# The Dynamic Interaction of the Swiss Franc/Euro Exchange Rate and SNB Sight Deposits: Empirical Evidence from Weekly Data 2009-2017

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# Introduction

- Increase in SNB balance sheet from 193 Bio in January 2009 to 775 Bio SFR in June 2017 mainly caused by an increase in sight deposits with SNB created by unsterilized interventions (SFR/Euro).
- Strong real appreciation of the Swiss Franc beyond the "usual" long run real trend appreciation equal to ca. 0.9% ( £ and $, 1916-2010) and ca. 0.5% (Euro, 1978-2014), Baltensperger/Kugler, Swiss Monetary History since the Early 19$^{th}$ Century, 2017, p. 189-198).
- SFR as a safe haven currency: unwillingness of the Swiss private sector to hold the increasing level of foreign assets after the recent financial and government debt crises of 2008-10.
- Three sub-periods: 2009/1 – 2011/8, 2011/10-2014/12 (1.20 floor), 2015/2.
- VAR analysis of SFR/Euro exchange rate and sight deposits with SNB.

*Swiss Foreign Assets and Liabilities, 2000Q1-2017Q1, Mio. Swiss Francs, Baltensperger/Kugler (2017, Figure 12.11p. 214), update Kugler( 2017, Figure 4)*

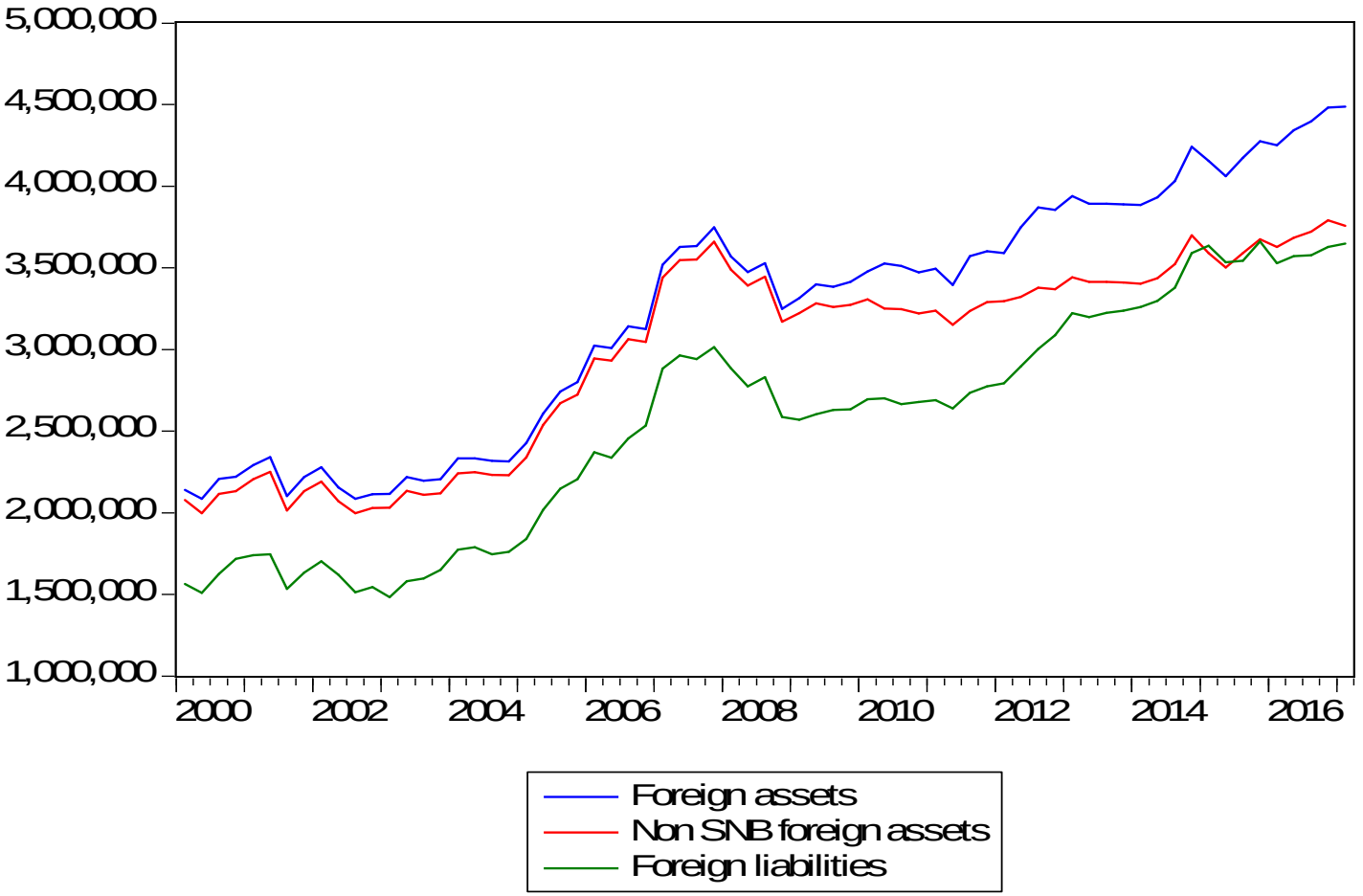
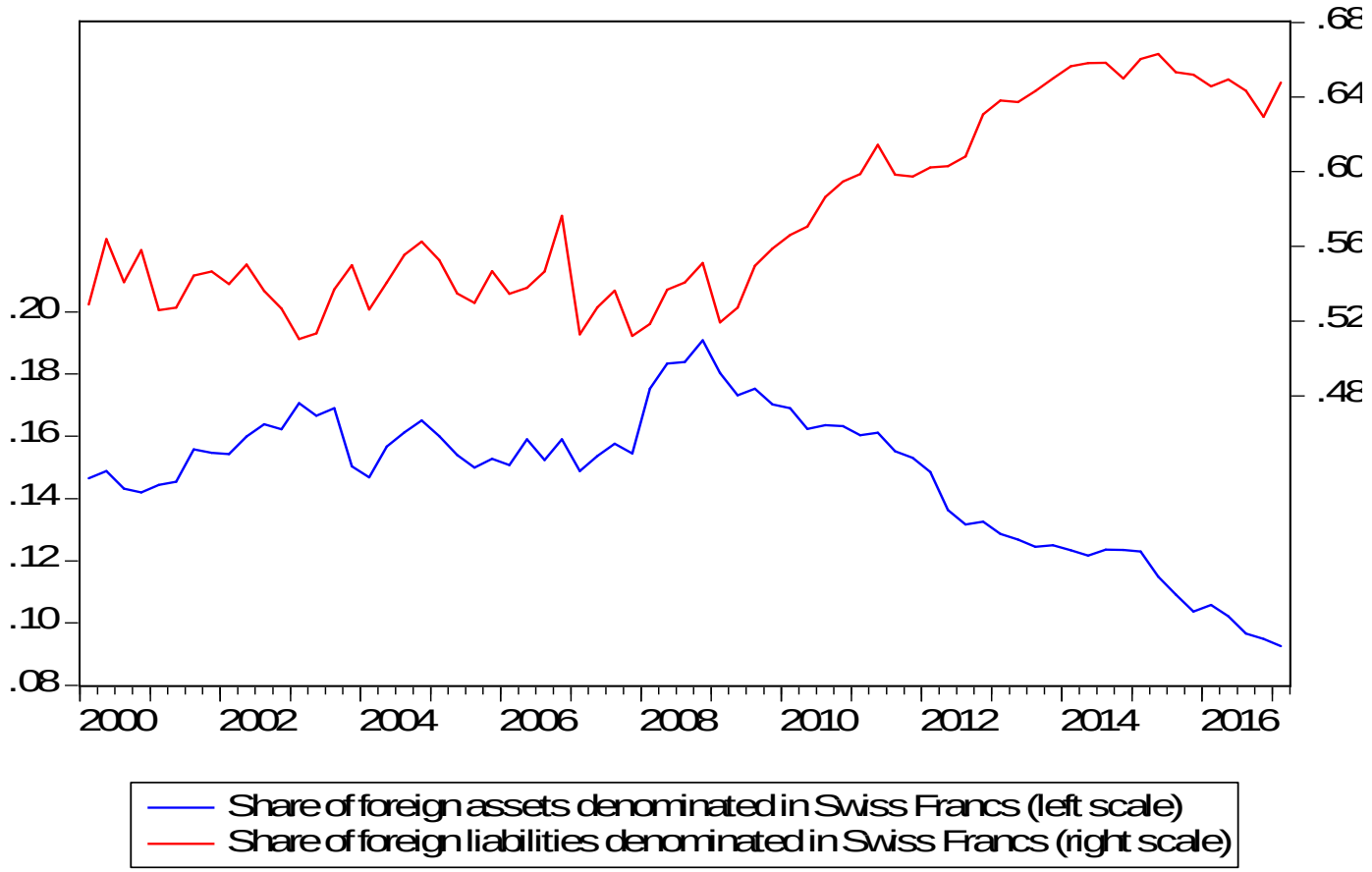


*Figure 5: Swiss Franc Share in Foreign Assets and Liabilities, 2000Q1-2017Q1, Baltensperger/Kugler (2017, Figure 12.12 p. 215), update Kugler (2017, Figure 5).*



# Sight Deposits with SNB and the Swiss Franc/Euro Exchange Rate: VAR Results 2009-2017

- Tremendous growth of total and domestic banks sight deposits, extremely high volatility during the period 2009-2011.
- Strong overvaluation of the Swiss Franc against the Euro judged against its long run path taking its real appreciation trend into account (Baltensperger/Kugler, 2017, p. 189-198).
- Log exchange rate and log sight deposits appear to be I(1), PP- and KPSS-tests.
- VAR analysis of first differences, weekly data, averages.

*Figure 1: Sight Deposits with SNB, Weekly Data, January 2009 – March 2017, million Swiss Franc*

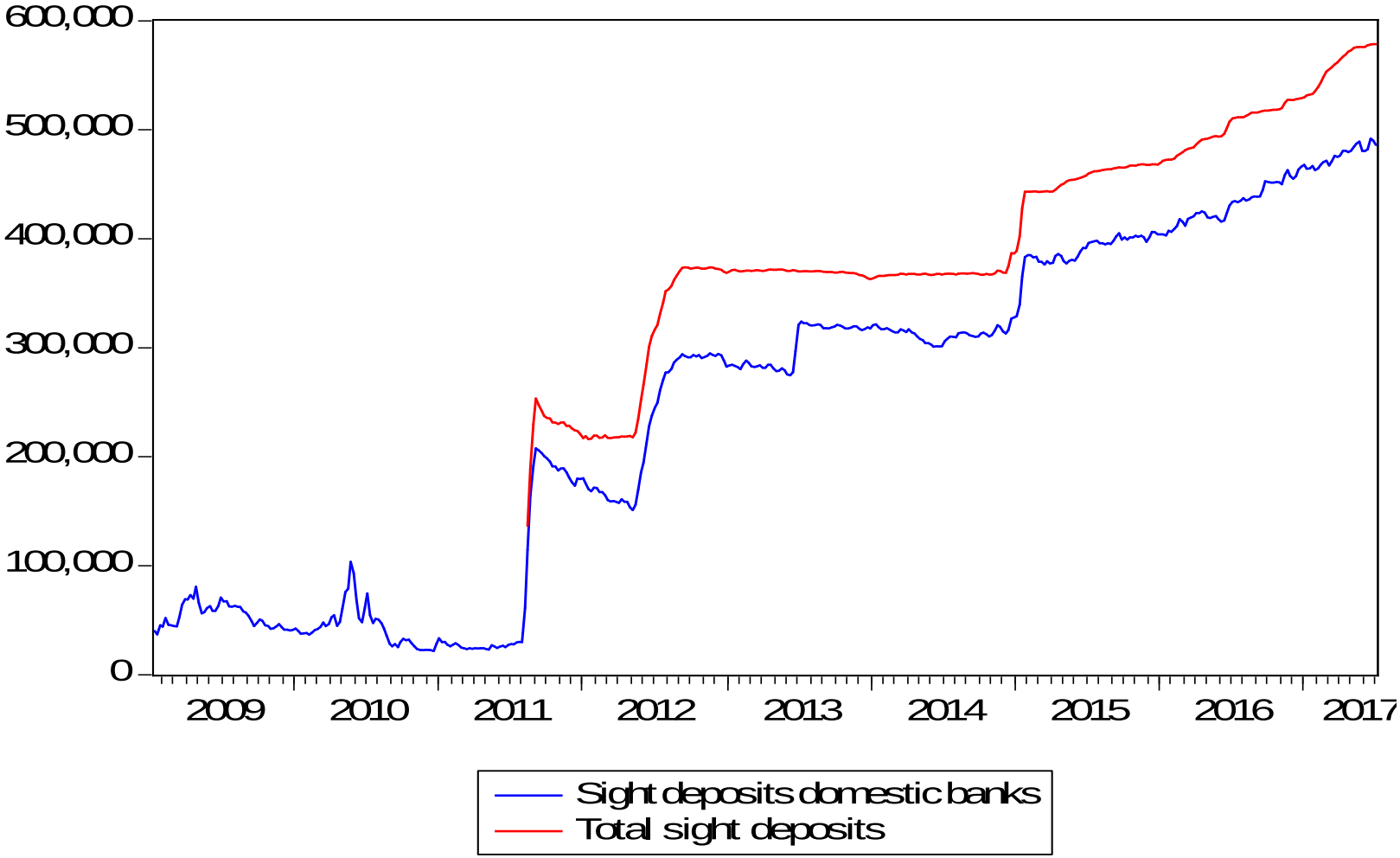


*Figure 2: Swiss Franc/Euro Exchange Rate, Weekly Data, January 2009 – June 2017*

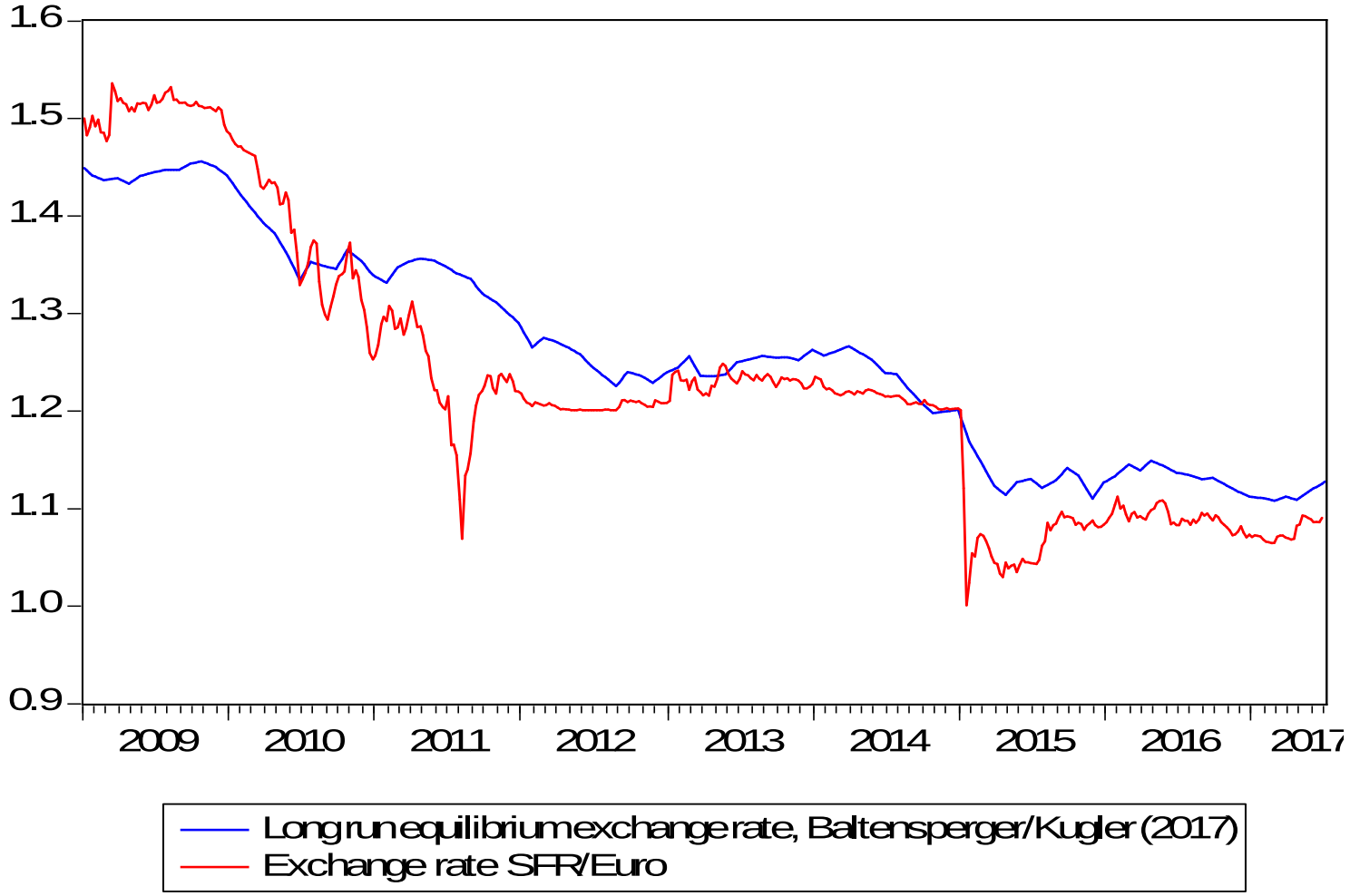


*Figure 3: Rate of Change Sight Deposits with SNB and Swiss Franc/Euro Exchange Rate, Percent, Weekly Data, January 2009 – June 2017*

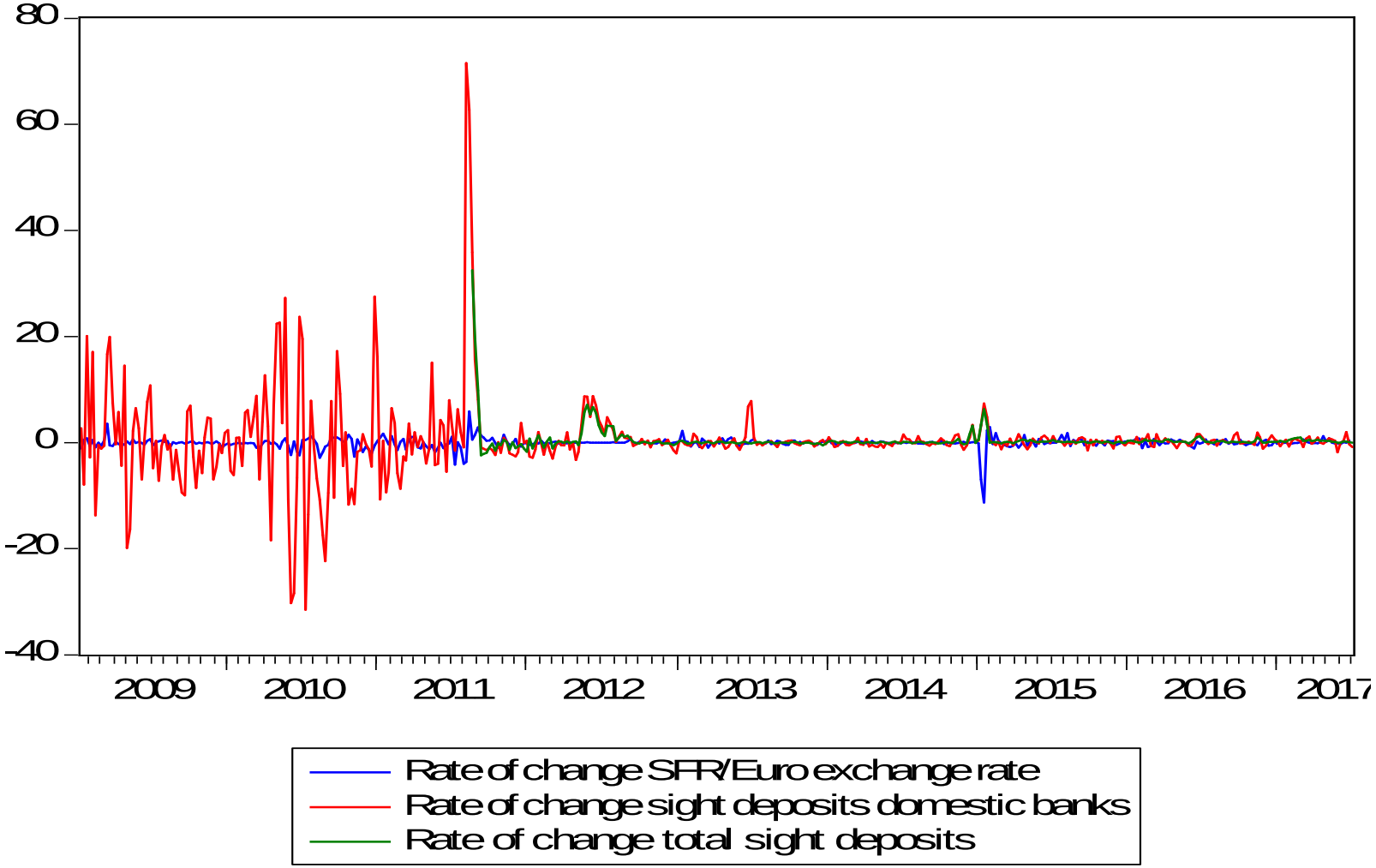


*Table 1: VAR Results Rate of Change in Sight Deposits (y) and Swiss Franc/Euro Exchange Rate (x), Weekly Data, January 2009 – June 2017*

| | January 2009 – August 2011 | Oktober 2011 – December 2014 | February 2015 – June 2017 |
|---|---|---|---|
| **Granger causality x to y** | 7.885*** | 0.1113 | 27.5886*** |
| **$X^2(1/3)$** | (0.0050) | (0.7387) | (0.0000) |
| **Granger causality y to x** | 6..479** | 0.3991 | 37.5812*** |
| **$X^2(1/3)$** | (0.0111) | (0.5276) | (0.0000) |
| **Correlation of VAR residuals** | 0.1481* | 0.0172 | -0.1315 |

Marginal significance in parentheses, *, **, *** indicates statistical significance at the 10 %, 5 % and 1 % level, respectively. A lag length of 1 (first two sub-samples) and 3 (third sub-sample) turned out to be optimal according to the Schwarz, Hannan-Quinn and Akaike criterion, respectively.

*Figure 4: Impulse Response, VAR(1) Rate of Change Swiss Franc/Euro Exchange Rate (SFEU) and SNB Sight Deposits of Domestic Banks (SDT), Weekly Data January 2009 – August 2011*

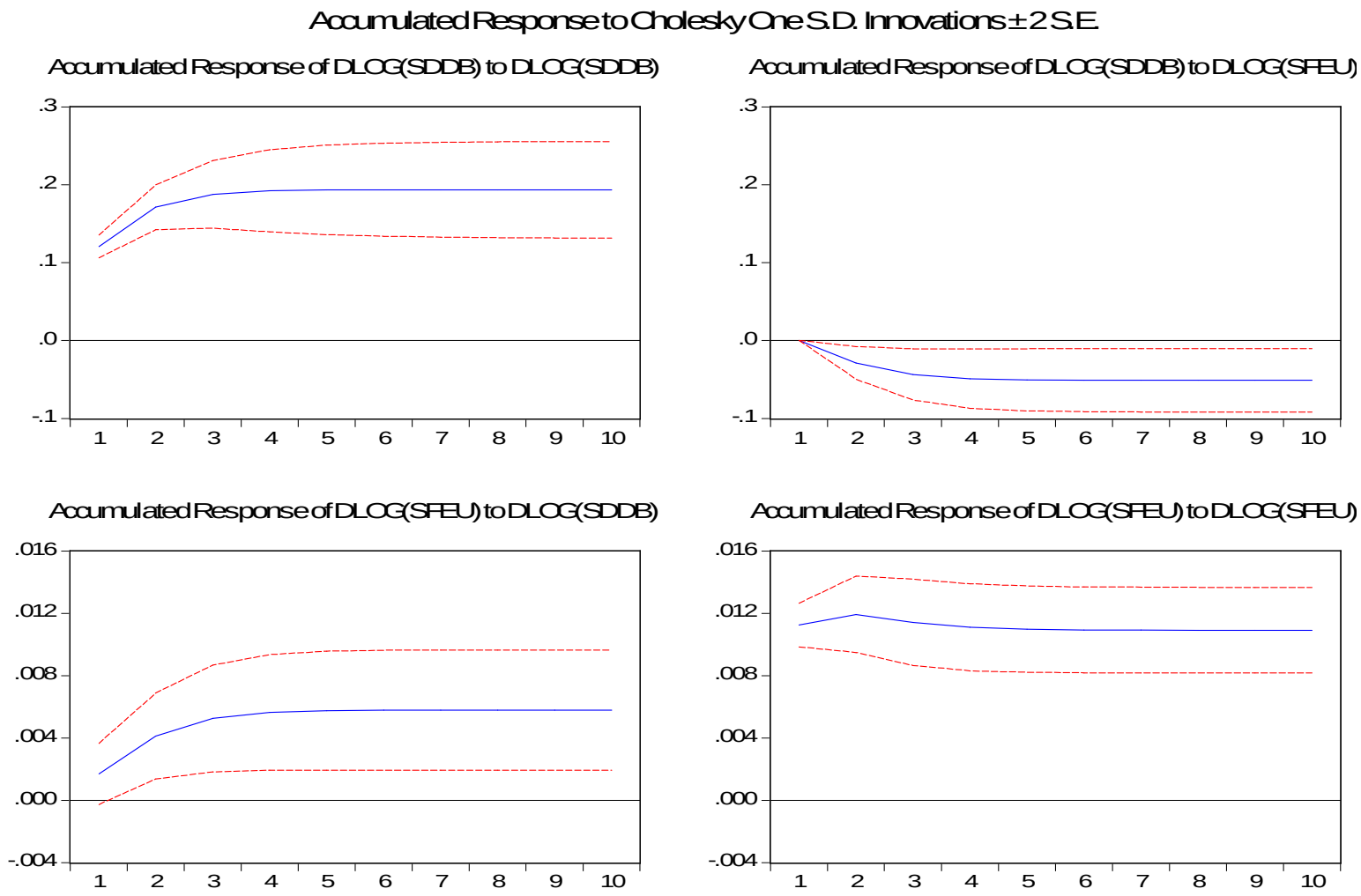
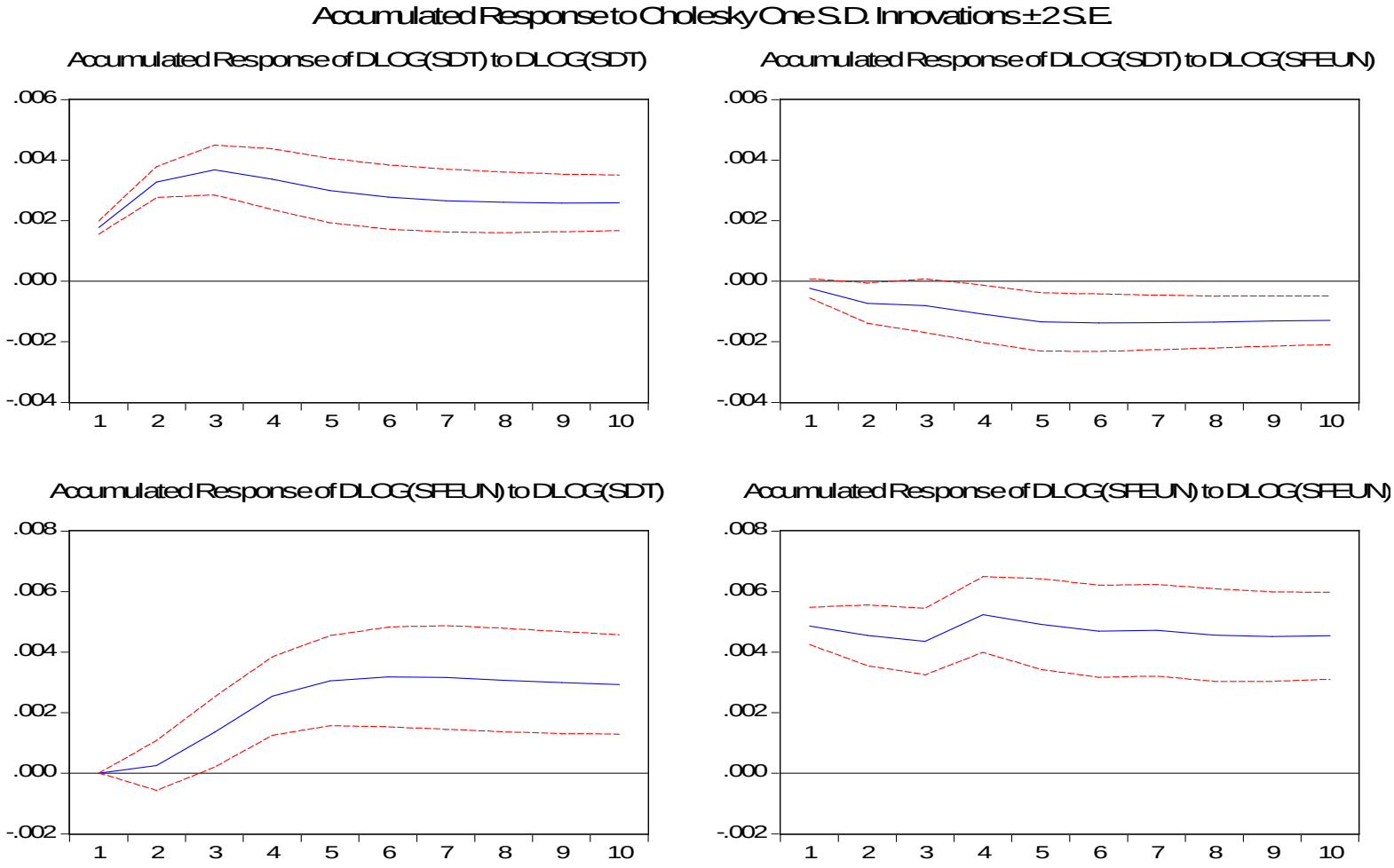


*Figure 5: Impulse Response, VAR(1) Rate of Change Swiss Franc/Euro Exchange Rate (SFEU) and SNB Sight Deposits (SDT), Weekly Data March 2015 – June 2017*



- Feedback relationship between sight deposits and the exchange rate for the first and third period, but, expectedly not for the floor-period:
- IRs, Choleski decomposition:

  - High long run elasticity of sight deposits with respect to exchange rate shocks (-4.63) and weak long run impact of sight deposits shocks on the exchange rate (=.03) for the 2009/1 – 2011/08 sample.

  - Relatively low long run elasticity of sight deposits with respect to exchange rate shocks (-0.38) and strong long run impact of sight deposits shocks on the exchange rate (1.24) for the 2015/2 – 2017/06 sample.

# Bank Reserves at SNB and the Swiss Franc/Euro Exchange Rate: Test for Non-Linearity and Level Effects 2009-2017

- Threshold variable: deviation from long run path (first and third sub-period) and 1.20 floor (second sub-period).
- Bai-Peron multiple break tests applied to data ordered according to lagged deviations from long run path or 1.20 floor.

*Table 2: Test for Structural Break in VAR According to Level Threshold, Rate of Change in Sight Deposits (y) and Swiss Franc/Euro Exchange Rate (x), Weekly Data, January 2009 – June 2017*

| | January 2009 – August 2011 | | November 2011 – December 2014 | | February 2015 – June 2017 | |
|---|---|---|---|---|---|---|
| | y | x | y | x | y | x |
| **Bai-Peron F-test** | | | | | | |
| **0 vs. 1 break** | 7.118*** | 7.369** | 13.966*** | 6.700*** | 2.236 | 2.038 |
| **1 vs. 2 break** | 1.522 | 1.394 | 4.181 | 2.651 | | |
| **Break point, $z_{t-1}$** | -0.054 | -0.059 | 0.00182 | 0.0273 | | |

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

*Table 3: Threshold VAR Results, Rate of Change in Sight Deposits (y) and Swiss Franc/Euro exchange rate (x), Weekly Data, January 2009 – December 2014*

| | January 2009 – August 2011 $z_{t-1}$ <-0.054 | January 2009 – August 2011 $z_{t-1}$ >-0.054 | November 2011 – December 2014 $z_{t-1}$>0.00182 | November 2011 – December 2014 $z_{t-1}$>0.0273 |
|---|---|---|---|---|
| **Granger causality x to y , $X^2(1)$** | 7.637*** (0.0057) | 0.328 (0.5668) | 0.175 (0.3978) | 0.295 (0.5869) |
| **Granger causality y to x, $X^2(1)$** | 13.112*** (0.0014) | 0.8898 (0.6903) | 1.851 (0.1737) | 4.706** (0.0301) |
| **Correlation of VAR residuals** | -0.109 | 0.213** | 0.125 | 0.124 |

Marginal significance in parentheses, *, **, *** indicates statistical significance at the 10 %, 5 % and 1 % level, respectively.

*Figure 6: Impulse Response, TVAR(1) Rate of Change Swiss Franc/Euro Exchange Rate (SFEU) and SNB Sight Deposits of Domestic Banks (SDT), weekly data January 2009 – August 2011, z<-0.054*

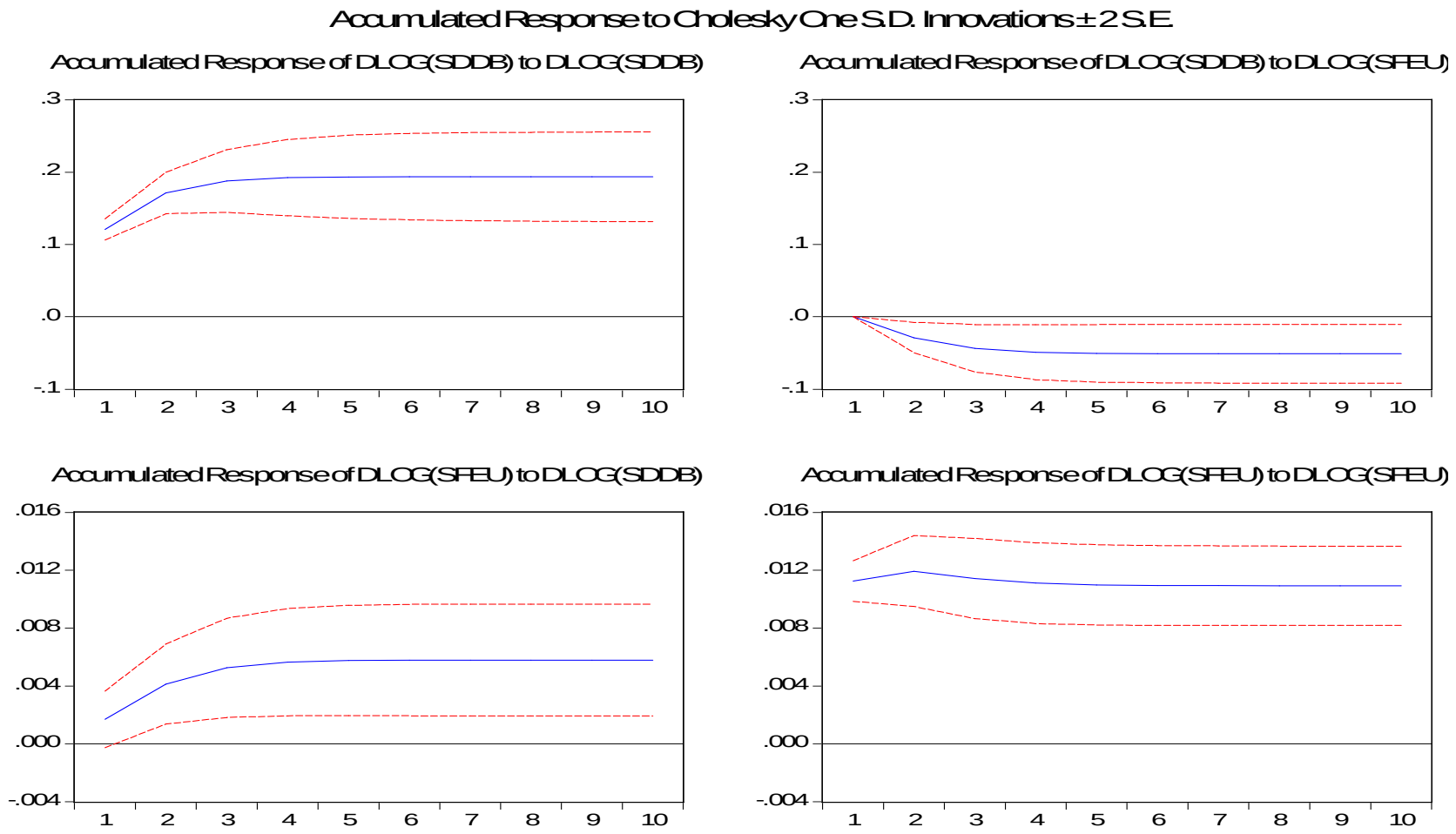


*Figure 7: Impulse Response, TVAR(1) Rate of Change Swiss Franc/Euro Exchange rate (SFEU) and SNB Sight Deposits of Domestic Banks (SDT), weekly data January 2009 – August 2011, z>-0.054*

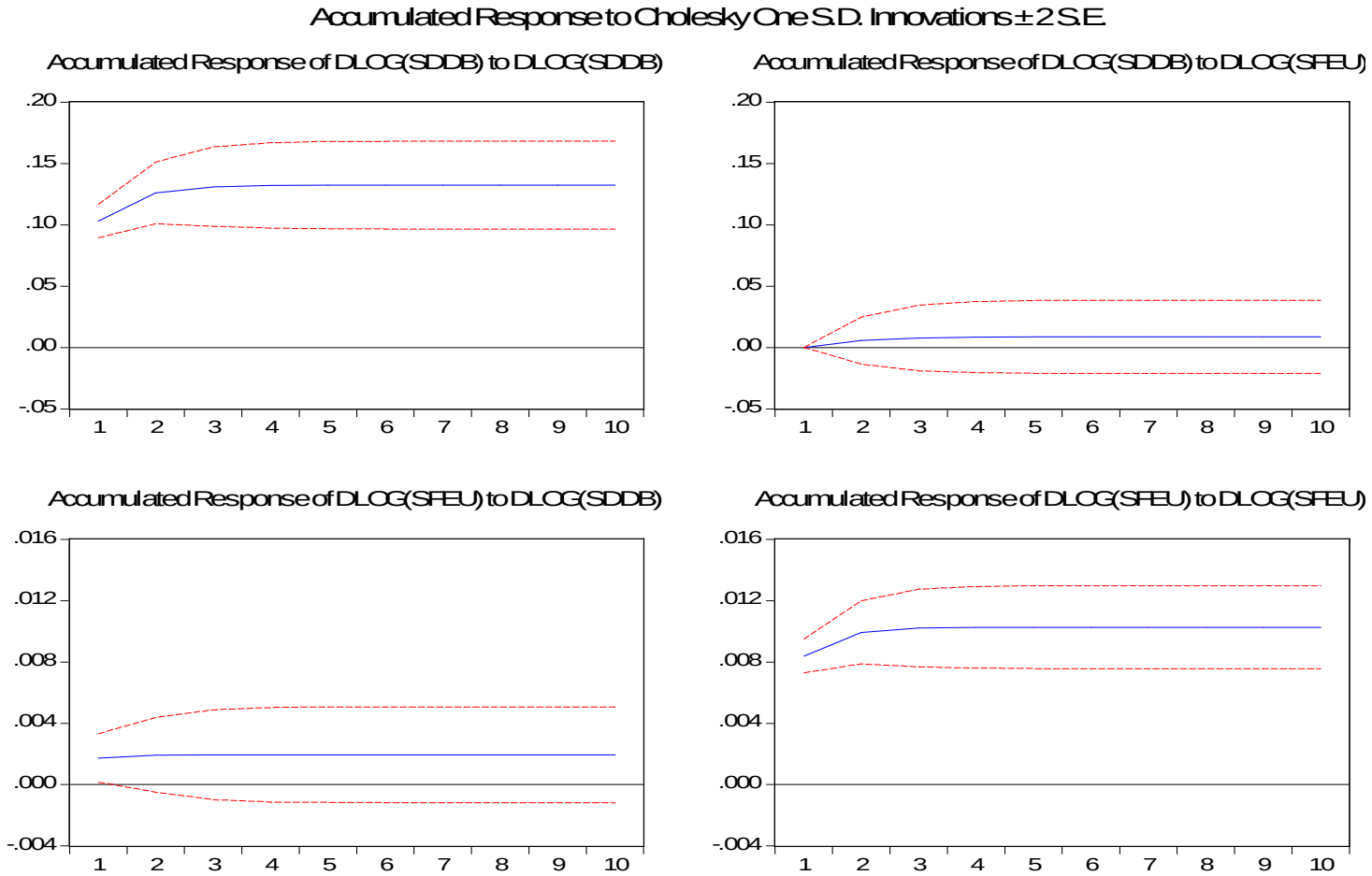
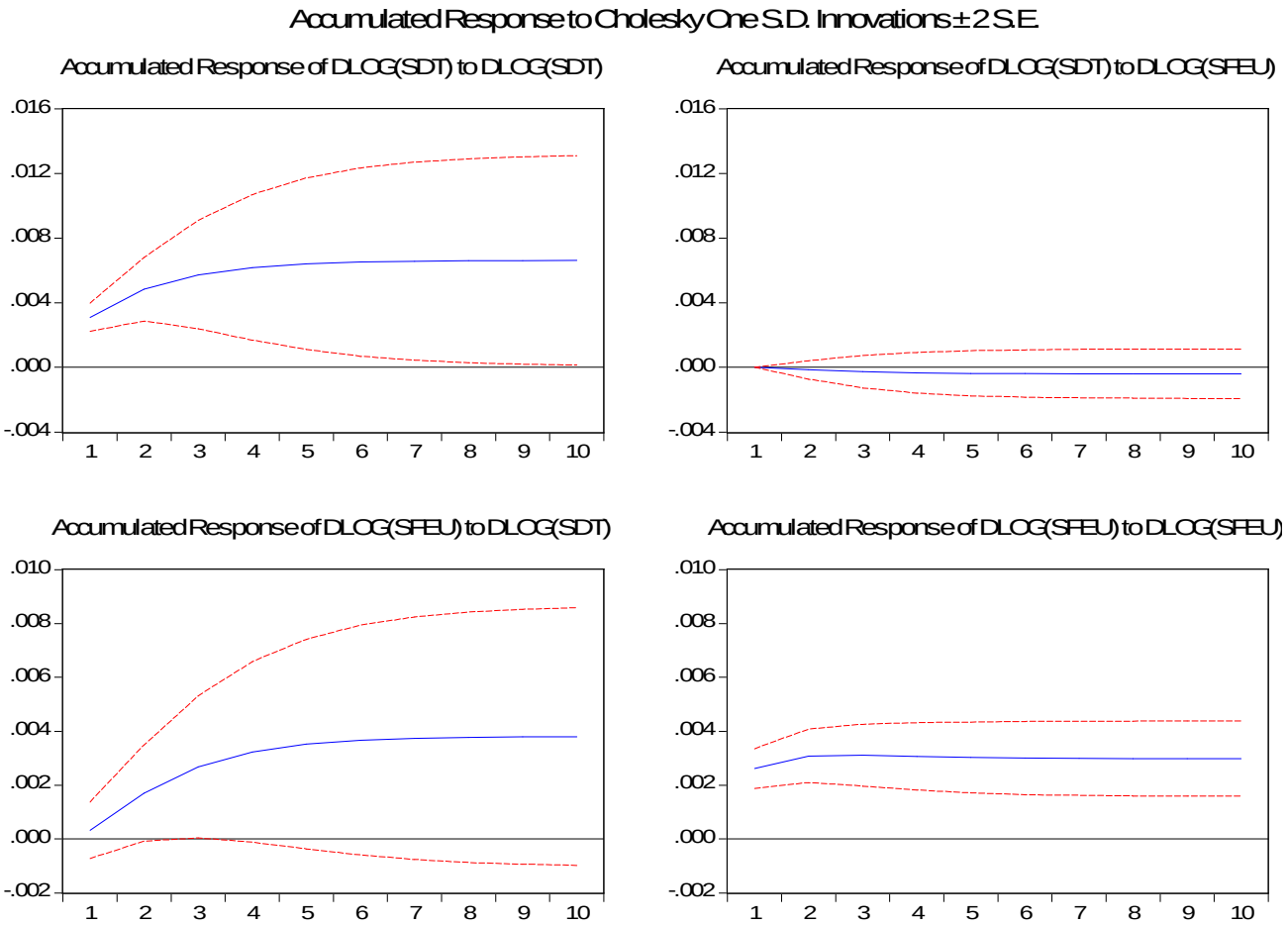


*Figure 8: Impulse Response, VAR(1) Rate of Change Swiss Franc/Euro Exchange rate (SFEU) and SNB Sight Deposits of Domestic Banks (SDT), weekly data November2011 – December 2014, z>0.0273*



- Statistically significant threshold effects in the first and second sub-period, but not in the third sub-period.
- No dynamic relationship between sight deposits for undervaluation and moderate overvaluation in the first sub-period.
- Strong feedback relationship with strong overvaluation of the Swiss Franc, similar to the results without threshold effects, but less asymmetric (long run elasticities -1.75 and 0.14 respectively.
- Dynamic effect of sight deposit changes on the exchange rate for deviation from floor larger than 2.73 %, no feedback. Long run elasticity 0.58.

# Identification by Heteroscedasticity

- Strongly changing volatility suggest identification of shocks by heteroskedasticity à la Rigobon (2003)

$u_{1t} = \varepsilon_{1t} + a_1 u_{2t}$

$u_{2t} = a_2 u_{1t} + \varepsilon_{2t}$

$cov(\varepsilon) = diag(\sigma_1^2, \sigma_2^2)$

$u_{1t} = b_{11}\,\varepsilon_{1t} + b_{12}\,\varepsilon_{2t}$

$u_{2t} = b_{21}\,\varepsilon_{1t} + b_{22}\,\varepsilon_{2t}$

$b_{11} = 1/(1-a_1 a_2)$, $b_{12} = a_1/(1-a_1 a_2)$, $b_{12} = a_2/(1-a_1 a_2)$,

$b_{22} = 1/(1-a_1 a_2)$.

$cov(u_1, u_2) = b_{21}\sigma_1^2 + b_{12}\sigma_2^2$

- Results similar to those obtained by Choleski decomposition.

*Figure 9: Structural Impulse Response, VAR(1) Rate of Change Swiss Franc/Euro Exchange Rate (SFEU) and SNB Sight Deposits of Domestic Banks (SDT), Weekly Data January 2009 – August 2011*

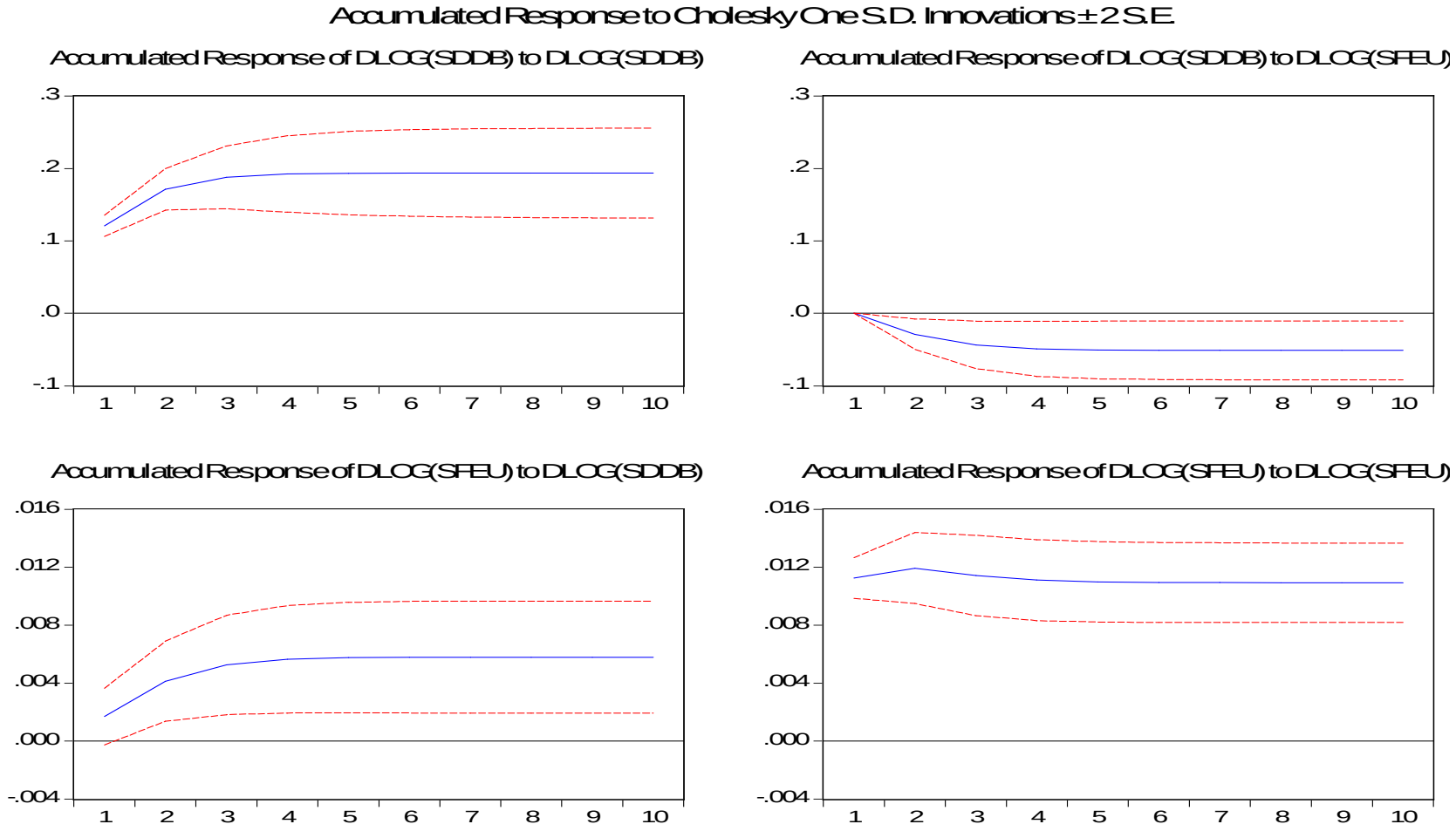
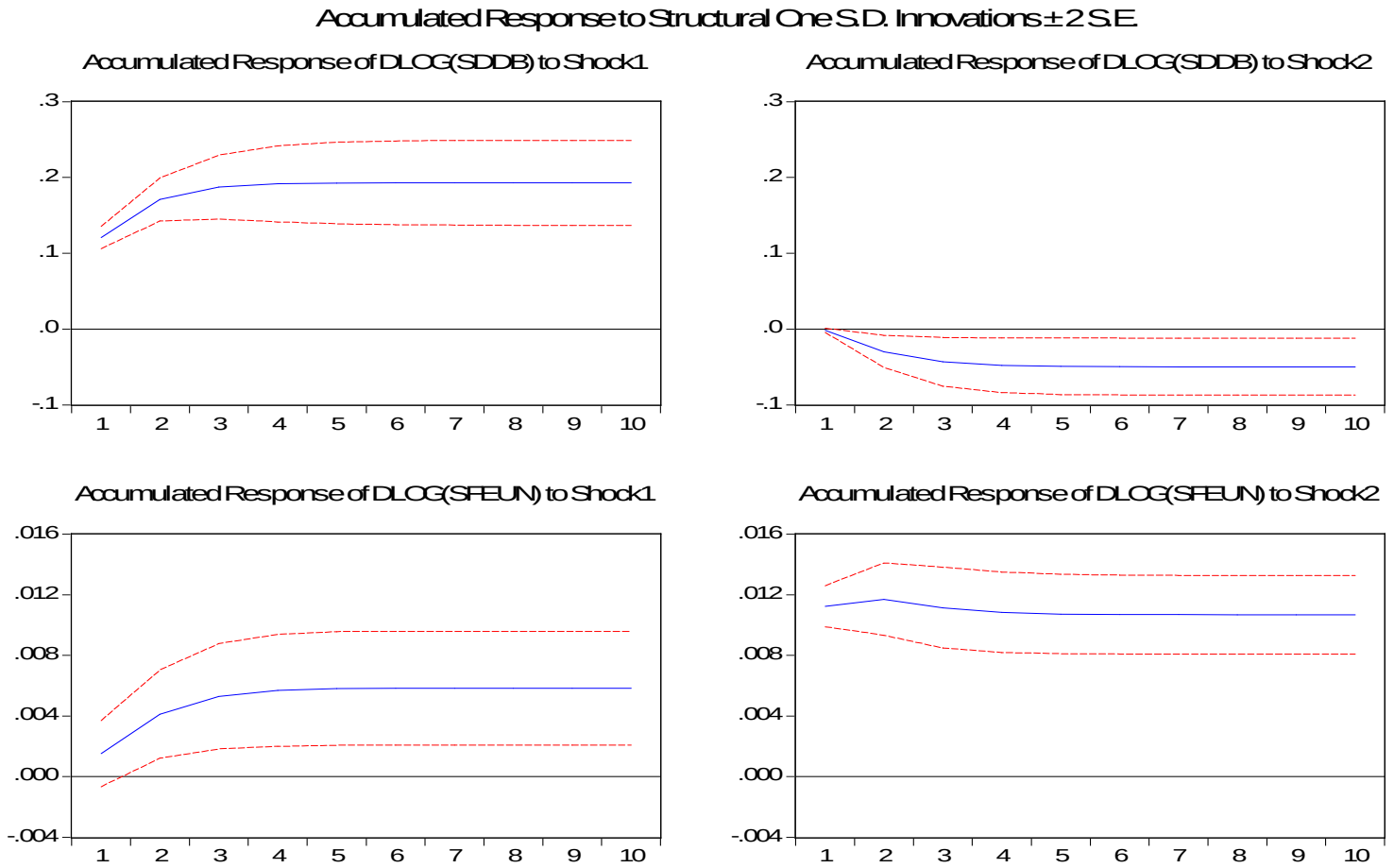


*Figure 10: Structural Impulse Response, VAR(3) Rate of Change Swiss Franc/Euro Exchange Rate (SFEU) and SNB Sight Deposits of Domestic Banks (SDT), Weekly Data January 2015 – June 2017*



# Conclusion

- For the ante 2011/9 period and post 2015/1 period we find the expected feedback pattern for the sight deposit and exchange rate changes, whereas there is no statistically significant relation for the intermediate period of the exchange rate floor.
- Strong asymmetry of the dynamic relationship between the first and third period: Strong effect of exchange rate shock on sight deposits ante 2011/9, opposite pattern post 2015/2. Probably caused by heavy sterilized interventions form spring 2010 to spring 2011.
- Threshold effects in the first and second sub-period.
- However, the publicly available data on sight deposits (weekly averages, no direct information on interventions) are not optimal for our purpose.