WELLINGTON MANAGEMENT®

November 2019

Muni market climate risk: Hidden perils, untapped opportunities

Chris Goolgasian, CFA, CPA, CAIA
Director of Climate Research and Portfolio Manager

Tim Antonelli, CFA, FRM
Multi-Asset Strategist

Conor McEachern
Fixed Income Credit Analyst

Additional contributor

Adam Norman
Investment Communications Manager

KEY POINTS:

- In our view, climate change represents an acknowledged, yet still underappreciated, risk in the municipal (muni) bond market, but also presents investment opportunities for active managers.
- We believe this risk should become part of the "mosaic" for how institutional investors approach the asset class — ideally sooner rather than later.
- For insurers, we believe having a diversified asset/liability mix, while very important, may not sufficiently mitigate potential portfolio losses related to climate risk.
- Given the risk of material climate impacts on certain municipalities, insurers may want to rethink their long-term assumptions on the asset class, particularly for credits in vulnerable areas.
- Insurers might consider:
  - making substitution trades for inefficiently priced municipal issues; and
  - diversifying their climate risk exposure (while maintaining favorable legacy book yields).

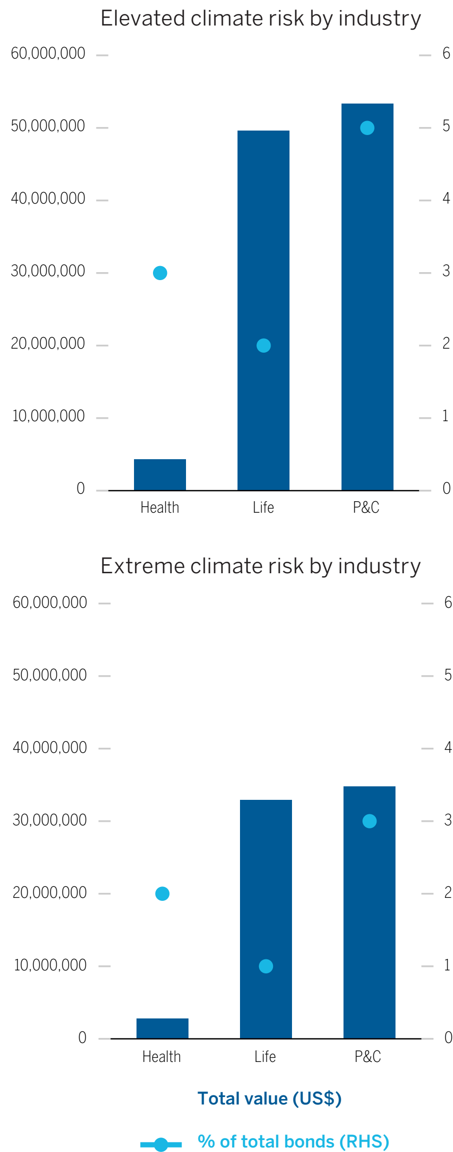
INSURANCE COMPANIES ARE KEENLY AWARE OF HOW TO ASSESS, PRICE, AND DIVERSIFY RISKS ASSOCIATED WITH THEIR LIABILITIES. But forward-looking issues like climate change, with little or no historical precedent, may pose a vexing challenge for their traditional methods of underwriting risk. And the same climate risk issues could also negatively impact the asset side of insurers' balance sheets. For example, municipalities in climate-sensitive regions are particularly vulnerable if/when their tax revenues decline as their citizens and businesses emigrate to lower-risk climates. We think these risks will play out, and perhaps intensify, over a number of years as the adverse impacts of climate change increase in frequency and severity.

As the threat of climate change grows and losses mount, insurance companies may face the potential "double whammy" of also incurring losses on their municipal (muni) bond portfolios at the same time as their insured losses increase. (While climate change is clearly a global matter, this paper focuses exclusively on US projections and the potential impact on the muni bond market.)

All investing involves risk. Before investing, investors should consider the risks that may impact their capital. The value of your investment may become worth more or less than at the time of original investment. Please refer to the 'risks' section for more information.

FOR PROFESSIONAL OR INSTITUTIONAL INVESTORS ONLY

Figure 1
Varying levels of climate risk by insurance industry



Sources: Woods Hole Research Center, Bloomberg Barclays, Wellington Management. Data as of 31 December 2018. This hypothetical analysis is for illustrative purposes only and is based on numerous assumptions. As the analysis relies upon assumptions and other expectations of future outcomes, it is subject to numerous limitations.

Highway to the danger zone?

To determine the estimated "elevated" and "extreme" levels of climate risk in the muni bond market, we applied the following methodology to the Bloomberg Barclays Taxable Municipal Index and the Bloomberg Barclays Municipal Index:

Elevated risk:

- **Wildfire:** Greater than 10 additional square kilometers (km) per square fields burned each year in the western US (1995 – 2004 versus 2045 – 2054)
- **Drought:** Greater than four additional three-month droughts (1975 – 2004 versus 2040s)
- **Heat:** Greater than 20 additional days in the National Weather Service "Danger Zone" (2008 – 2017 versus 2040s)
- **Hurricane:** Greater than 100 mm, 1 in 100-year rainfall during the 2031 – 2050 period

Extreme risk:

- **Wildfire:** Greater than 20 additional square km per square fields burned each year in the western US (1995 – 2004 versus 2045 – 2054)
- **Drought:** Greater than six additional three-month droughts (1975 – 2004 versus 2040s)
- **Heat:** Greater than 30 additional days in the National Weather Service "Danger Zone" (2008 – 2017 versus 2040s)
- **Hurricane:** Greater than 200 mm, 1 in 100-year rainfall during the 2031 – 2050 period

We calculate that 86% of the CUSIPs in the Bloomberg Barclays Taxable Municipal Index were exposed to some degree of climate risk (elevated or extreme), as were 74% of the CUSIPs in the Bloomberg Barclays Municipal Index. We then cross-referenced all municipal bond CUSIPs in the indices that met the above criteria against the 2018 year-end statutory financial statements of all US insurers to arrive at their aggregate exposure to these climate risk variables, shown in **Figure 1**. Insurers' muni holdings appear somewhat more insulated from climate risk than the broad muni market, with fewer than 17% of holdings meeting the elevated or extreme criteria.

Not all munis are a "safe haven"

The muni bond sector tends to be less liquid than some of its fixed income counterparts because a significant portion of the buyer base includes buy-and-hold investors. For the US$3.8 trillion US muni bond market,[1] the maturity of the bond is a key characteristic. And while munis are not necessarily viewed as having comparable credit quality to US Treasuries, many investors with low risk tolerances have flocked to the asset class given its historically low default rate — just 0.07% from 1970 – 2016, according to Moody's.[2]

However, skepticism over the muni market's perceived "safe-haven" status may begin to mount as the impacts of climate change become more apparent — a highly rated borrower today may face difficulty meeting its future debt obligations as its tax base potentially dwindles. Our research reveals that US insurers hold US$155 billion in index municipal bonds with elevated climate risk across wildfire, heat, and drought climate variables. (See "Highway to the danger zone?" above.)

[1]Source: Municipal Securities Rulemaking Board (MSRB). As of 31 March 2019

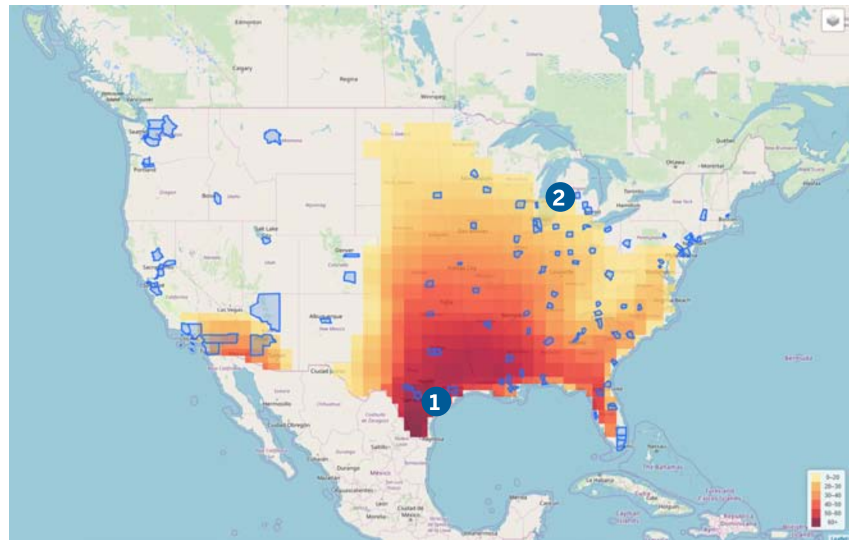
[2]Wellington has reviewed the above research and believes the findings are still valid even with the inclusion of more current data.

FOR PROFESSIONAL OR INSTITUTIONAL INVESTORS ONLY

Skepticism over the muni market's perceived "safe-haven" status may begin to mount as the impacts of climate change become more apparent.

For example, extreme heat (as calculated by the National Weather Service [NWS] Heat Index) measures the potent combination of heat and humidity, which takes the biggest toll on human health. The orange and dark red zones in **Figure 2** represent higher risks of heat stroke from being outside for even a short time. The maps therefore indicate that many southeastern and southwestern areas of the US will suffer multiple additional months per year of extreme heat — and most of these regions are already quite hot.

Figure 2:
US "heat map"
Additional days per year in NWS danger zone throughout the 2020 – 2029 decade
US: based on 1951 – 1980 reference period



For illustrative purposes only | Sources: Standard & Poor's, Investortools, Woods Hole Research Center | The projected data presented is hypothetical in nature. No assurance or guarantee is made that any projected data can or will be realized. Actual experience may differ. | Chart data as of 30 August 2019

We think buy-and-hold managers will need to be more discerning when deploying capital in climate-sensitive regions, whereas active managers may have the wherewithal to more nimbly invest in areas exposed to chronic risks. For example, we would not shy away from lending to municipalities that we expect to remain large and vibrant over our investment time horizon.

Don't mess with Texas heat

By the 2020s, Houston is expected to have 64 more days of extreme heat each year than the city did during the 1951 – 1980 period — and 82.4 more days by the 2040s.[3] Put simply, Houston summers are likely on their way to becoming unbearable.

Internal US migration risk due to climate change

It is important to keep in mind that the above discussion applies only to heat, not to hurricane and flood risks, both of which are major potential issues in the same southeastern and southwestern US areas. Ultimately, one or more of these climate risk variables could make certain states, cities, and towns far less attractive as places to live and work, driving both fewer people to move there and more people to leave. Here is how this trend may evolve:

1. Climate events compound in certain areas, driving up insurance costs and hurting quality of life.
2. These impacts ultimately drive fewer people into a region and more people/businesses out.

[3]Source: World Health Organization (WHO)

3. As a result, property values within that region fall, as do the municipality's corporate, sales, and use tax revenues.
4. Meanwhile, the municipality faces increased spending to address the repeated impacts of climate change (coastal barriers, levees, waste water management, etc.).
5. In short, shared costs increase, while the user base declines.
6. The municipality sees its borrowing costs climb and sees the need for higher taxes, thus making the area even less attractive.

We believe the outcome could be stagnant to declining populations in some areas, particularly for municipalities that lack the resources to invest in mitigation efforts. Indeed, some have already seen outmigration and increased debt burdens due to climate change.

Since 2015, Terrebonne Parish in southern Louisiana has lost 2.5% of its population, while its debt per capita has increased by 34%. One of the parish's islands has lost 98% of its land area from a combination of levee construction, coastal erosion, rising seas, and hurricane damage. The parish is planning to resettle the island's remaining population to a new location. Over 75% of the parish's capital budget is already allocated to climate-related projects, including drainage improvements, relocation of government buildings, and coastal restoration. The combination of falling population and rising capital needs has put pressure on the parish's credit profile, which may continue as the effects of climate change compound.[4] We expect other communities in the southeastern US to face similar financial pressures and credit deterioration going forward.

Climate risk may not be fully reflected in muni bond prices

We are often asked if security prices properly discount climate change and its accompanying risks. Thus far, we believe the answer is no, in large part because the federal government continues to be an "insurer of last resort" by providing valuable rebuilding dollars when natural disasters strike, with little local match typically required.

Take the two municipal bonds listed in **Figure 3**. Both of these states have the same credit rating and similar maturities. However, Texas is located in the crosshairs of future heat and current (and future) hurricane and flood risks, while Michigan is not. Yet they currently trade at very similar yields. We would argue that climate risk has not yet been reflected in these prices or in many municipal bond prices, but that may change going forward if climate-related events become more frequent, which in turn could threaten continued government commitment to certain regions and accelerate erosion of the tax base.

Figure 3
Texas vs Michigan municipal bonds

Texas

S&P rating	AA
Yield	2.43
Maturity date	1 April 2040
Heat percentile	66.8

Michigan

S&P rating	AA
Yield	2.39
Maturity date	1 May 2041
Heat percentile	29.6

Source: Bloomberg | As of 30 September 2019. For illustrative purposes only.

It is also worth noting that the major bond rating agencies are just beginning to incorporate climate risks into their reports, but they have not yet systematically integrated this risk into their credit ratings. If that too begins to change, as we believe it will, it could have a significant impact on bond pricing in the period ahead.

From a bondholder's standpoint, trying to adjust a municipal bond portfolio in the aftermath of these developments could prove costly, which is why we believe investors should give serious consideration to preparing their portfolios (without necessarily giving up yield) sooner rather than later. This is a prime example of where skilled active portfolio management can add real value, in our view.

[4]Sources: US Census Bureau, Merritt Research Services, http://isledejeancharles.la.gov/, https://emma.msrb.org/ES1152504-ES900887-ES1302110.pdf

We expect there to be times when investors will be more than adequately compensated for climate risk, or when the payment for other risks associated with a credit more than makes up for the inherent climate risk.

The power of collaboration

In September 2018, Wellington Management Company, California Public Employees' Retirement System (CalPERS), and Woods Hole Research Center (WHRC) jointly announced a research project to integrate the physical risks of climate change into the investment process. That work is well underway, as we have now completed study on four of the first six variables we deemed most pressing: heat, drought, wildfire, and hurricanes.

The investment implications, which have been wide-ranging, are uncovered by our integration of this work into sophisticated models among our Climate Research Team, global industry analysts, and portfolio management teams. An early observation that has helped crystallize some investment insights is that, within "poor climate" regions, fixed-location assets with long maturities are most at risk to climate change (i.e., municipal bonds).

Conversely, we expect to be able to exploit investment opportunities as awareness grows and market participants begin to assign higher premiums for perceived at-risk municipal issues. We expect there to be times when investors will be more than adequately compensated for climate risk, or when the payment for other risks associated with a credit more than makes up for the inherent climate risk.

Are cities and towns prepared?

Given that many state-driven investment regulations are based on credit rating, position-sizing dynamics could shift materially. The Climate Disclosure Project (CDP) provides questions to companies and cities around their preparedness for climate change. In the US, only around 35% of the top 200 cities (by population) responded to the call for voluntary climate disclosures; and out of these, less than 40% indicated they have a plan in place to address the effects of climate change.[5] It therefore seems unlikely that officials in all of these cities are focused on climate risks, meaning the muni "world" likely has little information to price risk from public sources — for now anyway.

Introducing C-ratio: An insurer's at-risk climate-related assets/ at-risk climate-related liabilities

Meanwhile, insurers must also consider their underwriting risk and the correlation of the risk of their liabilities and assets — for example, high exposure to underwriting policies in Florida and Louisiana, along with equal overexposure to holding muni bonds in those regions. In such cases, we think the increased risk from climate change could easily outweigh the potential tax benefits of owning bonds issued by those states.

We believe insurers should evaluate and refine their investment strategy now — before market pricing begins to more efficiently incorporate these growing risks. We suggest a new metric: climate ratio (C-ratio), which is the ratio of an insurer's at-risk climate-related assets divided by its at-risk climate-related liabilities.

One could define "at risk" using their own desired baseline; for now, let's consider the bottom 20% of geographic "problem climate" areas. For example, take an insurer that is overexposed to underwriting policies in Florida and Louisiana and equally overexposed to those states' muni bonds. Now assume both of those states were bottom 20% in heat or hurricane risk in the US. The resulting C-ratio would be very high. This is not a theoretical exercise, as climate projections can be mapped at 100 m resolution, enabling muni risk (for example) to be well identified and ranked by geography.

Final thoughts

- Economic losses from climate change have already been realized, although many investors remain complacent, believing they can adapt their investment strategy over time to what they perceive to be a long-term problem. But we believe the time to act is now in order to take advantage of market pricing inefficiencies while they last.
- As more insurance companies raise premiums in response to more frequent and devastating climate events, a vicious cycle for municipalities could begin. Insurers that hold muni bonds should consider these risks in the context of their entire enterprise (e.g., liability footprints and distribution of long-lived physical assets). As investors, we look at each municipal subsector through a different lens and are careful to weigh climate risk against a variety of other risk factors, as well as municipal bond pricing.

[5]Source: CDP Worldwide. As of 31 December 2018

FOR PROFESSIONAL OR INSTITUTIONAL INVESTORS ONLY

As investors, we look at each municipal subsector through a different lens and are careful to weigh climate risk against a variety of other risk factors, as well as municipal bond pricing.

- We believe climate risks exist across the entire fixed income universe. We believe clients are best served by hiring a manager who can make comparisons across broad sectors, weigh risks, and focus on themes where the risk/reward is balanced. While muni credits might be subject to outmigration, energy credits might be subject to adverse legislation. Our framework considers these risks from multiple angles.
- In our view, not only can munis effectively diversify credit risk, but many muni credits offer features clients are seeking for their portfolios, including: credit stability and flexibility, long-dated assets, significant legal authority to change course financially, infrastructure exposure, "green" characteristics, and socially responsible investing features. We are able to capture all of these benefits, while avoiding negative climate risks as appropriate to the mandate.

Studying how climate change may affect capital markets

In many places, more days of extreme heat, longer droughts, or repeated flooding could lead to migration. As people desert intolerable places for more livable ones, asset values will likely fall in the former and rise in the latter. Our goals are to:

- Understand which companies and regions are actively factoring in climate change
- Improve our ability to quantify liabilities and appropriately price securities
- Better assess material business costs and consequences

The scope of our initiative with WHRC and CalPERS includes the study of six climate variables: heat, drought, wildfires, floods, hurricanes, and water availability. Each poses different degrees of risk to different regions and asset types.

High-level summary of our process

- Determine most relevant metric for the climate variable
- Create map to highlight change in climate metric by geographic area globally
- Overlay map with portfolio holdings and relevant holdings characteristics
- Analyze securities with similar characteristics and pricing but very different climate outcomes

Results: Linking location to valuation

- The insights we are gleaning allow our investors to compare relative valuations and better engage with executive teams. We encourage investors to focus on location as a key input into their process. Sectors with significant dependence on fixed locations, such as municipal bonds (the focus of this paper), may be the most negatively impacted.
- For entities like CalPERS with very long-term liabilities, climate change presents a significant strategic challenge. For society, transparency about climate issues and the repricing of assets can help improve planning for local and federal governments on issues like infrastructure and migration.

Why it matters

We hope our work will inspire investors to rethink asset class and geographic exposures to better account for physical climate risks. We seek to drive discussions that incent longer-term performance measurement to better align climate time horizons with investor time horizons. In our view, these types of mind-set shifts should be required of forward-looking fiduciaries. They may also help provide better transparency and lead to more gradual asset repricing, while advancing and informing public discourse.

Learn more

To learn more about Wellington's deep commitment to SI, our ongoing collaboration with WHRC and CalPERS, and our range of SI capabilities, please visit our **Sustainable Investing Website**.

FOR PROFESSIONAL OR
INSTITUTIONAL INVESTORS ONLY

About the authors

Chris Goolgasian spearheads a collaborative initiative between Wellington Management and Woods Hole Research Center (WHRC) to integrate climate science and asset management. This alliance, launched in 2018, focuses on creating investor tools to help analyze and better understand how and where climate change may impact global capital markets.

Tim Antonelli is responsible for identifying, sharing, and acting on major business trends affecting insurers globally and their investments across asset classes. He interacts regularly with a range of insurance industry regulatory bodies, rating agencies, and trade organizations around the world.

Conor McEachern is a fixed income credit analyst specializing in municipal bonds. He primarily covers issuers in the tax-backed and public power sectors and also leads the Municipal Analyst Team.

IMPORTANT DISCLOSURES

For informational purposes only and should not be viewed as an offer to sell or the solicitation to buy securities or adopt any investment strategy. Views expressed reflect the current views of the authors at the time of writing, are based on available information and subject to change without notice, and should not be taken as a recommendation or advice. Individual portfolio management teams may hold different views and may make different investment decisions for different clients. The information presented in this material has been developed internally and/or obtained from sources believed to be reliable; however, Wellington Management does not guarantee the accuracy, adequacy, or completeness of such information.

This document may contain certain statements deemed to be forward-looking statements. All statements, other than historical facts, contained within this document that address activities, events, or developments that the authors expect, believe, or anticipate will or may occur in the future are forward-looking statements. These statements are based on certain assumptions and analyses made by the authors in light of their experience and perception of historical trends, current conditions, expected future developments, and other factors they believe are appropriate in the circumstances, many of which are detailed herein. Such statements are current only as of the date they are made and are subject to a number of assumptions, risks, and uncertainties, many of which are beyond Wellington Management's control. Please note that any such statements are not guarantees of any future performance and that actual results or developments may differ materially from those projected in the forward-looking statements. Diversification does not eliminate the risk of experiencing investment losses.

Past results are not necessarily indicative of future results. The indices referenced herein are broad-based securities market indices and used for illustrative purposes only. Broad-based securities indices are unmanaged and are not subject to fees and expenses typically associated with managed accounts or investment funds. Investments cannot be made directly in an index.

INDEX DEFINITIONS

The Bloomberg Barclays Municipal Index measures the performance of the USD-denominated long-term tax-exempt bond market. The Bloomberg Barclays Taxable Municipal Index measures the performance of the investment-grade US taxable municipal bond market.

RISKS

Below investment-grade – Lower-rated or unrated securities may have a significantly greater risk of default than investment-grade securities and can be more volatile, less liquid, and involve higher transaction costs.

Capital – Investment markets are subject to economic, regulatory, market sentiment, and political risks. Investors should consider the risks that may impact their capital before investing. The value of investments may become worth more or less than at the time of original investment and may experience high volatility from time to time.

Concentration – Concentration of investments within securities, sectors or industries, or geographical regions may impact performance.

Credit – The value of a bond may decline, or the issuer/guarantor may fail to meet payment obligations. Typically, lower-rated bonds carry a greater degree of credit risk than higher-rated bonds.

Currency – The value of investments may be affected by changes in currency exchange rates. Unhedged currency risk may subject investments to significant volatility.

Interest rates – The value of bonds tends to decline as interest rates rise. The change in value is greater for longer-term than shorter-term bonds.

Manager – Investment performance depends on the investment management team and its investment strategies. If the strategies do not perform as expected, if opportunities to implement them do not arise, or if the team does not implement its investment strategies successfully, investments may underperform or experience losses.

www.wellington.com

Wellington Management Company LLP (WMC) is an independently owned investment adviser registered with the US Securities and Exchange Commission (SEC). WMC is also registered with the US Commodity Futures Trading Commission (CFTC) as a commodity trading advisor (CTA) and serves as a CTA to certain clients including registered commodity pools and their operators. WMC provides commodity trading advice to all other clients in reliance on exemptions from CTA registration. WMC, along with its affiliates (collectively, Wellington Management), provides investment management and investment advisory services to institutions around the world. Located in Boston, Massachusetts, Wellington Management also has offices in Chicago, Illinois; Radnor, Pennsylvania; San Francisco, California; Beijing; Frankfurt; Hong Kong; London; Luxembourg; Singapore; Sydney; Tokyo; Toronto; and Zurich. ■ This material is prepared for, and authorized for internal use by, designated institutional and professional investors and their consultants or for such other use as may be authorized by Wellington Management. This material and/or its contents are current at the time of writing and may not be reproduced or distributed in whole or in part, for any purpose, without the express written consent of Wellington Management. This material is not intended to constitute investment advice or an offer to sell, or the solicitation of an offer to purchase shares or other securities. Investors should always obtain and read an up-to-date investment services description or prospectus before deciding whether to appoint an investment manager or to invest in a fund. Any views expressed herein are those of the author(s), are based on available information, and are subject to change without notice. Individual portfolio management teams may hold different views and may make different investment decisions for different clients.

In Canada, this material is provided by Wellington Management Canada ULC, a British Columbia unlimited liability company registered in the provinces of Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, Quebec, and Saskatchewan in the categories of Portfolio Manager and Exempt Market Dealer. ■ In Europe (ex Austria, Germany and Switzerland), this material is provided by Wellington Management International Limited (WMIL), a firm authorized and regulated by the Financial Conduct Authority (FCA) in the UK. ■ This material is directed only at persons (Relevant Persons) who are classified as eligible counterparties or professional clients under the rules of the FCA. This material must not be acted on or relied on by persons who are not Relevant Persons. Any investment or investment service to which this material relates is available only to Relevant Persons and will be engaged in only with Relevant Persons. ■ In Austria and Germany, this material is provided by Wellington Management Europe GmbH, which is authorized and regulated by the German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht – BaFin). This material is directed only at persons (Relevant Persons) who are classified as eligible counterparties or professional clients under the German Securities Trading Act. This material does not constitute investment advice, a solicitation to invest in financial instruments or information recommending or suggesting an investment strategy within the meaning of Section 85 of the German Securities Trading Act (Wertpapierhandelsgesetz). ■ In Hong Kong, this material is provided to you by Wellington Management Hong Kong Limited (WM Hong Kong), a corporation licensed by the Securities and Futures Commission to conduct Type 1 (dealing in securities), Type 2 (dealing in futures contracts), Type 4 (advising on securities), and Type 9 (asset management) regulated activities, on the basis that you are a Professional Investor as defined in the Securities and Futures Ordinance. By accepting this material you acknowledge and agree that this material is provided for your use only and that you will not distribute or otherwise make this material available to any person. ■ In Singapore, this material is provided for your use only by Wellington Management Singapore Pte Ltd (WM Singapore) (Registration Number 201415544E). WM Singapore is regulated by the Monetary Authority of Singapore under a Capital Markets Services Licence to conduct fund management activities and is an exempt financial adviser. By accepting this material you represent that you are a non-retail investor and that you will not copy, distribute or otherwise make this material available to any person. ■ In Australia, Wellington Management Australia Pty Ltd (WM Australia) (ABN19 167 091 090) has authorized the issue of this material for use solely by wholesale clients (as defined in the Corporations Act 2001). By accepting this material, you acknowledge and agree that this material is provided for your use only and that you will not distribute or otherwise make this material available to any person. Wellington Management Company LLP is exempt from the requirement to hold an Australian financial services licence (AFSL) under the Corporations Act 2001 in respect of financial services provided to wholesale clients in Australia, subject to certain conditions. Financial services provided by Wellington Management Company LLP are regulated by the SEC under the laws and regulatory requirements of the United States, which are different from the laws applying in Australia. ■ In Japan, Wellington Management Japan Pte Ltd (WM Japan) (Registration Number 199504987R) has been registered as a Financial Instruments Firm with registered number: Director General of Kanto Local Finance Bureau (Kin-Sho) Number 428. WM Japan is a member of the Japan Investment Advisers Association (JIAA), the Investment Trusts Association, Japan (ITA) and the Type II Financial Instruments Firms Association (T2FIFA). ■ WMIL, WM Hong Kong, WM Japan, and WM Singapore are also registered as investment advisers with the SEC; however, they will comply with the substantive provisions of the US Investment Advisers Act only with respect to their US clients.

©2019 Wellington Management Company LLP. All rights reserved.

518352_4