

THOMSON REUTERS BENCHMARKS SERVICED LIMITED

THOMSON REUTERS WM/REUTERS FX BENCHMARKS

SPOT & FORWARD RATES
METHODOLOGY GUIDE

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ABOUT THIS DOCUMENT

BENCHMARK STATEMENT

Thomson Reuters provides an exchange rate service that publishes Spot, Forward and Non Deliverable Forward benchmark rates at fixed times throughout the global trading day. Thomson Reuters is committed to publishing independent and transparent benchmark rates which, based on its methodology, it believes are reasonably designed to be reflective of the market at the time of each fix. As part of its normal business practices, Thomson Reuters routinely reviews its policies and practices against appropriate international foreign exchange 'FX' benchmark regulations and guidance, in particular the IOSCO Principles.

CHAPTER 1 INTRODUCTION

1.1 HISTORY

The WM/Reuters Closing Spot Rates service was introduced in 1994 to provide a standard set of currency benchmark rates so that portfolio valuations could be compared with each other and their performance measured against benchmarks without having any differences caused by exchange rates. These rates were adopted by index compilers, the Financial Times and other users and became the de facto standard for Closing Spot Rates on a global basis.

In 1997, the WM/Reuters Closing Forward Rates service was launched to complement the Closing Spot Rates service.

In 2001, the WM/Reuters Intraday Spot Rate service was launched to extend the Spot rates product and meet customers' growing requirements. This service has since expanded to provide hourly spot rates from Monday 06:00 in Hong Kong/Singapore until Friday 22:00 in the UK.

In 2004, the WM/Reuters Intraday Forwards were launched at 08:00, 10:00, 12:00 and 14:00 UK time. Further enhancements have since seen this extended to an hourly service from 06:00 – 21:00 UK time with additional rates provided at 17:00 New York time, 10:00 and 16:00 Sydney time, 14:00 New Zealand time, 11:00 Singapore time and 11:00 Bangkok time.

In 2009, the WM/Reuters Non Deliverable Forwards (NDF) Rates were launched covering 12 currencies. The NDF service provides both Closing and Intraday Rates.

In 2012, the WM/Reuters Intraday Spot Rates service was further enhanced by the introduction of half-hourly fixes for the trade currencies only.

In 2014, the WM/Reuters Spot Rates service was enhanced to include the WM/Reuters Tokyo Fix covering 24 currencies against JPY, USD, GBP and EUR.

1.2 USE OF THE RATES

We believe the majority of the main equity and bond index compilers use the WM/Reuters exchange rates in their calculations, and the original uses of the rates in portfolio valuations and performance measurement are still very relevant. However, other uses of the rates have developed and are becoming increasingly important. For example, many customers now use the rates as a bench-mark for currencies in contracts of different kinds including the settlement of financial derivatives. Many banks will now provide a service to their customers whereby they will guarantee to trade certain currency pairs at, or by reference to, the WM/Reuters rates which is useful for investment customers if they are making changes to a portfolio bench-marked against an index that uses the WM/Reuters rates, and seeks to minimize any reconciliation differences from foreign exchange. Corporate users will find that it is very useful to value currency holdings held globally at a common rate, and if necessary, swap or trade them at the same rate. Using WM/Reuters' rates in this way can avoid using expensive resources to check the market continually. Auditors accept the WM/Reuters rates as independently fixed.

1.3 KEY POINTS

Benchmark Administration

Thomson Reuters is the benchmark administrator for the WM/Reuters Rates and thus has primary responsibility for all aspects of the benchmark determination process. This includes the development, determination and dissemination, operation and governance of the Spot, Forward and Non Deliverable Forward Rate services. This methodology document provides a summary of the methodology (including the validation process and certain tolerance checks applied therein) that Thomson Reuters uses to establish the benchmark rates. However, certain portions of the methodology and related intellectual property are proprietary and confidential and are therefore not publicly disclosed.

Active Market

Thomson Reuters recognises that to enable the publication of a meaningful benchmark a market in each currency pair represented by the benchmark must genuinely exist, and that market must be active. However, the economic realities of each applicable currency market will dictate the relative meaning of what 'active' means, as market liquidity can vary greatly from a liquid major currency to an extremely illiquid exotic currency for example, and at particular times of the day. In certain cases, Thomson Reuters defines an active market as having only a 'single source'. A list of these currencies can be provided upon request.

Data Sourcing

Thomson Reuters undertakes a periodic review of the appropriateness of using specific data suppliers to provide the data used in the calculation and validation of the benchmark rates. This review is intended to, among other things, assist in ensuring that the benchmark rates are (i) based on reliable and observable market data that reflect the economic realities of a given market, and (ii) that the benchmark rates themselves are reliable representations of the foreign exchange market.

There is no solicitation process to obtain underlying data, either by panel or by polling in the benchmark calculation process. Thomson Reuters uses transactional data entered into on an at arm's length basis between buyers and sellers in that market, where that data is available and reflects sufficient liquidity.

In a market where lower liquidity exists the benchmark may be based predominantly or exclusively on bid and offer rates, or from prior transactions.

Validation of Data

All captured rates and fix rates are subject to a number of tolerance checks with the intent of determining benchmark rates that are reflective of the underlying market at a given time. Thomson Reuters performs tolerance checks at the time the data is sourced and again after the calculation of the benchmark is complete. This may result in some captured data being excluded from the fix calculation. Currency and tenor specific systematic tolerances are reviewed periodically, annually as a minimum, by the Currency Review Group. This group supplements the routine monitoring and reporting of the prevailing market dynamics performed during the validation process by providing further scrutiny of the inputs and ex-post analysis of trends and outliers. The Currency Review Group is tasked with effecting and managing the change process with the intent of reflecting underlying market conditions.

Governance and Transparency

Thomson Reuters is subject to a corporate risk framework which is based on three lines of risk management:

1. Business procedures and controls are designed to promote consistency throughout the process.
2. The corporate risk framework applies independent governance, reporting and risk management.
3. The Board of directors and relevant subcommittee are responsible for oversight of the benchmark rates, including reviewing and advising on the policies and methodologies, by which Thomson Reuters calculates, administers and publishes the benchmark.

A Benchmark Oversight Committee (the "Oversight Committee") has been established to provide advice and challenge to the Benchmark administrator executive. The Oversight Committee's Terms of Reference document provides details of the responsibilities of the Oversight Committee and its current members. The terms of reference are available via the [following link](#). The Oversight Committee comprises members selected on the basis of their experience and knowledge.

Thomson Reuters performs periodic due diligence on third parties and data sources. Thomson Reuters welcomes all enquiries with regards to the determination of the benchmark.

Exercise of Thomson Reuters Employee Judgement

Employees of Thomson Reuters may exercise discretion with respect to the use of data in determining a benchmark. The calculation of the benchmark rate includes a validation process whereby, among other steps, employees of Thomson Reuters review data and fix rates pursuant to certain pre-determined tolerance checks. When applying tolerance checks, an employee has discretion (subject to internal policies and procedures) to include or reject certain data from the calculation of the benchmark rate. Based on Thomson Reuters' experience interpreting market data, Thomson Reuters will use its own judgement when it believes it necessary with the intent of ensuring the quality and integrity of the benchmark rate. In particular, Thomson Reuters may rely on its own judgement more frequently in an active albeit low liquidity market where transactions may not be consistently available. Thomson Reuters has in place internal guidelines and quality control procedures that govern the application of employee judgement and are intended to provide consistency and oversight to this process. Employees receive initial and on-going training in how to comply with these guidelines and procedures.

CHAPTER 2 WM/REUTERS SPOT RATES

2.1 COVERAGE

The rates are intended to cover the currencies for those countries that are included in a global or regional stock market index or where there is sufficient liquidity in the currency market to provide accurate fixings. The addition of currencies not meeting these criteria will be at the discretion of Thomson Reuters, and in theory, any world currency may be included.

The coverage of the WM/Reuters rates is shown under section 2.6, Closing and Intraday, and 2.7, Tokyo Fix.

The European legacy currencies (ATS, BEF, CYP, DEM, EEK, FRF, FIM, GRD, IEP, ITL, LTL, LUF, LVL, MTL, NLG, PTE, ESP, SIT and SKK) are included, but these are derived from the fixed conversion factor and the USD/EUR quote. An example of this calculation is included under section 6.2. The XEU (European Currency Unit — ECU) is also included, but this is equal to the euro value.

In addition to publishing rates at the hourly fixing times from Monday 06:00 Hong Kong/Singapore time to Friday 22:00 UK time, there is also WM/Reuters Closing Spot Rates (4 p.m. UK fix) history available since 1994 and the WM/Reuters Intraday History available since 2001.

2.2 TIMING

The normal calculation times are hourly from Monday 06:00 Hong Kong/Singapore to Friday 22:00 in the UK, with half-hourly rates provided for the 'trade currencies' only. See Section 2.3 for details of these 'trade currencies.' The Tokyo Fix is calculated at 9.55JST (00:55GMT), see section 2.7 for details of the currencies covered.

Different calculation times may be used for reasons that include the following:

- An earlier time is chosen by Thomson Reuters according to the policy on national holidays (see section 5.1).
- An earlier or later time is chosen by Thomson Reuters due to technical difficulties in receiving or failure in supply of the source financial data.
- An earlier or later time is chosen by Thomson Reuters for particular currencies due to special market conditions.

Thomson Reuters' target for completion of calculation and publication of the service is 15 minutes after the fix time.

The rates fixed at 4 p.m. UK time are the Closing Spot rates.

2.3 SOURCING

The Thomson Reuters Market Data System is the primary infrastructure used to source spot foreign exchange (FX) rates used in the calculation of the rates. Other systems may be used by exception where the appropriate rates are not available on the Thomson Reuters architecture. Presently, the Central Bank Spot Rate is used for a number of non-major currencies where there is no accurate alternative. A list of these currencies is available on request.

Thomson Reuters determines the appropriate data sources to be used on a per currency basis. This is reviewed periodically and clients will be advised prior to any material change being made.

The underlying rates used are those deemed to be the most appropriate for foreign investment transactions.

A different type of rate may be selected by Thomson Reuters for reasons that include the following:

- Commercial interbank bid and offer rates are not available for a particular currency.
- An "official" fixing is created that is more appropriate for foreign investment transactions.

Wherever possible, a multi-contributor source of rates is used in preference to a single contributor unless an "official" fixing is being used.

Where data sufficiency is limited, Thomson Reuters will use its own judgement to determine representative and meaningful market rates.

The “base” currency for quoted rates selected from the Thomson Reuters System is the US dollar or the euro, depending on which base currency is predominant. Presently, currencies which are predominantly based against the euro are CHF, CZK, DKK, HUF, NOK, PLN, RON and SEK. All other currencies are based against the US dollar. However, this may be changed for particular currencies if Thomson Reuters believes that more appropriate or representative quotations are available against a different base currency.

It is a convention in the FX markets that some currencies are quoted against the USD on an inverted basis. Normally, a local currency is expressed per 1USD: for example, 1USD = x.xxxx CAD. An inverted currency is expressed per local currency: for example, 1GBP = x.xxxx USD. Normally, a local currency amount would be divided by the exchange rate to get a USD amount, but for inverted currencies, the local currency amount is multiplied by the exchange rate to get a USD amount. This convention applies only to rates quoted against the USD, not rates quoted against any other currency. These inverted currencies are GBP, EUR, AUD, NZD, IEP, BWP, SBD, TOP, WST and XEU.

The following 22 currencies (AUD, CAD, CHF, CNH CZK, DKK, EUR, GBP, HKD, HUF, ILS, JPY, MXN, NOK, NZD, PLN, RON, RUB, SEK, SGD, TRY and ZAR) are referred to as “Trade Currencies.” Bona fide arm’s length transactional Trade and Order rates are sourced from the following highly liquid platforms; Thomson Reuters Matching, EBS and Currenex. The Trade and Order rates are used in the validation and calculation of these currencies.

The following 17 currencies have Thomson Reuters Matching as their source: AUD, CAD, CZK, DKK, GBP, HKD, HUF, ILS, MXN, NOK, NZD, PLN, RON, SEK, SGD, TRY and ZAR. CNH and RUB are sourced from Thomson Reuters Matching and EBS. EUR, CHF and JPY are sourced from EBS, Currenex and Thomson Reuters Matching: EUR, CHF and JPY.

The primary source of rates will be actual traded rates taken from Thomson Reuters Matching, EBS and Currenex, as detailed above “Traded rates/Trades”.

The secondary source of rates will be the rates on the order matching systems of Thomson Reuters Matching, EBS and Currenex “Order rates/Orders”.

Bank quotes from Reuters RICs will be captured for instances where neither Trades nor Orders are available.

The choice of rates for any particular currency lies with Thomson Reuters based on its own judgement. Other market sources may be used by Thomson Reuters for quality control purposes.

All other currencies not identified above as 'trade' currencies can be assumed to be 'non trade'.

2.4 CALCULATION METHOD

The FX market is constantly monitored by capturing rates every 15 seconds and performing continuous and interactive validation.

The captured market data is subject to currency specific systematic tolerance checks which will identify outlying data. Validation is performed on the outlying data by Operations Specialists, who will seek corroboration, or rely upon their own judgement to determine the market level. The benchmark fix is then subject to further currency specific tolerance checks prior to publication. The use of Thomson Reuters’ own judgement may be appropriate to assess the validity of rates throughout this process, with quality control guidelines and procedures governing each application of such judgement.

2.4.1 Non-Trade Currencies

Over a five minute fix period snapshots of the quoted rates are taken from Thomson Reuters. These are extracted at 15 second intervals from 2 minutes 30 seconds before to 2 minutes 30 seconds after the fix time.

The median bid and offer rates are independently calculated from the individual snapshots for each currency. These bid and offer rates are validated prior to publication, against currency specific thresholds and this may result in expert judgement being applied.

2.4.2 Traded Rates

Over a five-minute fix period, actual trades executed and bid and offer order rates from the order matching systems are captured every second from 2 minutes 30 seconds before to 2 minutes 30 seconds after the time of the fix. Trading occurs in milliseconds on the trading platforms and therefore not every trade or order is captured, just a sample.

From each data source, a single traded rate will be captured – this will be identified as a bid or offer depending on whether the Trade is a buy or sell. A spread will be applied to the Trade rate to calculate the opposite bid or offer. The spread applied will be determined by the Order rate captured at the same time. All captured Trades will be subjected to validation checks. This may result in some captured data being excluded from the fix calculation.

Valid Trades from all sources captured during the fix period will be “pooled” together. Subject to a minimum number of valid Trades being present within this pool of data – the Trade rates will be used for the fix. A median Trade bid and Trade offer are calculated independently, using data from the single pool of trades across data sources. The mid-rate is calculated from the median Trade bid and Trade offer. A minimum standard spread is applied to the mid-rate to calculate a new bid and offer. These bid, offer and mid rates will be validated prior to publication, against currency specific tolerance thresholds, and this may result in expert judgement being applied.

If there are insufficient valid Trade rates from the pooled data sources, to be used in the fix then Order rates will be used. From each data source, the best bid and best offer rates will be captured simultaneously to the Trade data from each data source. All captured Order rates will be subjected to validation checks. This may result in some captured data being excluded from the fix calculation.

Order rates from different sources will not be pooled together. Using valid Order rates, a median bid and offer are calculated independently, for each data source. The mid-rate is calculated from the median Order bid and Order offer. A minimum standard spread is applied to the mid-rate to calculate a new bid and offer. The bid, offer and mid rates from the data source with the highest valid Orders over the fix period will be selected as the rates for publication. Consequently the data source to be used will be driven by the market. These bid and offer rates will be validated prior to publication, against currency specific tolerance thresholds, and this may result in expert judgement being applied.

In the event that two or more data sources have an equal number of valid Orders, then an average of the mid-rate from these data sources will be used.

In the event that two or more data sources have a single Order only, the most up to date Order rates will be used.

Standard Spreads

Pre-defined standard spreads are set for each currency at each fix to reflect liquidity at different times of day.

In order to reflect volatile market conditions, if the market dictates wider spreads than the standard spread then this will be represented in the fix – up to a maximum.

2.4.3 Local Close Currencies

For currencies where offshore trading is not permitted, the spot rates are published in line with local market levels. This means that when local markets are opened, the published spot rates will reflect activity in that market. When the local market closes, the spot rates published in each subsequent fix remain unchanged. This impacts the following currencies. Please note that the “Open Time” and “Close Fix” for each currency are subject to change.

ISO	OPEN TIME	CLOSE FIX
CNY	01:15 GMT	09:00 GMT
IDR/IDT	01:15 GMT	09:00 GMT

INR	03:15 GMT	11:00 GMT
KRW	23:15 GMT	07:00 GMT
MYR	23:15 GMT	10:00 GMT
PHP	00:15 GMT	08:00 GMT
THB	00:15 GMT	10:00 GMT
TWD	00:15 GMT	07:00 GMT
BRL	11:00/12:00GMT*	20:00/21:00GMT*

*Dependent on Local Daylight Saving Time

The method of fixing the rates is protected by a patent awarded in 2008, US serial 09/972,193.

Once the rates have been validated, cross rates to GBP and EUR are calculated. An example of these calculations is included under section 6.1. For currencies where the market convention is for the spot date to be T+1, no adjustment is made and the calculation is performed as if both currencies are T+2. Likewise no adjustment is made in the cross calculation when market holidays are observed in either currency.

Cross rates to further base currencies may be published, and if so, these will be calculated using the same principles.

The validation process used is protected by the patent detailed above.

Certain rates are calculated from other currencies or from proportions of other currencies, for example, XDR (Special Drawing Rights).

All rates are published using standard market quotation conventions. ISO codes are used.

Bid, offer and mid rates are derived. Mid rates are calculated as the arithmetic mean of rounded bid and offer rates. Bid and offer rates are published to four decimal places; the mid rates are published to five decimal places. Where a "5" is encountered, the convention is to round up.

2.5 SPOT RATE PRODUCTS

- Closing Spot Rates
- Historical Spot Rates
- Intraday Spot Rates
- Tokyo Fix Rates

2.6 COVERAGE OF CLOSING AND INTRADAY SPOT RATES

Coverage is currently in the following 155 currencies,

Europe					
Albania Lek	ALL	Austrian Schilling	ATS	Belarus Ruble	BYN
Belgian Franc	BEF	Bosnia Herzegovina Mark	BAM	Bulgarian Lev	BGN
Croatian Kuna	HRK	Cyprus Pound	CYP	Czech Koruna	CZK
Danish Krone	DKK	Estonian Kroon	EEK	ECU	XEU
Euro	EUR	Finnish Markka	FIM	French Franc	FRF
Deutsche Mark	DEM	Greek Drachma	GRD	Hungarian Forint	HUF
Iceland Krona	ISK	Irish Punt	IEP	Italian Lira	ITL
Latvian Lat	LVL	Lithuanian Litas	LTL	Luxembourg Franc	LUF
Macedonia Denar	MKD	Maltese Lira	MTL	Moldova Leu	MDL
Dutch Guilder	NLG	Norwegian Krone	NOK	Polish Zloty	PLN
Portugese Escudo	PTE	Romanian Leu	RON	Russian Ruble	RUB
Slovakian Koruna	SKK	Slovenian Tolar	SIT	Spanish Peseta	ESP

British Pound	GBP	Swedish Krona	SEK	Swiss Franc	CHF
Turkish New Lira	TRY	Ukraine Hryvnia	UAH	Serbian Dinar	RSD
Special Drawing Rights	XDR				

Africa & Gulf

Algerian Dinar	DZD	Angola Kwanza	AOA	Bahrain Dinar	BHD
Botswana Pula	BWP	Burundi Franc	BIF	Central African Franc	XAF
Comoros Franc	KMF	Congo Dem. Rep. Franc	CDF	Cote D'Ivoire Franc	XOF
Egyptian Pound	EGP	Ethiopia Birr	ETB	Gambian Dalasi	GMD
Ghana Cedi	GHS	Guinea Franc	GNF	Kenyan Shilling	KES
Israeli Shekel	ILS	Jordanian Dinar	JOD	Lesotho Loti	LSL
Kuwaiti Dinar	KWD	Lebanese Pound	LBP	Mauritanian Ouguiya	MRO
Malagasy Ariary	MGA	Malawi Kwacha	MWK	Mozambique Metical	MZN
Mauritius Rupee	MUR	Moroccan Dirham	MAD	Omani Rial	OMR
Namibia Dollar	NAD	Nigerian Naira	NGN	Saudi Arabian Riyal	SAR
Qatar Rial	QAR	Rwanda Franc	RWF	South African Rand	ZAR
Seychelles Rupee	SCR	Sierra Leone Leone	SLL	Tanzania Shilling	TZS
Tunisian Dinar	TND	Swaziland Lilangeni	SZL	Ugandan Shilling	UGX
Yemen Rial	YER	UAE Dirham	AED	New Zambian Kwacha	ZMW
Zim Dollar Notional	ZDN				

Asia-Pacific

Australian Dollar	AUD	Azerbaijan Manat	AZN	Bangladesh Taka	BDT
Bhutan Ngultrum	BTN	Brunei Dollar	BND	Chinese R. Yuan	CNY
Chinese R. Yuan HK	CNH	Fiji Islands Dollar	FJD	Georgia Lari	GEL
Hong Kong Dollar	HKD	Indian Rupee	INR	Kazakhstan Tenge	KZT
Indonesian Onshore Traded	IDT	Japanese Yen	JPY	Malaysian Ringgit	MYR
Kyrgystan Som	KGS	Macao Pataca	MOP	Nepal Rupee	NPR
Maldives Rufiyaa	MVR	Mongolia Tugrik	MNT	Pakistani Rupee	PKR
New Zealand Dollar	NZD	Pacifique Franc	XPF	Samoa Tala	WST
Papua NG Kina	PGK	Philippine Peso	PHP	South Korean Won	KRW
Singapore Dollar	SGD	Solomon Islands Dollar	SBD	Thai Baht	THB
Sri Lanka Rupee	LKR	Taiwan Dollar	TWD	Uzbekistan Som	UZS
Thai Baht Offshore	TOF	Tonga Pa'anga	TOP	Vanuatu Vatu	VUV
Vietnam Dong	VND				

Americas

Argentine Peso	ARS	Aruba Guilder	AWG	Bahamas Dollar	BSD
Barbados Dollar	BBD	Belize Dollar	BZD	Bermudan Dollar	BMD
Bolivian Boliviano	BOB	Brazilian Real	BRL	Canadian Dollar	CAD
Cayman Islands Dollar	KYD	Chilean Peso	CLP	Colombian Peso	COP
Costa Rica Colon	CRC	Cuba Peso	CUP	Dominican Republic Peso	DOP
East Caribbean Dollar	XCD	Ecuadorian Sucre	ECS	El Salvador Colon	SVC
Guatemala Quetzal	GTQ	Haiti Gourde	HTG	Honduras Lempira	HNL
Jamaica Dollar	JMD	Mexican Peso	MXN	Netherlands Antilles Guilder	ANG
Nicaragua Gold Cordoba	NIO	Panama Balboa	PAB	Paraguay Guarano	PYG
Peru New Sol	PEN	Surinam Dollar	SRD	Trinidad & Tobago Dollar	TTD
Uruguay Peso	UYU	US Dollar	USD	Venezuelan Bolivar	VEF

2.7 COVERAGE OF TOKYO FIX

Coverage is currently in the following 24 currencies:

Europe

Czech Koruna	CZK	Danish Krone	DKK	Euro	EUR
Hungarian Forint	HUF	Norwegian Krone	NOK	Polish Zloty	PLN
Romanian Leu	RON	Russian Rouble	RUB	Sterling	GBP
Swedish Krone	SEK	Swiss Franc	CHF	New Turkish Lira	TRY

Africa & Gulf

Israeli Shekel	ILS	South African Rand	ZAR
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Asia-Pacific

Australian Dollar	AUD	Chinese R. Yuan HK	CNH	Hong Kong Dollar	HKD
Japanese Yen	JPY	New Zealand Dollar	NZD	Singapore Dollar	SGD
Thai Baht	THB				

Americas

Canadian Dollar	CAD	Mexican Peso	MXN	US Dollar	USD
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CHAPTER 3 WM/REUTERS FORWARD RATES

3.1 COVERAGE

The rates are intended to cover the currencies for those countries where a significant level of forward trading exists in the country's currency and where forward quotes are reliably available on Thomson Reuters.

The coverage is presently 80 currencies and is periodically reviewed as more information is made available in the market.

Bid, offer and mid rates against the USD, GBP and EUR are provided. A list of currencies covered is under section 3.6.

The time periods covered for the forward rates are:

- ON Overnight
- TN Tomorrow Next
- SW Spot Week (One Week)
- 1M One Month
- 2M Two Months
- 3M Three Months
- 6M Six Months
- 9M Nine Months
- 1Y One Year
- 2Y Two Years (Some Currencies Only)
- 5Y Five Years (Some Currencies Only)

3.2 TIMING

The rates are intended to be "intraday and closing" rates. The normal calculation times are hourly from 06:00 to 21:00 UK time Monday to Friday. In addition, Thomson Reuters publishes at 17:00 hours New York time, 10:00 hours Sydney time, 14:00 hours New Zealand time, 11:00 hours Singapore time, 11:00 Bangkok time and 16:00 hours Sydney time.

A different calculation time may be used for reasons that include the following:

- An earlier time is chosen by Thomson Reuters according to the policy on national holidays (see section 5.2).
- An earlier or later time is chosen by Thomson Reuters due to technical difficulties in receiving or failure in supply of the source financial data.
- An earlier or later time is chosen by Thomson Reuters for particular currencies due to special market conditions.

Target time for the publication of the service is 30 minutes after the fix time.

The rates fixed at 4 p.m. UK time are the Closing Forward rates.

3.3 SOURCING

The Thomson Reuters Market Data System is the sole source of the forward FX rates used in the calculation of the rates. Other sources may be used by exception where the appropriate rates are not available on the Thomson Reuters architecture System.

As far as possible, the underlying rates used are those deemed to be the most appropriate for foreign investment transactions. These will normally be commercial interbank bid and offer premiums or discounts.

A different type of rate may be selected by Thomson Reuters if commercial interbank bid and offer rates are not available for a particular currency.

The “base” currency for rates selected from the Thomson Reuters System will normally be the US dollar. However, this may be changed for particular currencies if Thomson Reuters believes that more appropriate or representative quotations are available against a different base currency.

The choice of rates for any particular currency lies with Thomson Reuters and other market sources are used by Thomson Reuters for quality control purposes.

Some currencies are NDF (Non-Deliverable Forwards). The premium/discount NDF currencies, included in the Forwards services are ARS, BRL, CLP, COP, EGP and PEN. Also, due to there being distinct “onshore” and “offshore” forward rates for SGD, we provide offshore rates. For Thailand, we provide both onshore rates, THB, and offshore rates, TOF.

Where data sufficiency is limited, Thomson Reuters will use its own judgement to determine representative and meaningful market rates.

Thomson Reuters also provides outright NDF Rate services, detailed in section 4.

3.4 CALCULATION METHOD

The FX Forward market is constantly monitored by capturing rates every 2 minutes and performing continuous and interactive validation. The captured market data is subject to currency specific systematic tolerance checks which identify outlying data. Validation is performed on the outlying data by Operations Specialists, who will seek corroboration, or rely upon their own judgement to determine the market level. On the hour a snapshot of quoted rates is taken for each tenor, and considered the benchmark fix, subject to further currency specific tolerance checks prior to publication.

The use of such judgement may be appropriate to assess the validity of rates throughout this process, with quality control guidelines and procedures governing each application of such judgement.

Once the rates have been validated, premiums and discounts to GBP and EUR are calculated using the outright forward rates; an example of this is under section 6.3. Legacy currency premium/discounts are calculated using the fixed euro conversion rates; an example is shown under section 6.4. Further base currencies may be published, and if so, these will be calculated using the same principles.

All forward rates are published using premiums or discounts that can be directly added to the spot rate to provide an outright forward rate. Note that ON and TN premiums/discounts should be subtracted from the spot rate to calculate an outright forward rate. ISO codes are used.

All forward rates (bid, offer and mid) are rounded to five decimal places after the decimal point. Where a “5” is encountered, the convention is to round up.

3.4.1 Local Close Currencies

For currencies where offshore trading is not permitted, the forward rates are published in line with local market levels. This means that when local markets are opened, the published forward rates will reflect activity in that market. When the local market closes, the forward rates published in each subsequent fix remain unchanged.

This impacts the following currencies. Please note that the “Open Time” and “Close Fix” for each currency are subject to change.

ISO	OPEN TIME	CLOSE FIX
CNY	01:15 GMT	09:00 GMT
IDR	01:15 GMT	09:00 GMT
INR	03:15 GMT	11:00 GMT
KRW	23:15 GMT	07:00 GMT
MYR	23:15 GMT	10:00 GMT
PHP	00:15 GMT	08:00 GMT
THB	00:15 GMT	10:00 GMT
TWD	00:15 GMT	07:00 GMT

The method of fixing the rates is protected by a patent awarded in 2008, US serial 2002–0042765.

3.5 FORWARD RATE PRODUCTS

- Closing Forward Rates
- Historical Forward Rates
- Intraday Forwards Rates

3.6 COVERAGE OF FORWARD RATES

Coverage is currently in the following 80 currencies:

Europe					
Austrian Schilling	ATS	Belgian Franc	BEF	Bulgarian Lev	BGN
Croatian Kuna	HRK	Cyprus Pound	CYP	Czech Koruna	CZK
Danish Krone	DKK	Estonian Kroon	EEK	Ecu	XEU
Euro	EUR	Finnish Markka	FIM	French Franc	FRF
Deutsche Mark	DEM	Greek Drachma	GRD	Hungarian Forint	HUF
Iceland Krona	ISK	Irish Punt	IEP	Italian Lira	ITL
Latvian Lat	LVL	Lithuanian Litas	LTL	Maltese Lira	MTL
Dutch Guilder	NLG	Norwegian Krone	NOK	Polish Zloty	PLN
Portuguese Escudo	PTE	Romanian Leu	RON	Russian Rouble	RUB
Serbian Dinar	RSD	Slovakian Koruna	SKK	Slovenian Tolar	SIT
Spanish Peseta	ESP	British Pound	GBP	Swedish Krone	SEK
Swiss Franc	CHF	New Turkish Lira	TRY		

Africa & Gulf					
Bahrain Dinar	BHD	Botswana Pula	BWP	Egyptian Pound	EGP
Ghana Cedi	GHS	Israeli Shekel	ILS	Jordanian Dinar	JOD
Kenyan Shilling	KES	Kuwaiti Dinar	KWD	Moroccan Dirham	MAD
Omani Rial	OMR	Qatar Rial	QAR	Nigerian Naira	NGN
South African Rand	ZAR	Tunisian Dinar	TND	Saudi Arabian Riyal	SAR
Ugandan Shilling	UGX	New Zambian Kwacha	ZMW	UAE Dirham	AED

Asia-Pacific					
Australian Dollar	AUD	Chinese R. Yuan	CNY	Chinese R. Yuan HK	CNH
Hong Kong Dollar	HKD	Indian Rupee	INR	Indonesian Rupiah	IDR
Japanese Yen	JPY	Kazakhstan Tenge	KZT	Malaysian Ringgit	MYR
New Zealand Dollar	NZD	Pakistani Rupee	PKR	Philippine Peso	PHP
Singapore Dollar	SGD	S. Korean Won	KRW	Sri Lanka Rupee	LKR
Taiwan Dollar Vietnam Dong	TWD VND	Thai Baht	THB	Thai Baht Offshore	TOF

Americas

Argentine Peso	ARS	Brazilian Real	BRL	Canadian Dollar	CAD
Chilean Peso	CLP	Colombian Peso	COP	Mexican Peso	MXN
Peru New Sol	PEN	US Dollar	USD		

CHAPTER 4 WM/REUTERS NDF RATES

4.1 COVERAGE

The rates are intended to cover the emerging market currencies that do not allow trading out with the local market.

The coverage is presently 11 currencies and is periodically reviewed as more information is made available. Bid, offer and mid outright rates are published against USD, GBP and EUR. A list of currencies covered is under section 4.6.

The time periods covered for NDF rates are:

- SW Spot Week (One Week)
- 1M One Month
- 2M Two Months
- 3M Three Months
- 6M Six Months
- 9M Nine Months
- 1Y One Year
- 2Y Two Years (Some Currencies Only)
- 5Y Five Years (Some Currencies Only)

4.2 TIMING

The rates are intended to be “intraday and closing” rates. The normal calculation times are hourly from 06:00 to 21:00 UK time Monday to Friday. In addition, we publish at 17:00 hours New York time, 10:00 hours Sydney time, 14:00 hours New Zealand time, 11:00 hours Singapore time, 11:00 Bangkok time and 16:00 hours Sydney time.

A different calculation time may be used for reasons that include:

- An earlier time is chosen by Thomson Reuters according to the policy on national holidays (see section 5.2).
- An earlier or later time is chosen by Thomson Reuters due to technical difficulties in receiving or failure in supply of the source financial data.
- An earlier or later time is chosen by Thomson Reuters for particular currencies due to special market conditions.

Thomson Reuters’ target for completion of calculation and publication of the service is 30 minutes after the fix times.

The rates fixed at 4 p.m. UK time are the Closing NDF rates.

4.3 SOURCING

Thomson Reuters Market Data System is the sole source of NDF FX rates used in the calculation of the NDF rates. Other sources may be used by exception where the appropriate rates are not available on the Thomson Reuters architecture.

As far as possible, the underlying rates used are those deemed to be the most appropriate for foreign investment transactions. These will normally be commercial interbank bid and offer NDF.

The “base” currency for rates selected from the Thomson Reuters System will normally be the US dollar. However this may be changed for particular currencies if Thomson Reuters believes more appropriate or representative quotations are available against a different base currency.

The choice of rates for any particular currency lies with Thomson Reuters and other market sources are used by Thomson Reuters for quality control purposes. Where data sufficiency is limited, Thomson Reuters will use its own judgement to determine representative and meaningful market rates

4.4 CALCULATION METHOD

The FX Non Deliverable Forward market is constantly monitored by capturing rates every 2 minutes and performing continuous and interactive validation. The captured market data is subject to currency specific systematic tolerance checks which identify outlying data. Validation is performed on the outlying data by Operations Specialists, who will seek corroboration, or rely upon their own judgement to determine the market level. On the hour a snapshot of quoted rates is taken for each tenor, and considered the benchmark fix, subject to further currency specific tolerance checks prior to publication.

The use of Thomson Reuters' own judgement may be appropriate to assess the validity of rates throughout this process, with quality control guidelines and procedures governing each application of such judgement.

Once the rates have been validated, outright rates to GBP and EUR are calculated; an example of this is under section 6.5.

All NDF rates (bid, offer and mid) are rounded to five decimal places after the decimal point. Where a "5" is encountered, the convention is to round up.

The method of fixing the rates is protected by a patent awarded in 2008, US serial 2002-0042765.

4.5 NDF RATE PRODUCTS

- Closing NDF Rates
- Historical NDF Rates
- Intraday NDF Rates

4.6 COVERAGE OF NDF RATES

Coverage is currently in the following 11 currencies:

Europe

Russian Rouble	RUBNDF	Ukraine Hryvnia	UAHNDF
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Africa & Gulf

Nigerian Naira	NGNNDF
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Asia-Pacific

Chinese R. Yuan	CNYNDF	Indian Rupee	INRNDF	Indonesian Rupiah	IDRNDF
Kazakhstan Tenge	KZTNDF	Malaysian Ringgit	MYRNDF	Philippine Peso	PHPNDF
South Korean Won	KRWNDF	Taiwanese Dollar	TWDNDF		

CHAPTER 5 THE SPOT & FORWARD RATES

5.1 POLICY ON NATIONAL HOLIDAYS

The fixings will be produced on all weekdays of the year, subject to the policy detailed below. For further information, there is a schedule available that covers the service alterations up to five years in advance.

[Click here to view](#)

On national holiday dates, the principle is that the rates should be fixed at the normal times up to the latest fix time possible without compromising the quality of the rates.

In practice, national holidays in the following four financial centres will be monitored in advance: US, UK, Germany and Japan. WM/Reuters Closing Spot and Forward Rates will be produced as normal if two or more of these centres are open. WM/Reuters Intraday Spot and Forward Rates may not be produced for all fixings in any day if one or more of these financial centres are closed.

If only one centre is open, the normal policy will be that no fixings will be produced and the rates from the previous fixing would be used. However, if such a situation occurs on a month- end, then further analysis will be carried out as to other markets that are open and a decision taken as to whether or not to produce fixings.

Special circumstances may arise on the last weekdays prior to Christmas and New Year's where although markets are open, they may close early and therefore be illiquid at some normal fixing times. Under these circumstances, Thomson Reuters may take a decision to revert to an earlier fixing with the intent of ensuring the integrity of the rates.

5.2 DISRUPTION TO SERVICE

Thomson Reuters has robust controls and resilience architecture in place and where necessary, Thomson Reuters will invoke these controls to minimise any disruption to the service. Thomson Reuters has procedures in place to minimise the impact of a potential failover, but in exceptional circumstances it may not be possible for Thomson Reuters to produce an accurate benchmark rate. When this arises Thomson Reuters will notify clients as early as possible. Following any such incident, Thomson Reuters will undertake a full investigation and consider any remediation steps identified.

5.3 DISRUPTION TO FX RATES

Thomson Reuters appreciates that economic realities could from time to time disrupt normal market conditions and could create unusually illiquid or fragmented markets. When this occurs Thomson Reuters will use reasonable effort to provide an email notification to clients advising the nature and impact of the disruption. If you wish to receive these notifications please contact: wmreuters.sales@thomsonreuters.com

Where the disruption extends into the longer term, Thomson Reuters will use commercially reasonable efforts to identify additional solutions to provide a benchmark rate which is representative of the market.

5.4 CESSATION

Thomson Reuters accepts that it may be necessary to terminate the calculation and publication of a benchmark, currency or tenor currently provided within the WM/Reuters service. This may be due to external factors beyond Thomson Reuters' control, for example a market structure change or to a deterioration of data sufficiency. Thomson Reuters will consult with subscribers and work to identify whether a credible alternative which continues to represent the underlying interest can be identified.

If a credible alternative is identified then Thomson Reuters will endeavour to assess the viability of that alternative fully, again consulting with subscribers, as appropriate. If cessation is unavoidable Thomson Reuters will endeavour to assist subscribers in the selection process of an alternative benchmark. Contracts and other financial instruments that reference a benchmark need robust contingency provisions in the event of material changes to, or cessation of, the referenced benchmark. Please refer to our [Cessation of Rates Policy](#)

5.5 COMPLAINTS PROCEDURE

Clients are invited to raise price challenges or other queries or complaints through our mailbox wmreuters.ops@thomsonreuters.com. Each price challenge will be investigated in line with our [Price Challenge and Complaints Handling Policy](#). Other inquiries and complaints will be addressed pursuant to the appropriate internal guidelines or policies.

5.6 REPUBLICATION OF RATES

Under exceptional circumstances, it may be necessary to amend the rates for one or more currencies after publication. This will be determined by Thomson Reuters, after consultation with key users, if appropriate. Under no circumstances will the WM/Reuters Spot or Forward Rates for one day be amended after the publication of the following weekday's rates at the same publication time.

All material evidence will be retained as part of our [Republication Policy](#)

5.7 CHANGES TO METHODOLOGY AND SERVICE

From time to time Thomson Reuters may be required to make a material change to the methodology, including changes to its tolerances and validation process. A material methodology change is defined as a change which fundamentally alters the process by which a benchmark rate is calculated. A service change includes an amendment to currency coverage and the availability of particular fixes.

Prior to a methodology or service change the WM/Reuters Operations Management and Research and Development Executive teams will perform due diligence on the rationale for the proposed change and will consult with subscribers, where appropriate, before finalising the Proposal report. In addition, this report will be presented to the Benchmark Oversight Committee.

We endeavour to provide a reasonable notice period of any change to our methodology or service, up to 90 days wherever practicable.

For more information on changes to our methodology or service, please refer to our [Changes to the Methodology and Service Policy](#)

5.8 DELIVERY METHODS

All services are available directly from Thomson Reuters on an hourly or daily basis utilising Web-based technology. These delivery methods range from e-mail to faster methods for time-critical applications.

Also, the services are available via a range of data distributors including (in alphabetical order):

- Bloomberg
- Interactive Data Pricing and Reference Data
- Linedata
- Markit
- Morningstar
- Nomura Research Institute
- NTT Data Financial
- Proquote
- Rimes Technologies
- SIX Financial Information
- SunGard GL Trade
- Thomson Reuters (Including Eikon and Datastream)
- SunGard Asset Arena Pricing Services (Valuelink)

CHAPTER 6 CROSS CALCULATIONS

6.1 CROSSED SPOT RATES

6.1.1 For Currencies Quoted in Units to USD (For Example, CAD)

Sterling Cross Calculation

$$\text{GBP/CAD bid} = (\text{USD/CAD bid}) * (\text{GBP/USD bid})$$

$$\text{GBP/CAD offer} = (\text{USD/CAD offer}) * (\text{GBP/USD offer})$$

Euro Cross Calculation

$$\text{EUR/CAD bid} = (\text{USD/CAD bid}) * (\text{EUR/USD bid})$$

$$\text{EUR/CAD offer} = (\text{USD/CAD offer}) * (\text{EUR/USD offer})$$

6.1.2 For Currencies Quoted in USD per Unit (For Example, AUD)

Sterling Cross Calculation

$$\text{GBP/AUD bid} = (\text{GBP/USD bid}) / (\text{AUD/USD offer})$$

$$\text{GBP/AUD offer} = (\text{GBP/USD offer}) / (\text{AUD/USD bid})$$

Euro Cross Calculation

$$\text{EUR/AUD bid} = (\text{EUR/USD bid}) / (\text{AUD/USD offer})$$

$$\text{EUR/AUD offer} = (\text{EUR/USD offer}) / (\text{AUD/USD bid})$$

6.1.3 For Currencies Quoted in Units to EUR (For Example, CHF)

USD Cross Calculation

$$\text{USD/CHF bid} = (\text{EUR/CHF bid}) / (\text{EUR/USD offer})$$

$$\text{USD/CHF offer} = (\text{EUR/CHF offer}) / (\text{EUR/USD bid})$$

Sterling Cross Calculation

$$\text{GBP/CHF bid} = (\text{USD/CHF bid}) * (\text{GBP/USD bid})$$

$$\text{GBP/CHF offer} = (\text{USD/CHF offer}) * (\text{GBP/USD offer})$$

6.2 EMU LEGACY SPOT RATES

The same principle applies for all legacy currencies. DEM is used in the formulas below:

USD/DEM Bid Rate Calculation

Invert the EUR/USD offer rate; this now becomes the USD/EUR bid.

Then:

$$\text{USD/DEM bid} = \text{USD/EUR bid} * \text{EUR fixed conversion rate}$$

USD/DEM Offer Rate Calculation

Invert the EUR/USD bid rate; this now becomes the USD/EUR offer rate.

Then:

$$\text{USD/DEM offer} = \text{USD/EUR offer} * \text{EUR fixed conversion rate}$$

6.3 CROSSED FORWARD RATES

Example of How to Calculate the GBP/CAD 1M (One Month) Bid Premium/Discount

Use the bid rate for all of the following calculations:

- Add the USD/CAD 1M premium/discount to the USD/CAD spot rate
= the USD/CAD 1M outright forward rate
- Add the GBP/USD 1M premium/discount to the GBP/USD spot rate.
= the GBP/USD 1M outright forward rate
- Multiply these two outright forward rates together
= the GBP/CAD 1M outright rate
- GBP/CAD 1M outright forward rate – GBP/CAD spot rate
= GBP/CAD 1M premium/discount Therefore:
- USD/CAD 1M premium/discount bid + USD/CAD spot bid
= USD/CAD 1M outright rate bid
- GBP/USD 1M premium/discount bid + GBP/USD spot bid
= GBP/USD 1M outright rate bid
- USD/CAD 1M outright rate bid * GBP/USD 1M outright rate bid
= GBP/CAD 1M outright rate bid
- GBP/CAD 1M outright rate bid – GBP/CAD spot bid
= GBP/CAD 1M premium/discount bid

6.4 EMU LEGACY FORWARD RATES

Example of How to Calculate the USD/DEM 1M Bid Premium/Discount

- Add the EUR/USD 1M ask premium/discount to the EUR/USD ask spot rate
= the EUR/USD 1M outright ask forward rate
- Invert EUR/USD; this ask figure now becomes the bid
= USD/EUR 1M outright bid forward rate
- Multiply the newly created USD/EUR bid rate and the EUR/DEM fixed conversion rate
= the USD/DEM 1M outright bid rate
- USD/DEM 1M outright bid rate – USD/DEM spot bid rate
= USD/DEM 1M bid premium/discount rate Therefore:
- EUR/USD 1M premium/discount ask + EUR/USD spot ask
= EUR/USD 1M outright rate ask
- USD/EUR * EUR/DEM conversion rate
= USD/DEM 1M outright bid
- USD/DEM 1M outright rate bid – USD/DEM spot bid rate
= USD/DEM 1M bid premium/discount forward rate

6.5 CROSSED NDF RATES

Example of How to Calculate the GBP/CNYNDF 1M Bid Outright Use the bid rate for all of the following calculations:

- Add the GBP/USD 1M premium/discount to the GBP/USD spot rate
= the GBP/USD 1M outright forward rate
- Multiply USD/CNYNDF 1M outright bid * GBP/USD 1M outright bid
= GBP/CNYNDF 1M outright rate Therefore:
- GBP/USD 1M premium/discount bid + GBP/USD spot bid
= GBP/USD 1M outright bid
- USD/CNYNDF 1M outright rate bid * GBP/USD 1M outright bid
= GBP/CNYNDF 1M outright rate bid

CHAPTER 7 GLOSSARY

- **Arm's Length Transaction** – as defined by the IOSCO Principles, this refers to a transaction between two parties that is concluded on terms that are not influenced by a conflict of interest.
- **Benchmark** – a standard against which foreign exchange rates may be measured.
- **Benchmark Oversight Committee** – established to perform oversight of the WM/Reuters spot, forward and non-deliverable forward rate Benchmarks and Thomson Reuters' role as administrator of the Benchmark Rates. It will also be responsible for reviewing and advising on the policies and methodologies by which Thomson Reuters calculates, administers and publishes the Benchmark Rates, including for the avoidance of doubt, any cessation of Benchmark Rates.
- **Bona Fide** – as defined by the IOSCO Principles, this refers to data where the parties submitting the data have executed, or are prepared to execute, transactions generating such data and the concluded transactions were executed at arm's length from each other.
- **Closing Rate** – Thomson Reuters defines 4pm London as the Closing Rate Fix.
- **Economic Realities** – the appreciation that the availability, depth and quality of market data will vary from one market to another depending on the evolution and liquidity available within that market.
- **Interbank** – conducted between or involving two or more banks.
- **Intraday Rate** – Thomson Reuters produces benchmark fixings throughout the day; all fixes except the Closing Rate Fix are referred to as Intraday.
- **Inverted** – when a currency's market quotation is shown as the number of US dollars required to buy one unit of foreign currency, also known as 'American terms' or 'Direct'.
- **Non Inverted** – when a currency's market quotation is shown as the number of foreign currency required to buy one USD. Also known as 'European terms' or 'Indirect'.
- **IOSCO Principles** – 'The Principles for Financial Benchmarks' as at July 2013, published by The Board of the International Organization of Securities Commissions.
- **Local Close Currencies** – currencies identified by Thomson Reuters where offshore trading is not permitted. Rates are only published during local market opening hours, with no further updates permitted to the fix rate once that market closes.
- **Multi Contributor Rate** – a composite feed from Thomson Reuters which is typically updated by more than one contributor.
- **Official Fixing** – a daily exchange rate for a local currency based on market conditions, usually with involvement from the Central Bank.
- **Offshore** – a market where non domestic banks can participate.
- **Onshore** – a market which is accessible to domestic banks only.
- **WM Currency Review Group** – the group within Thomson Reuters responsible for the periodic review of currency and tenor specific systematic tolerances which enables the effective monitoring and scrutiny of pre-publication monitoring, as well as ex post analysis of trends and outliers.

If you would like to learn more about the WM/Reuters Rates Service, please visit our website or contact us by telephone or e-mail. A service representative will be available 24 hours a day from Monday 06:00 Hong Kong/Singapore until Friday 22:00 UK time.

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