Transforming commerce

Technological progress continues to challenge many traditional business models.

E-commerce, for example, is increasingly winning sales from conventional market retail channels.

Likewise, the revolution in robotics could enhance many businesses, while also posing a serious threat to some companies and sectors.

Companies that design and build robotic technologies – as well as potential beneficiaries of robotic automation – offer investment possibilities.

Investors also need to consider which assets might be negatively affected by the robotics revolution and position their portfolios accordingly.

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Technology's creative destruction

Steven Wieting, Global Chief Investment Strategist

Technological progress continues to challenge many traditional business models. Investors need to consider their portfolios in light of this.

Make more with less. Enhanced productivity has been the secret to rising living standards since the Stone Age. To enhance productivity, tools have been improved and working processes have been made more efficient. The resources consequently saved have been re-deployed to make even more.

US manufacturing is a case in point. Since manufacturing employment peaked in 1979, 7.3 million jobs have disappeared. We estimate the vast majority of those jobs were lost to greater automation or improved processes rather than to cheap competition from overseas. And yet US manufacturing output has grown 130% over the same period, while the economy overall has created an additional 46 million jobs, with real income per capita almost doubling.

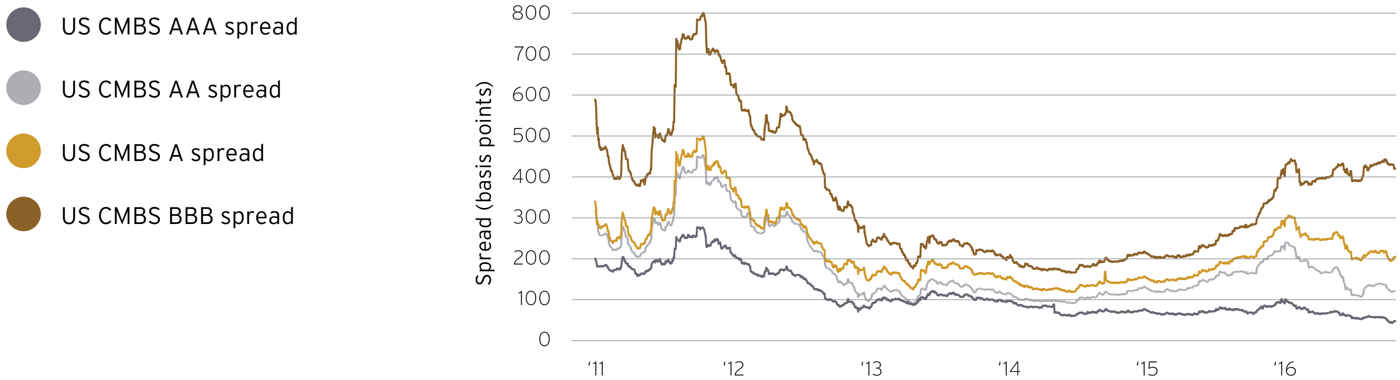
> The advance of robotics may soon allow significant labor-saving across manufacturing and service industries.

Over the last five years, however, labor productivity growth across the US and other developed economies appears to have been at its weakest since the early 1980s.[1] This is not an academic issue for investors. Among other things, it affects corporate profitability, interest rates, and overall investment returns.

Economists have a poor record of forecasting the impact of productivity-enhancing technologies. Productivity gains from major innovations – rather than from greater investment – are especially hard to predict. But we think one particular tool, robotics, and one particular process, e-commerce, could help accelerate productivity growth once more.

The advance of robotics – see **The robotics revolution** – may soon allow significant labor-saving across a swathe of manufacturing and service industries. The driverless taxis already navigating Singapore's streets offer one small glimpse of this. Next, robots could replace human long-haul truckers. Long-haul trucking currently accounts for 900,000 US jobs – or 0.6% of the total.

Figure 1. Wider spreads for weaker borrowers



Source: Bloomberg, as of 30 Oct 2016. Chart shows the spread of the yields-to-maturity on Commercial Mortgage Backed Securities over those on US Treasuries. Past performance is no guarantee of future results.

These are far from isolated examples. Unless new jobs can be created elsewhere for the workers replaced by robotics, governments will face an unprecedented challenge to maintain unemployed populations. However, the long history of economic progress accompanied by labor-destroying innovation leaves us more optimistic than many.

As we showed in **Victims and victors of transforming commerce** in 2015, e-commerce is steadily rendering a centuries-old retail business model obsolete. E-commerce is expanding consumer choice, enhancing price competitiveness, and eliminating unnecessary transportation. Rather than shipping large amounts of inventory to shops and malls where shoppers may or may not buy it, e-commerce connects goods in warehouses directly to the homes of consumers who definitely want them.

E-commerce is increasingly winning sales from conventional retail channels. As recently as 2007, e-commerce sales in the US were no larger than department store sales. Today, e-commerce sales are three times greater, mainly at the expense of main street stores. This process still has further to go, however. In many countries, the impact of e-commerce is early-stage, but growing. In otherwise slow-growing Europe, e-commerce has been forecast to grow at a 15% annualized rate for the remainder of the decade.[2]

As well as displacing workers – US department stores still employ 3.7 times as many workers as e-commerce retailers despite achieving just over a quarter of their sales – the advance of e-commerce has profound implications for retail-related real estate assets. For purpose-built malls in non-prime locations, for example, the future could be particularly challenging. By contrast, strategically-located logistics centers may stand to benefit.

The tougher outlook for weaker traditional retailers is already making itself felt in commercial mortgage backed bonds, where credit spreads have risen noticeably in the lower credit tiers – **figure 1**. Although this partly relates to non-retail forces – including the oil industry recession – we nevertheless advise property and bond investors to shift their holdings away from likely victims of e-commerce and towards the potential victors. The latter include investments in the logistics and distribution businesses via private equity – see **The liquidity trade-off** – as well as a variety of public market securities. We explore some more of these on the following pages.

1 US Bureau of Labor Statistics measure, as of 30 Oct 2016
2 Global e-commerce revolution, Prologis forecast, as of Dec 2015

All forecasts are expressions of opinion and are subject to change without notice and are not intended to be a guarantee of future events. Past performance is no guarantee of future events. Real results may vary. Mortgage-backed securities ("MBS"), which include collateralized mortgage obligations ("CMOs"), also referred to as real estate mortgage investment conduits ("REMICs"), may not be suitable for all investors. There is the possibility of early return of principal due to mortgage prepayments, which can reduce expected yield and result in reinvestment risk. Conversely, return of principal may be slower than initial prepayment speed assumptions, extending the average life of the security up to its listed maturity date (also referred to as extension risk). Additionally, the underlying collateral supporting non-Agency MBS may default on principal and interest payments. In certain cases, this could cause the income stream of the security to decline and result in loss of principal. Further, an insufficient level of credit support may result in a downgrade of a mortgage bond's credit rating and lead to a higher probability of principal loss and increased price volatility. Investments in subordinated MBS involve greater credit risk of default than the senior classes of the same issue. Default risk may be pronounced in cases where the MBS security is secured by, or evidencing an interest in, a relatively small or less diverse pool of underlying mortgage loans. MBS are also sensitive to interest rate changes which can negatively impact the market value of the security. During times of heightened volatility, MBS can experience greater levels of illiquidity and larger price movements. Price volatility may also occur from other factors including, but not limited to, prepayments, future prepayment expectations, credit concerns, underlying collateral performance and technical changes in the market.

The robotics revolution

Phil Watson, Head of the Global Investment Lab

The robotics revolution could have a significant impact on investment portfolios. Investors should prepare portfolios well in advance.

The age of the robot has dawned. Robotic technologies today are playing vital roles across many industries and increasingly in our everyday lives. Many people are probably unaware of how influential robots already are, perhaps because so few of them resemble the droids from the movies. Robots come in a wide variety of shapes and sizes and are performing an even wider range of functions.

Over the coming years, artificially intelligent machines will carry out ever more of the complex functions that we rely on humans to do today. Piloting passenger airliners, carrying out major surgery in hospitals, patrolling the streets as law-enforcers, and educating children in schools are just a few examples. They will also do work that humans will never be able to do – particularly in hazardous environments – as well as entirely new jobs, thus creating fresh opportunities for the economy and society.

Understandably, much of the discussion about the robotics revolution so far has focused upon the possible drawbacks. How will most of the population make a living if their labor is rendered redundant by robots? Who will buy robotically-produced goods and services if they have no income? Where will legal responsibility lie in accidents involving robotic vehicles? What are the moral – and demographic – implications of humans having relationships with artificially-intelligent and lifelike robotic beings?

These are just some of the critical questions that need to be answered over time. However, we are also optimistic about the potential benefits that the robotics revolution may deliver.

As we set out in the previous article, robotics could provide a much-needed boost to productivity and economic growth. They could also have numerous social benefits, such as freeing people from mundane domestic work, improving living standards, and even saving lives. For example, robotic carers could help millions of the world's rapidly aging population stay living in their own homes while also tending to those in nursing facilities. Driverless cars could avert many of the 1.5m deaths[1] on the world's roads each year.

The robotics revolution represents a potentially significant opportunity for investors. Investing in companies that design and build robotic technologies is part of this. But there are many other businesses that could embrace robotics to enhance the production and delivery of their own goods and services. At the same time, robotics may pose a serious threat to some companies and sectors and identifying these will be an equally important task for investors.

Robotics could provide a much-needed boost to productivity and economic growth.

Robotics producers

While the most significant advances in robotics may be yet to come, these technologies already represent fast-growing markets. The International Federation of Robotics (IFR) – a non-profit organization that provides robotic industry intelligence – has estimated that annual shipments of multipurpose industrial robots – those used in manufacturing – will grow from 290,000 in 2016 to 414,000 by 2019.[2] The value of software, peripherals and systems engineering associated with robots may together be worth some US$32 billion – or three times the level of hardware sales.[3]

One segment that could potentially experience faster growth than the industry as a whole is industrial robots for use outside of the automotive industry. (The industry is currently a particularly heavy user of robots and is expected to become even more so.) While non-automotive end-uses already account for 60% of robot unit shipments, industry participants see this market doubling by 2020. To put this in perspective, this is equivalent to some US$6bn of incremental non-automotive robots each year.[4]

If these forecast rates of growth do indeed occur, it could represent a substantial opportunity for investors in companies involved in the design and manufacture of both robotics hardware and software. The top suppliers of industrial robots that may be able to capture such growth are currently clustered in the developed markets of Japan, Germany and Switzerland. New suppliers are also emerging in China, where the authorities are keen for the robotics industry to catch up technologically with its developed-market peers.

Harnessing robotics

The possible applications of robotic technologies across the economy could be enormous. These include the more obvious – such as extending the range of manufacturing and assembly tasks already performed by robots in heavily automated factories – as well as areas where there is currently little robotic input, such as in homebuilding or fruit-picking. Simply put, much of the potential arises from replacing expensive – and sometimes inefficient – human labor with cheaper and more effective robotic involvement.

In manufacturing, labor costs globally are currently estimated to be approximately US$6 trillion a year.[5] But according to Boston Consulting Group, a global management consulting firm, substantial savings may be on the horizon. By 2025, it expects average manufacturing labor costs – adjusted for inflation, other costs and productivity enhancing measures – to be one-third lower in South Korea, and between 18% and 25% lower in China, Germany, the US and Japan than they otherwise would have been.

Differences in the pace of robotics adoption is likely to influence cost competitiveness between economies. South Korea – which is at the forefront of robotics adoption – is projected to improve its manufacturing cost competitiveness by 6 percentage points relative to the US by 2025, other things being equal. By contrast, high cost nations that lag behind in adoption – including Austria, Brazil, Russia, and Spain – could see their relative cost competitiveness suffer.

Four industries are seen leading the adoption of advanced industrial robots: computers and electronic products; electrical equipment, appliances and components; transportation and components; and machinery. More than 85% of production tasks in these industries are estimated to be potentially automatable, while wages are relatively high.[6]

It isn't just manufacturing businesses that may be able to benefit from increasing automation via robotics. For example, the US consumer discretionary sector – which includes retail – increased its profitability per employee by 71% between 2003 and 2013.[7] According to Citi Research, this may indicate growing automation in a traditionally labor-intensive sector. Among the most labor-intensive industry sectors are consumer discretionary, consumer staples, IT, and healthcare – **figure 1**.

The healthcare industry – particularly hospitals, patient care and treatment – looks like a prime candidate for ongoing automation via robotics. It is heavily reliant on human labor for now, which is set to become ever scarcer and thus more costly. According to the World Health Organization, there is currently an estimated global health workforce shortage of 7.2m professionals, forecast to increase to 12.9m by 2035. In the European Union, the European Commission projects a shortage of around 1m professionals by 2020, including 590,000 nurses and 230,000 physicians.[8]

Figure 1. US equity sector employee density

	# Employees as % of total
Consumer discretionary	31%
Consumer staples	20%
Industrials	16%
IT	13%
Healthcare	8%
Materials	4%
Energy	4%
Telecoms	3%
Utilities	1%

Source: Citi Research, Technology at work, February 2015.

THE ROBOTICS REVOLUTION

Few technologies have the potential to transform our everyday lives as much as robotics.

Industrial robotics growth potential

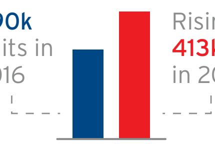
Global stock industrial robots:[i]

2015: 1,631,600

2019: 2,589,000

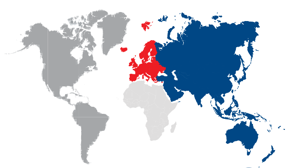
Global sales forecast:

290k units in 2016



Rising to **413k** units in 2019

Robot growth by region:



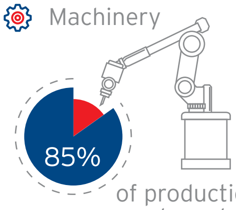
5% Americas

8% Europe

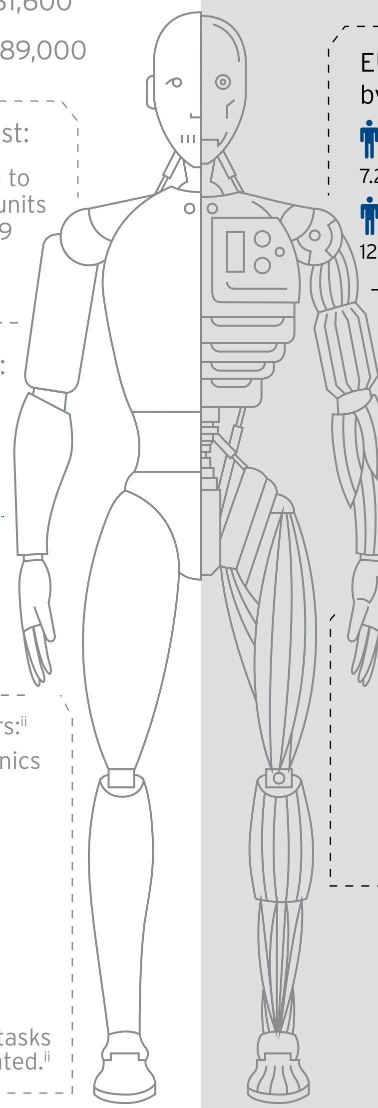
18% Asia & Australia

Leading robotics adopters:[ii]

- Computers & electronics
- Electrical equipment
- Transportation
- Machinery



of production tasks can be automated.[ii]



Healthcare case study

Healthcare is a prime candidate for ongoing automation.

EU workforce shortage by 2020:[iii]

7.2m in 2016

12.9m by 2035

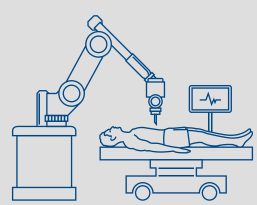
Workforce shortage in the EU could be 1m by 2020, including:[iii]

590k Nurses

230k Physicians

Automatable tasks:

- Collecting, preparing, and administering medication
- Analyzing samples
- Even surgery



Sources:

i World Robotics 2016 Industrial Robots, International Federation of Robotics

ii Industries and Economies Leading the Robotics Revolution, Boston Consulting Group, Sept 2015. Harold L. Sirkin, Micheal Zinser and Justin Rose.

iii World Health Organization, A Universal Truth: No Health Without a Workforce (2015)

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Disclosure: Strategies and investments mentioned in this document may not be suitable for all investors. Products, strategies and services discussed herein may have elegibility requirements that must be met prior to investing. Each investor should carefully view the risks associated with the investment and make a determination based upon the investor's own particular circumstances, that the investment is consistent with the investor's objectives.

Figure 2. Robotics beneficiaries

Healthcare

Surgery
Diagnosis & treatment
Nursing
Elderly care

Transportation & logistics

Driverless trucking
Robotic warehouse work
Delivery by drone

Manufacturing

Computers & electronics
Electrical equipment
Automotive & components

Customer services & finance

Banking & payments

Source: Citi Private Bank Global Investment Lab, as of 23 Nov 2016.

The healthcare industry has already begun to embrace robotics to enhance patient care. Since 2000, the Da Vinci system – a US$1.5 million robot that assists in surgery – has been used to perform minimally invasive surgery on 2.5m patients worldwide.[9] However, robots could in the future undertake many more medical tasks, ranging from the simple to the sophisticated, and with little or no human assistance. Monitoring and supporting the elderly in care homes, collecting, preparing and administering medication, and analyzing laboratory samples are just a handful of the functions that may be ripe for automation.

Transportation and logistical firms could also benefit from the robotics revolution. Aside from reducing the number of costly accidents and the heavy loss of life on the roads caused by human error, driverless trucking convoys might also serve to lower emissions and congestion. Driverless vehicles also offer an obvious solution to the shortage of human truckers currently affecting the logistics trade in Europe and North America. Many other service sectors – particularly those involved in e-commerce and retail – are also likely to embrace such vehicles, as well as drones.

Less visible than driverless transport – but no less important – could be greater automation among financial services and customer service firms. Besides streamlining the flow of money and credit around the economy, automation and artificial intelligence use could help firms to personalize their services to each particular customer. Improved customer experience may therefore accompany lower costs.

Despite the significant potential for both manufacturing and service industries worldwide to adopt robotics, there will inevitably be victims as well as victors. We do not think that these are likely to be confined to any particular sector or country. Instead, we see the most probable victims as those that fail to clear the various barriers that exist to adoption. These include capital investment requirements and the necessary understanding of how to make appropriate use of these technologies. Constant monitoring of the advance of robotics should become an essential part of the investment analysis process.

Adding robotics to a portfolio

Quite rightly, governments, companies and citizens have already begun to think deeply about the possible consequences of a more robotic future. However, we believe that investors may still be overlooking the potential opportunities from robotics and its implications for their portfolios. As more and more industries adopt robotics, the value of investments in many areas could be impacted both for better and for worse. The time to prepare portfolios is now.

For identifying potential investments in robotics companies, we look for evidence of a genuine leadership within a particular technology, rapid revenue growth, sufficient financing for capital expenditure, as well as a valuation that doesn't fully reflect the prospective growth. For companies that may benefit from adopting robotics, we look especially for industries and businesses that are highly labor-intensive or have high labor costs, and where many tasks can be and are likely to be automated going forward. Existing competitive position, robust finances, and valuation are also critical.

What, then, are the options for investors seeking exposure to robotics combined with tailored investment outcomes – such as yield enhancement or capital protection? One simple option is to invest in securities or investment structures relating to companies that are directly involved in robotics or that might be beneficiaries of robotic automation. Alternatively, investors may seek to extract value from investments that could benefit from the potential disruption in industries negatively affected by the robotics revolution.

Through managed investments, investors may also be able to obtain tailored exposure to robotics. Managers with the ability to go long and short may be able to capture some of the value in the relative performance between robotics victors and victims. It is also possible to construct bespoke, discretionarily managed portfolios that focus on particular robotics sub-themes. Specific technology based exchange-traded funds with exposure to robotic are another option.

Duygu Baydur also contributed to this article.

1 Global status report on road safety 2015 – the World Health Organization
2 World Robotics 2016 Industrial Robots, International Federation of Robotics
3 Technology at work v2.0 – Citi Global Perspectives & Solutions, January 2016
4 Disruptive innovations IV, Citi Global Perspectives & Solutions, July 2016
5 Technology at work – Citi Global Perspectives & Solutions, February 2015
6 Industries and Economies Leading the Robotics Revolution, Boston Consulting Group, September 2015. Harold L. Sirkin, Michael Zinser, and Justin Rose
7 Technology at work – Citi Global Perspectives & Solutions, February 2015
8 World Health Organization, A Universal Truth: No Health Without a Workforce (2015)
9 Technology at work v2.0 – Citi Global Perspectives & Solutions, January 2016

Glossary

Asset class definitions

Cash is represented by US 3-month Government Bond TR, measuring the US dollar-denominated active 3-Month, fixed-rate, nominal debt issues by the US Treasury.

Commodities asset class contains the index composites — GSCI Precious Metals Index, GSCI Energy Index, GSCI Industrial Metals Index, and GSCI Agricultural Index — measuring investment performance in different markets, namely precious metals (e.g., gold, silver), energy commodity (e.g., oil, coal), industrial metals (e.g., copper, iron ore), and agricultural commodity (i.e., soy, coffee) respectively. Reuters/Jeffries CRB Spot Price Index, the TR/CC CRB Excess Return Index, an arithmetic average of commodity futures prices with monthly rebalancing, is used for supplemental historical data.

Global Developed Market Corporate Fixed Income is composed of Bloomberg Barclays indices capturing investment debt from seven different local currency markets. The composite includes investment grade rated corporate bonds from the developed-market issuers.

Global Developed Market Equity is composed of MSCI indices capturing large-, mid- and small-cap representation across 23 individual developed-market countries, as weighted by the market capitalization of these countries. The composite covers approximately 95% of the free float-adjusted market capitalization in each country.

Global Developed Investment Grade Fixed Income is composed of Bloomberg Barclays indices capturing investment-grade debt from twenty different local currency markets. The composite includes fixed-rate treasury, government-related, and investment grade rated corporate and securitized bonds from the developed-market issuers. Local market indices for US, UK and Japan are used for supplemental historical data.

Global Developed Market Large-Cap Equity. The asset class is composed of MSCI indices capturing large cap representation across nine individual developed-market countries, as weighted by the market capitalization of these countries. The composite covers approximately 95% of the free float-adjusted market capitalization in each country.

Global Emerging Market Equity is composed of MSCI indices capturing large and mid-cap representation across 20 individual emerging-market countries. The composite covers approximately 85% of the free float-adjusted market capitalization in each country. For the purposes of supplemental long-term historical data, local-market country indices are used, wherever applicable.

Global Emerging Fixed Income is composed of Bloomberg Barclays indices measuring performance of fixed-rate local currency emerging markets government debt for 19 different markets across Latin America, EMEA and Asia regions. iBoxx ABF China Govt. Bond, the Markit iBoxx ABF Index comprising local currency debt from China, is used for supplemental historical data.

Global Equity is represented by the MSCI ACWI Index, capturing all sources of equity returns in 23 developed and 23 emerging markets.

Global Fixed Income is represented by the Bloomberg Barclays Multiverse Index, with returns hedged into US dollars.

Global High Yield Fixed Income is composed of Bloomberg Barclays indices measuring the non-investment grade, fixed-rate corporate bonds denominated in US dollars, British pounds and Euros. Securities are classified as high yield if the middle rating of Moody's, Fitch, and S&P is Ba1/BB+/BB+ or below, excluding emerging market debt. Ibbotson High Yield Index, a broad high yield index including bonds across the maturity spectrum, within the BB-B rated credit quality spectrum, included in the below-investment-grade universe, is used for supplemental historical data.

Hedge Funds is composed of investment managers employing different investment styles as characterized by different sub categories – HFRI Equity Long/Short: Positions both long and short in primarily equity and equity derivative securities; HFRI Credit: Positions in corporate fixed income securities; HFRI Event Driven: Positions in companies currently or prospectively involved in wide variety of corporate transactions; HFRI Relative Value: Positions based on a valuation discrepancy between multiple securities; HFRI Multi Strategy: Positions based on realization of a spread between related yield instruments; HFRI Macro: Positions based on movements in underlying economic variables and their impact on different markets; Barclays Trader CTA Index: The composite performance of established programs (Commodity Trading Advisors) with more than four years of performance history.

Private Equity characteristics are driven by those for Developed Market Small Cap Equities, adjusted for illiquidity, sector concentration, and greater leverage.

Real Estate contains index contains all Equity REITs (US REITs and publicly-traded real estate companies) not designated as Timber REITs or Infrastructure REITs: NAREIT US REIT Index, NAREIT Canada REIT Index, NAREIT UK REIT Index, NAREIT Switzerland REIT Index, NAREIT Euro-zone REIT Index, NAREIT Japan REIT Index, NAREIT Hong Kong REIT Index, NAREIT Singapore REIT Index, NAREIT Australia REIT Index

Index definitions

The Bloomberg-JPMorgan Asia Currency Index (ADXY) is a US dollar tradable index of emerging Asian currencies, which serves as a benchmark for monitoring Asia's currency markets on an aggregate basis. It is a spot index of emerging Asia's most actively traded currency pairs valued against the US dollar.

The Bloomberg Barclays Pan-European High Yield Index measures the market of non-investment grade, fixed-rate corporate bonds denominated in the following currencies: Euro, British pounds, Danish krone, Norwegian krone, Swedish krona, and Swiss franc. Inclusion is based on the currency of issue, and not the domicile of the issuer.

The Bloomberg Barclays US Corporate High Yield Total Return Index Value Unhedged USD is a Citi's Emerging Markets US Dollar Government Bond Index (EMUSDGBI) includes US Dollar-denominated emerging market sovereign debt issued in the global, Yankee, and Eurodollar markets. The index comprises debt of more than 50 countries from Latin America, Eastern Europe, Middle East, Africa, and Asia and offers geographical diversification without exposure to local currency fluctuations. The index provides exposure to a broad array of countries and sub-indices are available in any combination of country, maturity, and rating.

Citi's US High-Yield Market Index is a US dollar-denominated index which measures the performance of high-yield debt issued by corporations domiciled in the US or Canada. Recognized as a broad measure of the North American high-yield market amongst all Citi's fixed income indices, it includes cash-pay and deferred-interest securities. All the bonds are publically placed, have a fixed coupon, and are non-convertible.

Citi US Broad Investment Grade Index (USBIG)—Corporate, is a subsector of the USBIG. The index includes fixed rate US Dollar-denominated investment grade corporate debt within the finance, industrial and utility sectors. This index includes US and non-US corporate securities (excludes US government-guaranteed and non-US sovereign and provincial securities).

Commodity Index is the S&P Goldman Sachs Commodity Index (S&P GSCI), a composite index of commodity sector returns representing an unleveraged, long-only investment in commodity futures that is broadly diversified across the spectrum of commodities.

The CBOE Volatility Index (VIX) is a measure of expectations of near-term volatility based on S&P 500 stock index option prices.

Emerging market currencies are represented by the OITP (Other important trading partners) index is a weighted average of the foreign exchange values of the US dollar against a subset of currencies in the broad index that do not circulate widely outside the country of issue. The weights are derived by rescaling the currencies' respective weights in the broad index so that they sum to 1 in each sub-index.

European equities are represented by the MSCI Europe index, which captures large- and mid-cap representation across 15 Developed Markets (DM) countries in Europe. It covers approximately 85% of the free float-adjusted market capitalization across the European Developed Markets equity universe.

Gold is represented by the commodity futures price for gold.

The High Yield Energy Bond Price index measures the price performance of US bonds with ratings below investment grade comprising energy and natural resources industries.

Japan equities are represented by the MSCI Japan index, which is designed to measure the performance of the large- and mid-cap segments of the Japanese market. It covers approximately 85% of the free float-adjusted market capitalization in Japan.

LIBOR is a benchmark interest rate that some of the world's leading banks charge each other for short-term loans. It stands for London Interbank Offered Rate and serves as the first step to calculating interest rates on various loans throughout the world.

The MSCI All Country World Index represents 48 developed and emerging equity markets. Index components are weighted by market capitalization.

The MSCI Asia ex-Japan index has large and mid-cap representation across 2 of 3 Developed Markets countries and 8 Emerging Markets countries in Asia. It captures approximately 85% of the free float-adjusted market capitalization in each country.

The MSCI China index has large- and mid-cap representation across China H shares, B shares, Red chips and P chips. With 139 constituents, it covers about 85% of this China equity universe.

The MSCI Emerging Markets Index represents the performance of large- and mid-equities from 23 emerging countries, covering approximately 85% of the free float-adjusted market capitalization in each country.

The MSCI Emerging Markets (EM) Latin America Index captures large and mid cap representation across 5 Emerging Markets (EM) countries* in Latin America. With 121 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in each country.

The MSCI World Index represents the performance of more than 1,600 large- and mid-cap stocks across 23 developed markets countries. The index covers approximately 85% of the free float-adjusted market capitalization in each country.

The MSCI World ex-USA Index represents the performance of large- and mid-cap representation across 22 of 23 developed markets countries excluding the United States. With 1,005 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in each country.

Oil is represented by the West Texas Intermediate Crude Oil price.

The Standard & Poor's 500 Index is a capitalization-weighted index that includes a representative sample of 500 leading companies in leading industries of the US economy. Although the S&P 500 focuses on the large cap segment of the market, with over 80% coverage of US equities, it is also an ideal proxy for the total market.

US Investment Grade Corporate Debt Total Return Index is an index made up of investment-grade debt issued by US companies, measured on a total return basis.

USD vs developed currencies is a broad weighted average index of the foreign exchange values of the US dollar against the currencies of a large group of major US trading partners.

USD vs emerging markets = The OITP (other important trading partners) index is a weighted average of the foreign exchange values of the US dollar against a subset of currencies in the broad index that do not circulate widely outside the country of issue.

Other terminology

Adaptive Valuations Strategies is Citi Private Bank's own strategic asset allocation methodology. It determines the suitable long-term mix of assets for each client's investment portfolio.

Correlation is a statistical measure of how two assets or asset classes move in relation to one another. Correlation is measured on a scale of 1 to -1. A correlation of 1 implies perfect positive correlation, meaning that two assets or asset classes move in the same direction all of the time. A correlation of -1 implies perfect negative correlation, such that two assets or asset classes move in the opposite direction to each other all the time. A correlation of 0 implies zero correlation, such that there is no relationship between the movements in the two over time.

The price-to-book ratio (P/B) compares the capitalization of an individual stock or of an index of stocks to the value of that stock or that index's combined shareholder capital. It is calculated by dividing the current closing price of the stock by the most recently reported book value per share. A low P/B can indicate a lowly-valued company or index, while a high P/B can indicate high valuation.

The price-earnings ratio (P/E) measures a company's or an index of companies' current share price relative to its earnings per share. A low P/E can indicate a lowly-valued company or index, while a high P/E can indicate high valuation.

Return on equity (ROE) is the amount of net income earned as a percentage of shareholders equity. It captures a company's profitability – or aggregate profitability among numerous companies – by showing how much profit is achieved with shareholders' capital.

Strategic asset allocation is the process of creating a long-term investment plan by assembling an appropriate mix of equities, fixed income, cash and other investments. It can potentially enhance portfolio returns and help manage risk.

Strategic Return Estimates are Citi Private Bank's forecast of returns for specific asset classes over a 10-year time horizon. The forecast for each specific asset class is made using a proprietary methodology that is appropriate for that asset class. Equity asset classes are forecast using a proprietary methodology based on the calculation of valuation levels with the assumption these valuation levels revert to their long-term trends over time. Fixed Income asset classes are forecast using a proprietary methodology based on current yield levels. Other asset classes have other specific forecasting methodologies. Please note that hedge funds, private equity, real estate, structured products and managed futures are generally illiquid investments and are subject to restrictions on transferability and resale. Each SRE is gross of actual client fees and expenses. Components of the methodology used to create the SREs include the rate of return for various asset classes based on indices. Termination and replacement of investments may subject investors to new or different charges. Past performance is not indicative of future results. Future rates of return cannot be predicted with certainty. Investments that pay higher rates of return are often subject to higher risk and greater potential loss in an extreme scenario. The actual rate of return on investments can vary widely over time, especially for long-term investments. This includes the potential loss of principal on your investment. It is not possible to invest directly in an index.

Tactical asset allocation looks to adjust the strategic asset allocation of a client's investment portfolio to incorporate shorter-term market insights.

Yield-to-Maturity (YTM) is the total return received on a bond or index of bonds when held to maturity. The total return includes both the payment of coupons and the return of the principal at maturity.

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Alternative investments referenced in this report are speculative and entail significant risks that can include losses due to leveraging or other speculative investment practices, lack of liquidity, volatility of returns, restrictions on transferring interests in the fund, potential lack of diversification, absence of information regarding valuations and pricing, complex tax structures and delays in tax reporting, less regulation and higher fees than mutual funds and advisor risk. Asset allocation does not assure a profit or protect against a loss in declining financial markets.

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- Changes in Regulatory or Tax Treatment of Energy Related MLPs. If the IRS changes the current tax treatment of the master limited partnerships included in the Basket of Energy Related MLPs thereby subjecting them to higher rates of taxation, or if other regulatory authorities enact regulations which negatively affect the ability of the master limited partnerships to generate income or distribute dividends to holders of common units, the return on the Notes, if any, could be dramatically reduced.
- Concentration Risk. Investment in a basket of Energy Related MLPs may expose the investor to concentration risk due to industry, geographical, political, and regulatory concentration.
- The price and dividends paid by Energy Related MLPs may be affected by a number of factors, including:
- Worldwide and domestic supplies of, and demand for, crude oil, natural gas, natural gas liquids, hydrocarbon products and refined products;
- Changes in tax or other laws affecting MLPs generally;
- Regulatory changes affecting pipeline fees and other regulatory fees in the energy sector;
- The effects of political events and government regulation;
- The impact of direct government intervention, such as embargos;
- Changes in fiscal, monetary and exchange control programs:
- Changes in the relative prices of competing energy products;

- Changes in the output and trade of oil and other energy producers;
- Changes in environmental and weather conditions;
- The impact of environment laws and regulations and technological changes affecting the cost of producing and processing, and the demand for, energy products;
- Decreased supply of hydrocarbon products available to be processed due to fewer discoveries of new hydrocarbon reserves, short- or long-term supply distributions or otherwise;
- Risks of regulatory actions and/or litigation, including as a result of leaks, explosions or other accidents relating to energy products;
- Uncertainty or instability resulting from an escalation or additional outbreak of armed hostilities or further acts of terrorism in the United States or elsewhere;
- General economic and geopolitical conditions in the United States and worldwide.

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Please read offering documents and/or prospectus information carefully for the risks associated with the particular MBS security you are purchasing.