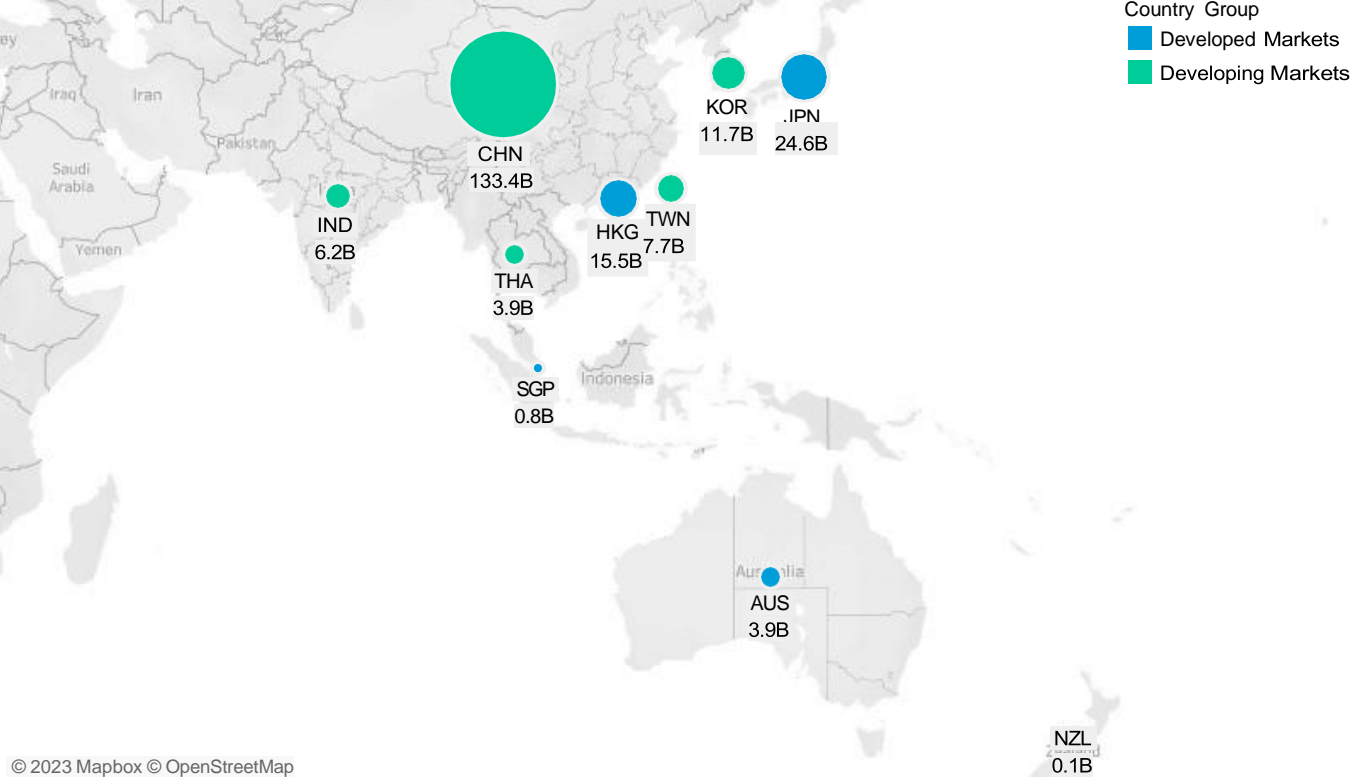


January 2023

APAC Market Structure Monthly

Average Daily Turnover (Notional USD)



© 2023 Mapbox © OpenStreetMap

Country Breakdowns

Hong Kong

China

Japan

Australia

South Korea

Taiwan

India

Thailand

New Zealand

Singapore

Jan 2023

AP Market Structure Monthly

MICROSTRUCTURE OBSERVATIONS

- Increased equities trading month-over-month (MoM) observed as 7 out of 10 countries in our universe saw higher average daily value traded (ADT). ADT in Thailand and Singapore increased +37% and +30%, whereas China, Hong Kong and Japan also saw single digit increases. Exceptions include India, Taiwan and New Zealand where ADT decreased by 2%, 4% and 16% respectively.
- Intraday spreads and volatility remained at similar levels MoM.

AP MARKET STRUCTURE NEWS

India Stock Markets Completed Move to T+1 Settlement Cycle from 27 January 2023

The National Exchange of India (NSE) reminded exchange members that all remaining T+2 settlement securities as of 25 January 2023 would be transitioned to T+1 rolling settlement effective from 27 Jan 2023, which completed the transition of India stock market fully to T+1 settlement.

<https://archives.nseindia.com/content/circulars/CMTR54992.pdf>

Shanghai and Shenzhen Stock Exchanges Prepares for Enhancing Trading Calendar of Hong Kong Stock Connect

On 19 Jan 2023, Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE) announced that they had collaborated with market participants to prepare for the optimization of the trading calendar of Hong Kong-China Stock Connect. This increases the number of trading days available via Stock Connect when both Hong Kong and Mainland China markets are open. SSE and SZSE pledged that they would "fully ensure" and "make all-out efforts" for the implementation of Stock Connect trading calendar enhancement.

This comes after the China Securities Regulatory Commission (CSRC) and the Hong Kong Securities and Futures Commission (SFC) jointly announced last August to enhance the Stock Connect trading calendar. The implementation was expected to take about six months.

<http://english.sse.com.cn/news/newsrelease/c/5715494.shtml>

http://www.szse.cn/English/about/news/szse/t20230120_598432.html

Korea Exchange Announced the List of Low Liquidity Stocks Subject to Periodic Call Auction in 2023

On 4 January 2023, Korea Exchange (KRX) published the list of low volume stocks that will be traded through the periodic call auction for one year in 2023. The goal is to improve the price discovery function of listed stocks that are not frequently traded.

Such classification is evaluated on an annual basis by KRX, and "if the average interval between trade executions of a stock exceeds 10 minutes", a stock would be deemed as a low liquidity stock, to which the periodic call auction applies, with exceptions of low liquidity stocks with designated liquidity providers (LPs). <https://global.krx.co.kr/contents/GLB/02/0203/0203000000/GLB0203000000.jsp#ab8758eced0475769e200e7e309baf77=1&view=20698>

To learn more, contact your sales representative or call our desk at:

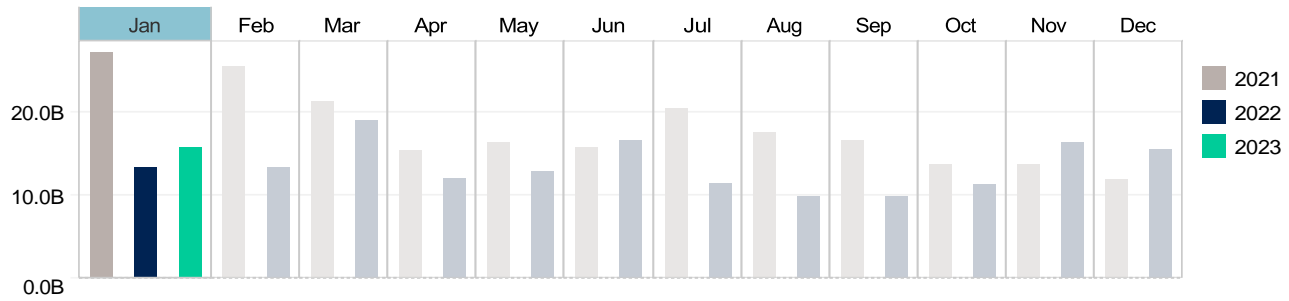
APAC +852.2846.3592 | **CAN** +1.416.874.0800 | **EMEA** +44.20.7670.4066 | **US** +1.646.682.6199
info@virtu.com | www.virtu.com

© 2023 Virtu Financial, Inc. All rights reserved. Not to be reproduced or retransmitted without permission. These materials are for informational purposes and are not intended to be used to make trading or investment decisions, they are not intended as an offer to sell or the solicitation of an offer to buy any security or financial product, and are not intended as advice (investment, tax or legal). The information contained herein includes Virtu proprietary information and/or has been taken from sources we believe to be reliable, but we do not represent or warrant that such information is accurate or complete and it should not be relied upon as such.

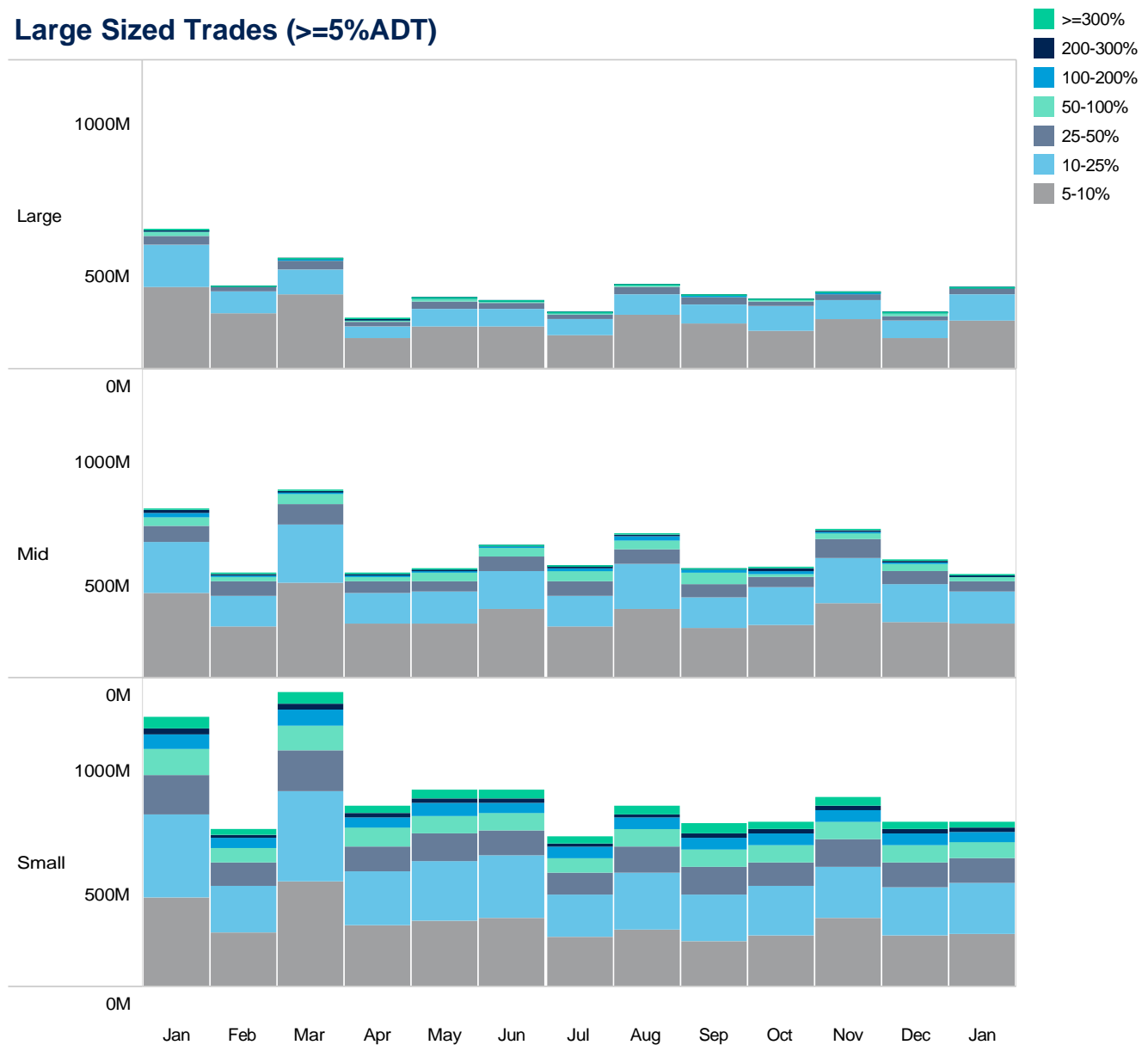
Securities products and services are offered by the following subsidiaries of Virtu Financial, Inc. In the U.S., Virtu Americas LLC, member FINRA and SIPC; in Canada, Virtu Canada Corp., member Canadian Investor Protection Fund and Investment Industry Regulatory Organization of Canada; in Europe, Virtu ITG Europe Limited, registered in Ireland No. 283940 ("VIEL") (VIEL is authorized and regulated by the Central Bank of Ireland), and Virtu Financial Ireland Limited, registered in Ireland No. 471719 ("VFIL") (VFIL is authorized and regulated by the Central Bank of Ireland). The registered office of VIEL and VFIL is Whitaker Court, Whitaker Square, Sir John Rogerson's Quay, Dublin 2, Ireland; in Asia, Virtu ITG Hong Kong Limited (SFC License No. AHD810), Virtu ITG Singapore Pte Limited (CMS License No. 100138-1), and Virtu ITG Australia Limited (AFS License No. 219582).

Hong Kong

Average Daily Turnover (Notional USD)

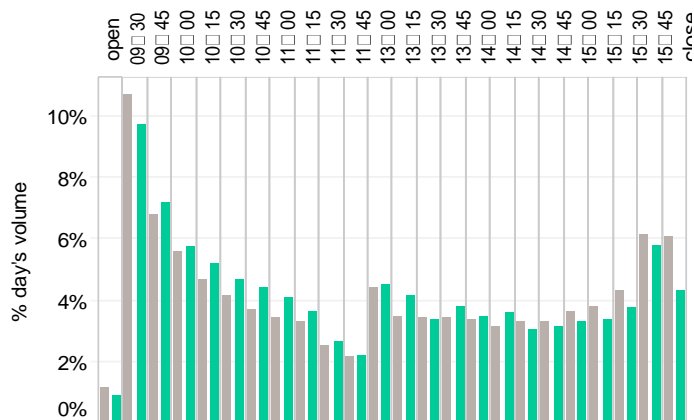


Large Sized Trades (>=5%ADT)

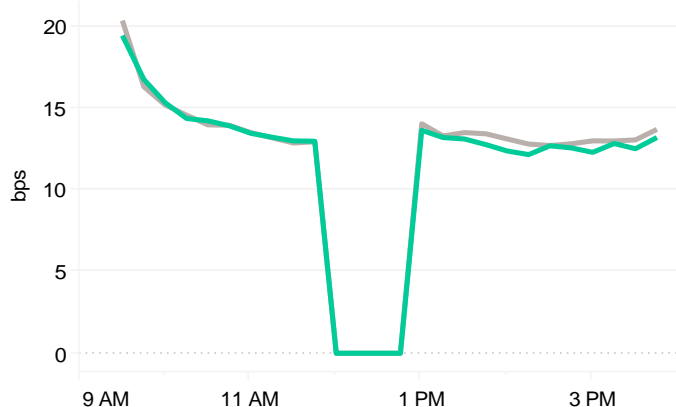


Hong Kong

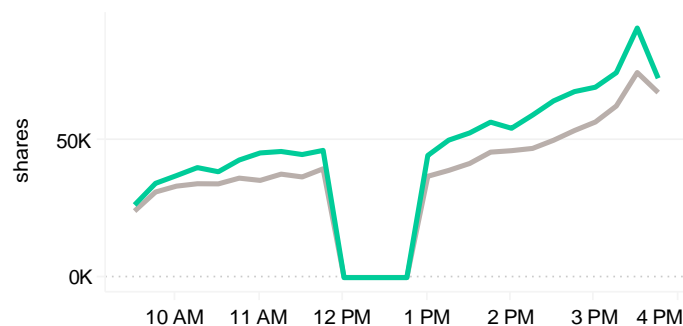
Volume Curve



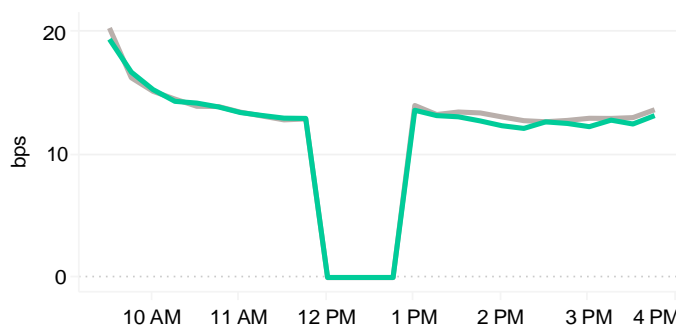
Intraday Spread (bps)



Intraday Quotesize (Shares)



Intraday Volatility (bps)



■ Rolling 12 Months Avg ■ January 2023

Spread Bps

	2022						2023
	Jul	Aug	Sep	Oct	Nov	Dec	Jan
FirstHalfHour	17.5	17.3	18.3	19.2	20.4	19.7	18.3
MidDay	12.3	12.4	13.1	14.0	14.6	14.0	13.1
LastHalfHour	12.3	12.4	13.3	13.7	14.0	14.0	13.0

One Minute Volatility Bps

FirstHalfHour	25.4	25.5	25.9	30.5	33.8	29.1	26.4
MidDay	15.6	14.3	15.1	18.5	20.1	18.3	17.0
LastHalfHour	15.0	14.6	15.7	18.0	19.1	18.6	16.5

Quotesize (shares)

FirstHalfHour	25,729	24,854	26,974	27,135	28,857	29,077	29,622
MidDay	38,254	36,313	45,633	39,201	38,664	40,980	46,105
LastHalfHour	69,882	68,441	79,907	71,053	67,304	66,542	78,406

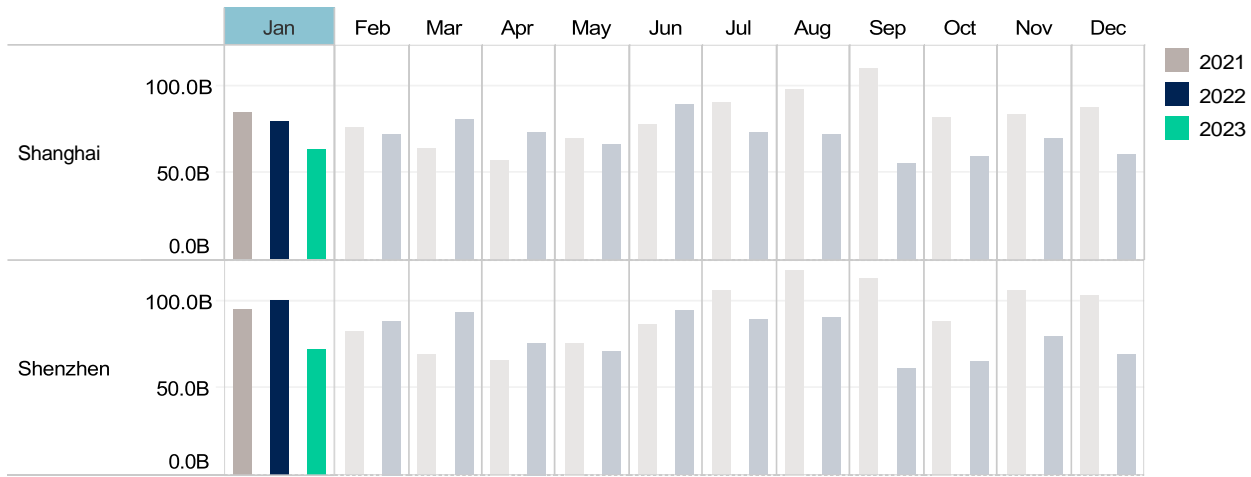
Median used for all metrics

One minute volatility is calculated using the difference between the high and low price within a one minute time bin, divided by that bin's VWAP

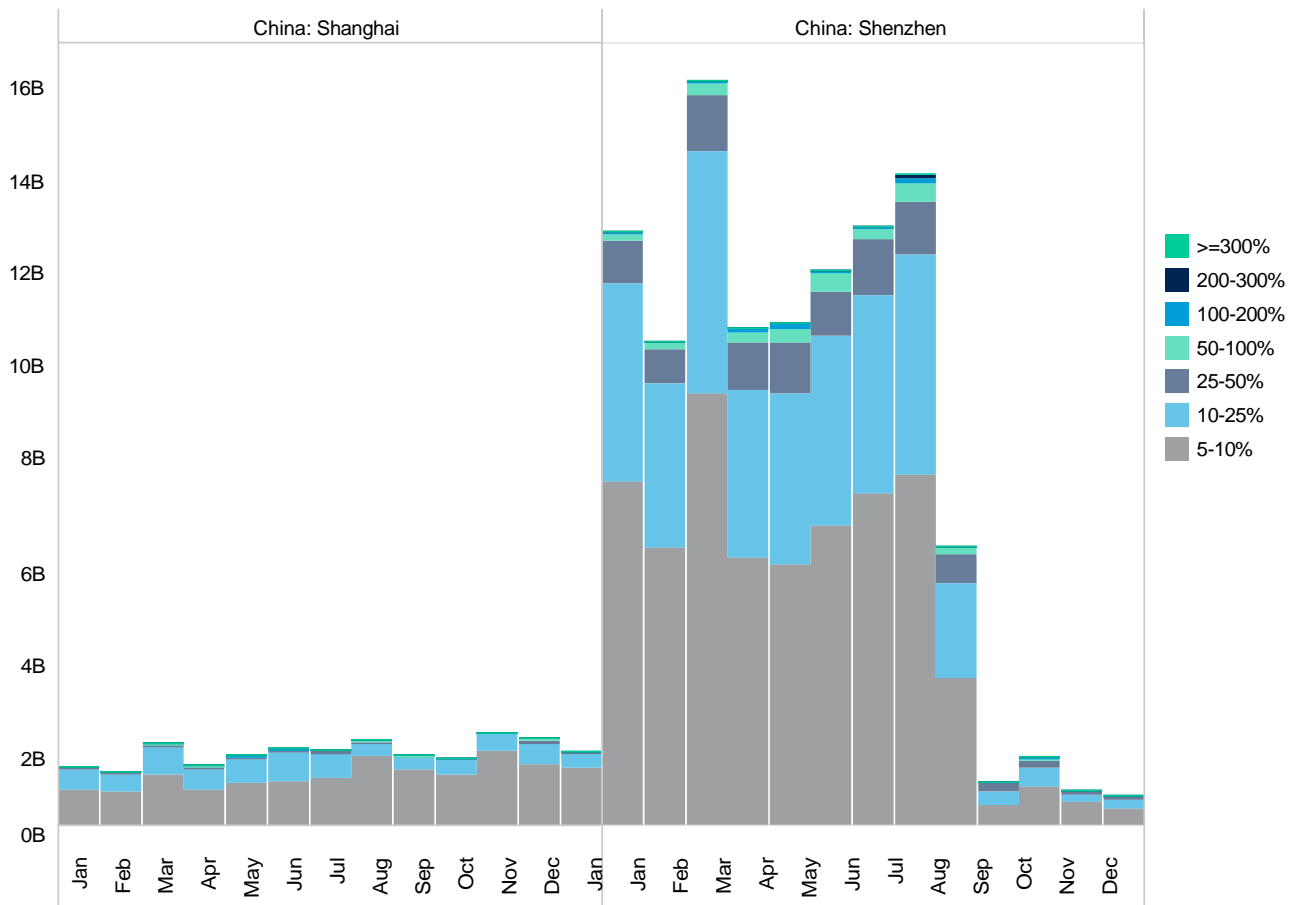
Source data: Virtu Financial

China

Average Daily Turnover (Notional USD)



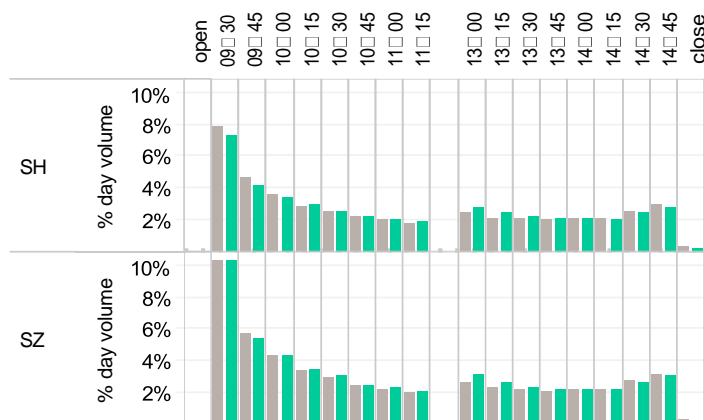
Large Sized Trades (>=5%ADT)



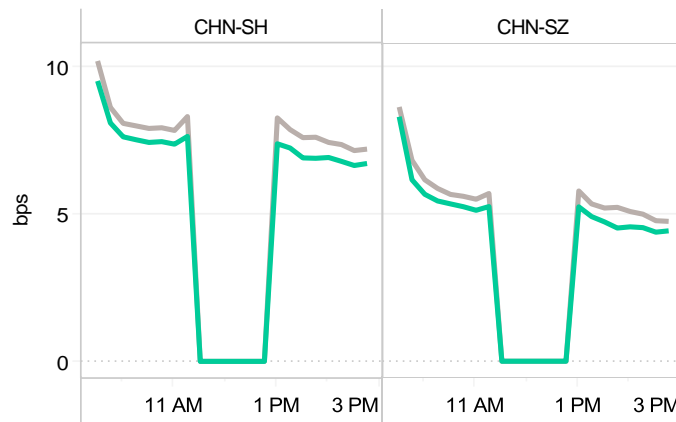
Source data: Virtu Financial

China

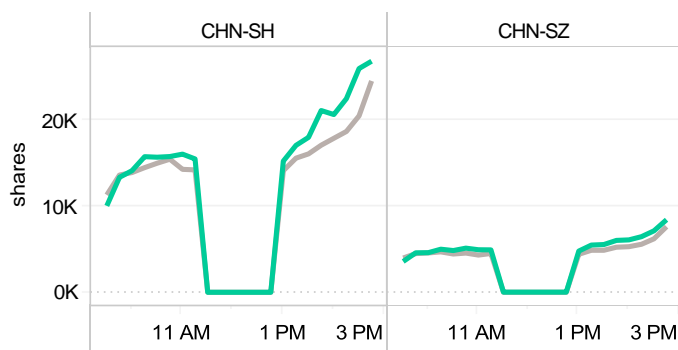
Volume Curve



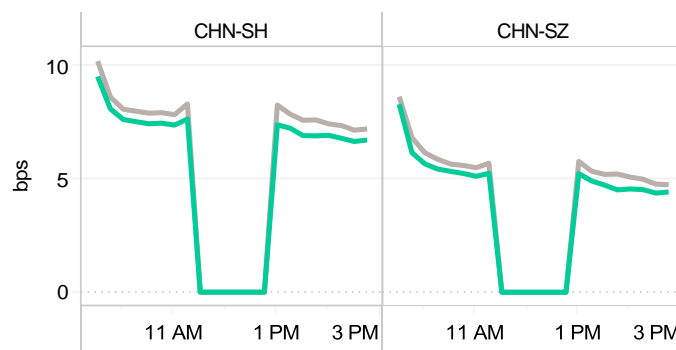
Intraday Spread (bps)



Intraday Quotesize (Shares)



Intraday Volatility (bps)



■ Rolling 12 Months Avg ■ January 2023

Spread Bps

	CHN-SH							CHN-SZ						
	2022						2023	2022						2023
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Jul	Aug	Sep	Oct	Nov	Dec	Jan
FirstHalfHo..	9.2	9.1	9.7	10.1	9.6	9.4	8.9	7.6	7.5	8.0	8.6	8.0	7.6	7.4
MidDay	7.4	7.5	8.1	8.5	8.3	8.0	7.4	5.4	5.4	5.7	6.3	5.9	5.6	5.2
LastHalfHo..	6.9	6.9	7.4	7.7	7.4	7.2	6.7	4.6	4.5	4.9	5.1	4.9	4.8	4.4

One Minute Volatility Bps

FirstHalfHo..	28.5	27.8	29.7	32.5	30.2	28.6	26.9	27.3	26.1	28.6	37.5	32.7	28.9	27.9
MidDay	16.0	15.6	15.9	17.8	17.3	16.1	15.1	13.6	12.7	13.1	16.8	15.2	14.1	14.0
LastHalfHo..	15.2	14.5	15.5	16.6	15.5	15.1	13.9	11.4	10.5	11.9	14.6	12.9	11.9	11.1

Quotesize (shares)

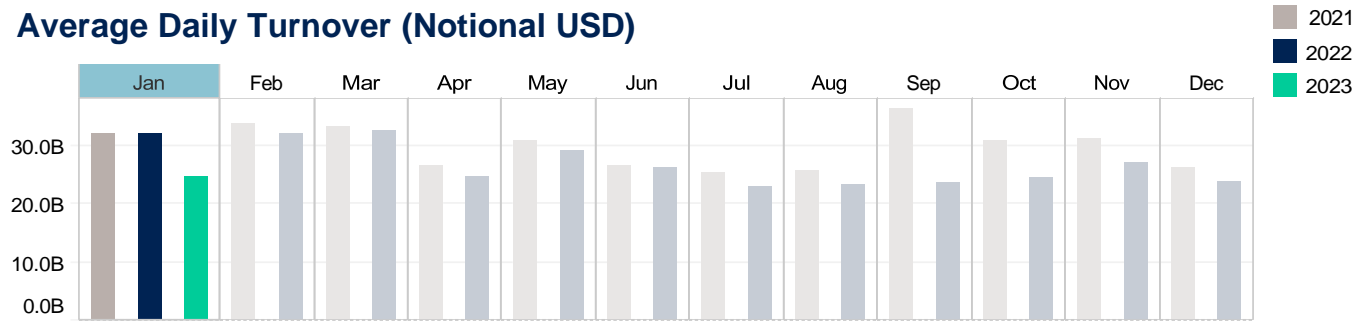
FirstHalfHo..	12,842	12,969	11,207	11,703	13,524	10,302	11,776	4,205	4,280	3,853	4,175	4,523	3,794	4,051
MidDay	15,220	15,717	13,698	14,484	15,699	12,904	15,847	4,636	4,799	4,346	4,539	5,072	4,328	5,045
LastHalfHo..	22,527	25,879	20,933	22,349	25,496	19,414	26,563	6,415	7,388	6,537	6,815	8,062	6,496	7,804

Median used for all metrics

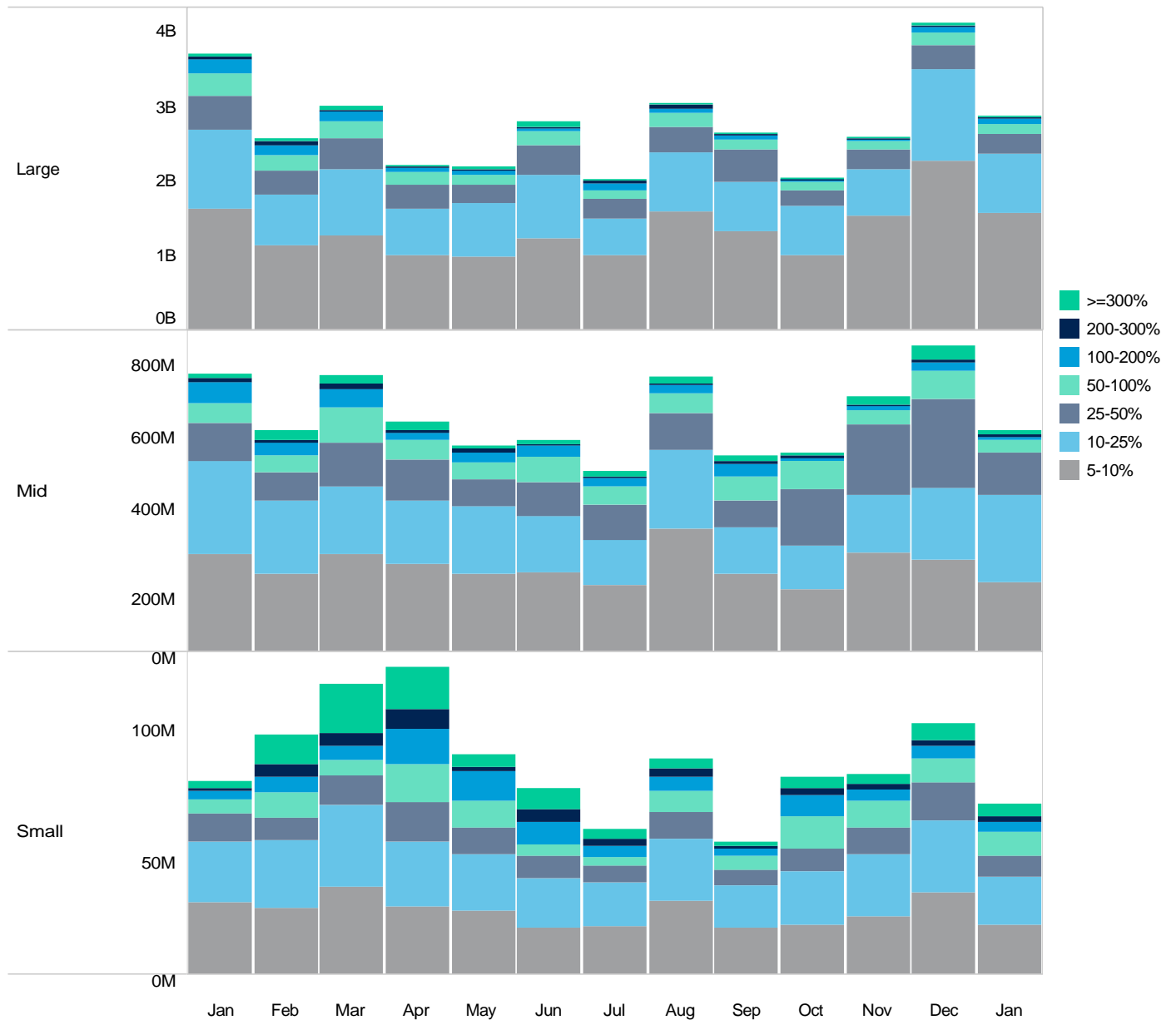
One minute volatility is calculated using the difference between the high and low price within a one minute time bin, divided by that bin's VWAP..

Japan

Average Daily Turnover (Notional USD)

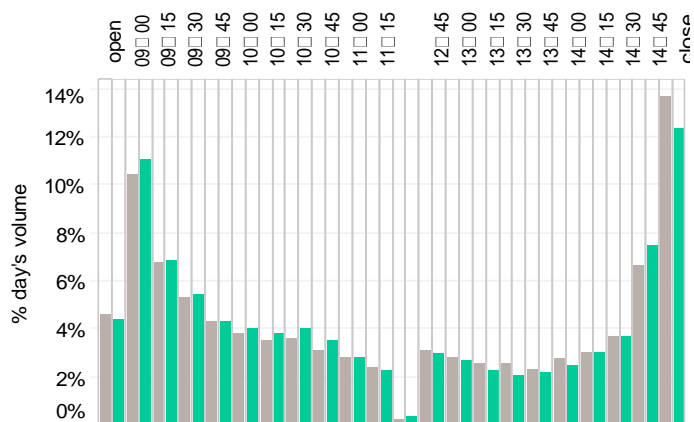


Large Sized Trades (>=5%ADT)

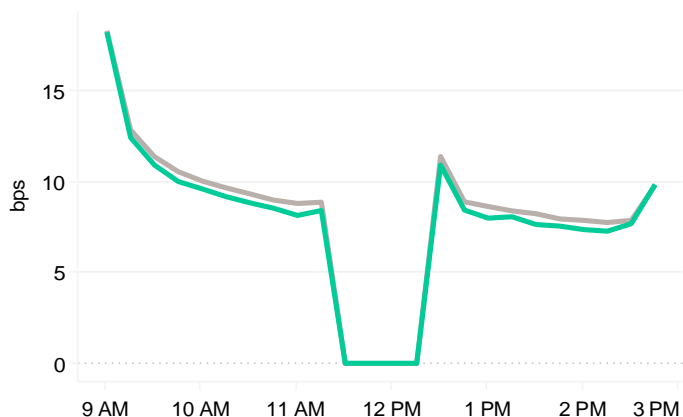


Japan

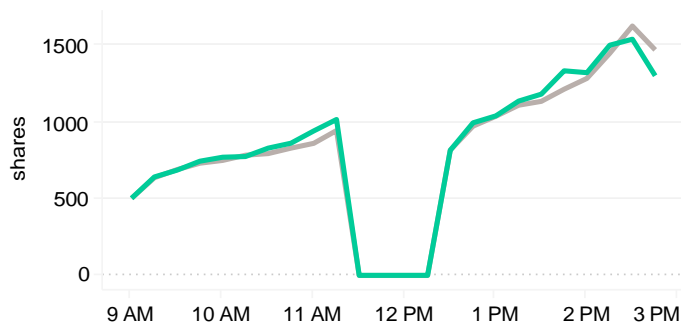
Volume Curve



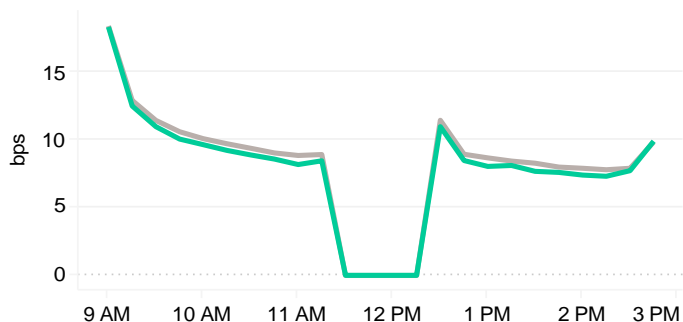
Intraday Spread (bps)



Intraday Quotesize (Shares)



Intraday Volatility (bps)



■ Rolling 12 Months Avg ■ January 2023

Spread Bps

	2022			2023		
	Aug	Sep	Oct	Nov	Dec	Jan
FirstHalfHour	15.6	15.7	16.4	16.2	15.9	15.6
MidDay	9.1	9.4	9.3	9.3	9.0	8.6
LastHalfHour	9.2	9.3	9.6	9.4	9.4	9.1

One Minute Volatility Bps

FirstHalfHour	16.8	16.4	17.6	17.7	16.1	16.2
MidDay	8.2	8.6	8.5	8.7	8.4	8.0
LastHalfHour	9.3	9.4	9.7	9.7	9.5	9.3

Quotesize (shares)

	2022			2023		
	FirstHalfHour	539	551	531	563	561
MidDay	883	839	809	927	902	897
LastHalfHour	1,539	1,370	1,375	1,572	1,441	1,414

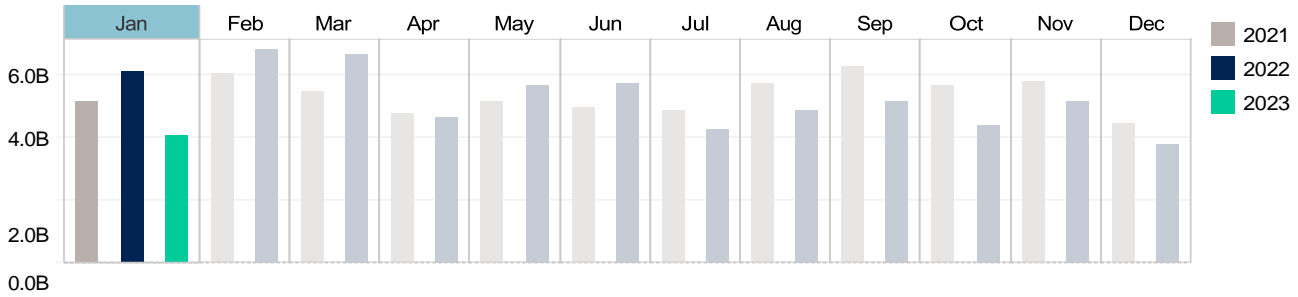
Median used for all metrics

One minute volatility is calculated using the difference between the high and low price within a one minute time bin, divided by that bin's VWAP

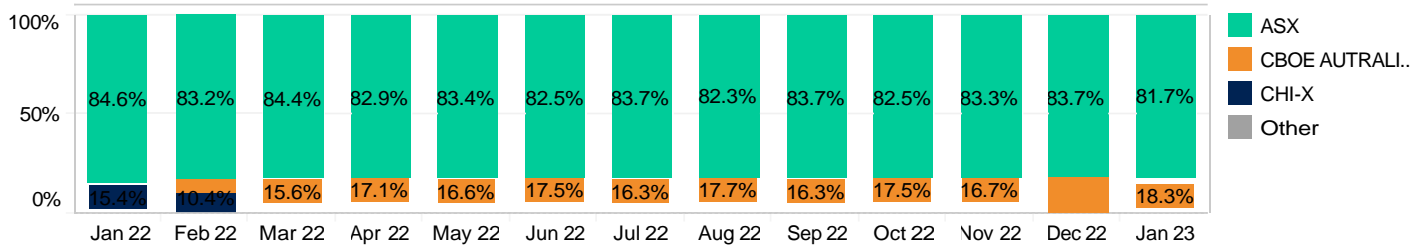
Source data: Virtu Financial

Australia

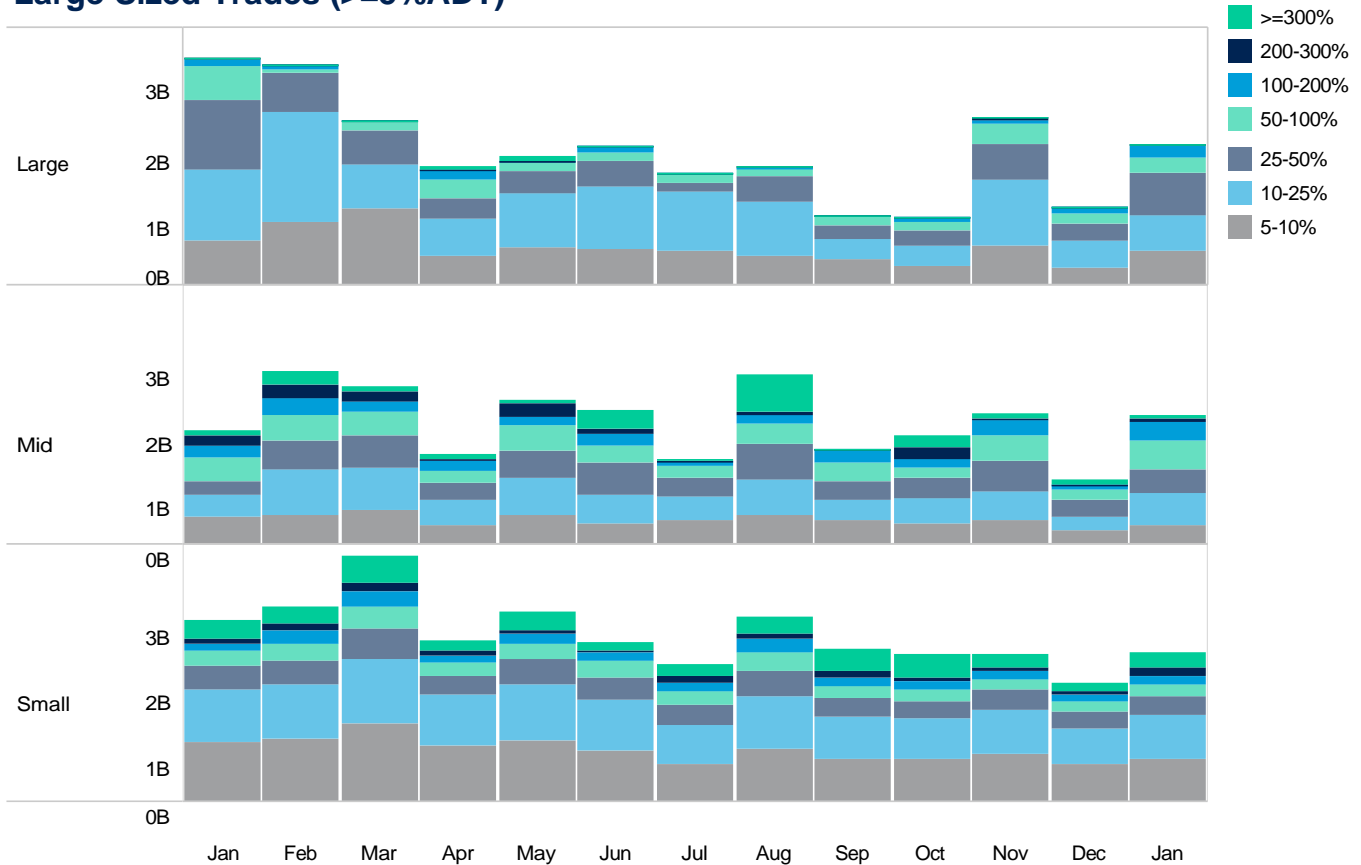
Average Daily Turnover (Notional USD)



Venue Market Share (Notional USD)



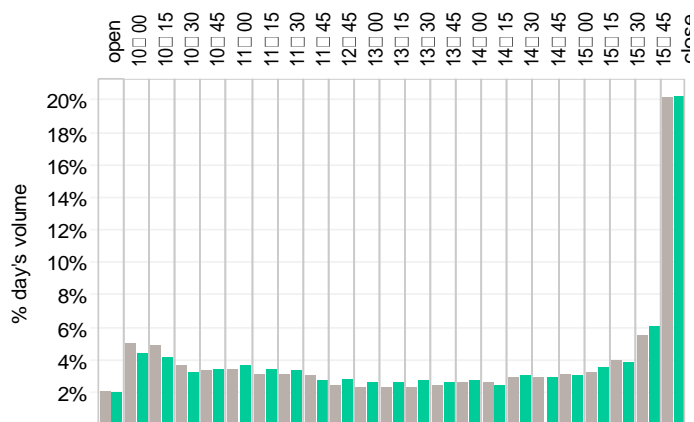
Large Sized Trades (>=5%ADT)



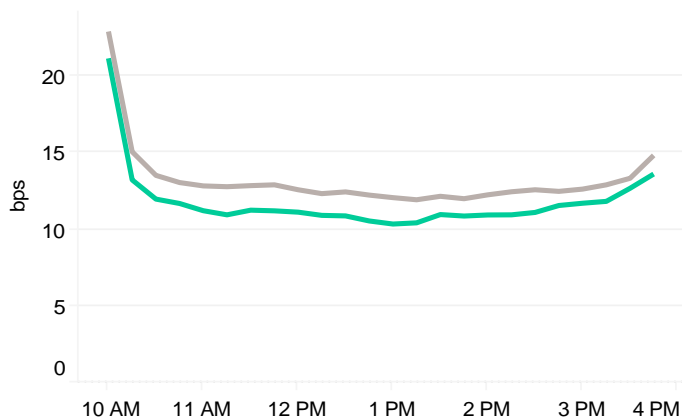
Source data: Virtu Financial

Australia

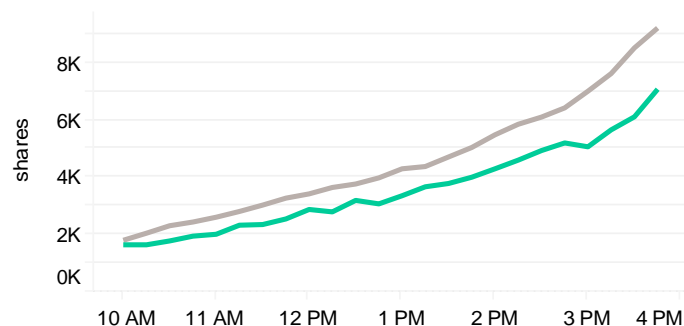
Volume Curve



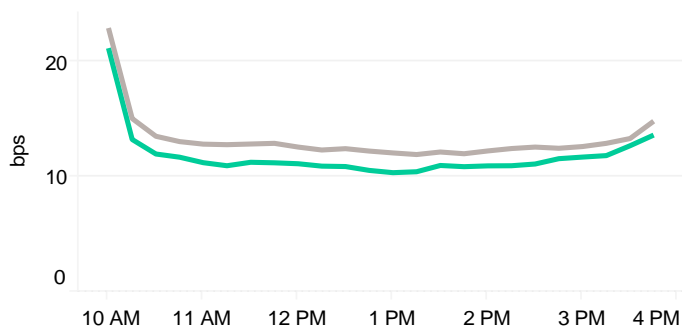
Intraday Spread (bps)



Intraday Quotesize (Shares)



Intraday Volatility (bps)



■ Rolling 12 Months Avg ■ January 2023

Spread Bps

	2022							2023
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	
FirstHalfHour	19.3	18.6	19.1	18.9	17.5	16.6	15.9	
MidDay	12.5	11.8	12.9	13.0	12.5	12.1	11.1	
LastHalfHour	14.4	13.4	14.7	14.9	13.9	13.7	13.1	

One Minute Volatility Bps

FirstHalfHour	24.6	24.0	24.8	22.9	21.5	20.4	19.1
MidDay	12.0	11.1	11.8	12.3	11.4	10.5	9.9
LastHalfHour	13.6	12.8	13.6	13.8	12.9	12.6	12.2

Quotesize (shares)

FirstHalfHour	1,825	1,837	2,216	1,938	2,000	1,772	1,629
MidDay	3,880	3,873	4,723	4,056	4,453	3,558	3,279
LastHalfHour	8,852	8,511	9,473	9,008	9,111	7,705	6,643

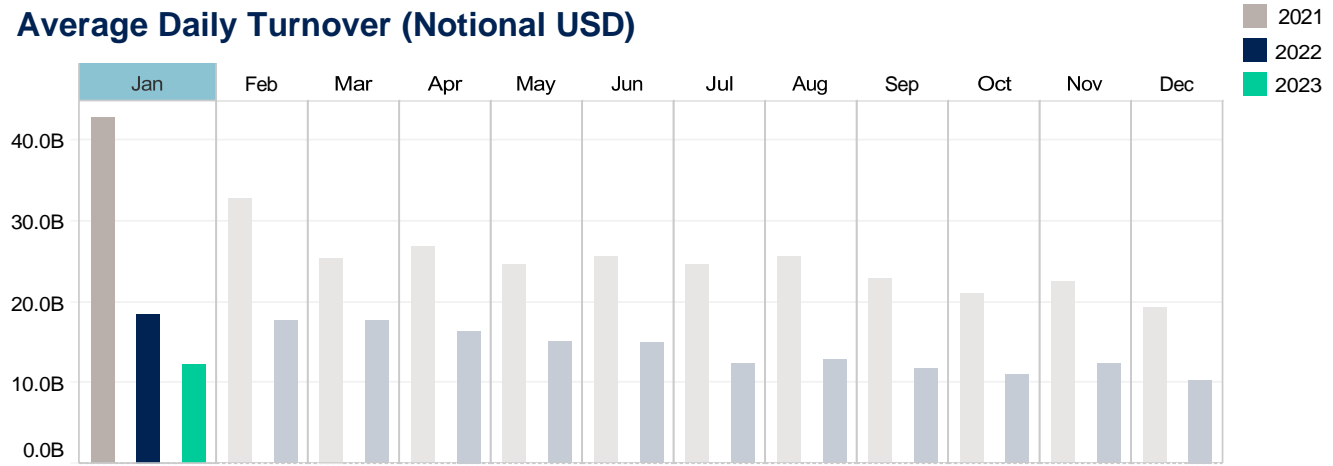
Median used for all metrics

One minute volatility is calculated using the difference between the high and low price within a one minute time bin, divided by that bin's VWAP

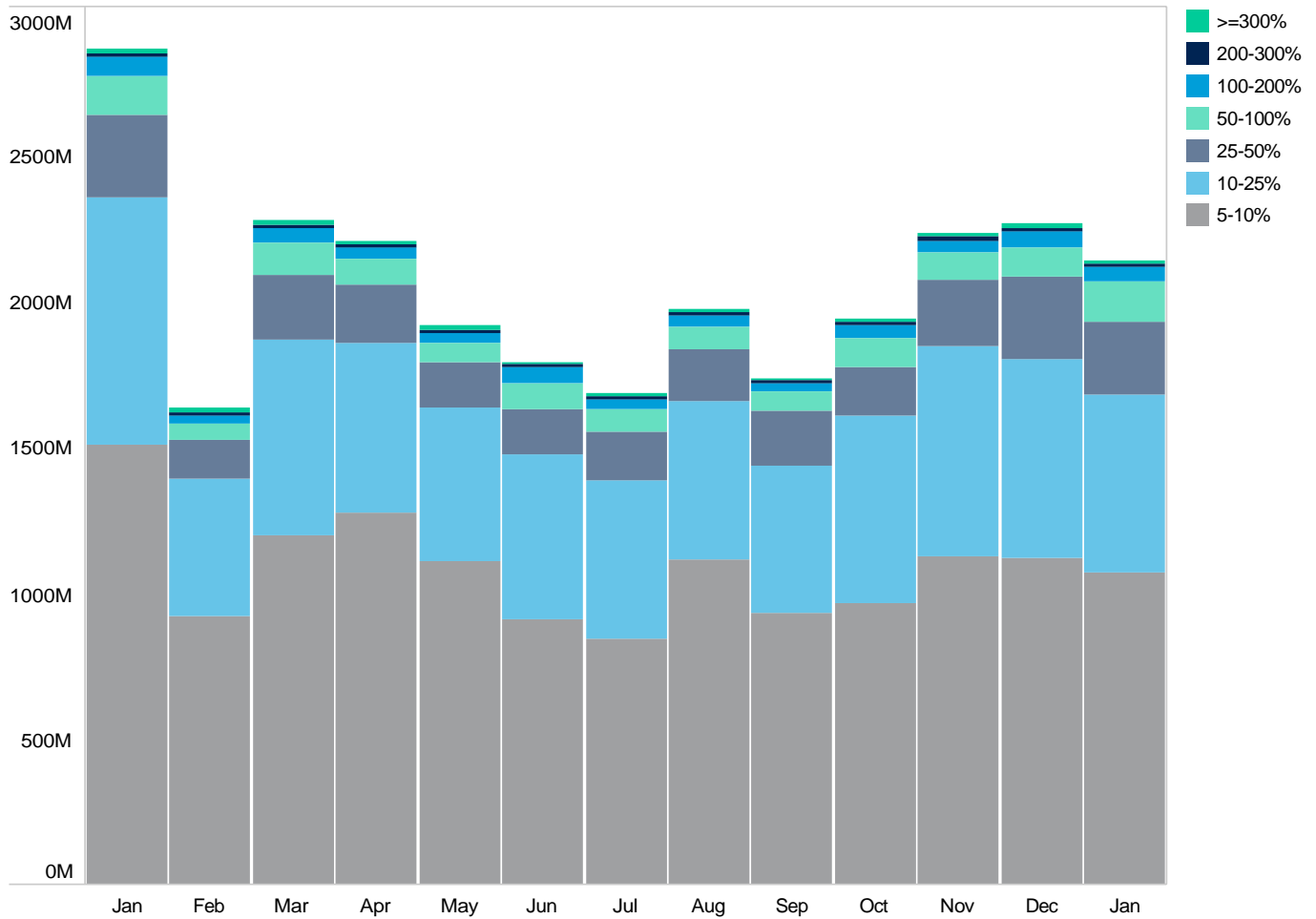
Source data: Virtu Financial

South Korea

Average Daily Turnover (Notional USD)



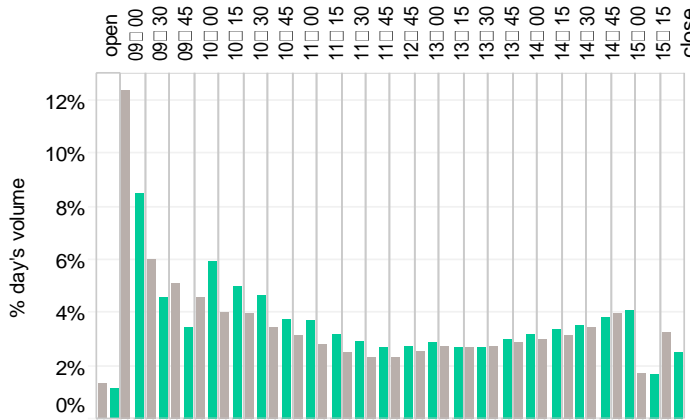
Large Sized Trades (>=5%ADT)



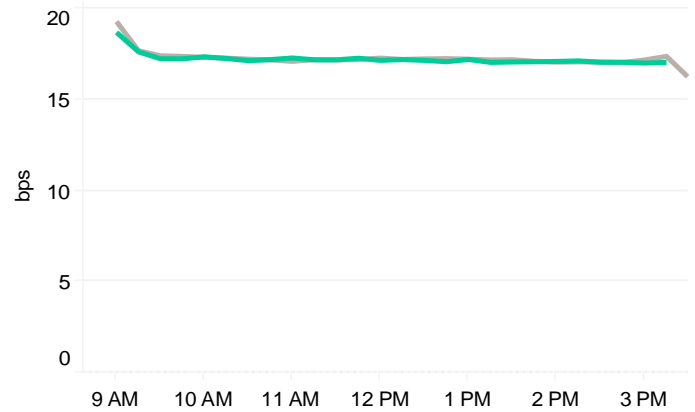
Source data: Virtu Financial

Korea

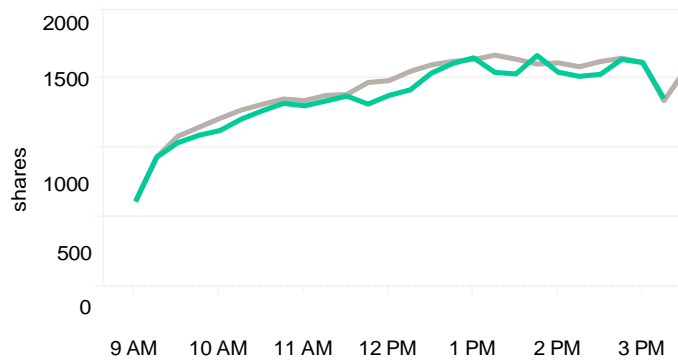
Volume Curve



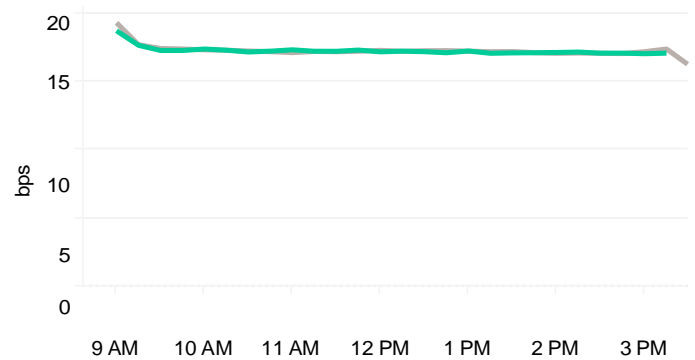
Intraday Spread (bps)



Intraday Quotesize (Shares)



Intraday Volatility (bps)



■ Rolling 12 Months Avg ■ January 2023

Spread Bps

	2022						2023
	Jul	Aug	Sep	Oct	Nov	Dec	Jan
FirstHalfHour	18.7	18.0	18.9	19.1	18.1	18.1	17.4
MidDay	17.3	17.0	17.5	17.5	16.7	17.1	16.5
LastHalfHour	17.3	16.9	17.6	17.5	16.2	17.1	16.5

One Minute Volatility Bps

FirstHalfHour	32.0	28.9	31.5	32.7	31.4	29.5	29.4
MidDay	19.5	18.6	19.3	19.6	18.7	18.7	18.1
LastHalfHour	20.8	19.7	21.3	20.8	19.7	20.6	18.9

Quotesize (shares)

FirstHalfHour	789	912	753	704	716	803	727
MidDay	1,478	1,978	1,511	1,415	1,541	1,721	1,396
LastHalfHour	1,496	1,928	1,580	1,529	1,360	1,628	1,506

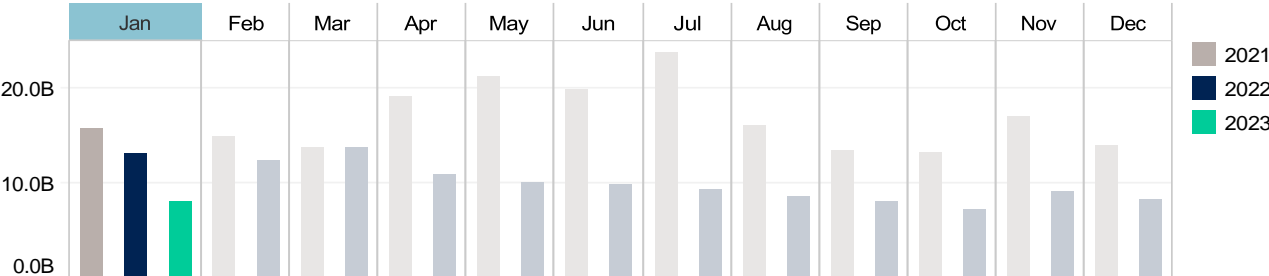
Median used for all metrics

One minute volatility is calculated using the difference between the high and low price within a one minute time bin, divided by that bin's VWAP

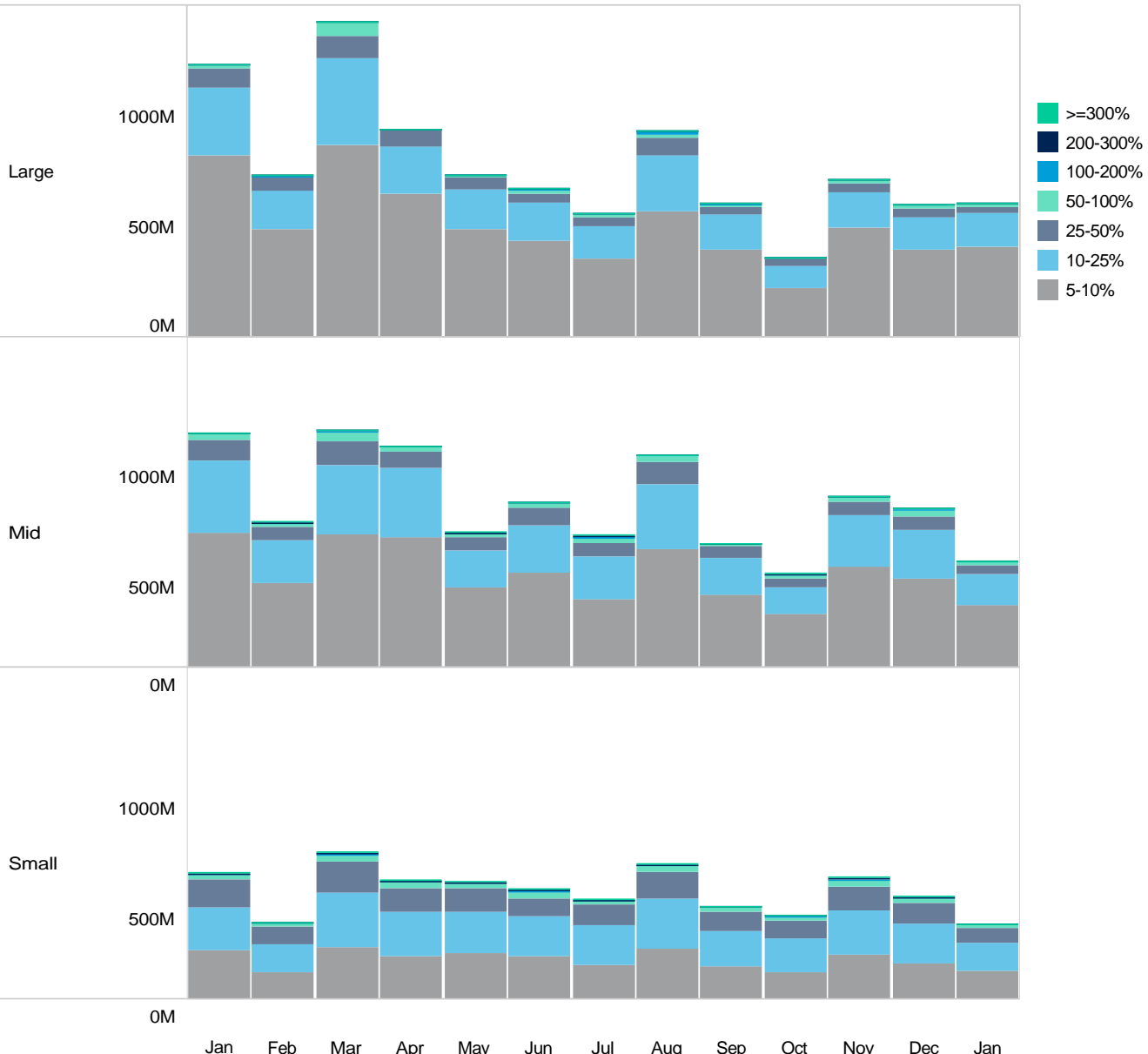
Source data: Virtu Financial

Taiwan

Average Daily Turnover (Notional USD)



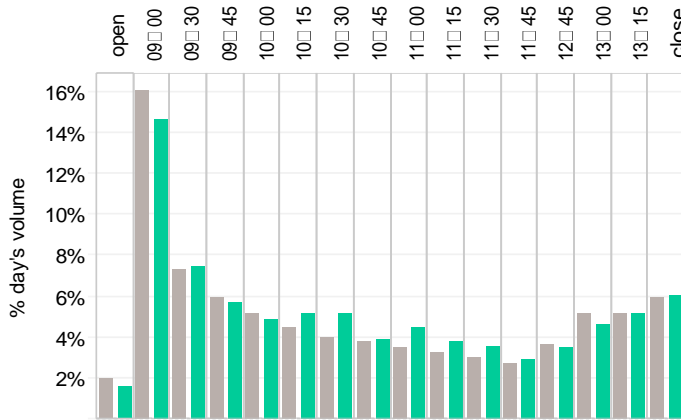
Large Sized Trades (>=5%ADT)



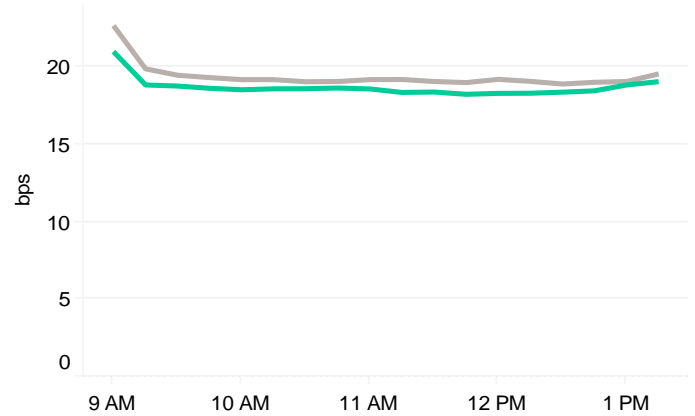
Source data: Virtu Financial

Taiwan

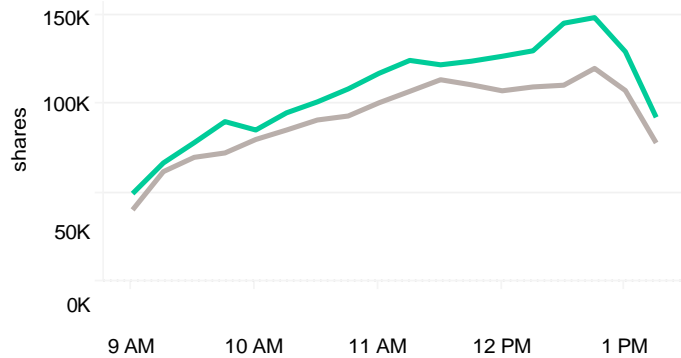
Volume Curve



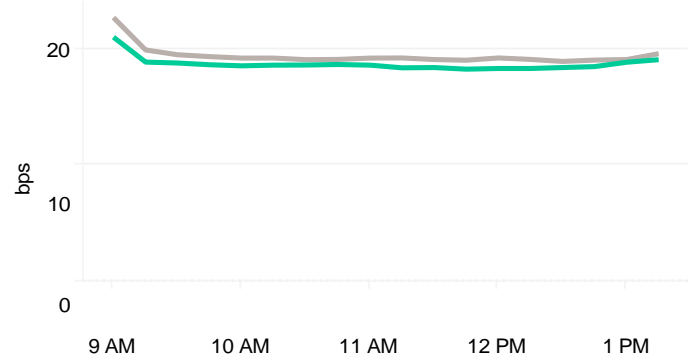
Intraday Spread (bps)



Intraday Quotesize (Shares)



Intraday Volatility (bps)



■ Rolling 12 Months Avg ■ January 2023

Spread Bps

	2022				2023		
	Jul	Aug	Sep	Oct	Nov	Dec	Jan
FirstHalfHour	21.8	21.0	21.7	24.0	21.5	20.9	20.2
MidDay	19.5	19.0	19.0	20.9	19.1	19.2	18.5
LastHalfHour	19.9	19.3	19.4	21.2	19.2	19.2	18.7

One Minute Volatility Bps

FirstHalfHour	32.7	29.3	30.4	34.5	30.8	31.0	31.1
MidDay	25.3	23.0	24.6	25.8	23.4	28.6	28.9
LastHalfHour	26.8	23.8	25.4	26.7	23.6	28.9	29.0

Quotesize (shares)

FirstHalfHour	44,467	53,141	46,405	42,999	52,487	55,849	59,008
MidDay	82,086	121,550	98,380	77,390	113,736	109,432	118,834
LastHalfHour	81,639	101,505	84,157	81,045	112,549	102,743	113,870

Median used for all metrics

One minute volatility is calculated using the difference between the high and low price within a one minute time bin, divided by that bin's VWAP

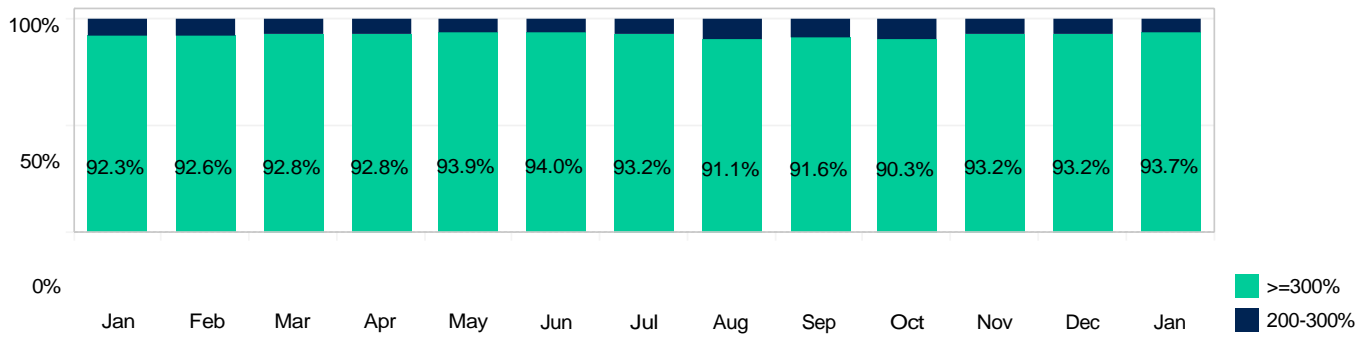
Source data: Virtu Financial

India

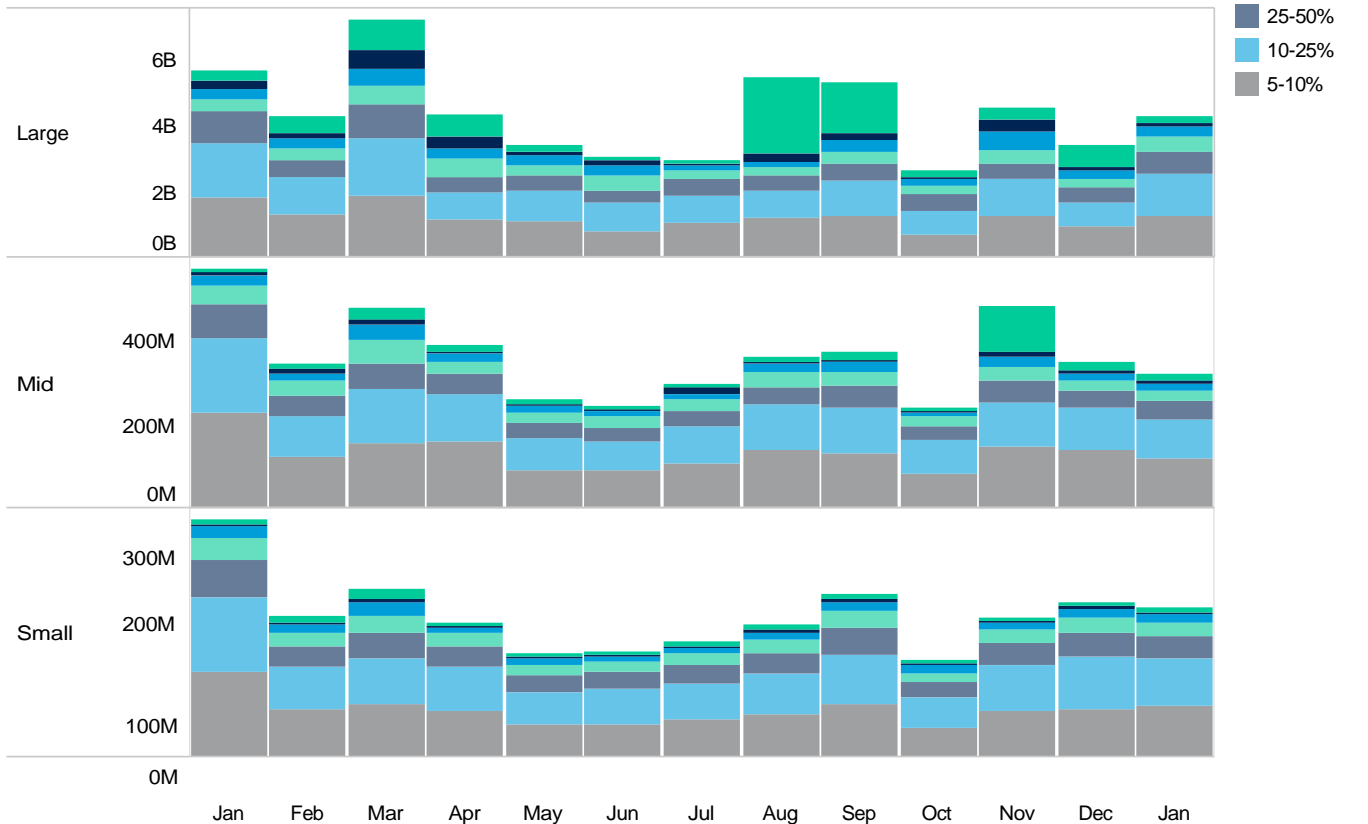
Average Daily Turnover (Notional USD)



Venue Market Share (Notional USD)

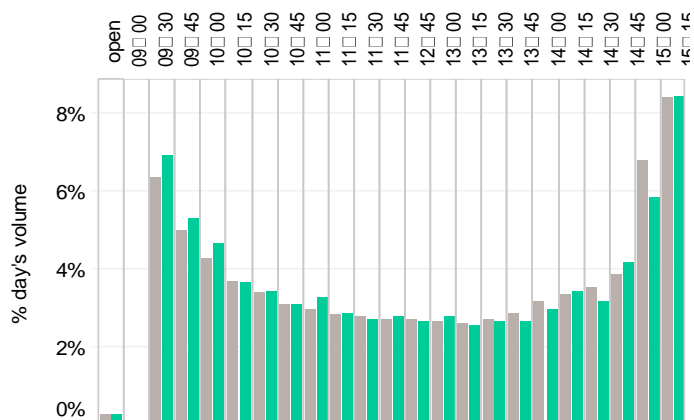


Large Sized Trades (>=5%ADT)

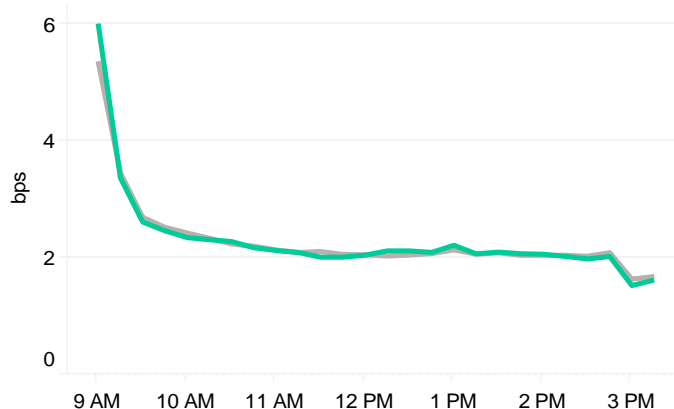


India

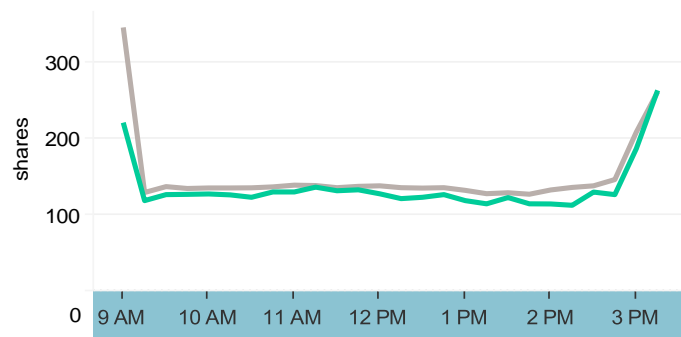
Volume Curve



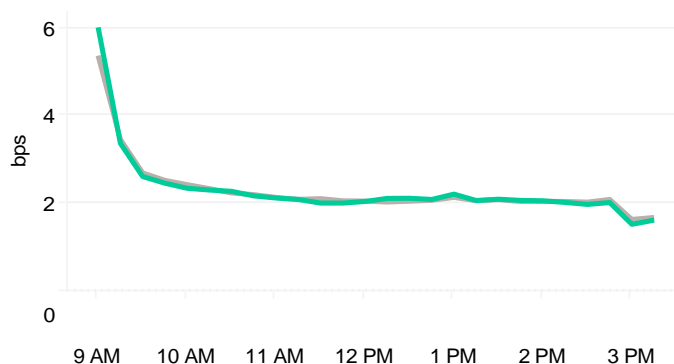
Intraday Spread (bps)



Intraday Quotesize (Shares)



Intraday Volatility (bps)



■ Rolling 12 Months Avg ■ January 2023

Spread Bps

	2022						2023	
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	
FirstHalfHour	3.7	3.7	3.6	3.5	3.3	3.4	3.5	
MidDay	2.2	2.1	2.1	2.1	1.9	2.0	2.1	
LastHalfHour	1.8	1.7	1.7	1.6	1.6	1.6	1.7	

One Minute Volatility Bps

FirstHalfHour	20.0	20.3	21.6	20.3	18.4	18.0	18.8
MidDay	8.3	8.2	8.9	8.2	7.4	7.7	8.2
LastHalfHour	10.8	10.5	11.0	10.2	9.7	10.2	10.1

Quotesize (shares)

FirstHalfHour	132.5	133.9	134.1	125.4	138.7	120.1	121.8
MidDay	142.5	139.0	133.5	131.3	143.8	122.4	128.7
LastHalfHour	239.8	229.6	242.2	243.8	257.7	257.9	228.8

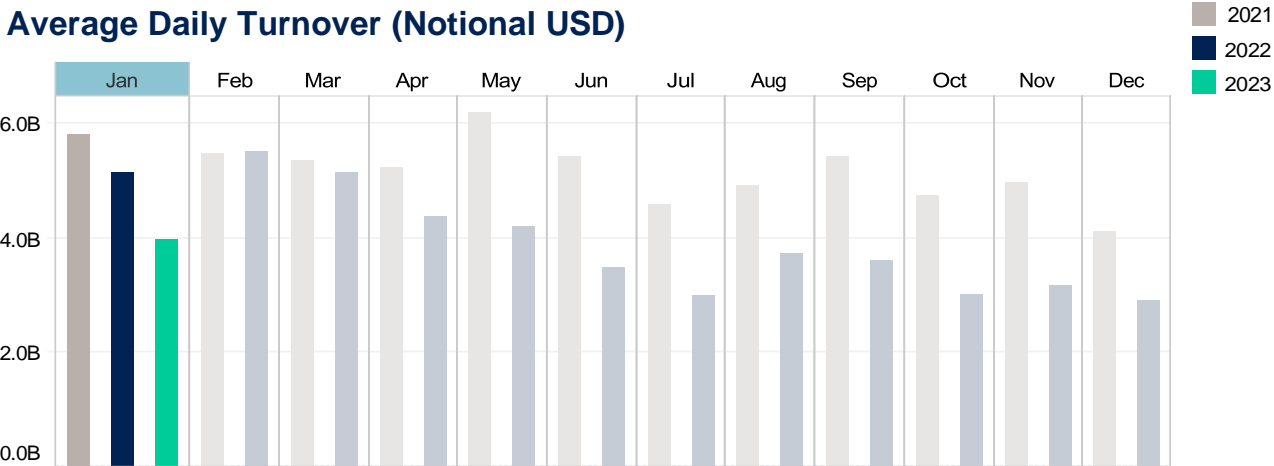
Median used for all metrics

One minute volatility is calculated using the difference between the high and low price within a one minute time bin, divided by that bin's VWAP

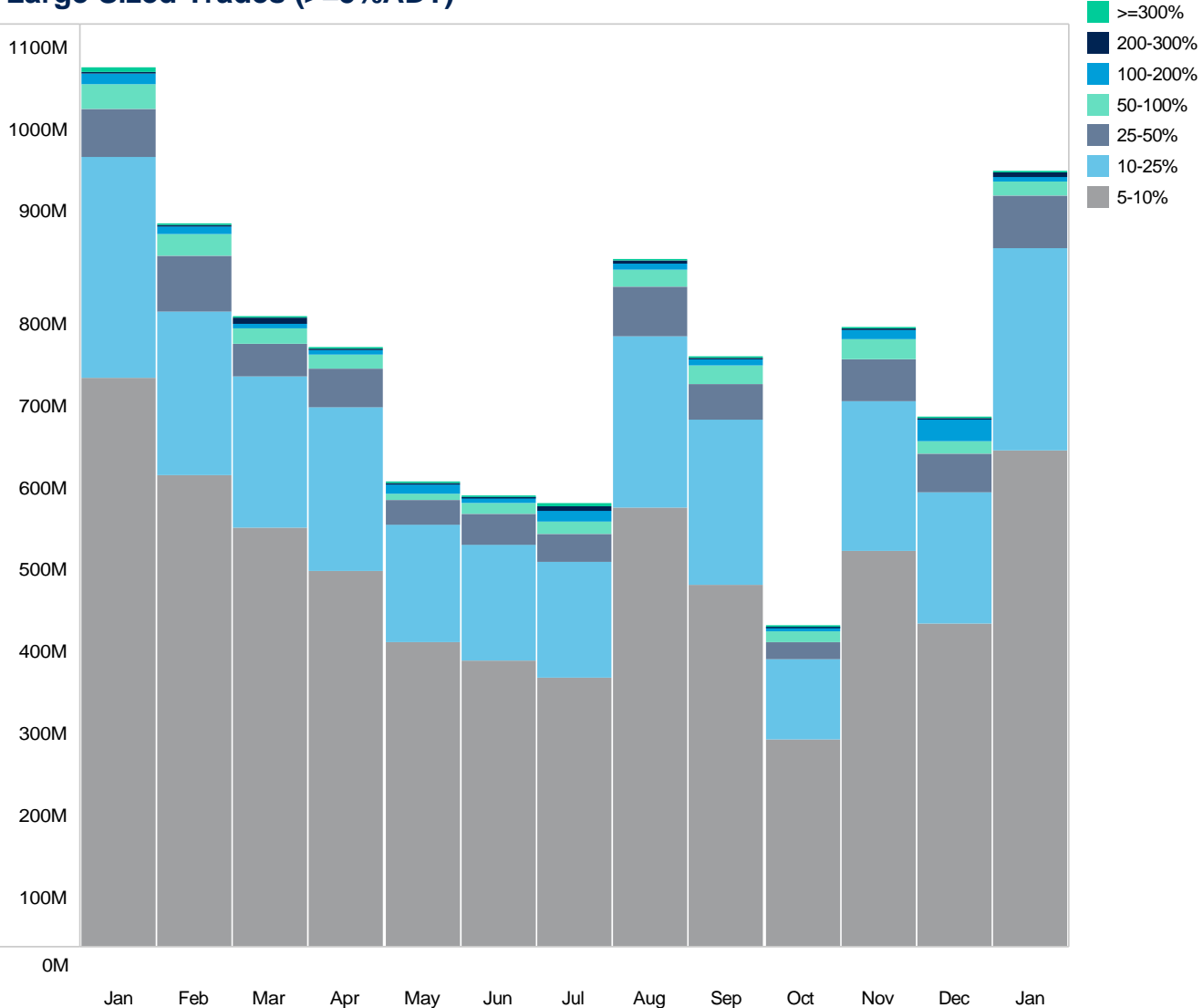
Source data: Virtu Financial

Thailand

Average Daily Turnover (Notional USD)



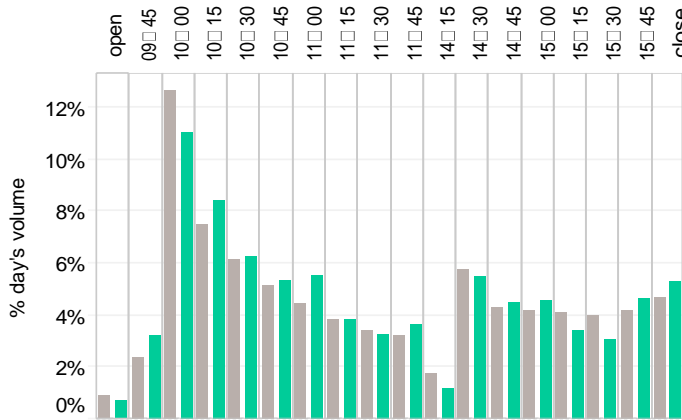
Large Sized Trades (>=5%ADT)



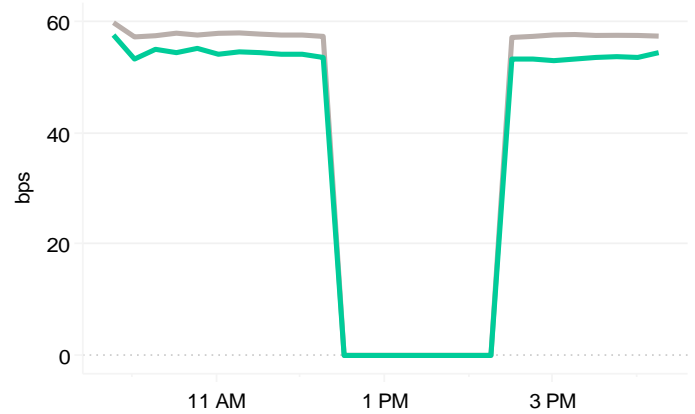
Source data: Virtu Financial

Thailand

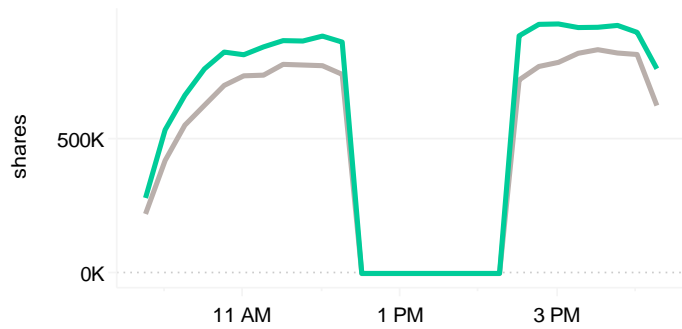
Volume Curve



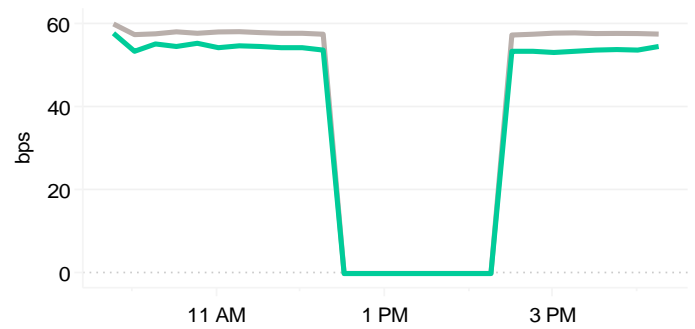
Intraday Spread (bps)



Intraday Quotesize (Shares)



Intraday Volatility (bps)



■ Rolling 12 Months Avg ■ January 2023

Spread Bps

	2022						2023
	Jul	Aug	Sep	Oct	Nov	Dec	Jan
FirstHalfHour	61.3	58.3	59.0	61.2	61.0	58.1	58.0
MidDay	58.8	57.0	57.6	59.2	57.6	55.9	54.1
LastHalfHour	59.0	57.3	57.6	59.7	57.3	55.7	54.2

One Minute Volatility Bps

FirstHalfHour	64.1	69.7	67.3	74.9	71.7	74.1	64.3
MidDay	60.4	58.0	59.0	60.8	58.3	56.7	55.4
LastHalfHour	60.4	58.0	59.0	60.4	58.0	56.7	56.0

Quotesize (shares)

FirstHalfHour	148,947	219,738	278,619	217,331	227,211	245,311	284,548
MidDay	564,119	759,699	785,511	691,861	760,712	805,102	865,107
LastHalfHour	528,163	729,764	713,965	620,002	675,335	738,049	812,231

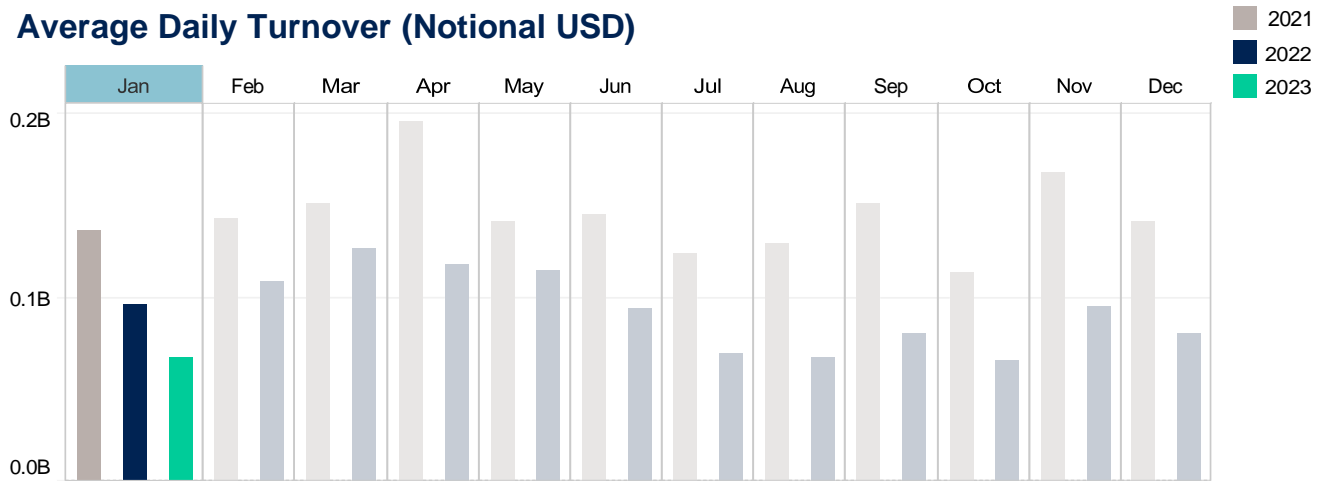
Median used for all metrics

One minute volatility is calculated using the difference between the high and low price within a one minute time bin, divided by that bin's VWAP

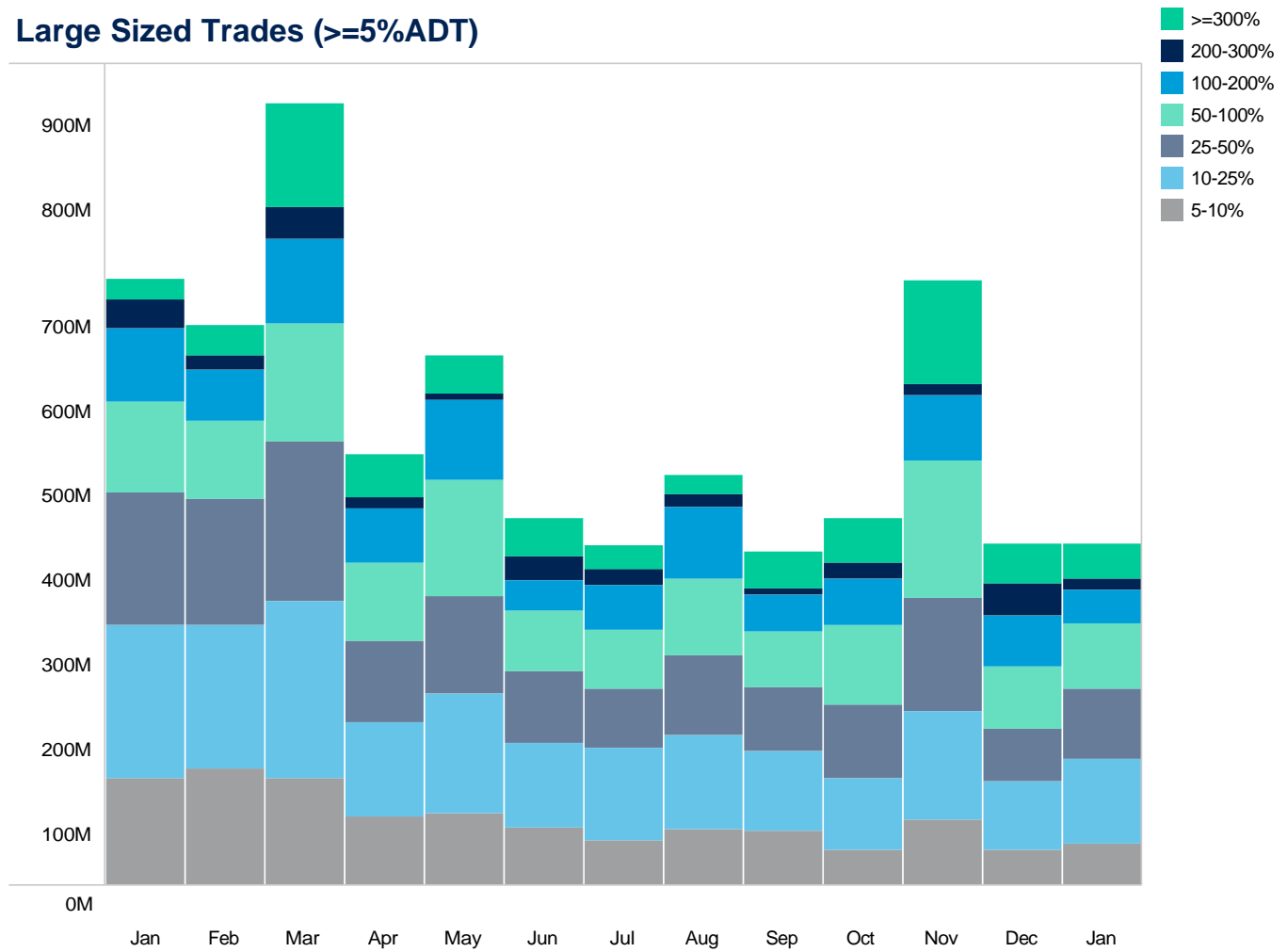
Source data: Virtu Financial

New Zealand

Average Daily Turnover (Notional USD)



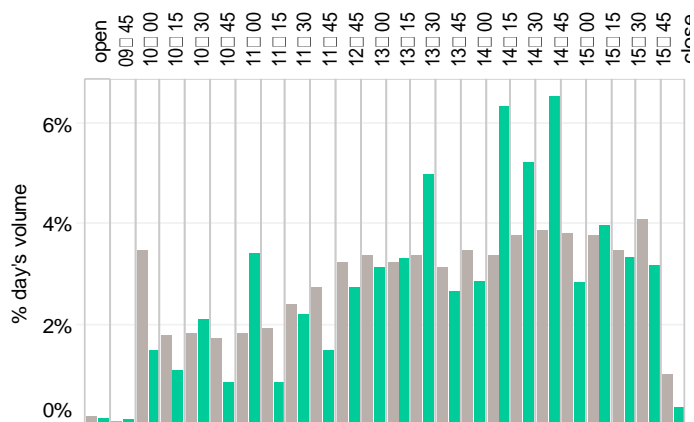
Large Sized Trades (>=5%ADT)



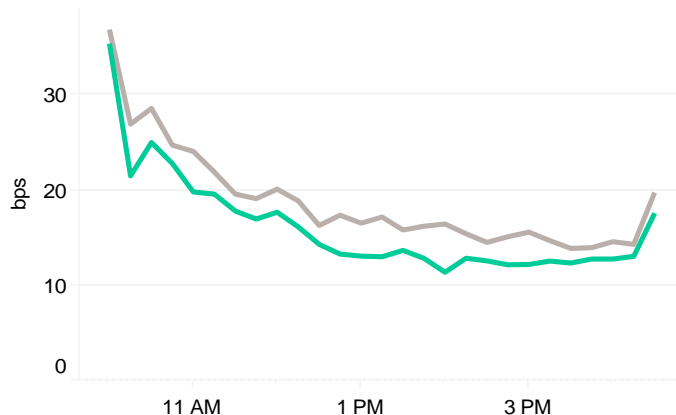
Source data: Virtu Financial

New Zealand

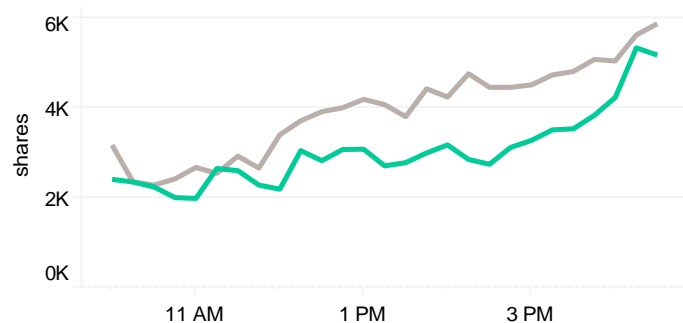
Volume Curve



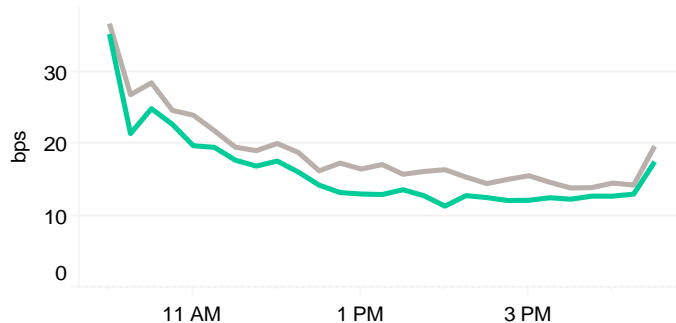
Intraday Spread (bps)



Intraday Quotesize (Shares)



Intraday Volatility (bps)



■ Rolling 12 Months Avg ■ January 2023

Spread Bps

	2022							2023
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	
FirstHalfHour	30.4	30.2	30.5	34.5	38.8	33.0	28.6	
MidDay	16.8	16.9	16.9	17.2	17.4	14.4	13.0	
LastHalfHour	20.0	18.7	18.5	20.3	19.7	19.9	17.6	

One Minute Volatility Bps

FirstHalfHour	20.9	19.5	19.5	25.5	25.6	20.2	19.2
MidDay	18.9	17.2	16.9	17.7	17.3	14.7	12.9
LastHalfHour	20.8	20.0	20.2	21.5	22.0	21.1	18.7

Quotesize (shares)

FirstHalfHour	3,025	2,728	2,703	2,695	2,859	2,800	2,352
MidDay	4,189	4,606	5,264	3,955	3,593	3,663	2,964
LastHalfHour	6,439	5,802	6,190	5,615	5,396	6,890	5,554

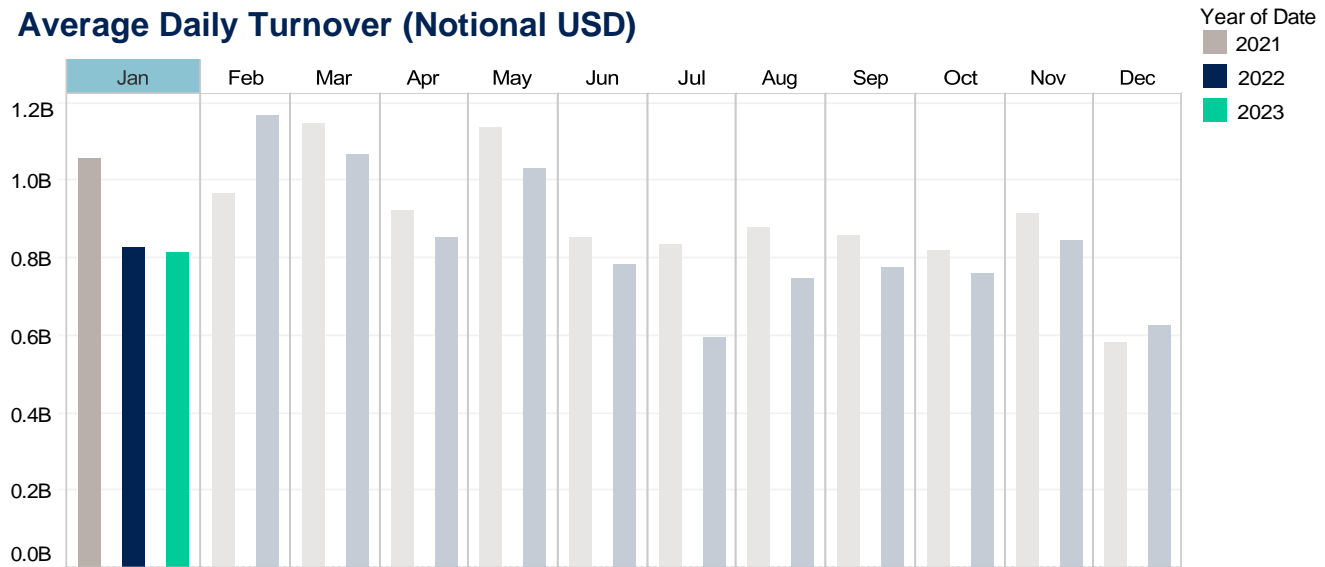
Median used for all metrics

One minute volatility is calculated using the difference between the high and low price within a one minute time bin, divided by that bin's VWAP

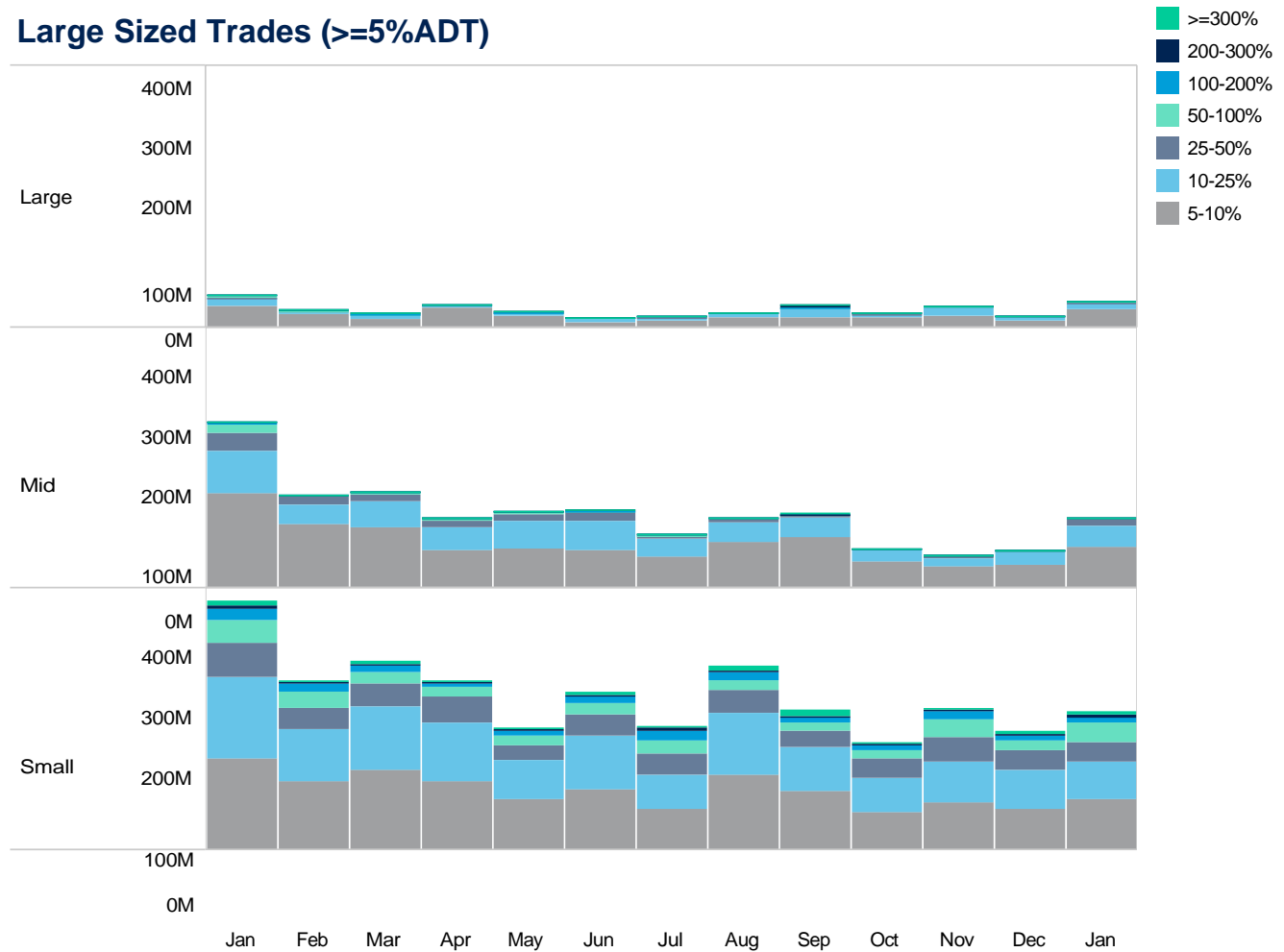
Source data: Virtu Financial

Singapore

Average Daily Turnover (Notional USD)

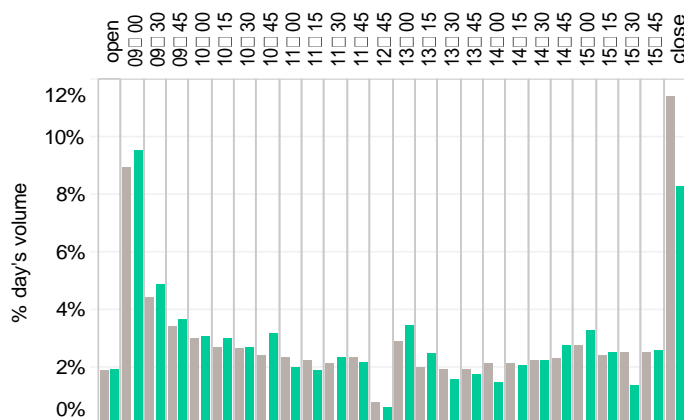


Large Sized Trades (>=5%ADT)

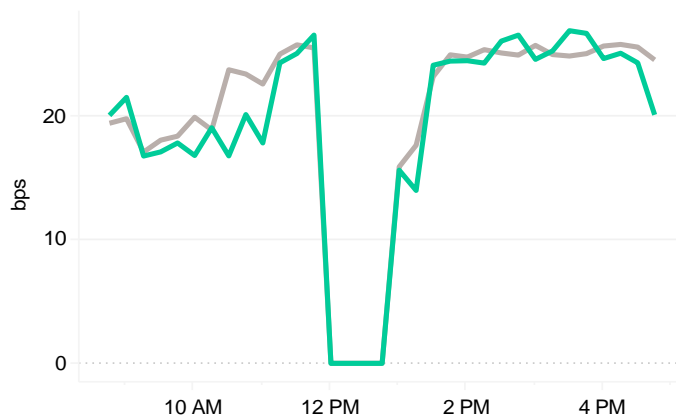


Singapore

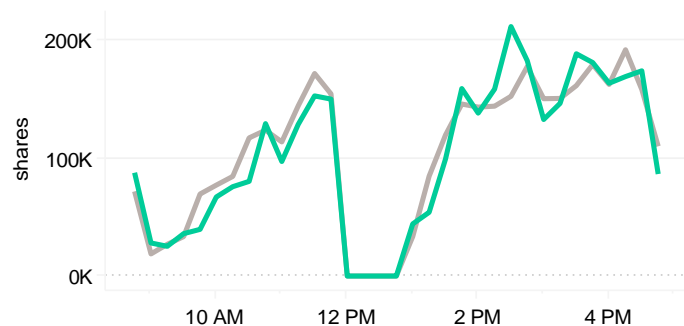
Volume Curve



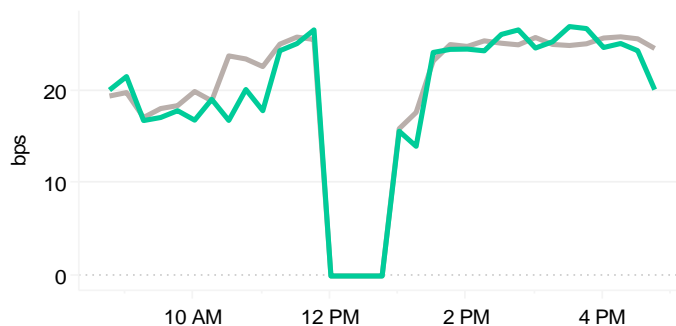
Intraday Spread (bps)



Intraday Quotesize (Shares)



Intraday Volatility (bps)



■ Rolling 12 Months Avg ■ January 2023

Spread Bps

	2022						2023	
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	
FirstHalfHour	15.8	18.1	19.4	19.2	16.5	18.0	19.8	
MidDay	24.7	24.5	26.6	22.8	22.3	24.2	24.3	
LastHalfHour	24.7	24.5	25.3	27.8	20.3	24.4	24.2	

One Minute Volatility Bps

FirstHalfHour	47.3	45.5	37.0	66.4	44.0	34.5	37.7
MidDay	24.9	24.6	26.8	26.6	25.3	24.6	25.2
LastHalfHour	24.8	24.6	26.6	28.5	24.7	27.1	24.8

Quotesize (shares)

FirstHalfHour	59,946	52,201	76,276	41,303	59,495	65,760	55,481
MidDay	147,637	241,175	283,930	89,492	106,664	123,584	140,704
LastHalfHour	124,848	183,469	212,063	121,825	94,969	128,454	109,921

Median used for all metrics

One minute volatility is calculated using the difference between the high and low price within a one minute time bin, divided by that bin's VWAP

Source data: Virtu Financial

Glossary

Volume curve - average of value traded during the month, per 15-minute time bin.

Intraday volatility - Median of difference between the high and low price within a one minute time bin, divided by that bin's VWAP

Spread - median of bid-ask spread of the index.

Quotesize - Median bid and ask size of all stocks in the index.

Average daily turnover - average daily value traded in the market.

Indices used:

Australia: ASX

200 Japan:

TOPIX China:

CSI 300

Hong Kong: Hang Seng Index

Taiwan: TWSE

India: NIFTY 50

Korea: MSCI Korea 25/50 Index

New Zealand: MSCI New Zealand IMI 25/50 Index

Singapore: MSCI Singapore Index

Thailand: MSCI Thailand IMI 25/50 Index

ABOUT VIRTU

Virtu is a leading financial services firm that leverages cutting-edge technology to provide execution services and data, analytics and connectivity products to its clients and deliver liquidity to the global markets. Leveraging its global market making expertise and infrastructure, Virtu provides a robust product suite including offerings in execution, liquidity sourcing, analytics and broker-neutral, multi-dealer platforms in workflow technology. Virtu's product offerings allow clients to trade on hundreds of venues across 50+ countries and in multiple asset classes, including global equities, ETFs, foreign exchange, futures, fixed income and myriad other commodities. In addition, Virtu's integrated, multi-asset analytics platform provides a range of pre and post-trade services, data products and compliance tools that clients rely upon to invest, trade and manage risk across global markets.

To learn more, contact your sales representative or call our desk at:

APAC+852.2846.3553 | **CAN**+1.416.874.0800 | **EMEA**+44.20.7670.4066 | **US**+1.212.444.6250

info@virtu.com | www.virtu.com

© 2023 Virtu Financial, Inc. All rights reserved. Not to be reproduced or retransmitted without permission. These materials are for informational purposes and are not intended to be used to make trading or investment decisions, they are not intended as an offer to sell or the solicitation of an offer to buy any security or financial product, and are not intended as advice (investment, tax or legal). The information contained herein includes Virtu proprietary information and/or has been taken from sources we believe to be reliable, but we do not represent or warrant that such information is accurate or complete and it should not be relied upon as such.

Securities products and services are offered by the following subsidiaries of Virtu Financial, Inc. In the U.S., Virtu Americas LLC, member FINRA and SIPC; in Canada, Virtu Canada Corp., member Canadian Investor Protection Fund and Investment Industry Regulatory Organization of Canada; in Europe, Virtu ITG Europe Limited, registered in Ireland No. 283940 ("VIEL") (VIEL is authorized and regulated by the Central Bank of Ireland), and Virtu Financial Ireland Limited, registered in Ireland No. 471719 ("VFIL") (VFIL is authorized and regulated by the Central Bank of Ireland). The registered office of VIEL and VFIL is Whitaker Court, Whitaker Square, Sir John Rogerson's Quay, Dublin 2, Ireland; in Asia, Virtu ITG Hong Kong Limited (SFC License No. AHD810), Virtu ITG Singapore Pte Limited (CMS License No. 100138-1), and Virtu ITG Australia Limited (AFS License No. 219582).