



Top-Down Portfolio Implications of Climate Change

March 2021

AUTHORS

Yesim Tokat-Acikel, PhD,

Director of Multi-Asset Research and
Portfolio Manager, QMA

Marco Aiolfi, PhD,

Director of Systematic Multi-Asset Strategies
and Portfolio Manager, QMA

Lorne Johnson, PhD,

Director of Institutional Solutions and
Portfolio Manager, QMA

John Hall, CFA,

Senior Investment Associate, QMA

Jessica (Yiwen) Jin,

Senior Investment Associate, QMA

ABOUT QMA

QMA began managing multi-asset portfolios for institutional investors in 1975. Today, we manage systematic quantitative equity and global multi-asset strategies as part of PGIM, the global investment management businesses of Prudential Financial, Inc. (PFI). Our investment processes, based on academic, economic and behavioral foundations, serve a global client base with \$120.3 billion in assets under management as of 12/31/2020.

FOR MORE INFORMATION

To learn more about our capabilities, please contact QMA by email at contactus@qma.com or by phone in the US at +1 (866) 748-0643 or in the UK at +44 (0) 20-7663-3400.

The physical risks of climate change have potential consequences for long-term investors.

Key Findings

- Environmental changes throughout the remainder of the 21st century will undoubtedly influence economic trends. To assess the top-down impact of climate change for strategic asset allocation, we consider both optimistic and pessimistic scenarios.
- Our analysis suggests that growth-oriented assets, such as equities, would be directly impacted by climate change. This impact is likely to vary significantly across countries, with the most sizable impact expected in certain emerging markets.
- A top-down climate risk-aware portfolio would tilt away from regions and assets that are expected to be adversely affected for better risk-adjusted returns.
- In our globally integrated world of cross-border revenue and supply chain links, we believe that combining both bottom-up and top-down views of the economic impacts of climate change is critical, as this may provide better opportunities for desired portfolio outcomes.

This brief summarizes the research paper with the same name by Yesim Tokat-Acikel, PhD; Marco Aiolfi, PhD; Lorne Johnson, PhD; John Hall, CFA and Jessica (Yiwen) Jin.

Please also see PGIM's megatrends white paper: "Weathering Climate Change: Opportunities and Risks in an Altered Investment Landscape."
www.pgim.com/megatrends/climate-change

Introduction

The macroeconomic implications of the physical risks of climate change are expected to lead to adverse growth outcomes for investors. In our analysis, we find that certain asset classes and countries are more vulnerable than others.

Countries that face more material environmental challenges face higher physical risks of climate change. The costs of dealing with these risks will be borne by local economies and societies. It is generally accepted that the Energy, Utilities, Materials and Industrials sectors will feel the greatest impact. Demand-side shocks could be related to mortality or growth impacts of climate change, particularly over the longer term. Such shocks are not always easy for central banks to disentangle from the business cycle, which can make them more difficult to respond to.

Study Design

To gauge the impact climate change will have on widely-held asset classes, we incorporate the impacts of both optimistic and pessimistic climate change scenarios into QMA's long-term Capital Market Assumptions (CMAs). Since our CMAs have a 10-year horizon and the impacts of climate change are expected to be much longer, we supplement our current process with steady-state estimates for asset class returns to produce long-term assumptions.

Asset Class Implications

Equities

Our models predict both slowing earnings growth and weaker equity returns in both the US and Japan in the pessimistic climate scenario. However, European equity returns are expected to be modestly positive. Compared to developed markets, the impact of climate change on emerging markets equity returns has larger cross-sectional variation. With already elevated temperatures, future global warming in India is forecast to have a significant negative impact on equity returns over the long term. Brazil and South Africa are also expected to be negatively impacted. China and Taiwan may experience more modest drags, while the effect in Korea is mixed. Aggregating the impact across all emerging market countries by market capitalization reveals a net negative impact.

Fixed Income

Climate change is expected to cause significant long-term global macroeconomic impact in the pessimistic climate scenario. We expect both US and global fixed income indexes to experience climate shocks through corporate credit channel. As a result, high yield bonds have lower returns in the climate scenario than in our long-term CMAs. Investment grade and aggregate bonds also have lower returns, though they are impacted more modestly.

Real Assets

Mitigation responses to climate change are likely to affect individual commodities in different ways at the micro level. For example, certain industrial metals that are used in green energy production will likely command higher prices, while fossil fuel prices will likely suffer from low demand alongside wider use of electric cars. Individual Real Estate Investment Trusts (REITs) may face varying levels of physical risk from climate change based on their location. There is no impact on (Treasury Inflation-Protected Securities) TIPS in our pessimistic climate change scenario.

Portfolio Allocation

We focus on a growth-oriented investor benchmarked against a policy portfolio consisting of 70% equities, 20% fixed income and 10% real assets. After adjusting return and volatility expectations to incorporate the impacts from climate change, our optimizer increases the developed markets ex-US position, while reducing the allocation to emerging markets equities, as shown in Figure 1, below.

Figure 1. Optimal Portfolio in Optimistic and Pessimistic Scenarios for a Growth-Oriented Investor

	Optimistic Portfolio	Pessimistic Portfolio	Diff
US Equities	40.00%	40.00%	0.00%
Developed International x USA Equities Unhedged	10.00%	18.00%	8.00%
EM Equities Unhedged	13.00%	5.00%	-8.00%
US AGG	25.00%	25.00%	0.00%
US TIPS	4.00%	4.00%	0.00%
US Reits	7.00%	7.00%	0.00%
Commodities	1.00%	1.00%	0.00%

Source: QMA. As of Mar 9, 2021. Notes: Benchmark policy portfolio has 45% US stocks, 15% developed ex-US stocks, 10% emerging markets stocks, 20% US aggregate bonds, 2% TIPS, 5% REITs, 3% commodities. We allow for +/-5% deviations from the policy portfolio in the Sharpe ratio maximization optimization, subject to these deviations; no shorting, and no leverage limit.

Return assumptions in the pessimistic climate scenario are weaker for emerging markets and stronger, on balance, for developed markets excluding the US. In fixed income, the return of US aggregate bonds is assumed to be modestly lower in the pessimistic climate scenario, primarily due to higher defaults among the credits.

Conclusion

From the perspective of a long-term investor, climate change is a source of considerable uncertainty. The transition to a sustainable economy in various climate change scenarios poses significant physical risks for investors' portfolios. Transition risks, which include the financial impact of changes to regulation and policies as a result of climate change, will be discussed in a future publication.

Our top-down cross-asset analysis suggests that the most direct impact will be on growth-oriented assets, such as equities and corporate credit. We find that the impact on developed sovereign bonds, REITs and commodities is likely to be more localized at the micro level of individual securities, rather than at the asset-class level.

A climate risk-aware portfolio should tilt away from regions and assets that are expected to be adversely affected for better risk-adjusted returns. Additionally, we believe that such macroeconomic views should be combined with specific microeconomic and firm-level implications, to more fully measure the impact of climate change within a sufficiently broad framework.



PURSUIT OF OUTPERFORMANCE

Notes to Disclosure

For Professional Investors only. All investments involve risk, including the possible loss of capital.

QMA is a wholly-owned subsidiary of PGIM, Inc., an SEC-registered investment adviser and a Prudential Financial, Inc. (PFI) company. PFI of the United States is not affiliated in any manner with Prudential plc, a company incorporated in the United Kingdom or with Prudential Assurance Company, a subsidiary of M&G plc, incorporated in the United Kingdom. Registration with the SEC does not imply a certain level of skill or training.

In the United Kingdom, information is issued by PGIM Limited with registered office: Grand Buildings, 1-3 Strand, Trafalgar Square, London, WC2N 5HR. PGIM Limited is authorised and regulated by the Financial Conduct Authority ("FCA") of the United Kingdom (Firm Reference Number 193418). In the European Economic Area ("EEA"), information is issued by PGIM Netherlands B.V. with registered office: Gustav Mahlerlaan 1212, 1081 LA Amsterdam, The Netherlands. PGIM Netherlands B.V. is authorised by the Autoriteit Financiële Markten ("AFM") in the Netherlands (Registration number 15003620) and operating on the basis of a European passport. In certain EEA countries, information is, where permitted, presented by PGIM Limited in reliance of provisions, exemptions or licenses available to PGIM Limited under temporary permission arrangements following the exit of the United Kingdom from the European Union. QMA LLC, which is an affiliate to PGIM Limited, is an SEC-registered investment adviser, and a limited liability company. Registration with the SEC does not imply a certain level of skill or training. These materials are issued by PGIM Limited and/or PGIM Netherlands B.V. to persons who are professional clients as defined under the rules of the FCA and/or to persons who are professional clients as defined in the relevant local implementation of Directive 2014/65/EU (MiFID II).

In Japan, investment management services are made available by PGIM Japan, Co. Ltd., ("PGIM Japan"), a registered Financial Instruments Business Operator with the Financial Services Agency of Japan. In Singapore, information is issued by PGIM (Singapore) Pte. Ltd. ("PGIM Singapore"), a Singapore investment manager that is licensed as a capital markets service license holder by the Monetary Authority of Singapore and an exempt financial adviser. These materials are issued by PGIM Singapore for the general information of "institutional investors" pursuant to Section 304 of the Securities and Futures Act, Chapter 289 of Singapore (the "SFA") and "accredited investors" and other relevant persons in accordance with the conditions specified in Sections 305 of the SFA. In South Korea, information is issued by QMA, which is licensed to provide discretionary investment management services directly to South Korean qualified institutional investors.

The opinions expressed in this research paper are those of the authors, and not necessarily of PGIM. The investments and returns discussed in this paper do not represent any PGIM product. This research paper makes no implied or express recommendations concerning how a client's account should be managed. This research paper is not intended to be used as a general guide to investing or as a source of any specific investment recommendations. Distribution of this information to any person other than the person to whom it was originally delivered is unauthorized, and any reproduction of these materials, in whole or in part, or the divulgence of any of the contents hereof, without prior consent of QMA LLC (QMA) is prohibited. Certain information contained herein has been obtained from sources that QMA believes to be reliable as of the date presented; however, QMA cannot guarantee the accuracy of such information, assure its completeness, or warrant that such information will not be changed. These materials are not intended as an offer or solicitation with respect to the purchase or sale of any security or other financial instrument or any investment management services and should not be used as the basis for any investment decision. No liability whatsoever is accepted for any loss (whether direct, indirect, or consequential) that may arise from any use of the information contained in or derived from this report. QMA and its affiliates may make investment decisions that are inconsistent with the views expressed herein, including for proprietary accounts of QMA or its affiliates.

These materials are for informational and educational purposes. In providing these materials, QMA is not acting as your fiduciary.

PGIM, QMA, the QMA logo and the Rock design are service marks of PFI and its related entities, registered in many jurisdictions worldwide.

QMA-20210309-85