Goldman Sachs

Investment Strategy Group

Sunday Night Insight
March 20, 2022

Walking a High Wire

Sharmin Mossavar-Rahmani	Chief Investment Officer
Brett Nelson	Head of Tactical Asset Allocation
Matheus Dibo	Vice President
Harm Zebregs	Vice President
Jeremy Nalewaik	Vice President
Michael Murdoch	Vice President
Kelly Han	Vice President
Fabian Mertes	Associate

Since the start of the Russian invasion of Ukraine on February 24th — when the S&P 500 Index reached its lowest intraday level of 2022 — the equity market has recovered 8.5%. Year-to-date, US equities are now down 6.1%.

In Europe — which bears a bigger brunt of the Ukraine-Russia war — the Euro Stoxx 50 troughed on March 7th and has recovered 15.2% from its intraday lows and is now down 8.9% year-to-date.

VIX, among the best measures of market fear, has declined from its peak level of 37.8 reached on February 24th to 23.9 now.

The inevitable questions on our clients' minds are whether the worst of the equity market decline is behind us and whether our investment recommendation to stay invested is still valid.

On our last client call on the Ukraine-Russia crisis on February 25 — which featured Jose Manuel Barroso, former President of the European Commission who dealt with President Putin during the Crimea War, Ash Carter, former Secretary of Defense, and Sir Alex Younger, former Chief of British Secret Intelligence (commonly known as MI6), all three of whom have Goldman Sachs affiliations — we shared an exhibit (abbreviated below, see Exhibit 1) on the downdrafts from past geopolitical shocks. The average excluding WWII has been 8.5%, and the largest decline occurred in the aftermath of the Iraq invasion of Kuwait at 16.9%. The intraday high-to-low decline of the S&P 500 during this shock has been 14.6% or 12.9% based on closing prices. If history if a useful guide — as we believe it to be — then the equity market decline may well be behind us.

1. Historical Equity Market Returns Around Geopolitical Shocks

Reaction to Select Geopolitical Events				
Event	Fed Policy Stance	S&P 500		
		Next Day	30-Day	To Worst
Downing of MH17 (Jul-2014)	Steady	-0.2	-1.3	-3.6
Crimea Conflict (Feb-2014)	Steady	0.8	0.7	N/A
US Invasion of Iraq (Mar-2003)	Easing	2.5	2.2	-3.0
September 11 Attacks (Sep-2001)	Easing	N/A	0.4	-11.6
Iraq Invasion of Kuwait (Aug-1990)	Easing	-3.0	-9.3	-16.9
Iran-Iraq War (Sep-1980)	Tightening	0.1	2.1	-4.4 (-27%)[1]
Arab Oil Embargo (Oct-1973)	Tightening	-0.2	-5.7	-16.4
Gulf of Tonkin Incident (Aug-1964)	Steady	-0.2	-1.2	-2.2
Cuban Missile Crisis (Oct-1962)	Tightening	-3.8	9.4	-3.8
Invasion of South Korea (Jun-1950)	N/A	-5.4	-10.0	-12.9
Pearl Harbor Attack (Dec-1941)	N/A	-3.8	-2.9	-10.2
World War II (Sep-1939–Sep-45)	N/A	1.1	14.4	-33.2 (-44%)[2]

Source: Investment Strategy Group, Council on Foreign Relations, Bloomberg, Datastream, Global Financial Data.
(1) Peak-to-trough maximum drawdown experienced by the S&P 500 during the subsequent recession and bear market (Nov-1980 through Aug-1982)
(2) Peak-to-trough maximum drawdown experienced by the S&P 500 during WWII (Oct-1939 through Apr-1942).

However, clients and colleagues are rightfully pushing back and pointing out the reasons why this time is different from past geopolitical crises. The geopolitical and economic risks are far greater and everyone is walking dangerous high wires.

Ukraine-Russia War: Based on geopolitical experts' insights into the possible scenarios, it is unlikely that this war will end soon. As explained by Dr. Carter on our client call, this will be a "big fight […] with the Ukrainian military […] and with the Ukrainian population." He also said that "this is not going to be something that settles down and stabilizes quickly."

The Russian invasion of Ukraine has turned everyone into a funambulist. President Putin is walking a high wire: there is a non-zero probability of escalation to the point where he may resort to cyber, biological, chemical, or even tactical nuclear attacks. In such a case, clearly, the worst

of equity market declines is not behind us. If there is no further escalation but more of the status quo, then we do not expect the war alone to lead to further downside in equities.

NATO allies are also trying to balance supporting Ukraine while not risking direct military engagement with Russia. The risks of an accident have increased, which could also lead to further downside.

The Federal Reserve: On March 16th, the Federal Reserve embarked upon its tightening cycle with a 25 basis point increase in the Federal Funds rate. While the market rallied by 5% from its intraday low on that day to its close on March 18th, some have argued that the equity market is mistaken — none more forcefully than Larry Summers, former Secretary of the Treasury. In a *Washington Post* opinion piece entitled, *The stock market like the Fed's plan to raise interest rates. It's wrong,* he points out that the Federal Open Market Committee's (FOMC's) economic projections represent "wishful and delusional thinking."[1]

The Federal Reserve is also walking a tight rope — fighting inflation that is driven by a mix of supply chain-driven constraints, tight labor markets, housing and most recently by increases in energy prices, while also trying to avoid causing a recession. Our colleagues in Global Investment Research estimate that every $10/barrel increase in the price of crude oil (about 10% at current prices) increases inflation in the US by 0.2% (incidentally, about the same in the Eurozone) and reduces US GP growth by 0.1% (about 0.2% in the Eurozone).

Clients have asked whether the late 1970s provide the best analogue for the outlook through 2023: high inflation, tightening monetary policy, geopolitical factors that increased the price of oil, and localized wars. They further ask whether they should brace for the stagflationary environment of that era and adjust their portfolios accordingly. We do not believe so. While there are similarities, the differences are far greater.

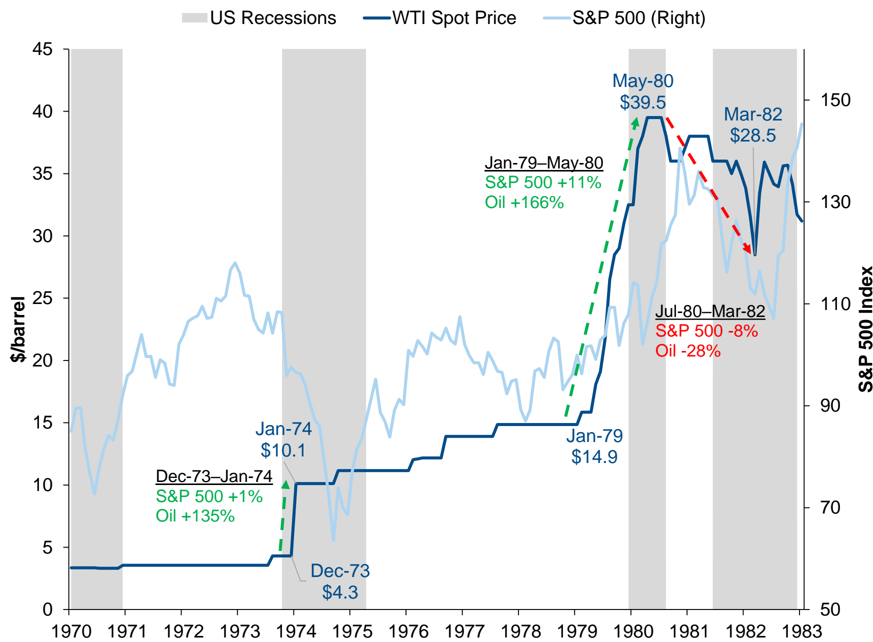
First, the oil price shocks from the Arab Oil Embargo, the Iranian Revolution and subsequent Iran-Iraq war dwarf the current increases in oil prices. As shown in Exhibit 2 below, oil prices nearly tripled from $4/barrel to $11/barrel after the Arab Oil Embargo which was in response to the Arab-Israeli war in October 1973. They nearly tripled a second time after the Iranian Revolution in late 1978/early 1979 when prices increased from $15/barrel to $40/barrel. Over the entire period, oil prices increased nearly 10-fold. It was a regime shift that will not be replicated.

In fact, we think there is zero probability of such an increase today. Therefore, we recommend clients avoid positioning their portfolios for such an outcome. While we have recommended a tactical allocation to energy stocks and Master Limited Partnerships as outlined in our 2022 *Outlook* — driven by favorable valuations and earnings and a modest increase in oil prices — we do not recommend a significant allocation to oil and other commodities.

We estimate that West Texas Intermediate oil will fluctuate between $100–$120 per barrel assuming:

- Absence of further government sanctions on Russian oil
- Continuation of some self-sanctioning by traders and other importers who have turned away Russian oil
- Expectation of 2–3 million b/d of increased production from several OPEC countries including Iran (following a deal between the US and Iran)

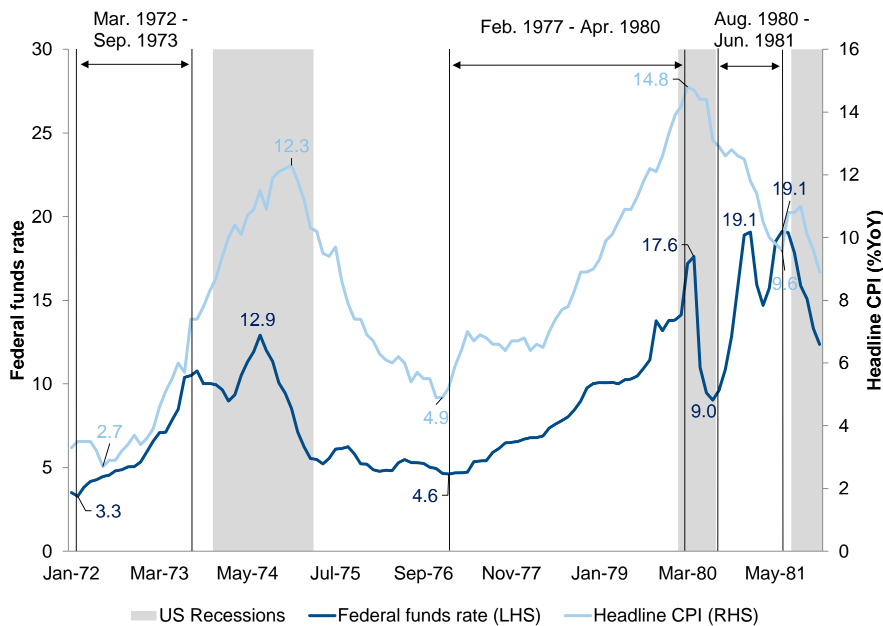
2. Major Moves in WTI (Oil in Nominal $)



Source: Investment Strategy Group, Federal Reserve, Bloomberg, NBER.

Second, inflation was substantially higher and the magnitude of Federal Reserve tightening was enormous. As shown in the Exhibit 3, the Federal Reserve raised rates for 4.6% to 17.6% in its second round of tightening and eventually to 19.1%. Inflation rose from 4.9% to a peak of 14.8%. Even the most pessimistic of forecasts today estimate that inflation will be trending downward through the second half of 2022 and into 2023.

3. Federal Funds Rate and Headline CPI between 1972 and 1981



Source: Investment Strategy Group, Datastream.

Exhibit 4 shows a brief summary of our inflation forecasts. By late 2022, inflation will be declining from peak levels of early 2022, with year-on-year core inflation of 6.5% in March declining to 4.0% by December. The comparable numbers for the headline CPI are 8.4% and 5.3%, respectively.

4. Investment Strategy Group – US Inflation Forecast

		Headline CPI:	Core CPI:
12-month % changes:	March 2022 (peak):	8.4	6.5
	December 2022:	5.3	4.0
Annual avg % changes:	2022	6.9	5.3

Source: Investment Strategy Group.
Note: Forecasts are estimated, are based on assumptions, are subject to revision and may change as economic and market conditions change. There can be no assurance the forecasts will be achieved.

Third, financial markets and the role of central banks are very different compared to the 1970s. There are many more financial instruments and economic research tools that help the central bankers assess how the markets are pricing inflation risks, with Treasury Inflation Protected Securities and 5-year-5-year forward swaps as just two examples. Access to such constant market pricing and feedback mechanisms did not exist in the 1970s.

China: China is another source of uncertainty. It is walking a tight rope on multiple fronts:

- Balancing a zero-covid policy against a 5.5% GDP target.
- Offsetting the dampening effects of both declines in the property sector and increases in oil prices by easing monetary policy and increasing lending activity. China's current account balance may turn negative very quickly if energy prices stay in the $100–$120 range in 2022.
- Trying to maintain economic relations with the US, Europe and the UK — who collectively account for 35% of its exports — while not condemning Russia and allegedly agreeing to provide more Russian military support.[2]

Economic and Investment Implications

Risk of Recession: We have typically said that recessions are caused by one or a combination of three factors:

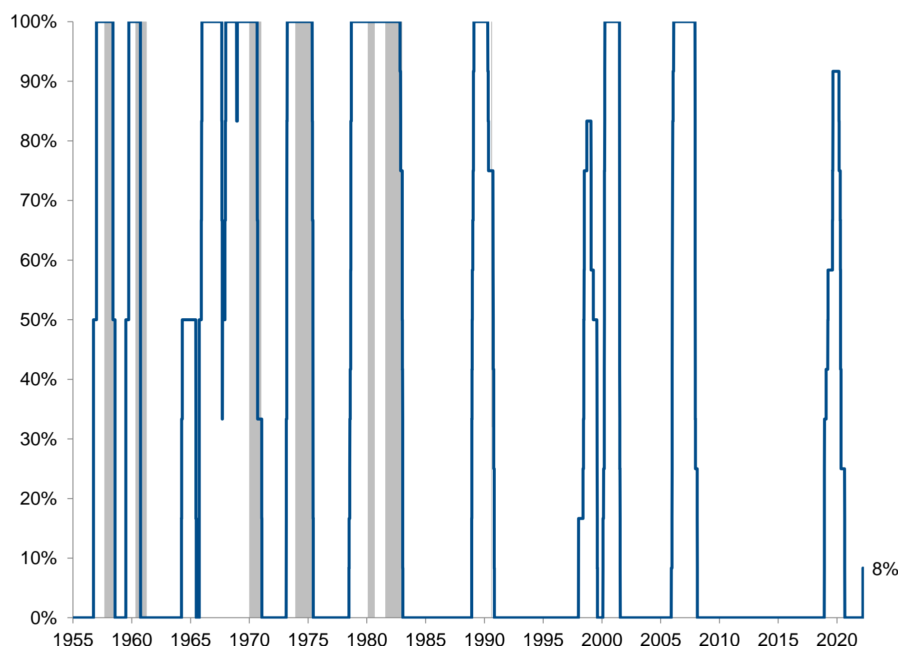
- Economic imbalances
- Federal Reserve tightening
- Exogenous shocks

While the US economy is well balanced, we have embarked upon Federal Reserve tightening and we are experiencing the shock of the Russian invasion of Ukraine. These two factors have prompted us to increase the likelihood of a recession in the next 12 months (this includes the first quarter of 2023) from the 10% presented in our 2022 *Outlook* to 15%–20%. We note that the unconditional probability of recession in the past 40 years is 13%.

The risks are not higher in our view because of the well balanced economy, excess savings of about $2.3 trillion, low unemployment rate of 3.8%, still easy financial conditions compared to year-end 2019, and a relatively modest pace of Federal Reserve tightening. The predicted pace of tightening of 1.75% by year end is not enough to throw the US economy into recession. On average, recessions occur 30 months after the first increase in the Federal Funds rate. And in the last 60 years, recessions have occurred when the Federal Reserve has increased rates by more than 3%.

Furthermore, our yield curve inversion diffusion index, which measures the bond market impact of Federal Reserve tightening, currently stands at 8%, as shown in Exhibit 5. While this index has increased from zero earlier this year, it has been more than 90% prior to every recession since 1955.

5. ISG Yield Curve Inversion Diffusion Index[1] - Through March 18, 2022



Source: Investment Strategy Group, Bloomberg, Haver Analytics.
(1) The diffusion index measures the percentage of yield curves inverted in the previous 6 months based on the total number of yield curves whose data was available at each point in time.

Economic Growth: We have lowered our US GDP forecast for 2022 to 3.6%, still well above an estimate of trend growth of about 2%. We also lowered our estimate of global growth to 3.6% from 4.5%.

Equity Market Return Expectations:

Earnings: We have lowered our earnings growth and S&P 500 price target as a result of slower US and non-US economic growth, as well as continued disruptions to the supply chain from China's zero-covid policy and the Ukraine-Russia war.

We expect S&P 500 earnings per share to grow by 8% compared to our 12% forecast at the beginning of year. During periods when economic growth is above trend, as we expect this year, earnings have grown by an average of 15%, with the median growth rate at 13%. Similarly, when headline inflation has stood between 4–6% and the economy has not been in recession, median earnings growth has been 13%.

The mid-point of our earnings estimate is $225.50 per share, which implies less than a 2% increase from annualized fourth quarter earnings of 2021. On average, earnings have grown 7% from the fourth quarter in non-recessionary periods.

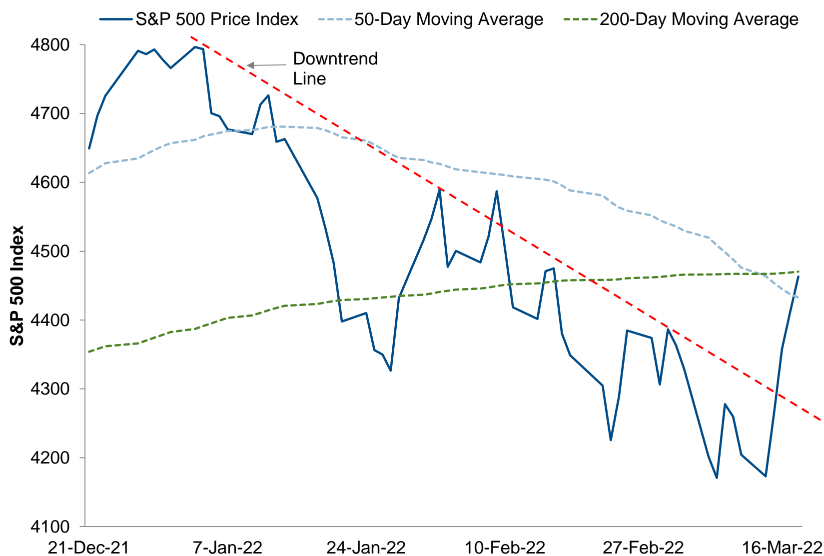
Given these strong historical growth precedents, we think our revised 8% earnings forecast is very achievable.

S&P 500 target: We have lowered our S&P 500 target range to 4700–4800 from our prior range of 4950–5050. Our total return for 2022 is now a modest 1%, compared to the 6% we forecast at the beginning of the year. From the closing price of the S&P 500 on March 18th, we expect the market to return about 7.5% in our base case, to which we assign a 60% probability. We assign equal 20% probabilities to our upside scenario of 5000 and our downside scenario of 3800.

Market technicals: In the Investment Strategy Group, we have always incorporated investor sentiment and positioning, as well as technical analysis, in our final investment recommendations. In fact, we have found such analysis to be particularly useful in periods of heightened market fear. Today, this analysis has three key implications.

First, as shown in Exhibit 6, recent S&P 500 price action has moved the index above it 50-day moving average, which is a favorable technical signal. The S&P 500 is also very close to its 200-day moving average, the recapturing of which would be an additional positive. More importantly, the Index has broken a trend of lower lows and lower highs in its daily pricing — another indication that the year-to-date downtrend could be reversing.

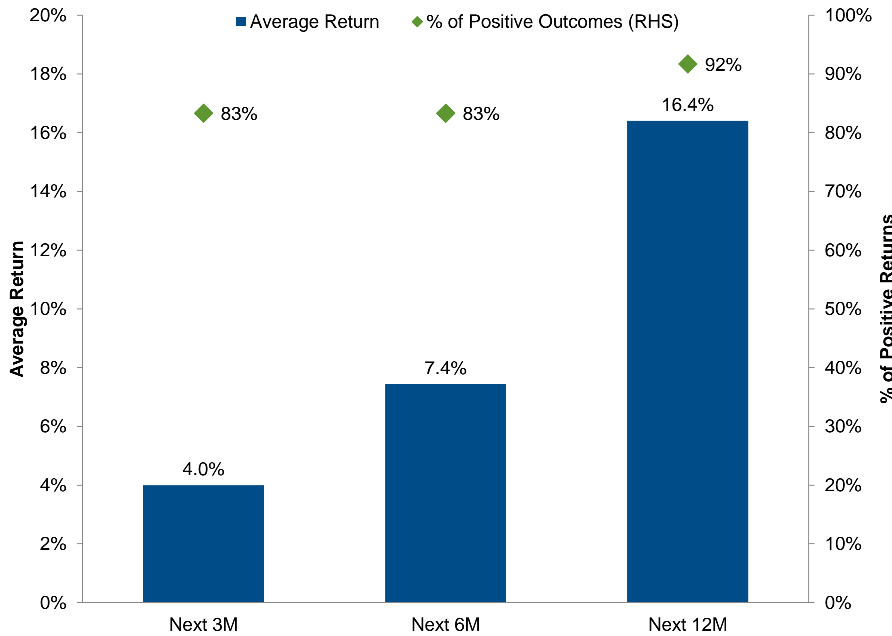
6. S&P 500 Price Index - Through March 18, 2022



Source: Investment Strategy Group, Bloomberg.

Second, as shown in Exhibit 7, when CBOE VIX has declined below 30 after a steady period of being above it, market returns have been well-above average in the next 3, 6, and 12 months — reaching 16.4% on average over the next 12 months.

7. Implied S&P 500 Upside from Past Episodes When VIX Crossed Below 30 After at Least 11 Days Above

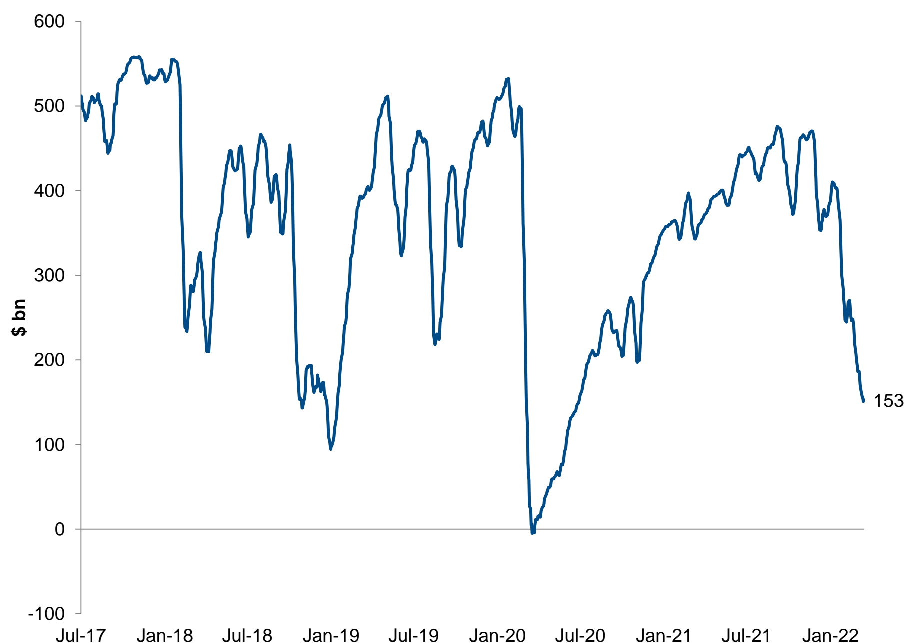


Source: Investment Strategy Group, LPL Research, Bloomberg.

Third, the significant selling of over $300 billion of equities by rule-based investors (see Exhibit 8) such as CTAs — who are heavily influenced by market momentum — is likely to begin reversing itself given last week's market rally. Our colleagues in the Global Markets Division estimate that such investors will have to buy $64 billion of equities even in an unchanged market. Should the market rise further, their rules-based strategies would imply even greater additional equity purchases. And even if the market were to decline, their selling pressure will not be significant since their equity exposure already stands in the bottom decile of its historical distribution.

Finally, David Kostin, Chief US equity strategist at Goldman Sachs, estimates $1 trillion of stock buybacks by US companies in 2022, providing a tailwind to US equities for the rest of the year. Indeed, US corporations have already authorized $306 billion of buybacks thus far in 2022, the largest amount at this point in the year in the history of the data.

8. Estimated Global Equity Position of Systematic Macro[1] (in $bn) – Through March 17, 2022



Source: Investment Strategy Group, Goldman Sachs Global Markets Division.
(1) Includes CTA/trend-following, risk parity/volatility-weighted and volatility-control funds.

Key Takeaways

- Greater risks from the Russian invasion of Ukraine, higher oil prices and a faster pace of Federal Reserve tightening have prompted us to lower our GDP growth forecast for the US and for the rest of the world.
- Lower growth implies lower earnings growth and lower equity market returns.
- Nevertheless, in spite of lower equity market returns, we still expect attractive returns from current levels and maintain our recommendation to stay invested.
- We encourage clients to make sure they have the right strategic asset allocation to be able to withstand the volatility in the current environment.
- The Russian invasion of Ukraine and China's high wire act further confirm our view of US Preeminence with a recommendation to have a higher allocation to US assets than suggested by market capitalization weighted indexes.

Endnotes:

(1) Lawrence H. Summers, "The stock market liked the Fed's plan to raise interest rates. It's wrong," *The Washington Post*, March 17, 2022.

(2) Edward Wong and Julian E. Barnes, "Russia Asked China for Military and Economic Aid for Ukraine War, U.S. Officials Say", *New York Times*, March 13, 2022.

This material represents the views of the Investment Strategy Group ("ISG") in Consumer and Wealth Management ("CWM") of Goldman Sachs. It is not financial research or a product of Goldman Sachs Global Investment Research ("GIR") and may vary significantly from those expressed by individual portfolio management teams within CWM or other groups of Goldman Sachs.

This material is intended to discuss general market activity, industry or sector trends, or other broad-based economic, market or political conditions. Any reference to a specific company or security is for illustrative purposes and does not constitute a recommendation to buy, sell, hold or directly invest in the company or its securities. This material does not constitute an investment recommendation for the purposes of Article 3(1)(35) of Regulation (EU) No 596/2014 or investment research for the purposes of Article 36(1) of Commission Delegated Regulation (EU) 2017/565, nor does it constitute investment advice.

Investment Strategy Group ("ISG"). ISG is focused on asset allocation strategy formation and market analysis for PWM. ISG material represents the views of ISG in Consumer and Wealth Management ("CWM") of GS. It was not prepared in compliance with applicable provisions of law designed to promote the independence of financial analysis and is not subject to a prohibition on trading following the distribution of financial research. If shown, ISG Model Portfolios are provided for illustrative purposes only. Your actual asset allocation may look significantly different based on your particular circumstances and risk tolerance. If a model performance calculation is provided, it assumes that (1) each asset class was owned in accordance with the recommended weight; (2) all tactical tilts were implemented at the time the recommendation was made; and (3) the portfolio was rebalanced every time a tactical tilt change was made and at the end of every quarter (unless a tactical tilt was made within a month of quarter-end). If model performance is shown, it is calculated using the daily returns (actual or interpolated) of indices that ISG believes are representative of the asset classes included in the model. Results shown reflect the total return but generally do not take into account any investment management fees, commissions or other transaction expenses, which would reduce returns. The results shown reflect the reinvestment of dividends and other earnings. All returns are pre-tax and are not adjusted for inflation. Additional information about the model portfolio performance calculation, including asset class benchmarks used for modeling performance and a history of tactical tilts, is available upon request.

Distributing Entities. This material has been approved for issue in the United Kingdom solely for the purposes of Section 21 of the Financial Services and Markets Act 2000 by GSI, Plumtree Court, 25 Shoe Lane, London, EC4A 4AU, United Kingdom; authorised by the Prudential Regulation Authority; and regulated by the Financial Conduct Authority and the Prudential Regulation Authority; by Goldman Sachs Canada, in connection with its distribution in Canada; in the United States by Goldman Sachs & Co. LLC Member FINRA/SIPC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in Japan by Goldman Sachs (Japan) Ltd; in Australia by Goldman Sachs Australia Pty Limited (ACN 092 589 770); in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198502165W); in Dubai by Goldman Sachs International, in Germany by Goldman Sachs Bank Europe SE; in Switzerland by Goldman Sachs Bank AG; in Spain by Goldman Sachs Bank Europe SE, Sucursal en España; in Italy by Goldman Sachs Bank Europe SE, Succursale Italia; in France by Goldman Sachs Bank Europe SE Succursale de Paris; in Sweden by Goldman Sachs Bank Europe SE, Sweden Bankfilial; in the Netherlands by Goldman Sachs Bank Europe SE, Amsterdam Branch; in Luxembourg by GSBE Luxembourg Branch; and in Ireland by Goldman Sachs Bank Europe SE, Dublin Branch.

Options. Options involve risk and are not suitable for all investors. The purchase of options can result in the loss of an entire investment and the risk of uncovered options is potentially unlimited. You must read and understand the current Options Disclosure Document before entering into any options transactions. The booklet entitled Characteristics and Risk of Standardized Options can be obtained from your PWM team or at http://www.theocc.com/about/publications/character-risks.jsp. A secondary market may not be available for all options. Transaction costs may be significant in option strategies that require multiple purchases and sales of options, such as spreads. Supporting documentation for any comparisons, recommendations, statistics, technical data, or other information will be supplied upon request.

Derivatives. Investments that involve futures, equity swaps, and other derivatives give rise to substantial risk and are not available to or suitable for all investors.

Digital Assets. Digital assets, sometimes known as cryptocurrency, are a digital representation of a stored value secured through cryptography that function as a medium of exchange, a unit of account, or a store of value, but generally do not have legal tender status. The regulatory regime related to digital assets is still in development across all jurisdictions and, as such, federal, state, or foreign governments may restrict the use and exchange of any or all digital assets, further contributing to their established volatility. Digital assets stored online are not FDIC insured and do not have the same protections that U.S. or other countries' bank deposits may have. Digital assets are sometimes exchanged for U.S. dollars or other currencies around the world, but they, generally, are not backed nor supported by any government or central bank. The value of digital assets is derived by market forces of supply and demand, and is therefore more volatile than traditional currencies' value. Transacting in digital assets carries various risks, including market volatility, market manipulation, and cybersecurity failures —such as the risk of hacking, theft, programming bugs, and accidental loss—and does not guarantee positive performance or profit. Before purchasing, investors should note that the risks applicable to one form of digital assets may not necessarily be the same risks applicable to all variants of digital assets. Markets and exchanges for digital assets are not regulated to the same degree or with customer protections available in equities, fixed income, options, futures, or foreign exchange markets. Additionally, there is no guarantee that any entity that currently accepts digital assets as payment will continue to do so in the future. The volatility and unpredictability of the price of digital assets may lead to significant and immediate losses. In certain circumstances it may not be possible to liquidate a digital assets position in a timely manner at a reasonable price.

No Distribution; No Offer or Solicitation. This material may not, without Goldman Sachs' prior written consent, be (i) copied, photocopied or duplicated in any form, by any means, or (ii) distributed to any person that is not an employee, officer, director, or authorized agent of the recipient. This material is not an offer or solicitation with respect to the purchase or sale of a security in any jurisdiction in which such offer or solicitation is not authorized or to any person to whom it would be unlawful to make such

offer or solicitation. This material is a solicitation of derivatives business generally, only for the purposes of, and to the extent it would otherwise be subject to, §§ 1.71 and 23.605 of the U.S. Commodity Exchange Act.

Currencies. Currency exchange rates can be extremely volatile, particularly during times of political or economic uncertainty. There is a risk of loss when an investor has exposure to foreign currency or is in foreign currency traded investments.

Argentina: The information has been provided at your request.

Australia: This material is being disseminated in Australia by Goldman Sachs & Co ("GSCo"); Goldman Sachs International ("GSI"); Goldman Sachs (Singapore) Pte ("GSSP") and/or Goldman Sachs (Asia) LLC ("GSALLC"). In Australia, this document, and any access to it, is intended only for a person that has first satisfied Goldman Sachs that:
• The person is a Sophisticated or Professional Investor for the purposes of section 708 of the Corporations Act 2001 (Cth) ("Corporations Act"); or
• The person is a wholesale client for the purposes of section 761G of the Corporations Act.
No offer to acquire any financial product or interest in any securities or interests of any kind is being made to you in this document. If financial products or interests in any securities or interests of any kind do become available in the future, the offer may be arranged by an appropriately licensed Goldman Sachs entity in Australia in accordance with section 911A(2)(b) of the Corporations Act. Any offer will only be made in circumstances where disclosures and/or disclosure statements are not required under Part 6D.2 or Part 7.9 of the Corporations Act (as relevant).
To the extent that any financial service is provided in Australia by GSCo, GSI, GSSP and/or GSALLC, those services are provided on the basis that they are provided only to "wholesale clients," as defined for the purposes of the Corporations Act. GSCo, GSI, GSSP and GSALLC are exempt from the requirement to hold an Australian Financial Services Licence under the Corporations Act and do not therefore hold an Australian Financial Services Licence. GSCo is regulated by the Securities and Exchange Commission under US laws; GSI is regulated by the Financial Conduct Authority and the Prudential Regulation Authority under laws in the United Kingdom; GSSP is regulated by the Monetary Authority of Singapore under Singaporean laws; and GSALLC is regulated by the Securities and Futures Commission under Hong Kong laws; all of which differ from Australian laws. Any financial services given to any person by GSCo, GSI, and/or GSSP in Australia are provided pursuant to ASIC Class Orders 03/1100; 03/1099; and 03/1102 respectively.

Bahrain: This memorandum and the financial product(s) and service(s) that shall be offered pursuant to this memorandum have not been approved or licensed by the Central Bank of Bahrain ("CBB"), the Bahrain Bourse, the Ministry of Industry, Commerce and Tourism ("MOICT") or any other relevant licensing authorities in the Kingdom of Bahrain. The CBB, the Bahrain Bourse and the MOICT of the Kingdom of Bahrain takes no responsibility for the accuracy of the statements and information contained in this memorandum or the performance of the financial product(s) and service(s), nor shall they have any liability to any person, investor or otherwise for any loss or damage resulting from reliance on any statements or information contained herein. This memorandum is only intended for Accredited Investors as defined by the CBB and the securities offered by way of private placement may only be offered in minimum subscriptions of USD100,000 (or equivalent in other currencies). We will not make any invitation to the public in the Kingdom of Bahrain to subscribe to the financial product(s) and service(s) and this memorandum will not be issued to, passed to, or made available to the public generally in the Kingdom of Bahrain. The CBB has not reviewed, nor has it approved this memorandum or the marketing thereof in the Kingdom of Bahrain. The CBB is not and will not be responsible for the performance of the financial products and services.

Brazil. These materials are provided at your request and solely for your information, and in no way constitutes an offer, solicitation, advertisement or advice of, or in relation to, any securities, funds, or products by any of Goldman Sachs affiliates in Brazil or in any jurisdiction in which such activity is unlawful or unauthorized, or to any person to whom it is unlawful or unauthorized. This document has not been delivered for registration to the relevant regulators or financial supervisory bodies in Brazil, such as the Brazilian Securities and Exchange Commission (Comissão de Valores Mobiliários – CVM) nor has its content been reviewed or approved by any such regulators or financial supervisory bodies. The securities, funds, or products described in this document have not been registered with the relevant regulators or financial supervisory bodies in Brazil, such as the CVM, nor have been submitted for approval by any such regulators or financial supervisory bodies. The recipient undertakes to keep these materials as well as the information contained herein as confidential and not to circulate them to any third party.

Chile: Fecha de inicio de la oferta:
(i) La presente oferta se acoge a la Norma de Carácter General N° 336 de la Comisión para el Mercado Financiero de Chile;
(ii) La presente oferta versa sobre valores no inscritos en el Registro de Valores o en el Registro de Valores Extranjeros que lleva la Comisión para el Mercado
Financiero, por lo que los valores sobre los cuales ésta versa, no están sujetos a su fiscalización;
(iii) Que por tratarse de valores no inscritos, no existe la obligación por parte del emisor de entregar en Chile información pública respecto de estos valores;y
(iv) Estos valores no podrán ser objeto de oferta pública mientras no sean inscritos en el Registro de Valores correspondiente.

Dubai: Goldman Sachs International ("GSI") is authorised and regulated by the Dubai Financial Services Authority ("DFSA") in the DIFC and the Financial Services Authority ("FSA") authorized by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and Prudential Regulation Authority in the UK. Registered address of the DIFC branch is Level 5, Gate Precinct Building 1, Dubai International Financial Centre, PO Box 506588, Dubai, UAE and registered office of GSI in the UK is Plumtree Court, 25 Shoe Lane, London EC4A 4AU, United Kingdom. This material is only intended for use by market counterparties and professional clients, and not retail clients, as defined by the DFSA Rulebook. Any products that are referred

to in this material will only be made available to those clients falling within the definition of market counterparties and professional clients.

Israel: Goldman Sachs is not licensed to provide investment advice or investment management services under Israeli law.

Korea: No Goldman Sachs entity, other than Goldman Sachs (Asia) L.L.C, Goldman Sachs Asset Management International and Goldman Sachs Asset Management Korea Co., Ltd., is currently licensed to provide discretionary investment management services and advisory services to clients in Korea and nothing in this material should be construed as an offer to provide such services except as otherwise permitted under relevant laws and regulations. Goldman Sachs (Asia) L.L.C. is registered as a Cross-Border Discretionary Investment Management Company and a Cross-Border Investment Advisory Company with the Korean Financial Supervisory Commission, and as a licensed corporation for, amongst other regulated activities, advising on securities and asset management with the Hong Kong Securities & Futures Commission. Goldman Sachs Asset Management International is licensed as a Cross-Border Discretionary Investment Management Company and a Cross-Border Investment Advisory Company with the Korean Financial Supervisory Commission, as an investment adviser with the Securities and Exchange Commission of the United States and for Managing Investments with the Financial Services Authority of the United Kingdom. Goldman Sachs Asset Management Korea Co., Ltd. is licensed as an Asset Management Company in Korea and is also registered as an Investment Advisory Company and Discretionary Investment Management Company with the Korean Financial Supervisory Commission. Details of their respective officers and major shareholders can be provided upon request.

Oman: By receiving this Memorandum, the prospective investors understands, acknowledges and agrees that neither this Memorandum nor the Units/securities have been filed, registered or approved by the Central Bank of Oman, the Oman Ministry of Commerce and Industry, the Oman Capital Markets Authority or any other authority in the Sultanate of Oman, No marketing of any financial products or services has been or will be made from within the Sultanate of Oman and no subscription to any securities, products or financial services may or will be consummated within the Sultanate of Oman. The offering of the Units has not been approved or licensed by the Capital Market Authority ("CMA") or any other relevant licensing authorities in the Sultanate of Oman, and accordingly does not constitute a public offer of securities in the Sultanate of Oman in accordance with the Commercial Companies Law of Oman (Royal Decree 4/74) or the Capital Market Authority Law (Royal Decree 80/98) (the "CMAL") or the solicitation of any offer to buy in the Sultanate of Oman as contemplated by Article 139 of the Executive Regulations of CMA or otherwise. Accordingly, the Units may not be offered to the public in the Oman. This Memorandum is strictly private and confidential and is being issued to a limited number of investors: (a) upon their request and confirmation that they understand that the [Units] have not been approved or licensed by or registered with the CMA or any other relevant licensing authorities or governmental agencies in the Oman; and
(b) must not be provided to any person other than the original recipient, and may not be reproduced or used for any other purpose"

Panama: These Securities have not been and will not be registered with the national Securities Commission of the Republic of Panama under Decree Law No. 1 of July 8, 1999 (the "Panamanian Securities Act") and may not be offered or sold within Panama except in certain limited transactions exempt from the registration requirements of the Panamanian Securities Act. These Securities do not benefit from the tax incentives provided by the Panamanian Securities Act and are not subject to regulation or supervision by the National Securities Commission of the Republic of Panama. This material constitutes generic information regarding Goldman Sachs and the products and services that it provides and should not be construed as an offer or provision of any specific services or products of Goldman Sachs for which a prior authorization or license is required by Panamanian regulators.

Peru: The products or securities referred to herein have not been registered before the Superintendencia del Mercado de Valores (SMV) and are being placed by means of a private offer. SMV has not reviewed the information provided to the investor.

Qatar: The investments described in this document have not been, and will not be, offered, sold or delivered, at any time, directly or indirectly in the State of Qatar in a manner that would constitute a public offering. This document has not been, and will not be, registered with or reviewed or approved by the Qatar Financial Markets Authority, the Qatar Financial Centre Regulatory Authority or Qatar Central Bank and may not be publicly distributed. This document is intended for the original recipient only and must not be provided to any other person. It is not for general circulation in the State of Qatar and may not be reproduced or used for any other purpose.

Russia: Information contained in these materials does not constitute an advertisement or offering (for the purposes of the Federal Law "On Securities Market" No. 39-FZ dated 22nd April 1996 (as amended) and the Federal Law "On protection of rights and lawful interests of investors in the securities market" No. 46-FZ dated 5th March, 1999 (as amended)) of the securities, any other financial instruments or any financial services in Russia and must not be passed on to third parties or otherwise be made publicly available in Russia. No securities or any other financial instruments mentioned in this document are intended for "offering," "placement" or "circulation" in Russia (as defined under the Federal Law "On Securities Market" No. 39-FZ dated 22nd April, 1996 (as amended)). Neither does the information contained herein constitute a personalised investment recommendation as defined under Russian laws and regulations, and is not designated for the purposes of an investment decision of a specific person, is prepared without analysing financial circumstances, investment or risk profile of any particular person. Goldman Sachs assumes no responsibility for the investment decisions that may be taken by a client or any other person based on the information contained herein.

Singapore: This document has not been delivered for registration to the relevant regulators or financial supervisory bodies in Hong Kong or Singapore, nor has its content been reviewed or approved by any financial supervisory body or regulatory

authority. The information contained in this document is provided at your request and for your information only. It does not constitute an offer or invitation to subscribe for securities or interests of any kind. Accordingly, unless permitted by the securities laws of Hong Kong or Singapore, (i) no person may issue or cause to be issued this document, directly or indirectly, other than to persons who are professional investors, institutional investors, accredited investors or other approved recipients under the relevant laws or regulations (ii) no person may issue or have in its possession for the purposes of issue, this document, or any advertisement, invitation or document relating to it, whether in Hong Kong, Singapore or elsewhere, which is directed at, or the contents of which are likely to be accessed by, the public in Hong Kong or Singapore and (iii) the placement of securities or interests to the public in Hong Kong and Singapore is prohibited. Before investing in securities or interests of any kind, you should consider whether the products are suitable for you.

South Africa: Goldman Sachs does not provide tax, accounting, investment or legal advice to our clients, and all clients are advised to consult with their own advisers regarding any potential investment/transaction. This material is for discussion purposes only, and does not purport to contain a comprehensive analysis of the risk/rewards of any idea or strategy herein. Any potential investment/transaction described within is subject to change and Goldman Sachs Internal approvals. Goldman Sachs International is an authorised financial services provider in South Africa under the Financial Advisory and Intermediary Services Act, 2002.

Ukraine: Goldman Sachs & Co. LLC is not registered in Ukraine and carries out its activity and provides services to its clients on a purely cross-border basis and has not established any permanent establishment under Ukrainian law. The information contained in this document shall not be treated as an advertisement under Ukrainian law.

United Arab Emirates: THE INFORMATION CONTAINED IN THIS DOCUMENT DOES NOT CONSITUTE, AND IS NOT INTENDED TO CONSTITUTE, A PUBLIC OFFER OF SECURITIES IN THE UNITED ARAB EMIRATES IN ACCORDANCE WITH THE COMMERCIAL COMPANIES LAW (FEDERAL LAW NO. 2 OF 2015), SECURITIES AND COMMODITIES AUTHORITY CHAIRMAN DECISION NO (13/T.M) OF 2021 ON THE FINANCIAL ACTIVITIES RULEBOOK AND COMPLIANCE PROCEDURE OR OTHERWISE UNDER THE LAWS OF THE UNITED ARAB EMIRATES. ACCORDINGLY, THE INTERESTS IN THE SECURITIES MAY NOT BE OFFERED TO THE PUBLIC IN THE UAE (INCLUDING THE DUBAI INTERNATIONAL FINANCIAL CENTRE AND THE ABU DHABI GLOBAL MARKET). THIS DOCUMENT IS PROVIDED FOR INFORMATION PURPOSES ONLY, AND CONTAINS GENERAL INFORMATION WHICH IS NOT SPECIFIC IN ANY WAY TO ANY PARTICULAR INVESTOR, INVESTOR TYPE, STRATEGY, INVESTMENT NEED OR OTHER FINANCIAL CIRCUMSTANCE, AS SUCH THE INFORMATION CONTAINED HEREIN DOES NOT CONSTITUTE FINANCIAL ADVICE, NOR IS IT INTENDED TO INFLUENCE AN INVESTOR'S DECISION TO INVEST, AND IS NOT A RECOMMENDATION FOR THE RECIPIENT TO PARTICIPATE IN ANY PARTICULAR TRADING STRATEGY IN ANY JURISDICTION. THIS DOCUMENT HAS NOT BEEN APPROVED BY, OR FILED WITH THE CENTRAL BANK OF THE UNITED ARAB EMIRATES, THE SECURITIES AND COMMODITIES AUTHORITY, THE DUBAI FINANCIAL SERVICES AUTHORITY, THE FINANCIAL SERVICES REGULATORY AUTHORITY OR ANY OTHER RELEVANT REGULATORY AUTHORITIES IN THE UNITED ARAB EMIRATES. IF YOU DO NOT UNDERSTAND THE CONTENTS OF THIS DOCUMENT, YOU SHOULD CONSULT WITH A FINANCIAL ADVISOR. THIS DOCUMENT IS PROVIDED TO THE RECIPIENT ONLY AND SHOULD NOT BE PROVIDED TO OR RELIED ON BY ANY OTHER PERSON.

United Kingdom: This material has been approved for issue in the United Kingdom solely for the purposes of Section 21 of the Financial Services and Markets Act 2000 by GSI, Plumtree Court, 25 Shoe Lane, London EC4A 4AU. Authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority.

ISG/GIR Forecasts. Economic and market forecasts presented (“forecasts”) reflect either ISG’s or GIR’s views and are subject to change without notice. Forecasts do not take into account specific investment objectives, restrictions, tax and financial situation or other needs of any specific client. Forecasts are subject to high levels of uncertainty that may affect actual performance and should be viewed as merely representative of a broad range of possible outcomes. Forecasts and any return expectations are as of the date of this material, and should not be taken as an indication or projection of returns of any given investment or strategy. Forecasts are estimated, based on capital market assumptions, and are subject to significant revision and may change materially as economic and market conditions change. Any case studies and examples are for illustrative purposes only. If applicable, a copy of the GIR Report used for GIR forecasts is available upon request. Forecasts do not reflect advisory fees, transaction costs, and other expenses a client would have paid, which would reduce return.

The probability that we assign to certain events is a subjective assessment based upon the research conducted by ISG including conversations with a number of experts in their respective fields. Investors should not rely upon the assigned probability in making an investment decision.

This material is for your information only and is not intended to be used by anyone other than you. To the extent this presentation is used by Private Wealth Management, this presentation is intended only to facilitate your discussions with Goldman Sachs as to the opportunities available to our Private Wealth Management clients. This is not an offer or solicitation with respect to the purchase or sale of any security. This presentation is intended only to facilitate your discussions with Goldman Sachs International (“GSI”), who are authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and Prudential Regulation Authority, as to the opportunities available to our retail clients. The presentation is not intended to be used as a general guide to investing, or as a source of any specific investment recommendations, and makes no implied or express recommendations concerning the manner in which any client’s account should or would be handled, as finding the appropriate investment strategies for a client will depend upon the client’s investment objectives. Discussion of

specific stocks is for educational purposes only and as a general guide to investing and should not be construed as investment advice or an offer or solicitation to buy or sell securities.

This presentation does not constitute an offer or solicitation to any person in any jurisdiction in which such offer or solicitation is not authorized or to any person to whom it would be unlawful to make such offer or solicitation. It is the responsibility of any person or persons in possession of this material to inform themselves of and to observe all applicable laws and regulations of any relevant jurisdiction. Prospective investors should inform themselves and take appropriate advice as to any applicable legal requirements and any applicable taxation and exchange control regulations in the countries of their citizenship, residence or domicile which might be relevant to the subscription, purchase, holding, exchange, redemption or disposal of any investments. Information contained herein is believed to be reliable but no warranty is given as to its completeness or accuracy and views and opinions, whilst given in good faith, are subject to change without notice. GSI, and/or its affiliates (together "Goldman Sachs") and its officers, directors, and employees, including persons involved in the preparation or issuance of this material, may from time to time have "long" or "short" positions in, or buy or sell, or otherwise have a material interest in, the investments mentioned herein or in related investments including, without limitation, securities, commodities, derivatives (including options) or other financial products of companies mentioned herein. In addition, Goldman Sachs may have served as manager or co-manager of a public offering of securities by any such company within the past 12 months and/or may be the only market maker in relation to investments mentioned herein and/or may be providing significant advice or investment services in relation to investments mentioned herein or related investments or have provided such advice or services within the previous 12 months.

Past performance is not a guide to future performance and the value of investments and the income derived from them can go down as well as up. Future returns are not guaranteed and a loss of principal may occur. Changes in exchange rates may cause the value of an investment to increase or decrease. Some investments may be restricted or illiquid, there may be no readily available market and there may be difficulty in obtaining reliable information about their value and the extent of the risks to which such investments are exposed. Certain investments, including warrants and similar securities, often involve a high degree of gearing or leverage so that a relatively small movement in price of the underlying security or benchmark may result in a disproportionately large movement, unfavorable as well as favorable, in the price of the warrant or similar security. In addition, certain investments, including futures, swaps, forwards, certain options and derivatives, whether on or off exchange, may involve contingent liability resulting in a need for the investor to pay more than the amount originally invested and may possibly result in unquantifiable further loss exceeding the amount invested. Transactions in over-the-counter derivatives involve additional risks as there is no market on which to close out an open position; it may be impossible to liquidate an existing position, to assess the value of a position or to assess the exposure to risk. Investors should carefully consider whether such investments are suitable for them in light of their experience, circumstances and financial resources.

No part of this material may be i) copied, photocopied or duplicated in any form, by any means, or ii) redistributed without the prior written consent of GSI.

Indices are unmanaged, and the figures for the index do not reflect any fees or expenses. We strongly recommend that these factors be taken into consideration before an investment decision is made. Investors cannot invest directly in indices. References to market or composite indices, benchmarks or other measures of relative market performance over a specified period of time ("benchmarks") are provided by Goldman Sachs for your information purposes only. Goldman Sachs does not give any commitment or undertaking that the performance of your account(s) will equal, exceed or track any benchmark.
GS may record telephone conversations and monitor emails between GS and you (and any of your authorised, connected or affiliated persons) for the purpose of evidencing your instructions, monitoring quality of service, for compliance and security purposes, otherwise for GS's internal records or where required by Applicable Rules.

This material has been approved for issue in the United Kingdom solely for the purposes of Section 21 of the Financial Services and Markets Act 2000 by GSI, Plumtree Court, 25 Shoe Lane, London, EC4A 4AU, United Kingdom; authorised by the Prudential Regulation Authority; and regulated by the Financial Conduct Authority and the Prudential Regulation Authority.
Certain aspects of the investment strategy described in this presentation may from time to time include commodity interests as defined under applicable law.

For investors based / receiving this document in the United Kingdom: This document may contain references to "non-mainstream pooled investments," as defined in the UK Financial Conduct Authority's Handbook of Rules and Guidance (the "FCA Handbook"). Non-mainstream pooled investments include (without limitation) unregulated collective investment schemes and certain structured products. Where this document refers to non-mainstream pooled investments, this document and the non-mainstream pooled investments referred to within it has been provided to you on the basis that you have demonstrated to Goldman Sachs that you fall within an exempt category of person to whom such an investment may lawfully be promoted in accordance with the rules of the FCA Handbook, including without limitation: (a) Certified High Net Worth Investors; (b) Professional or Eligible Counterparty clients; (c) Certified Sophisticated Investors; (d) Certified Self-Sophisticated Investors; or (e) by virtue of this document amounting to an Excluded Communication, as such terms are defined in the FCA Handbook.
If you are aware that the above exemptions do not apply or are no longer applicable to you, you must notify Goldman Sachs without delay and you must not pursue any of the investments highlighted in this document.

PURSUANT TO AN EXEMPTION FROM THE U.S. COMMODITY FUTURES TRADING COMMISSION IN CONNECTION WITH ACCOUNTS OF QUALIFIED ELIGIBLE CLIENTS, THIS BROCHURE IS NOT REQUIRED TO BE, AND HAS NOT BEEN, FILED WITH THE COMMODITY FUTURES TRADING COMMISSION. THE COMMODITY FUTURES TRADING COMMISSION DOES NOT PASS UPON THE MERITS OF PARTICIPATING IN A TRADING PROGRAM OR UPON THE ADEQUACY OR

ACCURACY OF COMMODITY TRADING ADVISOR DISCLOSURE. CONSEQUENTLY, THE COMMODITY FUTURES TRADING COMMISSION HAS NOT REVIEWED OR APPROVED THIS TRADING PROGRAM OR THIS BROCHURE.

© Copyright 2022 The Goldman Sachs Group, Inc. All rights reserved. Services offered through Goldman Sachs & Co. LLC. and Goldman Sachs International. Member NASD/SIPC.