

## The Transition to Net Zero A Challenge for Central Banks

PERSPECTIVES | JUNE 2022

**AUTHORS** 

#### KATHARINE NEISS, PHD Chief European Economist

**RITUSH DALMIA** European Economist Russia's invasion of Ukraine has given new impetus to Europe's ambition of achieving "strategic sovereignty," including—crucially—weaning itself off Russian energy. The green transition has become a focal point to not only deliver the region's climate objectives, but also increase its energy self-sufficiency. This will not happen overnight, and the path to net zero will evolve over the coming decades, likely accelerated by the recent conflict.

This paper looks at the potential consequences for inflation in the euro area over the transition period to net zero, and implications for monetary policy. The punchline is that both the physical effects of climate change such as extreme weather events, and climate mitigation strategies such as carbon taxes will further challenge the job of central banks in achieving price stability.

### THE CHANNELS OF INFLATION VOLATILITY

Extreme weather events are becoming more frequent and intense. They affect prices through several channels, such as food, energy and supply chains. This results in more volatile inflation.

• Evidence is growing that extreme temperatures, particularly hot summers, affect food prices. India's heatwave this year, and its effect on wheat supplies, is the most recent example.<sup>1</sup> Most studies focus on emerging economies. However, the evidence suggests that the impact may be growing in regions such as Europe, where it had so far been limited (see our earlier paper "<u>The Case for Central Bank Action on Climate Change</u>"). In France, for example, there is evidence that extreme summer heat affected crop yields in the summers of 2003 and 2006.<sup>2</sup> Agricultural producer prices rose, and food price inflation followed. This led to an identifiable increase in headline inflation. Given the large share of food in the consumption basket, the increasing frequency and intensity of such weather events could raise inflation volatility via this channel.

**For Professional Investors Only.** All Investments involve risk, including the possible loss of capital.

#### Figure 1: France headline inflation



Source: Macrobond, PGIM Fixed Income.

- Climate-related spikes in wholesale energy prices could also contribute to increased inflation volatility. Europe's reliance on energy imports and its phasing out of fossil fuels and nuclear energy could lead to more frequent price shocks, especially because renewable energy is yet to come on stream. Periods of unexpected demand, such as during the particularly cold winter of 2016-17, could exacerbate this effect.
- Third, extreme weather events can lead to temporarily damaged infrastructure and trigger short-term bottlenecks. Periods of extreme drought, for example, have led to low water levels in the Rhine River a key transport link for raw materials and goods across northern Europe. The continent's reliance on imports of critical materials makes prices vulnerable to transport disruptions, potentially contributing to inflation volatility.

## CLIMATE CHANGE IS GRADUAL, BUT ITS IMPACT ON INFLATION IS MATERIAL

We draw from several studies to formulate the potential magnitude of climate related shocks on euro area headline inflation (See Figure 2).

- ECB research finds that exceptionally hot summers can add approximately 1.5 percentage points (pp) of food price inflation in emerging economies within the quarter.<sup>3</sup> They don't find a significant impact for developed economies. But one could reasonably extrapolate developments in emerging markets as a harbinger of things to come in developed markets. In that sense, the ECB's results suggest a 0.3 pp increase in euro area inflation, given its smaller share of food in the region's consumption basket. This estimate is broadly in line with France's experience, where food price inflation added 0.2 pp to headline inflation during the summer heatwaves of 2003 and 2006.
- Other research shows that energy prices can also have a large and rapid effect on inflation, typically within the quarter.<sup>4</sup> When exceptionally cold and snowy weather hit Europe in January 2017, gas demand rose 20% compared to a year earlier, and headline eurozone inflation rose 0.6 pp. The recent experience of low energy stores in Europe and escalating tensions with Russia offers a sharp reminder of the sensitivity of headline inflation to large

<sup>4</sup> See European Central Bank (June 2021), Energy Markets and Euro Area Macroeconomy. Occasional Paper Series no 113.

<sup>&</sup>lt;sup>3</sup> See footnote 1.

and sudden moves in energy prices. As a result, this channel is the largest shock to inflation in Figure 1's illustrative example.

 Finally, COVID disruptions led the IMF and ECB to research the impact of supply chains on inflation.<sup>5</sup> Using IMF estimates, the rise in European shipping costs in April 2021, for example, added around 0.1 pp to headline inflation within three months. Similar distortions could arise from climate-related shocks, so this figure is included in our illustrative estimates.

Figure 2: Illustrative contribution of climate related shocks on headline inflation



Source: PGIM Fixed Income as of June 2022.

A "perfect storm" of, say, a heatwave that raises food prices, while increasing energy demand (e.g. for air conditioning) and disrupting supply chains (e.g. by lowering Rhine water levels) could raise eurozone inflation by a full percentage point in two quarters or less. The above analysis suggests that climate-related inflation shocks can add several tenths of a percentage point to inflation. A "perfect storm" of, say, a heatwave that raises food prices, while increasing energy demand (e.g., for air conditioning) and disrupting supply chains (e.g., by lowering Rhine water levels) could raise eurozone inflation by a full percentage point in two quarters or less.

## GOVERNMENT MEASURES TO LIMIT CARBON EMISSIONS MAY ALSO RAISE INFLATION

Energy's contribution to euro area headline inflation has declined over the last two decades. That decline mirrored a broader trend, as globalisation and China's integration into the global economy lowered goods price inflation, relative to services. This tailwind kept inflation stable in developed markets and enabled their central banks to support their domestic economies.

That trend is likely to reverse, now that governments have started charging for emissions that were free until now. Indeed, estimates suggest that carbon prices will need to increase significantly for governments to achieve their carbon-reduction targets.

According to the Network for Greening the Financial System (a network of 114 central banks and financial supervisors), the price of carbon would need to rise from its current level of close to zero to US\$160 per tonne by 2030.<sup>6</sup> Energy makes up a relatively large share of the overall consumption basket, so higher energy costs would materially boost inflation.<sup>7</sup>

<sup>&</sup>lt;sup>5</sup> See Carriere-Swallow, Yan, Deb Pragyan, Davide Furceri, Daniel Jimenez and Jonathan David Ostry (March 25, 2022), *Shipping Costs and Inflation*. IMF working paper, and Attinasi, Maria Grazia, Mirco Balatti, Michele Mancini and Luca Metelli, *Supply chain disruptions and the effects on the global economy*. ECB Economic Bulletin, Issue 8/2021.

<sup>&</sup>lt;sup>6</sup> See Network for Greening the Financial System (June 2021), NGFS Climate Scenarios for central banks and supervisors. June 2021.

<sup>7</sup> See Fabia and Reguat (2014), Passthrough of emissions costs in electricity markets, American Economic Review.

To assess the effect of rising emissions prices, we replicate a study of the effect of carbon pricing on energy inflation using an augmented Phillips Curve.<sup>8</sup>

Our analysis shows that an increase in the EU's Emissions Trading System (ETS)<sup>9</sup> CO<sub>2</sub> price by  $\notin 10$ /tonne increases energy price inflation by 0.3 pp in the following month (Figure 2). Over the past year, the ETS price of CO<sub>2</sub> has increased by around  $\notin 50$ /tonne, so this effect may have contributed as much as 1.5 pp to energy inflation. If fully passed through, that would have raised headline inflation by 0.15 pp, as energy makes up approximately 10% of the consumption basket.

Figure 3: F	Phillips	curve	estimation	table
-------------	----------	-------	------------	-------

	Estimate	t-statistic
Intercept	-1.54	-1.15
Unemployment	-0.13	-1.01
ETS (carbon price)	0.03*	2.16
$\Delta \text{NEER}$ (nominal effective exchange rate)	-0.02	-0.84
Inflation expectations	2.54*	7.52
Lagged energy inflation	0.77*	23.53

Note: Asterisk (\*) indicates statistical significance at the 5% level. Source: PGIM Fixed Income.

However, the pass-through effect of wholesale electricity costs to headline inflation is unlikely to be uniform across the euro area. For example, many households in Spain and Estonia are signed up to dynamic electricity tariffs. There, the effect of higher prices would be quicker, which could pose a challenge for policymakers. If governments were to reduce CO<sub>2</sub> allowances or expand the programme, inflation could be even higher.

In this scenario, the ECB would face a challenging trade-off: to offset higher energy inflation and deliver price stability, it would need to constrain domestically generated inflation. This trade-off is illustrated in Figure 4.

Energy makes up approximately 10% of the consumption basket in headline inflation. So even low energy price inflation of, say, 5% would require tighter policy to reduce non-energy inflation to ~1.5%. Even in this benign scenario, policy rates would need to be a couple of 100 bps higher to achieve lower, non-energy inflation and meet the 2% target. The costs would magnify in this context as the resulting weaker domestic growth would make it even harder to achieve transition goals.

#### Figure 4: Illustrative energy vs. non-energy inflation to deliver a 2% target

If energy prices rise by (%)	then non-energy inflation must be (%)
5	~1.5
10	~1.0
15	~0.5
20	~-0.5

Source: PGIM Fixed Income.

<sup>8</sup> See Moessner, Richhild (2022), *Effects of carbon pricing on inflation*. We use a market-based measure of inflation expectations in place of survey-based measures, and the unemployment rate in place of the output gap. Economists use Phillips curves to trace the relationship between inflation and economic activity.

<sup>&</sup>lt;sup>9</sup> The EU Emissions Trading System puts a limit on the amount of CO<sub>2</sub> emitted by business and creates a market price for carbon. <u>https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets\_en</u>

# THE TRANSITION TO NET ZERO COULD BE A FURTHER FACTOR WEIGHING ON REAL INTEREST RATES

In the long run, the green transition should stimulate innovation and growth. Central banks would welcome such a development, because weak growth since the global financial crisis limited their scope to cut interest rates. As a result, they relied on unconventional policies, in particular large scale asset purchases.

However, during the transition period, increased public debt to finance the green transition could crowd out private investment. Increased uncertainty, due to the physical effects of climate change or uncertainty over climate regulation, could further depress investment. And the physical and transition effects of climate change could make large parts of the existing capital stock obsolete, pushing down on productivity and growth.

Increased volatility and uncertainty could also affect the ability of households and businesses to plan. This could lead to suboptimal savings and investment decisions.<sup>10</sup> More generally, an uncertain and volatile environment could depress risk-taking, as investors seeks safe-haven assets.

Figure 5 plots market-based estimates of the five-year real interest rate in 5 years (the real 5y5y forward). Since the global financial crisis, the medium-term real interest rate has trended downward and into negative territory since the region's sovereign debt crisis. That period of negative real rates coincided with the ECB's use of unconventional tools, including large scale asset purchases.





Source: PGIM Fixed Income.

(%)

Moreover, estimates for the euro area find that the probability of hitting policy's effective lower bound would increase by around 5 pp for each 0.5 pp decline in the medium-term real interest rate.<sup>11</sup> These findings suggest that, if the net effect of climate change is to push growth and real interest rates lower, that could further challenge monetary policy at the zero lower bound.<sup>12</sup>

<sup>&</sup>lt;sup>10</sup> See *Climate change and monetary policy in the euro area* (2021), ECB Occasional Paper Series no 271.

<sup>&</sup>lt;sup>11</sup> See Haavio and Laine (2021), Monetary policy rules and the effective lower bound in the euro area, Bank of Finland Discussion Papers, 5.

<sup>&</sup>lt;sup>12</sup> See Kiley and Roberts (2017), Monetary policy in a low interest rate world, Brookings paper.

## CONCLUSION: CLIMATE CHANGE POSES MULTIPLE DILEMMAS FOR MONETARY POLICY

In June 2021, Bank of England Governor Andrew Bailey told a Reuters conference that "a disorderly transition [due to climate risk] could result in both lower growth and higher inflation from rising energy and materials costs in the economy". The preceding points detail what those effects could mean for the ECB and its policymaking.

- More volatile food and energy prices, and supply chain disruptions, could make it harder for the central bank to recognise underlying inflationary trends. That would complicate its job of stabilising the economy. Frequent and large deviations from the inflation target could chip away at central bank credibility. As a result, policymakers might place greater emphasis on core inflation measures, as we saw during the pandemic.
- A larger contribution from energy prices would raise headline inflation (all else being equal). The central bank would then be in the unenviable position of having to set policy tighter, to reduce inflation from the non-energy sector, to offset higher energy price inflation. This could come at a heavy economic cost over the transition period. The alternative would be to tolerate above-target inflation for a period of time, potentially undermining the central bank's credibility. ECB executive board member Isabel Schnabel articulated these difficult trade-offs in a recent speech.<sup>13</sup>
- Finally, increased volatility and uncertainty could weigh on investment and increase the demand for safe assets, further depressing growth and real interest rates. Low real interest rates pose a well-known challenge for monetary policymakers. They increase the likelihood that the central bank finds itself at the zero lower bound, where it has limited firepower.

Higher inflation and uncertainty due to climate change exacerbate the existing backdrop as economies emerge from the pandemic and decouple from Russia. In such an environment, investors are likely to demand greater risk premia.

Higher inflation and uncertainty due to climate change exacerbate the existing backdrop, as economies emerge from the pandemic and decouple from Russia. In such an environment, investors are likely to demand greater risk premia.

## NOTICE: IMPORTANT INFORMATION

Source(s) of data (unless otherwise noted): PGIM Fixed Income as of June 2022.

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; (iv) the public fixed income unit within PGIM (Hong Kong) Ltd. located in Hong Kong; and (v) 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. Clients seeking information regarding their particular investment needs should contact their financial professional. These materials represent the views and opinions 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 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., an entity authorised by the Autoriteit Financiële Markten ("AFM") in the Netherlands 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. 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 certain countries in Asia-Pacific, 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 Canada, pursuant to the international adviser registration exemption in National Instrument 31-103, PGIM, Inc. is informing you that: (1) PGIM, Inc. is not registered in Canada and is advising you in reliance upon an exemption from the adviser registration requirement under National Instrument 31-103; (2) PGIM, Inc.'s jurisdiction of residence is New Jersey, U.S.A.; (3) there may be difficulty enforcing legal rights against PGIM, Inc. because it is resident outside of Canada and all or substantially all of its assets may be situated outside of Canada; and (4) the name and address of the agent for service of process of PGIM, Inc. in the applicable Provinces of Canada are as follows: in Québec: Borden Ladner Gervais LLP, 1000 de La Gauchetière Street West, Suite 900 Montréal, QC H3B 5H4; in British Columbia: Borden Ladner Gervais LLP, 1200 Waterfront Centre, 200 Burrard Street, Vancouver, BC V7X 1T2; in Ontario: Borden Ladner Gervais LLP, 22 Adelaide Street West, Suite 3400, Toronto, ON M5H 4E3; in Nova Scotia: Cox & Palmer, Q.C., 1100 Purdy's Wharf Tower One, 1959 Upper Water Street, P.O. Box 2380 - Stn Central RPO, Halifax, NS B3J 3E5; in Alberta: Borden Ladner Gervais LLP, 530 Third Avenue S.W., Calgary, AB T2P R3.

© 2022 PFI and its related entities. 2022-4035

#### 留意事項

※本資料はPGIMフィクト・インカムが市場動向に関する情報提供としてプロの投資家向けに作成したものです。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。

※本資料で言及されている個別銘柄は例示のみを目的とするものであり、特定の個別銘柄への投資を推奨するものではありません。

※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日本投資顧問業協会、一般社団法人投資信託協会 PGIMJ91355