

US Semiconductors

Core Wars: INTC and AMD Q3 preview

Earnings Preview

Limited 2H upside potential, all about 2024 pipeline

We maintain our ratings of Underperform on INTC/Neutral on AMD ahead of their Q3 results on October 26/31, respectively. We expect Q3 results to be in line/slightly positive, but the Q4 outlook to be in line with/lower than expectations, driven by 1) unwind of PC channel normalization within Q3 and 2) continued pressure on traditional enterprise compute, telco, and embedded (industrial/IoT programmable chips/FPGA) demand, 3) restrained China shipments made worse by tight US restrictions, partially offset by 4) stronger pricing on new PC/server processors. We are not expecting a CY24 outlook but expect INTC to emphasize its foundry upside potential, progress roadmap, and ongoing restructuring benefits. AMD meanwhile will likely focus on formal launch of the MI300 GPU accelerator (via analyst call/event in mid-November?) featuring Microsoft, Oracle, and other hyperscale and supercomputing (El Capitan) customers.

INTC: focus on Apple M3, China restrictions, GM recovery

We expect INTC Q3 to beat but Q4 to be in line, though perhaps seen as “conservative” after beats of the last two quarters driven by PC channel normalization. However, we are now past that near-term lift, and investors will likely focus on the following: 1) ARM competition in PC: less so in enterprise but could become a factor in consumer PC in CY25 if NVDA, using ARM architecture, is able to leverage its stronger brand in “AI.” We also look forward to Apple’s potential October 30th launch of ARM-based M3 MacBook Pros (TSMC 3nm). 2) China restrictions: the recent round of US restrictions not only impacts NVDA but also INTC’s Habana Gaudi accelerators. 3) Restructuring progress and GM recovery: management toned down any large GM progress in CY24, versus consensus at 46.3%, ~200bp above the Q4’23 exit rate of 44.5%. INTC also has headroom left in its opex restructuring plan, but we are skeptical that it can regrow topline, compete in AI, and meet manufacturing commitments while cutting opex. We see limited valuation headroom with stock trading ~20x/16x CY24/25 PE (versus 13x historical), with enhanced geopolitical tensions seen as a risk.

AMD: all about AI pipeline

We expect AMD to report in line but likely guide Q4 in line to modestly below consensus as it faces headwinds in its embedded (Xilinx) and console (seasonal, product maturity) sales. However, all eyes will likely be on clues to MI300 AI (GPU) accelerator ramp for CY24. We are not expecting a specific CY24 outlook, though we sense market expectations in a broad range of \$1.5bn (our estimate) to \$4bn (supply capability from Asia), including \$0.5-\$0.7bn from the government supercomputing project. The lower end of estimates gets AMD CY24E pf-EPS close to \$3.70-\$4.00, while the upper end potentially gets EPS closer to \$4.50-\$5 (BofA at \$3.70, consensus at \$4.15). AMD is in the attractive “compute” neighborhood, but we maintain our Neutral rating given that even at consensus \$4.15 CY24 pf-EPS, the stock’s 25x CY24 PE is in line with/above NVDA’s implied multiple despite the latter’s faster growth/AI lead. We also question whether MI300 will have a sustainable runway given NVDA’s dominance in general-purpose compute and a faster product cadence ([see our 12 October 2023 note](#)) and multiple internal custom ASIC launches at hyperscalers (including MSFT’s Project Athena chip).

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 5 to 8. Analyst Certification on page 4. Price Objective Basis/Risk on page 3.

12615376

Timestamp: 24 October 2023 05:01PM EDT

24 October 2023

Equity
United States
Semiconductors

Vivek Arya
Research Analyst
BofAS
+1 646 855 1755
vivek.arya@bofa.com

Blake Friedman
Research Analyst
BofAS
+1 646 556 1850
blake.friedman@bofa.com

Duksan Jang
Research Analyst
BofAS
+1 646 556 4825
duksan.jang@bofa.com

Lauren Guy
Research Analyst
BofAS
+1 646 855 4273
lauren.guy2@bofa.com

Key terms

AI: artificial intelligence
AMD: Advanced Micro Devices
ASP: average selling price
CPU/MPU: central processing unit/microprocessor
DCAI: Data Center and AI
FPGA: Field-Programmable Gate Array
GM: gross margin
GPU: graphics processing unit
INTC: Intel
IoT: Internet of Things
MSFT: Microsoft
MU: Micron
NVDA: NVIDIA
opex: operating expense
PC: personal computer
pf: pro forma
PSG: Programmable Solutions Group

SKUs: stock keeping units
TAM: total addressable market

Additional details

PC: CY24 TAM at risk, INTC impacted disproportionately

While we expect strong seasonality to help Q3/Q4 results/guide, we see risks to the 2024 PC outlook for both INTC/AMD. After multiple downward revisions to CY23 TAM throughout the year (300mn units initially to 260-270mn levels), we now see PC sell-through of 250mn in CY23E, followed by just ~260mn units in CY24E. This is below our prior 275mn for CY24E and in line with IDC's latest PC outlook of 261mn. PCs represent nearly half of INTC's total sales (versus just ~20% for AMD) and should impact INTC's top-line/utilizations disproportionately. Increased competition from ARM should further pressure x86 TAM, limiting medium-/longer-term upside potential for both vendors.

Server: expanding capex pie, but limited goodness for both

In CPUs, we highlight continued elevated enterprise channel inventories, which should only normalize by the beginning of next year (per MU), favoring AI/cloud-heavy AMD over enterprise-indexed INTC. Outside CPUs, we see risks to investor expectations for AMD's MI300 in CY24E at the \$2bn-4bn range, well above our \$1bn-1.5bn. Though our latest cloud capex tracker points to strong spending recoveries in Q4'23E (+10% YoY) and CY24E (+16% YoY), we question whether MI300 customers (particularly MSFT) can launch in large volumes alongside supporting NVDA and internal Athena chips.

Exhibit 1: INTC Street versus BofA in September/December quarters

We expect \$13.4bn/\$14.4bn in sales in the September/December quarters, modestly below Street

	Sep-22	Jun-23	Sep-23E					Dec-23E			
			Guidance	Street	BofA	QoQ %	YoY %	BofA	Street	Guidance	New BofA
Sales (\$mn, Non-GAAP)	\$15,338	\$12,949	\$13,400	\$13,524	\$13,407	3.5%	(12.6%)	\$14,233	\$14,355		\$14,233
QoQ%	0.1%	10.5%		4.4%	3.5%			6.2%	6.1%		6.2%
Client Computing Group (CCG)	\$8,129	\$6,780		\$7,337	\$7,247	6.9%	(10.9%)	\$7,566	\$7,713		\$7,566
Data Center & AI (DCAI)	\$4,255	\$4,004		\$3,927	\$3,891	(2.8%)	(8.5%)	\$4,194	\$4,247		\$4,194
Networking & Edge (NEX)	\$2,133	\$1,364		\$1,330	\$1,303	(4.5%)	(38.9%)	\$1,400	\$1,438		\$1,400
Intel Foundry Services (IFS)	\$78	\$232		\$260	\$302	30.0%	286.7%	\$318	\$274		\$318
All Other	\$293	\$115		\$644	\$665	477.9%	126.8%	\$755	\$728		\$755
Gross Margin % (Non-GAAP)	45.9%	39.8%	43.0%	43.0%	43.0%	320	(288)	44.5%	44.3%		44.5%
Gross Profit	7,037	5,154			5,766	11.9%	(18.1%)	6,334			6,334
R&D	4,302	4,080			4,211	3.2%	(2.1%)	4,421			4,421
MG&A	1,744	1,374			1,422	3.5%	(18.5%)	1,479			1,479
Opex (Non-GAAP)	5,382	4,698			4,856	3.4%	(9.8%)	5,078			5,078
Operating Income	1,655	456		881	910	99.6%	(45.0%)	1,256	1,325		1,256
Operating Margin % (Non-GAAP)	10.8%	3.5%		6.5%	6.8%	327	(400)	8.8%	15.0%		8.8%
Financial Income	99	167			43			43			43
Pretax Income	1,754	623			953	53.0%	(45.7%)	1,299			1,299
Tax expense	-678	84			124	47.5%	(118.3%)	169			169
Tax rate (Non-GAAP)	-38.7%	13.5%	13.0%		13.0%	(48)	5,165	13.0%			13.0%
Net Income	2,432	547			829	51.6%	(65.9%)	1,130			1,130
Diluted EPS (Non-GAAP, ex-SBC)	\$0.59	\$0.13	\$0.20	\$0.21	\$0.20	51.4%	(66.5%)	\$0.27	\$0.31		\$0.27
Diluted Shares	4,125	4,196			4,201	0.1%	1.8%	4,206			4,206

Source: BofA Global Research estimates, Visible Alpha, Bloomberg, company reports

BofA GLOBAL RESEARCH

Exhibit 2: AMD Street versus BofA in September/December quarters

We expect \$6.4bn in sales in December quarter, -5% below Street

	Sep-22	Jun-23	Sep-23E					Dec-23E			
			Guidance	Cons	BofA	QoQ	YoY	BofA	Cons	Guidance	New BofA
Sales (\$mn)	\$5,565	\$5,359	\$5,700 +/- 300	\$5,703	\$5,702	6.4%	2.5%	\$6,104	\$6,398		\$6,104
QoQ%	-15.0%	0.1%		6.4%	6.4%			7.1%	12.2%		7.1%
Data Center	1,609	1,321		1,620	1,614	22.2%	0.3%	2,323	2,295		2,323
Server CPU	1,489	1,190			1,418	19.2%	(4.7%)	1,841			1,841
Data Center GPU	25	16			36	123.6%	47.6%	317			317
FPGA & Adoptive SoC	84	64			105	64.0%	NA	101			101
Pensando	12	51			55	NA	NA	64			64
Client	1,022	998		1,212	1,315	31.7%	28.6%	1,292	1,335		1,292
Desktop and Notebook Processors	955	938			1,242	32.4%	30.1%	1,220			1,220
Chipsets & IP (includes Samsung)	67	60			72	21.0%	8.2%	72			72
Embedded	1,303	1,459		1,324	1,267	(13.2%)	(2.8%)	1,198	1,296		1,198
Gaming	1,631	1,581		1,532	1,506	(4.8%)	(7.7%)	1,292	1,457		1,292
Gaming GPU	103	127			159	25.2%	53.6%	170			170
Game Console SoC	1,528	1,454			1,347	(7.4%)	(11.8%)	1,122			1,122
Gross Margin % (Non-GAAP)	49.9%	49.7%	51.0%	51.0%	51.0%	130	115	51.3%	52.1%		51.3%
Gross Profit	2776	2665		2,909	2,910	9.2%	4.8%	3,133	3,334		3133
R&D	1279	1443			1,479	2.5%	15.6%	1,494			1494
SG&A	557	547			558	2.0%	0.2%	569			569
Opex Total (Non-GAAP)	1520	1605	1,650	1,642	1,652	2.9%	8.7%	1,678	1,754		1678
Operating Income	1264	1068		1,267	1,258			1,455	1,580		1455
Op Margin % (Non-GAAP)	22.7%	19.9%		22.2%	22.1%	213	(66)	23.8%	24.7%		23.8%
Financial Income	(6)	21			21			21			21
Pretax Income	1258	1089			1,279			1,476			1476
Tax expense	163	141			166			192			192
Tax rate	13.0%	12.9%			13.0%	523.4%	429.3%	13.0%			13.0%
Net Income (Non-GAAP)	1095	948			1,112			1,284			1284
Diluted EPS (Non-GAAP)	\$0.67	\$0.58		\$0.68	\$0.68	17.1%	1.3%	\$0.79	\$0.90		\$0.79
Diluted Shares	1,625	1,627	1,630		1,630	0.2%	0.3%	1,632			1,632

Source: BofA Global Research estimates, Visible Alpha, Bloomberg, company reports

BofA GLOBAL RESEARCH

Exhibit 3: Stocks mentioned

Prices and ratings for stocks mentioned in this report

BofA Ticker	Bloomberg ticker	Company name	Price	Rating
AMD	AMD US	Advanced Micro	US\$ 101.67	C-2-9
INTC	INTC US	Intel	US\$ 34.59	B-3-8

Source: BofA Global Research

BofA GLOBAL RESEARCH

Price objective basis & risk**Advanced Micro Devices, Inc (AMD)**

Our \$120 PO is based on 32x our 2024E non-GAAP EPS, which is towards the middle of AMD's historical 17x-64x range.

Downside risks: 1) M&A integration risks, 2) Strong competition from larger names, 3) Lumpy nature of consumer and enterprise spending that could create delays in acceptance and success of new products, 4) High reliance on one outsourced manufacturing partner, 5) Maturity of current game console cycle.

Intel (INTC)

Our \$35 price objective is based on 22x our 2024E pf-EPS ex-stock comp expense, at the low end of compute peers (15x-40x), which we view as appropriate given manufacturing uncertainties and risks of new foundry strategy.

Upside risks to our price objective are 1) clarity or breakthrough on yields for 7nm



process technology, 2) new products allowing Intel to limit share loss, 3) improving product mix which can drive upside to gross margins, 4) manufacturing slip up at key foundry competitors.

Downside risks to our price objective are 1) weaker-than-expected trends in a mature PC market, which is largest revenue generator for Intel, 2) further delays in 7nm process technology and roadmap, 3) accelerated share loss to AMD, 4) more competition in profitable data center market.

Analyst Certification

I, Vivek Arya, hereby certify that the views expressed in this research report accurately reflect my personal views about the subject securities and issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

Special Disclosures

BofA Securities is currently acting as financial advisor to Intel Corp in connection with its sale of a minority stake in IMS Nanofabrication GmbH to Taiwan Semiconductor Manufacturing Co Ltd, which was announced on September 12, 2023.

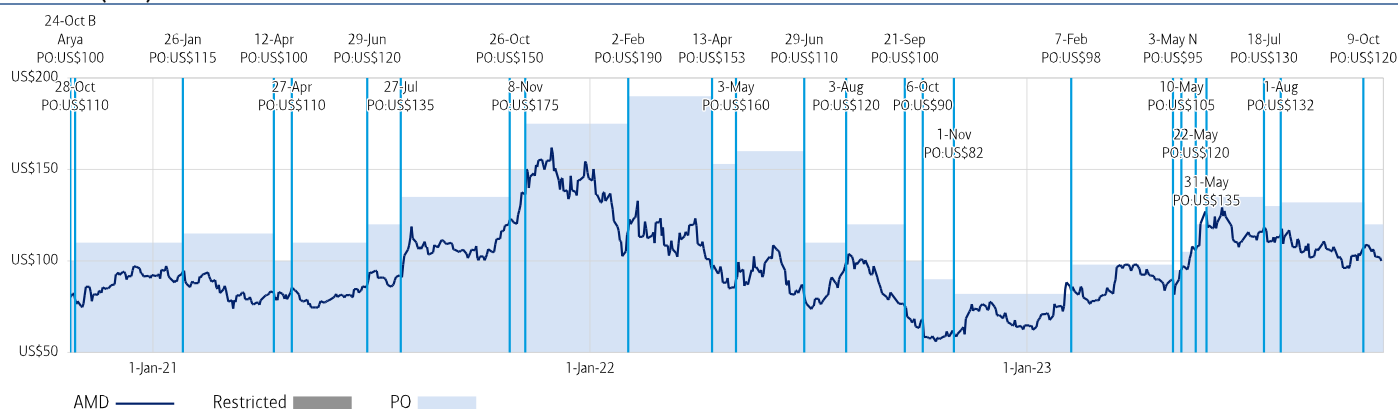
US - Semiconductors and Semiconductor Capital Equipment Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
BUY				
	Analog Devices Inc.	ADI	ADI US	Vivek Anya
	Applied Materials, Inc.	AMAT	AMAT US	Vivek Anya
	Arm Holdings	ARM	ARM US	Vivek Anya
	Axcelis Technologies	ACLS	ACLS US	Duksan Jang
	Broadcom Inc.	AVGO	AVGO US	Vivek Anya
	Cadence	CDNS	CDNS US	Vivek Anya
	Camtek	CAMT	CAMT US	Vivek Anya
	GlobalFoundries	GFS	GFS US	Vivek Anya
	KLA Corporation	KLAC	KLAC US	Vivek Anya
	Lam Research Corp.	LRCX	LRCX US	Vivek Anya
	Marvell Technology Group Ltd.	MRVL	MRVL US	Vivek Anya
	Microchip	MCHP	MCHP US	Vivek Anya
	Nova	NVMI	NVMI US	Vivek Anya
	NVIDIA Corporation	NVDA	NVDA US	Vivek Anya
	NXP Semiconductors NV	NXPI	NXPI US	Vivek Anya
	onsemi	ON	ON US	Vivek Anya
	Synopsys	SNPS	SNPS US	Vivek Anya
NEUTRAL				
	Advanced Micro Devices, Inc.	AMD	AMD US	Vivek Anya
	Allegro MicroSystems	ALGM	ALGM US	Blake Friedman
	Coherent Corp	COHR	COHR US	Vivek Anya
	Lattice Semiconductor	LSCC	LSCC US	Blake Friedman
	M/A-Com	MTSI	MTSI US	Vivek Anya
	Micron Technology, Inc.	MU	MU US	Vivek Anya
	Teradyne	TER	TER US	Vivek Anya
	Texas Instruments Inc.	TXN	TXN US	Vivek Anya
UNDERPERFORM				
	Ambarella	AMBA	AMBA US	Vivek Anya
	Credo Technology	CRDO	CRDO US	Vivek Anya
	Intel	INTC	INTC US	Vivek Anya
	Lumentum Holdings	LITE	LITE US	Vivek Anya
	Qorvo Inc.	QRVO	QRVO US	Vivek Anya
	Skyworks Solutions, Inc.	SWKS	SWKS US	Vivek Anya
	Wolfspeed Inc	WOLF	WOLF US	Vivek Anya

Disclosures

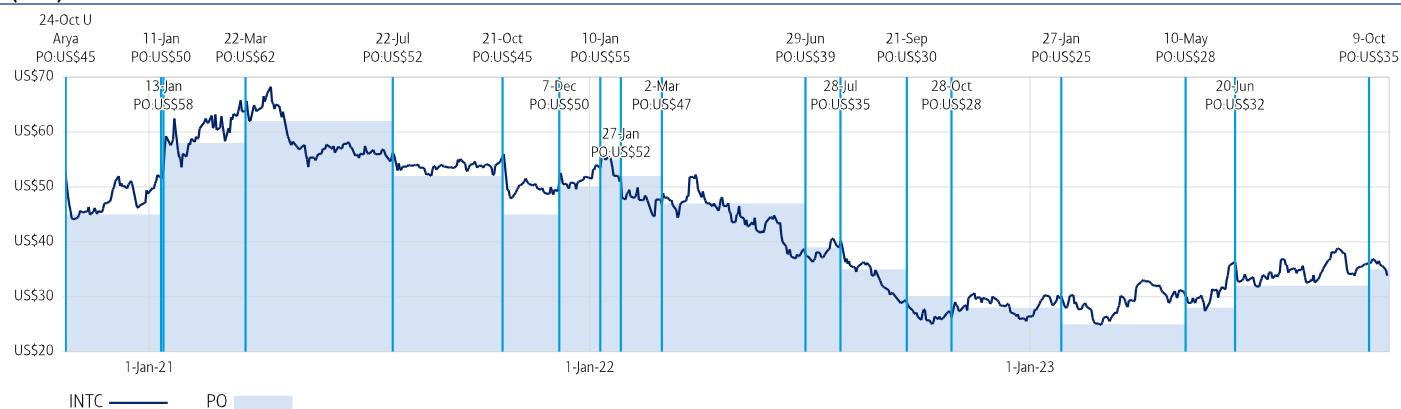
Important Disclosures

Advanced Micro (AMD) Price Chart



B: Buy, N: Neutral, U: Underperform, PO: Price Objective, NA: No longer valid, NR: No Rating

The Investment Opinion System is contained at the end of the report under the heading "Fundamental Equity Opinion Key". Dark grey shading indicates the security is restricted with the opinion suspended. Medium grey shading indicates the security is under review with the opinion withdrawn. Light grey shading indicates the security is not covered. Chart is current as of a date no more than one trading day prior to the date of the report.

Intel (INTC) Price Chart

The Investment Opinion System is contained at the end of the report under the heading "Fundamental Equity Opinion Key". Dark grey shading indicates the security is restricted with the opinion suspended. Medium grey shading indicates the security is under review with the opinion withdrawn. Light grey shading indicates the security is not covered. Chart is current as of a date no more than one trading day prior to the date of the report.

Equity Investment Rating Distribution: Technology Group (as of 30 Sep 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships ^{R1}	Count	Percent
Buy	204	51.52%	Buy	104	50.98%
Hold	95	23.99%	Hold	45	47.37%
Sell	97	24.49%	Sell	27	27.84%

Equity Investment Rating Distribution: Global Group (as of 30 Sep 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships ^{R1}	Count	Percent
Buy	1869	53.48%	Buy	1046	55.97%
Hold	828	23.69%	Hold	461	55.68%
Sell	798	22.83%	Sell	370	46.37%

^{R1} Issuers that were investment banking clients of BofA Securities or one of its affiliates within the past 12 months. For purposes of this Investment Rating Distribution, the coverage universe includes only stocks. A stock rated Neutral is included as a Hold, and a stock rated Underperform is included as a Sell.

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 ^{R2}
Buy	≥ 10%	≤ 70%
Neutral	≥ 0%	≤ 30%
Underperform	N/A	≥ 20%

^{R2} 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.

Price Charts for the securities referenced in this research report are available on the [Price Charts website](#), or call 1-800-MERRILL to have them mailed.

BofAS or one of its affiliates acts as a market maker for the equity securities recommended in the report: Advanced Micro, Intel.

BofAS or an affiliate was a manager of a public offering of securities of this issuer within the last 12 months: Intel.

The issuer is or was, within the last 12 months, an investment banking client of BofAS and/or one or more of its affiliates: Advanced Micro, Intel.

BofAS or an affiliate has received compensation from the issuer for non-investment banking services or products within the past 12 months: Advanced Micro, Intel.

The issuer is or was, within the last 12 months, a non-securities business client of BofAS and/or one or more of its affiliates: Advanced Micro, Intel.

BofAS or an affiliate has received compensation for investment banking services from this issuer within the past 12 months: Advanced Micro, Intel.

BofAS or an affiliate expects to receive or intends to seek compensation for investment banking services from this issuer or an affiliate of the issuer within the next three months: Advanced Micro, Intel.

BofAS or one of its affiliates is willing to sell to, or buy from, clients the common equity of the issuer on a principal basis: Advanced Micro, Intel.

The issuer is or was, within the last 12 months, a securities business client (non-investment banking) of BofAS and/or one or more of its affiliates: Advanced Micro, Intel.

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 Investment Industry Regulatory Organization of Canada; 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 CBI. 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.

BofA ESGMeter Methodology:

ESGMeter is a proprietary metric based on quantitative analysis and fundamental analyst inputs that reflects our assessment of a company's Environmental, Social and Governance-related attributes. The ESGMeter is intended to indicate a company's likelihood of experiencing stronger financial stability (higher return on equity and lower earnings and price volatility) over the next three years relative to peer group. There are three ESGMeter levels - Low, Medium, and High - which indicate whether a company has attributes most likely to translate into superior financial stability (in the case of a High level) or weaker financial stability (in the case of a Low level) over the next three years relative to its peer group. A Medium level suggests that a company exhibits ESG characteristics that are likely associated with financial stability results in line with its peer group over the next three years. Full details of our methodology, financial stability definition and disclaimers are available at [BofA ESGMeter methodology](#). ESGMeter is not indicative of a company's future stock price performance and is not an investment recommendation or rating.

ESGMeter is independent of the BofA Global Research fundamental equity analyst's investment rating, volatility risk rating, income rating or price objective for that company.

Copyright and General Information:

Copyright 2023 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 or 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.

Subject to the quiet period applicable under laws of the various jurisdictions in which we distribute research reports and other legal and BofA Securities policy-related restrictions on the publication of research reports, fundamental equity reports are produced on a regular basis as necessary to keep the investment recommendation current.

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.