Swiss Index

Methodology Rulebook Governing the Swiss Reference Rates

SMI
INDICES®

Table of Content

1 Structure of Swiss Reference Rates

1.1 Introduction

Repo transactions are an important instrument in day-to-day liquidity management. To serve the financial markets, SIX calculates and publishes CHF reference rates and indices for the various durations (overnight to 12 months). Specifications for reference rates have been drawn up in conjunction with the Swiss National Bank (SNB).

1.2 Basic Framework

The reference rates and indices are based on transaction data from SIX Repo Ltd's CHF repo interbank market. Repo transactions are an important tool in the banks' day-to-day liquidity management. The repo transaction has advanced to become a major money market instrument around the world. The SNB also uses the repo market to implement its monetary policy.

Only standardized, CHF-denominated GC contracts[1] against fixed-income securities eligible for SNB repo transactions are used to calculate the reference rates and indices.

1.3 Composition

Swiss Reference Rates comprise 24 reference rates and two indices that cover a range of durations from overnight to 12 months. A further eight reference rates are calculated for IMM contracts[2].

Terms to Maturity	Average Rates	Current Rates	Average Indices	Current Indices
Overnight ON	SARON	SCRON	SAION	SCION
Tom/Next TN	SARTN	SCRTN		
Spot/Next SN	SARSN	SCRSN		
1 Week 1W	SAR1W	SCR1W		
2 Weeks 2W	SAR2W	SCR2W		
3 Weeks 3W	SAR3W	SCR3W		
1 Month 1M	SAR1M	SCR1M		
2 Months 2M	SAR2M	SCR2M		
3 Months 3M	SAR3M	SCR3M		
6 Months 6M	SAR6M	SCR6M		
9 Months 9M	SAR9M	SCR9M		
12 Months 12M	SAR12M	SCR12M		
IMM March Contract	SARMAR	SCRMAR		
IMM June Contract	SARJUN	SCRJUN		
IMM September Contract	SARSEP	SCRSEP		
IMM December Contract	SARDEC	SCRDEC		

---

[1] GC contract: GC stands for General Collateral. In a repo transaction, the money that is loaned out is secured against securities of a defined quality that are drawn from a GC basket.

[2] IMM contracts: Exactly four contracts exist at any time: for March, June, September and December respectively. They all mature on the third Wednesday of the corresponding month. A contract always has a remaining term to maturity of less than one year. This term shortens with each trading day and converges to zero.

1.4 General Principles

In order to achieve the stated index objective, SIX defines the general principles that govern the index methodology. SIX publishes the index objective and rules for all indices.

- **Representative:**
  The development of the market is represented by the index.
- **Tradable:**
  The index components are tradable in terms of company size and market.
- **Replicable:**
  The development of the index can be replicated in practice with a portfolio.
- **Stable:**
  High index continuity.
- **Rules-based:**
  Index changes and calculations are rule-based.
- **Projectable:**
  Changes in rules are with appropriate lead time (usually at least 2 trading days) – no retrospective rule changes.
- **Transparent:**
  Decisions are based on public information.

1.5 Review of Index Concept

The validity of the index concepts and rules is reviewed on a regular basis. In exceptional cases a broad market consultation can be conducted. The changes to the index rules are publicly announced with appropriate lead time (usually 3 months).

1.6 Termination of the Index Calculation

A decision to discontinue will be publicly announced by SIX with appropriate lead time.

In case of existing financial products linked to the index, of which SIX is aware, a market consultation is conducted in advance and a transition period is introduced before the definitive termination. Otherwise no market consultation will be be carried out.

2 Calculation of the Average Rate

The Average Rate (rounded to six decimal places) is calculated on the basis of trades concluded (T_p), or on a reference price (R_q) that is based on quotes. The Average Rate is recalculated every time a trade is concluded or a new quote issued, providing they meet the following specifications.

2.1 Trades

The price of a trade and its volume (V_T) are fed directly in to the index calculation, providing the price is within the trade filter of 50 basis points (bp): $P_{n-1} - 50$ bp $\leq T_p \leq P_{n-1} + 50$ bp. Prices that correspond exactly to the marginal value are factored in to the calculation. There is no limit to trade volume. The Average Rate is not corrected if a trade is reversed.

2.2 Quotes

2.2.1 Quote Filter

The reference price (R_q) is calculated on the basis of the quotes available in the order book, providing they lie within the quote filter[3]. The starting point for the quote filter is the price which lies halfway between the bid and ask sides (mid price, m). It corresponds to the volume-weighted average of the best buy and sell quotes. Measured at the mid price and rounded to five decimal places, the quote spread (q_n) amounts to three basis points: m + 3 bp ≥ quote ≥ m - 3 bp. The calculation factors in both quotes that correspond exactly to the marginal value and those which are available to only a selection of participants.

2.2.2 Quote Rules

Any number of quotes may be used to calculate the reference price (R_q), providing the quotes concerned lie within the quote spread (q_n) and order book depth 10, i.e. a maximum of ten best buy and sell quotes are factored in to the calculation. Where quotes differ, one quote only from each bank will be included for each side of the order. Furthermore, it may be that the number of prices included from the ask side is greater than that from the bid side, and vice versa. If no quotes are available within the quote spread (q_n), the mid price (m) is used as the new reference price (R_q).

2.2.3 Quote Volume

The volume of quotes is restricted to CHF 100 million. If there are several identical quotes on each side of the order, but their volumes differ, then the volumes of these quotes are aggregated for the purposes of calculating the mid price (m). The aggregated volume is capped at CHF 100 million.

The volumes of identical quotes that lie within the quote spread (q_n) are cumulated and capped at CHF 100 million. The volumes given for the quotes that are to be factored in are also included in the calculation of average volume (no fractions), but the aggregated volume per quote is once again limited to CHF 100 million. This average volume is then fed into the recalculation of the Average Rate.

---

[3] The use of a quote filter prevents quotes that diverge sharply from the current interest level distorting the Average Rate.

2.2.4 Restrictions

In the cases described below, the Average Rate is not recalculated and the last reference price remains valid:

– The order book contains quotes for only one side of the transaction (buy or sell), or contains no quotes at all.
– New quotes are entered in the order book, but they do not change the reference price (R_q) compared with its previous value, neither do they impact on the total volume for the reference price (R_q).
– Changes in volume relating to quotes that are already in the order book do not trigger a recalculation.
– The spread between the best buy and sell quotes exceeds 20 basis points.

2.3 Formula

	Formula	Legend
Average Rate (**AR$_n$**)	$$AR_n = \frac{AR_{(n-1)} \cdot \sum_{j=1}^{n-1} v_j + p_n \cdot v_n}{\sum_{j=1}^{n} v_j}$$	$\sum_{j=1}^{n-1} v_j$ = Past volume for reference prices and trades used in calculating the reference rate
Trade Filter	$P_{n-1} - 50\ BP \le T_p \le P_{n-1} + 50\ BP$	
Price (**P$_n$**)	$p_n \nearrow^{T_p}_{\searrow R_q}$	P_n = Relevant price for the calculation, based on a trade (T_p) or a reference price (R_q)
Volume (**V$_n$**)	when $P_n = T_p \rightarrow V_n = V_T$ when $P_n = R_q \rightarrow V_n = V_q$	T_p = Price of a trade V_T = Volume of a trade (unlimited)
Calculation of the Reference Price (R$_q$):		
Mid Price (**m**):	$$m = \frac{b \cdot v_b + s \cdot v_s}{v_b + v_s}$$ If **s**=0 and/or **b**=0 -> no update	**b** = Best Buy v_b = Volume **b** (max.100 M) **s** = Best Sell v_s = Volume **s** (max.100 M)
Quote Spread (**q$_n$**)	(m + 3 BP $\ge q_n \ge m$ - 3 BP)	q_n= Buy and sell price within the spread
Reference Price (**R$_q$**)	$$R_q = \frac{\sum_{j=1}^{n} q_j \cdot v_j}{\sum_{j=1}^{n} v_j}$$	q_j = Quotes in q_n v_j = Volume of quote j **j** = 1, 2, 3, … max. volume per quote = CHF 100 M max. aggregated volume for identical quotes = CHF 100 M
Volume of R$_q$ (**V$_q$**)	$$V_q = \frac{\sum_{j=1}^{n} v_j}{n}$$	V_q = Average volume max. volume per quote = CHF 100 M max. aggregated volume for identical quotes = CHF 100 M
If **q$_n$** = { }	$R_q = m$ and $V_q = (\ v_b + v_s\ ) / 2$	v_b = Volume **b** (max. 100 M) v_s = Volume **s** (max. 100 M)

2.4 Sample Calculation: Reference Price R_q

Market participants may enter the price of a trade, and quotes, at up to six decimal places. Prices that correspond exactly to the marginal value are factored in to the calculation. In the example given below, a new quote triggers recalculation.

All quotes that lie within the quote spread (q_n) are used to calculate the reference price (R_q). They are weighted according to their volume, added together and finally divided by the total volume (the sum of all volumes for the quotes to be factored in to the calculation). The average volume must be taken into account in calculating the Average Rate.

2.5 Calculation Interval and Publication Times

The Average Rate is calculated for the first time when the first constellation arises in the order book. It is published for the first time at 08.30 and for the last time at the end of the trading day. The Average Rates for different durations may have different cut-off times. The cut-off time determines the end of the trading day, and the rates for different durations may have different cut-off times. Since the cut-off time is not necessarily the same as the publication time for the Average Rate, the publication of the last Average Rate figure may fall outside the defined publication interval of ten minutes.

The market value of the Average Rate is published every day at 12.00, 16.00 and at the end of the trading at 18.00. These figures are referred to as fixed rates[4].

Average Rates are calculated in real time but are published every ten minutes.

Reference rates and indices are calculated and published on all official trading days on the Swiss franc repo market. In case the fixing of the Swiss Reference Rates (e.g. SARON) is not available, the last published rate (previous business day) remains valid.

All data is distributed by SIX Exfeed Ltd, a subsidiary of SIX Group Ltd.

---

[4] Given the different trading hours, it may be that individual durations or interest rates have only two fixed rates (12:00 and 18:00) rather than the usual three average fixed rates (12.00, 16.00 and 18:00), or that the 16.00 fixed rate corresponds to that at 18:00.

3 Calculation of the Current Rate

The Current Rate shows the progress of trading during the day and reflects the current market price. The Current Rate gives an indication of the direction in which the market is moving. It may thus also serve as an indicator of short-term shifts.

3.1 Trades and Quotes

Rather than in real time, the Current Rate (rounded to six decimal places) is calculated and published every three minutes. It gives the last trade observed during the publication interval. In the absence of a trade during this period, the mid price is calculated and published as the Current Rate. Trades take precedence over the mid price, however. If no new trades have been concluded within the three-minute period, or no new quotes have been entered in the order book, the previous Current Rate is published again. This also applies if no trade has taken place and the spread between the best buy and sell quotes exceeds 20 basis points.

3.2 Formula

	Formel		Legend
Current Rate (CR_t)	If **T** exists in the interval prior to publication: $$CR_t = T$$ Otherwise: $$CR_t = M$$		**T** = Trade **M** = Mid Price
Mid Price (**M**)	$$M = \frac{b+s}{2}$$	If **s** = 0 and/or **b** = 0 → last available mid price	**b** = Best Buy **s** = Best Sell

3.3 Sample Calculation

Times at which the current rate is published:

- **V1** = 8:30:00
- **V2** = 8:33:00
- **V3** = 8:36:00
- **V4** = 8:39:00

The intervals are:

- up to 8:29:59   = **V1**
- 8:30:00 - 8:32:59   = **V2**
- 8:33:00 - 8:35:59   = **V3**
- 8:36:00 - 8:38:59   = **V4**

Timing	8.29	8.31	8.32	8.37
Bester Sell	0.59		0.60	0.65
Bester Buy	0.61		0.62	0.75
Trade		0.63		
M or T	M	T	M	M

Publication:

V1 (8:30)	No trade so far	$CR_{V1} = (0.59 + 0.61) / 2 = 0.60$
V2 (8:33)	Trade at 8:31 within the interval	$CR_{V2} = 0.63$
V3 (8:36)	No changes to quotes or trades	$CR_{V3} = CR_{V2} = 0.63$
V4 (8:39)	No trade within the interval	$CR_{V4} = (0.65 + 0.75) / 2 = 0.70$

3.4   Calculation Interval and Publication Times

The Current Rate is published for the first time at 08.30 and for the last time at the end of the trading day. The Current Rates for different durations may have different cut-off times. The cut-off time determines the end of the trading day, and the rates for different durations may have different cut-off times. Since the cut-off time is not necessarily the same as the publication time for the Current Rate, the publication of the last Current Rate figure may fall outside the defined publication interval of three minutes.

The Current Rate is calculated immediately prior to publication in each case. This takes place every three minutes.

Reference rates and indices are calculated and published on all official trading days on the Swiss franc repo market.

In case the Swiss Reference Rates are not available, the last published rate (previous business day) remains valid.

All data is distributed by SIX Exfeed Ltd, a subsidiary of SIX Group Ltd.

4 Calculation of the Average and Current Index

For the "overnight" duration, SIX calculates and publishes two indices, on the basis of the Average and Current Rates respectively. These give the performance generated by daily overnight transactions.

4.1 Formula

Index I_t

$$I_t = I_T \left(1 + \frac{SRR_T}{360} D_{T,t} \right)$$

Legend:

I:	Index
t:	Current trading day
T:	Last trading day prior to t
SRR	Swiss Reference Rate (as a percentage) for the corresponding duration and price type
D:	Number of calendar days between **t** and **T**
Interest Convention:	Current/360
	Publication at time **t** with date stamp **t** (no time stamp)

4.2 Sample Calculation

Index at time **T**	100
Swiss Reference Rate (overnight) at time **T**	0.15
Number of calendar days between **t** and **T**	1
Index at time **t**	$I_t = 100 \left[1 + \left(\frac{0.15/100}{360} \right) 1 \right] = 100.000417$

4.3 Calculation Interval and Publication Times

The Current and Average indices are calculated and published once a day at the end of the trading day (rounded to six decimal places).

Reference rates and indices are calculated and published on all official trading days on the Swiss franc repo market.

All data is distributed by SIX Exfeed Ltd, a subsidiary of SIX Group Ltd.

4.4 Information on Index Adjustments

Any relevant forthcoming extraordinary corporate events that result in an adjustment to the indices are published by email via "Index Service".

The registration form is available on the SIX website. SIX accepts no liability for the E-Mail Service.

4.5 Trade Suspension and Market Distorsions

Should a data source (for example a price source) not be available as result of challenging economic conditions or other market distortions, the last available data will normally be used.

In extreme cases a deviation from the rules defined in this rulebook can occur.

All changes will be publicly announced at least two trading days in advance.

4.6   Index Corrections

Index corrections distinguish between calculation errors and incorrect input data.

Calculation errors detected within a trading day are corrected immediately. Intraday tick data are not corrected retrospectively.

Calculation errors that are older or based on erroneous input data are corrected if technically possible and economically viable. If significant differences exist, index values can also be corrected retrospectively.

Interested parties may subscribe to an e-mail notifications service on the website. SIX distributes notifications over this channel on

–   Changes in corporate actions and dividends
–   Updates to the periodic index reviews
–   Problems and error in the index calculation
–   The launch of new indices
–   General information on SMI indices

5 Trademark, Protection, Use and Licensing

5.1 Protection

The Indices Trademarks are **internationally registered trademarks** of SIX Swiss Exchange.

5.2 Licensing

5.2.1 Free Usage

The Indices Trademarks may be freely used for the purpose of honest reporting of the relevant index. Insofar as it is technically possible, the symbols ® and ™ should be used, possibly with a footnote stating that these names are registered trademarks of SIX Swiss Exchange, Zurich.

5.2.2 Usage Subject to License

Any additional use of the Indices Trademarks or any commercial use of the index figures (e.g., issue of index-linked financial instruments or capital insurance with or without mention of the trademark in the name or description) is only permissible with a valid licensing agreement.

Offering prospectuses must include the disclaimer which is available on the SIX website.

6   Contact

Information concerning the indices of SIX (index adjustments, announcements etc.) is available at the following Internet address:

http://www.six-group.com/indices

Any requests with respect to the indices may be directed to the following address:

SIX
Swiss Index
Pfingstweidstrasse 110
P.O. Box
CH-8021 Zurich

Email: indexsupport@six-group.com
Phone: +41 58 399 22 29

7 Static Data

7.1 Average and Current Rate

Name	Short Name	Symbol	ISIN
SAR Swiss Average Rate ON	SAR® ON	SARON	CH0049613687
SAR Swiss Average Rate TN	SAR® TN	SARTN	CH0049613703
SAR Swiss Average Rate SN	SAR® SN	SARSN	CH0049613711
SAR Swiss Average Rate 1W	SAR® 1W	SAR1W	CH0049613737
SAR Swiss Average Rate 2W	SAR® 2W	SAR2W	CH0049613745
SAR Swiss Average Rate 3W	SAR® 3W	SAR3W	CH0049613752
SAR Swiss Average Rate 1M	SAR® 1M	SAR1M	CH0049613760
SAR Swiss Average Rate 2M	SAR® 2M	SAR2M	CH0049613778
SAR Swiss Average Rate 3M	SAR® 3M	SAR3M	CH0049613786
SAR Swiss Average Rate 6M	SAR® 6M	SAR6M	CH0049613802
SAR Swiss Average Rate 9M	SAR® 9M	SAR9M	CH0049613810
SAR Swiss Average Rate 12M	SAR® 12M	SAR12M	CH0049613828
SAR Swiss Average Rate MAR	SAR® MAR	SARMAR	CH0049613836
SAR Swiss Average Rate JUN	SAR® JUN	SARJUN	CH0049613851
SAR Swiss Average Rate SEP	SAR® SEP	SARSEP	CH0049613869
SAR Swiss Average Rate DEC	SAR® DEC	SARDEC	CH0049613885
SCR Swiss Current Rate ON	SCR® ON	SCRON	CH0049613901
SCR Swiss Current Rate TN	SCR® TN	SCRTN	CH0049613919
SCR Swiss Current Rate SN	SCR® SN	SCRSN	CH0049613927
SCR Swiss Current Rate 1W	SCR® 1W	SCR1W	CH0049613935
SCR Swiss Current Rate 2W	SCR® 2W	SCR2W	CH0049613950
SCR Swiss Current Rate 3W	SCR® 3W	SCR3W	CH0049613968
SCR Swiss Current Rate 1M	SCR® 1M	SCR1M	CH0049613976
SCR Swiss Current Rate 2M	SCR® 2M	SCR2M	CH0049613984
SCR Swiss Current Rate 3M	SCR® 3M	SCR3M	CH0049613992
SCR Swiss Current Rate 6M	SCR® 6M	SCR6M	CH0049614008
SCR Swiss Current Rate 9M	SCR® 9M	SCR9M	CH0049614016
SCR Swiss Current Rate 12M	SCR® 12M	SCR12M	CH0049614024
SCR Swiss Current Rate MAR	SCR® MAR	SCRMAR	CH0049614032
SCR Swiss Current Rate JUN	SCR® JUN	SCRJUN	CH0049614040
SCR Swiss Current Rate SEP	SCR® SEP	SCRSEP	CH0049614057
SCR Swiss Current Rate DEC	SCR® DEC	SCRDEC	CH0049614065

7.2　Average and Current Index

Name	Short Name	Symbol	ISIN
Swiss Average Index ON	SAION®	SAION	CH0100517157
Swiss Current Index ON	SCION®	SCION	CH0100484986

A current list of all indices calculated by SIX is accessible at the SIX website:

https://www.six-group.com/exchanges/downloads/indexinfo/online/calculated_indices.xls

SIX

Pfingstweidstrasse 110

8005 Zurich

Switzerland

T +41 58 399 2111