FIGURE 1. STAYING FULLY INVESTED WAS VOLATILE BUT BEAT SITTING IN CASH

Stay invested portfolio

Market timer portfolio

Y-axis: Index returns rebased to $100 as of Jan 1999 (0 to 1000)
X-axis: 1995, 1999, 2003, 2007, 2011, 2015, 2019, 2023

Source: Bloomberg, as of 22 Nov 2022.

Chart shows the inflation–adjusted return of two hypothetical allocations, one a buy and hold portfolio (Stay Invested Portfolio) which remained fully invested in the S&P 500 Index between Jan 1995 and Nov 2022, and the other portfolio (Timing Portfolio) which sold out of the S&P in Jan 2000, shifted entirely into 3–month Treasury Bills and remained there to Nov 2022. The hypothetical portfolios past performance information set forth above does not represent the performance of an actual portfolio and is no guarantee of future returns of any portfolio. As a result of market activity since the date above, current performance may be different from that shown. Indices on this page are widely recognized, unmanaged indices of major asset classes. For illustrative purposes only. Past performance does not guarantee future results. Real results may vary. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events. Indices are unmanaged and an investor cannot invest directly in an index. All performance information shown above is hypothetical, not the actual performance of any client account. Hypothetical information reflects the application of a model methodology and selection of securities in hindsight. No hypothetical record can completely account for the impact of financial risk in actual trading. See Glossary for definitions.

WHAT TO DO NOW?

Despite our longstanding message about the importance of unstoppable trends, we frequently encounter portfolios with insufficient allocations. And the bear market of 2022 has reduced overvaluation dramatically.

Within digitization, we contemplate the growing role of semiconductors, robotics and the metaverse for data creators in the years ahead. We consider how innovations in healthcare could help address the needs of an aging global population and of Asia's expanding middle class. With greening the world, we make the case for accelerating the transition to clean energy to help bolster energy security as well as fighting climate change. And we consider the potential beneficiaries of the recently escalated US-China trade war.

Having read the analysis that follows, please contact your Private Banker about actionable strategies for building exposure based on your individual needs.

Investing in unstoppable trends for sustainable outcomes

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CATHERINE TURULLOLS
Sustainable Investing
Specialist for North America

Unstoppable trends are reshaping how we live and work. Ongoing digital disruption, the need for innovative healthcare, and the transition to clean and secure energy are potential sources of both long-term economic growth and portfolio returns. But that is not all: we believe that investments relating to unstoppable trends can help seek out opportunities generated by a transition to a low-carbon economy and more just society that aims to deliver affordable and accessible solutions across sectors.

Adopted in 2015, the United Nations' Sustainable Development Goals (SDGs) aim to help safeguard people and planet. The 17 interrelated goals address a variety of pressing priorities for humanity. They include zero poverty, good health and well-being, quality education,

affordable and clean energy, climate action, and decent work and economic growth.

The SDGs also serve as a roadmap for investors when determining where to deploy their capital, and they offer targets by which to evaluate outcomes. They highlight areas where capital is needed most, with global investment needs around the SDGs estimated at as much as $7 trillion annually.[1] We believe that many assets and investment strategies linked to our unstoppable trends can contribute to the pursuit of the SDGs.

The link between certain unstoppable trend-related strategies and sustainability is obvious. Equities in companies that enable the transition to clean and secure energy are a case in point. The same applies to many healthcare firms, including providers that seek to improve patient outcomes, cut medical waste or broaden access to treatment.

Superficially, the connection between digitization and sustainability may not be quite as clear. However, digital technology is pivotal to the pursuit of many of the SDGs. For example, digital solutions are helping to reduce greenhouse gas emissions and conserve water in agriculture; some fintech firms are extending banking and finance to marginalized communities for the first time, such as female entrepreneurs in developing countries; and online education and internet connectivity are enhancing the life chances of people the world over.

Of course, not every asset or investment related to unstoppable trends has sustainable characteristics. Nevertheless, it is possible to construct all or part of an allocation to unstoppable trends following sustainability principles. Individual securities, managed public and private market strategies and capital markets strategies can all help to build exposure, depending on the objectives and suitability of the investor.

Our approach to investing in a sustainable manner aligns with your worldview while seeking to maintain quality and improve investment outcomes. To identify suitable strategies, we employ an extensive due diligence process. We work with third-party providers and sustainability data specialists to evaluate and classify risks and attributes. This includes seeking to mitigate exposure to "greenwashed" investments – those that are marketed as sustainable but whose actual credentials fall short.

Whether you seek exposure to sustainable themes via unstoppable trends or your entire portfolio, we stand ready to empower your efforts.

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[1]   Banking on 2030: Citi & the Sustainable Development Goals, Citigroup 2022

A greater separation between East and West: G2 polarization intensifies

The technology trade war marks an intensification of US-China polarization. This increases the challenges facing investors, but also creates parallel portfolio diversification potential.

- An intense and strategic technology trade war is underway between the US and China

- The US seeks to protect intellectual capital and onshore production of critical technologies

- China is likely to speed up its efforts to become more technologically self-reliant

- We expect upheaval within global supply chains, with security of supply prioritized over efficiency

- Potential beneficiaries include India, Indonesia, Malaysia and the Philippines but also the likes of Mexico

- We favor carefully diversified global allocations including both US and China allocations and exposure to potential third country beneficiaries

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The rivalry between the world's two leading powers has grown more intense. As China's economic and geopolitical influence keeps growing, the US is responding vigorously to the challenge. The struggle is playing out in many spheres including trade, finance, military capabilities and influence over other countries – see **Accelerating G2 polarization** in **Mid-Year Outlook 2022**.

The latest battleground is technology, with the US restricting China's access to sophisticated semiconductors and other vital components. We see this as the start of a lasting technology trade war between the US and China, the "G2 powers." What does this latest decoupling mean for the G2 economies, the wider Asia region and investment portfolios?

China's drive for self-reliance

Even before the latest US technology restrictions, China's economy was becoming more self-reliant. Its growth has already shifted somewhat from export-led to domestic demand-led. Its foreign trade dependency ratio has fallen from 62.2% in 2006 to 34.2% in 2021, resulting from weak global demand for its exports during the global financial crisis (2008-09) and its economic stimulus – **FIGURE 1.** Nevertheless, this is way above levels for the US and Japan, leaving China further to go.

We now expect China to double down on its drive for self-reliance on trade war fears, technology decoupling and 'just-in-case' supply chain risks. Areas of focus will include food, energy, secure supply chains and core technologies,

including semiconductors. The government has already invested more than $150bn in the chip sector and we expect more to come as hi-tech competition with the US intensifies.

Despite being the world's biggest market for semiconductors, China currently meets little of its own needs. In 2015, the government's Made in China 2025 plan set a self-sufficiency target of 70% by 2025.

FIGURE 1. CHINA'S DECREASING RELIANCE ON OVERSEAS TRADE

CHINA'S FOREIGN TRADE DEPENDENCY RATIO
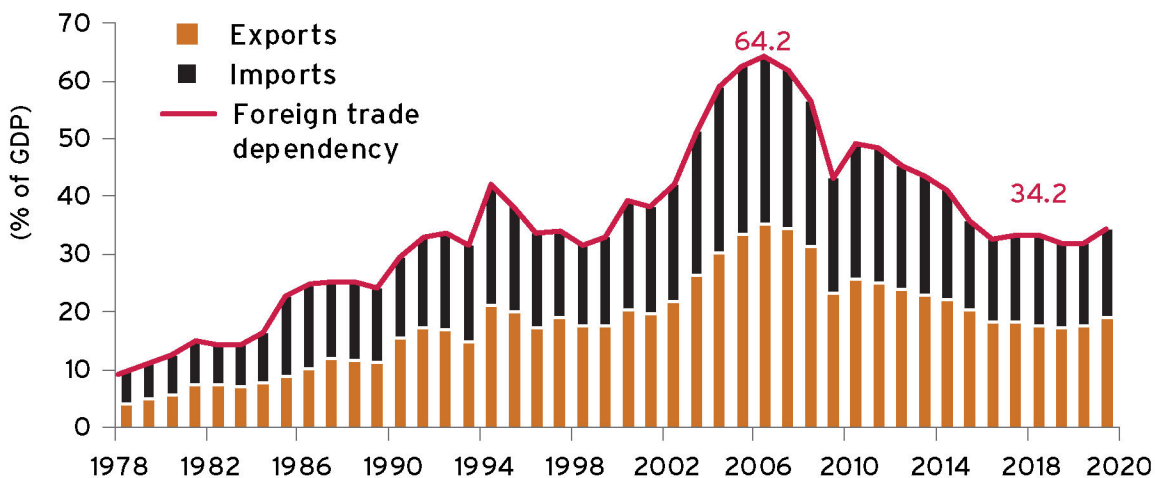
Source: National Bureau of Statistics of China, Citi GPS, as of Nov 2022. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only and do not represent the performance of any specific investment. Index returns do not include any expenses, fees or sales charges, which would lower performance. Past performance is no guarantee of future results. Real results may vary.

Chart shows Chinese exports, imports and its overall dependency on foreign trade expressed as a percentage of its GDP from 1978 to the present.

Admittedly, China has various relative strengths that could enable its ambitions in semiconductors and other technologies in the medium to long term. These include the highest savings ratio of any leading economy, the second-largest capital markets, the second-largest consumer market, and the most engineers and scientists working on applied innovation and scientific research. Government policies have helped various sectors become global leaders, including AI, 5G, quantum computing, clean energy and electric vehicles.

That said, China also faces major obstacles. Among them are limited support to basic research, distorted incentives, online information blockage and weak intellectual property protection. Overall, we see the US restrictions as likely to disrupt near-term tech sector operations in China and hinder its innovation ambitions for many years to come. This will also lead to slower GDP growth in China in the coming decade, making China's ambition to become the largest economy difficult to achieve if not impossible.

To play to its strengths and offset its weaknesses, China may take certain actions. First, we think markets may play a more important role, even amid government-led industrial policy. Second, innovation policy and funding support from the government should be equally accessible to private and foreign companies. Third, the government should communicate its economic thinking and consider external interests more transparently.

This would better manage domestic private and multinationals' enterprises alike.

The US chip technology restriction is a double-edged sword. It is not just Chinese chipmakers who stand to suffer. For US chipmakers, the new regulations mean less business near term. They are also withdrawing US personnel from their operations in China and are expected also to redeploy certain equipment away there too, perhaps in the US. Some firms face potential failure as they transition away from serving China – see **Deepening digitization.**

We expect an escalation of this tech rivalry over time. Indeed, we see it as similar to the Cold War "space race," where the US and the USSR sought to outdo each other in space exploration. And despite its near-term challenges, China has means to retaliate if it so chooses. For example, the country dominates global mined production and processing of rare earths, a group of materials critical to electric vehicles, wind turbines and energy storage, to name just a few.

Might the G2 standoff evolve into open conflict, particularly over Taiwan? We believe China is unlikely to take the military route unless provoked further by foreign interference or Taiwan unilaterally declaring independence. US legislative changes offering military and other support to Taiwan and next year's Taiwanese presidential election could both also increase friction.

Amid the sharpening polarization, the US and China will likely make valuable technological advances. We also envisage both powers going further to keep their most sophisticated technologies out of the others' hands. This could see pressure from each country upon nations within its sphere of influence to pick a side and not to deal with the other insensitive areas, just as the US is doing over sophisticated semiconductors and equipment.

As part of this, we look for the redrawing/ regrouping of global supply chains to accelerate. This could see production of a variety of key inputs serving the western markets shift away from China and toward Southeast Asia but also beyond. There is a case for leading Taiwanese and South Korean semiconductors to add to their capacity in Europe but mainly the US, helping to diversify and shore up supply chains.[1]

The upheaval involved should not be underestimated. And bifurcating technology blocs, duplicate supply chains and diminished cooperation are less economically efficient than a globalized system. Many companies and sub-sectors worldwide that have done well from serving China will have to seek business elsewhere because of the technological bifurcation. Restricted markets mean diminished overall opportunities compared to free markets.

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[1]   Citi GPS: Global Perspectives & Solutions, October 2022, CHINA'S INWARD TURN The Pursuit of Economic Self-Reliance

Opportunities for investment amid higher G2 competition

The US-China technology decoupling is at the intersection of the unstoppable trends of digitization and G2 polarization. We expect to find potential investment opportunities on both sides of the competitive divide. Our approach therefore stresses globally diversified exposure, including to key US and Chinese technology producers.

Beyond semiconductors, we envisage an ongoing drive to diversify and reinforce supply chains on both sides, with potential beneficiaries outside both China and the US. These include the trading partners of both G2 powers in Southeast Asia, as well as India and Mexico. Over the coming decade, we expect potential growth in emerging Asia to be led by India and then the likes of Indonesia, Malaysia and the Philippines. While the potential growth in China is set to slow further as its population ages faster, its economic size of over $18trn will still be an important market for others to rely upon.

Of course, ongoing polarization between the G2 powers creates risks for many companies and sectors. For example, business lost in one market is unlikely to be replaced instantly by activity elsewhere. Chipmakers unable to sell certain products to China are currently learning this the hard way. We believe that this favors a selective approach over broad-based passive exposure.

A less globalized, more polarized world presents challenges for investors. But weaker economic ties may also mean less correlated assets. Over time, this may mean potential diversification opportunities for portfolios.

Energy security is vital

Fossil fuel energy dependence is not only fueling climate change but also threatens the economy and national security. We believe this strengthens the case for the transition to clean energy and for positioning portfolios accordingly.

- The global energy crisis is causing inflation and lost output, especially in Europe, and deepening deprivation in some of the world's poorest countries

- Dependence on fossil fuel can also compromise energy importers' national security priorities

- We favor long-term investments in a variety of energy-related technologies

- Nevertheless, we recognize that natural gas has a continued role for now and related investments may see further near-term upside

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MALCOLM SPITTLER
Senior US Economist and Strategist

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The world is in the grip of an energy crisis. Consumers and businesses across multiple regions are already suffering heavier costs for electricity and gas – **FIGURE 1**. The epicenter of the crisis is in Europe, where Russia's near-halting of its natural gas exports has sent prices dramatically higher. Among the consequences are lower economic growth, higher inflation and greater human deprivation. What does this mean for the still early-stage transition from fossil fuels to clean energy sources?

On one level, it might appear as if the energy crisis is unhelpful to the transition. After all, public and government are focused on immediate imperatives such as keeping businesses powered and homes heated. This has seen a resurgence in fossil fuel usage, including of coal, the dirtiest of all. The crisis has also emboldened some – including certain fossil fuel executives and skeptical populist politicians – to claim that the transition will need to happen much more slowly than previously envisaged.

The case for an accelerated transition

At Citi Global Wealth Investments, we take the opposite view. Today's difficulties call not for slowing but for accelerating the transition toward renewable energy sources such as solar and wind. Indeed, we believe that failing to do so would create even greater risks.

FIGURE 1. NATURAL GAS'S UNSTABLE PRICE MOVES
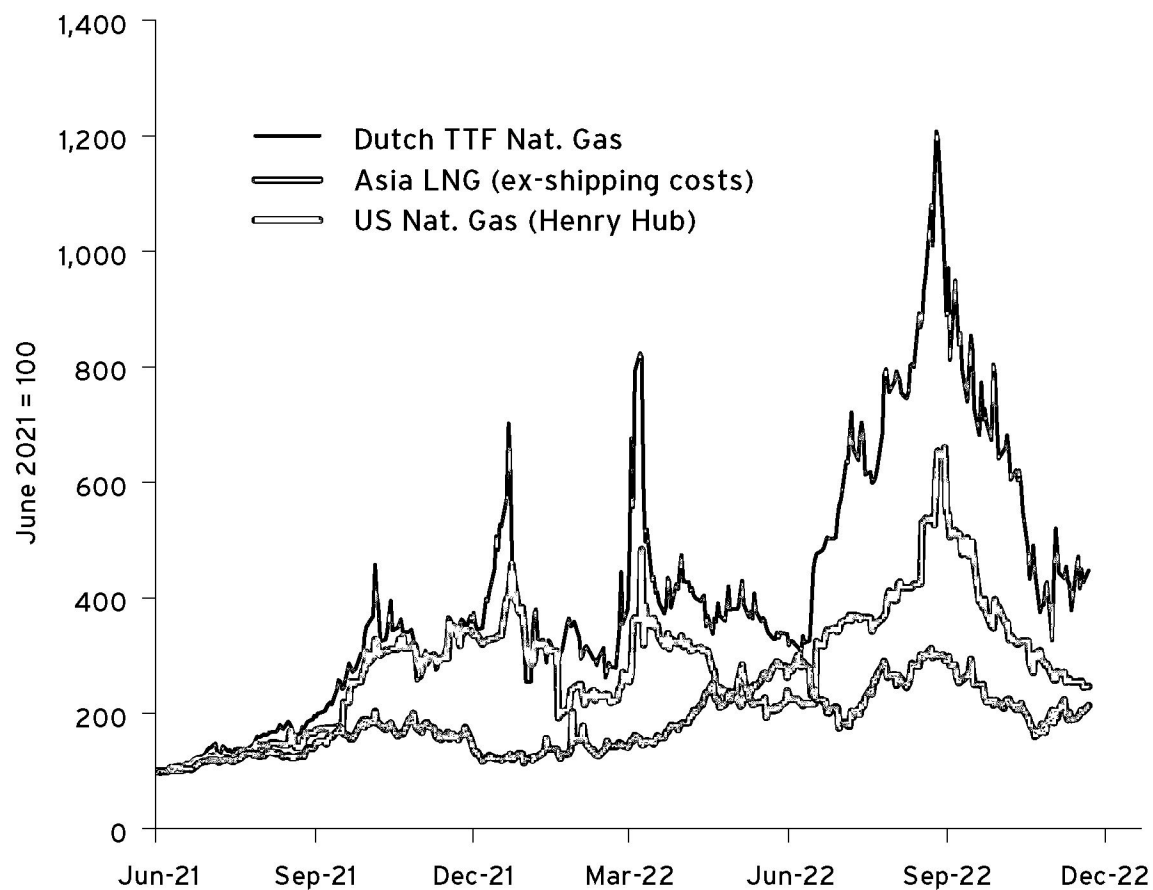
Source: Haver, as of 31 Oct 2022. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only and do not represent the performance of any specific investment. Index returns do not include any expenses, fees or sales charges, which would lower performance. For illustrative purposes only. Past performance is no guarantee of future results. Real results may vary. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events. See Glossary for definitions.

Chart shows spot prices for gas prices between Jun 2021 and Nov 2022 in Asia, Europe and the US.

Above all, the objective is to limit greenhouse gas emissions to avert a climate catastrophe. In 2022, summer heat records in multiple regions, Arctic wildfires and disastrous floods in Nigeria and Pakistan were the latest reminders of the intensifying threat to people and planet. However, it has become even clearer that other forms of our security also depend on the transition.

Fossil fuel reliance, economic vulnerability

The economic damage of Europe's reliance on Russian natural gas is mounting. With energy prices more than 40% higher than a year earlier, inflation in the eurozone hit an all-time high of almost 11% in October 2022. Amid the uncertainty, households and businesses are retrenching.[1]

Both the eurozone and the UK look set to suffer recession, despite government initiatives to subsidize energy bills amounting to many hundreds of billions of euros – see **"Europe: Bracing for winter recession"**. Globally, the cost of such initiatives has already breached $500bn.[2] Deprivation is nonetheless on the increase.

Seeking high prices for their output, liquid natural gas suppliers have diverted cargoes away from other destinations and toward Europe. Shortages in certain developing countries are already a reality.

As a result, the number of people with access to electricity worldwide has seen a decline for the first time ever. The longer the crisis persists, the greater the risk of social unrest and political instability, as in 2011 when soaring food prices stoked the "Arab spring" uprisings and revolutions.

Fossil fuel dependence can threaten national security as well as economic well-being. Russia's attempt to use its gas supplies as leverage has at times complicated Europe's response to the war in Ukraine.

Over time, some fossil fuel–importing nations have found themselves having to adapt their foreign policy in ways they would rather not have. By striking compromises with authoritarian regimes or engaging in overseas military ventures, for example, they have suffered reputational consequences on the world stage.

Shifting toward renewable energy can help mitigate such issues. By generating cost-efficient, clean energy locally, countries can strengthen their economic resilience and their national security.

This is not to say that renewable energy is fail-safe, however.

At times, for example, the UK's still-growing windfarm network can already supply over half of the nation's electricity needs. But unusually calm and cloudy conditions in 2021 saw a dip in its renewables' consumption, with the

shortfall made up by coal burning. For now, greater energy security thus means having diverse sources of supply, of which more comes from renewables.

We believe that diversity of supply will be essential to longer term energy security too. Today, much of that diversity comes from fossil fuels. However, this must change radically if the world is to have a chance of limiting climate change.

Massively increasing renewables' share within power production is clearly critical to the drive toward energy security. And yet it is still only part of what is needed. Electrification and improving energy efficiency are also essential.

Switching from fossil fuel burning to electricity from renewable sources in heating and cooling buildings, transport and industry has great potential to lower emissions. The same goes for increased efficiency – using less energy to do more. The less energy intensive we become, the more our energy security increases.

As in in the 1970s oil shocks, the drive for efficiency is increasing because of the current crisis. In Germany, for example, households are rapidly replacing gas heating with heat pumps. These electrical devices – which take in air from outside a building and raise its temperature to heat the building inside – are already 300% efficient. This means it takes one-third of the energy to heat a home compared to one with a

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[1] Bloomberg, as of 4 Nov 2022

[2] IEA (2022), World Energy Outlook 2022, IEA, Paris https://www.iea.org/reports/world-energy-outlook-2022, License: CC BY 4.0 (report); CC BY NC SA 4.0 (Annex A), as of Oct 2022
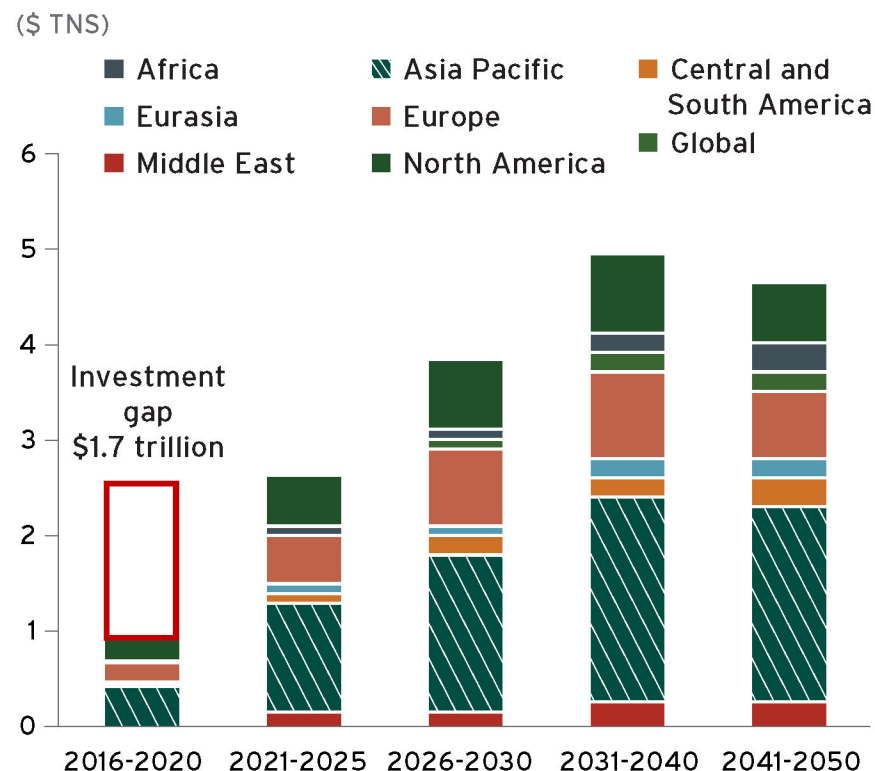
completely efficient combustion-based heater. Experimental designs may boost this to one fifth before long.

The potential here is substantial. A complete transition to next-generation heat pumps would reduce total energy use 40%, all else equal.[3] Admittedly, this would take a very long time, as it would require replacing heating systems in every building globally. However, with governments subsidizing adoption of these devices, uptake could increase rapidly.

Despite such encouraging progress, there is a very long way to go indeed in the quest for cleaner and more secure energy. Over the next thirty years, $125 trillion may be required to achieve net zero emissions. To get on track, Citi GPS estimates that $2.6 trillion a year annually needs to be mobilized between 2021 and 2025, $1.7 trillion a year more than of late – **FIGURE 2**.

Aside from the amount of capital required, there are many risks along the way. Trade wars and other supply chain disruptions, technological disappointments and policy reversals driven by populist skeptics represent just some of the potential challenges. But if these or other factors were to frustrate the transition, the resulting insecurities would be far worse than anything we have so far seen.

FIGURE 2. CLIMATE FINANCE GAP $1.7 TRILLION PER YEAR (2021–25)

($ TNS)

■ Africa   ▨ Asia Pacific   ■ Central and
■ Eurasia   ■ Europe   South America
■ Middle East   ■ North America   ■ Global

Investment gap $1.7 trillion

Source: UNFCCC Race to Zero campaign with support and analysis from Vivid Economics, Citi GPS. From Citi GPS: Global Perspectives & Solutions – Climate Finance, November 2022.

Chart shows the required climate finance by global region for periods out to 2050. Note: Current annual climate flows are estimated on average at between $600 billion and $900 billion depending on the data source used. CPI estimates climate finance flows in 2020 amounted to $640 billion, including both mitigation and adaptation. BNEF estimates total investment in Energy Transition was $611 billion in 2020 and increased to $798 billion in 2021. Vivid Economics estimates total investment averaged $900 billion annually between 2016 and 2020.

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[3]   According to the IEA World Energy Outlook 2022, heat accounted for 50% of global final energy consumption in 2018, and 40% of global carbon dioxide emissions.

FIGURE 3. CLEAN ENERGY'S LONG-TERM GAINS
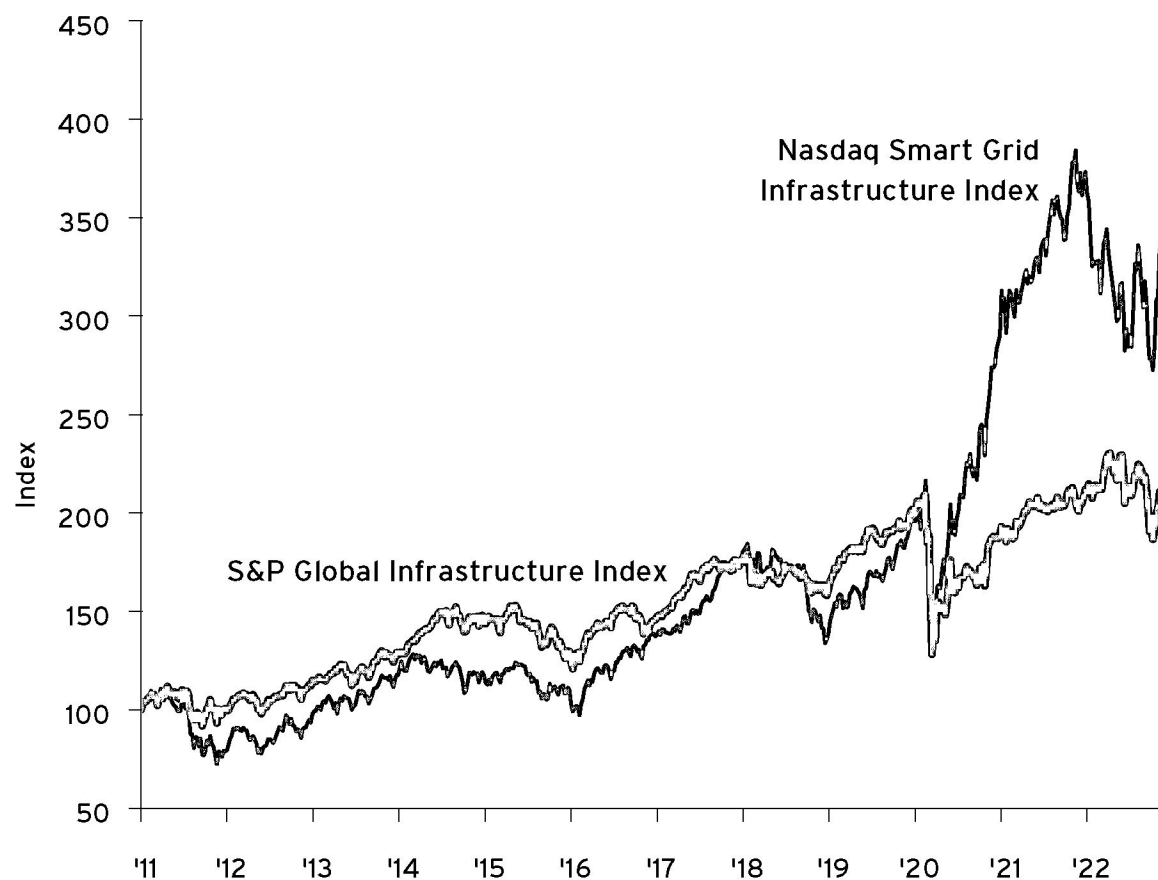
Source: Haver, as of 24 Nov 2022. Past performance is no guarantee of future returns. Real results may vary. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events. See Glossary for definitions.

Chart shows the performance of the Nasdaq Smart Grid Infrastructure Index and S&P Global Infrastructure Index between Jan 2011 and Nov 2022, with both series rebased to 100 at the start.

WHAT TO DO NOW?

Since 2021, the publicly traded green infrastructure sector has sold off, underperforming infrastructure investments more generally – **FIGURE 3**. However, this does not reflect any change in the fundamental case for the clean energy transition. Instead, we think it reflects the high valuations reached in the sharp rally in 2020 and the subsequent rise in interest rates that have hurt all growth-oriented assets. The selloff may present a potential long-term entry point. But we cannot rule out further downside, especially if we are wrong about a peak in interest rates in 2023.

Accelerating the transition will involve a wide variety of companies. These include specialists in renewable energy technology, energy storage, electric vehicles and heat pumps, sustainable materials and carbon capture. In aggregate, we believe such companies are likely to be significant winners over the medium term and bear much less long-term risk than fossil fuel assets. In the meantime, we recognize that liquid natural gas can serve as a transition fuel. New and existing supplies of this fossil fuel will be key to helping meet European energy needs – representing another kind of opportunity for investors.

In the long term, clean energy can be more secure energy. We believe that related technologies can help generate portfolio returns as well as sustainable power.

Deepening digitization

The unstoppable trend of digitization is still in force and has far to go. We believe current equity weakness may offer potential for building long-term exposure

- Digitization assets suffered sharp drawdowns in 2022 owing to rising rates and previously high valuations

- The transformative potential of digitization has not changed, however, and we see related investments as core long-term holdings

- We highlight semiconductors, robotics and automation and the metaverse, while reiterating our conviction in areas such as fintech and cybersecurity

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JOE FIORICA
Head of Global Equity Strategy

Investing in digitization was tough in 2022. Equities relating to the likes of fintech, cloud computing and semiconductors – **FIGURE 1** – experienced sharp falls, alongside many other growth-oriented assets. This marked a sharp reversal from the lockdown period in 2020. During that time, such investments soared as businesses and consumers relied more than ever on digital technologies in response to tight restrictions on daily life.

Despite recent performance, though, the digital revolution has not gone into reverse. Indeed, these technologies are becoming ever more deeply embedded in how we live and work. In the years ahead, we expect intensifying innovation driven by well-funded research and development. And we believe that businesses will have to either embrace new technologies and processes or face extinction. Put simply, the unstoppable trend of digitization remains in full force.

Given our view, we do not see the selloff in digitization assets in 2022 as reflecting the sector's prospects. Instead, it resulted from aggressive interest rate hikes and the valuation frothiness that had previously accumulated. Following the steep drop in valuations, we believe there may be opportunities to build long-term portfolio exposure to this transformative theme. While we retain our conviction across digitization broadly, we highlight three areas for consideration.

FIGURE 1. DIGITIZATION'S VALUATION DECLINE

Digitization theme EV/EBITDA (now vs November 2021)

Theme	Nov 21	Now	% Derating
Payments	16.3	11.4	−29.9%
E−commerce	16.0	11.4	−28.6%
S&P 500	14.3	11.9	−16.8%
Metaverse	21.4	12.6	−40.9%
Social media	20.8	12.7	−38.6%
Robotics	17.5	13.2	−24.7%
Fintech	24.1	13.9	−42.5%
Cyber security	23.1	16.2	−30.1%
AI & cloud computing	32.7	17.4	−46.9%
Healthcare tech	35.8	25.6	−28.5%

Source: Haver, as of 15 Oct 2022. Past performance does not guarantee future results. Investors cannot invest in an index. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events. See Glossary for definitions.

Table shows valuation multiples – enterprise value (market capitalization plus debt) divided by earnings before interest tax depreciation and amortization) – for a selection of sub−themes within digitization, comparing levels in November 2021 with those a year later. Sub−themes: e−Commerce: Solactive E−commerce Index; Payments: Prime Mobile Payments Index; Metaverse Ball Metaverse Index; Robotics: ROBO Global Robotics and Automation Index; Social media: Solactive Social Media Total Return Index; Fintech: Indxx Global FinTech Thematic Index, Cyber security: Nasdaq CTA Cybersecurity Total Return Index; AI & cloud computing: Indxx Global Cloud Computing Index; Healthcare tech ROBO Global Healthcare Technology and Innovation Index.

Semiconductors are powering digitization

Semiconductors are the brains of the digital revolution.

The little chips that store and process data are all around us, enabling every digital task however trivial or sophisticated. Indeed, there is no aspect of the unstoppable trend of digitization – from cybersecurity to robotics to artificial intelligence to the metaverse – that does not depend heavily on this technology. And we envisage the role of semiconductors only increasing further over the coming years.

The continued rollout of fifth-generation – or "5G" – data networks and thereafter 6G will see billions of devices connected to the internet for the first time ever and a vast increase in data produced – see **5G and beyond: Connection to the future** in Outlook 2022.

The upsurge in connectivity that we expect will require semiconductors to be incorporated into everything from mundane household objects to the smart cities and autonomous vehicles of

tomorrow. The vast "cloud" storage facilities where the newly created data will be held are also chip intensive.

This potential growth is not without risks, of course. The US' moves to block Chinese access to the most sophisticated chips and related equipment also means less business for US and other manufacturers for the foreseeable future – see **A greater separation between East and West: G2 polarization intensifies**. Tough competition and sharp cyclical swings have long impacted the industry. But given our outlook for chip demand, we believe equity price weakness may represent a way to build long-term portfolio exposure.

The age of automation

Slow productivity growth and labor shortages are intensifying challenges for many countries, especially in the developed world. From a pre-global financial crisis peak of in 2007, productivity growth worldwide has slowed. Meanwhile, aging populations are contributing significantly to a dearth of workers. By 2030, there could be a global deficit of some 85.2 million workers globally, causing a shortfall in output of $8.5 trillion, according to a report by Korn Ferry, a global organizational consulting firm.[1]

Given the threat to growth and living standards, we believe it essential that the world accelerates the adoption of robots and automation. The pandemic lockdowns reinforced the vulnerabilities that arise from overdependence on human labor in everything from logistics to advanced healthcare delivery. It also led to a surge in industrial robot installations, especially in Asia. In 2023, industrial robot installations are expected to grow by 10% to almost 570,000 units.[2]

Nevertheless, we think that much more is needed. Currently, just five countries account for 78% of global installations: China, Japan, the US, South Korea and Germany. Assuming continued gains in innovation, we expect the robots of tomorrow to be able to undertake many more tasks than they already do, either independently or alongside human workers. As such, the global market size for industrial robots could slightly more than double from $92.8bn to $165.3bn by 2028.

Aside from labor force shrinkage and upward pressure on wages, the trend toward onshoring manufacturing activity argues for more automation. The US and other nations are keen to secure their supply chains for certain vital products. Using robots could ultimately mitigate the costs of relocating production facilities from low-wage to high-wage countries. Further progress in robot capabilities will also make adoption more attractive.

Among the potential investments we see in this area are in the creators of robotic and automated processes, suppliers of components such as chips and sensors, and software makers. And there may be an even wider range of companies that could achieve productivity gains by integrating robotics into their business.

The internet's new dawn

The worldwide web has become an ever-more ubiquitous feature of daily life since it first went mainstream in the mid-1990s. Of course, today's internet experience is much slicker than in those early days of dial-up connections, basic webpages and little functionality beyond browsing information. Now, though, cyberspace may be on the cusp of a much greater leap forward.

Widely considered the next generation of the internet, the metaverse is an immersive 3D world that brings together physical and digital realities. Within this world, avatars of ourselves will interact with one another and businesses in a landscape that draws strongly from the physical world but with many hi-tech enhancements.

While still in its infancy, the metaverse or "Web 3.0" may in time prove transformative for consumers, technology companies and investors. By 2030, Citi Research estimates that the metaverse economy may be worth between $7.7 trillion and $12.8 trillion.[3] In

[1] Future of Work: The Global Talent Crunch – Korn Ferry, as of Oct 2022
[2] Executive Summary World Robotics 2022 Industrial Robots – International Federation of Robotics Executive_Summary_WR_Industrial_Robots_2022.pdf (ifr.org)
[3] Citi GPS report: Metaverse and Money: Decrypting the Future, June 2022

this environment, we see a broad range of companies that may be able to capture some of that value.

For now, we see limited ways to gain exposure to the rise of the metaverse. Telecom operators and equipment vendors may be best placed initially, given the greater data usage that is required to support this virtual world. Looking out somewhat further, makers of hardware components that enable the metaverse experience – such as optics/sensors, displays and semiconductors – are also placed to benefit.

While we see attractions to investing in hardware which will serve as building blocks to future virtual worlds, investability within the metaverse is much more challenging at present. Admittedly, there are competing visions of how the metaverse may evolve. Large incumbents today – such as leading social media platforms – are keen to retain their dominance in tomorrow's world and are investing heavily accordingly. But others favor a decentralized model where users have greater power over their data.

FIGURE 2. THE RISE OF THE ROBOTS
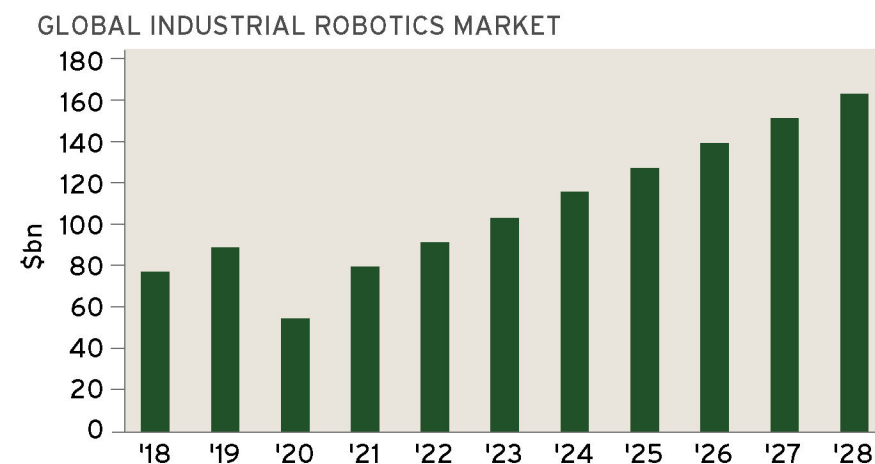
GLOBAL INDUSTRIAL ROBOTICS MARKET

Source: Statista and Citi Global Insights, as of 28 Oct 2022. All forecasts are expressions of opinion, are subject to change without notice, and are not intended to be a guarantee of future events.

Chart shows the estimated size in billions of dollars of the global industrial robotics market, with forecasts out to 2028.

WHAT TO DO NOW?

We reiterate our long-term conviction in the transformative potential of digitization. And we favor long-term exposure to this unstoppable trend in portfolios. Despite the sharp selloff in related assets to date, however, further near-term downside cannot be ruled out. That said, we believe a peak in interest rates to be likely in 2023 and that rate cuts should follow thereafter. If so, this would enable investors to focus more on digitization's long-term prospects.

We see a variety of possibilities for building exposure to semiconductors, robotics and automation and the metaverse, as well as in other areas such as fintech, cybersecurity and artificial intelligence. While broad-based passive exposure is one option, we favor equity strategies from specialist managers, as well as private market strategies for suitable investors – see **Digitization and the growth in alternative investments**.

Digitization has far to go. Get ready for the next stage of the revolution.

Digitization and the growth in alternative investments

- Falling tech valuations in public markets have also begun to hit many private companies needing equity capital in the second half of 2022

- With tech firms still needing to raise equity and debt capital, we see opportunities for alternative managers to make potentially attractive add-on investments

- Once rates peak and then reverse, investors are likely to refocus on digitization's long-term potential once more as public valuations recover

- For suitable investors, we favor technology-focused strategies from venture capital, growth, buyout and private debt managers

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The increasing role of alternatives in digitization

Innovation is the beating heart of the digital revolution. But developing new ideas and establishing a viable business around them requires significant amounts of capital over fairly long periods. The selloff in publicly traded technology equities in 2022 has made raising capital for private firms harder. At the same time, we believe these difficulties may create potential opportunities for the managers of various alternative strategies.

Venture capital, growth and buyout managers make up an important ecosystem for financing digital innovation. Venture capital managers incubate companies from initial idea and product development through all their expansion stages, typically called early-stage to late-stage venture capital. Growth managers select from some of the most successful private technology companies and support significant scale expansion. Buyout managers acquire more established businesses, often taking them from public to private ownership.

Valuations decline but deals hold up

The selloff in publicly traded technology equities has driven valuations substantially lower – see **Deepening digitization**. Market volatility and falling valuations pose challenges

for VC-backed tech firms seeking to sell their shares to the public via an initial public offering (IPO). As a result, there have been only 60 such public listings in 2022, compared to 303 VC-backed IPOs in 2021.[1] The IPO route is likely to remain largely closed to tech companies until markets stabilize.

For US VC-backed companies that previously went public within the past two years, the valuation declines are especially pronounced. Such firms' price-to-sales multiples – a metric expressing a company's market capitalization in relation to its revenues – fell some 60% to 67% through 17 August 2022[2] – **FIGURE 1**.

FIGURE 1. POST–IPO BLUES FOR VC–BACKED COMPANIES

Source: Pitchbook/Morningstar Quantitative Perspectives, as of Q3 2022

Chart shows price–to–sales multiples of the constituents of the Pitchbook/Morningstar VC–backed IPO index in the third quarter of 2022 versus one year earlier. Index constituents are VC–backed companies >$50 million that have completed a public offering within the prior 2 years. The companies are grouped by percentile according to their starting price–to–sales multiple, starting with the most expensive on the left.

[1] Q3 2022 Pitchbook-NVCA Venture Monitor
[2] Pitchbook Q3 2022 Quantitative Perspectives – Silver Linings on the Time Horizon

This public market weakness has seeped through to late-stage VC companies. The median pre-money valuation – or valuation just prior to an IPO or funding round from private investors – was 9% below 2021's level at $91m, as of the third quarter 2022.[3]

For seed and early-stage VC companies – those at an earlier stage of development – valuations have held up better. Deals involving such firms –

i.e., when they sell ownership stakes to venture capital firms – are not heavily based on valuation multiples. Instead, they focus more on factors such as the size of the market they're involved in, whether their product fills a gap in the market, their market leadership potential and growth rate.

That said, even seed and early-stage VC valuations will likely decline over the coming

year, as valuations in late-stage private markets and public markets reset. Nevertheless, technology deal activity has remained robust in 2022. Although down 10% from 2021's elevated levels, it still stands significantly above any previous year. And while overall VC deal activity has fallen for three straight quarters from those 2021 highs, VC activity has already exceeded all prior years except for 2021 – **FIGURE 2.**

FIGURE 2. US VENTURE CAPITAL DEALS FALL FROM THEIR HIGHS
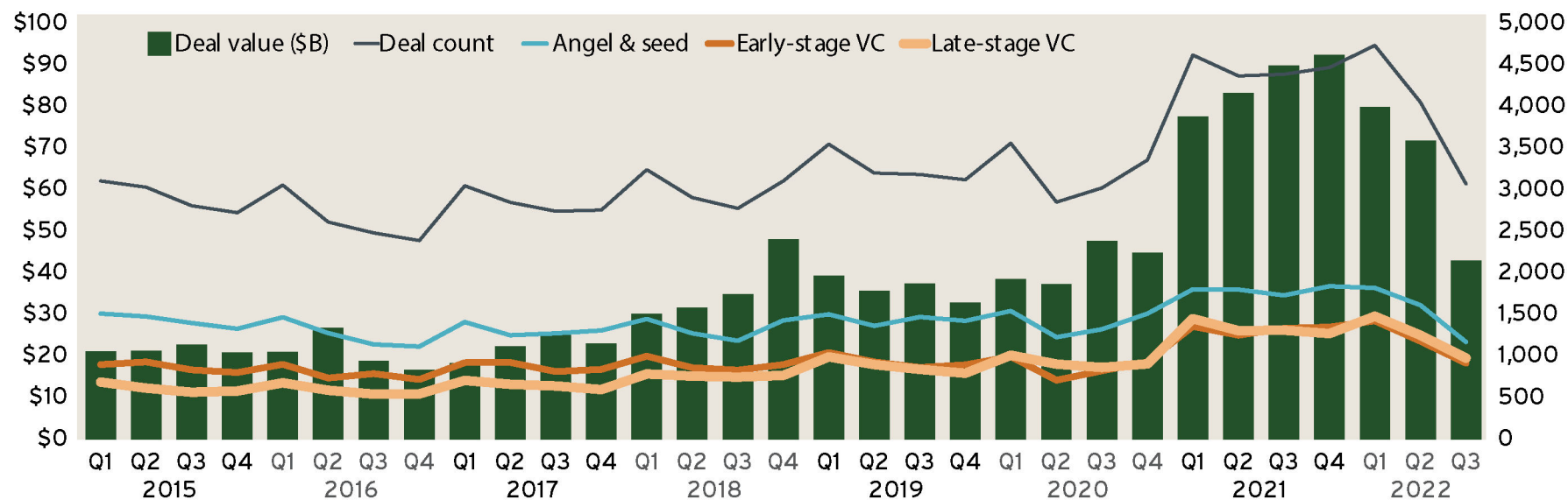
Source: Pitchbook, as of 30 Sep 2022.

Chart shows US venture capital deal activity by quarter since 2015, with the green bars denoting total deal value and the lines showing deal counts across angel & seed, early–stage VC and late–stage VC categories.

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[3] Source: Pitchbook/NVCA. as of 30 Sep 2022

With valuations coming down, we expect to see an increase in buyout managers taking listed companies private. IT deal value accounted for 31% of PE deal activity in the third quarter of 2022, near the highest level ever.[4] Technology is now a core focus for many buyout managers, given the sector's growth prospects and today's lower valuations.

With the IPO market effectively shut off for now, late-stage, growth and pre-IPO companies will need to access capital from private sources, including private lenders. Private equity's appetite for IT acquisitions did not significantly decline in the first three quarters of 2022 compared to the same period in 2021. Capital still flowed into the sector, with 1,239 deals closed globally during 2022 as of the third quarter, with an aggregate deal value of $128.9 billion.[5]

However, leveraged loan and high-yield issuances are near the lowest levels since the global financial crisis[6] at a time when rates and spreads have increased meaningfully, allowing alternative private credit providers to step in and provide financing to select deals – see **Alternative investments may enhance cash yields.**

WHAT TO DO NOW?

Given the decline in tech valuations and our positive long-term outlook for digitization, we see a case for investing in such companies via early- and late-stage venture capital managers as well as growth and buyout managers. We also favor lending to late-stage, growth and pre-IPO companies via private credit managers. Once interest rates peak, we believe investors will focus more on digitization's growth prospects again. As valuations recover over time, private managers will have scope to sell their stakes at higher prices.

While we believe a counter-cyclical approach of buying when others are fearful makes sense, these strategies come with risks, beyond that of rising interest rates undermining valuations. As private market strategies, they are illiquid, requiring investors to commit for a period of several years. For example, private technology investing typically involves investing in companies that are generating negative free cash flows and can require additional capital to fund growth.

Many suitable clients' portfolios do not have much exposure to private equity as an asset class. Indeed, many lack any exposure at all. We also note many of the same clients may be underinvested in digitization. Such clients should consider their current portfolio positioning and how they might add the potential for further return and diversification.

4,5 Source: Preqin, as of 30 Sep 2022
6   S&P LCD Quarterly Review, Q3 2022

How unstoppable trends are redefining real estate

Amid macroeconomic difficulties, long-term forces are continuing to create potential opportunities within real estate.

- Real estate came under pressure in 2022 from inflation and higher interest rates

- Unstoppable trends such as digitization are helping to drive certain areas within real estate

- We also see some areas of real estate as better placed to cope with inflation

- We favor strategies from specialist managers focusing on multifamily homes, e-commerce-related properties and quality offices in select locations

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Almost no asset class escaped the turmoil of 2022. That includes real estate, where pressures included increased financing costs, rising capitalization rates and inflation. Looking ahead, there is potential opportunity to exploit market inefficiencies, invest in assets at potentially cheaper levels and reposition properties to meet shifting consumer demand. Also, long-term trends such as digitization, more flexible working and delayed household formation are continuing to transform real estate.

Inflation poses a particular challenge. The cost of renovating and developing has risen sharply since the start of the pandemic. And the consequent rise in interest rates has made it more expensive to finance real estate projects. All this can potentially reduce returns for investors. That said, continued rent growth in certain sub-sectors like multifamily apartments and e-commerce-related industrial properties are mitigating headwinds.

We thus look to sub-sectors of real estate that we think may be best placed to perform under these conditions.

Resilient multifamily homes

Getting on the housing ladder is challenging right now. The US mortgage rate sat near a 20-year high of 7.14% as of 9 November 2022. To buy a property, the minimum annual income needed was over $120,000 as of June 2022.

That is more than double the level six years earlier. Compared to previous generations, millennials – those born from the early 1980s to around 2000 – are likely to end up renting for longer before buying their first homes.[1]

That said, renting is not especially easy now either. Rents too have risen sharply since 2021.

However, they are still broadly cheaper than getting a new mortgage. On average, a typical monthly mortgage payment was $904 more expensive than a typical monthly apartment rental payment as of Q3 2022. Four years ago, a mortgage cost only $387 more than renting – **FIGURE 1**.[2]

FIGURE 1. MORTGAGE PAYMENTS GO THROUGH THE ROOF

MORTGAGES SUBSTANTIALLY OUTPACE RENTS
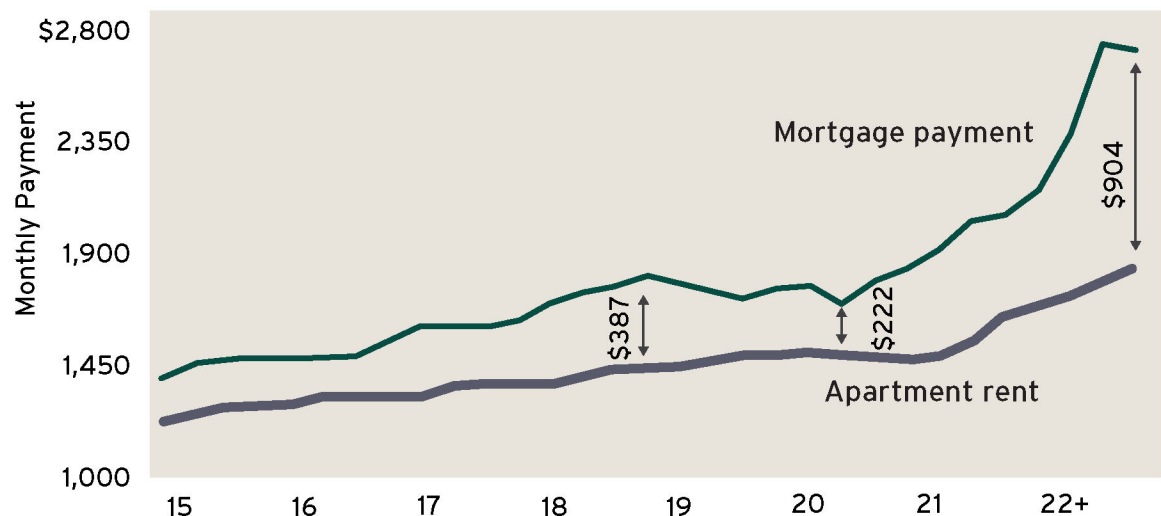
Source: Marcus & Millichap, as of September 2022.

Chart shows average mortgage payments and rental payments on an apartment from 2015 through September 2022.[3]

Multifamily rental properties – such as low-rise "garden style", mid-to-high-rise apartment towers and townhouse complexes – have proven resilient during periods of high inflation. That is because their rents may reset every time their short-duration leases – typically one year – expire. In 2022, multifamily rents have risen significantly alongside inflation. The average effective rental rate for multifamily rental properties in the US had risen almost 17% year on year as of the second quarter of 2022.[4]

Supply considerations also favor both developers and landlords. According to the National Apartment Association, the US will need 4.3 million new apartment units in the next twelve years to meet increasing housing demand.[5] The insufficient supply of housing, coupled with less attainable home ownership and inflation limiting new build, is expected to continue to sustain robust rental demand.

FIGURE 2. ROBUST DEMAND FOR INDUSTRIAL PROPERTIES

INDUSTRIAL SUPPLY & DEMAND
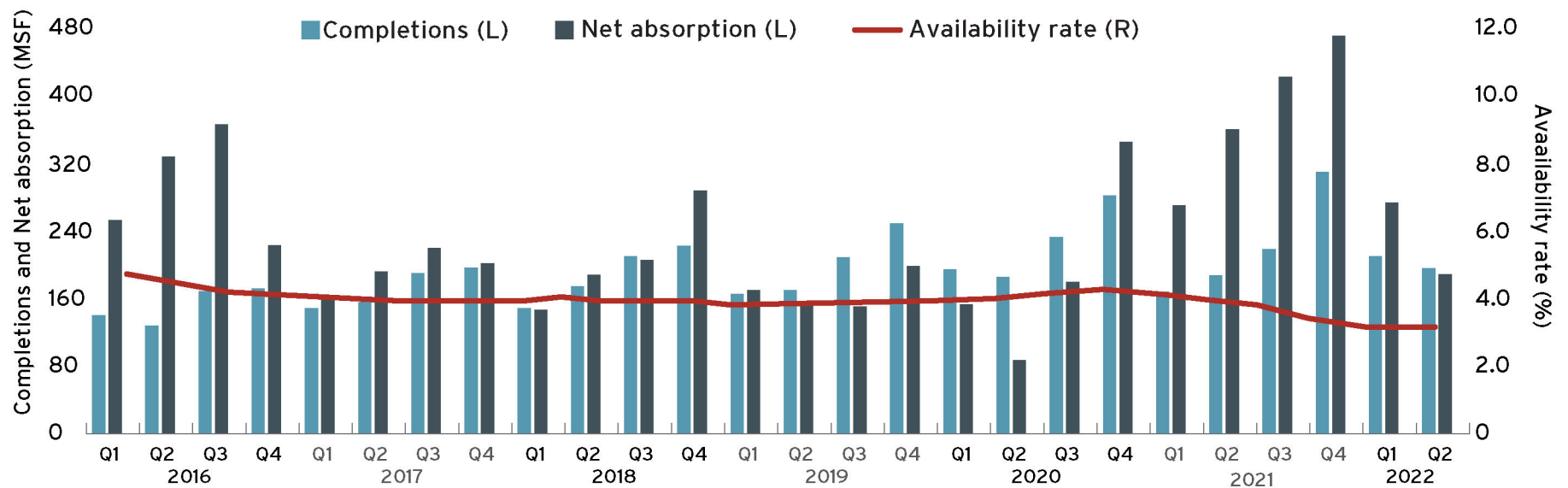
Source: Crow Holdings, as of Oct 2022.

Chart shows completions of new industrial properties in millions of square feet, the absorption rate – a metric which looks at how much space was occupied versus how much became available – and the availability rate or how much space was available.

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[4]   Marcus & Millichap, as of August 2022
[5]   National Multifamily Housing Council & National Apartment Association (US apartment demand through 2035)

Identifying markets with favorable supply and demand fundamentals and strong demographic tailwinds will be critical, as increased financing costs may impact the profitability for both new developments and existing assets with near-term debt maturities.

Enabling the e-commerce revolution

E-commerce took a great leap forward during the pandemic. With restrictions on in-person shopping, consumers pivoted to ordering more goods online. These habits have stuck: US e-commerce sales grew 32% year-on-year in 2020, 14% in 2021 and 9% between the first and second quarters of 2022.[6] And they are forecast to grow at 10% to 15% annually after the pandemic, gaining more market share from brick-and-mortar stores.[7] The same story applies globally, as e-commerce sales have increased 133% over the past five years, and 46% in the first two pandemic years of 2020 and '21.[8]

While e-commerce may reduce the need for retail floor space, online transactions require

three times the warehouse space of traditional retail.[9] Each 1% increase in e-commerce sales as a proportion of overall retail sales is expected to result in over 65 million square feet of demand for industrial space. E-commerce demand has particularly increased the need for larger, more sophisticated and centrally located distribution centers to enhance "last-mile" facilities for same-day or next-day delivery. This will continue to be the case in 2023.[10]

With demand outpacing supply, overall US vacancy rates are historically low at below 4%.[11] The US industrial real estate sector – which includes storage and distribution as well as manufacturing, production and research & development facilities – remains strong and stable.

Industrial properties' overall availability rate dropped by 60bps in 2022 in the US compared to mid-year 2021 due to robust demand and a large amount of preleased construction completions – **FIGURE 2**.[12] Year-on-year rent growth surpassed 21%.[13] As much as 2.1 billion square feet (0.64 billion square meters) of additional e-commerce-dedicated logistics space

will be required globally over the next five years to support the growth of internet sales.[14]

Like multifamily, the industrial sector has held up well amid inflation. Rent growth within logistics has outpaced inflation due to strong tenant demand and to the shorter lease terms – typically 3-5 years – which has allowed rental rates to keep pace as the current market rate adjusts.

Despite higher interest rates, US commercial capitalization rates continued to edge down across industrial property types in the second quarter of 2022, hovering around 5.1%.[15] Capitalization rates are measured as a property's net operating income, expressed as a percentage of the property's value. In 2023, industrials' capitalization rates may rise, but its stability to date speaks for the sector's resilience.

The industrial market is not immune to increased financing costs nor to slowing growth. But while the outsized e-commerce growth over the last two years may moderate, the long-term outlook for the industrial sector remains positive.

[6]   US Department of Commerce, as of Q2 2022

[7]   CBRE Global E-commerce Outlook, as of Q2 2022

[8,14] CBRE Global E-commerce Outlook 2022 Update, June 2022

[9]   Prologis, as of Q3 2020

[10] United States Industrial Outlook, Q2 2022, JLL Research

[11] CBRE, "Global Real Estate Remains an Attractive Investment Despite Economic Headwinds", August 31, 2022, https://www.cbre.com/insights/viewpoints/global-real-estate-remains-an-attractive-investment-despite-economic-headwinds

[12] Crow Holdings, as of Oct 2022

[13] United States Industrial Outlook, Q2 2022, JLL Research

[15] Real Capital Analytics. Capital Trends: U.S. Big Picture. Q2 2022

The workplace of the future

Since the pandemic struck, the way we work has changed drastically. Many employers and their employees have enthusiastically embraced flexible, digitization-enhanced working practices, with some firms going wholly remote and many more choosing a hybrid model. The new patterns of work – and changing priorities – are creating strong demand for certain types of offices.

Overall, there is a marked preference for quality. This means offices in highly connected locations, complete with market-leading amenities, including outdoor space and fitness centers, and good sustainability credentials such as LEED platinum, a green certification standard. Meanwhile, older, outdated premises that do not accommodate new ways of working are struggling.

For example, since the start of the pandemic, 84% of total leasing activity in midtown Manhattan has occurred in Class-A assets.[16] Over the last two years, new Class-A offices in the US are the only office vintage with positive absorption, a metric which looks at how much space was occupied and how much was vacated. Whereas such offices saw 61.6 million square feet (18.8 million m²) net absorption, those built in 2014 or before suffered negative absorption.[17]

This appetite for quality is evident in office markets around the world, including Sydney, London, Seoul, Dubai, Shanghai and Berlin. In the US, the leasing of new-vintage offices is unfolding alongside ongoing migration to secondary markets. Companies and workers are increasingly attracted to places such as Austin, Texas, Raleigh, North Carolina and Phoenix, Arizona. Such places offer favorable employment prospects, a potentially better quality of life and lower costs of living.
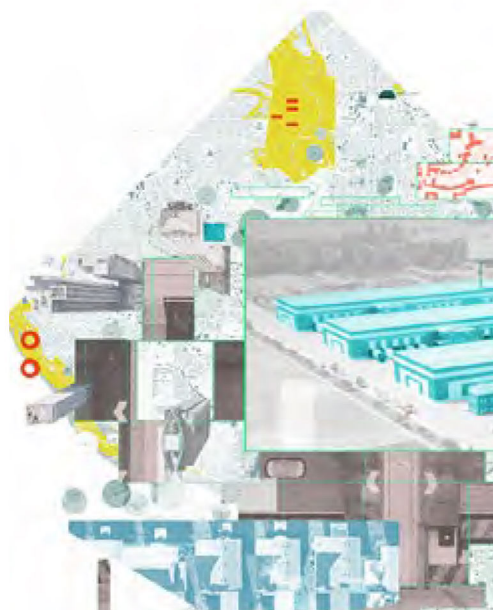
WHAT TO DO NOW?

We believe suitable investors should consider adding appropriate exposure to select multifamily, industrial and office real estate to their portfolios. To do so, we favor strategies from specialist managers with deep expertise in these segments in particular geographies. Such strategies may help mitigate the effects of inflation upon returns while helping to mitigate the risks of a globally diversified allocation.

Of course, private investments in real estate come with various risks. These include illiquidity, with investors typically having to make a commitment for some years. A deeper economic contraction than we expect might also moderate rent growth and demand in the near term.

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16   Cushman & Wakefield, Q4 2021 Office Overview, January 2022
17   JLL, "The Workplace Evolution," June 2022

Seeking to boost portfolio immunity with healthcare

Aging populations and the expanding global middle class are likely to boost demand for healthcare over many years.

- With increasing age and wealth comes greater demand for healthcare

- We believe rising spending on research and development globally will drive the sector's innovation

- Among the areas we favor are biologics, life science tools, value-based care and agetech

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The world's population is undergoing profound change

Not only are there more people on Earth than at any time previously, but their average age is now older than ever before. This pattern is set to intensify. By 2050, more than a quarter of citizens in certain global regions may be over 65 – **FIGURE 1**. This change is the result of life expectancy and fertility patterns established over many generations, which would take at least as long to reverse. At Citi Global Wealth Investments, we thus regard aging populations as an unstoppable trend.

At the same time, the world's middle class is on the rise. This phenomenon is largely driven by Asia, where economic development and rising incomes are enabling hundreds of millions of people to live and consume in ways they never have before. In mid-2017, the emerging world's middle class was around 3.3 billion people – a number that may hit 5 billion by 2027.[1]

These two major shifts have far-reaching implications for societies, industries and investors everywhere.

Among the consequences we expect is growing demand for healthcare. As people get older, the amount of spending required on their healthcare increases. And with rising incomes and wealth comes the tendency to spend more on staying well and getting better from illnesses.

## FIGURE 1. GRAYING OF THE WORLD

POPULATION % AGED OVER 65 YEARS
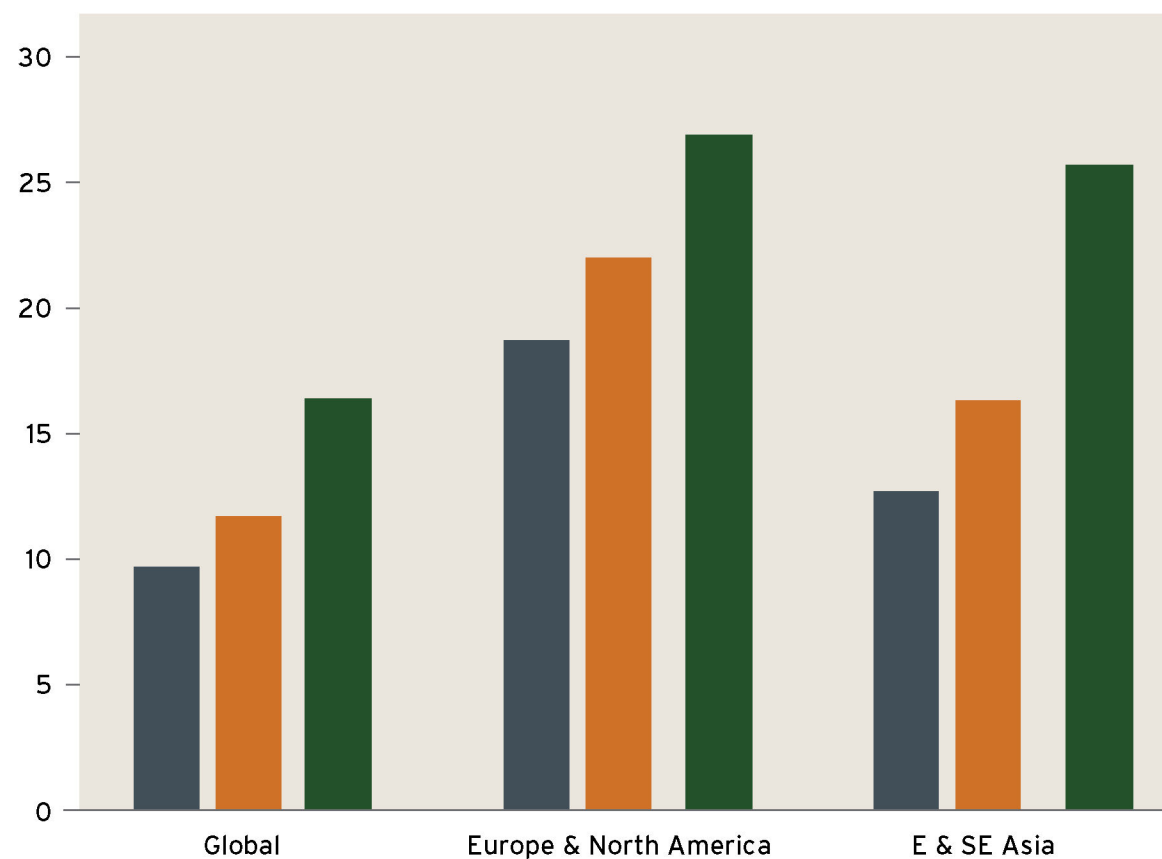
Source: World Population Prospects 2022: Summary of Results by Department of Economic and Social Affairs. © United Nations 2022. Reprinted with the permission of the United Nations.

Chart shows the rising percentage of the population aged over 65 globally, in Europe & North America and East & Southeast Asia in 2022, 2030 and 2050.

[1]   Haver, as of 27 Oct 2022

FIGURE 2. RESEARCH DRIVES HEALTHCARE INNOVATION
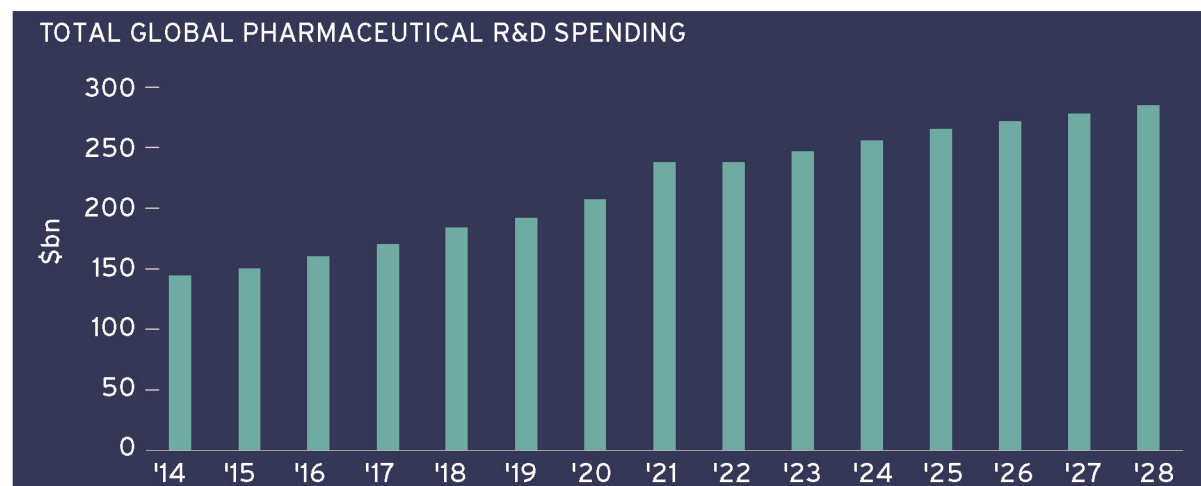
TOTAL GLOBAL PHARMACEUTICAL R&D SPENDING

Source: Statista and Citi Global Insights, as of 28 Oct 2022. All forecasts are expressions of opinion, are subject to change without notice, and are not intended to be a guarantee of future events.

Chart shows global spending on research and development since 2014, with forecast data from 2022 until 2028.

We see healthcare as well placed to meet the challenge. The sector has a strong record of innovation, driven by increasing spending on research and development, a trend that seems likely to continue – **FIGURE 2**. While we see growth potential for healthcare broadly, there are certain areas of particular focus for us.

Biologics and bioproduction

With advancing years comes greater incidence of many illnesses. These include various forms of cancer, Alzheimer's disease, rheumatoid arthritis, osteoporosis and diabetes. Some of the most novel treatments for these conditions are biologics.

Biologics are complex drugs made from parts of or complete living cells from humans, animals or microorganisms. This "bioproduction" process differs from traditional "small molecule" drug development, where drugs are synthesized via chemical processes without living cells. Biologics have proven superior to many small molecule drugs in addressing many difficult-to-treat illnesses. And they may hold the key to treating or curing diseases that are today untreatable.

Developing biologics is now a major focus for biopharmaceutical companies. Around 60% of all drugs in development in 2022 may be biologics, up from 20% two decades ago, according to Danaher Corporation. While just 500 such products have been approved by US regulators to date, there are some 20,000 in the pipeline.[2]

From an investment perspective, we find the potential growth compelling. Evaluate Pharma, an industry intelligence provider, forecasts that new biological drugs – excluding COVID-related therapies – will represent $541 billion in sales by 2026, an annualized growth rate of 10% from current levels. Risks faced include clinical development failures, delays and stiff regulatory hurdles.

Life science tools

Developing cutting-edge treatments such as biologics is intensely demanding. So much so that biopharmaceutical companies often outsource parts of the long and intricate process. They do so to take advantage of specialist skills at certain stages and to seek manufacturing efficiencies. This trend is on the rise.

Some 86.9% of qualified bioprocessing respondents in the 19th annual industry survey conducted by BioPlan Associates, a biotechnology market and information provider, indicated they planned to outsource at least

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[2]   Source: Danaher Analyst Day – Cytiva HQs, as of Sep 2022

"some" bioprocessing activities over the next 24 months. This is up from 82.6% the year before.[3]

Around a third of the most frequently outsourced steps are entrusted to life science tools (LST) companies. LST companies create and deploy instruments and tests that empower the research and development process. The LST business model can be compared to that of suppliers of picks and shovels to miners during 19th century extractive booms. Irrespective of whether the miners struck gold, the hardware suppliers made money from selling them hardware.

The global LST market was estimated at around $92.2 billion in 2020. This may increase at a compound annual growth rate (CAGR) of 11.9% between 2021 to 2028, according to Grand View Research.[4] Some of the key drivers could be from creating or adopting new solutions for analyzing and separating chemicals as well as genetic and other sequencing.

Risks to this growth potential include slowing demand from biopharma companies, softer academic demand due to reduced government funding, and an inability to execute on mergers & acquisitions integration.

Value-based care

The way that patients receive healthcare is changing. Traditionally, physicians and other healthcare providers have been paid according to how many services they provide to patients. This creates an obvious incentive for as many treatments to be supplied as possible. An increasingly popular alternative to this "fee-for-service" approach is "value-based care," where providers get paid according to patient outcomes. The emphasis here is on results, including disease prevention and promoting wellness.

Over time, we believe that companies that seek to enhance patient experience and improve health outcomes are likelier to gain market share. This may be especially true in the US, the world's largest market. US healthcare spending per head is greater than in any other country while patient satisfaction with their experience can sometimes be found wanting.

Technology could play a leading role in driving advances in value-based care. Capturing and analyzing vast amounts of patient data could make preventative measures and treatments increasingly personalized. Given their expertise in artificial intelligence, big technology companies may enter the healthcare industry and act as disruptors.

Risks to the leading incumbent providers of value-based care include competition from new entrants outside the healthcare space and potential government regulation, which could restrict flexibility and innovation.

Agetech

Caring for rapidly growing elderly populations – both in sickness and health – is an enormous challenge. Already, certain countries are feeling the pressure of shrinking workforces combined with large numbers of people requiring monitoring, companionship and help with daily functions. We believe that agetech – hardware and software that address old age challenges – may ultimately have an important role to play in addressing this situation.

Wearable devices – such as smartwatches – are already widely used to help people track their wellness. Increasingly, they may be used to monitor the health and well-being of seniors, giving early warnings of heart attacks and strokes and alerting emergency services. And by monitoring for falls, they could also help support those living independently. Likewise, robots may be able to provide vital companionship and stimulation, both for those living in their own homes and in retirement homes.

Agetech is closely related to several aspects of our unstoppable trend of digitization, including robotics, automation and artificial intelligence. Given the amount of data captured and stored – and the often personal nature of it – cyber security presents one risk to many related companies.

[3] Source: Langer, E.S., et al., Report and Survey of Biopharmaceutical Manufacturing Capacity and Production, 19th annual edition, BioPlan Associates, Rockville, MD, April 2022, 500+ pages. From article entitled 2022 Outsourcing Trends In Biopharmaceutical Manufacturing by Smita Khanna, Ph.D., BioPlan Associates`

[4] Source: Grand View Research, as of Sep 2022. Science Tools Market Size, Share & Trends Analysis Report By Technology (Cell Biology, Genomics), By Product (Flow Cytometry, Mass Spectrometry), By End-use, By Region, And Segment Forecasts, 2021 - 2028

WHAT TO DO NOW?

We believe that demand for healthcare will likely grow faster than the economy over time. And we see a compelling case for portfolio exposure to this source of long-term growth. Healthcare is the least cyclical of all economic sectors: the least tied to economic performance. Major pharmaceuticals firms have routinely raised their dividends through turbulent times.

Amid 2022's difficult conditions, for example, large-cap pharmaceuticals showed comparative resilience, falling by less than broad market indices. They may continue to perform this role in 2023, should volatility persist. By contrast, life sciences and small-cap indices underperformed – **FIGURE 3** – but may potentially perform strongly once the Fed ceases raising and then starts cutting interest rates. Further selloffs in the meantime may present us with opportunities to build longer term positions in innovative segments such as life sciences, medical technology and biotech.

We see many possibilities for gaining exposure to this vital industry for the years ahead, including strategies from specialist managers and capital markets strategies for suitable investors. With the unstoppable trends of aging and the rise of Asia's middle class continuing, the prognosis for healthcare looks positive. Is your portfolio taking the prescription?

FIGURE 3: PHARMACEUTICALS BEAT BIOTECH IN 2022'S TOUGH CONDITIONS
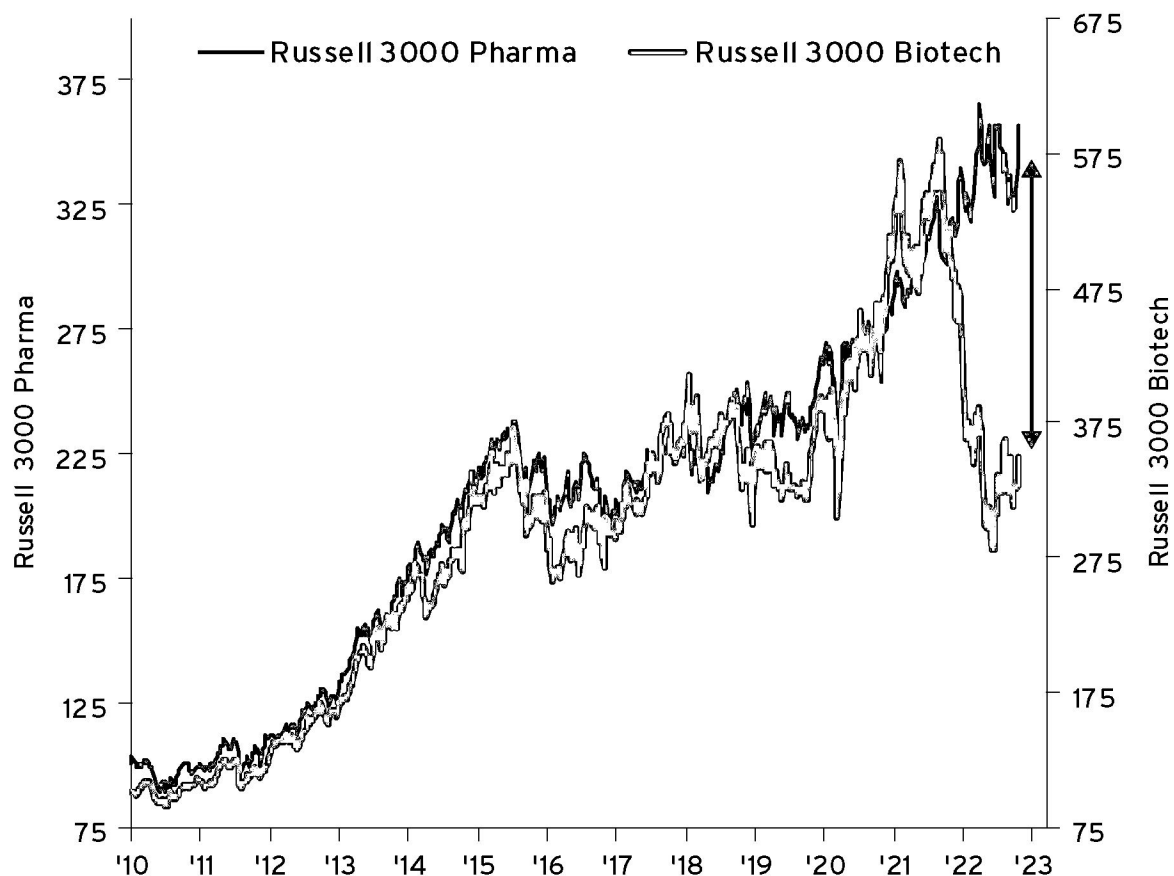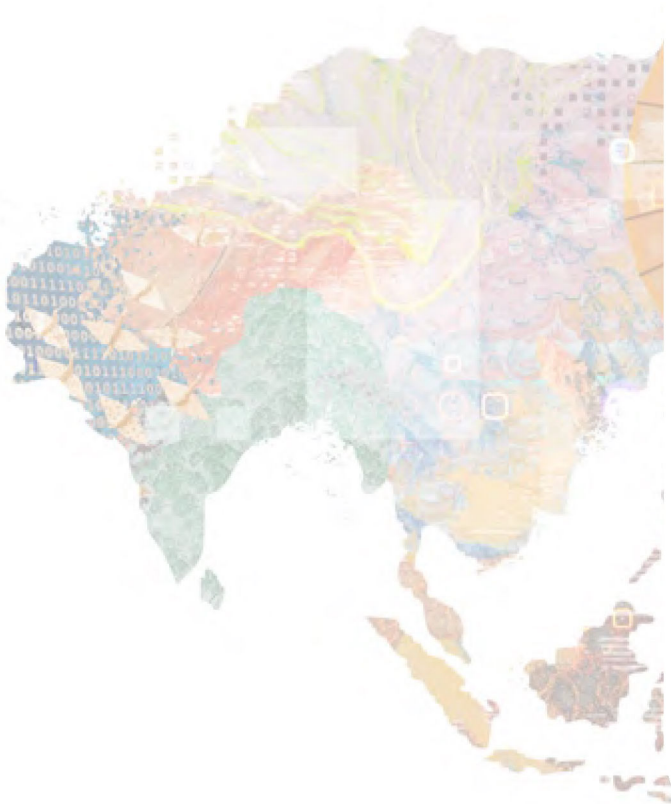

Source: Haver, as of 14 Oct 2022.

Chart shows the performance since 2010 of the Russell 3000 Pharmaceutical and Biotech sub–indices, noting the former's outperformance of the latter in 2022. Past performance does not guarantee future results. Investors cannot invest in an index. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events.

CONTENTS

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Regional asset class previews

Asia: Broader re-opening to enable regional recovery

Asia is likely to face pressure from potential US recession, but it is also likely to see some lift from China's recovery.

KEN PENG
Head of Investment Strategy, Asia Pacific

BRUCE HARRIS
Head of Global Fixed Income Strategy

- Regional prospects for 2023 look mixed, with potential US recession weighing on sentiment, while China's potential re-opening could support regional growth

- In equities, we seek exposure to recovery in China and Hong Kong, with initial focus on re-opening beneficiaries, followed by industries that have policy support

- In fixed income, we favor higher rated financials, energy, materials and tech/telecom

- The weakest currencies of 2022 may gain most in 2023, including the Japanese yen, Australian dollar and Chinese yuan

Even as global markets struggled in 2022, many parts of Asia experienced a boom. As the US potentially enters a recession in 2023, broader re-opening in Asia could increase resilience and create opportunities.

Asia saw north-south divergence in economic and market performance in 2022. Thailand enjoyed a strong revival of tourism that is likely to accelerate. India saw a notable investment boom and capital inflows. Indonesia and Malaysia rode the commodities boom. North Asia, meanwhile, was generally slower in re-opening, which weighed most on Hong Kong and mainland China. Geopolitical escalation weighed on Taiwan, while Korea was also hit by the tech bear market, especially in semiconductors.

In 2023, Asia is likely to see broader re-opening, including China. Recent medical developments and changes in government messaging suggest substantial easing in zero-COVID policy lies ahead, perhaps in spring 2023, after the winter wave of infections.

China's reopening could have positive effects beyond its borders. Reviving demand may boost Chinese imports from the wider region, offsetting some of the impact from the European and US downturns. Potential resumption of outbound Chinese tourism can help to extend recovery in markets like Thailand, where tourism recovered to 50% of 2019's levels without Chinese travel resuming.

Regional external resilience remains robust. Asian markets have seen their FX reserves fall in 2022, while their import bills rose and their currencies weakened. But reserves can still amply cover current account and short-term debt by more than one year. This curbs Fed tightening's spillover effect on Asia.

Together, we believe Asia could avoid recession in 2023, even considering potential external weakness. We expect emerging market (EM) Asian real GDP growth to reach 5.0% in 2023 after dipping to just below 4.0% in 2022. The key turnaround is China where growth is likely to rebound from 3.5% to 4.5%. Hong Kong's economy may reverse from 2.6% contraction to 2.8% growth. Among developed Asia, Japan is likely to be the most resilient, holding above-trend growth at 1.6%, which contributes to our preference for this market. Most other economies are likely to see moderate deceleration.

Equities

Our favored markets

SECTORS

Financials	▮	14.5%
Consumer disc	▮	28.6%
IT	▯	-12.1%
Telecom	▮	15.5%

Sources: 1 - FactSet consensus estimates, as of 25Nov 2022; 2 - Bloomberg, as of 23 Nov 2022. Past performance is no guarantee of future returns. Real results may vary. Indices are unmanaged. An investor cannot invest directly in an index. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events.

Amid deeply negative sentiment toward global equities, Indonesia was the only Asian market to produce positive returns in US dollar terms in 2022, up 2%. India (down 6% in US dollar terms) and Thailand (down 5%) managed positive local currency returns. China (down 32%), Taiwan (down 30%) and Korea (down 28%) suffered falling local equities and currencies. Earnings results for the year seem to corroborate the equity returns, with Indonesia, Thailand and India leading, while China and Korea lagged.

Performance in 2023 will depend much on the timing of US and China's cycles. Markets that are most insulated from potential external economic weakness may do best. China may do better after two dire years of negative earnings and equity performance. Even though China's longer term outlook seems uncertain – see **A greater separation between East and West: G2 polarization intensifies** – the leadership has clearly shown that it plans to restore economic activity after the passing of the pre-Congress political struggle.

A few weeks after the Communist Party Congress, the leadership laid out a path to exiting "zero-COVID" policies, announced comprehensive measures to stabilize the property sector and managed to tone down the confrontational rhetoric with the US. We expect additional progress to restoring capital market activity, including more IPOs from the tech sector.

These measures could enable a more visible recovery in 2023, restoring some investor confidence. After 2022's 7% decline in earnings, China is likely to see low double-digit growth. Valuations may also rise from distressed levels

in the process, a powerful combination for potential returns in 2023.

Japan's equity performance was around the middle of the pack, as its 15% earnings growth in 2022 beat expectations. The drag came mainly from a 30% depreciation in its currency through October. Traditionally, Japanese equities have benefited from a weaker yen. However, 2022's depreciation came from a record tightening in US monetary policy, which weighed on all assets. Meanwhile, Japan's economy was largely unscathed by inflation. The Bank of Japan's controversial easing policy amid Fed tightening may be vindicated if the US dollar continues to weaken in 2023. The potential for yen recovery, with relatively stable policy and growth, may draw more investor inflows to Japanese equities.

Elsewhere in Asia-Pacific, countries more exposed to the global cycle may still feel pressure, such as Korea, Taiwan and Australia, where earnings are expected to fall in 2023. Indonesia's commodity advantage may also fade in 2023. Others in Southeast Asia like Thailand and Singapore may do well amid broader re-opening.

As Asia continues relaxing COVID restrictions, we favor re-opening beneficiaries in consumer, e-commerce, pharma and medical tech. Longer term, as US-China rivalry persists, we expect a drive toward building more domestic production capacity as well as those in friendly markets. This is likely to shift the investor mindset from focusing on companies that enable consumption to those that facilitate production, likely boosting industries like sustainable energy, telecom, core technologies and select infrastructure.

FIGURE 1. ASIA VALUATIONS AND OUR FAVORED ASIA SECTORS

	FREE MKT CAP	PE			EPS YoY %			P/B	ROE	Div Yld	CAPE
	US $bn	22E	23E	24E	22E	23E	24E	22E	22E	22E	10yr
Japan	3175	13.0	12.2	12.2	4.4	5.9	5.9	1.3	9.5	2.5	20.8
Asia Pac ex Jp	6570	12.5	11.1	11.1	4.5	13.8	13.8	1.5	11.6	3.1	15.7
Australia	1152	14.6	14.6	14.6	−1.5	0.0	0.0	2.1	14.8	4.7	20.6
Hong Kong	387	12.7	11.4	11.4	26.0	11.4	11.4	1.0	6.1	3.6	13.5
Singapore	210	13.1	11.8	11.8	24.1	10.8	10.8	1.3	8.3	4.0	12.0
New Zealand	26	34.1	28.1	28.1	17.2	21.4	21.4	3.0	7.3	2.6	25.7
China	1800	9.6	8.4	8.4	14.6	14.2	14.2	1.2	10.8	2.5	10.2
Korea	747	10.7	8.8	18.9	−11.1	28.2	16.4	0.9	9.4	2.4	12.9
Taiwan	919	12.9	11.0	11.0	−13.0	16.8	16.8	2.1	19.0	4.0	21.6
India	927	22.2	18.9	8.8	18.9	16.4	28.2	3.6	14.0	1.3	38.8
Thailand	132	17.4	15.5	15.5	12.9	12.2	12.2	2.0	10.1	2.6	17.2
Indonesia	126	13.9	13.0	13.0	5.3	6.6	6.6	2.5	17.4	3.2	21.1
Malaysia	97	13.4	12.6	12.6	11.4	6.2	6.2	1.4	9.6	3.9	14.0
Philippines	48	14.2	12.5	12.5	17.0	13.7	13.7	1.7	10.3	2.0	19.2

Source: Citi Research, Worldscope, MSCI, FactSet, data as of 25 Nov 2022. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only and do not represent the performance of any specific investment. Past performance is no guarantee of future results. Real results may vary. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events.

Note: The above data are compiled based on companies in MSCI AC World Index. The market capitalization for regions, markets and sectors are free−float adjusted. P/E, EPS Growth, P/B, Dividend Yield and ROE are aggregated from FactSet consensus estimate (calendarized to December year end) with current prices. CAPE is calculated by current price divided by 10−year average EPS based on MSCI index−level data. NM = Not Meaningful; NA = Not Available.

Fixed income

Asian fixed income was not spared the effects of rising global central bank policy rates in 2022. The Fed's rate hikes of almost 400bps through November caused all fixed income valuations to fall. Higher US rates also pressured foreign exchange values. The Bank of Japan (BoJ) reportedly intervened several times in recent months to support the yen, as the BoJ remains unwilling for now to follow other G7 central banks in raising rates.

In US dollar-denominated corporate bonds, China's real estate sector continued to experience very high levels of distress due in part to government policies contributing to a continual loss of market confidence. This led to large sector price falls not only in high-yield but also formerly investment-grade (IG) bonds.

Policies around the real estate sector have been improving since the third quarter of 2022. After the October Party Congress, China's financial authorities announced comprehensive measures to stop widening defaults, accelerate project completions, facilitate restructuring and restore housing demand. Market confidence rebounded sharply in November and may mark the end of this round of crisis in China.

For investors with high risk tolerance, real estate can potentially offer tactical outperformance if policies enable a rebound in sales and cash flows. For more conservative investors, US dollar-denominated investment-grade issuers may offer interesting yield premiums to their US counterparts of similar ratings and maturities, such as those in higher rated financials, energy, materials and tech/telecom.

Corporates aside, various Asian sovereigns with strong trade balances and healthy US dollar reserves may also be interesting for adding potential diversification to a global fixed income allocation.

OUR FAVORED ASIA SECTORS (EX-JAPAN)

	FREE MKT CAP	PE		EPS YoY %		P/B	ROE	Div Yld	CAPE
	US $bn	22E	23E	22E	23E	22E	21E	22E	10yr
Financials	1540	8.8	8.1	14.3	8.5	1.1	11.0	4.1	11.9
Consumer disc	795	15.3	12.6	28.6	21.2	2.0	10.0	1.1	14.6
IT	1265	14.8	11.5	−12.1	28.3	2.1	16.0	3.0	23.9
Telecom	130	19.0	16.8	15.5	13.5	2.5	11.4	3.7	15.2

Source: Citi Research, Worldscope, MSCI, FactSet, data as of 11 Nov 2022. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only and do not represent the performance of any specific investment. Past performance is no guarantee of future results. Real results may vary. All forecasts are expressions of opinion, are subject to change without notice, and are not intended to be a guarantee of future events.

Note: The above data are compiled based on companies in MSCI AC World Index. The market capitalization for regions, markets and sectors are free-float adjusted. P/E, EPS Growth, P/B, Dividend Yield and ROE are aggregated from FactSet consensus estimate (calendarized to December year end) with current prices. CAPE is calculated by current price divided by 10-year average EPS based on MSCI index-level data. NM = Not Meaningful; NA = Not Available.

Currencies

Asian currencies - as represented by the Bloomberg JP Morgan Asia Dollar Index - weakened 11.3% in 2022 through October. The Fed's 400bps of rate hikes through November left US yields much more attractive than many local Asian sovereign yields. The resulting negative carry caused capital outflows and hit Asian currencies, with some central banks repeatedly intervening to support their currencies, notably Japan, China and Hong Kong.
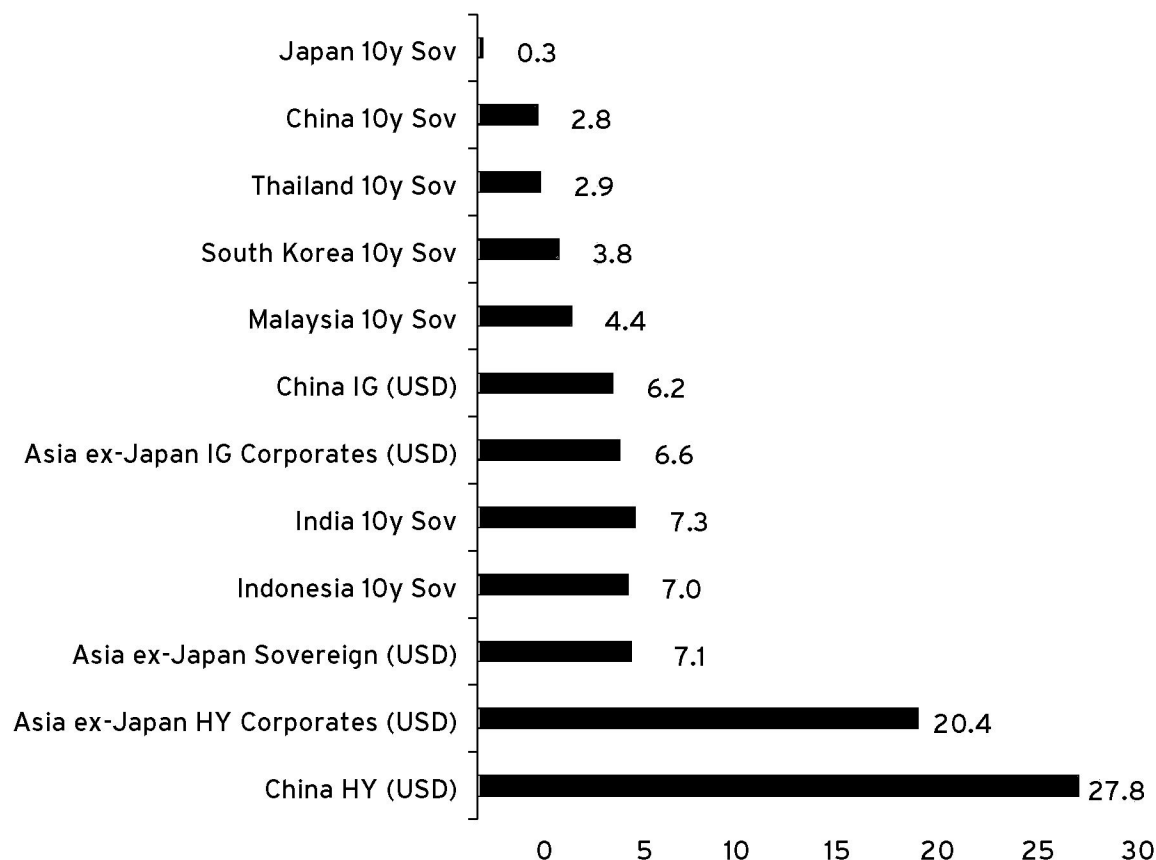
Fed tightening may continue in early 2023, during which time the US dollar may remain supported. But when US economic data turn weaker and the Fed pivots to cutting, the dollar may see substantial downside. Some early signs of this are already evident in late 2022.

The Japanese yen appears best placed among Asian currencies for a snapback. Due to the Bank of Japan's easing stance, short yen positions are at record levels. The reversal will likely be as dramatic as the yen's 30% weakening through October in 2022.

The Australian dollar may also reverse substantially. After an 18% depreciation between April and October, it rebounded 8% in one month on the first hints of peak in US yields. The Reserve Bank of Australia had also been consistently raising rates and may outlast the Fed's hikes.

The Chinese yuan saw 16% peak-to-trough depreciation in 2022 but could see a comeback in 2023. Some suspect that China's recovery may weaken its currency because its import demand would rise, while exports fall as the US economy stutters. However, the Chinese yuan's depreciation resulted mainly from Chinese government bonds' 1% positive carry turning to a 2% negative carry versus US Treasury bonds. This gap is likely to narrow if China stages a recovery and emerges from deflation, lifting Chinese yields in 2023, while US yields likely fall.

FIGURE 3. ASIA PACIFIC FIXED INCOME YIELDS (%)

Japan 10y Sov	0.3
China 10y Sov	2.8
Thailand 10y Sov	2.9
South Korea 10y Sov	3.8
Malaysia 10y Sov	4.4
China IG (USD)	6.2
Asia ex-Japan IG Corporates (USD)	6.6
India 10y Sov	7.3
Indonesia 10y Sov	7.0
Asia ex-Japan Sovereign (USD)	7.1
Asia ex-Japan HY Corporates (USD)	20.4
China HY (USD)	27.8

Source: Bloomberg Barclays, Bloomberg and The Yield Book, as of 24 Nov 2022. Past performance is no guarantee of future returns. Real results may vary. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only and do not represent the performance of any specific investment. Past performance is no guarantee of future results.

Europe: Bracing for winter recession

Amid the energy crisis, Europe looks set for a difficult year. Despite cheap assets and currencies, we remain cautious for now.

GUILLAUME MENUET
Head of Investment Strategy
and Economics, EMEA

JUDIYAH AMIRTHANATHAR
EMEA Investment Strategy

- We expect both the eurozone and the UK to see slightly negative GDP growth in 2023

- While valuations are low, we are neutral UK equities and underweight Europe ex-UK

- We are staying underweight European sovereign and credit

- The euro and sterling seem likely to remain at weak levels pending any decisive turn in the US dollar

Overview

Real GDP growth in the eurozone may fall 0.5% in 2023 after rising 3.2% in 2022. In the UK, we see a 1.0% drop in 2023 after a rise of 4.3% in 2022. Consumer spending should weaken in coming quarters as household confidence declines given high levels of inflation and the 'cost of living' crisis. Elevated uncertainty and the central bank-driven rapid tightening in financing conditions will likely induce firms to trim hiring and investment in early 2023. A short-lived recession lasting between three or four quarters is our baseline scenario for 2023.

Some European countries could be at risk of power shortages this winter as natural gas storage facilities are not evenly distributed. Geopolitical risk is a clear and present danger until the war in Ukraine ends. As a large exporter of goods and services, Europe will be impacted by the expected slowdown in global economic activity, even if recent currency depreciation against the dollar cushions the blow.

While no major elections are due in 2023, politics could pose a significant risk. The UK is struggling with the barriers that it now faces when trading with the European Union since Brexit. It is also suffering from temporarily stressed public finances. It is not clear whether the new prime minister (PM) Rishi Sunak can establish a more constructive trading relationship with the EU.

France and Germany – the EU's foremost powers – seem to disagree on many important issues such as energy and defense. In Italy, new PM Georgia Meloni leads a fractious far-right-led coalition. Her administration is keen to receive cash from the NextGenEU COVID Recovery Fund. However, her euro-skepticism creates risks of confrontation with the EU over sovereignty-related issues.

Fiscal policy in 2023 is set to tighten, as governments seek to shrink their budget deficits. However, the EU is unlikely to reintroduce strict fiscal rules – suspended during the pandemic – before 2024. The European Central Bank (ECB) and others will probably tighten monetary policy further. But as inflation begins falling back from multi-decade highs, we expect policy rates to peak amid weakening domestic demand.

Equities

Our favored European markets

SECTORS EPS GROWTH FORECAST[1]

Consumer staples	■	9.3%
Healthcare	■	7.8%

Sources: 1 - FactSet consensus estimates, as of 23 Nov 2022; 2 - Bloomberg, as of 23 Nov 2022. Past performance is no guarantee of future returns. Real results may vary. Indices are unmanaged. An investor cannot invest directly in an index. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events.

Europe ex-UK equities have been under pressure amid the Russia-Ukraine war, gas supply issues, tighter financial conditions and higher-than-expected inflation. UK equities have done much better, thanks to higher weightings in stronger performing sectors such as energy, healthcare and financials. For 2023/24, we remain underweight Europe ex-UK equities and neutral on UK equities.

As the global economy slows markedly in 2023, corporate revenues could come under pressure. With various input costs including wages set to increase further next year, operating margins are expected to narrow during the first half of 2023. This will likely translate into lower expectations for corporate earnings per share (EPS).

Bottom-up analyst consensus forecasts are for European ex-UK EPS to grow 2.1% in 2023 after rising 15.8% in 2022. UK EPS are seen contracting 2.8% in 2023 after rising 36.8% in 2022. We believe these expectations are too optimistic, with further downgrades likely in the coming quarters. Relative and absolute valuations remain cheap for 2023, with Europe ex-UK on 12.7% forecast earnings and the UK on 9.6%.

In this challenging environment, we prefer firms with strong management, robust balance sheets, plentiful cash flow and resilient earnings and dividends. We favor defensive sectors such as healthcare and consumer staples, while being less constructive on energy and industrials. We continue to see upside potential for green energy and infrastructure going into 2023, given Europe's need to diversify its energy mix away from Russian natural gas dependency.

Persistently high inflation in early 2023 and tighter central bank policies will likely challenge equities. By the second half, however, we expect European and UK equities will likely be looking ahead to an early-stage economic recovery. Key risks to our view are still skewed to the downside, ranging from a deeper recession, higher inflation for longer, gas supply issues and delayed Chinese recovery.

FIGURE 1. EMEA VALUATIONS AND OUR FAVORED EMEA SECTORS

Priced as of close on 18 Nov 22	P/E			EPS YoY %			P/B	ROE	Div Yld	CAPE
	22E	23E	24E	22E	23E	24E	22E	22E	22E	10yr
Europe	12.1	11.8	11.2	21.4	0.6	6.1	1.8	14.9	3.5	20.2
UK	9.4	9.6	9.4	36.8	−2.8	2.1	1.6	17.6	4.1	16.9
Europe ex UK	13.3	12.7	11.8	15.8	2.1	7.7	1.8	14.0	3.3	21.6
France	11.7	11.9	11.3	34.2	−1.7	5.4	1.7	14.5	3.2	24.5
Switzerland	18.2	16.1	14.6	−7.2	13.2	9.9	3.0	16.6	3.1	23.7
Germany	10.9	10.8	9.8	4.9	2.1	10.5	1.3	12.1	3.7	16.3
Netherlands	23.0	18.0	15.2	−11.6	27.6	18.9	2.6	10.9	2.1	29.2
Sweden	14.8	13.8	13.0	4.0	7.3	8.3	1.9	14.6	3.3	20.0
Denmark	29.7	20.6	20.3	40.5	−29.1	1.8	4.7	28.9	1.3	37.0
Italy	7.7	7.9	7.5	63.6	−2.6	5.6	1.1	14.2	5.2	20.0
Spain	9.7	9.9	9.3	20.0	−1.3	5.9	1.1	10.9	4.9	14.8
Finland	15.9	14.1	13.4	−6.1	12.3	5.2	2.2	13.6	3.5	26.1
Belgium	18.2	17.3	14.5	1.8	5.1	19.0	1.5	8.3	2.5	17.1
Norway	7.0	7.6	8.8	93.0	−8.2	−14.2	1.8	25.5	6.7	18.9
Ireland	16.1	15.4	13.6	14.9	4.4	12.8	1.8	11.1	1.9	28.7
Portugal	18.5	15.7	14.8	29.9	18.1	5.9	2.3	12.3	3.3	24.6
Austria	5.5	6.1	6.8	39.0	−10.3	−10.1	0.9	16.3	6.2	13.0

Priced as of close on 18 Nov 22	P/E			EPS YoY %			P/B	ROE	Div Yld	CAPE
Energy	4.5	5.3	6.4	148.2	−14.8	−16.1	1.3	27.5	4.7	18.9
Consumer staples	17.9	16.4	15.0	11.0	9.3	9.4	3.2	17.6	3.0	22.8
Healthcare	16.9	15.6	14.0	11.3	7.8	11.8	3.5	20.2	2.5	26.5
Financials	9.0	8.0	7.1	0.2	13.2	12.1	0.9	9.5	5.2	13.2

Source: Citi Research, Worldscope, MSCI, FactSet, data as of 18 Nov 2022. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only and do not represent the performance of any specific investment. Past performance is no guarantee of future results. Real results may vary. All forecasts are expressions of opinion, are subject to change without notice, and are not intended to be a guarantee of future events.

Note: The above data are compiled based on companies in MSCI AC World Index. The market capitalization for regions, markets and sectors are free-float adjusted. P/E, EPS Growth, P/B, Dividend Yield and ROE are aggregated from FactSet consensus estimate (calendarized to December year end) with current prices. CAPE is calculated by current price divided by 10-year average EPS based on MSCI index-level data. NM = Not Meaningful; NA = Not Available.

Fixed income

Developed European investment-grade and sovereign yields soared in 2022 as central banks hiked rates to tackle much higher-than-anticipated inflation. After eight years, the ECB ended its negative rates experiment and two of its pandemic-era asset-buying programs. Ten-year Bund yields surged from -0.18% to 2.41% before slipping below 1.98% in late November.

The Bank of England (BoE) had already started hiking rates in December 2021. This initiated a bear market in bonds, with 10-year UK gilt yields surging from 0.97% to a peak of 4.50% in late September. The rise was exacerbated by unfunded tax cut proposals from short-lived prime minister Liz Truss. However, a change of PM, finance minister and a new autumn budgetary statement reassured financial markets, with 10-year gilt yields dropping toward 3.14%.

We anticipate a further withdrawal of liquidity in 2023 as both the ECB and BoE shrink their balance sheets. We see policy rates peaking at 2.5% and 4.25% respectively. Lower inflation and restrictive policy stances throughout 2023 will likely result in range-bound euro area and UK sovereign yields.

However, recessionary conditions could create opportunities for local investors keen to increase their exposure to short-dated sovereign bonds while reducing portfolio volatility. By end 2023, we see 10-year yields at 2.25%-2.50% for Bunds and 3.50%-3.75% for gilts.

For European corporate bonds, investors spent much of 2022 seeking out more creditworthy issuers. In 2021, they did the opposite, prioritizing yield over ratings. Corporate earnings were resilient in the first half of 2022, with companies refinancing most of their maturing debt early and at lower yields. The second half was a different story in the European investment-grade market, amid a significant reduction in bond supply.

We anticipate this trend will likely continue in 2023. On the one hand, fundamentals remain positive, with leverage ratios at an all-time low and interest rate coverage ratios at all-time highs. On the other, profit margins are coming under pressure from higher debt servicing and input costs, which is impacting firms' net income. From record low default rates in 2022,

we anticipate an increase in 2023 that will increase investors' appetite for higher quality issuers. We thus remain underweight European sovereign and credit.

FIGURE 2: EMEA FIXED INCOME YIELDS (%)
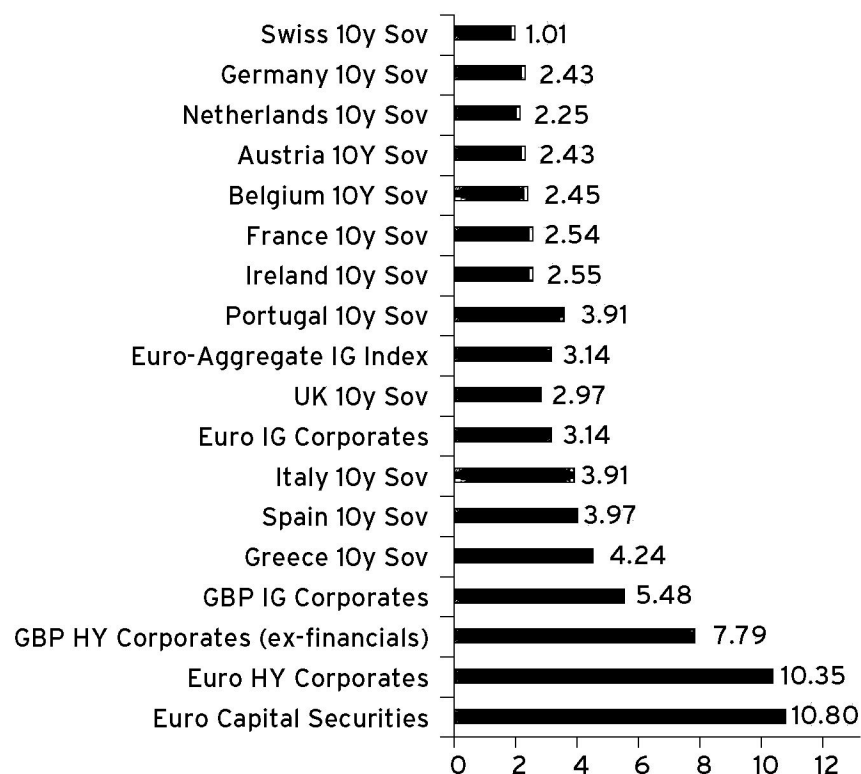
Source: Bloomberg Barclays, Bloomberg and The Yield Book, as of 22 Nov 2022. Past performance is no guarantee of future returns. Real results may vary. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only and do not represent the performance of any specific investment. Past performance is no guarantee of future results.

Currencies

The British pound has recovered somewhat from the intense selling that greeted former PM Liz Truss's unfunded tax cut proposals in September 2022. For sterling to make sustained gains, though, the UK needs to present a sustainable long-term growth strategy. The outlook for 2023 is bleak, with recession likely, the developed world's worst external deficit and trade with the EU hampered by Brexit.

The BoE has an equally difficult task of trying to lower a high inflation rate without deepening the UK recession and home price declines. Against this backdrop, we see sterling vulnerable to further bouts of weakness against the US dollar. We expect an average range of $1.23-$1.28 until the longer term picture shows improvement.

Like sterling, the euro faces multiple headwinds. The single currency zone also faces an unfavorable mix of lower growth, high inflation and rising rates in the months ahead. The ECB is expected to hike rates to 2.5% amid fears of a severe winter's effect on energy consumption, China's delayed recovery and likely recession in Europe. These forces suggest the euro staying weaker for longer in a $1.09-$1.14 average range.

The caveat is the timing of a turn in the US dollar. Should the Fed turn more dovish in its monetary policy, the US dollar could weaken across the board, including against the euro and sterling. The timing of such a move remains difficult to forecast, however.

Latin America: Selective opportunities amid cheap valuations

With regional central banks having done their job in fighting inflation in 2022, our focus is on individual countries' fiscal policies, as well as political and social dynamics. Equity valuations are attractive across the board, but upside could be limited by uncertainty around government spending policies.

JORGE AMATO
Head of Investment Strategy,
Latin America

BRUCE HARRIS
Head of Global Fixed
Income Strategy

- Amid a decelerating global economy, Latin America may grow around 1% in 2023

- Equities in Brazil and Mexico are on low valuations while their fundamentals look solid

- We see Latin American fixed income as a "bond picker's market" at the moment

- Conditions for regional currencies may be favorable in 2023, especially if the US dollar weakens

Our favored markets

EQUITY EPS GROWTH FORECAST[1]

Brazil		-15%

SECTORS EPS GROWTH FORECAST[1]

IT		38%
Telecom		84%
Healthcare		20%
Consumer Staples		13%

FIXED INCOME YIELDS[2]

Brazil investment grade and high yield		6%

Sources: 1 - FactSet consensus estimates, as of 23 Nov 2022; 2 - Bloomberg, as of 23 Nov 2022. Past performance is no guarantee of future returns. Real results may vary. Indices are unmanaged. An investor cannot invest directly in an index. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events.

Latin America's largest economies could grow on average around 1% in 2023. This rate is lower than the 2.5-3.0% range for 2022. And it reflects our view that the global economy will decelerate in 2023 as higher policy rates take effect.

In 2022, the region added two further left-leaning presidents: Gustavo Petro in Colombia and Luis Ignacio Lula da Silva in Brazil. These two elections completed the wave of left-wing populism across all the major economies. Argentina, which often goes against the grain, might break this pattern in 2023.

Despite a shift in economic policy toward higher public spending among these countries, the magnitude of risks is quite different. Each nation exhibits different political and economic undercurrents, requiring investor discernment in portfolio construction.

Mexico's economy is likely to suffer the deceleration we expect in the US, its largest trading partner. López Obrador's ("AMLO") six-year term will end in 2024, suggesting he will focus more on building his legacy as he cannot be re-elected. Reduced economic activity constrained fiscal resources and political uncertainty could put pressure on Mexico's solid market performance since the 2020 pandemic lows.

The fate of Brazil's fiscal accounts will remain markets' principal focus. Lula's campaign pledges for social spending add up to roughly $40bn, around 2% of GDP, such resources that are unavailable within the current spending framework. The fiscal spending debate may dominate economic headlines throughout 2023. While the central bank has managed to bring down inflation expectations, its success could be at risk if Lula's spending plans are undiluted.

Colombia, Peru and Chile have unproven new administrations, which face the challenge of reconciling aggressive social spending promises with available resources. Chile and Colombia are the most uncertain here, as they are dealing with proposals for more significant changes such as constitutional reform and contentious pension, tax, labor and property rights reforms.

Argentina will likely have another rough year, with government spending and inflation accelerating as elections loom. Investors will watch for a potential change in administration that could foster positive expectations. But the macroeconomic adjustment required is massive and a challenge for any government.

Equities

The MSCI Latin America Index is up nearly 4% year to date, a strong performance compared to global equities, down around 18%. Excluding Colombia – down 15% albeit still outperforming global equities – every other major regional equity market saw positive returns to varying degrees.

Latin American earnings per share (EPS) growth was a solid 13% in 2022. And the absolute level of expected EPS of $287 is not far from the commodity super cycle record of 2007-2011. Forward price/earnings multiples going into 2023 are practically the same as last year, again suggesting the potential for attractive valuations. For the region, a 12.5% decline in EPS is forecast.

FIGURE 1. LATIN AMERICA VALUATIONS

	MKT cap	P/E		EPS YoY %		P/B	ROE	Div Yld	CAPE
	US$bn	'23Fwd	'24FWD	'23E	'24E	'23E	'23E	'23E	10yr
MSCI EM Latin America	541.2	7.9	7.9	−13.0%	0.3%	1.4	23.8	9.9	16.0
Argentina	5.9	4.4	5.8	NA	−25.4%	0.3	9.6	NA	NA
Brazil	324.3	6.6	6.8	−15.0%	−2.2%	1.3	30.1	12.8	15.2
Mexico	154.4	12.9	11.5	5.8%	12.4%	1.9	18.0	3.2	18.8
Chile	35.4	7.5	8.1	−26.8%	−7.3%	1.4	18.2	15.1	14.6
Colombia	9.2	5.5	5.8	−18.2%	−4.5%	0.4	36.6	8.8	11.6
Peru	17.8	11.8	10.2	−13.4%	16.0%	1.8	20.8	3.9	NA

Source: FactSet Consensus, MSCI, as of 22 Nov 2022. Note: The above data are compiled based on companies in MSCI AC World Index. Free MC is free−float adjusted market capitalization for regions, markets and sectors. P/E (Price/Earnings), EPS growth (Earnings per share), P/B (Price/Book), Dividend yield (DY) and RoE (Return on Equity) are aggregated from FactSet consensus estimates. CAPE stands for Cyclically Adjusted Price to Earnings, and is defined as: Current price/ten−year average inflation−adjusted EPS. Indices all from MSCI. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only. Past performance is no guarantee of future returns. Real results may vary.

FIGURE 2. OUR FAVORED LATIN AMERICAN SECTORS

	MKT cap	P/E		EPS YoY %		P/B	ROE	Div Yld	CAPE
	US$bn	'23Fwd	'24FWD	'23E	'24E	'23E	'23E	'23E	10yr
Info technology	2.9	23.3	18.6	38%	25%	3.8	11.4	1.3	NA
Telecom	10.2	18.5	14.1	84%	31%	1.4	0.7	1.7	NA
Healthcare	39.1	13.4	11.4	20%	18%	1.8	20.7	2.8	NA
Consumer staples	82.6	16.2	14.4	13%	12%	2.4	17.8	2.9	23.2

Source: Citi Research, Worldscope, MSCI, FactSet, as of 22 Nov 2022. Note: The above data are compiled based on companies in MSCI AC World Index. The market capitalization for regions, markets and sectors are free−float adjusted. P/E (Price/Earnings), EPS growth (Earnings per share), P/B (Price/Book), Dividend yield and RoE (Return on Equity) are aggregated from FactSet consensus estimates (calendarized to December year end) with current prices. CAPE is calculated by current price divided by ten−year average EPS based on MSCI index level data. NM = Not Meaningful; NA = Not Available. Indices all from MSCI. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only. Past performance is no guarantee of future returns. Real results may vary. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events.

The Brazil MSCI Index had a volatile but solid performance in 2022, gaining 9%. Of the large, more accessible equity markets in the region, it stands out again in 2023. By nature, a highly volatile market, Brazilian valuations remain quite attractive. And despite fiscal policy uncertainty, fundamental dynamics look fairly solid.

While more concentrated than Brazil's well-diversified economy, the MSCI Brazil Index offers potential opportunities for global portfolios to participate in agriculture, energy, financial, retail and materials. The large-cap companies that dominate the index offer sizable revenue streams, improved balance sheets and profitability, and generous dividend payout policies. Despite their cyclical bent, forward price/earnings multiples of around seven compensate for this. Notwithstanding high expected volatility, Brazil could again prove an attractive play in 2023 as China reopens and the US economic cycle bottoms out.

The MSCI Mexico Index is up 108% from its 2020 lows, compared with 82% and 67% for the S&P 500 and MSCI World respectively. This is impressive both in absolute and relative terms. While up nearly 2% year to date, Mexico more importantly is down only 7% from its post-pandemic highs. That compares to a 20% decline for the S&P.

On around 11 times forward earnings, Mexico trades below its historical average of around 13, but above Brazil. We expect its strong economic ties to the US to hit profitability in 2023, although this is not yet visible in 2023 earnings forecasts. Domestic confidence and investment could also suffer from rising political uncertainty

ahead of the 2024 elections, leading to capital outflows and currency weakness, the latter impacting equity returns in US dollars.

Our favored regional sectors are healthcare and consumer discretionary, energy and materials. These sectors should benefit from easier monetary policy and still robust external and commodity sectors.

Fixed income

Latin American US dollar–denominated fixed income fared poorly in 2022, like bonds globally. However, for the two large bellwethers in the region of Brazil and Mexico, poor total return performance due to rising yields was almost entirely attributable to dollar rates moving higher.

The credit risk of those two countries – as measured by credit spreads – did not increase much. Brazil 10-year credit spreads had risen only marginally from 291bps to 352bps in the year to 23 November 2022. Likewise, the Brazilian national oil company saw 10-year credit spreads rise only about 70bps from 346bps to 413bps. Both Brazil and the national oil company are rated just below investment grade. So, compared to US high yield index credit spreads which rose over 160bps from 280bps to 445bps, they clearly outperformed.

Mexico – which has an investment-grade rating – saw more credit spread deterioration, with 10-year credit default swaps (CDS) rising from 156bps to 229bps. Again, though, this was somewhat marginal when compared to the

impact from almost 400bps of Federal Reserve rate hikes.

Not all countries or large issuers performed as well, however. Mexico's state-owned oil company PEMEX, for example, was unable to reduce its debt burden despite a very strong oil market. Its 10-year credit default spread widened from 400bps to 760bps. Colombia elected a left-leaning president whose initial platform included eliminating crude oil exports. Given oil is one of Colombia's primary exports, the country's US dollar credit spreads also widened considerably, from 273bps to 425bps.

Throughout Latin America sovereign and corporate bonds, there is a large disparity in credit performance. We think this will persist, so investors should consider the region a "bond picker's" market. The region is reasonably well protected against a stronger dollar owing to its status as a commodity-exporting powerhouse, along with its strong intermediate goods export sectors as well, both of which draw dollars into the region.

In addition, most countries' central banks have acted speedily in raising rates to combat inflation and stay ahead of the Fed's hikes. This has resulted in significant relative currency strength against the dollar.

That said, commodity and other goods prices may decline in 2023 if the US or Europe enter recession. Additionally, following Lula's election in Brazil, all countries in Latin America are now run by left-leaning administrations, who may favor ramping up spending on social programs and tempering market-based outcomes in the

corporate sector. Given this uncertainty around policy mix within countries, we suggest investors focus on sovereigns with stronger credit metrics. For corporates, we suggest investors primarily consider globally dominant companies and local banks that finance them, with management who have already exhibited balance sheet and capital allocation discipline.
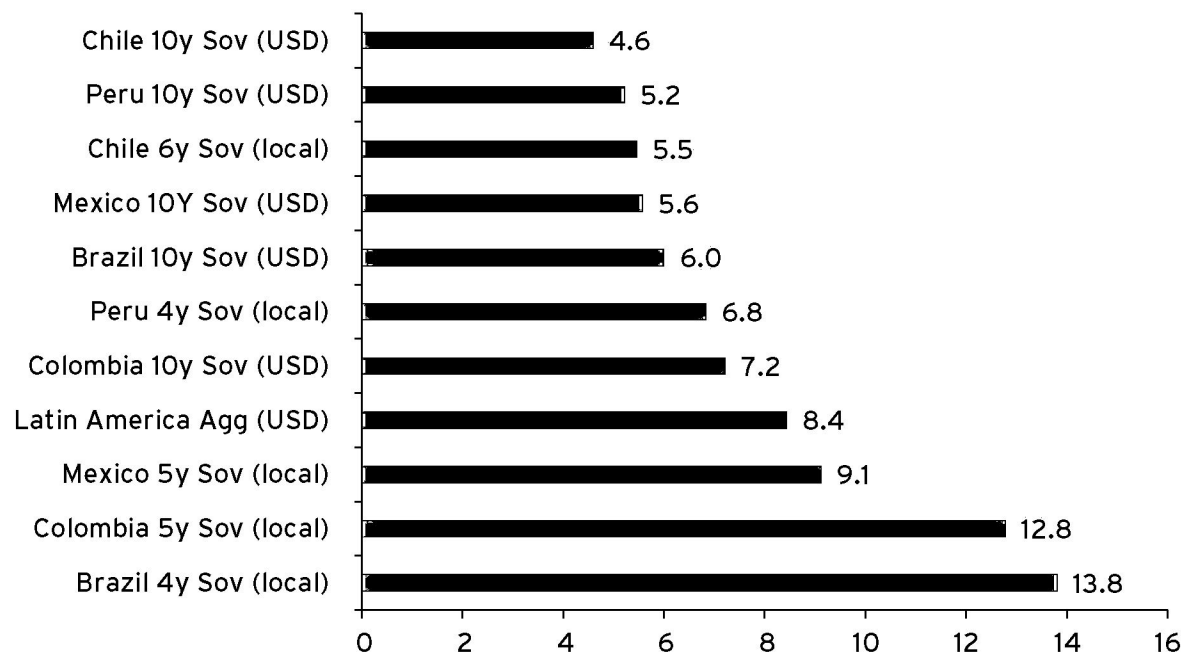
Currencies

Most regional currencies had a solid 2022 thanks to strong trade flows and central bank tightening. The exceptions to this were the Colombian and Chilean pesos, down 15% and 4% against the US dollar respectively. These falls mostly resulted from domestic political and structural reform uncertainty. Higher inflation that left real policy rates in slightly negative territory was also a factor. But this is expected to correct as 2023 inflation expectations are much lower.

Broadly speaking, monetary policy in the region is likely to become less restrictive than in the developed world as nominal policy rates are now much higher than recent inflation. The challenge for central banks will be handling the inflationary risks from 2023's looser fiscal policy. As the US enters recession and markets look for Fed rate cuts, the US dollar could see a broad-based weakening. Latin American policy rates are likely to continue to provide attractive carry. Barring policy mistakes, the environment could be relatively benign.

We expect the Brazilian real to range trade in 2023, capped by fiscal policy uncertainty but also supported by very high real rates. The Mexican peso could see depreciation pressure as its economy and trade slow, while the political environment puts pressure on capital flows.

FIGURE 3. LATIN AMERICA FIXED INCOME YIELDS

Chile 10y Sov (USD)	4.6
Peru 10y Sov (USD)	5.2
Chile 6y Sov (local)	5.5
Mexico 10Y Sov (USD)	5.6
Brazil 10y Sov (USD)	6.0
Peru 4y Sov (local)	6.8
Colombia 10y Sov (USD)	7.2
Latin America Agg (USD)	8.4
Mexico 5y Sov (local)	9.1
Colombia 5y Sov (local)	12.8
Brazil 4y Sov (local)	13.8

Source: Bloomberg Barclays, Bloomberg and The Yield Book, as of 23 Nov 2022. Past performance is no guarantee of future returns. Real results may vary.

North America: The hunt for quality and yield

We enter 2023 positioned for end-of-cycle conditions. But we expect to pivot in the second half of the year toward falling interest rates' potential beneficiaries.

- We expect 0.7% full-year average real GDP growth in the US and 0.9% in Canada in 2023

- In equities, we favor dividend growers, plus the consumer staples and healthcare sectors

- North American fixed income offers some of the world's most attractive yields

- We look for the US dollar to peak and then weaken in 2023

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BRUCE HARRIS
Head of Global Fixed
Income Strategy

Our Favored US Market

EQUITY EPS GROWTH FORECAST[1]

| US large-cap equities | ☐ | 6.4% |

SECTORS

| Consumer staples | ▮ | 3.7% |
| Healthcare | ▏ | 0.9% |

FIXED INCOME

US IG Preferreds	▪	7.5%
US IG Corporates	▪	5.4%
US Treasury (2-year)	▪	4.5%

Sources: 1 – FactSet consensus estimates, as of 23 Nov 2022; 2 – Bloomberg, as of 23 Nov 2022. Past performance is no guarantee of future returns. Real results may vary. Indices are unmanaged. An investor cannot invest directly in an index. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events.

Overview

As Fed monetary tightening sequentially hits housing, manufacturing, profits and employment, we see 70% odds of a recession in 2023. For the year overall, we look for full-year average real GDP growth of 0.7% before it accelerates to 2.0% in 2024.

If we are correct, the unemployment rate should rise toward 5.25%. The large fiscal measures of 2020-2022 and split federal government resulting from the midterm elections have reduced the appetite for big spending initiatives. The fiscal response to a downturn is likely to rest with automatic stabilizers such as unemployment insurance and perhaps some well-timed spending derived from 2021's infrastructure bill.

The Fed is likely to stop raising rates in early 2023 as signs of economic strain become more apparent. After a pause in the policy rate near 5%, we expect the Fed to cut rates as inflation and employment decline. We expect US inflation to fall in 2023 to 3.5%. This should allow 10-year Treasury yields to slip lower toward 3%.

After growth near 3.3% in 2022, Canadian GDP may increase by just 0.9% in 2023 before picking up in 2024. Like the Fed, the Bank of Canada appears likely to stop raising rates in early 2023.

In recent years, the US has undergone a series of policy initiatives to address its competitiveness in manufacturing, bolster supply chain resilience and encourage onshoring and friend-shoring, or the relocation of activities to allied nations.

It has also separated parts of its cutting-edge technology ecosystem from that of China's, with a special focus on semiconductors, renewable energy and electric vehicles. These efforts include a lower corporate tax rate, accelerated depreciation schedules, tariffs on China, the US-Mexico-Canada trade agreement (USMCA), 2021's infrastructure bill, and 2022's Chips & Science Act and Inflation Reduction Act (renewable energy bill).

Together, these initiatives represent the makings of a nascent US industrial policy. They are amplified by incentives to substitute cutting-edge digital technology for labor. This policy should shape activity during the next economic expansion and beyond. And its impact could intensify when the US dollar weakens, further enhancing US competitiveness.

In addition to central bank tightening, war in Ukraine, Chinese lockdowns, elevated European energy prices and potential geopolitical provocations are among the risks to monitor. We are also watching the degree to which home prices respond to elevated mortgage rates.

Longer term, we cannot rule out that greater centralized planning and supply chains that prioritize resiliency over efficiency could lead to a less dynamic allocation of resources. If so, a less favorable growth-inflation trade-off could ensue.

Equities

US equities declined 18.8% in the year through 31 October, as investors adjusted to a hawkish Fed trying to arrest inflation by slowing the economy. This came after robust returns in 2019-2021. We expect early-year challenges in 2023 followed by gains later in the year. Markets traditionally turn up a few months before the economy pulls out of a recession. S&P 500 earnings per share (EPS) is likely to contract by almost 10% in 2023 before growing again in 2024, in our view.

Canada's market trades on a lower multiple of 2023's estimated earnings than the US market, given its higher weighting in value-oriented financials, materials and energy companies. We have a neutral stance on Canadian large caps. This is based on our view that oil prices may not respond well to a recession.

We head into 2023 with end-of-cycle, defensive positioning. We see potential opportunities in high-quality US large-cap equities with dividend payments that have consistently increased over time. These stocks tend to be less volatile than the overall market, and this approach generally skews more toward consumer staples and industrials than would result from investing in the S&P 500 Index. We also favor healthcare stocks. They have outperformed the broader market in seven of the past eight times the economy decelerated.

FIGURE 1. NORTH AMERICA VALUATIONS

Priced as of close on 25 Nov 22	Free MC	Wgt	P/E			EPS YoY %			P/B	ROE	Div Yld	CAPE	Perf % (local)		Perf % (USD)	
	US$bn	%	22E	23E	24E	22E	23E	24E	22E	22E	22E	10yr	Weekly	YTD	Weekly	YTD
North America	37,492	64.5	18.3	17.4	16.1	5.6	5.4	9.5	3.7	20.0	1.7	32.1	1.5	−16.2	1.5	−16.5
USA	35,655	61.3	18.7	17.8	16.3	4.7	5.6	9.9	3.9	20.5	1.6	32.7	1.5	−16.8	1.5	−16.8
Canada	1,837	3.2	12.6	12.3	13.1	19.3	3.0	2.1	1.8	15.0	3.3	23.4	2.0	−4.1	2.1	−9.4

Source: FactSet Consensus, MSCI, as of 23 Nov 2022. Note: The above data are compiled based on companies in MSCI AC World Index. Free MC is free−float adjusted market capitalization for regions, markets and sectors. P/E (Price/Earnings), EPS growth (Earnings per share), P/B (Price/Book), Dividend yield (DY) and RoE (Return on Equity) are aggregated from FactSet consensus estimates. CAPE stands for Cyclically Adjusted Price to Earnings, and is defined as: Current price/ten−year average inflation−adjusted EPS. Indices all from MSCI. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only. Past performance is no guarantee of future returns. Real results may vary.

When rates do start falling, we see potential opportunity in technology, a sector that often outperforms in the twelve months following the first Fed rate cuts. Staples, retailers and transportation stocks also tend to perform well when the Fed lowers rates. In the first year of a new bull market, small-cap stocks often outperform large-cap stocks.

Longer term, we see opportunities in the intersection of technology and manufacturing – industrial technology – created by harnessing the potential of robotics, artificial intelligence, quantum algorithms, transportation logistics and other elements of the digital age.

As the internet of things (IoT) offers consumers smart doorbells and temperature control,

smart technology offers industrial tech firms the opportunity to re-engineer products, parts, materials, systems, processes and transportation utilizing vast amounts of data. Tech-enabled industrial firms, as well as their supply chains, stand to benefit from US industrial policy efforts and our unstoppable trends.

FIGURE 2. OUR FAVORED NORTH AMERICAN SECTORS

Priced as of close on 25 Nov 22	Free MC	Wgt	P/E			EPS YoY %			P/B	ROE	Div Yld	CAPE	Perf % (local)		Perf % (USD)	
	US$bn	%	22E	23E	24E	22E	23E	24E	22E	22E	22E	10yr	Weekly	YTD	Weekly	YTD
US	35,655	100	18.7	17.8	16.3	4.7	5.6	9.9	3.9	20.5	1.6	32.7	1.5	−16.8	1.5	−16.8
Consumer staples	2,410	6.8	21.9	21.1	19.6	3.4	3.7	7.7	6.2	29.1	2.5	29.7	2.1	−1.1	2.1	−1.1
Healthcare	5,378	15.1	17.5	17.9	16.5	1.9	0.9	8.1	4.6	25.4	1.5	38.4	1.9	−3.8	1.9	−3.8

Source: Citi Research, Worldscope, MSCI, FactSet, as of 28 Oct 2022. Note: The above data are compiled based on companies in MSCI AC World Index. The market capitalization for regions, markets and sectors are free−float adjusted. P/E (Price/Earnings), EPS growth (Earnings per share), P/B (Price/Book), Dividend yield and RoE (Return on Equity) are aggregated from FactSet consensus estimates (calendarized to December year end) with current prices. CAPE is calculated by current price divided by ten−year average EPS based on MSCI index level data. NM = Not Meaningful; NA = Not Available. Indices all from MSCI. Indices are unmanaged. An investor cannot invest directly in an index. They are shown for illustrative purposes only. Past performance is no guarantee of future returns. Real results may vary. All forecasts are expressions of opinion, are subject to change without notice and are not intended to be a guarantee of future events.

Fixed income

US fixed income markets have suffered one of their worst years ever in 2022 as the Fed moved aggressively to tackle stubborn inflation. After hiking rates by almost 4% in 2022, the market still expects the central bank to raise rates again in December and in early 2023 near 5%. With these expectations already discounted, long-term investors can now benefit from all types of US dollar-denominated fixed income offering very high yields relative to the past 15 years.

Monetary policy works with long and variable lags. Because the Fed has raised its Fed Funds Rate to so high and so quickly in 2022, the chances of recession in the US are elevated in 2023. One sign that the market is concerned about this is that longer dated Treasury bonds yield less than short-dated Treasury bonds, a phenomenon known as "an inverted yield curve."

For example, as of 23 November 2022, the one-year Treasury bill currently yields 4.74%, which is 100bps above the 10-year Treasury yield of 3.74%. The norm is for longer dated issues to have higher yields to reward investors for locking up their money for a longer period and forgoing potential investment opportunities along the way.

Amid the uncertainty, we are cautious. The primary ways to express caution in the bond market are by buying higher quality and shorter dated issues. Fortunately, given today's yield curve inversion, investors do not have to buy long-dated or lower rated bonds to earn significant yield. For investors with a heavy cash allocation, we favor shifting some into shorter duration Treasury bonds and shorter duration

US investment-grade bonds, with maturities of one to three years.

For investors who would like to lock in today's higher yields for slightly longer, they might consider three- to seven-year maturities. Selected BB-rated high-yield bonds – as well as selected investment-grade preferred securities – may provide incremental yield opportunities over traditional investment-grade corporate bonds. As such, they are worth considering if the risks are well understood.

Another possibility is fixed income ladder portfolios, with bonds of staggered maturity dates that allow for reinvestment of matured principal at potentially higher rates in the future. For investors concerned about inflation, Treasury Inflation Protected Securities (TIPS) pay a nominal yield plus the headline Consumer Price Inflation (CPI) rate and offer a portfolio hedging opportunity. For the first time in many years, TIPS pay a high nominal yield of over 1.4% for most maturities as of 23 November, which would allow investors to preserve their purchasing power.

For most higher US taxpaying investors, tax-exempt municipal bonds ("munis") offer an attractive tax-advantaged yield that may pay more than even lower rated investment-grade bonds on a tax-equivalent basis. Whether shorter or longer dated, munis may offer suitable core portfolio income, historically a good blend with dividend stocks.

Currencies

We expect the US dollar rally since 2021 to exhaust itself sometime in 2023 and then to reverse course. This is partly because the Fed

is likely to stop raising interest rates more aggressively than other G10 central banks as economic growth slows. Positioning for dollar strength has become a crowded trade as investors seek out "safe haven" assets amid uncertainty. The US has large trade and fiscal deficits that should prompt softening over time. We expect the Canadian dollar to strengthen once broader US dollar strength wanes.

FIGURE 3. NORTH AMERICA FIXED INCOME YIELDS (%)

US HY Corporates	8.7
US HY Bank Loans	8.7
Emerging Markets Agg (USD)	8.2
US HY Preferreds	8.2
US IG Preferreds	7.5
US HY Corporates (BB-rated)	7.1
US IG Corporates (BBB-rated)	5.7
US IG Corporates	5.4
US CMBS (IG only)	5.5
US ABS (fixed-rate)	5.5
US Agency Mortgage-backed	4.7
US Treasury (10-year)	4.2
Canada Sov (10-year)	3.0
US Municipals (10-year)	2.9

Source: Bloomberg Barclays, Bloomberg, as of 22 Nov 2022. Past performance is no guarantee of future returns. Real results may vary.

The emergence of US industrial policy

CHARLIE REINHARD
Head of Investment Strategy, North America

Industrial policy has a mixed reputation at best. The idea of governments forming a grand strategy to develop their economies or key sectors goes against free market orthodoxy. However, this is no mere question of ideology. Past experiments with industrial policy – particularly during its postwar heyday – raise serious doubts over the ability of politicians and public servants to intervene effectively and pick winners, be they sectors or firms. Costly failures at taxpayers' expense and accusations of pork-barrel politics are rife throughout the history of industrial policy.

Although not branded as such, a series of US policy initiatives in recent years together make up what we believe amounts to an industrial policy. The Trump and Biden administrations have both acted to boost US manufacturing competitiveness, strengthen supply chains, encourage domestic and foreign companies to relocate operations to its North American soil and restrict China's access to its technology ecosystem. The new US industry policy's aims – while broad-based – are especially focused on semiconductors, leadership in science, technology, engineering, and mathematics (STEM) subjects, research & development, clean energy, infrastructure and electric vehicles.

It is easy to understand why the US government is targeting these areas. Research-driven technological leadership has served the world's largest economy well in recent decades, as a driving force in real GDP growth and in its relative equity market performance. In the coming years and beyond, clean energy, electric vehicles and digitization are likely to become even more vital to prosperity in the US and elsewhere. The US government may believe that it can improve its international competitiveness and keep the upper hand in its economic rivalry with China by intervening more systematically to drive its economy.

How likely is this nascent US industrial policy to achieve its aims? Despite industrial policy's patchy performance over time, there have been notable successes, such as China. However, that country's authorities are very much more experienced at central planning and have fewer checks and balances to contend with than the US.

We identify a range of risks associated with the US' new path. A more prominent role for the US government in directing economic activity could lead to a less favorable mix of growth and inflation through a less efficient allocation of resources. Industrial policy initiatives could also become snarled up in domestic political controversy, especially with the two houses of Congress now each under the control of different parties. Today's more polarized US-China relationship will also see diminished cooperation between the two, perhaps stifling trade and the ease of innovation. It is very early days for US industrial policy and many of its results may take some years to materialize.

We believe these efforts will provide a long-term tailwind for a number of our unstoppable trends, but only in time will it become clearer to what degree. We will be monitoring the situation closely.

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.

Direct Private Investments or Direct Investments imply the purchase or acquisition of a stake or controlling interest in a business, asset or special purpose vehicle/instrument by means other than the purchase of shares.

Emerging Markets (EM) Hard Currency Fixed Income is represented by the FTSE Emerging Market Sovereign Bond Index (ESBI), covering hard currency emerging market sovereign debt.

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 Emerging Market 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.

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 are composed of investment managers employing different investment styles as characterized by different subcategories - 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 a 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.

High Yield Bank Loans are debt financing obligations issued by a bank or other financial institution to a company or individual that holds legal claim to the borrower's assets in the event of a corporate bankruptcy. These loans are usually secured by a company's assets, and often pay a high coupon due to a company's poor (noninvestment grade) credit worthiness.

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.

Private Equity is an alternative investment class which at its most basic form is the capital or ownership of shares not publicly traded or listed on a stock exchange. Its characteristics are often driven by those for Developed Market Small Cap Equities, adjusted for illiquidity, sector concentration, and greater leverage.

Real Estate Investment Trust or REIT is a corporate entity that either has bulk or all its asset base, income and investments related to real estate. In the US under Security and Exchange Commission (SEC)

guidelines, for an entity to qualify as an REIT, at least 90% of its taxable annual income to shareholders in the form of dividends must be from real estate. While typically REITs are publicly traded, not all are, as Public Non–Listed REITs (PNLRs) can register with SEC as REITs, but do not trade on major stock exchanges.

INDEX DEFINITIONS:

Ball Metaverse Index is a selection of companies in categories defined by the Metaverse Market Map.

Bloomberg Global Aggregate Bond Index is a flagship measure of global investment grade debt from twenty–four local currency markets. This multi–currency benchmark includes treasury, government–related, corporate and securitized fixed–rate bonds from both developed and emerging markets issuers.

Bloomberg JPMorgan Asia Currency Index or ADXY is a US dollar tradable index of emerging Asian currencies. It creates a benchmark for monitoring Asia's currency markets on an aggregate basis.

Bloomberg US Aggregate Index is a broad–based flagship benchmark that measures the investment grade, US dollar denominated, fixed–rate taxable bond market.

Bloomberg US Corporate Bond Index measures the investment grade, fixed–rate, taxable corporate bond market. It includes US dollar denominated securities publicly issued by US and non–US industrial, utility and financial issuers.

Bloomberg US Treasury Index measures US dollar–denominated, fixed–rate, nominal debt issued by the US Treasury. Bloomberg–JP Morgan Asia currency index is a spot index of the most actively traded currency pairs in Asia's emerging markets valued against the US dollar.

FTSE All–World Index is a stock market index representing global equity performance that covers over 3,100 companies in 47 countries starting in 1986.

FTSE NAREIT Mortgage REITS Index is a freefloat adjusted, market capitalization–weighted index of US Mortgage REITs. Mortgage REITs include all tax–qualified REITs with more than 50 percent of total assets invested in mortgage loans or mortgage–backed securities secured by interests in real property.

HFRI ED Distressed/Restructuring Index tracks distressed/restructuring strategies which employ an investment process focused on corporate fixed income instruments, primarily on

corporate credit instruments of companies trading at significant discounts to their value at issuance or obliged (par value) at maturity as a result of either formal bankruptcy proceeding or financial market perception of near–term proceedings. Managers are typically actively involved with the management of these companies, frequently involved on creditors' committees in negotiating the exchange of securities for alternative obligations, either swaps of debt, equity or hybrid securities. Managers employ fundamental credit processes focused on valuation and asset coverage of securities of distressed firms; in most cases portfolio exposures are concentrated in instruments which are publicly traded, in some cases actively and in others under reduced liquidity but in general for which a reasonable public market exists. In contrast to Special Situations, Distressed Strategies employ primarily debt (greater than 60%) but also may maintain related equity exposure.

Indxx Global Cloud Computing Index tracks the performance of companies that are in the Cloud Computing Industry. The Cloud Computing Industry is involved in the delivery of computing services, servers, storage, databases, networking, software, analytics and more over the Internet which is referred to as 'The Cloud'.

Indxx Global Fintech Thematic Index tracks the performance of companies listed in developed markets that are offering technology–driven financial services which are disrupting existing business models in the financial services and banking sectors.

MSCI AC Asia ex–Japan Index captures large and mid–cap representation across 2 of 3 Developed Markets (DM) countries* (excluding Japan) and 9 Emerging Markets (EM) countries* in Asia. With 1,187 constituents, the index covers approximately 85% of the free float–adjusted market capitalization in each country.

MSCI AC World Automobiles Index is composed of large– and mid–cap automobile stocks across emerging and developed countries.

MSCI ACWI World ex–USA Index covers large and mid cap representation across 22 of 23 Developed Markets (DM) countries (excluding the US) and 27 Emerging Markets (EM) countries. With 2,352 constituents, the index covers approximately 85% of the global equity opportunity set outside the US.

MSCI AC World Index is designed to represent performance of the full opportunity set of large– and mid–cap stocks across 23 developed and 24 emerging markets. As of May 2022, it covers more than 2,933 constituents across 11 sectors and approximately 85% of the free float–adjusted market capitalization in each market.

MSCI Brazil Index measures the performance of large and midcap

segments of the Brazilian market. With 48 constituents, the index covers about 85% of the Brazilian equity universe.

MSCI China Index captures large and mid–cap representation across China A shares, H shares, B shares, Red chips, P chips and foreign listings (e.g. ADRs). With 704 constituents, the index covers about 85% of this China equity universe.

MSCI Emerging Markets Index captures large and midcap representation across twenty–four Emerging Markets (EM) countries. With 837 constituents, the index covers approximately 85% of the free float–adjusted market capitalization in each country.

MSCI Emerging Markets (EM) Latin America Index captures large and mid–cap representation across five Emerging Markets (EM) countries in Latin America. With 113 constituents, the index covers approximately 85% of the free float adjusted market capitalization in each country.

MSCI Global Alternative Energy Index includes developed and emerging market large–, mid– and small–cap companies that derive 50% or more of their revenues from products and services in Alternative energy.

MSCI World Information Technology Index tracks the large– and mid–cap IT segments across 23 developed markets countries.

MSCI World Index covers large– and mid–cap equities across 23 Developed Markets countries. With 1,603 constituents, the index covers approximately 85% of the free float–adjusted market capitalization in each country.

MSCI World Momentum Index is designed to reflect the performance of an equity momentum strategy by emphasizing stocks with high price momentum, while maintaining reasonably high trading liquidity, investment capacity and moderate index turnover.

Nasdaq 100 is a large–cap growth index consisting of 100 of the largest US and international nonfinancial companies listed on the Nasdaq Stock Market based on market capitalization.

Nasdaq CTA Cybersecurity Index tracks the performance of companies engaged in the Cybersecurity segment of the technology and industrial sectors. The Index includes companies primarily involved in the building, implementation and management of security protocols applied to private and public networks, computers and mobile devices in order to provide protection of the integrity of data and network operations.

Nasdaq OMX Clean Edge Smart Grid Infrastructure Index includes

companies that are primarily engaged and involved in electric grid; electric meters, devices, and networks; energy storage and management; and enabling software used by the smart grid and electric infrastructure sector.

Prime Mobile Payments Index provides a reference measure for the global payments industry by focusing on companies facilitating the mass migration from physical cash registers to a mobile point of sale. Potential beneficiaries of this growing trend include software providers, payment processors, gateways, and credit card networks. Those companies collectively represent mobile payments industry.

ROBO Global Robotics & Automation Index tracks the robotics, automation, and AI revolution for investors. It includes more than 80 robotics and automation stocks across 11 subsectors in over 14 countries.

ROBO Global Healthcare Technology and Innovation Index tracks the global value chain of healthcare technology and innovation. It includes more than 80 stocks across 9 subsectors in 15 countries.

Russell 2000 Index measures the performance of the small–cap segment of the US equity universe. The Russell 2000 Index is a subset of the Russell 3000 Index representing some 10% of the total market capitalization of that index.

S&P 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.

S&P 500 Healthcare Index includes companies from the S&P 500 Index that are involved from such areas as pharmaceuticals, healthcare equipment & supplies, biotechnology and healthcare providers and services.

S&P 500 Hotels, Resorts and Cruise Lines Index is a sub–index of the S&P 500 Index and represents the performance of hotels, resorts and cruise line companies that are represented in the latter index.

S&P Global Dividend Aristocrats is designed to measure the performance of the highest dividend yielding companies within the S&P Global Broad Market Index (BMI) that have followed a policy of increasing or stable dividends for at least ten consecutive years.

Securities Industry and Financial Markets Association or SIFMA Municipal Swap Index is a 7–day high–grade market index comprised of tax–exempt Variable Rate Demand Obligations (VRDOs) with certain characteristics. The Index is calculated and published by

Bloomberg. The Index is overseen by SIFMA's Municipal Swap Index Committee.

Solactive e-commerce Index tracks the price movements in shares of companies which are active in the field of e-commerce. This may include companies that operate e-commerce platforms, provide e-commerce software, analytics or services, and/or primarily sell goods and services online and generate the majority of their overall revenue from online retail.

Solactive Social Media Index tracks the price movements in shares of companies which are active in the social media industry, including companies that provide social networking, file sharing, and other web-based media applications. A maximum of 50 components are included and weighted according to freefloat market capitalization. The index is calculated as a total return index in US dollars.

VIX or the Chicago Board Options Exchange (CBOE) Volatility Index, is a real-time index representing the market's expectation of 30-day forward-looking volatility, derived from the price inputs of the S&P 500 index options.

OTHER TERMINOLOGY:

Adaptive Valuations Strategies or AVS 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.

Assets Under Management or AUM are the total market value of the investments that a person or entity handles on behalf of investors.

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.

Digital commerce involves transactions conducted online to purchase goods and services. Digital remittances are funds sent from one person to another over the internet, typically across borders.

EU or the European Union is a political and economic union of 27 member states in Europe.

Eurodollar futures and options are market tools for traders to express views on future interest rate moves.

Fed funds rate or the effective federal funds rate (EFFR) is calculated as a volume-weighted median of overnight federal funds transactions reported in the US FR 2420 Report of Selected Money Market Rates. The federal funds market consists of domestic unsecured borrowings in US dollars by depository institutions from other depository institutions and certain other entities, primarily government-sponsored enterprises.

Internal Rate of Return or IRR is used to measure the profitability of potential investments. It is defined as the discount rate at which the net present value (NPV) of all cash flows from an investment are equal to zero. This measure of return takes into consideration the time value of money and allows for comparison with projected rates of return on other investments.

Mobile POS payments are payments made at the point of sale but facilitated via mobile devices like smart phones.

Sharpe ratio is a measure of risk-adjusted return, expressed as excess return per unit of deviation, typically referred to as risk.

SPAC, short for Special Purpose Acquisition Company, also known as a "blank check company", is a shell corporation listed on a stock exchange with the purpose of acquiring a private company, thereby making it public without going through the traditional initial public offering process.

Strategic Return Estimates or SREs are based on Citi Private Bank's forecast of returns for specific asset classes (to which the index belongs) over a 10-year time horizon. The forecast for each specific asset class is made using a proprietary methodology based on the assumption that equity valuations revert to their long-term trend over time.

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Bond rating equivalence

Alpha and/or numeric symbols used to give indications of relative credit quality. In the municipal market, these designations are published by the rating services. Internal ratings are also used by other market participants to indicate credit quality.

Bond credit quality ratings	Rating agencies		
Credit risk	**Moody's[1]**	**Standard and Poor's[2]**	**Fitch Ratings[2]**
Investment grade			
Highest quality	Aaa	AAA	AAA
High quality (very strong)	Aa	AA	AA
Upper medium grade (strong)	A	A	A
Medium grade	Baa	BBB	BBB
Not Investment grade			
Lower medium grade (somewhat speculative)	Ba	BB	BB
Low grade (speculative)	B	B	B
Poor quality (may default)	Caa	CCC	CCC
Most speculative	Ca	CC	CC
No interest being paid or bankruptcy petition filled	C	D	C
In default	C	D	D

[1] The ratings from Aa to Ca by Moody's may be modified by the addition of a 1, 2, or 3 to show relative standing within the category.

[2] The ratings from AA to CC by Standard and Poor's and Fitch Ratings may be modified by the addition of a plus or a minus to show relative standing within the category.

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Equity Premia as Low as Three Percent? Evidence from Analysts' Earnings Forecasts for Domestic and International Stock Markets

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ABSTRACT

The returns earned by U.S. equities since 1926 exceed estimates derived from theory, from other periods and markets, and from surveys of institutional investors. Rather than examine historic experience, we estimate the equity premium from the discount rate that equates market valuations with prevailing expectations of future flows. The accounting flows we project are isomorphic to projected dividends but use more available information and narrow the range of reasonable growth rates. For each year between 1985 and 1998, we find that the equity premium is around three percent (or less) in the United States and five other markets.

THE EQUITY RISK PREMIUM LIES at the core of financial economics. Representing the excess of the expected return on the stock market over the risk-free rate, the equity premium is unobservable and has been estimated using different approaches and samples. The estimates most commonly cited in the academic literature are from Ibbotson Associates' annual reviews of the performance of various portfolios of U.S. stocks and bonds since 1926. Those estimates lie in the region of seven to nine percent per year, depending on the specific series examined. This historic evidence is objective and easy to interpret and has convinced many, especially academic financial economists, that the Ibbotson estimates are the best available proxies for the equity premium (Welch (1999)).[1] For discussion purposes, we use "eight percent"

[1] The annualized distribution of monthly common stock returns over the 30-day T-bill rate has a mean of 9.12 percent and a standard deviation of 20.06 percent (from data in Table A-16, Ibbotson Associates (1999)). If these 73 observations are independent and identically distributed, the sample mean is a reasonable estimate for the equity premium, and the standard error of 2.35 percent associated with the sample mean allows an evaluation of other hypothesized values of the equity premium.

and "the Ibbotson estimate" interchangeably to represent the historic mean of excess returns earned by U.S. equities since 1926. (Unless noted otherwise, all amounts and rates are stated in nominal, not real, terms.)

Our objective is to show empirically that eight percent is too high an estimate for the equity premium in recent years. Rather than examine observed returns, we estimate for each year since 1985 the discount rate that equates U.S. stock market valuations with the present value of prevailing forecasts of future flows. Subtracting 10-year risk-free rates from these estimated discount rates suggests that the equity premium is only about three percent.[2] An examination of five other large stock markets (Canada, France, Germany, Japan, and the United Kingdom) provides similar results. Despite substantial variation in the underlying fundamentals across markets and over time, observing that every one of our 69 country-year estimates lies well below eight percent suggests that the Ibbotson estimate is too high for our sample period. Examination of various diagnostics (such as implied future profitability) confirms that the projections required to support an eight percent equity premium are unreasonable and inconsistent with past experience.

Some features of our study should be emphasized at the outset. As we only seek to establish a reasonable upper bound for the equity premium, we select long-term growth assumptions that exceed past experience and do not adjust for optimism in the analyst forecasts used.[3] Also, we use the simplest structure necessary to conduct our analysis. Our estimates refer to a long-term premium expected to hold over all future years (whereas historical estimates measure one-period premia), and we assume that the premium is constant over those future years (we do incorporate anticipated variation in risk-free rates). Finally, each annual estimate is conditional on the information available in that year; we do not consider an unconditional equity premium toward which those conditional premia might gravitate in the long run.

We are not the first to question the validity of the Ibbotson estimate. Mehra and Prescott (1985) initiated a body of theoretical work that has examined the so-called "equity premium puzzle." Their model indicates that the variance–covariance matrix of aggregate consumption and returns on stocks and bonds, when combined with reasonable risk-aversion parameters, implies equity premium estimates that are less than one percent. Despite subsequent efforts to bridge this gap (e.g., Abel (1999)), concerns remain about the validity of the Ibbotson estimate (see Kocherlakota (1996), Cochrane (1997), and Siegel and Thaler (1997) for summaries).

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[2] Gebhardt, Lee, and Swaminathan (forthcoming) find similar results when estimating firm-specific discount rates, rather than the market-level discount rates considered in this paper.

[3] As described later, analyst optimism has declined systematically over time and a simple adjustment for mean bias is inappropriate. Bayesian adjustments to control for observed analyst optimism are not considered because we focus on an upper bound. In general, we do not use more complex econometric techniques and data refinements that are available to get sharper point estimates (e.g., Mayfield (1999), Vuolteenaho (1999), and Ang and Liu (2000)).

Surveys of institutional investors also suggest an equity premium substantially below eight percent (e.g., Burr (1998)), and there are indications that this belief has been held for many years (e.g., Benore (1983)).[4] Also, the weighted average cost of capital used in discounted cash flow valuations provided in analysts' research reports usually implies an equity premium below five percent. Current share prices appear systematically overpriced if an eight percent equity premium is used on reasonable projections of future flows. This overpricing is more evident when examining mature firms, where there is less potential for disagreement about growth opportunities.

To identify possible reasons why the Ibbotson estimate might overstate the equity premium in recent years, apply the Campbell (1991) decomposition of observed returns (in excess of the expected risk-free rate) for the market portfolio. The four components are: (1) the expected equity premium for that period; (2) news about the equity premium for future periods; (3) news about current and future period real dividend growth; and (4) news about the real risk-free rate for current and future periods. Here, news represents changes in expectations between the beginning and end of the current period (for current period dividend growth and risk-free rates, it represents the unexpected portion of observed values). Summing up both sides of this relation for each year since 1926 indicates that the average excess return observed would exceed the equity premium today if: (1) conditional one-year-ahead equity premia have declined; (2) the conditional long-term equity premium anticipated for future years has declined; (3) news about real dividend growth was positive on average; or (4) the expected real risk-free rate has declined.

The first and second reasons for why the Ibbotson estimate overstates the current equity premium highlight the potential pitfalls of estimating equity premia from observed returns. Holding aside news about dividends and risk-free rates, valuations would exceed expectations if the equity premium has declined (since present values increase when expected rates of return decline). That is, unexpected changes in the equity premium cause historical equity premium estimates to move in the opposite direction. Blanchard (1993) concludes that the equity premium has declined since 1926 to two or three percent by the early 1990s, and speculates that this decline is caused by a simultaneous decline in expected real rates of return on stocks and an increase in expected real risk-free rates. (This increase in expected real risk-free rates is another puzzle, but that puzzle is beyond the scope of this paper.) The remarkable run-up in stock prices during the 1990s, both domestically as well as internationally, is also consistent with a recent decline

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[4] While many argue for an equity premium between two and three percent (e.g., Bogle (1999, p. 76)), some suggest that the premium is currently close to zero (e.g., Glassman and Hassett (1998), and Wien (1998)). Surveys of *individual* investors, on the other hand, suggest equity premia even higher than the Ibbotson estimate. For example, the *New York Times* (October 10, 1997, page 1, "High hopes of mutual fund investors"), reported an equity premium in excess of 16 percent from a telephone survey conducted by Montgomery Asset Management.

in the equity premium. Stulz (1999) argues that increased globalization has caused equity premia to decline in all markets.

Examination of historic evidence over other periods and markets suggests that the U.S. experience since 1926 is unusual. Siegel (1992) finds that the excess of observed annual returns for NYSE stocks over short-term government bonds is 0.6, 3.5, and 5.9 percent over the periods 1802 to 1870, 1871 to 1925, and 1926 to 1990, respectively. Jorion and Goetzmann (1999) examine the evidence for 39 equity markets going back to the 1920s, and conclude that the high equity premium observed in the United States appears to be the exception rather than the rule. Perhaps some stock markets collapsed and those markets that survived, like the U.S. exchanges, exhibit better performance than expected (see Brown, Goetzmann, and Ross (1995)). This evidence is consistent with the third reason for the high Ibbotson premium: since 1926, news about real dividend growth for U.S. stocks has been positive on average.

Partially in response to these limitations of inferring equity premia from observed returns, financial economists have considered forward-looking approaches based on projected dividends.[5] Informally, expected rates of return on the market equal the forward dividend yield plus expected growth in dividends (this dividend growth model is discussed in Section I). While dividend yields are easily measured, expected dividend growth in perpetuity is harder to identify. Proxies used for expected dividend growth include observed growth in earnings, dividends, or economy-wide aggregates (e.g., Fama and French (2000)). Unfortunately, the dividend growth rate that can be sustained in perpetuity is a hypothetical rate that is not necessarily anchored in any observable series, leaving considerable room for disagreement (see the Appendix for explanation).

We use a different forward-looking approach, labeled the abnormal earnings (or residual income) model, to mitigate problems associated with the dividend growth model.[6] Recognizing that dividends equal earnings less changes in accounting (or book) values of equity allows the stream of projected dividends to be replaced by the current book value of equity plus a function of future accounting earnings (details follow in Section I). While book values feature prominently in the model, the inclusion of future abnormal earnings makes it isomorphic to the dividend discount model. Relative to the dividend growth model, this approach makes better use of currently

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[5] A related approach is to run predictive regressions of market returns or equity premium on dividend yields and other variables (e.g., Campbell and Shiller (1988)). We do not consider that approach because the declining dividend yields in recent years have caused predicted equity premium to turn negative (e.g., Welch (1999)).

[6] The approach appears to have been discovered independently by a number of economists and accountants over the years. Preinreich (1938) and Edwards and Bell (1961) are two early cites. More recently, a large body of analytical and empirical work has utilized this insight (e.g., Penman (1999)). Examples of empirical investigations include market myopia (Abarbanell and Bernard (1999)), explaining cross-sectional variation in returns (Liu and Thomas (2000)), and stock picking (Frankel and Lee (1998a, 1998b)).

available information to reduce the importance of assumed growth rates, and it narrows the range of allowable growth rates by focusing on growth in rents, rather than dividend growth.

If the equity premium is as low as our estimates suggest, required rates of return (used for capital budgeting, regulated industries, and investment decisions) based on the Ibbotson estimate are severely overstated. Second, a smaller equity premium reduces the importance of estimating beta accurately (because required rates of return become less sensitive to variation in beta) and increases the magnitude of beta changes required to explain abnormal returns observed for certain market anomalies. Finally, reducing substantially the magnitude of the equity premium puzzle to be explained might reinvigorate theory-based studies.

In Section I we develop the abnormal earnings approach used in this paper and compare it with the dividend growth model. Section II contains a description of the sample and methodology. The equity premium estimates for the United States are reported in Section III, and those for the five other markets are provided in Section IV. To confirm that our estimates are robust, we conducted extensive sensitivity analyses, which we believe represent an important contribution of our research effort. A summary of that investigation is reported in Section V (details are provided in Claus and Thomas (1999a)) and Section VI concludes.

I. Dividend Growth and Abnormal Earnings Models

The Gordon (1962) dividend growth model is described in equation (1). This relation implies that the expected rate of return on the stock market (k^*) equals the forward dividend yield (d_1/p_0) plus the dividend growth rate in perpetuity (g) expected for the market.

$$p_0 = \frac{d_1}{k^* - g} \Rightarrow k^* = \frac{d_1}{p_0} + g \tag{1}$$

where

p_0 = current price, at the end of year 0,
d_t = dividends expected at the end of future year t,
k^* = expected rate of return on the market, derived from the dividend growth model, and
g = expected dividend growth rate, in perpetuity.

The Gordon growth model is a special case of the general Williams (1938) dividend discount model, detailed in equation (2), where dividend growth is constrained to equal g each year.

$$p_0 = \frac{d_1}{(1 + k^*)} + \frac{d_2}{(1 + k^*)^2} + \frac{d_3}{(1 + k^*)^3} + \cdots \tag{2}$$

Research using the dividend growth model has often assumed that g equals forecasted earnings growth rates obtained from sell-side equity analysts, who provide earnings forecasts along with their buy/sell recommendations. These forecasts refer to earnings growth over the next "cycle," which is commonly interpreted to represent the next five years. Consequently, we refer to this earnings growth forecast as g_5. While most studies using g_5 as a proxy for g have focused on the U.S. market alone (e.g., Brigham, Shome, and Vinson (1985)), some have examined other major equity markets also (e.g., Khorana, Moyer, and Patel (1997)). Estimates of the equity premium based on the assumption that g equals g_5 are similar in magnitude to the Ibbotson estimate derived from historical data. For example, Moyer and Patel (1997) estimate the equity premium each year over their 11-year sample period (1985 to 1995) and generate a mean estimate of 9.38 (6.96) percent relative to the 1-year (30-year) risk-free rate.

However, others have balked at using g_5 as a proxy for g (e.g., Malkiel (1996), Cornell (1999)) because it appears unreasonably high at an intuitive level, and have stepped down assumed growth rates. Forecasted values of g_5 for the United States over our sample period, which are close to 12 percent in all years, exceed nominal growth in S&P earnings, which has been only 6.6 percent since the 1920s (*Wall Street Journal*, June 16, 1997, "As stocks trample price measures, analysts stretch to justify buying"). Also, the real growth rate implied by the nominal 12 percent earnings growth rate exceeds both forecast and realized growth in GDP (since 1970, forecasts of expected real growth in GDP have averaged 2.71 percent, and realized real growth has averaged 2.81 percent).

While we show that g_5 is systematically optimistic relative to realized earnings, it is difficult to infer reliably the level of that optimism from the relatively short time-series of forecast errors available (reliable data on analyst forecasts go back only about 15 years). Moreover, the incentives for analysts to make optimistic forecasts vary across firms and over time. For example, the literature on U.S. analysts' forecasts suggests that while analysts tended to make optimistic forecasts early in our sample period (to curry favor with management), more recently, management has tended to guide near-term analyst forecasts downward to be able to meet or beat them when announcing earnings.[7] Even if unbiased estimates of near-term earnings growth (g_5) were available, the Appendix describes why those estimates as well as observed growth rates are conceptually different from g, the hypothetical dividend growth that can be sustained in perpetuity.

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[7] Results reported in Table VI offer clear evidence of such a decline in optimism for all horizons. Bagnoli, Beneish, and Watts (1999) document how recent analyst forecasts are systematically below reported earnings for their sample, and also below "whisper" forecasts that are generally viewed as representing the market's true earnings expectations. Matsumoto (1999) offers evidence in support of management guiding analyst forecasts downward, and also investigates factors that explain cross-sectional variation in this propensity to guide analysts.

The abnormal earnings model is an alternative that mitigates many of the problems noted above. Expected dividends can be related to forecasted earnings using equation (3) below, and that relation allows a conversion of the discounted dividends relation in equation (2) to the abnormal earnings relation in equation (4).

$$d_t = e_t - (bv_t - bv_{t-1}) \tag{3}$$

$$p_0 = bv_0 + \frac{ae_1}{(1+k)} + \frac{ae_2}{(1+k)^2} + \frac{ae_3}{(1+k)^3} + \ldots, \tag{4}$$

where

e_t = earnings forecast for year t,

bv_t = expected book (or accounting) value of equity at the end of year t,

$ae_t = e_t - k(bv_{t-1})$ = expected abnormal earnings for year t, or forecast accounting earnings less a charge for the cost of equity, and

k = expected rate of return on the market portfolio, derived from the abnormal earnings model.

Equation (3), also known as the "clean surplus" relation, requires that all items affecting the book value of equity (other than transactions with shareholders, such as dividends and share repurchases/issues) be included in earnings. Under U.S. accounting rules, almost all transactions satisfy the clean-surplus assumption. An examination of the few transactions that do not satisfy this relation suggests that these violations occur ex post, and are not anticipated in analysts' earnings forecasts (e.g., Frankel and Lee (1998b)). Since we construct future book values using equation (3), by adding forecast income to and subtracting forecast dividends from beginning book values, clean surplus is maintained and the dividend and abnormal earnings relations in equations (2) and (4) are isomorphic.

Equation (4) shows that the current stock price equals the current book value of equity plus the present value of future expected abnormal earnings. Abnormal earnings, a proxy for economic profits or rents, adjusts reported earnings by deducting a charge for equity capital. Note that the market discount rates estimated from the abnormal earnings and dividend growth approaches are labeled differently: k and k^*. Also, the standard transversality conditions apply to both models: in the limit as t approaches infinity, the present value of future price, p_t (difference between price and book value, $p_t - bv_t$) must tend to zero in equation (2) (in equation (4)).

Financial economists have expressed concerns about accounting earnings deviating from "true" earnings (and book values of equity deviating from market values), in the sense that accounting numbers are noisy and easily manipulated. However, the equivalence between equations (2) and (4) is not impaired by differences between accounting and economic numbers, nor is it affected by the latitude available within accounting rules to report different

accounting numbers. As long as forecasted earnings satisfy the clean surplus relation in equation (3) in terms of expectations, equation (4) is simply an algebraic restatement of equation (2), subject to the respective transversality conditions mentioned above.

Since the I/B/E/S database we use does not provide analysts' earnings forecasts beyond year +5, we assume that abnormal earnings grow at a constant rate (g_{ae}) after year +5, to incorporate dates past that horizon. Equation (4) is thus adapted as follows.

$$
p_0 = bv_0 + \frac{ae_1}{(1+k)} + \frac{ae_2}{(1+k)^2} + \frac{ae_3}{(1+k)^3} + \frac{ae_4}{(1+k)^4}
$$
$$
+ \frac{ae_4}{(1+k)^5} + \left[\frac{ae_5(1+g_{ae})}{(k-g_{ae})(1+k)^5} \right].
$$

(5)

The last, bracketed term is a terminal value that captures the present value of abnormal earnings after year +5. The terms before are derived from accounting statements (bv_0) and analyst forecasts $(e_1$ to $e_5)$. Note that there are three separate growth rates in this paper and the different growth rates refer to different streams and periods and arise from different sources. The rate g refers to dividend growth in perpetuity and is assumed by the researcher; g_5 refers to growth in accounting earnings over the first five years and is provided by financial analysts; and g_{ae} refers to abnormal earnings growth past year +5 and is assumed by the researcher.

Whereas expected rates of return are typically viewed as being stochastic (Samuelson (1965)), k^* and k in equations (1) and (5) are nonstochastic discount rates. Barring a few recent exceptions (e.g., Ang and Liu (2000) and Vuolteenaho (1999)), the literature has assumed that expected rates of return can be approximated by discount rates. We make that assumption too. While equation (1) is designed to only reflect a flat k^*, equation (2) can be restated to incorporate predictable variation over time in discount rates. Similarly, equation (5) can be restated to incorporate nonflat discount rates, as shown in Claus and Thomas (1999a). We consider the case when the equity premium is assumed to remain flat but discount rates vary over future periods based on the term-structure of risk-free rates. This restated version of equation (5) is

$$
p_0 = bv_0 + \sum_{t=1}^{\infty} \left[\frac{ae_t}{\prod_{s=1}^{t}(1+r_{fs}+rp)} \right],
$$

$(5a)$

where

r_{fs} = forward one-year risk-free rate for year s,
rp = equity risk premium, assumed constant over all future years,
ae_t = expected abnormal earnings for year t, equals $e_t - bv_{t-1}(r_{ft}+rp)$ for years +1 through +5, and equals $ae_5(1+g_{ae})^{t-5}$, from year +6 on.

While the abnormal earnings stream in equation (4) is equivalent to the corresponding dividend stream in equation (2), the abnormal earnings relation in equation (5) (and equation (5a)) offers the following advantages over the dividend growth model in equation (1). First, a substantial fraction of the "value profile" for the abnormal earnings model in equation (5) is fixed by numbers that are currently available and do not need to be assumed by the researcher (current book value and abnormal earnings for years +1 through +5). Value profile is a representation of the fraction of total value captured by each future year's flows. In contrast, the entire value profile for the dividend growth model is affected by the assumed growth rate, g. Since the fraction of value determined by assumed growth rates is lower for the abnormal earnings approach, those risk premium estimates are more reliable.

Second, in contrast to the potential for disagreement about a reasonable range for g, the rate at which rents can grow in perpetuity after year +5, g_{ae}, is less abstract and easier to gauge using economic intuition. For example, to obtain equity premia around 8 percent, rents at the market level would have to grow forever at about 15 percent, on average. It is unlikely that aggregate rents to U.S. equity holders would grow at such high rates in perpetuity because of factors such as antitrust actions, global competition, and pressure from other stakeholders. The historical evidence (e.g., Myers (1999)) is also at odds with such high growth rates in abnormal earnings.

Third, future streams for a number of value-relevant indicators, such as price-to-book ratios (P/B), price-to-earnings ratios (P/E), and accounting return on equity (*roe*), can also be projected under the abnormal earnings approach. This allows one to paint a more complete picture of the future for different assumed growth rates. Analysis of the levels of future P/B and profitability (excess of *roe* over k) implied by growth rates required to obtain equity premium estimates around eight percent are also inconsistent with past experience.

II. Data and Methodology

I/B/E/S provides the consensus of all available individual forecasts as of the middle (the Thursday following the second Friday) of each month. Forecasts and prices should be gathered soon after the prior year-end, as soon as equity book values (bv_0) are available. Rather than collect forecasts at different points in the year, depending on the fiscal year-end of each firm, we opted to collect data as of the same month each year for all firms to ensure that the risk-free rate is the same across each annual sample. Since most firms have December year-ends, and book values of equity can be obtained from the balance sheets that are required to be filed with the SEC within 90 days of the fiscal year-end, we collect forecasts as of April each year.[8] For

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[8] For the few firm-years not filing within this 90-day deadline, the book value of equity can be inferred by the market by adding (subtracting) fourth quarter earnings (dividends) from the third quarter book value of equity.

firms with fiscal year-ends other than December, this procedure creates a slight upward bias in estimated equity premium, since the stock prices used (as of April) are on average higher than those near the prior year's fiscal year-end, when bv_0 was released. In addition to earnings forecasts, I/B/E/S also provides data for actual earnings per share, dividends per share, share prices, and the number of outstanding shares. Equity book values are collected from COMPUSTAT's Industrial Annual, Research, and Full Coverage Annual Files, for years up to and including 1997.

The sample includes firms with I/B/E/S earnings forecasts for years +1 and +2 (e_1 and e_2) and a five-year growth forecast (g_5) as well as share prices and shares outstanding as of the I/B/E/S cut off date each April. We also require nonmissing data for the prior year's book value, earnings, and dividends. Explicit forecasts for years +3, +4, and +5 are often unavailable, and are generated by projecting the growth rate g_5 on the prior year's earnings forecast: $e_t = e_{t-1}(1 + g_5)$.[9]

Earlier years in the I/B/E/S database, before 1985, were dropped because they provided too few firms with complete data to represent the overall market. From 1985 on, the number of firms with available data increases substantially. As shown in column 1 of Table I, the number of sample firms increases from 1,559 in 1985 to 3,673 in 1998. Comparison with the total number of firms and market capitalization of all firms on NYSE, AMEX, and Nasdaq each April indicates that, although our sample represents only about 30 percent of all such firms, it represents 90 percent or more of the total market capitalization. Overall, we believe our sample is fairly representative of the value-weighted market, and refer to it as "the market" hereafter.

Firm-level data are aggregated each year to generate market-level earnings, book values, dividends, and capitalization. Actual data for year 0 (the full fiscal year preceding each April when forecasts were collected) is provided in columns 2 through 6 of Table I. Forecasted and projected earnings for years +1 through +5 are reported in columns 7 through 11.

Table I reveals an interesting finding relating to dividend payouts: the ratio of market dividends to earnings is around 50 percent in most years (with a noticeable decline toward the end of the sample period).[10] We use this 50 percent payout ratio to project future dividends from earnings fore-

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[9] If any of the explicit earnings forecasts for years +2, +3, +4, or +5 were negative, they were not used to project earnings for subsequent years. For about five percent of our sample, explicit earnings forecasts are available for all five years and do not need to be inferred using g_5. That subsample was investigated to confirm that projections based on five-year growth rates are unbiased proxies for the explicit forecasts for those years.

[10] Although this statistic is well known to macroeconomists, it is higher than average firm-level dividend payouts. Note, however, that aggregate earnings include many loss firms, especially in the early 1990s, when earnings were depressed because of write-offs and accounting changes. This results in a higher aggregate dividend payout than the average firm-level payout ratio, which is computed over profitable firms only (the payout ratio is meaningless for loss firms). Also, since the aggregate payout ratio is a value-weighted average dividend payout, it is more representative of large firms, which tend to have higher dividend payouts than small firms.

Table I

Market Capitalization, Book Values, Dividends, and Actual and Forecast Earnings for U.S. Stocks (1985 to 1998)

The market consists of firms on the I/B/E/S Summary files with forecasts for years +1, +2, and a five-year earnings growth estimate (g_5) as of April each year, and actual earnings per share, dividends per share, number of shares outstanding and share prices as of the end of the prior fiscal year (year 0). Book values of equity for year 0 are obtained from COMPUSTAT. When missing on the I/B/E/S files, forecasted earnings per share for years +3, +4, and +5 are determined by applying g_5, the forecasted five-year growth rate, to year +2 forecasted earnings. All per share numbers are multiplied by the number of shares outstanding to get amounts at the firm level, and these are added across firms to get amounts at the market level each year. All amounts, except for dividend payout, are in millions of dollars.

Forecast as of April	Number of Firms	Actual Values for Year 0					Forecast Earnings for Years +1 to +5				
		Earnings	Dividends	Payout	Book Value	Market Value	Year +1	Year +2	Year +3	Year +4	Year +5
	1	2	3	4	5	6	7	8	9	10	11
1985	1,559	154,858	71,134	46%	1,191,869	1,747,133	180,945	205,294	228,208	254,181	283,706
1986	1,613	155,201	73,857	48%	1,214,454	2,284,245	178,024	203,677	226,018	251,313	280,035
1987	1,774	146,277	81,250	56%	1,323,899	2,640,743	186,319	220,178	244,174	271,432	302,529
1988	1,735	167,676	86,237	51%	1,430,672	2,615,857	222,497	246,347	273,204	303,642	338,262
1989	1,809	229,070	97,814	43%	1,541,231	2,858,585	261,278	284,616	315,204	349,721	388,776
1990	1,889	228,216	107,316	47%	1,636,069	3,143,879	257,657	295,321	328,803	366,798	410,028
1991	1,939	218,699	108,786	50%	1,775,199	3,660,296	241,760	294,262	328,513	367,521	412,073
1992	2,106	202,275	113,962	56%	1,911,383	4,001,756	252,109	308,567	344,742	386,098	433,552
1993	2,386	247,988	127,440	51%	2,140,668	4,918,359	295,862	356,086	397,969	445,840	501,081
1994	2,784	290,081	129,186	45%	2,168,446	5,282,046	339,694	402,689	450,559	505,315	568,179
1995	2,965	365,079	147,575	40%	2,670,725	6,289,760	444,593	518,600	579,954	650,120	730,648
1996	3,360	446,663	175,623	39%	3,182,952	8,207,274	512,921	588,001	659,732	742,244	837,577
1997	3,797	547,395	201,017	37%	3,679,110	10,198,036	614,932	709,087	800,129	905,787	1,029,061
1998	3,673	526,080	178,896	34%	3,412,303	12,908,495	577,297	682,524	775,707	884,529	1,012,294

casts, as well as to project future book values (using equation (3)). The validity of this assumption is not critical; however, varying the payout ratio between 25 and 75 percent has little impact on the estimated discount rate (results available upon request).

Both short- and long-term risk-free rates have been used in studies that estimate discount rates from flows that extend over many future periods. While one-month or one-year rates are appropriate when inferring the equity premium from historic returns (observed return less risk-free yield for that period), for studies based on forecasted flows, the maturity of risk-free rates used should match that of the future flows (Ibbotson Associates (1999)). Although we allow for expected variation in risk-free rates when estimating the risk premium, using equation (5a), we find almost identical results using a constant risk-free rate in equation (5) equal to the long-term rate. In essence, the shape of the yield curves over our sample period is such that the forward rates settle rather quickly at the long-term rate, and the impact of discounting flows from earlier years in the profile at rates lower than the long-term rate is negligible. For the sensitivity analyses, we find it convenient to use the constant rate structure of equation (5), rather than the varying rate structure of equation (5a). We selected the 10-year risk-free rate for the constant risk-free rate because it is the longest maturity for which data could be obtained for all country-years in our sample. To allow comparisons with other studies that use 30-year risk-free rates, we note that the mean 30-year risk-free rate in April for each year of our U.S. sample period is 31 basis points higher than the mean 10-year risk-free rate we use.

For years beyond year +5, abnormal earnings are assumed to grow at the expected inflation rate, g_{ae}. As explained in the Appendix, the expected nominal inflation rate is higher than values of g_{ae} assumed in the literature, and is an upper bound for expected growth in abnormal earnings. We derive the expected inflation rate from the risk-free rate, based on the assumption that the real risk-free rate is approximately three percent.[11] Since we recognize that this assumption is only an educated guess, we consider in Section V.D other values of g_{ae} also. Fortunately, our estimated risk premium is relatively robust to variation in the assumed growth rate, g_{ae}, since a lower proportion of current market value is affected by g_{ae} in equations (5) and (5a), relative to the impact of g in equation (1).

III. Results

Since k appears in both the numerators (ae_t is a function of k) and denominators of the terms on the right-hand side of equation (5), the resulting

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[11] The observed yields on recently issued inflation-indexed government bonds support this assumption. Although estimates of the real risk-free rate vary through time, and have historically been lower than three percent, more recently, the excess of the long-term risk-free rate over inflation forecasts has risen to three or four percent (e.g., Blanchard (1993), and discussion by Siegel).

equation is a polynomial in k with many possible roots. Empirically, however, only one root is real and positive (see Botosan (1997)). We search manually for the value of k that satisfies the relation each year, with the first iteration being close to the risk-free rate. The equity risk premium estimate (rp) that satisfies the valuation relation in equation (5a) is also estimated iteratively.

Table II provides the results of estimating rp, k, and k^*. The annual estimates for rp (in column 13) lie generally between three and four percent and are much lower than the historic Ibbotson estimate. Also, there is little variation over time: each annual estimate is remarkably close to the mean value of 3.39 percent. The annual estimates for k (in column 9) vary between a high of 14.38 percent in 1985 and a low of 8.15 percent in 1998. The corresponding risk-free rates (10-year Government T-bond yields) reported in column 8 vary with the estimated ks, between 11.43 percent in 1985 and 5.64 percent in 1998. As a result, the estimated equity premia (in column 11), equal to k less r_f, exhibit little variation around the time-series mean of 3.40 percent.

While the equation (5a) equity premium estimates (rp) derived from non-flat risk-free rates are in concept more accurate than those derived by subtracting 10-year risk-free rates from the flat k estimated from equation (5), the numbers reported in column 11 are very similar to those reported in column 13. We only consider the equation (5) estimates hereafter because (a) the magnitudes of the discount rates and their relation to risk-free rates are more transparent for the risk premium estimates based on constant risk-free rates, and (b) forward one-year rates for different maturities are not available for the other five markets,.

To understand better the relative magnitudes of the terms in equation (5), we report in the first seven columns of Table II the fraction of market values represented by each term. The fraction represented by book value (column 1) has generally declined over our sample period, from 68.2 percent in 1985 to 26.4 percent in 1998. To compensate, the fraction represented by terminal value (column 7) has increased from 26.6 percent in 1985 to 60 percent in 1998. The fraction represented by abnormal earnings for years $+1$ to $+5$ has also increased.

Column 10 of Table II contains our estimates for k^*, the market discount rate based on the dividend growth model described by equation (1), when dividends are assumed to grow in perpetuity at the five-year growth in earnings forecast (g_5). Since g_5 is not available at the aggregate level, we use the forecast growth in aggregate earnings from year $+4$ to $+5$ (see column 16 of Table V) to identify g_5 at the market level. To maintain consistency with prior research using the dividend growth model, we estimate d_1 by applying the earnings growth forecast for year 1 on prior year dividends $(d_1 = d_0 * e_1/e_0)$. Our estimates for k^* are almost identical to those reported by Moyer and Patel (1997).[12] Note that these estimates of k^* are much larger than the

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[12] Similar results are expected because the underlying data is taken from the same source, with minor differences in samples and procedures; for example, they use the S&P 500 index whereas we use all firms with available data.

Table II
Implied Expected Rate of Return on the Market (k and k^*) and Equity Risk Premium (rp and $k - r_f$) for U.S. Stocks (1985 to 1998)

The market is an aggregate of firms on the I/B/E/S Summary files with forecasts for years $+1$, $+2$, and a five-year earnings growth estimate (g_5) as of April each year, and actual earnings, dividends, number of shares outstanding and prices as of the end of the prior full fiscal year (year 0). Book values of equity for year 0 (bv_0) are obtained from COMPUSTAT. When missing, forecasted earnings for years $+3$, $+4$, and $+5$ are determined by applying g_5, the forecasted five-year growth rate, to year $+2$ forecasted earnings. The implied discount rate that satisfies the valuation relation in equation (5) below is k. Abnormal earnings (ae_t) equal reported earnings less a charge for the cost of equity ($=$ beginning book value of equity $* k$). Assuming that 50 percent of earnings are retained allows the estimation of future book values from current book values and forecast earnings. The terminal value represents all abnormal earnings beyond year $+5$. Those abnormal earnings are assumed to grow at a constant rate, g_{ae}, which is assumed to equal the expected inflation rate, and is set equal to the current 10-year risk-free rate less 3 percent. The expected rate of return on the market is also estimated using equation (1), and is labeled k^*. Equation (1) is derived from the dividend growth model, and dividend growth in perpetuity, g, is assumed to equal the five-year earnings growth rate, g_5. Subtracting r_f from the discount rates k and k^* generates equity premium estimates. The equity premium (rp) is also estimated using equation (5a), which is based on the same information used in equation (5), except that the constant discount rate k is replaced by forward one-year risk-free rates at different maturities (r_{fs}) plus a constant risk premium (rp). All amounts, except for rates of return, are in millions of dollars.

$$k^* = \frac{d_1}{p_0} + g \tag{1}$$

$$p_0 = bv_0 + \frac{ae_1}{(1+k)} + \frac{ae_2}{(1+k)^2} + \frac{ae_3}{(1+k)^3} + \frac{ae_4}{(1+k)^4} + \frac{ae_5}{(1+k)^5} + \left[\frac{ae_5(1+g_{ae})}{(k-g_{ae})(1+k)^5} \right] \tag{5}$$

$$p_0 = bv_0 + \sum_{t=1}^{\infty} \left[\frac{ae_t}{\prod_{s=1}^{t}(1+r_{fs}+rp)} \right] \tag{5a}$$

Forecast as of April	Book Value as Percent of Market Value	Percent of Market Value Represented by Present Value of						10-year r_f	k from (5)	k^* from (1)	$k - r_f$	$k^* - r_f$	rp from (5a)
		ae_1	ae_2	ae_3	ae_4	ae_5	Terminal Value						
	1	2	3	4	5	6	7	8	9	10	11	12	13
1985	68.2%	0.5%	0.9%	1.1%	1.3%	1.5%	26.6%	11.43%	14.38%	16.14%	2.95%	4.71%	2.88%
1986	53.2%	1.6%	2.0%	2.1%	2.3%	2.4%	36.3%	7.30%	11.28%	14.90%	3.98%	7.60%	4.03%
1987	50.1%	1.3%	1.9%	2.1%	2.2%	2.3%	40.0%	8.02%	11.12%	15.08%	3.10%	7.06%	3.25%
1988	54.7%	1.7%	1.8%	1.9%	2.0%	2.2%	35.7%	8.72%	12.15%	15.52%	3.43%	6.80%	3.58%
1989	53.9%	2.0%	2.0%	2.0%	2.1%	2.2%	35.7%	9.18%	12.75%	14.85%	3.57%	5.67%	3.54%
1990	52.0%	1.6%	2.0%	2.1%	2.2%	2.3%	37.8%	8.79%	12.33%	15.41%	3.54%	6.62%	3.56%
1991	48.5%	1.1%	1.9%	2.0%	2.2%	2.4%	41.8%	8.04%	11.05%	15.16%	3.01%	7.12%	2.96%
1992	47.8%	1.1%	1.9%	2.1%	2.3%	2.5%	42.4%	7.48%	10.57%	15.55%	3.09%	8.07%	3.06%
1993	43.5%	1.7%	2.3%	2.5%	2.7%	2.9%	44.4%	5.97%	9.62%	15.12%	3.65%	9.15%	3.76%
1994	41.1%	2.1%	2.6%	2.8%	2.9%	3.1%	45.5%	5.97%	10.03%	15.02%	4.06%	9.05%	3.53%
1995	42.5%	2.1%	2.6%	2.7%	2.8%	3.0%	44.3%	7.06%	11.03%	14.96%	3.97%	7.90%	4.02%
1996	38.8%	2.2%	2.5%	2.6%	2.8%	3.0%	48.2%	6.51%	9.96%	14.96%	3.45%	8.45%	3.50%
1997	36.1%	2.2%	2.5%	2.6%	2.8%	3.0%	50.8%	6.89%	10.12%	13.88%	3.23%	6.99%	3.25%
1998	26.4%	2.1%	2.5%	2.7%	3.0%	3.2%	60.0%	5.64%	8.15%	13.21%	2.51%	7.57%	2.53%
Mean								7.64%	11.04%	14.98%	3.40%	7.34%	3.39%
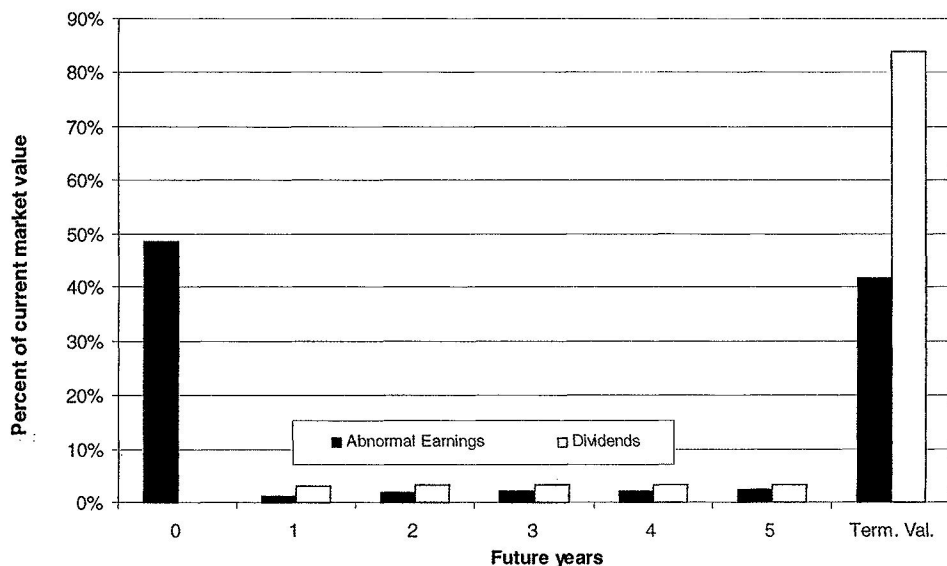
Figure 1. Comparison of value profile for abnormal earnings versus dividends, for abnormal earnings approach for U.S. stocks as of April, 1991. Based on the data in Table II, for the abnormal earnings approach described by equation (5), abnormal earnings are assumed to grow at 5.04 percent, the anticipated inflation rate, past year +5, and the resulting market discount rate (k) is 11.05 percent. For the abnormal earnings profile, the fractions represented by book value, abnormal earnings in years +1 through +5, and the terminal value are shown by the solid columns. For the dividend profile corresponding to those abnormal earnings projections, the fractions of current market capitalization that are represented by dividends in years +1 through +5 and the terminal value are shown by the hollow columns.

corresponding values of k, and the implied equity premium estimates reported in column 12 ($k^* - r_f$) are about twice those in column 11 ($k - r_f$). The mean equity premium of 7.34 percent in column 12 of Table II is approximately the same as the Ibbotson estimate. Note also the larger variation in column 12, around this mean, relative to the variation in columns 11 and 13.

The results in Table II can be used to illustrate two primary advantages of the abnormal earnings model over the dividend growth model. First, the abnormal earnings approach uses more available "hard" data (current book value and forecast abnormal earnings for years +1 to +5) to reduce the emphasis on "softer" growth assumptions (g_{ae}) used to build terminal values. Figure 1 contains a value profile for the terms in equation (5), using data for 1991. This year was selected because it represents a "median" profile: the terminal value is a smaller (larger) fraction of total value for years before (after) 1991. Recall from Table II that our estimate for k in 1991 is 11.05 percent. The terminal value is based on abnormal earnings growing at an anticipated inflation rate of 5.04 percent (g_{ae} is three percent less than the risk-free rate of 8.04 percent). The value profile for the abnormal earn-

ings model, represented by the solid columns in Figure 1, shows that approximately 50 percent of the total value is captured by current book value, 10 percent is spread over the abnormal earnings for the next five years, and about 40 percent remains in the terminal value. This last term is the only one affected by our growth assumption. In contrast, for the dividend growth model in equation (1), the dividend growth rate (g), which is assumed to equal the five-year analyst forecast for earnings growth $(g_5 = 12.12$ percent), is the primary determinant of the estimated k^* $(= 15.16$ percent).

To offer a different perspective on why growth assumptions are more influential for projected dividends, relative to abnormal earnings, we converted the abnormal earnings profile in Figure 1 to an isomorphic value profile for dividends, represented by the hollow columns in Figure 1. (Note that these dividends refer to the flows underlying k, from the abnormal earnings model, and are different from the flows underlying k^*, the dividend growth model estimate.) The year $+5$ terminal value for the dividend profile in Figure 1 corresponds to a dividend growth in perpetuity of 6.8 percent.[13] Even though the abnormal earnings and dividend profiles in Figure 1 correspond to the same underlying projections, the terminal value for the dividend profile represents almost 85 percent of total value. As a result, assumed dividend growth rates have a larger impact on estimated discount rates, relative to abnormal earnings growth rate assumptions. For example, doubling the assumed value of g_{ae} to 10 percent increases the estimated discount rate by only about two percentage points. In contrast, increasing the dividend growth assumption by one percentage point raises the estimated discount rate by almost the same amount.[14]

The second major benefit of the abnormal earnings approach is that we can narrow the range of reasonable growth assumptions (g_{ae}), relative to the assumed growth rate for dividends (g). Since g is a hypothetical rate, it is not easy to determine whether 12.12 percent (the value of g underlying our 1991 estimate for k^*) is more or less reasonable than the 6.8 percent dividend growth in perpetuity (after year $+5$) implied by our abnormal earnings model projections. Fortunately, restating implied dividend growth rates in terms of terminal growth in abnormal earnings makes it easier to see why some dividend growth assumptions are unreasonable. The assumption that dividends grow at 12.12 percent implies that abnormal earnings past year $+5$ would need to grow in perpetuity at about 15 percent per year in equa-

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[13] This dividend growth rate is obtained by using equation (1) on projected market value in year $+5$, rather than current market values (p_0) and the dividend in year six is the dividend in year $+5$ $(= 50$ percent of the earnings forecast for year $+5)$ times the unknown growth rate. That is, solve for g in the relation $p_5 = d_5(1 + g)/(k - g)$.

[14] Note that in equation (1), changes in g increase k^* by exactly the same amount. For the dividend value profile in Figure 1, however, dividends for years $+1$ to $+5$ have been fixed by forecasted earnings and dividend payout assumptions. Therefore, increases in the dividend growth rate underlying the terminal value increase the estimated discount rate by a slightly smaller amount.

tion (5). This abnormal earnings growth rate corresponds to a real growth in rents of 10 percent (assumed long-term inflation rate is 5.04 percent), which is clearly an unreasonably optimistic assumption.

In sum, our estimates of the equity risk premium using the abnormal earnings approach are considerably lower than the Ibbotson rate, even though we believe the analyst forecasts we use, as well as the terminal growth assumptions we make, are optimistic. Adjusting for such optimism would lower our estimates further. While our estimates from the dividend growth approach are much closer to the Ibbotson rate, we believe they are biased upward because the assumed growth rate ($g = g_5$) is too high an estimate for dividend growth in perpetuity. The estimates from the abnormal earnings approach are more reliable because we use more available information to reduce the importance of assumed growth rates, and we are better able to reject growth rates as being infeasible by projecting rents rather than dividends. Additional benefits of using the abnormal earnings approach are illustrated in Section V.

IV. Equity Premium Estimates from Other Markets

Other equity markets offer a convenient opportunity to validate our domestic results. As long as the different markets are integrated with the United States and are of similar risk, those markets' estimates should proxy for the equity premium in the United States. We replicated the U.S. analysis on five other important equity markets with sufficient data to generate reasonably representative samples of those markets. Only a summary of our results is provided here; details of those analyses are in Claus and Thomas (1999b). The six markets exhibit considerable diversity in performance and underlying fundamentals over our sample period. This across-market variation increases the likelihood that the estimates we obtain from each market offer independent evidence.

As with the U.S. data, earnings forecasts, actual earnings per share, dividends per share, share prices, and the number of outstanding shares are obtained from I/B/E/S. Book values of equity as of the end of year 0 are collected from COMPUSTAT and Global Vantage for Canada and from Datastream for the remaining four countries. Unlike I/B/E/S and COMPUSTAT, Datastream drops firms that are no longer active. While such deletions are less frequent outside the United States, only surviving firms are included in our sample. Fortunately, no bias is created in this study since we equate market valuations with contemporaneous forecasts, and do not track performance.[15] Therefore, even if the surviving firms (included in our sample) performed systematically better or worse than firms that were dropped, our equity premium estimates are unbiased as long as market prices and earnings forecasts in each year are efficient and incorporate the same information.

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[15] Note that there is no "backfilling" in our sample, where prior years' data for successful firms are entered subsequently.

All data are denominated in local currency. Currency risk is not an issue here, since it is present in the required rates of returns for both equities and government bonds. Thus the difference between the two rates should be comparable across countries.

We find that analysts' forecasts in these five markets exhibit an optimism bias, similar to that observed in the United States. We considered other potential sources of measurement error in the forecasts, but are confident that any biases created by these errors are unlikely to alter our equity premium estimates much. For example, in Germany, earnings could be computed in as many as four different ways: GAAP per International Accounting Standards, German GAAP, DVFA, and U.S. GAAP.[16] I/B/E/S employees indicated that they have been more successful at achieving consistency in recent years (all forecasts are on a DVFA basis), but they are not as certain about earlier years in their database. While differences in basis between forecast and actual items would affect analyst bias, they do not affect our estimates of market discount rates. Differences in basis across analysts contaminate the consensus numbers used, but the estimated market discount rates are relatively insensitive to changes in the near-term forecasts used.

To select the month of analysis for each country, we followed the same logic as that for the U.S. analysis. December was the most popular fiscal year-end for all countries except for Japan, where it was March. We then identified the period after the fiscal year-end by which annual earnings are required to be disclosed. This period differs across countries (see Table 1 in Alford et al. (1993)): it is three months for Japan and the United States, four months for France, six months for Canada and the United Kingdom, and eight months for Germany. We selected the month following the reporting deadline as the "sure to be disclosed" month to collect forecasts for any given year.

To include a country-year in our sample, we required that the total market value of all firms in our sample exceed 35 percent of the market value of "primary stock holdings" for that country, as defined by Datastream. Although we used a low hurdle to ensure that our sample contained contiguous years for all countries, a substantially greater proportion of the Datastream Market Index than our minimum hurdle is represented for most country-years.

The equity-premium estimates using the abnormal earnings and dividend growth approaches as well as the prevailing risk-free rates for different country-year combinations with sufficient data are reported in Table III. The number of years with sufficient firms to represent the overall market was highest for Canada (all 14 years between 1985 and 1998), and lowest for Japan (8 years). As with the U.S. sample, we use a 50 percent aggregate

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[16] The German financial analyst society, Deutsche Vereinigung für Finanzanalyse (DVFA), has developed a system used by analysts (and often by firms) to adjust reported earnings data to provide a measure that is closer to permanent or core earnings. The adjustment process uses both reported financial information as well as firms' internal records. GAAP refers to Generally Accepted Accounting Principles or the accounting rules under which financial statements are prepared in different domiciles.

Table III

Implied Equity Premium Using Abnormal Earnings and Dividend Growth Approaches ($k - r_f$ and $k^* - r_f$) for International Stocks (1985 to 1998)

The market is an aggregate of firms on the I/B/E/S Summary files with forecasts for years $+1$, $+2$, and a five-year earnings growth estimate (g_5) as of April each year, and actual earnings, dividends, number of shares outstanding, and prices as of the end of the prior full fiscal year (year 0). Book values of equity for year 0 (bv_0) are obtained from COMPUSTAT, Global Vantage, and Datastream. Forecasted earnings for years $+3$, $+4$, and $+5$ are determined by applying g_5, the forecasted 5-year growth rate, to year $+2$ forecasted earnings. All amounts are measured in local currencies. r_f is the 10-year government bond yield. The implied discount rate that satisfies the valuation relation in equation (5) below is k. Abnormal earnings (ae_t) equal reported earnings less a charge for the cost of equity ($=$ beginning book value of equity $*k$). Assuming that 50% of earnings are retained allows the estimation of future book values from current book values and forecast earnings. The terminal value represents all abnormal earnings beyond year $+5$. Those abnormal earnings are assumed to grow at a constant rate, g_{ae}, which is assumed to equal the expected inflation rate, and is set equal to r_f less 3 percent. The expected rate of return on the market is also estimated using equation (1), and is labeled k^*. Equation (1) is derived from the dividend growth model, and dividend growth in perpetuity, g, is assumed to equal the five-year earnings growth rate, g_5.

$$p_0 = bv_0 + \frac{ae_1}{(1+k)} + \frac{ae_2}{(1+k)^2} + \frac{ae_3}{(1+k)^3} + \frac{ae_4}{(1+k)^4} + \frac{ae_5}{(1+k)^5} + \left[\frac{ae_5(1+g_{ae})}{(k-g_{ae})(1+k)^5} \right] \tag{5}$$

$$k^* = \frac{d_1}{p_0} + g \tag{1}$$

Year	Canada			France			Germany			Japan			U.K.		
	r_f	$k-r_f$	k^*-r_f	r_f	$k-r_f$	k^*-r_f	r_f	$k-r_f$	k^*-r_f	r_f	$k-r_f$	k^*-r_f	r_f	$k-r_f$	k^*-r_f
1985	10.50%	4.41%	7.45%												
1986	8.82%	2.93%	6.64%												
1987	9.16%	1.56%	4.53%	8.72%	2.06%	6.06%									
1988	9.66%	2.83%	4.67%	9.35%	4.00%	3.90%									
1989	9.29%	3.08%	3.66%	8.76%	3.64%	6.11%	6.78%	3.43%	4.59%				10.16%	3.17%	7.24%
1990	10.69%	1.51%	2.97%	9.66%	3.04%	4.23%	6.83%	3.87%	5.48%				11.39%	2.57%	5.06%
1991	10.08%	0.75%	3.71%	8.81%	2.94%	4.41%	8.99%	1.10%	3.23%	6.72%	−0.95%	0.38%	10.49%	2.47%	7.27%
1992	8.18%	0.42%	6.36%	8.74%	2.26%	5.81%	8.42%	1.03%	4.72%	5.38%	−0.86%	−0.34%	9.12%	2.77%	8.69%
1993	7.32%	1.69%	6.59%	7.18%	2.31%	10.57%	7.89%	2.16%	5.03%	4.45%	−1.05%	4.36%	7.64%	3.29%	10.75%
1994	9.29%	1.65%	7.67%	6.82%	1.70%	8.24%	6.14%	0.70%	4.19%	4.24%	−1.04%	4.56%	8.63%	2.87%	8.50%
1995	7.93%	2.71%	6.77%	7.80%	2.06%	10.04%	7.26%	1.30%	8.77%	2.80%	1.12%	9.50%	8.44%	3.02%	8.59%
1996	7.69%	2.69%	6.89%	6.39%	2.38%	12.26%	6.70%	2.22%	9.84%	3.17%	0.79%	7.82%	7.92%	3.34%	8.43%
1997	6.35%	2.28%	7.10%	5.66%	2.28%	9.69%	6.41%	2.14%	8.40%	2.47%	1.65%	9.46%	7.02%	2.53%	7.81%
1998	5.36%	2.68%	7.44%	5.02%	2.53%	13.44%	5.68%	2.28%	11.56%	1.65%	1.99%	10.89%	5.84%	2.09%	6.77%
Mean	8.59%	2.23%	5.89%	7.74%	2.60%	7.90%	7.11%	2.02%	6.58%	3.86%	0.21%	5.83%	8.66%	2.81%	7.91%
S.D.	1.55%	1.04%	1.62%	1.51%	0.68%	3.27%	1.04%	1.03%	2.82%	1.67%	1.31%	4.27%	1.68%	0.40%	1.49%

dividend payout ratio to generate future dividends and book values, and assume that abnormal earnings grow at the expected inflation rate, which is assumed to be three percent less than the prevailing risk-free rate. For the few years when r_f in Japan is below three percent, we set $g_{ae} = 0$.

The equity premium values based on the abnormal earnings approach ($k - r_f$) generally lie between two and three percent, except for Japan, where the estimates are considerably lower (and even negative in the early 1990s). Finding that none of the almost 70 estimates of $k - r_f$ reported in Tables II and III are close to the Ibbotson estimate suggests strongly that that historical estimate is too high. In contrast, the equity premium estimates based on the dividend growth approach with dividends growing in perpetuity at the five-year earnings growth forecast (g_5) are considerably higher, similar to the pattern observed in the United States. The dividend growth estimates are very close to those reported in Khorana et al. (1997), which uses a similar approach and a similar sample.

Repeating the sensitivity analyses conducted on the United States (described in Section V) on these five markets produced similar conclusions. The abnormal earnings estimates generate projections that are consistent with experience, but the dividend growth estimates are biased upward and generate projections that are too optimistic because the five-year earnings growth forecast (g_5) is too high an estimate for dividend growth in perpetuity. The values of g_5 suggest mean real dividend growth rates in perpetuity that range between 6.09 percent for Canada and 8.25 percent for Japan. These real rates exceed historic real earnings growth rates, and are at least twice as high as the real GDP growth rates forecast for these countries.

The results observed for Japan are unusual and invite speculation. While our results suggest that the equity premium in Japan increased during the sample period, from about -1 percent in the early 1990s to 2 percent in the late 1990s, these results are also consistent with a stock market bubble that has gradually burst. That is, early in our sample period, prices were systematically higher than the fundamentals (represented by analysts' forecasts) would suggest, and have gradually declined to a level that is supported by analysts' forecasts. Note that our sample excludes the peak valuations in the late 1980s before the crash. Perhaps the implied equity premium in that period would be even more negative than the numbers we estimate for the early 1990s. Regardless of whether the poor performance of Japanese equities in the 1990s is due to correction of an earlier mispricing, it is useful to contrast the inferences from a historic approach with those from a forward-looking approach such as ours: the former would conclude that equity premia have fallen in Japan during the 1990s, whereas our approach suggests the opposite.

V. Sensitivity Analyses

This section summarizes our analysis of U.S. equity data designed to gauge the robustness of our conclusion that the equity premium is much lower

than historic estimates. We begin by considering two relations for P/B and P/E ratios that allow us to check whether our projections under the dividend growth and abnormal earnings models are reasonable. Next, we document the extent of analyst optimism in our data. Finally, we consider the sensitivity of our risk premium estimates to the assumed abnormal earnings growth rate (g_{ae}).[17]

A. P/B Ratios and the Level of Future Profitability

The first relation we examine is that between the P/B ratio and future levels of profitability (e.g., Penman (1999)), where future profitability is the excess of the forecast market accounting rate of return (roe_t) over the required rate of return, k.

$$\frac{p_0}{bv_0} = 1 + \frac{roe_1 - k}{(1+k)} + \frac{roe_2 - k}{(1+k)^2}\left(\frac{bv_1}{bv_0}\right) + \frac{roe_3 - k}{(1+k)^3}\left(\frac{bv_2}{bv_0}\right) + \ldots, \qquad (6)$$

where $roe_t = e_t/bv_{t-1}$ is the accounting return on equity in year t.

This relation indicates that the P/B ratio is explained by expected future profitability $(roe_t - k)$.[18] Firms expected to earn an accounting rate of return on equity equal to the cost of capital should trade currently at book values $(p_0/bv_0 = 1)$. Similarly, the P/B ratio expected in year +5 (p_5/bv_5), which is determined by the assumed growth in abnormal earnings after year +5 (g_{ae}), should be related to profitability beyond year +5. To investigate the validity of our assumed growth rates, we examine the profiles of future P/B ratios and profitability levels to check if they are reasonable and related to each other as predicted by equation (6). Future book values are generated by adding projected earnings and subtracting projected dividends (assuming a 50 percent payout) to the prior year's book value. Similarly, projected market values are obtained by growing the prior year's market value at the discount rate (k) less projected dividends.

Table IV provides data on current and projected values of P/B ratios and profitability. Current market and book values are reported in columns 1 and 2, and projected market and book values in year +5 are reported in columns

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[17] We also examined Value Line data for the DOW 30 firms for two years: 1985 and 1995 (details in Claus and Thomas (1999a)). Value Line provides both dividend forecasts (over a four- or five-year horizon) and a projected price. This price is, in effect, a terminal value estimate, which obviates the need to assume dividend growth in perpetuity. Unfortunately, those risk premium estimates appear to be unreliable: The estimated discount rate is 20 percent (8.5 percent) for 1985 (1995). These results are consistent with Value Line believing that the DOW 30 firms are undervalued (overvalued) in 1985 (1995); that is, current price does not equal the present value of forecast dividends and projected prices. This view is supported by their recommendations for the proportion to be invested in equity: it was 100 percent through the 1980s, and declined through the 1990s (it is currently at 40 percent).

[18] The growth in book value terms in equation (6), bv_t/bv_0, which add a multiplicative effect, have been ignored in the discussion because of the built-in correlation with $roe_t - k$. Higher roe_t results in higher e_t, which in turn causes higher growth in bv_t because dividend payouts are held constant at 50 percent for all years.

Table IV
Price-to-Book Ratios (p_t/bv_t), Forecast Accounting Return on Equity (roe_t) and Expected Rates of Return (k) for U.S. Stocks (1985 to 1998)

To examine the validity of assumptions underlying k, which is the implied discount rate that satisfies the valuation relation in equation (5), current price-to-book ratios are compared with estimated future returns on equity (roe_t) to examine fit with equation (6) below. The market is an aggregate of firms on the I/B/E/S Summary files with forecasts for years $+1$, $+2$, and a five-year earnings growth estimate (g_5) as of April each year, and actual earnings, dividends, number of shares outstanding, and prices as of the end of the prior full fiscal year (year 0). Book values of equity for year 0 (bv_0) are obtained from COMPUSTAT. When missing, forecasted earnings for years $+3$, $+4$, and $+5$ are determined by applying g_5 to year $+2$ forecasted earnings. Assuming that 50 percent of earnings are retained allows the estimation of future book values from current book values and forecast earnings. Return on equity (roe_t) equals forecast earnings scaled by beginning book value of equity (bv_{t-1}). Market and book value amounts are in millions of dollars.

$$p_0 = bv_0 + \frac{ae_1}{(1+k)} + \frac{ae_2}{(1+k)^2} + \frac{ae_3}{(1+k)^3} + \frac{ae_4}{(1+k)^4} + \frac{ae_5}{(1+k)^5} + \left[\frac{ae_5(1+g_{ae})}{(k-g_{ae})(1+k)^5} \right] \tag{5}$$

$$\frac{p_0}{bv_0} = 1 + \frac{\frac{roe_1 - k}{(1+k)} + \frac{roe_2 - k}{(1+k)^2}\left(\frac{bv_1}{bv_0}\right) + \cdots}{} \tag{6}$$

Forecasts as of April	Year 0 Equity Values		Year +5 Equity Values		Price/Book Ratio		Forecast Accounting Return on Equity						k from Eq. (5)
	Market Value (p_0)	Book Value (bv_0)	Market Value (p_5)	Book Value (bv_5)	In Year 0 (p_0/bv_0)	In Year 5 (p_5/bv_5)	In Year 1 (roe_1)	In Year 2 (roe_2)	In Year 3 (roe_3)	In Year 4 (roe_4)	In Year 5 (roe_5)	In Year 6 (roe_6)	
	1	2	3	4	5	6	7	8	9	10	11	12	13
1985	1,747,133	1,191,869	2,676,683	1,768,036	1.5	1.5	15%	16%	16%	17%	17%	17%	14.38%
1986	2,284,245	1,214,454	3,197,490	1,783,987	1.9	1.8	15%	16%	16%	17%	17%	17%	11.28%
1987	2,640,743	1,323,899	3,727,459	1,936,215	2.0	1.9	14%	16%	16%	16%	17%	17%	11.12%
1988	2,615,857	1,430,672	3,779,033	2,122,648	1.8	1.8	16%	16%	16%	17%	17%	17%	12.15%
1989	2,858,585	1,541,231	4,200,867	2,341,029	1.9	1.8	17%	17%	17%	18%	18%	18%	12.75%
1990	3,143,879	1,636,069	4,589,685	2,465,373	1.9	1.9	16%	17%	17%	18%	18%	18%	12.33%
1991	3,660,296	1,775,199	5,181,184	2,597,264	2.1	2.0	14%	16%	16%	17%	17%	17%	11.05%
1992	4,001,756	1,911,383	5,574,848	2,773,918	2.1	2.0	13%	15%	16%	16%	17%	17%	10.57%
1993	4,918,359	2,140,668	6,595,210	3,139,088	2.3	2.1	14%	16%	16%	17%	17%	17%	9.62%
1994	5,282,046	2,168,446	7,336,322	3,301,664	2.4	2.2	16%	17%	18%	18%	19%	18%	10.47%
1995	6,289,760	2,670,725	8,837,148	4,132,682	2.4	2.1	17%	18%	18%	19%	19%	19%	11.03%
1996	8,207,274	3,182,952	11,206,787	4,853,189	2.6	2.3	16%	17%	18%	18%	19%	18%	9.96%
1997	10,198,036	3,679,110	14,103,523	5,708,609	2.8	2.5	17%	18%	18%	19%	20%	19%	10.12%
1998	12,908,495	3,412,303	16,838,377	5,378,478	3.8	3.1	17%	18%	19%	20%	21%	20%	8.15%
Mean					2.2	2.1	15%	17%	17%	18%	18%	18%	11.04%

3 and 4. These values are used to generate current and year +5 P/B ratios, reported in columns 5 and 6. Columns 7 through 12 contain the forecasted accounting rate of return on equity for years 1 to 6, which can be compared with the estimated market discount rate, k, reported in column 13, to obtain forecasted profitability.

The current P/B ratio has been greater than 1 in every year in the sample period, and has increased steadily over time, from 1.5 in 1985 to 3.8 in 1998. Consistent with equation (6), all forecasted *roe* values for years 1 through 6 in Table IV exceed the corresponding values of k. Increases in the P/B ratio over the sample period are mirrored by corresponding increases in forecast profitability $(roe_t - k)$ in years +1 through +5 as well as forecast profitability in the posthorizon period (after year +5), as measured by the implied price-to-book ratio in year +5. Finally, the tendency for P/B ratios to revert gradually over the horizon toward one (indicated by the year +5 values in column 6 being smaller than the year 0 values in column 5) is consistent with intuition (e.g., Nissim and Penman (1999)).

We also extended our investigation to years beyond year +5 for the assumptions underlying the abnormal earnings estimates, and find that the pattern of projections for P/B and *roe* remain reasonable. In contrast, those projections for the assumptions underlying the dividend growth model estimates suggest that the underlying growth rates are unreasonably high. To provide an illustrative example of those results, we contrast in Figure 2 the patterns for future *roe* and P/B that are projected for the dividend growth and abnormal earnings approaches for 1991. The *roe* levels are marked off on the left scale, and P/B ratios are shown on the right scale. Recall that the market discount rates estimated for the abnormal earnings and dividend growth approaches are 11.05 percent (k) and 15.16 percent (k^*) and the corresponding terminal growth rates for abnormal earnings and dividends are 5.04 percent and 12.12 percent.

The projections for the abnormal earnings method (indicated by bold lines) continue to remain reasonable. The P/B ratio always exceeds one, but it trends down over time. Consistent with P/B exceeding one, the *roe* is always above the 11.05 percent cost of capital, and trends toward it after year +5. Note that the optimistic analyst forecasts cause *roe* projections to climb for years +1 through +5, but the subsequent decline in *roe* is because the profitability growth implied by g_{ae} (our assumed growth in abnormal earnings past year +5) is lower than that implied by g_5.

The results for the dividend growth approach illustrate the benefits of using projected accounting ratios to validate assumed growth rates. The profitability (roe) is actually below the cost of equity of 15.16 percent (k^*), for the first three years, even though the P/B ratio is greater than one. Thereafter, the profitability keeps increasing, to a level above 20 percent by year +15. Both the high level of profitability and its increasing trend are not easily justified, especially when they are observed repeatedly for every year in our sample. Similarly, the increasing pattern for P/B, which is projected to increase from about two to about three by year +15, is hard to justify.
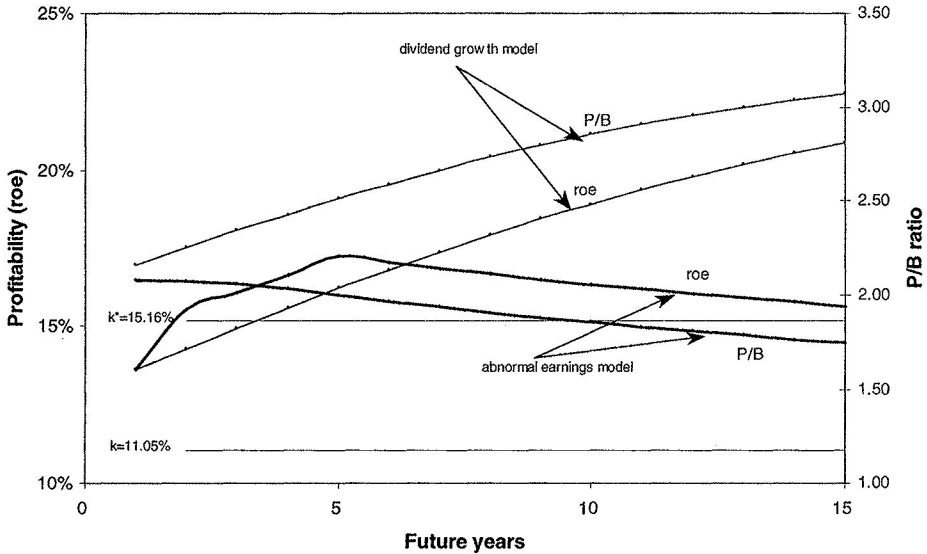
Figure 2. Pattern of future price-to-book (P/B) ratios and profitability, measured as excess of accounting return on equity (*roe*) over estimated discount rates (k^* and k), for dividend growth and abnormal earnings approaches for U.S. stocks as of April, 1991. For the dividend growth model described by equation (1) in Table II, dividends are assumed to grow at the consensus five-year earnings growth rate of 12.12 percent, and future *roe* is compared with the estimated market discount rate of 15.16 percent (k^*). For the abnormal earnings model described by equation (5) in Table II, abnormal earnings are assumed to grow at an anticipated inflation rate of 5.04 percent, and *roe* is compared with the estimated market discount rate of 11.05 percent (k). Projected P/B ratios are shown for both models.

These projections are, however, consistent with an estimated discount rate that is too high. Since near-term analysts' forecasts of profitability are below this discount rate, future levels of profitability have to be unreasonably high to compensate.

B. P/E Ratios and Forecast Growth in Profitability

The second relation we use to check the validity of our assumptions regarding g_{ae} is the price–earnings ratio, described by equation (7) (see derivation in Claus and Thomas, 1999a). Price–earnings ratios are a function of the present value of future changes in abnormal earnings, multiplied by a capitalization factor ($= 1/k$).

$$\frac{p_0}{e_1} = \frac{1}{k}\left[1 + \frac{\Delta ae_2}{e_1(1+k)} + \frac{\Delta ae_3}{e_1(1+k)} + \cdots\right], \tag{7}$$

where $\Delta ae_t = ae_t - ae_{t-1}$ is the change in expected abnormal earnings over the prior year.

The price–earnings ratio on the left-hand side deviates slightly from the traditional representation in the sense that it is a "forward" price–earnings ratio, based on expected earnings for the upcoming year, rather than a "trailing" price–earnings ratio (p_0/e_0), which is based on earnings over the year just concluded. The relation between future earnings growth and forward price–earnings ratios is simpler than that for trailing price–earnings ratios.[19] Therefore, we use only the forward price–earnings ratio here and refer to it simply as the P/E ratio.

The results reported in Table V describe P/E ratios and growth in abnormal earnings derived from analysts' forecasts for the market. The first four columns provide market values and the corresponding upcoming expected earnings for year 0 and year +5. These numbers are used to generate the current and year +5 P/E ratios reported in columns 5 and 6, which can be compared to the values of $1/k$ reported in column 18.[20] According to equation (7), absent growth in abnormal earnings, the P/E ratio should be equal to $1/k$, and the P/E ratio should be greater (less) than $1/k$ for positive (negative) expected growth in abnormal earnings. Forecast growth rates in abnormal earnings for years +2 through +6 are reported in columns 7 through 11. To maintain equivalence with the terms in equation (7), growth in abnormal earnings is scaled by earnings expected for year +1 (e_1) and then discounted.

To understand the relations among the numbers in the different columns, consider the row corresponding to 1991. The market P/E ratio of 15.1 is higher than the inverse of the discount rate ($1/k = 9.0$). That difference of 6.1 is represented by the sum of the present value of the abnormal earnings growth terms in future years, scaled by e_1 (this sum needs to be multiplied by $1/k$ as shown in equation (7)). These growth terms decline from 13 percent in year 2 to 2 percent in year 6, and continue to decline thereafter. By year +5, the market P/E is expected to fall (to 11.7), since some of the growth in abnormal earnings (represented by the amounts in columns 7 through 11) is expected to have already occurred by then. Turning to the other sample years, the P/E ratios in year 0 (column 5) have generally increased through the sample period, and so have the values of $1/k$. Consistent with P/E ratios exceeding $1/k$ in every year, abnormal earnings are forecast to exhibit positive growth for all cells in columns 7 to 11. Also, the P/E ratios in year +5 are forecast to decline, relative to the corresponding year 0 P/E values, because of the value represented by the amounts in columns 7 to 11.

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[19] Since the numerator of the P/E ratio is an ex-dividend price (p_0), the payment of a large dividend (d_0) would reduce p_0 without affecting trailing earnings (e_0), thereby destroying the relation between p_0 and e_0. This complication does not arise when expected earnings for the upcoming period (e_1) is used instead of e_0.

[20] If the numbers in Table V appear to be not as high as the trailing P/E ratios commonly reported in the popular press, note that forward P/E ratios are generally smaller than trailing P/E ratios for the following reasons. First, next year's earnings are greater than current earnings because of earnings growth. Second, current earnings contain one-time or transitory components that are on average negative, whereas forecast earnings focus on core or continuing earnings.

For purposes of comparison with other work, we also report in columns 12 through 17 of Table V the growth in forecast earnings (as opposed to growth in abnormal earnings) for years +1 through +6. Forecasted growth in earnings declines over the horizon, similar to the pattern exhibited by growth in abnormal earnings. Note the similarity in the pattern of earnings growth for all years in the sample period: the magnitudes of earnings growth estimates appear to settle at around 12 percent by year +5, before dropping sharply to values around 7 percent in the posthorizon period (year +6). Again, this decline occurs because the earnings growth implied by g_{ae} (our assumed growth in abnormal earnings past year +5) is lower than g_5.

The results in Table V confirm the predictions derived from equation (7) as well as the intuitive links drawn in the literature. As with the results for P/B ratios, the trends for P/E ratios and growth in abnormal earnings exhibit no apparent discrepancies that might suggest that the assumptions underlying our abnormal earnings model are unreasonable.

C. Bias in Analyst Forecasts

We considered a variety of biases that may exist in the I/B/E/S forecasts, but found only the well-known optimism bias to be noteworthy (details provided in Claus and Thomas (1999a)).[21] We compute the forecast error for each firm in our sample, representing the median consensus forecast as of April less actual earnings, for different forecast horizons (year +1, +2, ... +5) for each year between 1985 and 1997. Table VI contains the median forecast errors (across all firms in the sample for each year), scaled by share price. In general, forecasted earnings exceed actual earnings, and the extent of optimism increases with the horizon.[22] There is, however, a gradual reduction in optimism toward the end of the sample period.

Since the forecast errors in Table VI are scaled by price, comparing the magnitudes of the median forecast errors with the inverse of the trailing P/E ratios (or E/P ratios) is similar to a comparison of forecast errors with earnings levels. While the trailing E/P ratios for our sample vary between 5 and 9 percent, the forecast errors in Table VI vary between values that are in the neighborhood of 0.5 percent for year +1 to around 3 percent in year +5. Comparing the magnitudes of year +5 forecast errors with the implied E/P ratios indicates that forecasted earnings exceed actual earnings by as

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[21] I/B/E/S removes one-time items (typically negative) from reported earnings. That is, the level of optimism would have been even higher if we had used reported numbers instead of actual earnings according to I/B/E/S.

[22] In addition to increasing with forecast horizon, the optimism bias is greater for certain years where earnings were depressed temporarily. The higher than average dividend payouts observed in Table I for 1987 and 1992 indicate temporarily depressed earnings in those years, and the forecast errors are also higher than average for those years. For example, the two largest median year +2 forecast errors are 1.86 and 1.81 percent, and they correspond to two-year out forecasts made in 1985 and 1990.

Table V

Forward Price-to-Earnings Ratios (p_t/e_{t+1}) and Growth in Forecast Abnormal Earnings and Earnings for U.S. Stocks (1985 to 1998)

To examine the validity of assumptions underlying k, which is the implied discount rate that satisfies the valuation relation in equation (5), current and forecast forward price-to-earnings ratios are compared with growth in forecast abnormal earnings to examine fit with equation (7) below. The market is an aggregate of firms on the I/B/E/S Summary files with forecasts for years $+1$, $+2$, and a five-year earnings growth estimate (g_5) as of April each year, and actual earnings, dividends, number of shares outstanding, and prices as of the end of the prior full fiscal year (year 0). Book values of equity for year 0 (bv_0) are obtained from COMPUSTAT. Abnormal earnings (ae_t) equal reported earnings less a charge for the cost of equity (= beginning book value of equity $\ast k$). Future market values are projected for each year by multiplying beginning market values by $(1 + k)$ and subtracting dividends. When missing, forecasted earnings for years $+3$, $+4$, and $+5$ are determined by applying g_5 to year $+2$ forecasted earnings. Assuming that 50 percent of earnings are retained allows the estimation of future book values from current book values and forecast earnings. Market equity values and earnings amounts are in millions of dollars.

$$p_0 = bv_0 + \frac{ae_1}{(1+k)} + \frac{ae_2}{(1+k)^2} + \frac{ae_3}{(1+k)^3} + \frac{ae_4}{(1+k)^4} + \frac{ae_5}{(1+k)^5} + \left[\frac{ae_5(1 + g_{ae})}{(k - g_{ae})(1+k)^5} \right] \qquad (5)$$

$$\frac{p_0}{e_1} = \frac{1}{k} \left[1 + \frac{\Delta ae_2}{e_1(1+k)} + \frac{\Delta ae_3}{e_1(1+k)^2} + \cdots \right] \qquad (7)$$

Forecasts as of April	Year 0 Values Market Value (p_0) [1]	Earnings (e_1) [2]	Year +5 Values Market Value (p_5) [3]	Earnings (e_6) [4]	Forward P/E Ratio In Year 0 (p_0/e_1) [5]	In Year 5 (p_5/e_6) [6]	PV of ae Growth (Δae_t), Scaled by e_1 +2 [7]	+3 [8]	+4 [9]	+5 [10]	+6 [11]	Growth in Forecast Earnings +1 [12]	+2 [13]	+3 [14]	+4 [15]	+5 [16]	+6 [17]	1/k from Eq. (5) [18]
1985	1,747,133	180,945	2,676,683	308,308	9.7	8.7	5%	3%	3%	3%	1%	17%	13%	11%	11%	12%	9%	7.0
1986	2,284,245	178,024	3,197,490	299,896	12.8	10.7	7%	4%	5%	5%	1%	15%	14%	11%	11%	11%	7%	8.9
1987	2,640,743	186,319	3,727,459	324,573	14.2	11.5	10%	5%	5%	5%	1%	27%	18%	11%	11%	11%	7%	9.0
1988	2,615,857	222,497	3,781,766	364,583	11.8	10.4	4%	4%	4%	4%	1%	33%	11%	11%	11%	11%	8%	8.2
1989	2,858,585	261,278	4,200,867	420,673	10.9	10.0	2%	3%	3%	4%	1%	14%	9%	11%	11%	11%	8%	7.8
1990	3,143,879	257,657	4,589,685	442,911	12.2	10.4	7%	4%	4%	4%	1%	13%	15%	11%	12%	12%	8%	8.1
1991	3,660,296	241,760	5,181,184	442,291	15.1	11.7	13%	5%	6%	6%	2%	11%	22%	12%	12%	12%	7%	9.0
1992	4,001,756	252,109	5,574,848	463,780	15.9	12.0	14%	6%	6%	6%	2%	25%	22%	12%	12%	12%	7%	9.5
1993	4,918,359	295,862	6,595,210	531,812	16.6	12.4	13%	6%	7%	7%	1%	19%	20%	12%	12%	12%	6%	10.4
1994	5,282,046	339,694	7,174,214	604,559	15.5	11.9	11%	6%	6%	7%	1%	17%	19%	12%	12%	12%	6%	10.0
1995	6,289,760	444,593	8,837,148	783,736	14.1	11.3	9%	5%	6%	6%	2%	22%	17%	12%	12%	12%	7%	9.1
1996	8,207,274	512,921	11,206,787	893,185	16.0	12.5	8%	6%	7%	7%	2%	15%	15%	12%	13%	13%	7%	10.0
1997	10,198,036	614,932	14,103,523	1,100,714	16.6	12.8	8%	7%	7%	8%	2%	19%	16%	11%	12%	12%	7%	9.9
1998	12,908,495	577,297	16,838,377	1,069,786	22.4	15.7	12%	9%	10%	11%	2%	19%	16%	11%	12%	12%	7%	12.3
Mean					14.6	11.6	9%	5%	6%	6%	1%	19%	16%	11%	12%	12%	7%	9.2

Table VI
Optimism Bias in I/B/E/S Forecasts for U.S. Stocks: Median Forecast Errors for Forecasts Made Between 1985 and 1997

The following table represents the median of all forecast errors scaled by share price for each year examined. The forecast error is calculated for each firm as of April each year, and equals the median consensus forecasted earnings per share minus the actual earnings per share, scaled by price. The year when the forecasts were made is listed in the first row, while the first column lists the horizon of that forecast. For each year and horizon combination, we report the median forecast error and the number of firms in the sample. To interpret the Table, consider the values of 0.78 percent and 1,680 reported for the +1/1985 combination., in the top left-hand corner of the table. This means that the median value of the difference between the forecasted and actual earnings for 1986 was 0.78 percent of price, and that sample consisted of 1,680 firms with available forecast errors. The results confirm that analyst forecasts are systematically positively biased and that this bias increases with the forecast horizon; however, the extent of any such bias has been declining steadily over time.

		Year Forecast Was Made													
		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Mean
Forecast Year +1	Median	0.78%	0.65%	0.37%	0.07%	0.44%	0.58%	0.39%	0.17%	0.15%	0.03%	0.04%	0.00%	0.00%	0.28%
	Obs.	1,680	1,707	1,878	1,815	1,868	1,932	1,959	2,176	2,492	2,710	2,895	3,261	3,462	
Forecast Year +2	Median	2.05%	1.40%	0.79%	0.99%	1.74%	1.88%	1.21%	0.87%	0.58%	0.34%	0.32%	0.27%	—	1.04%
	Obs.	1,545	1,572	1,732	1,701	1,757	1,815	1,896	2,084	2,287	2,594	2,694	2,852	—	
Forecast Year +3	Median	2.84%	0.99%	1.44%	2.22%	2.78%	2.39%	1.50%	0.95%	0.63%	0.54%	0.45%	—	—	1.52%
	Obs.	1,406	1,449	1,596	1,576	1,634	1,744	1,826	1,936	2,159	2,396	2,346	—	—	
Forecast Year +4	Median	2.63%	2.04%	2.80%	3.19%	3.17%	2.83%	1.54%	0.91%	0.77%	0.60%	—	—	—	2.05%
	Obs.	1,285	1,344	1,492	1,474	1,586	1,696	1,724	1,825	2,024	2,132	—	—	—	
Forecast Year +5	Median	3.54%	3.44%	3.86%	3.59%	3.43%	2.91%	1.36%	0.94%	0.74%	—	—	—	—	2.65%
	Obs.	1,201	1,260	1,411	1,432	1,528	1,621	1,618	1,704	1,815	—	—	—	—	

much as 50 percent at that horizon. These results suggest that our equity premium estimates are biased upward because we do not adjust for the considerable optimism in earnings forecasts for years +1 to +5. They also suggest that we are justified in dropping assumed growth rates for earnings past year +5 (column 17 versus column 16 in Table V).

D. Impact of Variation in the Assumed Growth Rate in Abnormal Earnings Beyond Year +5 (g_{ae})

We begin by considering two alternative cases for g_{ae}: three percent less and three percent more than our base case, where g_{ae} is assumed to equal the expected inflation rate. As mentioned in the Appendix, our base growth rate of $g_{ae} = r_f - 3\%$ is higher than any rate assumed in the prior abnormal earnings literature. Adding another three percent to the growth rate, which would require rents to grow at a three percent real rate in perpetuity, raises the level of optimism further. Dropping three percent from the base case, in the lower growth scenario, would be equivalent to assuming a very low nominal growth rate in abnormal earnings, and would be only slightly more optimistic than the assumptions in much of the prior abnormal earnings literature.

For the higher (lower) growth rate scenario, corresponding to $g_{ae} = r_f$ ($g_{ae} = r_f - 6\%$), the average risk premium over the 14-year sample period increases (decreases) to a mean of 4.66 (2.18), from a mean of 3.40 percent for the base case. Even for the high growth rate in abnormal earnings, the increase in the estimated risk premium is modest, and leaves it substantially below the traditional estimates of the risk premium. While increasing (decreasing) the growth rate increases (decreases) the terminal value, it also reduces (increases) the present value of that terminal value because of the higher (lower) discount rate it engenders.

We also considered a synthetic market portfolio each year constructed to have no expected future abnormal earnings, to avoid the need for an assumed abnormal earnings growth rate beyond year +5. As described in equation (6), portfolios with P/B = 1 should exhibit no abnormal earnings; that is, the roe_t should on average equal k for this synthetic market. The last term in equation (5), representing the terminal value of abnormal earnings beyond year +5, is set to zero and the estimates for k obtained iteratively each year. The mean estimate for $k - r_f$ from this synthetic market is 2.20 percent, which is slightly lower than the mean risk premium of 3.40 percent in Table II. Note that a lower discount rate is not expected for the synthetic market, since it has a beta close to one each year and has a lower P/B than the market. (Low P/B firms are expected to generate higher returns (e.g., Gebhardt, Lee, and Swaminathan (forthcoming).) The higher discount rates observed for the assumptions underlying our abnormal earnings model support our view that the analyst forecasts we use and our assumption that the terminal growth in abnormal earnings equals expected inflation ($g_{ae} = r_f - 3\%$) are both optimistic.

VI. Conclusion

Barring some notable exceptions (e.g, Siegel (1992 and 1998), Blanchard (1993), Malkiel (1996), and Cornell (1999)), academic financial economists generally accept that the equity premium is around eight percent, based on the performance of the U.S. market since 1926. We claim that these estimates are too high for the post-1985 period that we examine, and the equity premium is probably no more than three percent. Our claim is based on estimates of the equity premium obtained for the six largest equity markets, derived by subtracting the 10-year risk-free rate from the discount rate that equates current prices to forecasted future flows (derived from I/B/E/S earnings forecasts). Growth rates in perpetuity for dividends and abnormal earnings need to be much higher than is plausible to justify equity premium estimates of about eight percent. Not only are such growth rates substantially in excess of any reasonable forecasts of aggregate growth (e.g., GDP), the projected streams for various indicators, such as price-to-book and price-to-earnings ratios, are also internally contradictory and inconsistent with intuition and past experience.

We agree that the weight of the evidence provided by the historical performance of U.S. stock markets since 1926 is considerable. Yet there are reasons to believe that this performance exceeded expectations, because of potential declines in the equity premium, good luck, and survivor bias. While projecting dividends to grow at earnings growth rates forecast by analysts provides equity premium estimates as high as eight percent, we show that those growth forecasts exhibit substantial optimism bias and need to be adjusted downward. In addition to our results, theory-based work, historical evidence from other periods and other markets, and surveys of institutional investors all suggest that the equity premium is much lower than eight percent. Overall, we believe that an eight percent equity premium is not supported by an analysis that compares current market prices with reasonable expectations of future flows for the markets and years that we examine.

Appendix: Assumed Growth Rates in Perpetuity for Dividends (g) and Abnormal Earnings (g_{ae})

While the conceptual definition of g is clear—it is the dividend growth rate that can be sustained in perpetuity, given current capital and future earnings[23]—determining this rate from fundamentals is not easy. To illustrate, take two firms that are similar in every way, except that they have announced different dividend policies in the current period, which results in a higher expected forward dividend yield (d_1/p_0) for one firm than the other, say 7 percent and 1 percent. What can be said about g for the two firms?

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[23] Assuming too high a rate would cause the capital to be depleted in some future period, and assuming too low a rate would cause the capital to grow "too fast."

Examination of equation (1) indicates that g for the low dividend yield firm must be 6 percent higher than g for the higher dividend yield firm, assuming they both have the same discount rate (k^*). If k^* equals 10 percent, for example, the value of g for the two firms must be 3 percent and 9 percent. These two values of g are substantially different from each other, even though the two firms are not.

In addition to being a hypothetical rate, g need not be related to historic or forecasted near-term growth rates for earnings or dividends. Dividend payout ratios can change over time because of changes in the investment opportunity set available and the relative attractiveness of cash dividends versus stock buybacks. Since changes in dividend payout affect the dividend yield, which in turn affects g, historic growth rates may not be relevant for g. Also, if dividend policies are likely to change over time, g need not be related to g_5 (the growth rate forecast for earnings over the next five years), a rate that is frequently used to proxy for g. Various scenarios can be constructed for the two firms in the example above to obtain similar historic and/or near-term forecast growth rates and yet have substantially different values for g.

Despite the difficulties noted above, both historic and forecast rates for aggregate dividends, earnings, and other macroeconomic measures (such as GDP) have been used as proxies for g. We note that these proxies create additional error. First, it is important to hold the unit of investment constant through the period where growth is measured. In particular, any growth created at the aggregate level by the issuance/retirement of equity since the beginning of the period should be ignored. Second, profits from all activities conducted outside the publicly traded corporate sector that are included in the macroeconomic measures should be deleted, and all overseas profits relating to this sector that are excluded from some macroeconomic measures should be included.

To control for the unit of investment problem, we use forecasted growth in per-share earnings rather than aggregate earnings, and to mitigate the problems associated with identifying g, we focus on growth in rents (abnormal earnings), g_{ae}, rather than dividends. To understand the benefits of switching to g_{ae}, it is important to describe some features of abnormal earnings. Expected abnormal earnings would equal zero if book values of equity reflected market values.[24] If book values measure input costs fairly, but do not include the portion of market values that represent economic rents (not yet earned), abnormal earnings would reflect those rents. However, the magnitude of such rents at the aggregate market level is likely to be small, and any rents that emerge are likely to be dissipated over time for the usual reasons (antitrust actions, global competition, etc.). As a result, much of the

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[24] That is, if market prices are efficient and book values are marked to market values each period, market (book) values are expected to adjust each period so that no future abnormal returns (abnormal earnings) are expected.

earlier literature using the abnormal earnings approach has assumed zero growth in abnormal earnings past the "horizon" date.[25]

Returning to the two-firm example, shifting the focus from growth in dividends to growth in rents removes much of the confusion caused by transitory changes in dividend payouts and dividend yields: these factors should have no impact on growth in rents, since the level of and growth in rents are determined by economic factors such as monopoly power. That is, even though the two firms have different forecasted earnings and dividends, the forecasted abnormal earnings and growth in abnormal earnings should be identical.

We believe, however, that the popular assumption of zero growth in abnormal earnings may be too pessimistic because accounting statements are conservative and understate input costs: assets (liabilities) tend to be understated (overstated) on average. For example, many investments (such as research and development, advertising, and purchased intangibles) are written off too rapidly in many domiciles. As a result, abnormal earnings tend to be positive, even in the absence of economic rents. Growth in abnormal earnings under conservative accounting is best understood by examining the behavior of the excess of *roe* (the accounting rate of return on the book value of equity) over k (the discount rate). Simulations and theoretical analyses (e.g., Zhang (2000)) of the steady-state behavior of the accounting rate of return under conservative accounting suggest two important determinants: the long-term growth in investment and the degree of accounting conservatism. These analyses also suggest that *roe* approaches k, but remains above it in the long-term.

Even though a decline in the excess of *roe* over k should cause the magnitude of abnormal earnings to fall over time, a countervailing factor is the growth in investment, which increases the base on which abnormal earnings are generated. We assume as a first approximation that the latter effect is greater than the former, and that abnormal earnings increase in perpetuity at the expected inflation rate. Since we recognize that this assumption is an approximation, we elected to err on the side of choosing too high a growth rate to ensure that our equity premium estimates are not biased downward. Also, we conduct sensitivity analyses to identify the impact on our equity premium estimates of varying the assumed growth rate within a reasonable range.

REFERENCES

Abarbanell, Jeffrey and Victor Bernard, 1999, Is the U.S. stock market myopic? *Journal of Accounting Research* 38, 221–242.

→ Abel, Andrew B., 1999, Risk premia and term premia in general equilibrium, *Journal of Monetary Economics* 43, 3–33.

→ Alford, Andrew, Jennifer Jones, Richard Leftwich, and Mark Zmijewski, 1993, The relative informativeness of accounting disclosures in different countries, *Journal of Accounting Research* 31, 183–223.

[25] That is, abnormal earnings persist, but show no growth. Some papers are even more conservative, and have assumed that abnormal earnings drop to zero past the horizon date.

Ang, Andrew and Jun Liu, 2000. A generalized affine earnings model, Working paper, Columbia University.

Bagnoli, Mark, Messod D. Beneish, and Susan G. Watts, 1999, Whisper forecasts of quarterly earnings per share, *Journal of Accounting and Economics* 28, 27–50.

Benore, Charles, 1983, A survey of investor attitudes toward the electrical power industry, Paine Webber Mitchell Hutchins, Inc., New York.

Blanchard, Oliver J., 1993, Movements in the equity premium, *Brookings Papers on Economic Activity* 2, 75–138.

Bogle, John C., 1999, *Common Sense on Mutual Funds* (John Wiley & Sons, New York).

Botosan, Christine A., 1997, Disclosure level and the cost of equity capital, *Accounting Review* 72, 323–350.

→ Brigham, Eugene F., Dilip K. Shome, and Steve R. Vinson, 1985, Risk premium approach to measuring a utility's cost of equity, *Financial Management* 14, 33–45.

→ Brown, Stephen J., William N. Goetzmann, and Stephen A. Ross, 1995, Survival, *Journal of Finance* 50, 853–873.

Burr, Barry B., 1998, 20%+ again? Keep dreaming, *Pensions and Investments* 26, 33–34.

Campbell, John Y., 1991, A variance decomposition for stock returns, *The Economic Journal* 101 (405), 157–179.

→ Campbell, John Y. and Robert J. Shiller, 1988, The dividend-price ratio and expectations of future dividends and discount factors, *Review of Financial Studies* 1, 195–228.

Claus, James J. and Jacob K. Thomas, 1999a, The equity risk premium is lower than you think it is: Empirical estimates from a new approach, Working paper, Columbia University.

Claus, James J. and Jacob K. Thomas, 1999b, Measuring the equity premium using earnings forecasts: An international analysis, Working paper, Columbia University.

Cochrane, John H., 1997, Where is the market going? Uncertain facts and novel theories, *Economic Perspectives* 21, 3–37.

Cornell, Bradford, 1999, *The Equity Risk Premium: The Long-Run Future of the Stock Market* (John Wiley & Sons, New York).

Edwards, Edgar O. and Philip W. Bell, 1961, *The Theory and Measurement of Business Income* (University of California Press, Berkeley, CA).

Fama, Eugene F. and Kenneth R. French, 2000, The equity premium, Working paper, University of Chicago.

→ Frankel, Richard and Charles M. C. Lee, 1998a, Accounting valuation, market expectation, and cross-sectional stock returns, *Journal of Accounting and Economics* 25, 283–319.

Frankel, Richard and Charles M. C. Lee, 1998b, Accounting diversity and international valuation, Working paper, University of Michigan.

Gebhardt, William, Charles M. C. Lee and Bhaskaran Swaminathan, Toward an ex ante cost of capital, *Journal of Accounting Research* forthcoming.

Glassman, James K. and Kevin A. Hassett, 1998, Are stocks overvalued? Not a chance, *Wall Street Journal*, March 30.

Gordon, Myron, 1962, *The investment, financing and valuation of the corporation* (Irwin, Homewood, IL).

Ibbotson Associates, Inc., 1999, Stocks, Bonds, Bills and Inflation, *Yearbook*, Chicago, IL.

→ Jorion, Philipe and William N. Goetzmann, 1999, Global stock markets in the twentieth century, *Journal of Finance* 54, 953–980.

Khorana, Ajay, R. Charles Moyer, and Ajay Patel, 1997, An examination of equity risk premium forecasts in G-6 countries, Working paper, Babcock Graduate School of Management, Wake Forest University.

→ Kocherlakota, Naryana, 1996, The equity premium: It's still a puzzle, *Journal of Economic Literature* 34, 42–71.

Liu, Jing and Jacob K. Thomas, 2000, Stock returns and accounting earnings, *Journal of Accounting Research* 38, 71–101.

Malkiel, Burton G., 1996, The equity premium puzzle, Keynote speech at 1996 Ibbotson Associates equity risk premium conference, Chicago, IL.

Matsumoto, Dawn A., 1999, Management's Incentives to Guide Analysts' Forecasts, Working paper, Harvard Business School.

Mayfield, E. Scott, 1999, Estimating the market risk premium, Working paper, Harvard Business School.

→ Mehra, Rajnish and Edward C. Prescott, 1985, The Equity Premium: A Puzzle, *Journal of Monetary Economics* 15, 145–161.

Moyer, R. Charles, and Ajay Patel, 1997, The equity market risk premium: a critical look at alternative ex ante estimates, Working paper, Babcock Graduate School of Management, Wake Forest University.

Myers, James N., 1999, Conservative accounting and finite firm life: Why residual income valuation estimates understate stock price, Working paper, University of Washington.

Nissim, Doron and Stephen H. Penman, 1999, Ratio analysis and equity valuation, Working paper, Columbia Business School.

Penman, Stephen H., 1999, *Financial Statement Analysis and Security Valuation* (Irwin/McGraw Hill, New York).

Preinreich, Gabriel A. D., 1938, Annual survey of economic theory: the theory of depreciation, *Econometrica* 6, 219–241.

Samuelson, Paul, 1965, Proof that properly anticipated prices fluctuate randomly, *Industrial Management Review* 6, 41–49.

Siegel, Jeremy J., 1992, The equity premium: Stock and bond returns since 1802, *Financial Analysts Journal* January/February, 28–38.

Siegel, Jeremy J., 1998, *Stocks for the long run,* 2nd edition (McGraw-Hill, New York).

→ Siegel, Jeremy J., and Richard H. Thaler, 1997, The equity risk premium puzzle, *Journal of Economic Perspectives* 11, 191–200.

Stulz, René M., 1999, Globalization, corporate finance, and the cost of capital, *Journal of Applied Corporate Finance* 12(3), 8–25.

Vuolteenaho, Tuomo, 1999, Understanding the aggregate book-to-market ratio, Working paper, University of Chicago.

Welch, Ivo, 1999, Views of financial economists on the equity premium and professional controversies, Working paper, UCLA.

Wien, Byron R., 1998, U.S. strategy: Risk premium—R.I.P. Morgan Stanley Dean Witter.

Williams, John. B., 1938, *The Theory of Investment Value* (Harvard University Press, Cambridge, MA).

→ Zhang, Xiao-jun, 2000, Conservative accounting and equity valuation, *Journal of Accounting and Economics* 29, 125–149.
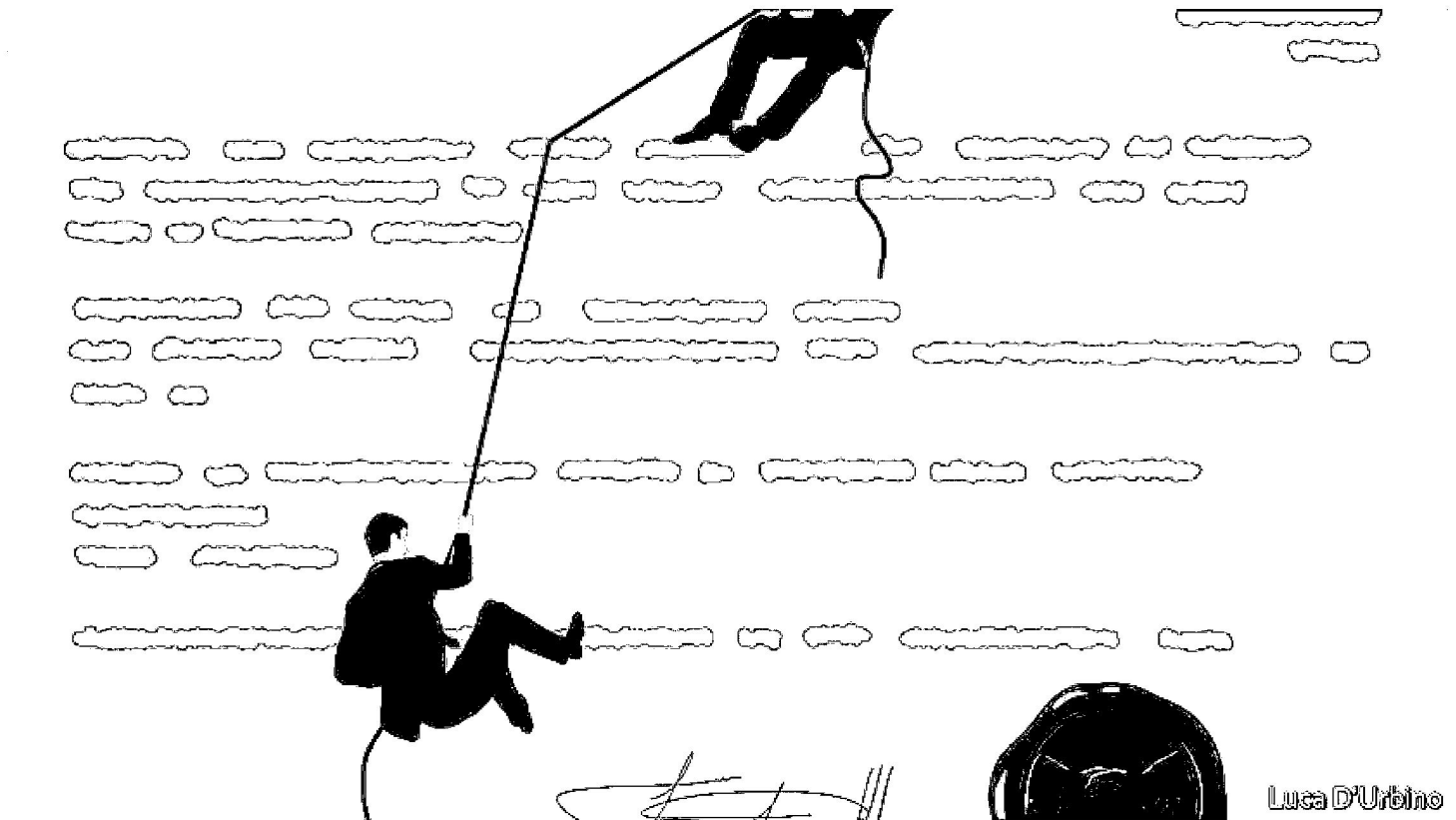
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RW ⌄

Schools brief | Six big ideas

Coase's theory of the firm

If markets are so good at directing resources, why do companies exist? The first in our series on big economic ideas

Luca D'Urbino

Jul 29th 2017

Saved   (Share)   (Give)

ONE morning, an economist went to buy a shirt. The one he chose was a marvel of global production. It was made in Malaysia using German machines. The cloth was woven from Indian cotton grown from seeds developed in America. The collar lining came from Brazil; the artificial fibre from Portugal. Millions of shirts of every size and colour are sold every day, writes Paul Seabright, the shirt-buying economist, in his 2004 book, "The Company of Strangers". No authority is in charge. The firms that make up the many links in the chain that supplied his shirt had merely obeyed market prices.

Throwing light on the magic of market co-ordination was a mainstay of the "classical" economics of the late-18th and 19th centuries. Then, in 1937, a paper published by Ronald Coase, a British economist, pointed out a glaring omission. The standard model of economics did not fit with what goes on within companies. When an employee switches from one division to another, for instance, he does not do so in response to higher wages, but because he is ordered to. The question posed by Coase was profound, if awkward for economics:

why are some activities directed by market forces and others by firms?

His answer was that firms are a response to the high cost of using markets. It is often cheaper to direct tasks by fiat than to negotiate and enforce separate contracts for every transaction. Such "exchange costs" are low in markets for standardised goods, wrote Coase. A well-defined task can easily be put out to the market, where a contractor is paid a fixed sum for doing it. The firm comes into its own when simple contracts of this kind will not suffice. Instead, an employee agrees to follow varied and changing instructions, up to agreed limits, for a fixed salary.

Coase had first set out his theory while working as a lecturer in Dundee, in 1932, having spent the prior academic year in America, visiting factories and businesses. "The nature of the firm", his paper, did not appear for another five years, in part because he was reluctant to rush into print. Though widely cited today, it went largely unread at first. But a second paper, "The problem of social cost", published in 1960, by which time he had moved to America, brought him to prominence. It argued that private bargaining could resolve social problems, such as pollution, as long as property rights are well defined and transaction costs are low (they rarely are). He had been asked to expound his new theory earlier that year to a sceptical audience of University of Chicago economists. By the end of the evening, he had won everyone around. Coase was invited to join the university's faculty in 1964; and there he remained until his death in 2013 at the age of 102.

In 1991 Coase was awarded the Nobel prize for economics, largely on the strength of these two papers. But as late as 1972, he lamented that "The nature of the firm" had been "much cited and little used". In a strange way, Coase himself was partly to blame. The idea of transaction costs was such a good catch-all explanation for

tricky subjects that it was used to close down further inquiry. In fact, Coase's paper raised as many difficult questions as it answered. If firms exist to reduce transaction costs, why have market transactions at all? Why not further extend the firm's boundaries? In short, what decides how the economy as a whole is organised?