SUMMER 2021

SACRS

STATE ASSOCIATION *of* COUNTY RETIREMENT SYSTEMS

Climate Change & Financial Markets

Page 9

CONTENT

SUMMER 2021

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Remember!
2021–2022 Annual Membership Renewal Deadline for Dues is July 31, 2021

On the MOVE . . .

As we put the finishing touches on this edition of *SACRS Magazine*, we are surrounded by packing boxes and are ready to move to a new location. Please take note of our new information, shown below, and update your contacts. We move at the end of June and expect to be settled in by July 1. If you ever visit the Sacramento area, be sure to come by and see us!

SAVE THE DATE

With the re-opening of California, comes the ability to hold our SACRS Fall Conference 2021 in-person! I'm looking forward to once again being gathered together at the unique locations our conferences enjoy. Be sure to save the date to join us **November 9-12 at Loews Hollywood Hotel in Hollywood**, California. Our conferences are a great way to network and learn from each other and from the experts we bring to you.

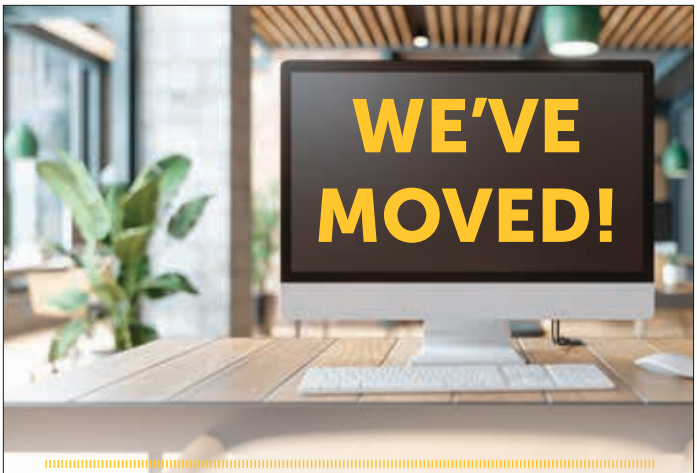
Please know that your health and safety is of utmost importance. Recently, upon completion of a course offered by Health Education Services and recognized by the Events Industry Council, I became a certified Pandemic Compliance Advisor (PCA). The role of a PCA is to ensure that the newest safety protocols and practices are implemented, communicated, and effectively carried out throughout face-to-face meetings in compliance with the CDC and WHO recommendations to cultivate safe meeting environments. I am fully ready to bring these practices to SACRS.

If you have a suggestion for a presentation, topic, or speaker for a session at the conference, go to the sacrs.org/Events/Fall-Conference page and complete the speaker solicitation form for consideration. Please keep in mind that topics for conference submissions must be educational, non-marketing, and relevant to SACRS members.

We look forward to welcoming everyone back in-person this fall with post-pandemic caution. Registration and hotel room block information will be available in the coming weeks!

Sulema H. Peterson

***Sulema H. Peterson**, SACRS Executive Director, State Association of County Retirement Systems*



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Thankful

The pandemic has been a great challenge and disrupter to us all. I want everyone to know that SACRS is steadily moving forward. Our guideposts are keeping SACRS' members safe and healthy as much as possible, while at the same time keeping our programs relevant and sustainable.

As we begin to return to a "new normal", I want to thank everyone for attending our virtual conferences and webinars. While we are excited to be "in-person" for the SACRS Fall Conference, I want to acknowledge the great successes we have had with our virtual educational offerings and extend my gratitude to everyone who has made it successful from our staff to our various committees to our attendees. We couldn't have accomplished all that we have without the participation of our pension professionals, affiliates, and supportive non-profits.

Our UC Berkeley Public Pension Investment Management Program presented by the UC Berkeley Haas School of Business will be virtual again this year. We will also have our SACRS Summer Spotlight Series, which gives an insider's view of our SACRS' systems and the moving forces behind them.

I would like to congratulate and welcome our new SACRS Board leadership for 2021-22 Vice President: Kathryn Caveness, Mendocino County; Board Secretary: Thomas Garcia, Imperial County; Treasurer: Harry Hagen, Santa Barbara County; Board members at-large: David McDonald, Contra Costa County; and Vere Williams, San Bernadino County.

Your SACRS membership becomes more valuable the more you lean into what SACRS offers through insights, education and connections, be sure to take full advantage of all we are doing.

I can't wait to see you in Hollywood at SACRS Fall Conference!

***Vivian Gray**, President of SACRS & LACERA Trustee*

EMERGING MARKETS, Localized Opportunities

While we are favorable on the overall outlook for emerging markets (EMs), there is a wide disparity in the pace and stage of their recoveries from economic disruptions caused by the COVID-19 pandemic.

While gross domestic product (GDP) expectations for all EMs decreased significantly because of the pandemic, this delta is significantly smaller for countries such as China that were among the first to experience widespread infections and implement measures to control the pandemic.

China's path to economic recovery provides somewhat of a roadmap for what recoveries in other Ems that are later in the outbreak/shutdown/recovery cycle could look like. As a result, we are seeing increasing opportunities in laggard countries such as India, Indonesia, and Brazil that are just now coming out of the pandemic and moving more significantly into their recovery phases.

Seeking Sustainable Growth Opportunities Amid the Evolution of EMs

While some EMs are still heavily dependent on commodities and exports, technology has become as central to EMs as it has to developed markets. This evolution underpins much of our portfolio positioning and where we are finding opportunities for sustainable value creation in EMs.

Growth and Asia Are More Prominent in EMs

The drivers of value creation over the past decade have shifted, transforming the shape of EM equities as an asset class. The MSCI EM Index has gone from being highly dependent on energy and commodities to being driven by IT, media, and consumer companies.

This shift is reflected in Figure 1, which shows that the four largest components of the index in 2020—Alibaba, Tencent, TSMC, and Samsung—account for nearly a quarter of the index weighting. We find that current valuations in EMs do not fully reflect the index's shift toward higher-growth sectors.

Figure 1. Tech Has Transformed the MSCI EM Index (Top 10 Weights, 2008 vs. 2020)

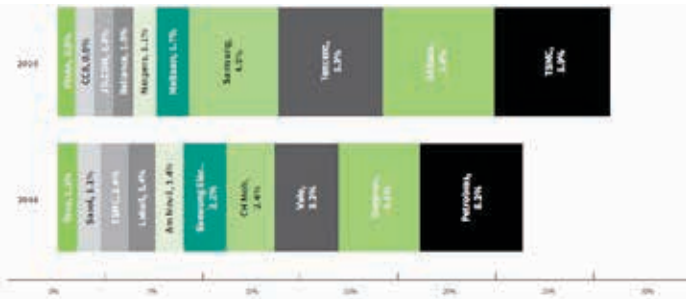


Figure 1. Source: MSCI, as of December 31, 2020. References to specific companies are provided for illustrative purposes only and should not be interpreted as recommendations to buy or sell any security.

> *"The inclusion of China A-shares in the MSCI EM Index should lead to additional inflows as both active and passive investors gain broader access to mainland Chinese stocks."*

The transformation of Reliance Industries is a microcosm of the shift in EMs broadly. Reliance was originally an oil and gas infrastructure and energy company, but in the past decade the company has invested heavily in telecommunications and other less commodity-driven areas. As part of that change, Reliance has built a wireless and fiber optic network in India and then moved to capitalize on e-commerce, financial technology (fintech), and social media opportunities from the broad consumer base it built through that rollout.

Country weightings in the index have changed significantly as well, shifting toward Asia at the expense of Latin America and the Europe, Middle East, and Africa (EMEA) region.

In particular, China's weighting is poised to increase. In addition to China's strong economic recovery from the pandemic, companies such as Alibaba and Tencent continue to have significant potential room for expansion. China A-shares have become far more important and provide what we see as a massive opportunity for both fundamental and technical reasons. The inclusion of China A-shares in the MSCI EM Index should lead to additional inflows as both active and passive investors gain broader access to mainland Chinese stocks.

E-commerce, Healthcare, and Fintech Offer Compelling Opportunities

The increased importance of technology and rising consumer spending dominate the growth investing landscape in EMs. Looking beyond these mega-trends, we are particularly focused on the following sectors and themes in our search for high-quality companies offering sustainable growth.

The first sector/theme is e-commerce, which is one of the most compelling trends shaping EMs. Fueled primarily by Alibaba, China shows the potential for e-commerce penetration in other EMs. As shown in Figure 2, e-commerce penetration in non-China EMs significantly trails developed markets, but major investments in digital infrastructure have expanded mobile data coverage and increased smartphone adoption in EMs.

In addition to these longer-term drivers, the pandemic has spurred more consumers to purchase online in both emerging and developed markets. In our view, part of the appeal of investing in e-commerce companies in EMs is that many EM governments create barriers to Amazon and other foreign players; this reduces price competition and supports the development of "local champions," such as Reliance Industries in India and Magazine Luiza in Brazil.

Figure 2. E-Commerce Penetration by County (Online Sales as a Percentage of Retail Gross Revenue)

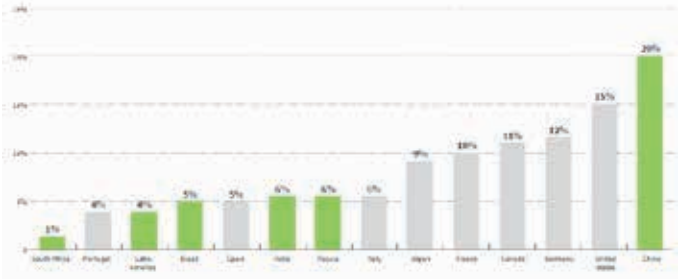


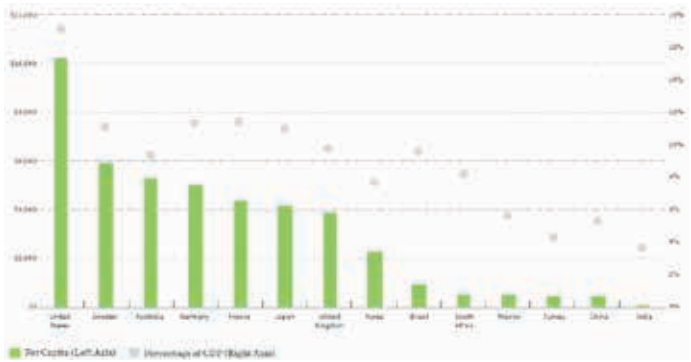
Figure 2. Source: Bank of America, as of September 2019.

> *"We have found attractive investment opportunities in the healthcare sector for many years, and the pandemic has only enhanced our conviction in healthcare as a long-term quality growth sector in EMs."*

Another sector/theme is healthcare. We have found attractive investment opportunities in the healthcare sector for many years, and the pandemic has only enhanced our conviction in healthcare as a long-term quality growth sector in EMs.

We see healthcare expenditures as an extension of an overall increase in consumer spending in EMs. As shown in Figure 3, healthcare spending per capita is still very low in EMs relative to developed markets. As disposable incomes grow, we expect to see significant increases in spending on health and wellness by consumers in EMs.

Figure 3. Healthcare Expenditures Per Capital by Country



Lastly, we see opportunities in consumer and financial technology. We believe that the consumer sector will continue to experience structural growth, fueled by rising disposable incomes in EMs. We also like that the sector provides exposure to fintech, which we see as the most attractive aspect of financials.

Tapping into the tremendous potential of digital payments and other aspects of fintech are the only paths to sustainable growth in EM financials, in our view. We are selectively adding to our broader financials exposure in India as we seek to capitalize on the country's improving economic conditions.

Expanding Opportunity Set for Quality Growth Investors

As we evaluate the longer-term landscape for EM equities, we see an expanding opportunity set full of leading companies with tremendous growth potential.

Our investment approach centers on identifying companies with sustainable value creation characteristics, including those with industry-leading return on invested capital (ROIC) profiles and durable competitive advantages.

Figure 4 shows that EMs include a disproportionate share of top-quintile companies in terms of sustainable value creation. Moreover, the share of top-quintile companies domiciled in EMs has increased over time—a trend that we expect to continue.

Figure 4. Top Quintile of Companies Exhibiting Sustainable Value Creation by Region

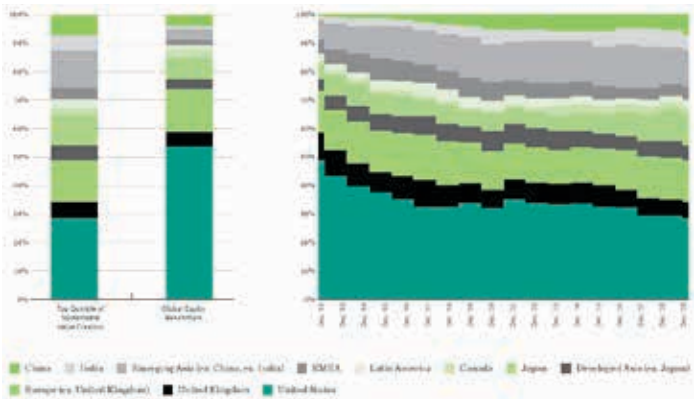


Figure 4. Source: MSCI and William Blair, as of December 2019. Global benchmark is the MSCI ACWI IMI. Top quintile of sustainable value creation is equal weighted. Sustainable value creation is an aggregate measure of corporate returns on capital. Several quantitative financial statement factors are used to measure profit and cash flow.

Given the widely diverging outlooks for sectors, countries, and companies in EMs, we believe active management is paramount. While the asset class as a whole appears attractive now, passive exposure would force investors to own the less attractive sectors, countries, and companies with more perilous economic growth prospects.

We believe the ability to successfully navigate EM equities requires extensive experience and bottom-up research to capitalize on the opportunities and manage risks in this dynamic asset class.

***Todd McClone**, CFA, partner, is a portfolio manager for William Blair's emerging markets strategies. Before joining the firm in 2000, he was a senior research analyst specializing in international equity for Strong Capital Management. Previously, he was a corporate finance research analyst with Piper Jaffray, where he worked with the corporate banking financials team on a variety of transactions, including initial public offerings, mergers and acquisitions, and subordinated debt offerings. He also issued fairness opinions and conducted private company valuations.*

The MSCI ACWI Investable Market Index (IMI) captures large-, mid- and small-cap representation across 23 developed markets. The ex-U.S. variation of the index excludes the United States. The MSCI Emerging Markets (EM) Index captures large- and mid-cap representation across 27 EMs. Index performance is provided for illustrative purposes only. Indices are unmanaged and do not incur fees or expenses. A direct investment in an unmanaged index is not possible.

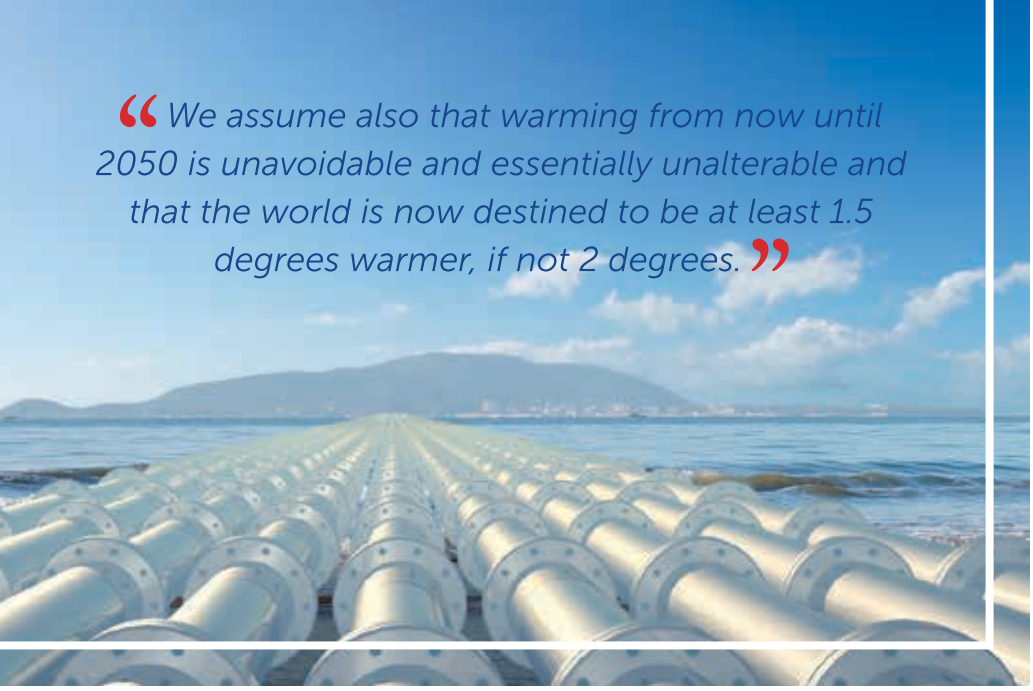
Climate Change & Financial Markets

Schroders Economics Group produces 30-year return forecasts, on an annual basis, for a range of asset classes. Until now, these forecasts have been agnostic on the subject of climate change, making no explicit adjustments for the physical and transition costs associated with global warming. We have produced a separate tool – the Climate Change Dashboard – for a number of years that provided analysis of climate change, but lacked the tools to form solid conclusions about investment implications.

However, driven as they are by long-term assumptions around growth rates and productivity, it seems likely that climate change will have implications for our forecasts. It is not difficult to imagine ways in which this might be the case; more extreme weather events will likely inflict greater damage on infrastructure and business capital, higher temperatures could hurt labor productivity by making physical labor more arduous, and the plans to address climate change would require sacrifices of resources and abandoning existing economic growth models. Equally, warmer temperatures could make some parts of the world more attractive and productive, with melting ice easing sea navigation, facilitating agricultural cultivation in previously inhospitable climates, and so on.

Ultimately, the potential channels through which climate change could impact growth and financial returns are too numerous, and indeed often unknown, for us to hope to model every moving part, particularly considering data constraints in poorer economies. Instead, we adopt a three-step process.

The first step is a focus on what happens to output as temperatures rise, which we will refer to as the 'physical cost' of climate change. The second considers the economic impact of steps taken to mitigate those temperature increases, or the 'transition cost'. This second step is slightly more complicated, in that there is a range of possible transition scenarios;



we have focused on the impacts of carbon pricing, which remains the dominant policy lever for most countries. Finally, we adjust for the effects of stranded assets where we take account of the losses incurred where oil and other carbon based forms of energy have to be written off, as it is no longer possible to make use of them such that they are left in the ground.

As an aside, we should be clear that in what follows we are analyzing only the impact on economic growth and financial returns. We do not attempt to incorporate what economists refer to as ‘externalities’, or the impacts of climate change not directly captured in prices. This means our analysis does not factor in costs like reduced life expectancies or quality of life from higher pollution, for example. As a result, even where we might find a ‘positive’ impact from climate change, this should not be read as our advocating for global warming.

The Science

While we have tried to limit the use of climate science terminology, there are cases where it becomes inevitable. There are a few basic concepts that might be helpful in understanding the work in this article.

There is broad scientific consensus now that the world is getting warmer. What remains to be decided is just how much warmer the world will get. Chiefly, this will be determined by how much greenhouse gas (GHG) we continue to produce. The Intergovernmental Panel on Climate Change (IPCC), a UN body tasked with providing scientific information relevant to understanding the risk of climate change, issued a 2014 report[1] adopting four possible scenarios for GHG emissions. Known as Representative Concentration Pathways (RCPs), each corresponds to a different level of warming. RCP2.6 is a ‘best case’ scenario, in which GHG emissions are cut back sufficiently such that global warming is capped at around 1.5 to 2 degrees above the pre-industrial average. At the other end of the scale, RCP8.5 is a worst case, ‘business as usual’ scenario in which no effort is made to rein in emissions and as a result global temperatures increase by 4 degrees compared to the pre-industrial average by 2100.

MODELING THE IMPACT OF CLIMATE CHANGE

STEP 1 The Physical Costs of Climate Change

By this point, a certain amount of global warming is baked in; regardless of mitigation efforts undertaken, we know the world will be warmer in 30 years than it is today. In our analysis, the temperature profiles of different climate change scenarios begin to diverge only after 2050, when mitigation efforts (or the lack thereof) begin making more of an impact.

Burke and Tanutama – A Non-Linear Approach to the Physical Costs of A Warmer World

One approach taken in assessing the physical impact of climate change is to assume a non-linear relationship between temperatures and productivity, as measured by output per person. Intuitively, this makes sense; an increase in temperatures in a cold country is less likely to adversely affect someone’s ability to work than a similar increase in an already hot country. It turns out that there is plenty of evidence that labor productivity, as well as health and crop yields exhibit a non-linear relationship of this kind[2]. Parlaying this into a broader macroeconomic impact is the task undertaken by Burke and Tanutama (2019)[3].

Deciding On An Approach

In our analysis, we have opted to follow the Burke and Tanutama methodology. Partly this is because their work utilizes a much larger, and more granular, dataset. Partly it is because there is an intuitive appeal in a non-linear relationship between temperatures and output, and in the idea that colder regions should benefit as temperatures rise.

We assume also that warming from now until 2050 is unavoidable and essentially unalterable and that the world is now destined to be at least 1.5 degrees warmer, if not 2 degrees. Some of this, relative to pre-industrial averages, has already happened.

STEP 2 The Transition Costs of Climate Change

Business as usual, when it comes to climate change, is projected to give us a much warmer world in the years to come. If the promises of world leaders are to be believed, business as usual will very much be disrupted. The aim of the 2015 Paris Agreement, for example, is to limit warming to no more than two degrees above the pre-industrial average.

At present, the world is not on track to meet the Paris Agreement objectives.

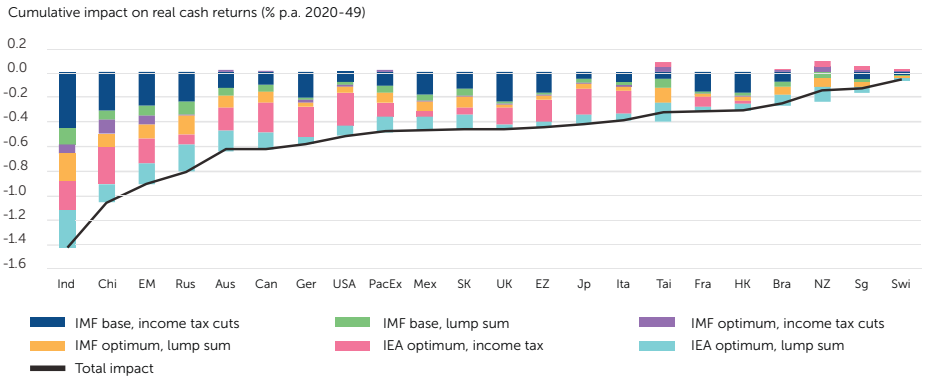
Nations are already falling short on self-imposed targets, which in themselves are anyway insufficient to limit warming to 2 degrees, and the gap is widening[4].

Consistent with the theme observed throughout, equities in service-focused economies suffer far less than those in commodity intensive areas. Singapore and Switzerland face very limited mitigation costs, for example, as they have a negligible carbon reduction need. Canada, Australia and the US take more of a hit, though in more modest mitigation scenarios and with a more efficient use of resulting revenues, it looks quite manageable. For example, US equity returns are expected to be 0.5% p.a. lower with the highest carbon price and lump sum dividends, but if we assume the IMF optimum price of $75 and income tax cuts, then per annum returns are reduced by just 0.1%.

For emerging markets, the pain seems more palpable. China and India in particular look badly hit, and this feeds through to the EM aggregate. Per annum returns for EM fall 0.7% with full mitigation efforts, and even if we pare the carbon price down to $50 per metric ton and implement tax cuts, returns fall by 0.2% p.a. But this level of pricing does not reach the Paris Agreement goals.

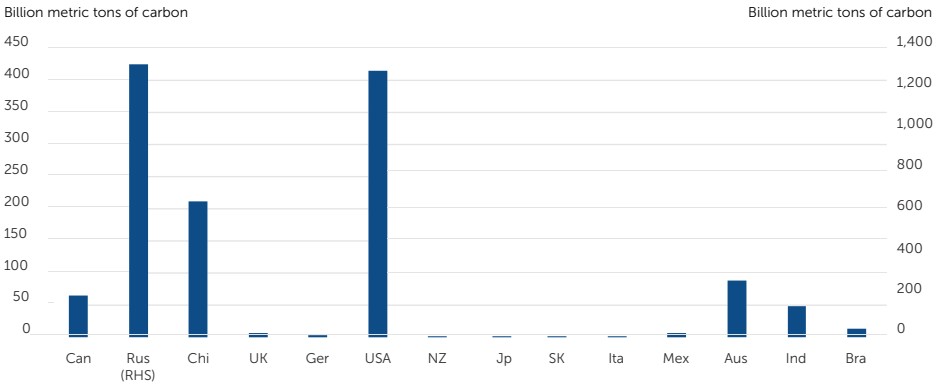
Fixed income returns (Chart 1) tell a similar story. Focusing on real cash rates (with a reminder that the changes here will be matched one for one in revisions to bond and credit returns) we see some quite dramatic reductions in expected returns. Under more extreme scenarios, Indian real cash returns see a decline of 1.4% per annum, the largest downward revision of the markets we forecast. China too sees a sizeable fall of almost 1.1%, while in developed markets the worst affected are Canada and Australia, where annualized returns fall by 0.6 percentage points each. In a slight difference from the physical costs, no country benefits from the effects of transition in this timeframe; returns are lower everywhere as a result of the costs associated with mitigation efforts.

Chart 1: The Impact of Transition Costs Alone on Cash Returns



Source: IMF, IEA, World Bank, Schroders. February 2020.

Chart 2: Reserves of Oil, Gas and Coal



Source: BP Statistical Review of World Energy 2019. January 8, 2020. We have focused on countries for which we provide market forecasts.

STEP 3 Stranded Assets and Equity Returns

In order to limit the increase in global temperature to 2 degrees Celsius as established in the Paris Agreement, a fraction of the existing reserves of fossil fuels must remain in the ground, thereby becoming stranded assets.

Current reported fossil fuel reserves worldwide consist of around 1 trillion metric tons of coal, 1700 billion barrels of oil and 200 trillion cubic meters of gas. Recent analysis from the International Energy Agency IEA finds that the CO2 emissions that would result from combusting these reserves account for around 2800 Gt of CO2, more than three times the carbon budget allowed in the 2°C Scenario (880 Gt)[5]. In particular, the IEA highlight that, globally, almost 60% of oil and gas reserves, and over 80% of current coal reserves should remain unused in order to meet the target of 2°C.

"In order to limit the increase in global temperature to 2 degrees Celsius as established in the Paris Agreement, a fraction of the existing reserves of fossil fuels must remain in the ground, thereby becoming stranded assets."

Chart 2 shows the cross-country distribution of reserves of fossil fuels, highlighting that Russia has by far the largest amount of reserves, followed by the US and China. This suggests that these countries are therefore at risk of witnessing severe wealth losses if climate policies were to be implemented in a low carbon transition. In this scenario fossil fuel markets would dramatically shrink and the prices would decline substantially, with large losses to asset owners. Proven reserves, which are estimated to be extracted profitably at current prices, may also remain undeveloped, if governments impose policies to limit the market supply of fossil fuel resources. Recent research shows that approximately $4 trillion of financial value could vanish off their balance sheets globally in the form of stranded assets[6].

This would clearly pose risks to financial markets, particularly on stock markets, as companies' equity value is likely to shrink in a low carbon transition scenario.

STEP 4 The Aggregate Impact of Climate Change

Notable throughout has been the range of uncertainty, not only around the economic relationships, but also policy responses. The choice of economic model, carbon price and the use of funds raised by a carbon tax all have material consequences for the final estimate. To narrow down our results, we will have to make some decisions about what seems a more likely scenario.

Physical Cost Assumptions

First, considering the modeling of the physical impact, a non-linear relationship between temperature and productivity seems more plausible than a linear one. With temperatures much above 35 degrees, for example, the human body simply cannot function for long. Meanwhile, Russia and Canada are already enjoying benefits of a warmer world as the Arctic becomes more navigable. For this reason, we will take the Burke and Tanutama (2019) results as our assumption for the physical cost modeling. We then need to decide which iteration of their model we want to use. The authors ran models allowing for lagged effects, as well as one in which contemporaneous impacts only were considered. Again, to us, a lagged relationship makes more sense; we are used to allowing 12 to 18 months for monetary policy to feed through, and responses to warmer temperatures are also likely to take time to fully play out. We will use the five-year lag version of their model in what follows.

Transition Cost Assumptions

Next, we need to make an assumption about the likely policy response. In the previous section we ran through a number of possibilities, both in terms of the price set on carbon by any carbon tax (which we have already assumed is the chosen policy, rather than quotas, or a carbon trading scheme for example) and in how the revenues of such a tax might be used. Inevitably, political calculations will at least partially drive the decision made by policymakers. We might (optimistically) hope that politicians committed to the Paris Agreement goals opt for the IEA recommended pricing of carbon – higher than the IMF's – but choose to make it politically palatable by using the revenues to pay lump sums to all citizens. On the IMF's analysis, such a policy would increase the economic distortions and hence the cost, but we think it will likely be more acceptable to electorates than a regressive policy of essentially taking money from the poor with a carbon tax and giving it to the wealthy (the IMF's more efficient solution). Of course, we may still be too naïve on the politics. The IMF suggest a carbon price of $50 per ton given political difficulties.

Stranded Assets

Finally, to complete our transition analysis, we need to make an assumption about the lost or stranded assets occasioned by climate change policy. We assume that nearly 60% of oil and gas reserves, and 80% of coal reserves are left in the ground resulting in a $4 trillion reduction in global market cap for a scenario consistent with meeting the Paris Agreement. If governments opt to fall short, the value of stranded assets will be less, but still enough to weigh materially on equity returns.

CLIMATE CHANGE AND INFLATION

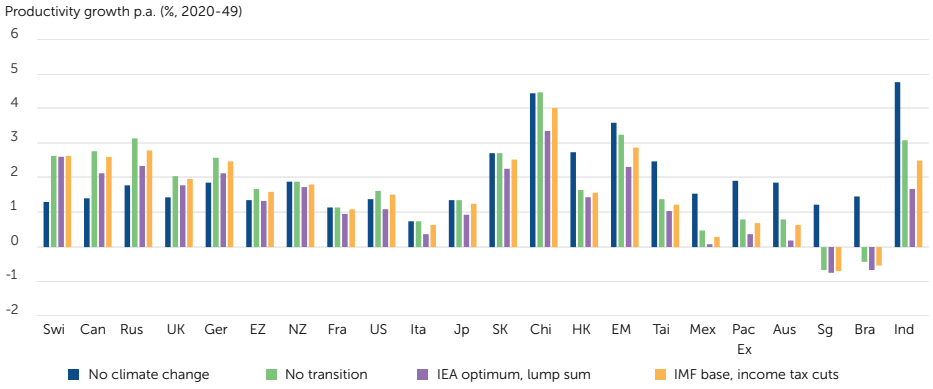
So far we have focused on the impact of climate change on output, without considering the consequences for prices and inflation. Given that we are discussing applying a tax to carbon in a deliberate attempt to make carbon intensive products more expensive and so reduce their consumption, some inflationary impact seems obvious. We do have some numbers to work with. The IMF[7] provided some estimates of the impact of a carbon tax on energy prices in their 2019 Fiscal Monitor, reproduced opposite.

A separate study[8] looks at the impact on product prices of a push for net zero emissions. In general, end product prices are estimated to increase only marginally, but intermediate goods prices increase more substantially. For example, cement could double in price, ethylene could see a 50% increase, and steel costs could increase by 20%, but end user products: construction, plastics, and autos, would increase in price by only 1-3%. Perhaps the biggest consequence for consumers would be in aviation, where a doubling of fuel costs would result in a 20% increase in long distance economy flight prices.

As McKibbin et al (2017)[9] note, what these increases mean for the inflation profile depends on how the carbon reduction methods are implemented; all at once, or gradually over time. A sudden imposition of carbon taxation in 2030, for example, would see a sudden spike in inflation for that year before price growth returned more or less to trend, with price levels permanently elevated. A more gradual increase would see less of an immediate

"Climate change seems likely to manifest as both a demand and supply shock."

Chart 3: Productivity Growth and Climate Change



Source: IMF, IEA, World Bank, US Census Bureau, Schroders. February 2020. 'No transition' assumes no efforts are made at mitigation, and so captures physical costs (or benefits) only.

Table 1: Impact of Carbon Taxes on Energy Prices, 2030

$75/ton carbon tax	Price increase (%) Electricity	Price increase (%) Gasoline
Argentina	48	13
Australia	75	15
Brazil	7	13
Canada	11	17
China	64	13
France	2	9
Germany	18	8
India	83	13
Indonesia	63	32
Italy	18	9
Japan	42	11
Korea	42	6
Mexico	74	18
Russia	25	12
Saudi Arabia	40	28
South Africa	89	16
Turkey	40	9
United Kingdom	16	8
United States	53	20
Simple average	43	14
$50/ton carbon tax		
Simple average	32	9

"There is no agreement as yet in the literature about the impact of climate change on economic activity even for a given quantity of warming, and even less so for the costs of transition where there is also no agreement on what form mitigation efforts will take."

spike, but would mean higher inflation over an extended period. For the 30-year period we are considering, the price increases discussed above should not be that noticeable when averaged out. Bear in mind also that increases in energy prices, though large, are only a relatively small part of most inflation baskets.

However, the overall consequences for inflation, as for growth, are ambiguous. Climate change seems likely to manifest as both a demand and supply shock. The demand shock has been a recurring theme through this article; GDP is set to be lower in many economies, which means lower income growth. But that lower growth is coming about, at least partly, because climate change is also acting as a shock to the supply side. Lower productivity growth means the productive capacity of the economy is reduced relative to what it might have been in the absence of climate change. Of course, for some economies there is an overall boost to output and productivity, and the effects run in the opposite direction.

The question for us, and for policymakers, is where the balance between the two effects lies. Is the weaker demand sufficiently disinflationary to offset the higher costs of production associated with lower productivity and a carbon tax? This is a question that central bankers have begun to ponder but, as the BIS[10] note, "there are still relatively few studies analyzing the impact of climate related shocks on inflation" and for now "the impacts of climate change on inflation are unclear".

SUMMING UP: WARMER WORLD, LOWER RETURNS?

Nothing Is Certain

Overall, the impact of climate change on asset returns is very uncertain. Throughout our analysis, we have had to make a number of simplifying assumptions, many, if not all, of which are open to challenge. There is no agreement as yet in the literature about the impact of climate change on economic activity even for a given quantity of warming, and even less so for the costs of transition where there is also no agreement on what form mitigation efforts will take.

Consequently, we would be remiss not to flag, one last time, the immense variability in asset return forecasts depending on the models used and assumptions made. There are some countries for which all our forecasts are for lower returns as temperatures rise even if the extent of that reduction remains uncertain, but for others – particularly countries which are neither hot nor cold – whether climate

"Having a clear framework for measuring the impact of climate change on a company-by-company basis and from a country perspective has never been more important."

change helps or hurts returns hinges on the assumptions we make. In this section, we provide only our forecast returns without climate change and under our 'base case' climate change scenario, as outlined below.

Key Assumptions

- **Physical Costs:** We use the Burke and Tanutama model incorporating a five-year lag for the impact of temperature changes on productivity, and assume that temperatures rise by 0.04 degrees Celsius per year throughout the 30 year forecast period. Note that a different lag structure would radically alter our returns, with negative consequences for all countries below 20 degrees Celsius.
- **Transition Costs and Mitigation Efforts:** We assume the world adopts carbon pricing in the form of a carbon tax in the year 2030, imposing a price of $50 per ton of carbon emitted. We assume that the revenues from this tax are used to make lump sum payments to the electorate and maintain political support, weighing on efficiency further. Again, our results are sensitive to this assumption; if we instead assumed a carbon price consistent with the Paris Agreement, returns would be reduced considerably for a number of developed market economies.
- **Stranded Assets:** We assume that 60% of oil and gas reserves, and 80% of coal reserves are left in the ground resulting in a $4 trillion reduction in global market cap. In keeping with a less ambitious mitigation effort, we assume a larger quantity, consistent with at least three degrees of warming by 2100, are consumed.

Asset Return Implications

As goes productivity, so go our return forecasts. Using the three-stage climate model we have advocated in this report, warmer countries are likely to lose out in a changing climate, with considerable reductions in expected returns for hotter countries like India and Singapore. Colder countries meanwhile may experience increased returns; considerably so for Canada and Switzerland, though the UK and US also see some benefits.

However, there are clearly many factors to take into account when deciding how to allocate assets to companies and countries. Having a clear framework for measuring the impact of climate change on a company-by-company basis and from a country perspective has never been more important. The message is clear: An active approach to managing the risks of climate change is no longer optional; it is essential.

Irene Lauro *is an Economist at Schroders, which involves conducting research on the economic impact of climate change. She also conducts research on the Canadian and Australian economies. She is a member of the Equity Risk Premium, Currency Risk Premium groups of the Strategic Investment Group Multi-Asset (SIGMA). Lauro joined Schroders in January 2018 and is based in London.*

Andrew Howard *is a Head of Sustainability Research at Schroders, which involves thought leadership, ESG integration and engagement, in addition to his role as a climate change specialist for Schroders' Global Climate Change strategy. He joined Schroders in 2016 and is based in London.*

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Should Investors Consider A Stand-Alone All-China Equity Allocation?

"State Owned Enterprises have significantly reformed and no longer dominate Chinese equity markets."

As China's weight within key global equity indices increases and as financial markets there mature and become more accessible, US public pension plans face a dilemma: Should they consider a dedicated All-China allocation or should they continue gaining their exposure to Chinese equities as they currently do, typically via international or emerging market (EM) allocations?

Chinese Equity Markets Are Coming of Age

Chinese equity markets are rapidly changing. Whereas historically China's economy was powered by State Owned Enterprises (SOEs), the modern economy is increasingly driven by small- and mid-size private companies, foreign investment, increasing capital supply and investment in biotech, artificial intelligence, 5G and other innovative sectors.

As a result, Allianz Global Investors contends that All-China equity is the best way to take advantage of these trends. The market, from Hong Kong to A-share exchanges and the new Nasdaq-like STAR board, has matured and is evolving in five constructive ways:

1 **China's economy is no longer dominated by SOEs:** SOEs have significantly reformed and no longer dominate Chinese equity markets. The combination of the growing number of SOE privatizations and IPOs has made Chinese equity markets more dynamic. The number of SOEs was 97 at the end of 2018, down from nearly 200 in 2002. Crucially, the public/private composition of Chinese listings today is very different than a decade ago making China's markets a better reflection of the country's future growth drivers. Shanghai is now the world's No. 1 listing venue, ahead of New York and Hong Kong and, over the last five years, there have been almost 1,100 new China A-share listings even the number of IPOs in other top markets has been on a declining trend. At the same time, Hong Kong is attracting high-profile listings.

"China's increasing weight in key benchmarks, such as the MSCI EM Index and the MSCI ACWI Index, is accelerating market institutionalization."

4 China's benchmark weightings are rising: China's increasing weight in key benchmarks, such as the MSCI EM Index and the MSCI ACWI Index, is accelerating market institutionalization. China's weight in the MSCI AC Asia Pacific ex Japan Index has risen to 40% from 20% five years ago, led by the internet sector, which accounts for 22% of the index weight versus 5% five years ago. As rising weightings attract foreign inflows, the still relatively high proportion of trading conducted by retail investors (often funded by margin debt) creates inefficiencies that institutions can exploit to derive potential alpha.[iii]

5 China's new consumer buys domestic: China's growing cohort of middle- and upper-income consumers increasingly buy domestic products. In 2008, three foreign brands accounted for 90% of smartphone sales in China. Today, eight of the top 10 brands are Chinese.[iv] There have been similar shifts in appliances, computers and industrial equipment. As a result, US investors that once gained exposure via multinationals operating in China can now only properly access this opportunity by investing in the local firms that own these increasingly popular brands.

2 Corporate governance has improved: The reduced dominance of SOEs (often used as tools of government policy) and regulatory reforms that are aligning corporate and shareholder interests have changed the governance landscape. How far has China come? A 2008 report from the RAND policy think tank highlighted several governance challenges, among them two-thirds of Shanghai listings being SOEs, a lack of board independence, "rampant insider trading", poor control of false financial disclosures and immature capital markets.[i] Since then, China has progressed in all those areas as President Xi has made stamping out corruption a priority. Progress is seen in myriad public and private initiatives, from the China Banking and Insurance Regulatory Commission releasing new rules for the governance of banks and insurers, to the Shenzhen Stock Exchange classifying listings into four categories, from high-risk to normal.

3 Capital markets have developed: The development of China's capital market is illustrated by the total number and market capitalization of listings in Shanghai, Shenzhen, Hong Kong and US-listed American Depositary Receipts (ADRs) — 5,333 companies valued at $14.1 trillion at the end of June. That compares to the $7.8 trillion market capitalization of equities in the euro area.[ii]

Foreign investor access to domestic A-shares began opening in 2003, with the launch of the Qualified Foreign Institutional Investor (QFII) program, and it has gradually expanded since then through Stock Connect schemes, adding a steady flow of foreign investment. Developments such as the Nasdaq-like STAR board, which streamlined listing requirements, are facilitating the growing number of tech-driven IPOs. Capital market improvements have also lowered transaction costs and improved investors' legal rights, allaying long-standing concerns among some international investors.

"We believe that investors should not refrain from increasing allocations to China equity based on concerns about rising US-China trade tensions."

What About US-China Trade Tensions?

We believe that investors should not refrain from increasing allocations to China equity based on concerns about rising US-China trade tensions. Over the long term, we believe that trade tensions are a natural derivative of the world's two largest economies having very different political and social structures. This could increase volatility—which has been more significant for individual stocks than for the overall market—but should not derail the long-term investment opportunity, in our view. Notably, over the past two years, rising trade tensions have not restrained the relative performance of Chinese equities, especially A-shares.

Foreign inflows **(Exhibit 1)** also suggest that investors are relatively comfortable with this new risk factor. Since the Shanghai Stock Connect opened in November 2014, Chinese equities have enjoyed steady foreign inflows with only 12 months of outflows.

"China plans to invest $170 billion on 5G wireless networks over five years, significantly more than the US."

Exhibit 1: Global investors have increased Chinese equity holdings, even as trade tension rose

Monthly northbound buying via Stock Connect (RMB billion)

As of August 31, 2020

Source: Wind, Allianz Global Investors

China Is Investing Heavily In Innovation

The outlook for Chinese equities is underpinned by government investment in "new infrastructure"—foundational technologies in which Beijing wants to reduce its foreign reliance; artificial intelligence, 5G, cybersecurity, alternative energy, electric vehicles and semiconductors.

For example, China plans to invest $170 billion on 5G wireless networks over five years,[v] significantly more than the US. China's plan for 5G dominance—it has filed one third of the world's 5G patents—is just one marker of its efforts to become a global tech leader.

Beijing's policies are also encouraging a startup culture it hopes can rival Silicon Valley, a crucial mindset change: Instead of controlling the corporate sector via SOEs, Beijing is enabling a more attractive opportunity for both startups and investors alike.

These centrally coordinated investments are part of the "Made in China 2025" policy, which promotes capabilities in "new infrastructure" sectors such as semiconductors and aircraft. In 2017, just two years after Made in China 2025 was established, China invested $279 billion in R&D, second only to the US.[vi]

These efforts are paying off: China has the most "unicorns", tech startups valued at $1 billion or more. In 2019, China surpassed the US in filing for the most international patents. Since 2009, China has spent more than $1 trillion[vii] to create the world's largest high-speed rail network. China is also a major producer of solar components, electric vehicle batteries and is investing to be a digital currency leader.

China is developing a 21st century economy built on "new infrastructure", backed by maturing capital markets that can fund a growing number of innovative, strategically important domestic firms.

Why Index Tracking Is A Flawed Approach to China Investing

We believe that investors allocating to China by index tracking could face unintended consequences, such as an imbalance between allocations to the various Chines equity markets. As a result, we believe that international investors should adopt an All-China allocation to attempt to exploit inefficiencies and maximize potential alpha. **Exhibit 2** illustrates how, for example, domestic Chinese equities are sharply underrepresented in global equity indices. As of August 31, Chinese equities accounted for 5.1% of the MSCI All Country World Index, with a whopping 80% of that representation (4.1%) tied to "offshore" China equities and a mere 1% tied to China A-shares.

"We believe that pension plans' China allocations do not reflect the country's bright prospects and that this misalignment creates potential costly imbalances in portfolios."

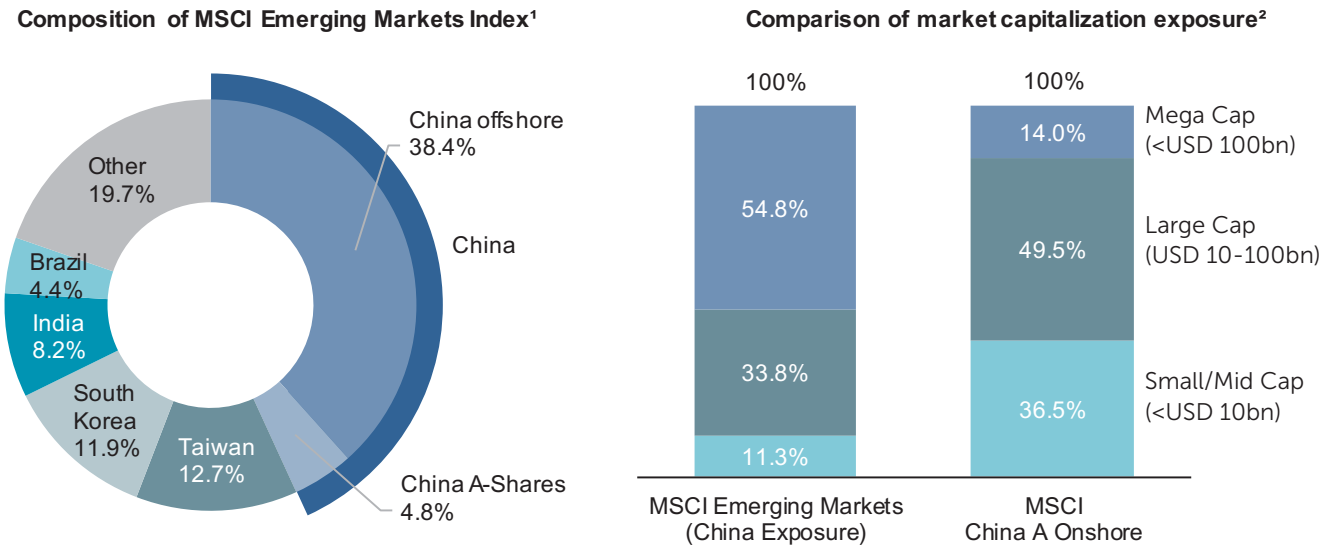
Exhibit 2: MSCI's evolving weightings are changing the balance of China equity allocations

MSCI China weightings in MSCI All Country World Index

As of August 31, 2020
Note: "November 2019" data represents regional/country weightings at the time of the final step of the first phase of MSCI's inclusion process for China A-shares into the MSCI ACWI Index while "Future" represents potential future allocations. As of the time of writing this paper, MSCI had not disclosed a formal timeline for the second phase of inclusion.

Source: Bank of America Merrill Lynch, Allianz Global Investors

Exhibit 3: MSCI EM Index leaves investors underweight China A-shares, overweight large caps



As of October 30, 2020
1 - MSCI Country Category as of October 30,2020. Figures may not sum to 100% due to rounding errors.
2 - For more details, see The Time is Right to Use China A-Shares to Optimize Equity Allocation, Allianz Global Investors, March 2020.

Source: Bloomberg, Allianz Global Investors

MSCI's EM Index **(Exhibit 3)** is similarly weighted toward offshore China at the expense of A-shares. So, allocating to China by tracking benchmarks is akin to gaining US equity exposure by overweighting mega-caps at the expense of everything else. Creating a China equities allocation offers a more balanced approach and enhances the odds of capturing potential future returns.

Another issue facing institutions is aggregating China and EM allocations. As **Exhibit 3** shows, China is 43.2% of the MSCI EM Index, slightly more than the combined 37.2% for Taiwan, South Korea, India and Brazil. As the free float of China A-shares increases and as market access improves, it will dominate the index even more, thereby reducing portfolio diversification.

Allocating to China via EM also leaves investors underweight some of the fastest growing Chinese companies, specifically onshore China firms traded as A-shares in Shenzhen and Shanghai—the same young, dynamic tech and "new infrastructure" firms discussed earlier.

Setting allocations against various MSCI indices would leave investors with an exposure that, in our view, is out of step with China's prospects. Although this paper is not proposing a pre-determined All-China allocation—that determination depends on risk appetite and mandate restrictions—we believe investors should at least augment China allocations beyond benchmark levels, now 5.6% of MSCI ACWI. We believe investors should also consider the large alpha opportunity available in China, where the rapid evolution of equity markets still creates inefficiencies that can be exploited.

For example, over the past 10 years (through September 30, 2020), the median actively managed China A-shares strategy has outperformed the MSCI China A Onshore index by 8.2%, annualized while the median manager outperformed the MSCI EM index by 0.9%, annualized. The alpha potential available in China equities is even more striking when comparing to US equities, where the median manager has underperformed the S&P 500 Index by 50 basis points, annualized. For long-only equity investors, China offers a rare source of meaningful, sustainable alpha potential, on top of portfolio allocation benefits.

Conclusion

We believe that pension plans' China allocations do not reflect the country's bright prospects and that this misalignment creates potential costly imbalances in portfolios. Our analysis suggests that plans, especially large ones, should consider a stand-alone All-China allocation to bring their overall China allocation beyond current benchmark levels and that less benchmark-sensitive investors could consider an even larger allocation.

We fundamentally believe that China's prospects—buoyed by maturing capital markets, a dynamic corporate landscape, and technical support from MSCI index changes that is providing a tailwind of foreign investment inflows—create conditions that warrant an All-China allocation in most portfolios.

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***Christian McCormick**, CFA, is a Senior Product Specialist China Equity.*

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SHORT TAKES

CONVERSATIONS WITH SPRING CONFERENCE KEYNOTES

MAY 11-14 2021

The virtual 2021 Spring Conference offered insightful speakers and dynamic breakout sessions. Presented here are outtakes from a few sessions; all responses are from the point in time of May.

SEEMA R. HINGORANI

Seema Hingorani is a Managing Director at Morgan Stanley Investment Management. As part of the senior leadership team, Seema is focused on strategic client relationships, investment talent development and diversity initiatives across the platform. She is also Senior Sponsor of Investment Management's Diversity Council and a member of Morgan Stanley's Diversity and Inclusion Senior Leaders Advisory Council. Seema joined Morgan Stanley in 2019 and has 26 years of investment experience. Seema is also the Founder and Chair of Girls Who Invest, a non-profit organization dedicated to increasing the number of women in portfolio management and executive leadership in the asset management industry. During the SACRS general session **Diversity Equity and Inclusion** Seema and Nancy Sims, the CEO of the *Toigo Foundation*, had a conversation facilitated by Maisie Short of Manulife and the Co-Founder of Women in Institutional Investments Network.

SACRS Magazine: Why did you found Girls Who Invest?

SH: Getting interested in the asset management industry and becoming an investor was by luck and chance for me. I feel very lucky to have bumped into this industry. One of the main reasons I started Girls Who Invest is because I did not want any young woman to feel lucky to bump into our industry. I want them to have every option on the table.

It really came about around 2013/2014 when I was managing the New York City Portfolio, and because it is the fourth largest public pension plan in the US, every asset manager in the world was coming to visit me. And when I looked at their organizational charts, I would see this lack of women. I really was shocked by how few women, if any, there were on investment teams all over the world. When I asked 'why' they would tell me they don't get resumes from women. It was clear we had a pipeline problem. I never intended to start this non-profit, but in 2015 Girls Who Invest launched to train, educate, and prepare young women for this industry. We are on our sixth year now and we have put over 500 college women through a 10-week summer program and 80% are staying in the investment business.

SACRS Magazine: How do you benchmark equity, diversity, and inclusion?

SH: People in the beginning of Girls Who Invest would ask me why wouldn't your goal be the number of women in portfolio management. And honestly, I don't really care about the number of women in portfolio management, it is the amount of capital that they manage and control; that is where the power and influence is. So that is what I made the measurement.

Roughly of the 80 to 90 trillion dollars invested globally professionally, women manage less than 5%. That's not good for anybody. But this isn't just about the women coming into the industry, but also the women currently in the industry. How do we help these women who are currently analysts that should be promoted to portfolio managers? We have to focus on the cultures, particularly at the larger firms, and that honestly is where it gets hard. It gets uncomfortable. But I have to say, over the last five years with Girls Who Invest, I am very encouraged with the conversations I have been having with the leadership of our industry. You know we do a lot of hard things, making money for people is hard, and you know what? We're really good at it. So we can figure this out too.

NANCY SIMS

Nancy Sims is President and CEO of the Toigo Foundation. She brings 30 years of service in the financial services industry to her leadership of the non-profit beginning with her 5-year service as a member of the board of directors while SVP, Client Relations of McNeil Capital and prior with The RREEF Funds, both real estate investment firms. Nancy's entrepreneurial leadership has transformed the organization through a mission-driven strategic plan designed to increase industry engagement, program development, participant expansion and a more robust financial platform. She has advanced the brand of Toigo to a broad mix of industries from finance to technology to government as part of her vision to elevate the message and impact of the organization around inclusion.

SACRS Magazine: In your opinion, are firms addressing equity, diversity, and inclusion?

NS: There is such complexity. Last year was an amazing year in a lot of different ways, painful as well as exciting based on the efforts that firm leadership tried to undertake to demonstrate humanity, sensitivity, and empathy around what was going on, and it puts Toigo at a really interesting intersection of dialog with a lot of firm leaders, and with HR practitioners around how to really address this. One aspect that is clearly a focus is recruiting. I think it becomes the lowest-hanging fruit, it is often the easiest way – the in-flow into an organization. But when we started to take deeper dives, I asked many of the organizations as they looked to move into this area, what are you trying to solve? Many of them could not answer. It was because they really weren't thinking about the culture of the organization.

What we have been trying to do in some of our engagements that we have had through a new service we started last year called Inclusion Strategies, is to work with CEOs and what we find is that there needs to be an ongoing assessment of what the pulse of an organization is. Leaders have great aspirational goals, these goals are real to them, but are they actually being carried through the organization down to the levels that are having the most interaction with the employees; with the young talent that is seeking to grow and advance? And also the sense of visibility – is there access to the deals that will allow employees to demonstrate their talents? There are huge gaps between who makes those decisions and who actually benefits from those decisions that are being made. The biggest issues we have heard are around how do I get promoted? Is there a sponsor that can speak on my behalf? There are so many pieces that organizations need to figure out about how to make transparency work.

SACRS Magazine: What should organizations be focusing on?

NS: There is a lot of talk about equity, in one sense for many of us equity means money, but equity is also fairness, it is also making sure that the workplace environment gives the same opportunities for exposure and for connections as everyone else on the team. We see this as an area of continued concern.

Right now, Toigo has a national diversity survey out and I was surprised when I looked at preliminary data to see that 58% of the respondents at the mid-career level have contemplated leaving their jobs in the past six months. So I would say to industry, you need to be aware of what is going on out there and that it is important to develop young talent. Think about the individuals that are in your organizations today, because the remote work environment has given people time for reflection and conversation. If organizations haven't been proactive to stay connected, you could find some of those stars that have been relied upon so heavily do not feel valued or recognized.

These are extremely complex topics, but the more we can engage in dialog there is greater understanding and awareness of all the pieces that have to come together.

MOHAMED A. EL-ERIAN

Dr. Mohamed El-Erian, Chair of Gramercy Funds Management, is a renowned economist and leader in emerging markets investment and research, having previously held senior roles in investment management and international policymaking. He is one of the world's most famous fixed income investors and was on Foreign Policy's list of Top 100 Global Thinkers for four years in a row. In the SACRS Spring Conference general session, **Why You Should See the World Through the Eyes of a Bond Investor** Mohamed El-Erian shared his views on the state of the economy and discussed how growth, credit, access to capital, inflation and geopolitical dynamics are likely to be shaped by monetary and fiscal policy in the US, International Developed Markets, and Emerging Markets.

SACRS Magazine: Why do bond investors see the world differently?

ME: There are a couple of reasons. One, they are much more aware or more sensitive to what I call 'the neighborhood effects' – they don't just look at the house. They look at the whole neighborhood. So they tend to be much more macro by construction and much more sensitive to top down issues. These top down issues don't just inform and influence how you think bottom up, but also importantly at times can be deterministic. The second way in which they are different is the upside downside is completely different from an equity investor. If you look at the upside downside – downside being default, upside being you get paid back with interest, but there is a cap unless you trade out – bond investors tend to be more pessimistic than your typical equity investor.

SACRS Magazine: Why should public pension fund trustees look at their investments and portfolios, at least some of the time, though the eyes of a bond investor?

ME: Today we live in a very uncertain world, and mistakes happen. The more uncertain the world, the bigger the chances for mistakes. Most mistakes in the investment world are recoverable, if you have time and you behave accordingly. But a few are non-recoverable mistakes. For a pension a non-recoverable mistake is something you have to worry about. This is why it is important to think about distributions – we have a baseline, we know what we are targeting, we know how much risk we are able to absorb,

but we also have to think of the tails. We have to ask the question, especially as a trustee, how will we and the institution behave in one of those tails. If you look back on the mistakes being made, they are made because people overreacted to something or alternatively hadn't thought about what the tails will look like and were so surprised they ended up falling into behavioral traps. And we know enough about these behavioral traps to suggest we should be thinking about the whole distribution and not just the baseline.

SACRS Magazine: How do you see the state of the US economy? Will we grow?

ME: The US economy is going to boom. I think we are going to grow in excess of 7%. Most consensus projections are in the 6% to 6.5% — but I think we are looking at 7% plus. If you look at the engines that are being brought in that are powering the US economy right now, they are really impressive. Fiscal policy is incredibly expansionary, monetary policy is exceptionally expansionary, and in addition to that, the average person, and I say average because there are issues with distribution, has a lot of savings and pent up consumption. When you look at that, we will grow. The question to deal with is can we grow in a healthy manner without triggering inflation? Can we grow in a world that is going to be multi-speed and to what extent do the multi-speed dynamics impact us? We are going to grow and we are going to grow relatively well, but we have to keep an eye on these two qualifications, in addition, of course, to COVID-19.

SACRS Magazine: Will inflation be short-lived?

ME: When COVID hit and the world got stopped, it did not stop in a synchronized manner. Things were out of place. We can't just re-start it and assume everything is going to be fine. We are going to have bottlenecks in the supply chain, but most of them are going to be temporary. But how long it takes is critical to the inflation debate. There is mistiming between demand and supply. Demand surges and supply cannot keep up. And this will be different for different sectors. To use the Federal Reserves favorite phrase this is 'transitory effect' – in the old days we called that Demand Pull, where demand pulls inflation up. The real uncertainty here, and where you come out on the transitory issue is ultimately what view you take, is the Cost Push. How much of the disruption in the supply and the labor markets are going to cause their own dynamics? That is the key question we face right now. Certain sectors are not going to come back quickly. There is also the labor market. The assumption is – and I hope it is reality – we are going to reabsorb over 8 million people who have lost jobs, but can we attract them back in? There is a question mark about that. The economy post pandemic is going to look different than the economy pre-pandemic. The major question we should all be dealing with is to what extent will the supply side be a source of discomfort, especially in respect to inflation.

It is easy to run the demand side, but if you don't use that to enhance supply, physical infrastructure, human infrastructure, and technological infrastructure, then pretty soon it is the supply side that is going to be a problem, not the demand side. At that point you get inflation building into the system, and you get markets reacting. We haven't worried about inflation since the 80s. We have a whole system that is built on low and stable inflation. Take low and stable inflation that has been less that 2% and take it to 4% or 4.5% -- we can do as much deficit financing as we want, but without caring about the supply side we will get there pretty quickly. At that point the system is under stress. But understand, we don't have to get there. We have every single tool that we need to avoid this. But we have to be careful and think holistically about the economy and not just the demand side.

State Association of County Retirement Systems

LEGISLATIVE REPORT

The Legislature just reached a critical legislative deadline – the House of Origin deadline. This deadline requires all bills to pass out of the house where they were introduced. This means that at this point in the legislative process, all remaining bills that are still viable have passed out of policy committees, fiscal committees (if applicable) and the Floor of their first house. Now, bills face the second house, where all remaining Senate bills move through the Assembly, and all Assembly bills move through the Senate.

Now that we have reached this stage, policy committees will begin to ramp up again. Legislators have until July 7 for bills to pass out of policy committees before facing the fiscal committee deadline.

In the meantime, legislative leadership and Budget Committee chairs are convening to negotiate the final version of the 2021-22 State Budget with the Governor's Administration. The negotiation process must conclude by June 15, the constitutional deadline for the Legislature to pass a balanced budget. Due to the large surpluses seen this year, we anticipate there will be further budget negotiations on a "budget bill junior" beyond June 15 to address other outstanding issues and programs not included in the June 15 budget agreement.

"In the meantime, legislative leadership and Budget Committee chairs are convening to negotiate the final version of the 2021-22State Budget with the Governor's Administration."

LEGISLATION OF INTEREST

SB 634 (Committee on Labor, Public Employment, and Retirement) - SACRS Sponsored Bill. This bill makes a few clarifying changes to the CERL, including clarifying that a 37 Act Retirement board may contract with a private physician to provide medical advice to the board to process disability claims, changing an obsolete code reference related to when a 37 Act system member may opt to continue as a member of the 37 Act system instead of enrolling in CalSTRS, and deleting an obsolete reference authorizing a 37 Act member who contributes by installment payments to complete payment through a lump sum payment any time prior to retirement.

The bill passed out of the Senate and is currently in the Assembly.

AB 845 (Rodriguez) - COVID-19 Presumption. This bill creates a rebuttable presumption for members that a COVID-19 related illness contracted on the job must be eligible for an in-service disability retirement. The provisions sunset January 1, 2023. The bill is sponsored by SEIU. The co-chairs of the Legislative Committee have been closely engaged with the sponsor and committee staff working on the legislation to ensure smooth implementation in CERL Systems.

This bill passed out of the Assembly and is currently in the Senate.

PUBLIC MEETING BILLS

Now that the pandemic and its associated restrictions are coming to a close, public agencies are anticipating various Brown Act requirements that were suspended by the Governor's Executive Order to allow for remote meetings. It remains to be seen when and how the Governor will take action on this issue.

On the legislative side, three public meeting bills have been introduced relating to the pandemic and teleconference/virtual meetings for local public agencies.

AB 361 (Rivas)- Virtual Meetings for Declared Emergencies Only. This bill is sponsored by the CA Special Districts Association and would codify the Governor's Executive Order allowing for teleconference for declared emergencies. The bill would require local agencies to re-declare an emergency every 30 days that would then allow them to continue meeting remotely.

This bill is currently in the Senate.

AB 339 (Lee) - Mandatory Virtual Meetings with Translation Services – As introduced, this bill would have required the Legislature and public boards to continue to provide virtual access for the public, even if all of the members attended in-person, included requirements for translation services upon request and posting instructions in the two most spoken languages in the jurisdiction. The bill is sponsored by the Leadership Counsel for Justice & Accountability and the ACLU of California.

Due to opposition from public agency groups, the bill was amended to limit the bill's applicability to city councils and boards of supervisors in jurisdictions with over 250k residents, limit the public access to phone or internet (not both), remove all translation requirements, and add a sunset date, among other changes.

This bill is currently in the Senate.

AB 703 (Rubio) - Continues Option for Virtual Meetings beyond pandemic. This bill codifies the Governor's Executive Order allowing for teleconference meetings after the pandemic is over. However, the author's office has confirmed that this bill is a two-year bill that will not be moving further this year.

Michael R. Robson *has worked since 1990 in California politics and has been lobbying since 2001 when he joined Edelstein, Gilbert, Robson & Smith LLC. Prior to joining the firm, he began a successful career with Senator Dede Alpert as a legislative aide soon after she was elected to the Assembly in 1990. He became staff director/chief of staff in 1998, while the Senator served in the position of Chair of the Senate Appropriations Committee. He is experienced in all public policy areas with particular expertise in environmental safety, utilities, revenue and taxation, local government finance, education, and the budget.*

Trent E. Smith *worked for over 12 years in the State Capitol prior to joining the Edelstein, Gilbert, Robson & Smith LLC. He started his career in 1990 working for the well-respected late Senate Republican Leader Ken Maddy. He was later awarded one of 16 positions in the prestigious Senate Fellowship Program. Upon completion, he started working in various positions in the State Assembly. He worked as a Chief of Staff to Assembly Member Tom Woods of Redding and later to Orange County Assembly Member, Patricia Bates, who served as Vice Chair of the Assembly Appropriations Committee. In this position, he gained a unique and valuable knowledge of the State budget and related fiscal policy matters. In addition, he has extensive experience in numerous policy areas.*

Bridget McGowan *joined Edelstein Gilbert Robson & Smith in 2018. Prior to joining the firm, she gained policy experience in the California State Assembly. Through internships in the district office of her local Assemblymember and later, in the office of the Chief Clerk, McGowan developed her knowledge of California's legislative process, rules and procedures. A graduate from UC Davis in 2018 with a Bachelor of Arts in International Relations, she is currently pursing a Master of Public Administration from the University of Southern California Price School of Public Policy.*

DIGITAL

CURRENCIES PRIMER

PART TWO

Could we have a financial industry without banks or brokers? That's the vision of decentralized finance – or DeFi – in which financial products are built from tamper-proof digital smart contracts interacting with blockchains effectively removing intermediaries like banks, brokerages, or exchanges.

In this second of a two-part series that explores aspects of the transformative digital currency universe SACRS Winter 2021 edition offered a primer on cryptocurrency, blockchain, and bitcoin) the focus here is on the rapidly evolving fields of DeFi, smart contracts, and cryptocurrency mining.

"The overall goal of DeFi is to rebuild traditional finance in an open, permissionless way."

WHAT IS DEFI?

DeFi, or decentralized finance, is a burgeoning ecosystem of traditional financial services like lending, borrowing, trading and prediction markets with minimal or no need for a trusted intermediary. In that way, DeFi may be "trust minimized" or "trustless." As an analogy, DeFi is the equivalent of turning the New York Stock Exchange, or the local Wells Fargo, into a mobile app. However, instead of getting the app from the NYSE or Wells Fargo, it's an open source program where anyone can read the source code. Other people run the same app, so users can trade or send money to peers without asking anyone for permission.

DEFI APPLICATIONS

The DeFi ecosystem, most of which operates on the Ethereum blockchain, has seen some of the most traction of any use case for cryptoassets outside of the store of value use case for Bitcoin. At time of writing, more than $1 billion of ETH is currently "locked up" in smart contracts operating DeFi applications, the largest of which is MakerDAO (or "Maker").

Maker is a decentralized stablecoin lending platform and one of the most exciting and successful projects in crypto. Maker works by allowing ETH to be deposited in a smart contract and Dai, a stablecoin pegged to the US dollar, to be issued using that deposited ETH as collateral at 67% loan-to-value for Dai. Interest is paid on the issued Dai by the person putting up the ETH through smart contracts. Maker has more than $600 million of ETH currently deposited as collateral.

Prediction markets are one of the more complex but fascinating areas of DeFi. Prediction markets are exchanges that allow for trading on the outcome of future events via smart contracts executed on a blockchain. Market prices of an event occurring in the future allow for an indication of what the crowd thinks the probability of an event occurring is. The most challenging technical design aspect of decentralized prediction markets is what is referred to as "The Oracle Problem", or relaying real-world events to the blockchain in a trustless manner. Augur, built on top of Ethereum, is the most successful DeFi prediction market currently in operation, although it has still seen limited actual usage.

Decentralized exchanges, or DEXs, are noncustodial trading platforms. Unlike Coinbase, which operates as a trusted intermediary to facilitate trading, DEXs utilize smart contracts to create an order book and execute orders directly from customers' wallets in a peer-to-peer fashion, removing the need for a trusted centralized authority. The main advantage of DEXs is that they significantly reduce the attack vectors for hackers to steal funds, a problem which has plagued centralized exchanges and resulted in end users' funds being stolen. By operating the entire exchange with smart contracts, a DEX relies on the security of a blockchain to protect customers' accounts. Uniswap, IDEX and Kyber are three of the more widely used DEXs; notably, volume statistics still pale in comparison to centralized alternatives, given clunky user interfaces and difficulty in creating highly liquid markets solely through the use of smart contracts. Looking longer term, there is potential for DEXs to will see significant user adoption as the technology improves.

OPEN FINANCE

DeFi is a subset of FinTech and provides decentralized solutions (as opposed to centralized finance, or CeFi). The overall goal of DeFi is to rebuild traditional finance in an open, permissionless way. DeFi is sometimes referred to as "Open Finance," because of the transparency inherent in utilizing a blockchain to deliver financial tools. Open Finance may be a more applicable label in instances where trust is minimized, rather than removed entirely, like Maker. Dharma and Compound are two examples of trust-minimized DeFi applications. Dharma allows for the creation and trading of digital lending products by tokenizing debt. Compound creates pools of digital assets and uses algorithms to create interest rates based on the supply and demand of a pool.

The overarching goal of DeFi applications – to rebuild traditional finance in a permissionless manner without the need for a trusted intermediary – is an ambitious one. There are many challenges facing this vision, both on the technological and regulatory front. If these hurdles are cleared, DeFi has the potential to bring financial products and services to billions of people around the world who do not currently have access to centralized alternatives.

SMART CONTRACTS

A smart contract is, simplistically, a collection of if-then statements written in code that exists on a blockchain – "IF this happens, THEN do this." It is a contract in the sense that one or more parties agree to the rules and parameters written in the code that

executes the smart contract. Smart contracts guarantee a very specific set of outcomes, so as to remove any confusion or need for litigation. The existence of smart contracts on a blockchain allows for transactions and agreements to be executed among parties in a secure manner utilizing established cryptography, without the need for a central authority or intermediary.

The name "smart contract" is a bit of a misnomer, as such contracts are neither intelligent nor currently legally enforceable in a court of law. However, like traditional contracts, smart contracts have (1) signatories, (2) a subject of agreement and (3) specific terms of agreement. They are "smart" in the sense that they are programmable and exist digitally on a blockchain.

The advantages of smart contracts are numerous. They remove the need for a middleman, thus removing both the trust requirement and costs associated with an intermediary. They are automated and trackable in real-time. They are transparent, accurate, fast and secure. Smart contracts guarantee outcomes, as there is no ambiguity in the code that creates and enforces them.

SMART CONTRACT PLATFORMS

There are many use cases for smart contracts that currently exist or are in various stages of testing and development: digital identity, banking and capital markets, crowdfunding, tax records, insurance, real estate and land titles, supply chain management, IoT, gaming and gambling, music, art, intellectual property rights, health care, voting and many more.

Much of the current smart contract development is occurring on the **Ethereum public blockchain**, or on private forks of the Ethereum blockchain. The Ethereum blockchain is much more flexible than the Bitcoin blockchain in terms of the type of code that can be executed on it. This allows for many different types of smart contracts to be programmed and executed on the Ethereum Virtual Machine (EVM).

While Ethereum is the most widely used smart contract platform, there are others with varying degrees of network activity, including EOS, Tezos, Cardano, Tron, Rootstock, Algorand, Hedera Hashgraph and more. Ethereum's smart contracts are written in the programming language Solidity, but other smart contract platforms utilize different languages, including Golang and Haskell.

For Ethereum and most other smart contract blockchains, executing smart contracts almost always requires the payment of a fee, such as a transaction fee to the miners (termed "gas" in the case of Ethereum), which essentially pays for the CPU cycles used to run the code. Complicated Ethereum smart contracts require more gas to run because they require more CPU time to compute. Therefore, users are incentivized to implement the simplest smart contract that accomplishes its goal.

Smart contracts are not without drawbacks. The software code is written by humans, and any bugs or errors in the code can lead to unintended consequences. There have been numerous examples of this over the years that have led to significant financial loss. Smart contracts are also not clearly regulated, so their legal status and enforceability are ambiguous at this time. The speed with which smart contracts can execute is a function of the capabilities of the underlying blockchain. The Ethereum blockchain, for example, can only perform ~15 functions per second, which is inadequate for many use cases that appear promising for smart contracts.

However, progress is being made on each of these drawbacks. Many audited "off-the-shelf" smart contracts already exist, allowing for different use cases to be performed with a trusted code base. Regulators are working with blockchain legal advocates to create smart contract legal frameworks. Many new blockchains with faster transaction times have been created, and scaling solutions for existing blockchains are being developed so that smart contracts can be executed more quickly.

PAST & FUTURE OF SMART CONTRACTS

Smart contracts were first proposed by Nick Szabo in the early 1990s and formally introduced in the paper "The Idea of Smart Contracts" in 1997 – more than 10 years before Bitcoin was invented. In this paper, Szabo gives the simplistic example of a vending machine as a smart contract, where if a given amount of money is put into the vending machine, a snack may be selected. That snack is then released along with any change required.

Research and experimentation with smart contracts continued into the 2000s, and the creation of the Bitcoin blockchain in 2009 brought smart contract usage on a decentralized network to the world for the first time. However, Bitcoin's blockchain is inherently inflexible in its ability to execute a diverse set of smart contract functions because of its focus on security and simplicity at the base layer.

Due to the inflexibility of the Bitcoin blockchain, Vitalik Buterin proposed the Ethereum blockchain in late 2013 with the specific purpose of creating a more flexible network for running different types of smart contracts – this is referred to as "Turing Complete." The Ethereum blockchain went live in 2015, and, since then, many new smart contract blockchains have been created with various technical specifications. However, none of the Ethereum competitors have been able to take significant developer mindshare away from the ETH ecosystem, which continues to have the largest quantity and highest quality development of any smart contract platform.

CRYPTOCURRENCY MINING

Cryptocurrency mining is the backbone that allows blockchain networks to operate in a trustless, decentralized manner. While this article focuses on Bitcoin mining as an example, all proof of work-based crypto assets require mining, and many operate in a very similar manner to that of Bitcoin mining. Crypto assets that use other consensus mechanisms besides proof of work, like proof of stake, are not mineable.

The most revolutionary innovation of Bitcoin is the solution of the "double spend problem" in a trustless manner – ensuring that one Bitcoin is not spent by multiple parties at the same time without using a centralized intermediary. Bitcoin solves this problem in a truly ingenious way.

The computer science and cryptography which underpin the Bitcoin network are contained in open source code built and maintained by many of the world's top computer scientists. Bitcoin miners run software that plugs them into this network. Each miner collects transactions and organizes them into a new block every ~10 minutes. This queue of new transactions awaiting confirmation is called a mempool. Miners (or the mining pools that individual miners connect to) constantly scan the mempool in search of transactions that will pay them the most fees. All pending transactions that have been found valid are then sorted into a new candidate block in order to maximize the fees earned. As a result, paying a higher fee can ensure faster transaction processing time.

Miners perform established cryptographic techniques called hash functions, or hashing, on every transaction in the new block. They then "hash" that group of transactions with the previous block. This combination of the hashed current block and the hashed previous block is called the "root hash." The root hash is then hashed together with the previous block's hash along with a randomly generated number called a "nonce". This combination of (1) the root hash, (2) the hashed previous block and (3) nonce are included in what is called the "block header," or the metadata of the new block. Those three items, along with a few other parameters, are then hashed again into what is called the "block hash."

This block hash must be a smaller number than a certain arbitrary number controlled by the Bitcoin software. The only way to change the size of the block hash is by changing the nonce value. If the block hash does not meet the required size parameters, the block is rejected, and the miner randomly guesses a different nonce and performs the hash function of the block hash

again. Miners perform this process over and over again until the correct block hash is randomly selected through sheer chance within the given parameters.

Eventually, one miner correctly selects the right nonce that creates a block hash that fits the required parameters, which is called a "valid hash." That miner then broadcasts this valid hash to the entire Bitcoin network – all the thousands of nodes around the world that keep track of the Bitcoin blockchain. When a valid hash is broadcast, that block is considered complete; the miner is rewarded with newly created Bitcoin as included in the original block header; and the entire process starts over again. The Bitcoin blockchain has been conducting this process over and over again every ~10 minutes since January 2009.

DIFFICULTY ADJUSTMENT

One of the most beautiful innovations of the Bitcoin blockchain is the difficulty adjustment. At the outset of Bitcoin's history, there were very few computer processors performing this hashing process to create new blocks. As time went on, more and more computers started racing to guess the valid block hash. The more computers racing to guess the block hash, the faster it will be randomly guessed. After every 2,016 blocks (roughly every two weeks), each node measures the expected vs actual amount of time to mine each of the prior 2,016 blocks. The nodes then adjust how difficult it is to guess the nonce by changing the number of zeroes in the nonce. As an illustration, consider the increased difficulty and time involved to guess a single number out of ten million vs out of one million. As a result of this adjustment system, as more computer processors begin mining the Bitcoin blockchain – resulting in block hashes behind found more quickly – the nonce becomes increasingly more difficult to randomly guess, thus leading to new Bitcoin being created via the block reward in a stable and predictable manner. The same is true if fewer computer processors are mining Bitcoin – the difficulty can be adjusted downward to make it easier to guess the nonce.

MINING INFRASTRUCTURE

A miner is simply computer hardware.

At the beginning of Bitcoin's history, standard multi-core CPUs, like what is found in a desktop computer, were used to mine Bitcoin. In the early days, if someone had a couple computers lying around with decent specs, they could earn ~$5 per day mining Bitcoin. As Bitcoin became increasingly popular, mining hardware became increasingly more specialized and powerful. In

2010, code was released that enabled Bitcoin mining with graphics processing units (GPUs) – allowing for a significant increase in processing capacity and, through the difficulty adjustment process described above, mining difficulty. By 2013, application-specific integrated circuit (ASIC) manufacturing for Bitcoin mining began, creating a new class computers that were the processing power equivalent of a Formula 1 car. ASICs are purpose-built to do one thing incredibly quickly – guess the correct nonce. ASICs were manufactured specifically to mine Bitcoin; by focusing on this task alone, they were able to increase their output by orders of magnitude, making CPU mining obsolete. ASICs are estimated to be more than 100,000x faster than the fastest CPUs. Thus, Bitcoin's mining difficulty has increased in the same parabolic fashion as its price. As of January 2020, the collective Bitcoin mining ecosystem guesses more than 120 quintillion hashes per second.

These days, Bitcoin mining is big business. In 2018 Bitcoin miners collectively received $5.5bn in block rewards. Mining pools allow for individuals and smaller mining companies to work together and earn pro-rata shares of Bitcoin rewards, thus smoothing out the randomness of actually finding a block reward. ASIC hardware manufacturers, including Bitmain, MicroBT and publicly-traded Canaan are collectively valued at several billion dollars. There are billions of dollars of ASICs racing to solve the block hash every 10 minutes. The competitiveness of Bitcoin mining has launched a worldwide search for the cheapest sources of electricity on the planet to mine Bitcoin as profitably as possible (the cost of electricity to run equipment comprises approximately half of the all-in costs to mine). An estimated 65% of all mining hashpower is located in China, with the large majority of that sourcing electricity from hydroelectric power. Texas is also quickly becoming a major player in mining, utilizing stranded natural gas to power large mining facilities.

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> *"The FBI recorded over 23,000 complaints of Business Email Compromise in 2019, amounting to $1.7 billion in losses to organizations."*

CYBER'S HUMAN CONDITION

Understanding what makes us click and strategies for reducing preventable cyber breaches

In a recent conversation with a client, an all-too common horror story emerged. An employee in the finance department received an email from the chief executive officer, asking him to immediately pay a vendor invoice. The email included an attachment of the invoice, along with the CEO's email signature. With the urgency communicated in the email, the employee paid the invoice and moved on with his day. Unfortunately, the CEO's email was spoofed.

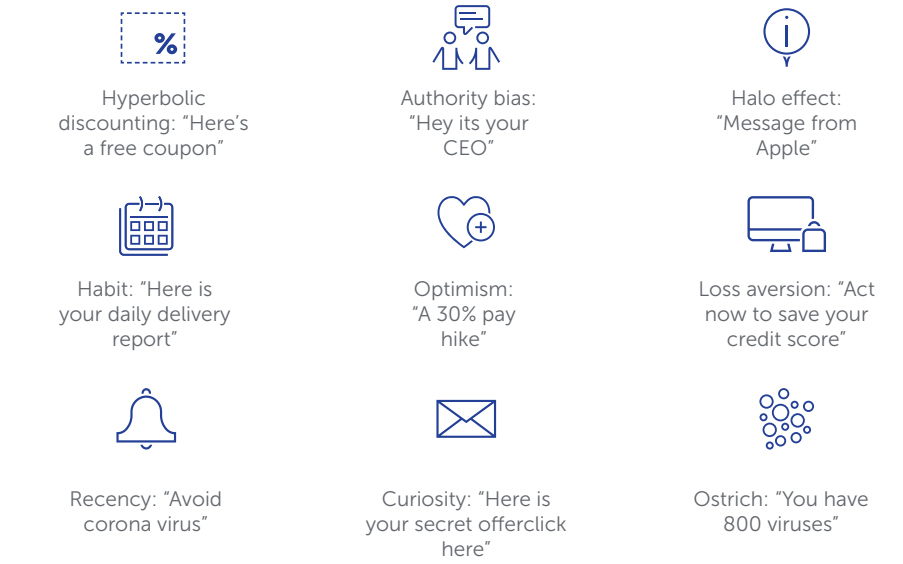
> *"Cybersecurity is not just a technological challenge, but increasingly a social and behavioral one."*

This phishing scenario is quite familiar to us nowadays. People, no matter their tech savviness, are often duped by these scams because of their familiarity and immediacy factors. The US Federal Bureau of Investigations aptly named this trend: Business Email Compromise. In 2019, the FBI recorded over 23,000 of these types of complaints, amounting to $1.7 billion in losses to organizations.[1]

Cybersecurity is not just a technological challenge, but increasingly a social and behavioral one. The top reasons cyber breaches happen point to human actions, according to Willis Towers Watson.[2] From mistakenly disclosing account information to falling for phishing attacks, an organization's data can leak through

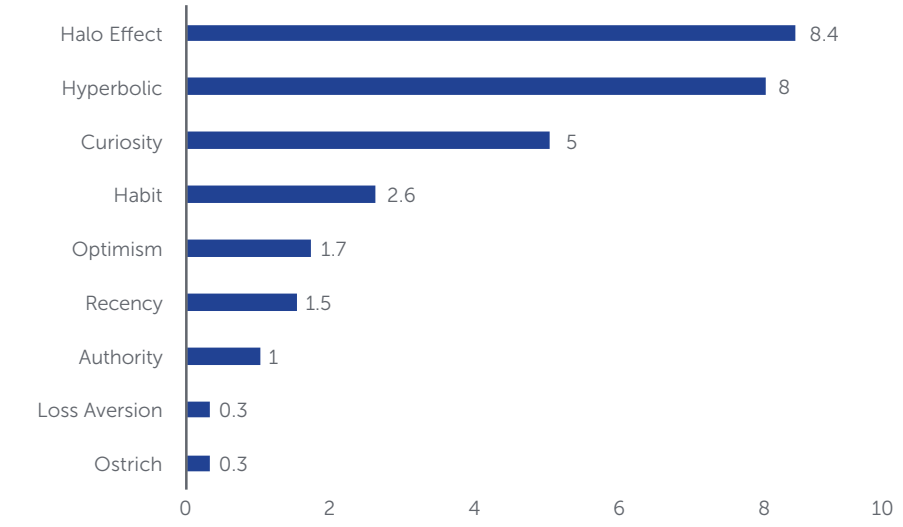
"Hackers have become increasingly savvy at launching specialized attacks that target specific employees and tap into their fears, hopes, and biases to get access to their data."

Top 9 Cognitive Biases Used by Hackers



Source: SecurityAdvisor

Relative usage of cognitive biases by hackers



Source: SecurityAdvisor

legitimate channels and compromise its security. This social engineering easily bypasses technology barriers.

Hackers have become increasingly savvy at launching specialized attacks that target specific employees and tap into their fears, hopes and biases to get access to their data. Through a more robust understanding of how employees can be duped by hackers, companies can develop strategies to identify potential biases, create training programs to change those behaviors and cut down on cyber breaches.

Understanding Cognitive Bias

Behavioral economics studies the effects of psychological, cognitive, emotional, cultural and social factors on the decisions of individuals and institutions.[3] It wasn't until 1970 that behavioral economics came of age thanks to the work of Israeli social scientists, Nobel Prize winning economist, Daniel Kahneman and Amos Tversky.[4] The understanding of cognitive psychology was revolutionized by their discovery of emotional biases. Kahneman and Tversky found significant evidence that humans, in certain circumstances, show a systematic pattern of deviation from the norm or rational judgment.

Five decades later, their research is helping companies understand why they're seeing their own employees easily fall for cyber breaches. For example, hackers tap into human cognitive biases such as anchoring and representative heuristics to sway their decisions based on irrelevant or misleading information and based on false or generalized categorization.

Every day, hackers use specific cognitive biases to repeatedly target employees, according to research by SecurityAdvisor, a Mastercard partner. Employees are

enticed to click on fraudulent links or share sensitive company data through fake coupons or fake messages from 'team managers.'

To truly understand how hackers operate, the SecurityAdvisor study assessed more than 500,000 data points from real-world situations to see how hackers leverage human cognitive biases to trick end users. Each data point was mapped to one or more of Kahneman and Tversky's discovered biases.

In today's world, where many employees now work remotely, some of the most common attacks include:

- Scams like the one at the beginning of this report, where employees, especially those in finance departments, get phishing emails masked as a request from their CXO to pay an invoice or transfer money. These scams leverage "authority bias," where humans naturally are more influenced by and trust those in positions of authority.
- Hackers use "recency bias" and "halo effect bias" to send employees emails with COVID-19 tips from what looks like legitimate global organizations, such as the World Health Organization (WHO), and other government bodies. These messages may have malicious content as embedded links or attachments.
- Stoking our fears of compliance and security with the "ostrich effect bias," hackers send emails or pop-up notifications to employees, alerting them of a violation or viruses on their machine, and then offering a simple fix by clicking on a link. Many employees tend to postpone a patch deployment or update reminder from the IT team, so a message like this can trigger unintended consequences despite "good" intentions.

"The workforce needs to be able to recognize cyber threats, how they work and the role an employee plays in counteracting them."

The impact of these biases on the business is defined by frequency and by severity. How frequently the bias is used is a strong indicator of the probability of the event occurring. Most people have received some type of phishing email based on the halo and hyperbolic biases. Given the frequency of these types of phishing emails, there is a high likelihood that employees will fall prey to it.

The severity impact relies on human fears as the employee grants higher authority in some form to do much harm. Granting access to their computer or transferring money in an unconventional way to comply with an urgent request may not be frequent, relatively speaking, but are often targeted. The loss to the organization is potentially more damaging with these infrequent but severe attacks.

Counteracting Cognitive Bias

Human biases are part of human nature, but that doesn't mean organizations can't learn from cognitive psychology and counteract these biases.[5]

The work of Nobel Prize winner behavioral economist Richard Thaler, from the University of Chicago, shows that decision architecture and human behavior can be influenced by 'subtle nudges.' Based on indirect encouragement and enablement, the nudge theory offers curated choices that encourage people to make positive and helpful decisions.[6] This reshapes existing behaviors and counteracts innate human cognitive bias. This theory can be applied to combatting behavioral biases in cybersecurity.

As end users tend to be the most compromised link in the cybersecurity chain, organizations need to invest in making their employees stronger cybersecurity advocates and weed out the bad habits that negatively impact the organization's cyber posture. The workforce needs to be able to recognize cyber threats, how they work and the role an employee plays in counteracting them.

Further, as technology and threat landscapes continuously evolve, employees' cyber sense needs to be developed to recognize the new security threats through a continual refresh cycle.

Take, for example, the way children learn to look both ways before crossing the street. This happens through a few in-the-moment reminders, and soon looking both ways becomes second nature. In the same manner, workforces need in-the-moment reminders about behaving securely.

By providing gentle nudges and reinforcements about recognizing threats and counteracting them, organizations have a greater chance of reducing cybersecurity incidents and breaches.

In learning how to cross the street, the foundation is set with initial training by a parent. If someone lives on a busier street, they likely need more coaching. As people learn this behavior well, they become an ambassador in helping others learn how to cross the street.

Similar steps can be taken for a comprehensive employee cyber engagement program, including education, training and assessment.

A cybersecurity awareness and enablement program requires a multipronged approach such as, but not limited to:

1. **Educating the entire organization on cybersecurity basics and roles.**
2. **Using artificial intelligence and data analysis for a surgical and targeted approach for highrisk users.**
3. **Empowering employees to be the organization's cyber eyes and ears.**
4. **Providing a learning program that's relevant and personalized.**

Set the Foundation

Across the organization, people need to understand the fundamentals of making the most secure cyber decisions and what's expected from them in complying with security policies. Cybersecurity awareness training introduces the workforce to the organization's security policies, the most prevalent cyber threats, best practices for behaving securely and how to reach someone for help with cybersecurity matters.

Many companies deliver this training online or in-person as part of their new employee orientation. Sessions can last 2-4 hours. Annual refreshers are then required to remind the workforce of the expectations.

But there are challenges with this approach. The workforce may lose focus sitting through such a long session—attention spans last about 10-20 minutes. It's not surprising that knowledge retention rates drop by more than 50 percent when training is more than two minutes.

In light of this, SecurityAdvisor recommends coaching employees through short, relevant messages. A Cornell study[7] showed that people are more motivated and more likely to adopt a new behavior when given small tasks and immediate small rewards. This is the same in cybersecurity. A key enabler for the cyber immune culture is micro learning.

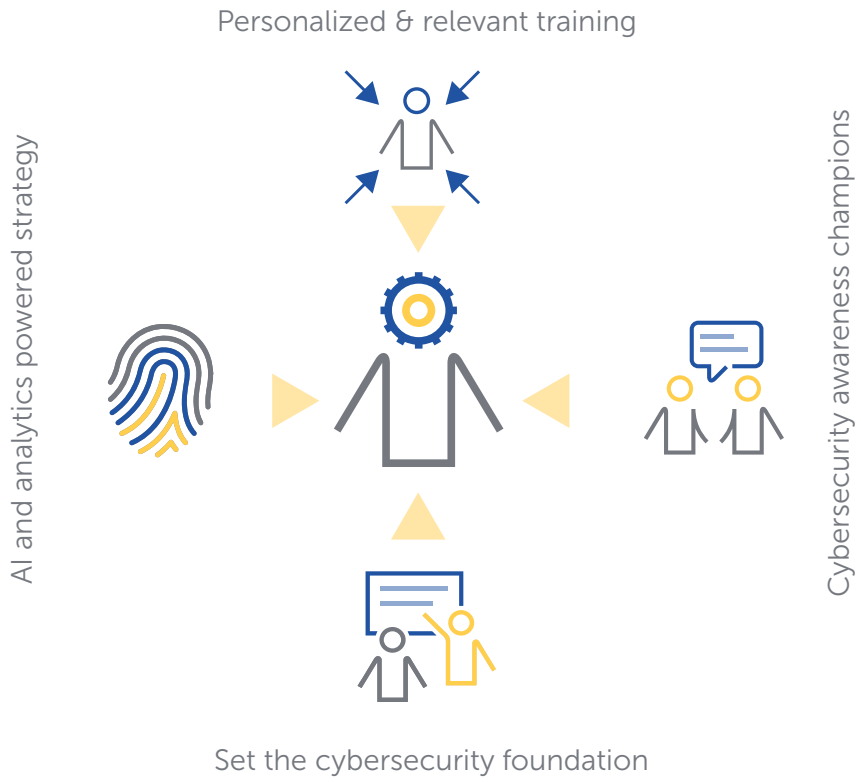
Further, with an annual security training approach, too much time passes between reminders, and companies risk a return to old habits and biases. For better retention of the training, the content needs to be engaging, relevant, interactive, quick and frequent.

The Mastercard SecurityAdvisor solution provides security awareness training through nudges in a variety of formats. The content can be customized to fit the organization's needs, and the training administrator can set the curriculum to specific topics in a short format. Most sessions are less than two minutes, and delivered through videos, quizzes or short newsletters.

The platform can also deliver training in text messages or application pop-ups with quick tips. The variety of delivery methods, and the flexibility and frequency of the lessons ensure employees are getting nudged frequently enough to help counteract cognitive biases.

Build on the Foundation

SecurityAdvisor has analyzed malware sources across seven multinational firms and discovered that 20 percent of users account for more than 90 percent of malware infections. It's important to identify these high-risk users, and then provide them with specific guidance to reduce their infection rates.



The Mastercard SecurityAdvisor approach is to conduct analytics and leverage AI to identify the most targeted users. The AI engine learns which approach works best for an organization, department and user. This enables a personalized, surgical approach to make the users and organization safe. The platform delivers early warnings or just-in-time alerts to specific users to help them avoid certain actions or from falling victim to phishing or online scams.

As a bonus to reduced malware infections, the personalized approach also reduces the burden of training and associated costs on lower risk users who do not need the same level of engagement.

Designating employees as the organization's eyes and ears by asking them to identify and report cyber breach attempts is vital. This can be achieved by giving them easy-to-use tools and personalized nudges.

This collective approach has proven successful in other settings. For example, community safety programs in Los Angeles that leaned on neighborhood involvement drove a significant reduction in crime.[8] Cybersecurity is similar, and the number of incidents drop when employees are engaged.

As we build a cyber-immune culture, users become more motivated to help and behave securely. As the Mastercard SecurityAdvisor solution is adopted across the organization, employees gain confidence in acting securely instead of fearing the repercussions of a breach.

Many employees also become evangelists and mentors as they help their peers adopt good practices. They can help colleagues report phishing emails, store and share files in approved ways and stop them from risky behaviors, such as sharing passwords and visiting harmful websites.

The Takeaway

Hackers use human cognitive biases to dupe employees and get access to a company's sensitive data. The most common biases hackers use include people's love for specific consumer brands, people's willingness to click when offered free or interesting things, and the tendency to follow daily habits.

To avoid falling victim to such scams, organizations need to fortify their employees and help them overcome their cognitive biases. Generic training for the employees is not sufficient, and organizations need to reach higher-risk employees with personalized, bite-sized tips. They need to engage their workforce with subtle nudges enabled by AI. Over time, they will become the eyes and ears of the cybersecurity team.

Overall, with AI-based technology, behavioral science and concerted human effort, organizations can cut down on cyber scams.

***Sai Venkataraman**, CEO/ Co-Founder Security Advisor*

***Ashish Gupta**, Vice President, Cybersecurity Pathfinder, Mastercard*

SecurityAdvisor provides the only real-time and personalized security awareness platform that delivers a measurable reduction in security incidents. The company's patented platform integrates easily with existing security infrastructure to deliver personalized coaching for each employee, teaching them how to identify and remediate cyberattacks and help security teams better understand the human element of their organization's security posture.

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Methodology

The data in this report came from SecurityAdvisor's analysis of over 500,000 emails that were either phishing emails or spam emails. The analysis used seven anonymized datasets collected by SecurityAdvisor. The analysis was done in seven spreadsheets. In each data set, pivot tables were run, and the subjects used by hackers were sorted. The subject that occurred the most was at the top and the subject that occurred the least was at the bottom. From there, the ten subjects that occurred the most in that sheet were mapped to a specific cognitive bias. This was repeated for each of the seven data sets. This way, over 500,000 emails were reduced to 70 data points. Knowing the frequency of occurrence of each of the 70 data points allowed us to sum up the frequency of occurrence for each cognitive bias and identify the most common cognitive biases leveraged by hackers.

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UPCOMING CONFERENCE SCHEDULE

FALL 2021

November 9-12

Loews Hollywood Hotel
Hollywood, CA

FALL 2022

November 8-11

Hyatt Regency Long Beach
Long Beach, CA

FALL 2023

November 5-11

Omni Rancho Las Palmas Resort & Spa
Rancho Mirage, CA

SPRING 2022

May 10-13

Omni Rancho Las Palmas Resort & Spa
Rancho Mirage, CA

SPRING 2023

May 9-12

Paradise Point Resort & Spa
San Diego, CA

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