis" indicators (DIDPER, DLPG, DVIX) have a strong negative effect on the Swiss exchange rates. This reflects the tendency of the Swiss franc to appreciate in times of crisis.

Our model is closed by equations for changes in the bond return differentials and sight deposits. Table 2 indicates a statistically significant impact of changes in sight deposits on bond returns. A 1 percent increase in sight deposits leads to a 0.030 and 0.044 percentage fall of the 2 and 10 years bond return, respectively. Besides this, a 1-percentage point change in the corresponding US bond return leads to 0.24 and 0.40 change in the Swiss bond return, respectively. This implies that we have an additional indirect effect of sight deposits on the exchange rate. The last equation for the change in sight deposits indicates the expected negative impact of the change in the euro exchange rate on changes in sight deposits. The

[3] When we use all observations, we get very similar results, which are statistically in general of a little bit lower significance.

effect is highly persistent: the coefficient estimates of the lagged endogenous variables imply that the short run effect of -0.07 increases to -0.17 in the long run.

What are the implications for the total effect of changes in the in sight deposits on the exchange rate? This can be easily calculated by adding the direct effect and the product of the sight deposit impact on the two bond rates with the exchange rate effect of the bond differentials. Table 3 displays this calculation. Besides the point estimate of the total effect of a 1-percentage increase in sight deposits, which is 0.41%, we calculate the standard error of this estimate using the covariance matrix of the system estimates. The 95% confidence interval is accordingly [0.25, 0.56]. This estimate is close to that reported by Abbuy (2018), namely 0.33, who used changes in international reserves as proxy for interventions. However our estimate appears low if we compare it with the multicounty panel estimate reported by Adler et al. (2019) which is [1.7-2.0] for a one percent intervention of GDP. The average ratio of GDP to sight deposits is 1.28 in our sample. Thus, we can scale up our confidence interval to [0.33, 0.72] which is much lower than the multicounty panel estimate. This may be caused by the different sample (monthly data, 1996-2013) or the model specification (model in log level and not changes, panel estimate over a group of 52 countries). Finally, we may compare our current result with that of the simple bivariate VAR of Kugler (2017). There we got a rather high point estimate of 1.25 for the long run reaction to the log exchange rate to a 1 percent shock in sight deposits, but with a large 95 percent confidence interval of approximately [0.5,2.0]. This is not strongly different from our new results with a completely different model and identification strategy.

Finally we may mention that a linear instead of a log linear specification of the impact of exchange rates leads to essentially the same results: in the linear specification we get a total effect of a 1 billion change in sight deposits on the exchange rate equal to 0.072 (se=0.0098). Our log linear estimate implies an effect of 0.079 evaluated at the sample mean level of sight deposits.

Table 2: GMM estimation four variables model, daily data, March 2015 to December 2018, DLST < 0.6 percent

Endogenous variables	DLEUR	DLUSD	DChGovBond2y	DChGovBond10y	DLSDT
Right-hand side variables					
DLSDT	0.3804*** (0.0788)	0.3804*** (0.0788)	-0.034*** (0.017)	-0.044*** (0.017)	1.014 *** (0.150)
DLSDT(-1)					-0.416** (0.211)
DLSDT(-2)					
DLFEUR					
DIRDDECH2Y	0.0311 (0.129)				-0.071 * (0.044)
DIRDDECH10Y	0.603 *** (0.105)				
DIRDUSCH2Y		0.0311 (0.129)			
DIRDUSCH10Y		0.603 *** (0.105)			
DEURF	0.215*** (0.0526)	-0.838*** (0.0574)			
DUSDF	-0.354*** (0.036)	0.580*** (0.0387)			
DIRDPER	-0.514 (0.513)	0.050 (0.222))			
DLPG	-0.098*** (0.0186)	-0.0758*** (0.0075)			
DVIX	-0.0462** (0.0206)	-0.061 ***(0.0186)			
DChGovBond2y			0.242 *** (0.041)		
DChGovBond10y				0.398***(0.0242)	
se	0.277	0.283	0.0414	0.0427	0.146
DW	1.752	1.745	1.905	1.885	1.858
J, (p-value)	0.466				

Standard errors in parentheses, *, ** and *** denotes significance at the 10, 5 and 1% level, respectively. J is the test statistics for over-identifying restrictions

Table 3: Total effect of 1% percentage increase in sight deposits on exchange rate (percent)

Direct exchange rate effect	Effect on gov bonds return	Effect of gov bond return on exchange rates	Total effect
0.380	-0.034 (2y) -0.044 (10y)	0.0012 0.0265	0.408*** (0.0797)

Standard error in parentheses, *, ** and *** denotes significance at the 10, 5 and 1% level, respectively.

Conclusion

This paper provides an econometric analysis of the short-run impact sight deposits at the SNB on the Swiss franc exchange rate covering the period March 2015 to June 2018 using weekly data. This recent period appears interesting as the SNB abolished the exchange rate floor of 1.20 for the euro and did not change the target 3-month CHF Libor rate band of the SNB. Monetary policy was implemented by foreign exchange market interventions, which we approximate by publicly available changes in the level of sight deposits. Our model includes both the exchange rate of the Swiss franc against euro and dollar and uses the plausible assumption that changes in sight deposits at the SNB have no influence on the euro-dollar exchange rate. In addition, we consider international return differentials for 2 and 10 years governments bonds and we take into account a couple of exogenous determinants of the exchange rates. The model contains equations for the change in Swiss bond returns depending on changes in sight deposits and foreign bond returns. Changes in sight deposits in turn depend on the Swiss franc euro exchange rate by policy reaction. The model is estimated by GMM assuming that foreign bond returns are exogenous. This exercise indicates that a one percentage increase in the sight deposits leads to 0.41 % depreciation of the Swiss franc against euro and dollar. This result seems to be roughly in line with other estimates of the effect of interventions obtained with other models and or samples. It clearly indicates that the SNB foreign exchange market interventions have an impact on the exchange rate and are not a useless leaning-against-the-wind that results only in an unwanted tremendous increase in the SNB balance sheet.

References

Abbuy, K. E., 2018, An empirical test for the effectiveness of central bank interventions in foreign exchange markets: An application to the Canadian and Swiss central Banks, Journal of Economics and Political Economy, 6 (4), 450-58.

Adler, G. Lisack, N. and Mano, R. C., 2019, Unveiling the effects of foreign exchange intervention, Emerging Market Review, 40, 1-29.

Fink, F., Frei, L. and Gloede, O., 2019, An estimated decomposition model for the daily Swiss franc exchange rate, Swiss National Bank, Mimeo.

Fratscher, M. Gloede, O, Menkoff, L. Sarno, L. and Stöhr, T., 2019, When is foreign exchange intervention effective? Evidence for 33 Countries, American Economic Journal 11, 132-156.

Kugler, P, 2017, The Dynamic Interaction of the Swiss Franc/Euro Exchange Rate and SNB Sight Deposits: Empirical Evidence from Weekly Data 2009-2017, Universität Basel, Mimeo

Kugler, P, 2019, The Short-Run Impact of Interest Rates on Exchange Rates: Results for the Swiss Fanc Against the Euro and US Dollar from Daily Data 2001 – 2011, WWZ Working Paper 2020-01.