Katharine Neiss, PhD
Chief European Economist,
Global Macroeconomic Research

September 2020

An Altered Trajectory: The Macroeconomic Effects of Europe's Plans to Address Climate Change

As global temperatures rise at an accelerating rate, climate change and the policies aimed at mitigating its effects are poised to leave an indelible signature on economic outcomes.[1,2] Yet, as recently observed in the euro area, these outcomes can be shifted in a more positive direction.

Climate change affects the macroeconomy through two main channels: the physical impacts of climate-related events and the transitional impacts to a lower-carbon economy.[3,4] These transmission channels highlight that, even if the physical effects from climate change are assumed to be small, the transition to a low-carbon economy carries significant macro implications. Momentum within the euro area for addressing climate change grew in 2019, and the Covid pandemic only added to the political impetus. Fiscal packages aimed at addressing climate change, such as the European Green Deal and the more recent European recovery fund, known as Next Generation EU, have the potential to provide a 2% boost to the level of euro area GDP by 2024. The momentum has extended to monetary policy as well—the ECB's ongoing monetary policy review, the completion of which is now on hold until mid-2021, incorporates climate change as part of its overall policy framework review.

Europe's comprehensive commitment to address climate change is becoming increasing ingrained across the region, unlikely to be derailed by political changes. The implications extend beyond the continent as it provides Europe's key trading partners with a strong incentive to adopt similar commitments in order to retain access to the region. The investment implications may be significant as well and include reduced fragmentation risk, support for the euro's recent appreciation, stable peripheral bond spreads to Bunds, and improved credit fundamentals in key sectors including, among others, utilities, transport, and building materials/construction.

[1] NOAA Global Climate Report Annual 2019, https://www.ncdc.noaa.gov/sotc/global/201913

[2] See the Intergovernmental Panel on Climate Change (2014) Climate change 2014 Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.) IPCC, Geneva, Switzerland, 151 pp. https://www.ipcc.ch/report/ar5/syr/

[3] See Recommendations of the task force on climate-related financial disclosures, TCFD June, 2017

[4] Alongside these macroeconomic impacts, climate change can also introduce financial risks that impact on asset valuations and potential credit losses. See https://www.bankofengland.co.uk/paper/2019/biennial-exploratory-scenario-climate-change-discussion-paper

The Extent of the Physical and Transitional Channels

The physical impacts of climate change include climate events—such as flooding, droughts, and the impact of higher temperatures on labour productivity and crop yields—which are expected to increase in frequency and intensity as global temperatures continue to rise. For example, a drought in 2018 led to significantly lower water levels in the Rhine river, which negatively affected German industry.

Transitional impacts are the costs associated with climate mitigation polices or technological innovation. Examples include a ban on heavily polluting cars in European city centres and advances in battery life that encourage a shift away from the combustion engine.

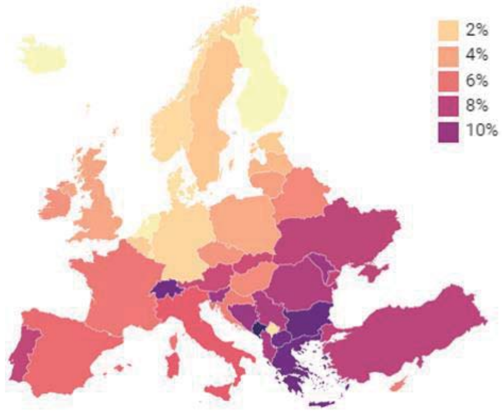
The physical and transitional impacts of climate change can affect the euro area through domestic and global spillover channels. The latter becomes particularly apparent as the euro area is relatively open economically, with exports making up close to 30% of GDP. So if, for example, a key trading partner, such as the U.S., is impacted by extreme weather events, or if China implements incentives towards the purchase of electric cars, these have the potential to spillover to the EA via their impact on export demand.

Both of these channels can affect key macro variables. For instance, regulations banning the use of coal can lead to obsolete capital stock. Grants for clean energy can stimulate investment, leading to innovation and higher productivity. Droughts can trigger agricultural price spikes that are reflected in consumer price indices. Policymakers and politicians are generally attuned to these changes and are providing support for the fiscal and monetary initiatives aimed at climate change.

Europe's Transition to Low-carbon—The Greater the Emissions, the Greater the Impact

The most comprehensive study to date of the long-term macroeconomic effects from climate change models the effect that a persistent increase in temperature relative to a historical baseline has on euro area productivity.[5] The results observed in Figure 1 suggest relatively sizable effects on per capita GDP assuming that temperatures continue to rise at their current trend in the absence of climate mitigation policies.[6]

Figure 1: Estimated Loss in GDP Per Capita by 2100 in the Absence of Climate Policies (%)



Sources: Kahn et al. (2019), Ourworldindata, PGIM Fixed Income.

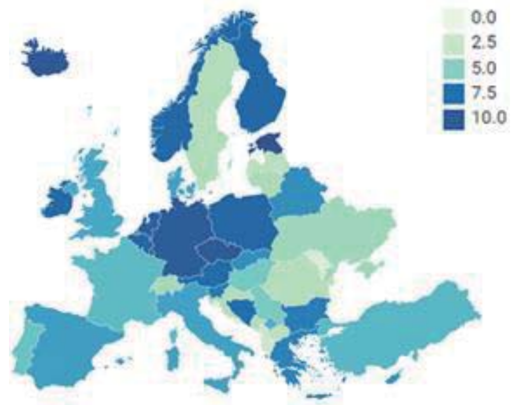
While research measuring the effects of climate change are based on numerous assumptions, leading to a high degree of uncertainty, studies have also found that rising temperatures create a drag on GDP. Some of these studies have found that the effect of climate change on GDP may be relatively small.

However, the euro area's ambitious climate commitments, coupled with its relatively large per-capita CO_2 emissions, largely drive the significant transitional effects of climate change in the region. Figure 2 illustrates the scale of the transitional effect to a lower-carbon economy, and the greater the current per-capita emissions, the greater the likely economic impact of the transition. For example, Germany—the leading engine of euro area economic activity—faces a particularly challenging transition as it is currently a relatively large emitter of CO_2 gases and is continuing its decade-long shift away from nuclear-generated power.

[5] *Kahn, Mohaddes, Ng, Pesaran, Raissi and Yang, Long-term macroeconomic effects of climate change: a cross country analysis, IMF working paper WP/19/215, Oct 2019.*

[6] *This corresponds with a scenario of high greenhouse gas emissions constructed by the Intergovernmental Panel on Climate Change (IPCC).*

Figure 2: Per Capita CO_2 Emissions (2017 tonnes)



Sources: Kahn et al. (2019), Ourworldindata, PGIM Fixed Income.

A Growing Constituency to Address Climate, Aided by Additional Policies

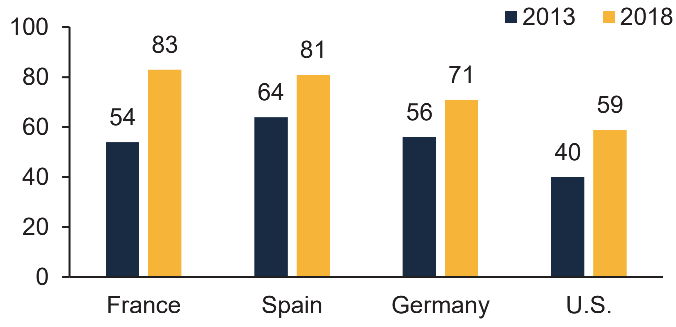
Europe's growing constituency for addressing climate change gathered pace in 2019 amidst further observations regarding its economic impact and perhaps reflecting a "Greta Thunberg effect." For example, the number of governments including the Green party now consists of Austria, Sweden, Finland, Luxembourg and—most recently—Ireland. That growing constituency has been reflected by the commitments from European governments to reduce carbon emissions (Figure 3) and the shift in public attitudes towards climate change (Figure 4).

Figure 3: EA Commitments to Reduce CO_2 Emissions

Country	Announced Commitment	Target Year for Net Zero Emissions	Status
Austria	Apr-19	2040	in policy document
Belgium	May-19	2050	target under discussion
Cyprus	Jun-19	2050	target under discussion
Estonia	Oct-19	2050	target under discussion
Finland	Jun-19	2035	in policy document
France	May-19	2050	in law
Germany	May-19	2050	in policy document
Greece	Jun-19	2050	target under discussion
Ireland	Jun-19	2050	in policy document
Italy	Jun-19	2050	target under discussion
Latvia	May-19	2050	target under discussion
Lithuania	Jun-19	2050	target under discussion
Luxembourg	May-19	2050	target under discussion
Malta	Jun-19	2050	target under discussion
Netherlands	Jun-18	2050	target under discussion
Portugal	May-19	2050	in policy document
Slovak Republic	Jun-19	2050	target under discussion
Slovenia	Jan-20	2050	in policy document
Spain	May-19	2050	proposed legislation

Sources: Energy & Climate Intelligence Unit, Climate Home News, national sources.

Figure 4: Rising Concern About Climate Change *(% responding that climate change is a major threat)*



Source: Pew Research Center

Alongside these national commitments, complementary EU-led actions have pivoted to support these aspirations. For example, the EU Emissions Trading System was established in 2005, becoming the world's first and largest major carbon market, covering approximately 45% of EU greenhouse gas emissions. More recently, under the helm of Ursula von der Leyen, the European Commission announced a European Green Deal in December 2019, establishing the objective for Europe to be the first climate-neutral continent.[7] The Sustainable Europe Investment Plan, supported by the Sustainable Finance Plan,[8] is the investment arm of the European Green Deal and aims to raise €1 trillion to support sustainable investments over 10 years. Around half of this money is expected to come from the EU budget, with the other half made up of a mixture of public and private investment via the European Investment Bank and InvestEU. As is clear from the breakdown, much of that money reflects a diversion of existing funds from within the EU budget, and, as such, the likely additional benefit to investment and GDP is expected to be relatively limited. Nevertheless, it is clear that fiscal policy is visibly shifting towards addressing the climate challenge.

ECB Policy: Contributing to the Union's Objectives

European monetary policy has pivoted to address the climate challenge as well. Despite the absence of an explicit environmental target, the ECB has purchased green bonds as part of its corporate sector purchase programme (CSPP) and its public sector purchase programme. These purchases reflect the growing market

[7] *See https://ec.europa.eu/clima/policies/strategies/2050_en and https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en*

[8] *Other aspects of the Sustainable Finance Plan include guidance on corporate disclosures of climate related information, taxonomy for sustainable activities, and the development of a green bond standard.*

for green bonds within the euro area, particularly since 2016, and align with the ECB's overall aim of maintaining a diversified portfolio. However, the overall size of these purchases remains very small at around 1% of the total CSPP eligible universe.

Perhaps more significantly, under the new leadership of President Lagarde, the ECB launched a monetary policy framework review in January 2020. This review is in sharp contrast to the Federal Reserve's recently announced shift to a [2% flexible average inflation target]. The ECB review is much broader as it includes a review of how price stability is interpreted, as well as other elements seemingly outside the normal purview of an independent central bank, i.e. climate change. The latter aspect of the review has received considerable criticism that the ECB has acted outside of its remit. However, both aspects of the review are wholly consistent with the ECB's mandate, which stipulates that "the primary objective is to maintain price stability. And without prejudice to the objective of price stability, shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union." And achieving carbon neutrality *is* a general economic policy objective for the Union.

It should also be noted that a large majority of European Parliamentarians across a broad political spectrum endorsed the ECB's review including climate change. Indeed, it would be odd if delegated institutions in a free society were not structured in a way that facilitated the achievement of the Union's objectives.[9]

In light of the Covid pandemic, the ECB postponed the completion of its framework review until mid-2021. However, Lagarde has recently re-emphasised the critical nature of climate change in the review, referring to it as "mission critical." Possible areas of focus could include building on existing activities, such as purchasing green bonds as part of its Asset Purchase Facility, actively phasing out purchases of carbon-related assets, and aligning the collateral framework with climate objectives. Modelling work on the potential impact of climate change on the macroeconomy and the implications for policy will be explored as well.[10]

The Pandemic Recovery Plan Adds Political Momentum to Address Climate Change

The economic impact from the Covid pandemic and the potential for long-term scarring has provided additional impetus to Europe's climate aspirations. The recently agreed European recovery fund, known as Next Generation EU, is aimed at addressing Europe's recovery over the next five years. The €750 billion agreement is comprised of a mix of grants and loans to European countries most affected by the Covid crisis. These funds, which would be made available starting in January 2021, are targeted towards addressing climate change and digitalisation. But in order for funding to be disbursed, countries need to submit recovery and resilience plans that detail the contributions to green and digital transitions to Brussels for approval.

So how confident can we be that this initiative—if agreed by the European and national Parliaments, as is expected—might be successful? There is good precedent within the European Union for strategic investment initiatives. The European Fund for Strategic Investments—often referred to as the "Junker Plan"—has exceeded its investment target of €500 billion, added 1.1 million jobs, and increased GDP by 1.3%, according to an EC report published in July.[11] Indeed, the recovery in investment since the launch of the initiative in 2015 is notable (see Figure 5), although it likely reflects the positive economic tailwinds at the time as well. However, if we consider the limited absorption capacity of available EU funds on a country basis, this could somewhat dampen the impact from what will still be a meaningful effect on the euro area economy (Figure 6).

[9] We see the flip side to this in the U.S., with the Fed notably absent from the debate on the impact of climate change on monetary policy, consistent with the U.S. administration's decision in 2017 to withdraw from the Paris Agreement. In January of this year, Fed Chair Powell emphasised that "Society's overall response to climate change needs to be decided by elected officials, and not by the Fed."

[10] The Fed has been somewhat more active in this area, noting that the potential for climate change to affect the macroeconomy and financial stability—similar to globalisation and technological innovation—is something that it needs to monitor. See Brainard (2019), Why climate change matters for monetary policy and financial stability. https://www.bis.org/review/r191111a.pdf

[11] See https://ec.europa.eu/commission/sites/beta-political/files/efsi-factsheet-june2020_en.pdf

Figure 5: EA Net Fixed Capital Formation (€ in billions)

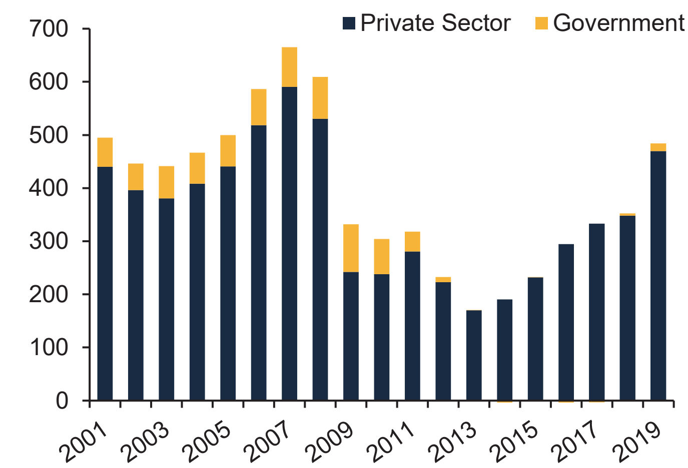
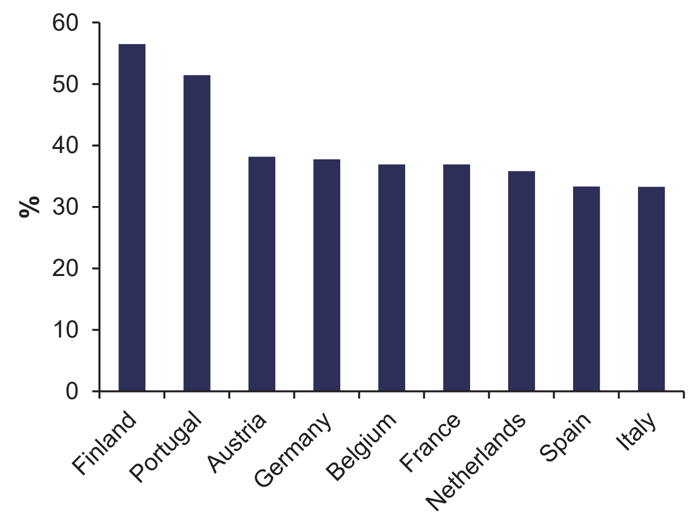


Figure 6: EU Payment Rate to Country Supported Programmes



Source: European Commission and PGIM Fixed Income

Assuming economic effects similar to those seen with the Juncker plan, the €750 billion EU recovery plan of suggests an uplift in EU GDP of about 2% by 2024 while contributing to the economic potential of the region as well.

Europe's Approach to Climate Change Brings Long Lasting, Far Reaching Implications

When considering Europe's approach to climate change, the key takeaway is that climate change will affect the macroeconomic outlook in Europe given the region's commitment to addressing the challenge through the adoption of ambitious plans towards carbon neutrality. These transition effects are over and above any possible physical effects from climate change as modelled in the research literature. This commitment was forged by a growing constituency for addressing the climate challenge across the political spectrum and, as such, is unlikely to be unwound by a leadership change, as has occurred elsewhere. Moreover, the objective of carbon neutrality is being hardwired into the very fabric of European institutions. As such we see this trend as having a substantive and long-lasting impact on the region. Finally, as a large and relatively open economic region, the standards adopted in Europe to address climate change will likely have consequences far beyond the continent. Having taken a leadership role, Europe's key trading partners will have a strong incentive to adopt similar standards in order to retain access to one of the world's largest and wealthiest economic regions.

Europe's Plans to Address the Climate Challenge Presents Three Areas of Investment Opportunity

Europe's shifting centre of gravity to address the climate challenge is strengthening. The Covid crisis added to the momentum, with European governments united in their view that addressing the climate challenge should be a key part of putting the recovery on a sustainable trajectory. With the recent agreement by the European Council of the European recovery plan known as Next Generation EU, we see three areas of opportunity for the investor community.

First, the unity displayed by the European authorities reduces fragmentation risk and should support narrower and more stable spreads between periphery EA country sovereign bonds and German bunds. Second, the overall size of the recently agreed upon plan and the potential boost to GDP should help sustain the recent euro appreciation. And finally, the plan is expected to support credit fundamentals, leading to tighter credit spreads. Many sectors are likely to see significant impacts including, among others, utilities, transport, and building materials/construction. We'll delve into these investment effects in future work.

Notice: Important Information

Source(s) of data (unless otherwise noted): PGIM Fixed Income as of July 2020.

PGIM Fixed Income operates primarily through PGIM, Inc., a registered investment adviser under the U.S. Investment Advisers Act of 1940, as amended, and a Prudential Financial, Inc. ("PFI") company. Registration as a registered investment adviser does not imply a certain level or skill or training. PGIM Fixed Income is headquartered in Newark, New Jersey and also includes the following businesses globally: (i) the public fixed income unit within PGIM Limited, located in London; (ii) PGIM Netherlands B.V. located in Amsterdam; (iii) PGIM Japan Co., Ltd. ("PGIM Japan"), located in Tokyo; and (iv) the public fixed income unit within PGIM (Singapore) Pte. Ltd., located in Singapore ("PGIM Singapore"). PFI of the United States is not affiliated in any manner with Prudential plc, incorporated in the United Kingdom or with Prudential Assurance Company, a subsidiary of M&G plc, incorporated in the United Kingdom. Prudential, PGIM, their respective logos, and the Rock symbol are service marks of PFI and its related entities, registered in many jurisdictions worldwide.

These materials are for informational or educational purposes only. The information is not intended as investment advice and is not a recommendation about managing or investing assets. In providing these materials, PGIM is not acting as your fiduciary. These materials represent the views, opinions and recommendations of the author(s) regarding the economic conditions, asset classes, securities, issuers or financial instruments referenced herein. Distribution of this information to any person other than the person to whom it was originally delivered and to such person's advisers 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 PGIM Fixed Income is prohibited. Certain information contained herein has been obtained from sources that PGIM Fixed Income believes to be reliable as of the date presented; however, PGIM Fixed Income cannot guarantee the accuracy of such information, assure its completeness, or warrant such information will not be changed. The information contained herein is current as of the date of issuance (or such earlier date as referenced herein) and is subject to change without notice. PGIM Fixed Income has no obligation to update any or all of such information; nor do we make any express or implied warranties or representations as to the completeness or accuracy or accept responsibility for errors. **All investments involve risk, including the possible loss of capital. 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 risk management technique can guarantee the mitigation or elimination of risk in any market environment. Past performance is not a guarantee or a reliable indicator of future results and an investment could lose value. 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. PGIM Fixed Income and its affiliates may make investment decisions that are inconsistent with the recommendations or views expressed herein, including for proprietary accounts of PGIM Fixed Income or its affiliates.**

The opinions and recommendations herein do not take into account individual client circumstances, objectives, or needs and are not intended as recommendations of particular securities, financial instruments or strategies to particular clients or prospects. No determination has been made regarding the suitability of any securities, financial instruments or strategies for particular clients or prospects. For any securities or financial instruments mentioned herein, the recipient(s) of this report must make its own independent decisions.

Conflicts of Interest: PGIM Fixed Income and its affiliates may have investment advisory or other business relationships with the issuers of securities referenced herein. PGIM Fixed Income and its affiliates, officers, directors and employees may from time to time have long or short positions in and buy or sell securities or financial instruments referenced herein. PGIM Fixed Income and its affiliates may develop and publish research that is independent of, and different than, the recommendations contained herein. PGIM Fixed Income's personnel other than the author(s), such as sales, marketing and trading personnel, may provide oral or written market commentary or ideas to PGIM Fixed Income's clients or prospects or proprietary investment ideas that differ from the views expressed herein. Additional information regarding actual and potential conflicts of interest is available in Part 2A of PGIM Fixed Income's Form ADV.

In the European Economic Area ("EEA"), information is issued by PGIM Limited or PGIM Netherlands to persons who are professional clients as defined in Directive 2014/65/EU (MiFID II). PGIM Limited's 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). PGIM Netherlands B.V. is authorised by the Dutch Authority for the Financial Markets (Autoriteit Financiële Markten – AFM) as an alternative investment fund manager with MiFID top up service capabilities under registration number 15003620. PGIM Limited and PGIM Netherlands are authorized to provide services or operate with a passport in various jurisdictions in the EEA. In certain countries in Asia, information is presented by PGIM (Singapore) Pte. Ltd., a Singapore investment manager registered with and licensed by the Monetary Authority of Singapore. In Japan, information is presented by PGIM Japan Co. Ltd., registered investment adviser with the Japanese Financial Services Agency. In South Korea, information is presented by PGIM, Inc., which is licensed to provide discretionary investment management services directly to South Korean investors. In Hong Kong, information is provided by PGIM (Hong Kong) Limited, a regulated entity with the Securities & Futures Commission in Hong Kong to professional investors as defined in Section 1 of Part 1 of Schedule 1 (paragraph (a) to (i) of the Securities and Futures Ordinance (Cap.571). In Australia, this information is presented by PGIM (Australia) Pty Ltd ("PGIM Australia") for the general information of its "wholesale" customers (as defined in the Corporations Act 2001). PGIM Australia is a representative of PGIM Limited, which is exempt from the requirement to hold an Australian Financial Services License under the Australian Corporations Act 2001 in respect of financial services. PGIM Limited is exempt by virtue of its regulation by the FCA (Reg: 193418) under the laws of the United Kingdom and the application of ASIC Class Order 03/1099. The laws of the United Kingdom differ from Australian laws. In South Africa, PGIM, Inc. is an authorised financial services provider – FSP number 49012.

2020-5893

留意事項

※ 本資料はPGIMフィクスト・インカムが作成したものです。PGIMフィクスト・インカムは、米国SECの登録投資顧問会社であるPGIMインクの債券運用部門です。
※ 本資料は情報提供を目的としたものであり、特定の金融商品の勧誘又は販売を目的としたものではありません。また、本資料に記載された内容等については今後変更されることもあります。
※ 記載されている市場動向等は現時点での見解であり、これらは今後変更することもあります。また、その結果の確実性を表明するものではなく、将来の市場環境の変動等を保証するものでもありません。
※ 本資料に記載されている市場関連データ及び情報等は信頼できると判断した各種情報源から入手したものですが、その情報の正確性、確実性について当社が保証するものではありません。
※ 過去の運用実績は必ずしも将来の運用成果等を保証するものではありません。
※ 本資料は法務、会計、税務上のアドバイスあるいは投資推奨等を行うために作成されたものではありません。
※ 当社による事前承諾なしに、本資料の一部または全部を複製することは堅くお断り致します。
※ "Prudential"、"PGIM"、それぞれのロゴおよびロック・シンボルは、プルデンシャル・ファイナンシャル・インクおよびその関連会社のサービスマークであり、多数の国・地域で登録されています。
※ PGIMジャパン株式会社は、世界最大級の金融サービス機関プルデンシャル・ファイナンシャルの一員であり、英国プルーデンシャル社とはなんら関係がありません。

PGIMジャパン株式会社
金融商品取引業者　関東財務局長（金商）第392号
加入協会　一般社団法人 投資信託協会、一般社団法人 日本投資顧問業協会
PGIMJ75324