Replication Files for "Central Bank Swap Lines: Evidence of the Effect of the Lender of Last Resort"

1 Organisation of the Replication Files

The replication files are organised into two parts.

First, the folder "Data_Files" contains available raw data that is neither propiertary or administrative and tickers for the data that comes from a propiertary source (if not defined below). The folder is organised into subfolders by data type: "CIP_deviations" covers on the data on deviations from covered interest parity primarily used in Section 4 of the paper; "Central_Bank_Operations" covers data on the dollar operations of central banks that are funded through the swap lines primarily used in Section 5; "Zen" covers the data on bond transcactions used in Section 6; "BAML" covers the data from the Bank of America Merrill Lynch corporate bond indices used in Section 6; "Bank_Equities" covers the data on bank equity returns around the swap line rate cut in November 2011 primarily used in Section 6.4. A detailled description of these data including sources, access, file descriptions etc are included in this Readme below. Unfortunately, it is the case that most of the data used is not available publicly so we are restricted primarily to describing sources rather than providing the data.

Second, the folders "Section_4", "Section_5" and "Section_6" contain replication code for the analysis in the equivalent sections in the paper (alongside the accompanying appendices) and the code output. In terms of the specific files:

- Section_4
  - QuoteDataAnalysis.do replicates Figures 4a-b, Table 1 (& A1,A2) columns 1-3,5-7, Table A3 columns 1-2 and Table A4.
  - DailyDataAnalysis.do replicates Figures 4c, A5b, A6a-c, Table 1 column 4, Table A3 columns 3-6 and 8, and Table A9.
  - The m file TableA3_col7_bootstrap replicates the named table column.
  - CeilingAnalysis.do replicates Table A5.
- Section_5

  - CeilingViolationsAnalysis.do replicates Figures 7a, 7b and A10. The actual figures are reproduced in the spreadsheets of the same name.
  - AuctionAnalysis.do replicates Tables A6 and A11.
  - The spreadsheet Figure 1 replicates Figure 1.
  - The spreadsheet OneWeekOperations replicates Figure A11 and links to the raw data from the folder "DataFiles/Central_Bank_Operations". OneWeekOperations_upload is the same data with the links broken to make loading the data into Stata easier.

- Section_6
  - ZenDataAnalysis.do replicates Figure 8 (see also the Figure_8 spreadsheet), Table 2, A7 and A10 (Table A7 column 1 is estimated in ZenDataAnalysis_TableA7_col1_placebo.do).
  - BAMLDataAnalysis.do replicates Table 3.
  - EquityDataAnalysis.m replicates Tables 4 and A8 and Figure 9.
  - The do files ZenDataProcess.do, BAMLDataProcess.do, YieldDataProcess.do process raw data from ZEN, BAML and from Refinitiv Datastream on Bond Yield changes around the November 30th 2011 announcement.

Note that Figures 2, 5 and A1 are diagrams and do not have accompanying replication code. Figures 3, 6, A2, A3, A4a, A7 and A9 are simple time series plots of propietary data hence we do not provide replication code. Figure A12 is a reproduction of Figure 1 in Bahaj and Reis (2020) "Central Bank Swap Lines During the Covid Pandemic".

Code Running Instructions The Stata do files and matlab m files require that the user defines a global rootfolder where the replication files have been saved. This rootfolder should contain the four subfolders included in the replication package for the pathing to work. The code in folders Section_4, Section_5 and Section_6 are independent from one another. The code files with "Process" in the name refer to code that processes the raw data and should not be run seperately. Whereas files with "Analysis" in the name refers to code that replicates the results and can be run independently and in any order depending on which result replicating authors wish to obtain. The results are saved in the folders called "outputs". Note that the excel spreadsheets "Figure_7a_A10.xls", "Figure_7b.xls" and "Figure_8.xls" draw on the exported outputs from the relevant do files. All do files have been run on Stata 13, m files on Matlab16b using a computer running Windows 10.

2 Notes to Specific Datasets Used

2.1 Financial market data used to construct CIP deviations and ceilings

This subsection summarises the source of the data on CIP deviations and central bank ceilings. This data is used in Figures 3, 4, 6, 7, A2, A3, A4 and Tables 1, A1, A2, A3, A4. We obtain the data on interest rates, spot and forward exchange rates primarily from Refinitiv Datastream at a daily frequency. Exceptions include some OIS rates, which are taken from Bloomberg and some central bank policy rates, which are taken directly from the institution's website. Quote data on FX swaps and spot exchange rates are taken from Refinitiv Datascope. Below we list specific data series along with the source used to construct CIP deviations $x_{j,t}$, and swap line ceilings $c_{j,t}$ and provide the relevant ticker. These are broken down by currency.

The daily data was downloaded from 30th December 2005 until 17th April 2019 (which corresponds to the last access date). The actual analysis and figures refer to specific sub samples, please see the notes provided in the paper.

Data Files: The actual data files are not included in the replication files as the data (with limited the exception of interest rates downloaded from central bank websites) are from proprietary sources. We conduct only minor manipulations on the raw series to compute CIP deviations/swap line series that we describe below. Given these series, the replication code then documents the actual analysis. If the data is obtained, replicating authors should save it in "Data_Files/CIP_deviations"

2.1.1 Notes and details of data manipulations

Computing CIP deviations from the daily data: Let $F_{j,t}$ be the forward price of currency j and at time t and $S_{j,t}$ be the equivalent spot. These are defined as the foreign currency price of purchasing one US dollar. Raw data occasionally is the dollar price of foreign currency (e.g. for AUD) in which case we take the inverse. The forward premium given by $X \times (ln(F_{j,t}) - ln(S_{j,t}))$ where X is factor that annualises the forward premium; for one week forwards $X = 52$, for 3-month forwards $X = 4$. The interest differential is the difference between the USD and the foreign currency net interest rates: $i_t^* - i_t$, for the same maturity as the forward and either in terms of annualised LIBOR, OIS or IOER rates (with a consistent definition for both i_t and i_t^*). The CIP deviation is then given by $x_{j,t} = (i_t^* - i_t) - X \times (ln(F_{j,t}) - ln(S_{j,t}))$.

Computing CIP deviations from FX swap quotes: We download all available quotes for 1 week FX swaps versus USD for the ten currencies in our sample on Thomson Reuters Datascope over the period 1st November 2011 to 31st January 2012. We then drop quotes that occur over the weekend, on holidays or between 21:40-06:50 London time. This leaves us with 1,763,608 unique quotes across 10 currencies in November 2011 (671,388), December 2011 (534,971) and January 2012 (557,249). Let q indicate a specific quote for an FX-swap between USD and currency j. We

take the mid swap price in swap points (i.e. $F_{j,q} - S_{j,q}$) and match each quote to the mid-spot exchange rate in the minute that the quote was taken to obtain an $S_{j,q}$. The mid spot is calculated as the average of the mid open and mid close in the minute interval; these are computed directly by Datascope using the intraday summary feature. This enables us to calculate the implicit outright forward price in the swap (i.e. $F_{j,q}$) and hence the log forward premium associated with the quote ($ln(F_{j,q}) - ln(S_{j,q})$). Note that GBP, AUD and NZD swaps and spot exchange rates are quoted in USD per local currency unit and hence we transform the exchange rates accordingly. We then use the relevant daily interest rate fixing (OIS/LIBOR) sourced from Datastream or Bloomberg to compute the relevant interest differential and hence the CIP deviation associated with the quote using the same formula as above.

Computing Swap Line Ceiling: The swap line ceiling is given by the swap line spread less plus the difference between the foreign currency policy rate and the foreign currency deposit facility rate. We describe exactly what source we use for these variables below.

2.1.2 Data sources by currency

Swap Line Currencies data:

USD: The 1-week OIS rate is Datastream ticker OIUSDSW. The 1-week (3-month) LIBOR rate is Datastream ticker BBUSD1W (BBUSD3M). The deposit facility (interest on excess reserves) rate is the US Excess Reserve Balance Rate, Ticker: USEXCRB. As described in the main text, the swap line spread is 100bps until 30th November 2011 when it is cut to 50bps. Our sample ends before further rate cuts during the Covid pandemic.

EUR: The 1-week OIS rate is Datastream ticker OIEURSW. The 1-week (3-month) LIBOR rate is Datastream ticker BBEUR1W (BBEUR3M). The spot price of a USD in EUR is Datastream ticker EUDOLLR. The 1-week (3-month) forward price of USD in EUR is Datastream ticker EUDOL1W (EUDOL3F). The ECB deposit facility rate is Datastream ticker EURODEP and is the interest rate on excess reserves. The ECB main policy rate is the rate on the short term repo facility, Datastream ticker EURORPS. For the quote data: the 1 week EUR FX swap versus USD has Datascope RIC EURSW=, the spot exchange rate is EUR=.

GBP: The 1-week OIS rate is Datastream ticker OIGBPSW. The 1-week (3-month) LIBOR rate is Datastream ticker BBGBP1W (BBGBP3M). The spot price of a USD in GBP is Datastream ticker UKDOLLR. The 1-week (3-month) forward price of USD in GBP is Datastream ticker UKUSDWF (UKUSD3F). The BoE main policy rate is the Bank rate, Datastream ticker LCBBASE. The BoE deposit facility rate is Datastream ticker BOESTOD, with policy rate -25bp prior to 20th October 2008. From 5th March 2009 the Bank of England switched to a floor system and we set the deposit facility rate equal to the policy rate. This is also the interest rate on excess reserves. For the quote

data: the 1 week GBP FX swap versus USD has Datascope RIC GBPSW=, the spot exchange rate is GBP=.

JPY: The 1-week OIS rate is Bloomberg ticker JYSO1Z Curncy. The 1-week (3-month) LIBOR rate is Datastream ticker BBJPY1W (BBJPY3M). The spot price of a USD in JPY is Datastream ticker JAPAYE$. The 1-week (3-month) forward price of USD in JPY is Datastream ticker: USJPYWF (USJPY3F). The BoJ main policy rate is Datastream ticker JPCALLT; the BoJ opened its complementary deposit facility on 31/10/2008, the deposit interest rate has been equal to policy rate since its introduction, hence we always treat the deposit facility rate as the policy rate (see weblink). This is also the interest rate on excess reserves. For the quote data: the 1 week JPY FX swap versus USD has Datascope RIC JPYSW=, the spot exchange rate is JPY=.

CAD: The 1-week OIS rate is Bloomberg ticker CDSO1Z Curncy. The 1-week (3-month) LIBOR rate is Datastream ticker BBCAD1W (BBCAD3M). The spot price of a USD in CAD is Datastream ticker CNDOLL$. The 1-week forward price of USD in CAD is Datastream ticker USCADWF (USCAD3F). The BoC main policy rate comes directly from the BoC website and the series code is V39078 (Bank Rate). The deposit facility rate is the lower corridor rate, series code V39076. This is also the interest rate on excess reserves. For the quote data: the 1 week CAD FX swap versus USD has Datascope RIC CADSW=, the spot exchange rate is CAD=.

CHF: The 1-week (3-month) OIS and Libor rate is Bloomberg ticker BBCHF1W (BBCHF3M). The spot price of a USD in CHF is Datastream ticker SWISSF$. The 1-week (3-month) forward price of USD in CHF is Datastream ticker USCHFWF (USCHF3F). For technical reasons, the CHF TOIS fixing in not an effective gauge of risk free interest rates in CHF (and has recently been replaced with SARON). Since the SNB directly targets CHF LIBOR rates, and the CHF 1-week LIBOR adheres closely to that target (subject to a corridor system) we prefer to use always LIBOR rates for our CHF basis. Our regression results are robust to using the TOIS fixing as an alternative, but with a CHF/USD basis based on TOIS there are persistent and large ceiling violations in 2015. The SNB main policy rate is Datastream ticker SWSNBTI (3 month LIBOR Target). The deposit facility rate is the lower bound on the 3 month LIBOR target, Datastream ticker SWSNBTL. We also treat this as This is also the interest rate on excess reserves. For the quote data: the 1 week CHF FX swap versus USD has Datascope RIC CHFSW=, the spot exchange rate is CHF=.

Non-Swap Line Currencies data: 1-week OIS rates are not always available for all the currencies that are not part of the swap line network. Hence we exclusively compute bases using LIBOR and the central bank interest on excess reserves (this also applies to the equivalent USD interest rates).

AUD: The 1-week (3-month) LIBOR rate is Datastream ticker GSAUD1W (GSAUD3M). The spot price of a USD in AUD is the inverse of Datastream ticker AUSTDOI. The 1-week (3 month)

forward price of USD in AUD is Datastream ticker USAUDWF (USAUD3M). The interest rate on excess reserves is the RBA cash rate, Datastream ticker RBACASH, less 25 basis points. For the quote data: the 1 week AUD FX swap versus USD has Datascope RIC AUDSW=, the spot exchange rate is AUD=.

DKK: The 1-week (3-month) LIBOR rate is Datastream ticker CIBOR1W (CIBOR3M). The spot price of a USD in DKK is Datastream ticker DANISH$. The 1-week (3-month) forward price of USD in DKK is Datastream ticker USDKKWF (USDKK3F). The interest rate on excess reserves is the daily minimum of the Danmarks Nationalbank's official certificates of deposit rate sourced directly from DNB statbank table DNRENTD and the Danmarks Nationalbank's Current Account Rate, Datastream ticker DKFOLIO. For the quote data: the 1 week DKK FX sawp versus USD has Datascope RIC DKKSW=, the spot exchange rate is DKK=.

NOK: The 1-week (3-month) LIBOR rate is Datastream ticker NWIBK1W (NWIBK3M). The spot price of a USD in NOK is Datastream ticker NORKRO$. The 1-week (3-month) forward price of USD in NOK is Datastream ticker USNOKWF (USNOK3F). Norway operates a floor system, so the interest rate on excess reserves is the Norges Bank's reserve rate, Datastream ticker NWRESVR. For the quote data: the 1 week NOK FX swap versus USD has Datascope RIC NOKSW=, the spot exchange rate is NOK=.

NZD: The 1-week (3-month) LIBOR rate is Datastream ticker GSNZD1W (GSNZD3M). The spot price of a USD in NZD is Datastream ticker NZDOLL$. The 1-week (3-month) forward price of USD in NZD is Datastream ticker USNZDWF (USNZD3F). The interest rate on excess reserves is the RBNZ official cash rate, Datastream ticker: NZRBCSH. For the quote data: the 1 week NZD FX swap versus USD has Datascope RIC NZDSW=, the spot exchange rate is NZD=.

SEK: The 1-week (3-month) LIBOR rate is Datastream ticker SIBOR1W (SIBOR3M). The spot price of a USD in SEK is Datastream ticker SWEKRO$. The 1-week (3-month) forward price of USD in SEK is Datastream ticker USSEKWF (USSEK3F). The interest rate on excess reserves is the Riksbank's deposit facility rate, Datastream ticker SDDEPOS. For the quote data: the 1 week SEK FX swap versus USD has Datascope RIC SEKSW=, the spot exchange rate is SEK=.

2.2 Data on Central Bank USD operations funded through the swap line

This subsection summarises the source of the data for central bank operations funded through the swap line. This data is used in Figures 1, 6, 7, A4b, A9, A10 and A11 as well as Tables A6 and A11. We organise the description of the data by central bank. As the data is publically available it is saved in "Data_Files/Central_Bank_Operations". The spreadsheet AuctionTiming aggregates the timings of the one week operations across central banks. All data last accessed 20th December 2020. Website links last accessed April 29th 2021.

Federal Reserve: The total amount of swap line financing provided by the federal reserve (as in figure 1) is downloaded from FRED (https://fred.stlouisfed.org/), data code SWPT. The breakdown by counterparty comes from the other spreadsheets.

ECB: Data on ECB operations funded through swap line drawings are contained in the spreadsheet ECB_dollar_auctions.xlsx. The raw data is available in csv form from here:

https://www.ecb.europa.eu/mopo/implement/omo/html/top_history.en.html.

The raw data is the tab "tops" coloured red. ECB euro operations are in the spreadsheet EUB_EUR_auctions.xlsx; Euro operations come from the same raw data source.

BoE: Data on the BoE is in the spreadsheet BoE_dollar_auctions.xlsx. The raw data in tab "USD Repo Summary" (coloured red) is available here: https://www.bankofengland.co.uk/markets/bank-of-england-market-operations-guide/results-and-usage-data.

BoJ: Data on the BoJ's swap line drawings are availabe in the spreadsheet BoJ_dollar_auctions.xlsx. The raw historical data on BoJ open market operations is available here:

https://www.boj.or.jp/en/statistics/boj/fm/ope/index.htm/.

Swap line funded operations are listed as "US Dollar Funds-Supplying Operations against Pooled Collateral". The results of operations are available in month by month spreadsheets from the BoJ that have been combined in the BoJ_dollar_auctions.xlsx spreadsheet.

SNB: Data on the SNB's operations are availabe in the spreadsheet SNB_dollar_auctions.xlsx. The underlying data is available in pdf form here: https://www.snb.ch/en/ifor/finmkt/id/finmkt_usdollars. The results are given a pdf which we transcribed into the spreadsheet manually (see sheet "all", coloured red).

BoC: The Bank of Canada conducted no USD operations funded via the swap line during our sample period.

2.3 Data on Bond Market Transactions: ZEN

The data on bond market transactions used in Figure 8 and Tables 2, 3, A7 and A10 comes from the ZEN database compiled by the UK FCA. Details of the ZEN dataset and the manipulations we apply to it are provided in the online appendix. The do file ZenDataProcess in the folder "Section_6" provides the processing code. The data is confidential and is not provided. We use the Bank of England's dataset on corporate bond trades within ZEN which arrives in .txt organised by the month when the transaction takes place.

2.4 Data on Bonds in the Bank of America/Merrill Lynch Corporate Bond Indices (BAML)

This subsection summarises the data on corporate bonds making up the Bank of America/Merrill Lynch Corporate Bond Indices (BAML). This data is used as an input in Figure 8 and Tables 2, 3, A7 and A10. The replication code is in Section_6/, the BAML data is processed in BAMLDataProcess.do.

The data is stored in 9 spreadsheets detailing the composition of the different bond indices considered as of 31st January 2012 (see data appendix). The spreadsheets are labeled by the ticker of the index. The actual data files are not included in the replication files as the data is from a proprietary source.

We augment the BAML data from 31st January 2012 with data from Refinitiv Datastream on the price and yield of the bonds in the trading days in the immediate vicinity of the swap line rate cut on November 30th since there are many bonds in the indices we download the data in blocks. These are processed in Section_6/YieldDataProcess.do.

2.5 Financial market data used to estimate bank equity returns around the swap line rate cut

This subsection summarises source of the data on bank equity returns. This data is used in Figure 9 and Tables 4 and A8. The accompanying replication code is provided in the folder "Section_6".

The equity market data is primarily sourced from Refinitiv Datastream at a Daily frequency. The datasteam data used here was last accessed on 9th September 2018. Since this data is proprietary we only provide the tickers in the data files and not the actual data. Whether or not the bank has a US presence is taken from the "U.S. Branches and Agencies of Foreign Banking Organizations" dataset provided by the *U.S. Federal Institutions Examination Council*. Since this data is public we include it in the replication files, as well as the indicator for the US presence for the banks. This data was last accessed on 20th March 2018.

When providing weighted estimates we use the market capitalization of the banks calculated as of 1st November 2011 and converted into USD using the prevailing exchange rate on the day to provide weights.

Data Files

The data files are saved in the folder "Data_Files/Bank_Equities". We have preserved the structure of the files while deleting the proprietary data. The following files are available:

- *bankequities*: Tickers for the total return indices for all banks listed in Datastream in the U.K., Switzerland, Canada, Japan (non-Euro Area swapline banks); Germany, France, Spain, Italy,

Belgium, Portugal, Netherlands, Ireland, Austria (Euro-area swap line banks); Australia, Norway, Denmark, Sweden (banks in countries without a swap line, no data on New Zealand banks were available.). We exclude banks for where there are gaps in coverage anytime between 1st July 2010 and the 31st of December 2012. We exclude banks with very illiquid stocks where the the price changes in less than 50% of trading days. This leaves us with the banks listed in the spreadsheet. Also included is the ticker for the market return in each country and the Fama French Factors.

- *bankequities_US*: Tickers for the total return indices for all banks listed in Datastream in the U.S. No banks are excluded here. Instead we exclude banks for where there are gaps in coverage anytime between 1st July 2010 and the 31st of December 2012 and banks with very illiquid stocks where the the price changes in less than 50% of trading days in the accompanying matlab code (EquityDataAnalysis.m).

- *bankequities_characteristics*: For each bank in bankequities, contains the indicator for US presence. This spreadsheet would also contain the USD market value on November 1st 2011 for the purposes of computing weights but these are omitted as the data is proprietary.

- *bankequities_USmarket*: Tickers for the US total market return index.

- *bankequities_USmarketvalue*: Equivalent to bankequities_US except with bank market values rather than total return indices.

- *USPresence*: the "U.S. Branches and Agencies of Foreign Banking Organizations" dataset provided by the *U.S. Federal Institutions Examination Council*. The tab "SwapLineBankList" provides a list of all banks headquartered in a country whose central bank has access to the Federal reserve swap line who have an affiliate, branch or registered office in the United States. We use the variable "TOP_COUNTRY" in the dataset to identify these banks. We then manually match the bank's name, "TOP_NAME", to the bank name in datastream to produce our US presence indicator. This indicator is saved in *bankequities_characteristics*, a value of 1 is a bank in a country with a swap line that has a US presence, a value of 2 is a bank in a country with a swap line that has no US presence and a value of 3 is a bank in a country without a swap line.

In the robustness section we additionally use the Fama-French size (SML), book to market (HML), profitability (RMW) and investment (CMA) factors to compute excess returns. These are downloaded directly from Ken French's website. Last accessed 3rd September 2018.

3 Data Accessability Statements

Refinitiv Datastream: Datastream is a subscription based service provided by Refinitiv. Please see the relevant URL here. Subscriptions are usually managed at the level of the institution and we encourage replicators to first contact their library or equivalent. Individual subscriptions would have to be negotiated with a Refinitiv sales representative at a variable price. The original dataset used in this paper has been archived and can be shared with replicators that have obtained written permission from a Refinitiv representative. Our experience is that this permission is normally straightforward to obtain once in possession of a Datastream license.

Refinitiv Datascope: Datascope is a subscription based service provided by Refinitiv. Please see the relevant URL here. Compared to Datastream (see previous entry) this dataset is targetted at market participants rather than researchers. Hence, it is less likely that a university library will have a subscription but we would advise replicators to atleast explore that route first. Otherwise, individual subscriptions would have to be negotiated with a Refinitiv sales representative at a variable price. The original dataset used in this paper has been archived and can be shared with replicators that have obtained written permission from a Refinitiv representative. Our experience is that this permission is normally straightforward to obtain once in possession of a Datascope license.

Bloomberg market data: Bloomberg data requires access to a Bloomberg terminal. Typically, access can be arranged through an institution's library. Otherwise please contact a Bloomberg sales representative to obtain a subscription. The original dataset has been archived and can be shared with replicating authors who have written permission to use it.

Data on central bank operations funded through the swap line: This data are publicly available and we provide the raw data in the replication files. The description in the previous section lists the specific sources of the data for each central bank.

ZEN data on financial market transactions This data can only be accessed through the Bank of England or the UK's Financial Conduct Authority. Bank of England staff members, include research assistants, are able to access the data for research purposes. This requires approval from the internal data owner who checks there is a reasonable case for access and that the staff member understands internal controls around the use of the data. External academics may request access to the data through the UK Financial Conduct Authority who is the source of the data and grants the Bank of England access. For contact information see https://www.fca.org.uk/contact.

Bank of America Merrill Lynch (BAML) fixed income indices: Intercontinental Exchange (ICE) acquired the BAML fixed income platform over the course of the paper's development. Replicating authors would need to contact ICE for a subscription to the data detailing the composition

their indices. Please see here. We accessed the data through the Bank of England's subscription and the data was provided to the Bank on the 1st August 2012. The original version of this data is archived on a hard disk at the Bank of England. We anticipate being able to share the data replicating authors who have written permission from ICE to use it, subject to approval from the data owner at the Bank of England.

U.S. Branches and Agencies of Foreign Banking Organizations: This is dataset provided by the *U.S. Federal Institutions Examination Council*. Since this data is public we include it in the replication files, as well as the indicator for a US presence for the banks in our sample.

Data Citations

Bank of England (2020). *Results and usage data: USD Repo Operations.* (Last Accessed: December 2020) URL: https://www.bankofengland.co.uk/markets/bank-of-england-market-operations-guide/results-and-usage-data.

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Ice Data Indices, LLC (2012). *ICE BofA Fixed Income Indices.* Subscription Service. URL: https://www.theice.com/market-data/indices/fixed-income-indices. (Accessed: August, 2012).

Refinitiv (2019). *Refinitiv Datastream.* Subscription Service. (Last Accessed: April 2019) URL: https://www.refinitiv.com/en/products/datastream-macroeconomic-analysis.

Refinitiv (2019). *Refinitiv Datascope.* Subscription Service. (Last Accessed: April 2019) URL: https://www.refinitiv.com/en/products/datascope-plus-securities-database.

Swiss National Bank (2020) *Results of the Swiss National Bank's US dollar auctions.* (Last Accessed: December 2020) URL: https://www.snb.ch/en/ifor/finmkt/id/finmkt_usdollars.

UK Financial Conduct Authority (2018) *ZEN database.* (Last Accessed: March 2018).