

Medical Technology

New PFA market model – how PFA impacts company EP growth

Industry Overview

New PFA model; look at how PFA launches impact growth

We rebuilt our Electrophysiology (EP) market model to break out RF/Cryo/PFA and get a better sense of how market share and growth could look as each PFA technology launches. We made it much more dynamic to help investors see how their own assumptions impact company EP growth rates (excel available). The biggest thing we came away with from doing bottom up modeling is BSX could have more upside to EP revenue than we appreciated after thinking about upside potential from market growth and cryo in addition to Farapulse. We looked at two scenarios in this note: 1. A base case that's bullish PFA (assumes cryo switches first then RF); 2. A case more similar to BSX's view of PFA penetration that's even more bullish PFA (assumes both cryo/RF switch).

PFA base case: 20% mkt growth; PFA 25% of mkt by 2025

Our bullish PFA base case assumes afib market grows 20% and cryo is the larger share donor in 2024 and RF starts converting more in 2025. This implies PFA goes from <5% of the ablation mkt in 2023 to 25% in 2025 and 45% in 2026. This scenario has BSX EP growing 89% in 2024 and 45% in 2025; JNJ EP growing 15% in 2024 and 17% in 2025; ABT EP growing 7% in 2024 and 2% in 2025; and MDT EP growing 14% in 2024 and 43% in 2025. Total EP market share in 2025 is 51% JNJ, 19% ABT, 18% BSX, 12% MDT. We assume PFA market share by company in 2025 is BSX 50%, MDT 30% and JNJ 20%.

BSX case: 15% mkt growth; PFA 35% of mkt by 2025

We took a view that started with what BSX laid out at its analyst day (ablation market grow at ~16% CAGR; PFA will have 40-60% share in 2026). We assume both cryo and RF converts quickly to PFA. We assume PFA goes from <5% of the ablation mkt in 2023 to 35% in 2025 and 50% in 2026. This scenario has BSX EP growing 131% in 2024 and 43% in 2025; JNJ EP growth flat in 2024 and 7% in 2025; ABT EP declining -7% in 2024 and -4% in 2025; and MDT EP growing 41% in 2024 and 35% in 2025. Total EP market share in 2025 is 44% JNJ, 17% ABT, 23% BSX, 15% MDT. We assume PFA market share by company in 2025 is BSX 58%, MDT 30% and JNJ 12%.

See inside for all more detailed models and more detailed assumptions. Ask for our dynamic excel modeling.

15 March 2024

Equity
United States
Medical Technology

Travis Steed
Research Analyst
BofAS
+1 404 607 3251
travis.steed@bofa.com

Craig Bijou
Research Analyst
BofAS
+1 646 855 2590
craig.bijou@bofa.com

Stephanie Piazzola
Research Analyst
BofAS
+1 646 855 4568
stephanie.piazzola@bofa.com

Carolyn Huszagh
Research Analyst
BofAS
+1 312 259 7414
carolyn.huszagh@bofa.com

Abbreviations:

EP = electrophysiology

AFib = atrial fibrillation

PFA = pulse field ablation

RF = radiofrequency

Cryo = cryoablation

BSX = Boston Scientific

MDT = Medtronic

ABT = Abbott

JNJ = Johnson & Johnson

BofA Securities does and seeks to do business with issuers covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision. Refer to important disclosures on page 7 to 9.

12670885

Timestamp: 15 March 2024 05:00AM EDT

Model scenarios

Base Case

Our key Assumptions

- Market growth: 20%
- **AFib ablation market by ablation type:** We assume the cryo market is the larger share donor to PFA in 2024 vs RF and that RF starts converting more significantly to PFA in 2025.
 - PFA goes from <5% of the ablation mkt in 2023 to 25% in 2025 and 45% in 2026
 - RF goes from 82% in 2023 to 68% in 2025 and 48% in 2026
 - Cryo goes from 16% in 2023 to 7% in 2025 and 7% in 2026
- **PFA market share by company:** We assume BSX will maintain its share leadership position but by 2026 share is close to evenly split between BSX, MDT and JNJ
 - 2023: BSX 92%, MDT 8%
 - 2024: BSX 68%, MDT 26% and JNJ 6%
 - 2025: BSX 50%, MDT 30% and JNJ 20%
 - 2026: BSX 37%, MDT 33% and JNJ 30%
- **Cryo market share by company:** We assume BSX is able to increase its share in cryo given pull through/bundling with Farapulse, taking share from MDT
 - 2023: BSX 21% and MDT 79%
 - 2024: BSX 31% and MDT 69%
 - 2025: BSX 37% and MDT 63%
 - 2026: BSX 40% and MDT 60%
- **RF market share by company:** We assume BSX and MDT are able to increase share in RF given pull through/bundling with Farapulse and PulseSelect/Affera respectively, taking share from ABT in RF. We assume JNJ has stable RF share given Varipulse.
 - 2023: BSX 7%, MDT 2%, JNJ 64% and ABT 28%
 - 2024: BSX 9%, MDT 3%, JNJ 63% and ABT 25%
 - 2025: BSX 10%, MDT 4%, JNJ 63% and ABT 23%
 - 2026: BSX 11%, MDT 5%, JNJ 63% and ABT 21%
- **Mapping/other market share by company:** We don't expect major share shifts from current market but assume BSX sees a slight pick up in mapping revenue from Rhythmia/Farapulse integration (expected later this year) and MDT to generate some mapping revenue from Affera
 - 2023: BSX 4%, MDT 0%, JNJ 62% and ABT 34%
 - 2024: BSX 5%, MDT 3%, JNJ 60% and ABT 32%
 - 2025: BSX 6%, MDT 4%, JNJ 60% and ABT 30%
 - 2026: BSX 8%, MDT 4%, JNJ 60% and ABT 28%

This scenario has BSX EP growing 89% in 2024 and 45% in 2025; JNJ EP growing 15% in 2024 and 17% in 2025; ABT EP growing 7% in 2024 and 2% in 2025; and MDT EP growing 14% in 2024 and 43% in 2025. Total EP market share in 2025 is 51% JNJ, 19% ABT, 18% BSX, 12% MDT.

Exhibit 1: Base case model summary for the AFib market

Our base case key assumptions include 20% mkt growth and that PFA is 25% of mkt by 2025. We assume PFA market share by company in 2024 of BSX 68%, MDT 26% and JNJ 6% and in 2025 BSX 50%, MDT 30% and JNJ 20%. This scenario has BSX EP growing 89% in 2024 and 45% in 2025; JNJ EP growing 15% in 2024 and 17% in 2025; ABT EP growing 7% in 2024 and 2% in 2025; and MDT EP growing 14% in 2024 and 43% in 2025. Total EP market share in 2025 is 51% JNJ, 19% ABT, 18% BSX, 12% MDT.

	2021A	2022A	2023A	1Q24E	2Q24E	3Q24E	4Q24E	2024E	2025E	2026E
WW Total Atrial Fibrillation Sales (\$m)										
JNJ	3,328	3,803	4,688	1,319	1,350	1,351	1,394	5,413	6,309	7,118
ABT	1,907	1,927	2,195	577	591	586	595	2,349	2,401	2,193
BSX	365	585	799	304	376	397	433	1,509	2,185	3,015
MDT	876	868	897	271	257	240	256	1,024	1,460	2,500
Total Afib	6,476	7,183	8,579	2,471	2,574	2,574	2,677	10,295	12,354	14,825
Atrial Fibrillation CC Growth (%)										
JNJ	33%	13%	21%	21%	13%	16%	12%	15%	17%	13%
ABT	22%	8%	16%	14%	7%	8%	0%	7%	2%	-9%
BSX	28%	18%	32%	73%	95%	109%	80%	89%	45%	38%
MDT	36%	4%	4%	8%	19%	17%	13%	14%	43%	71%
Afib Market Growth	29%	11%	19%	22%	19%	23%	16%	20%	20%	20%
Atrial Fibrillation Market Share										
JNJ	51%	53%	55%	53%	52%	52%	52%	53%	51%	48%
ABT	29%	27%	26%	23%	23%	23%	22%	23%	19%	15%
BSX	6%	8%	9%	12%	15%	15%	16%	15%	18%	20%
MDT	14%	12%	10%	11%	10%	9%	10%	10%	12%	17%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Upside / Downside to Street EP revenue:										
JNJ				3%	1%	3%	1%	2%	7%	11%
ABT				4%	-1%	0%	-6%	-1%	-7%	-23%
BSX				31%	46%	55%	39%	43%	64%	84%
MDT				-13%	-3%	-10%	-12%	-10%	20%	113%
Key Model Drivers (inputs in green):										
Total Afib Ablation Market Growth		11%	19%	21%	20%	23%	16%	20%	20%	20%
Total Mapping / Other Market Growth		10%	21%	24%	18%	21%	17%	20%	20%	20%
Total Afib Market Growth	29%	11%	19%	22%	19%	23%	16%	20%	20%	20%
Afib Ablation Market Mix by Ablation Type:										
Cryo % Afib	19%	17%	16%	14%	11%	9%	7%	10%	7%	7%
RF % Afib	81%	82%	82%	81%	79%	78%	75%	78%	68%	48%
PFA % Afib	0%	1%	3%	5%	10%	13%	18%	12%	25%	45%
Company Market Share by Ablation Type:										
Cryo Market Share:										
JNJ	--	--	--	--	--	--	--	--	--	--
ABT	--	--	--	--	--	--	--	--	--	--
BSX	11%	16%	21%	25%	30%	35%	37%	31%	37%	40%
MDT	89%	84%	79%	75%	70%	65%	63%	69%	63%	60%
RF Market Share:										
JNJ	60%	61%	64%	63%	63%	63%	63%	63%	63%	63%
ABT	32%	29%	28%	25%	25%	25%	25%	25%	23%	21%
BSX	6%	8%	7%	9%	9%	9%	9%	9%	10%	11%
MDT	2%	2%	2%	3%	3%	3%	3%	3%	4%	5%
PFA Market Share:										
JNJ	0%	0%	0%	0%	0%	5%	11%	6%	20%	30%
ABT	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BSX	100%	100%	92%	82%	76%	69%	60%	68%	50%	37%
MDT	0%	0%	8%	18%	24%	26%	29%	26%	30%	33%
Mapping Market Share:										
JNJ	59%	61%	62%	60%	60%	60%	60%	60%	60%	60%
ABT	39%	36%	34%	32%	32%	32%	32%	32%	30%	28%
BSX	2%	2%	4%	5%	5%	5%	5%	5%	6%	8%
MDT	0%	0%	0%	3%	3%	3%	3%	3%	4%	4%

Source: Company filings, BofA Global Research.

BSX View

BSX estimates the global AFib ablation market will grow at a ~16% CAGR (from ~\$5bn in 2023 to ~\$8bn in 2026) and PFA will have 40-60% share in 2026. BSX expects to have a leadership position in PFA which we assume as 35-50%.

- Market growth: 15%
- **AFib ablation market by ablation type:** We assume both cryo and RF markets convert to PFA starting in 2024
 - PFA goes from <5% of the ablation mkt in 2023 to 35% in 2025 and 50% in 2026
 - RF goes from 82% in 2023 to 55% in 2025 and 43% in 2026
 - Cryo goes from 16% in 2023 to 10% in 2025 and 7% in 2026
- **PFA market share by company:** We assume BSX will continue to be the share leader through 2026 and in 2026 will have 45% share of the PFA ablation market
 - 2023: BSX 92%, MDT 8%
 - 2024: BSX 68%, MDT 26% and JNJ 6%;
 - 2025: BSX 58%, MDT 30% and JNJ 12%
 - 2026: BSX 45%, MDT 35% and JNJ 20%.
- **Cryo market share by company:** Consistent with the base case, we assume BSX is able to increase its share in cryo given pull through/bundling with Farapulse, taking share from MDT
 - 2023: BSX 21% and MDT 79%
 - 2024: BSX 31% and MDT 69%
 - 2025: BSX 37% and MDT 63%
 - 2026: BSX 40% and MDT 60%
- **RF market share by company:** Consistent with the base case, we assume BSX and MDT are able to increase share in RF given pull through/bundling with Farapulse and PulseSelect/Affera respectively, taking share from ABT in RF. We assume JNJ has stable RF share given Varipulse.
 - 2023: BSX 7%, MDT 2%, JNJ 64% and ABT 28%
 - 2024: BSX 9%, MDT 3%, JNJ 63% and ABT 25%
 - 2025: BSX 10%, MDT 4%, JNJ 63% and ABT 23%
 - 2026: BSX 11%, MDT 5%, JNJ 63% and ABT 21%
- **Mapping/other market share by company:** Consistent with the base case, we don't expect major share shifts from current market but assume BSX sees a slight pick up in mapping revenue from Rhythmia/Farapulse integration (expected later this year) and MDT to generate some mapping revenue from Affera
 - 2023: BSX 4%, MDT 0%, JNJ 62% and ABT 34%
 - 2024: BSX 5%, MDT 3%, JNJ 60% and ABT 32%
 - 2025: BSX 6%, MDT 4%, JNJ 60% and ABT 30%

- 2026: BSX 8%, MDT 4%, JNJ 60% and ABT 28%

This scenario has BSX EP growing 131% in 2024 and 43% in 2025; JNJ EP growth flat in 2024 and 7% in 2025; ABT EP declining -7% in 2024 and -4% in 2025; and MDT EP growing 41% in 2024 and 35% in 2025. Total EP market share in 2025 is 44% JNJ, 17% ABT, 23% BSX, 15% MDT.

Exhibit 2: Model summary of BSX's view of the AFib market

Our key assumptions in this scenario include the global AFib ablation market will grow at a ~16% CAGR (from ~\$5bn in 2023 to ~\$8bn in 2026), PFA will have 40-60% share in 2026, and BSX will be a market leader in PFA which we assume as 35-40%. This scenario has BSX EP growing 131% in 2024 and 43% in 2025; JNJ EP growth flat in 2024 and 7% in 2025; ABT EP declining -7% in 2024 and -4% in 2025; and MDT EP growing 41% in 2024 and 35% in 2025. Total EP market share in 2025 is 44% JNJ, 17% ABT, 23% BSX, 15% MDT.

	2021A	2022A	2023A	1Q24E	2Q24E	3Q24E	4Q24E	2024E	2025E	2026E
WW Total Atrial Fibrillation Sales (\$m)										
JNJ	3,328	3,803	4,688	1,220	1,202	1,176	1,109	4,708	5,039	5,625
ABT	1,907	1,927	2,195	535	530	512	466	2,044	1,953	1,829
BSX	365	585	799	322	432	488	605	1,848	2,646	3,163
MDT	876	868	897	290	302	290	385	1,268	1,709	2,431
Total Afib	6,476	7,183	8,579	2,368	2,467	2,467	2,565	9,866	11,346	13,048
Atrial Fibrillation CC Growth (%)										
JNJ	33%	13%	21%	12%	1%	1%	-11%	0%	7%	12%
ABT	22%	8%	16%	6%	-4%	-6%	-21%	-7%	-4%	-6%
BSX	28%	18%	32%	83%	124%	157%	152%	131%	43%	20%
MDT	36%	4%	4%	16%	40%	42%	70%	41%	35%	42%
Afib Market Growth	29%	11%	19%	17%	14%	18%	12%	15%	15%	15%
Atrial Fibrillation Market Share										
JNJ	51%	53%	55%	52%	49%	48%	43%	48%	44%	43%
ABT	29%	27%	26%	23%	21%	21%	18%	21%	17%	14%
BSX	6%	8%	9%	14%	18%	20%	24%	19%	23%	24%
MDT	14%	12%	10%	12%	12%	12%	15%	13%	15%	19%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Upside / Downside to Street EP revenue:										
JNJ				-5%	-10%	-11%	-20%	-11%	-14%	-12%
ABT				-4%	-11%	-13%	-27%	-14%	-24%	-36%
BSX				39%	68%	91%	94%	75%	98%	93%
MDT				-7%	14%	9%	33%	12%	40%	107%

Key Model Drivers (inputs in green):										
Total Afib Ablation Market Growth		11%	19%	16%	15%	18%	12%	15%	15%	15%
Total Mapping / Other Market Growth		10%	21%	19%	13%	16%	12%	15%	15%	15%
Total Afib Market Growth	29%	11%	19%	17%	14%	18%	12%	15%	15%	15%
Afib Ablation Market Mix by Ablation Type:										
Cryo % Afib	19%	17%	16%	16%	14%	11%	12%	13%	10%	7%
RF % Afib	81%	82%	82%	77%	71%	67%	53%	67%	55%	43%
PFA % Afib	0%	1%	3%	7%	15%	22%	35%	20%	35%	50%
Company Market Share by Ablation Type:										
Cryo Market Share:										
JNJ	--	--	--	--	--	--	--	--	--	--
ABT	--	--	--	--	--	--	--	--	--	--
BSX	11%	16%	21%	25%	30%	35%	37%	31%	37%	40%
MDT	89%	84%	79%	75%	70%	65%	63%	69%	63%	60%
RF Market Share:										
JNJ	60%	61%	64%	63%	63%	63%	63%	63%	63%	63%
ABT	32%	29%	28%	25%	25%	25%	25%	25%	23%	21%
BSX	6%	8%	7%	9%	9%	9%	9%	9%	10%	11%
MDT	2%	2%	2%	3%	3%	3%	3%	3%	4%	5%
PFA Market Share:										
JNJ	0%	0%	0%	0%	0%	5%	11%	6%	12%	20%
ABT	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BSX	100%	100%	92%	82%	76%	69%	60%	67%	58%	45%
MDT	0%	0%	8%	18%	24%	26%	29%	26%	30%	35%
Mapping Market Share:										
JNJ	59%	61%	62%	60%	60%	60%	60%	60%	60%	60%
ABT	39%	36%	34%	32%	32%	32%	32%	32%	30%	28%
BSX	2%	2%	4%	5%	5%	5%	5%	5%	6%	8%
MDT	0%	0%	0%	3%	3%	3%	3%	3%	4%	4%

Exhibit 2: Model summary of BSX’s view of the AFib market
Our key assumptions in this scenario include the global AFib ablation market will grow at a ~16% CAGR (from ~\$5bn in 2023 to ~\$8bn in 2026), PFA will have 40-60% share in 2026, and BSX will be a market leader in PFA which we assume as 35-40%. This scenario has BSX EP growing 131% in 2024 and 43% in 2025; JNJ EP growth flat in 2024 and 7% in 2025; ABT EP declining -7% in 2024 and -4% in 2025; and MDT EP growing 41% in 2024 and 35% in 2025. Total EP market share in 2025 is 44% JNJ, 17% ABT, 23% BSX, 15% MDT.

	2021A	2022A	2023A	1Q24E	2Q24E	3Q24E	4Q24E	2024E	2025E	2026E
--	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Source: Company financials, BofA Global Research

BofA GLOBAL RESEARCH



Disclosures

Important Disclosures

FUNDAMENTAL EQUITY OPINION KEY: Opinions include a Volatility Risk Rating, an Investment Rating and an Income Rating. VOLATILITY RISK RATINGS, indicators of potential price fluctuation, are: A - Low, B - Medium and C - High. INVESTMENT RATINGS reflect the analyst’s assessment of both a stock’s absolute total return potential as well as its attractiveness for investment relative to other stocks within its Coverage Cluster (defined below). Our investment ratings are: 1 - Buy stocks are expected to have a total return of at least 10% and are the most attractive stocks in the coverage cluster; 2 - Neutral stocks are expected to remain flat or increase in value and are less attractive than Buy rated stocks and 3 - Underperform stocks are the least attractive stocks in a coverage cluster. An investment rating of 6 (No Rating) indicates that a stock is no longer trading on the basis of fundamentals. Analysts assign investment ratings considering, among other things, the 0-12 month total return expectation for a stock and the firm’s guidelines for ratings dispersions (shown in the table below). The current price objective for a stock should be referenced to better understand the total return expectation at any given time. The price objective reflects the analyst’s view of the potential price appreciation (depreciation).

Investment rating	Total return expectation (within 12-month period of date of initial rating)	Ratings dispersion guidelines for coverage cluster ^{R1}
Buy	≥ 10%	≤ 70%
Neutral	≥ 0%	≤ 30%
Underperform	N/A	≥ 20%

^{R1} Ratings dispersions may vary from time to time where BofA Global Research believes it better reflects the investment prospects of stocks in a Coverage Cluster.

INCOME RATINGS, indicators of potential cash dividends, are: 7 - same/higher (dividend considered to be secure), 8 - same/lower (dividend not considered to be secure) and 9 - pays no cash dividend. Coverage Cluster is comprised of stocks covered by a single analyst or two or more analysts sharing a common industry, sector, region or other classification(s). A stock’s coverage cluster is included in the most recent BofA Global Research report referencing the stock.

BofA Global Research personnel (including the analyst(s) responsible for this report) receive compensation based upon, among other factors, the overall profitability of Bank of America Corporation, including profits derived from investment banking. The analyst(s) responsible for this report may also receive compensation based upon, among other factors, the overall profitability of the Bank’s sales and trading businesses relating to the class of securities or financial instruments for which such analyst is responsible.

Other Important Disclosures

From time to time research analysts conduct site visits of covered issuers. BofA Global Research policies prohibit research analysts from accepting payment or reimbursement for travel expenses from the issuer for such visits. Prices are indicative and for information purposes only. Except as otherwise stated in the report, for any recommendation in relation to an equity security, the price referenced is the publicly traded price of the security as of close of business on the day prior to the date of the report or, if the report is published during intraday trading, the price referenced is indicative of the traded price as of the date and time of the report and in relation to a debt security (including equity preferred and CDS), prices are indicative as of the date and time of the report and are from various sources including BofA Securities trading desks. The date and time of completion of the production of any recommendation in this report shall be the date and time of dissemination of this report as recorded in the report timestamp.

Recipients who are not institutional investors or market professionals should seek the advice of their independent financial advisor before considering information in this report in connection with any investment decision, or for a necessary explanation of its contents. Officers of BofAS or one or more of its affiliates (other than research analysts) may have a financial interest in securities of the issuer(s) or in related investments.

Refer to [BofA Global Research policies relating to conflicts of interest](#). **"BofA Securities" includes BofA Securities, Inc. ("BofAS") and its affiliates. Investors should contact their BofA Securities representative or Merrill Global Wealth Management financial advisor if they have questions concerning this report or concerning the appropriateness of any investment idea described herein for such investor. "BofA Securities" is a global brand for BofA Global Research.**

Information relating to Non-US affiliates of BofA Securities and Distribution of Affiliate Research Reports: BofAS and/or Merrill Lynch, Pierce, Fenner & Smith Incorporated ("MLPF&S") may in the future distribute, information of the following non-US affiliates in the US (short name: legal name, regulator): Merrill Lynch (South Africa): Merrill Lynch South Africa (Pty) Ltd., regulated by The Financial Service Board; MLI (UK): Merrill Lynch International, regulated by the Financial Conduct Authority (FCA) and the Prudential Regulation Authority (PRA); BofASE (France): BofA Securities Europe SA is authorized by the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and regulated by the ACPR and the Autorité des Marchés Financiers (AMF). BofA Securities Europe SA ("BofASE") with registered address at 51, rue La Boétie, 75008 Paris is registered under no 842 602 690 RCS Paris. In accordance with the provisions of French Code Monétaire et Financier (Monetary and Financial Code), BofASE is an établissement de crédit et d'investissement (credit and investment institution) that is authorised and supervised by the European Central Bank and the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and regulated by the ACPR and the Autorité des Marchés Financiers. BofASE's share capital can be found at www.bofam.com/BofASEdisclaimer; BofA Europe (Milan): Bank of America Europe Designated Activity Company, Milan Branch, regulated by the Bank of Italy, the European Central Bank (ECB) and the Central Bank of Ireland (CBI); BofA Europe (Frankfurt): Bank of America Europe Designated Activity Company, Frankfurt Branch regulated by BaFin, the ECB and the CBI; BofA Europe (Madrid): Bank of America Europe Designated Activity Company, Sucursal en España, regulated by the Bank of Spain, the ECB and the CBI; Merrill Lynch (Australia): Merrill Lynch Equities (Australia) Limited, regulated by the Australian Securities and Investments Commission; Merrill Lynch (Hong Kong): Merrill Lynch (Asia Pacific) Limited, regulated by the Hong Kong Securities and Futures Commission (HKSF); Merrill Lynch (Singapore): Merrill Lynch (Singapore) Pte Ltd, regulated by the Monetary Authority of Singapore (MAS); Merrill Lynch (Canada): Merrill Lynch Canada Inc, regulated by the Canadian Investment Regulatory Organization; Merrill Lynch (Mexico): Merrill Lynch Mexico, SA de CV, Casa de Bolsa, regulated by the Comisión Nacional Bancaria y de Valores; Merrill Lynch (Argentina): Merrill Lynch Argentina SA, regulated by Comisión Nacional de Valores; BofAS Japan: BofA Securities Japan Co., Ltd., regulated by the Financial Services Agency; Merrill Lynch (Seoul): Merrill Lynch International, LLC Seoul Branch, regulated by the Financial Supervisory Service; Merrill Lynch (Taiwan): Merrill Lynch Securities (Taiwan) Ltd., regulated by the Securities and Futures Bureau; BofAS India: BofA Securities India Limited, regulated by the Securities and Exchange Board of India (SEBI); Merrill Lynch (Israel): Merrill Lynch Israel Limited, regulated by Israel Securities Authority; Merrill Lynch (DIFC): Merrill Lynch International (DIFC Branch), regulated by the Dubai Financial Services Authority (DFSA); Merrill Lynch (Brazil): Merrill Lynch S.A. Corretora de Títulos e Valores Mobiliários, regulated by Comissão de Valores Mobiliários; Merrill Lynch KSA Company: Merrill Lynch Kingdom of Saudi Arabia Company, regulated by the Capital Market Authority. This information has been approved for publication and is distributed in the United Kingdom (UK) to professional clients and eligible counterparties (as each is defined in the rules of the FCA and the PRA) by MLI (UK), which is authorized by the PRA and regulated by the FCA and the PRA - details about the extent of our regulation by the FCA and PRA are available from us on request; has been approved for publication and is distributed in the European Economic Area (EEA) by BofASE (France), which is authorized by the ACPR and regulated by the ACPR and the AMF; has been considered and distributed in Japan by BofAS Japan, a registered securities dealer under the Financial Instruments and Exchange Act in Japan, or its permitted affiliates; is issued and distributed in Hong Kong by Merrill Lynch (Hong Kong) which is regulated by HKSF; is issued and distributed in Taiwan by Merrill Lynch (Taiwan); is issued and distributed in India by BofAS India; and is issued and distributed in Singapore to institutional investors and/or accredited investors (each as defined under the Financial Advisers Regulations) by Merrill Lynch (Singapore) (Company Registration No 198602883D). Merrill Lynch (Singapore) is regulated by MAS. Merrill Lynch Equities (Australia) Limited (ABN 65 006 276 795), AFS License 235132 (MLEA) distributes this information in Australia only to 'Wholesale' clients as defined by s.761G of the Corporations Act 2001. With the exception of Bank of America N.A., Australia Branch, neither MLEA nor any of

its affiliates involved in preparing this information is an Authorised Deposit-Taking Institution under the Banking Act 1959 nor regulated by the Australian Prudential Regulation Authority. No approval is required for publication or distribution of this information in Brazil and its local distribution is by Merrill Lynch (Brazil) in accordance with applicable regulations. Merrill Lynch (DIFC) is authorized and regulated by the DFSA. Information prepared and issued by Merrill Lynch (DIFC) is done so in accordance with the requirements of the DFSA conduct of business rules. BofA Europe (Frankfurt) distributes this information in Germany and is regulated by BaFin, the ECB and the CBL. BofA Securities entities, including BofA Europe and BofASE (France), may outsource/delegate the marketing and/or provision of certain research services or aspects of research services to other branches or members of the BofA Securities group. You may be contacted by a different BofA Securities entity acting for and on behalf of your service provider where permitted by applicable law. This does not change your service provider. Please refer to the [Electronic Communications Disclaimers](#) for further information.

This information has been prepared and issued by BofAS and/or one or more of its non-US affiliates. The author(s) of this information may not be licensed to carry on regulated activities in your jurisdiction and, if not licensed, do not hold themselves out as being able to do so. BofAS and/or MLPF&S is the distributor of this information in the US and accepts full responsibility for information distributed to BofAS and/or MLPF&S clients in the US by its non-US affiliates. Any US person receiving this information and wishing to effect any transaction in any security discussed herein should do so through BofAS and/or MLPF&S and not such foreign affiliates. Hong Kong recipients of this information should contact Merrill Lynch (Asia Pacific) Limited in respect of any matters relating to dealing in securities or provision of specific advice on securities or any other matters arising from, or in connection with, this information. Singapore recipients of this information should contact Merrill Lynch (Singapore) Pte Ltd in respect of any matters arising from, or in connection with, this information. For clients that are not accredited investors, expert investors or institutional investors Merrill Lynch (Singapore) Pte Ltd accepts full responsibility for the contents of this information distributed to such clients in Singapore.

General Investment Related Disclosures:

Taiwan Readers: Neither the information nor any opinion expressed herein constitutes an offer or a solicitation of an offer to transact in any securities or other financial instrument. No part of this report may be used or reproduced or quoted in any manner whatsoever in Taiwan by the press or any other person without the express written consent of BofA Securities. This document provides general information only, and has been prepared for, and is intended for general distribution to, BofA Securities clients. Neither the information nor any opinion expressed constitutes an offer or an invitation to make an offer, to buy or sell any securities or other financial instrument or any derivative related to such securities or instruments (e.g., options, futures, warrants, and contracts for differences). This document is not intended to provide personal investment advice and it does not take into account the specific investment objectives, financial situation and the particular needs of, and is not directed to, any specific person(s). This document and its content do not constitute, and should not be considered to constitute, investment advice for purposes of ERISA, the US tax code, the Investment Advisers Act or otherwise. Investors should seek financial advice regarding the appropriateness of investing in financial instruments and implementing investment strategies discussed or recommended in this document and should understand that statements regarding future prospects may not be realized. Any decision to purchase or subscribe for securities in any offering must be based solely on existing public information on such security or the information in the prospectus or other offering document issued in connection with such offering, and not on this document.

Securities and other financial instruments referred to herein, or recommended, offered or sold by BofA Securities, are not insured by the Federal Deposit Insurance Corporation and are not deposits or other obligations of any insured depository institution (including, Bank of America, N.A.). Investments in general and, derivatives, in particular, involve numerous risks, including, among others, market risk, counterparty default risk and liquidity risk. No security, financial instrument or derivative is suitable for all investors. Digital assets are extremely speculative, volatile and are largely unregulated. In some cases, securities and other financial instruments may be difficult to value or sell and reliable information about the value or risks related to the security or financial instrument may be difficult to obtain. Investors should note that income from such securities and other financial instruments, if any, may fluctuate and that price or value of such securities and instruments may rise or fall and, in some cases, investors may lose their entire principal investment. Past performance is not necessarily a guide to future performance. Levels and basis for taxation may change.

This report may contain a short-term trading idea or recommendation, which highlights a specific near-term catalyst or event impacting the issuer or the market that is anticipated to have a short-term price impact on the equity securities of the issuer. Short-term trading ideas and recommendations are different from and do not affect a stock's fundamental equity rating, which reflects both a longer term total return expectation and attractiveness for investment relative to other stocks within its Coverage Cluster. Short-term trading ideas and recommendations may be more or less positive than a stock's fundamental equity rating.

BofA Securities is aware that the implementation of the ideas expressed in this report may depend upon an investor's ability to "short" securities or other financial instruments and that such action may be limited by regulations prohibiting or restricting "shortselling" in many jurisdictions. Investors are urged to seek advice regarding the applicability of such regulations prior to executing any short idea contained in this report.

Foreign currency rates of exchange may adversely affect the value, price or income of any security or financial instrument mentioned herein. Investors in such securities and instruments, including ADRs, effectively assume currency risk.

BofAS or one of its affiliates is a regular issuer of traded financial instruments linked to securities that may have been recommended in this report. BofAS or one of its affiliates may, at any time, hold a trading position (long or short) in the securities and financial instruments discussed in this report.

BofA Securities, through business units other than BofA Global Research, may have issued and may in the future issue trading ideas or recommendations that are inconsistent with, and reach different conclusions from, the information presented herein. Such ideas or recommendations may reflect different time frames, assumptions, views and analytical methods of the persons who prepared them, and BofA Securities is under no obligation to ensure that such other trading ideas or recommendations are brought to the attention of any recipient of this information.

In the event that the recipient received this information pursuant to a contract between the recipient and BofAS for the provision of research services for a separate fee, and in connection therewith BofAS may be deemed to be acting as an investment adviser, such status relates, if at all, solely to the person with whom BofAS has contracted directly and does not extend beyond the delivery of this report (unless otherwise agreed specifically in writing by BofAS). If such recipient uses the services of BofAS in connection with the sale or purchase of a security referred to herein, BofAS may act as principal for its own account or as agent for another person. BofAS is and continues to act solely as a broker-dealer in connection with the execution of any transactions, including transactions in any securities referred to herein.

Copyright and General Information:

Copyright 2024 Bank of America Corporation. All rights reserved. iQdatabase® is a registered service mark of Bank of America Corporation. This information is prepared for the use of BofA Securities clients and may not be redistributed, retransmitted or disclosed, in whole or in part, or in any form or manner, without the express written consent of BofA Securities. BofA Global Research information is distributed simultaneously to internal and client websites and other portals by BofA Securities and is not publicly-available material. Any unauthorized use or disclosure is prohibited. Receipt and review of this information constitutes your agreement not to redistribute, retransmit, or disclose to others the contents, opinions, conclusion, or information contained herein (including any investment recommendations, estimates or price targets) without first obtaining express permission from an authorized officer of BofA Securities.

Materials prepared by BofA Global Research personnel are based on public information. Facts and views presented in this material have not been reviewed by, and may not reflect information known to, professionals in other business areas of BofA Securities, including investment banking personnel. BofA Securities has established information barriers between BofA Global Research and certain business groups. As a result, BofA Securities does not disclose certain client relationships with, or compensation received from, such issuers. To the extent this material discusses any legal proceeding or issues, it has not been prepared as nor is it intended to express any legal conclusion, opinion or advice. Investors should consult their own legal advisers as to issues of law relating to the subject matter of this material. BofA Global Research personnel's knowledge of legal proceedings in which any BofA Securities entity and/or its directors, officers and employees may be plaintiffs, defendants, co-defendants or co-plaintiffs with or involving issuers mentioned in this material is based on public information. Facts and views presented in this material that relate to any such proceedings have not been reviewed by, discussed with, and may not reflect information known to, professionals in other business areas of BofA Securities in connection with the legal proceedings or matters relevant to such proceedings.

This information has been prepared independently of any issuer of securities mentioned herein and not in connection with any proposed offering of securities or as agent of any issuer of any securities. None of BofAS any of its affiliates or their research analysts has any authority whatsoever to make any representation or warranty on behalf of the issuer(s). BofA Global Research policy prohibits research personnel from disclosing a recommendation, investment rating, or investment thesis for review by an issuer prior to the publication of a research report containing such rating, recommendation or investment thesis.

Any information relating to the tax status of financial instruments discussed herein is not intended to provide tax advice or to be used by anyone to provide tax advice. Investors are urged to seek tax advice based on their particular circumstances from an independent tax professional.

The information herein (other than disclosure information relating to BofA Securities and its affiliates) was obtained from various sources and we do not guarantee its accuracy. This information may contain links to third-party websites. BofA Securities is not responsible for the content of any third-party website or any linked content contained in a third-party website. Content contained on such third-party websites is not part of this information and is not incorporated by reference. The inclusion of a link does not imply any endorsement by or any affiliation with BofA Securities. Access to any third-party website is at your own risk, and you should always review the terms and privacy policies at third-party websites before submitting any personal information to them. BofA Securities is not responsible for such terms and privacy policies and expressly disclaims any liability for them.

All opinions, projections and estimates constitute the judgment of the author as of the date of publication and are subject to change without notice. Prices also are subject to change without notice. BofA Securities is under no obligation to update this information and BofA Securities ability to publish information on the subject issuer(s) in the future is subject to applicable quiet periods. You should therefore assume that BofA Securities will not update any fact, circumstance or opinion contained herein. Certain outstanding reports or investment opinions relating to securities, financial instruments and/or issuers may no longer be current. Always refer to the most recent research report relating to an issuer prior to making an investment decision.

In some cases, an issuer may be classified as Restricted or may be Under Review or Extended Review. In each case, investors should consider any investment opinion relating to such issuer (or its security and/or financial instruments) to be suspended or withdrawn and should not rely on the analyses and investment opinion(s) pertaining to such issuer (or its securities and/or financial instruments) nor should the analyses or opinion(s) be considered a solicitation of any kind. Sales persons and financial advisors affiliated with BofAS or any of its affiliates may not solicit purchases of securities or financial instruments that are Restricted or Under Review and may only solicit securities under Extended Review in accordance with firm policies. Neither BofA Securities nor any officer or employee of BofA Securities accepts any liability whatsoever for any direct, indirect or consequential damages or losses arising from any use of this information.