Inflation as an Ecological Phenomenon

PositiveMoney

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Executive Summary

Climate change, environmental degradation, and global energy markets are all sources of price instability, with important implications for inflation forecasting and macroeconomic policy. Central banks will have to deepen their understanding of these drivers of inflation and adapt their policymaking accordingly, recognising that achieving environmental targets is necessary to avoid persistent environment-related macroeconomic instability. While primary responsibility for the transition to a sustainable economy lies with fiscal, industrial, and environmental authorities, new approaches to monetary policy and improved inflation forecasting should support these efforts.

Energy's relevance to price stability is widely acknowledged, as fossil fuel prices driving inflation ('fossilflation') is a longstanding phenomenon, most recently triggered by Russia's invasion of Ukraine. The inflationary effects of climate change ('climateflation') and environmental degradation in a modern context are comparatively novel though increasingly pronounced. Climateflation, which is global in nature yet borne disproportionately by lower income households and countries, occurs primarily through reductions in agricultural activity and damage to crop yields. As environmental disruptions intensify, they will play an increasingly significant role in driving price instability.

In this context, orthodox monetary policy is counterproductive to achieving price stability, as well as governments' economic, social and environmental objectives. Increasing interest rates fails to address the core drivers of rising energy and food prices, disproportionately hampers investment in capital-intensive green projects, and reduces government's fiscal space. Instead, central banks should factor environmental considerations into the conduct of monetary policy and explore greater macroeconomic policy coordination with fiscal and industrial authorities. New international monetary arrangements will also be necessary to secure price stability and a just transition.

Introduction

In March 2022, following the outbreak of the war in Ukraine, European Central Bank (ECB) Executive Member Isabel Schnabel delivered a speech where she declared a "new age of energy inflation", coining the terms "climateflation" and "fossilflation".[1,2] We review the evidence and policy implications related to these phenomena, both of which are directly a result of our economies' dependence on fossil fuels.

Fossilflation, meaning fossil fuels driving inflation, is not a new phenomenon, as exemplified by the well-known oil price shocks in the 1970s.[3] Energy prices affect headline inflation both directly and indirectly, as our economies' productive structures, and the transportation of goods, rely heavily on energy as an input.[4] The United States' new position as a net energy exporter in the world economy has resulted in global energy price rises coinciding with an appreciating U.S. dollar, which made the recent fossil fuel shock uniquely challenging for net-energy-importing countries.

Meanwhile, the burning of fossil fuels is also the primary driver of climate change, causing rising temperatures and an increase in the frequency and persistence of extreme weather events, which doubled between 1990 and 2016.[6] This pattern is in turn subjecting economies to negative supply shocks, which generate inflationary pressures referred to as climateflation.[7] These pressures primarily occur in the agricultural sector, and evidence is mounting that extreme weather events and rising temperatures have an overall inflationary impact, which is set to worsen as climate change and environmental degradation intensifies.[8,9,10]

Climateflation exacerbates both intra-country and inter-country inequality, as low-income households and climate-vulnerable countries in the Global South are most adversely affected by rising food prices.[11,12] The primary policy response by inflation-targeting and price level targeting central banks – interest rate increases – further deepens this inequality,[13] while failing to address the sources of inflation,[14] jeopardising financial stability,[15] and hampering the green investment necessary to achieve a green transition and secure price stability in the long run.[16,17]

1. Schnabel, I. (2022). The new age of energy inflation: climateflation, fossilflation and greenflation. **2.** Schnabel also discusses 'greenflation', referring to the potential inflationary pressures resulting from shortages of critical metals and minerals necessary for renewable energy infrastructure (see, for example, Miller et al., 2023). Carbon taxes and other climate policies also have price stability implications (Mckibbin et al., 2021), which could equally be referred to as 'greenflation'. While we recognise that transition scenarios will present their own inflationary pressures (Jackson and Jackson, 2021), this falls outside of the scope of this paper, where we focus on the price instability resulting from delay or outright failure to transition. **3.** ONS. (2022a). Consumer price inflation, historical estimates and recent trends, UK 1950 to 2022. **4.** ONS. (2023). The energy intensity of the Consumer Prices Index 2022. **5.** Hofmann et al., (2023). The changing nexus between commodity prices and the dollar: causes and implications. **6.** IPCC. (2023). Synthesis report of the IPCC sixth assessment report. **7.** While the term 'climateflation' refers specifically to the inflationary consequences of climate change, it is worth noting that wider environmental pressures beyond climate change will also have implications for price stability. **8.** Kotz et al., (2023). The impact of global warming on inflation: averages, seasonality and extremes. **9.** Mukherjee and Outtara. (2021). Climate and monetary policy: do temperature shocks lead to inflationary pressures? **10.** Faccia et al., (2021). Feeling the heat: extreme temperatures and price stability. **11.** See 8, 9. **12.** Among high-income economies, fossilflation is also disproportionately borne by low-income households, as they have higher shares of energy in their consumption baskets. It is unclear whether this applies more generally within and between countries as data on shares of energy consumption in baskets across countries, and across households in low income economies, is lacking. **13.** Furceri et al., (2018). The effects of monetary policy shocks on inequality. **14.** Stiglitz and Regmi. (2022). The Causes of and Responses to Today's Inflation. **15.** Boissay et al., (2023). Prudential policy and financial dominance: exploring the link. **16.** Monnet and van't Klooster. (2023). Using green credit policy to bring down inflation: what central bankers can learn from history. **17.** Schmidt et al., (2019). Adverse effects of rising interest rates on sustainable energy transitions.

Therefore, in a global economy rocked by energy shocks and climate crisis, inflation is, albeit a complex political phenomenon, increasingly ecological in nature, and disproportionately affects lower income households and countries. Economic authorities, particularly central banks and finance ministries, will have to adapt to this new era, greening their policy tools and engaging in greater coordination to secure price stability and a just transition.

The outline of this paper is as follows: section 1 presents evidence on the role of fossil fuels in driving inflation, including in the context of the U.S.' becoming a net energy exporter; section 2 reviews the literature on climate change impacting headline inflation in a non-linear and global manner, particularly through food prices; section 3 explains how fossilflation and climateflation, as well as central banks' traditional policy response to inflation, exacerbates intra and inter-country inequality; and section 4 outlines far-reaching policy implications for monetary policy, macroeconomic coordination, and international monetary arrangements.

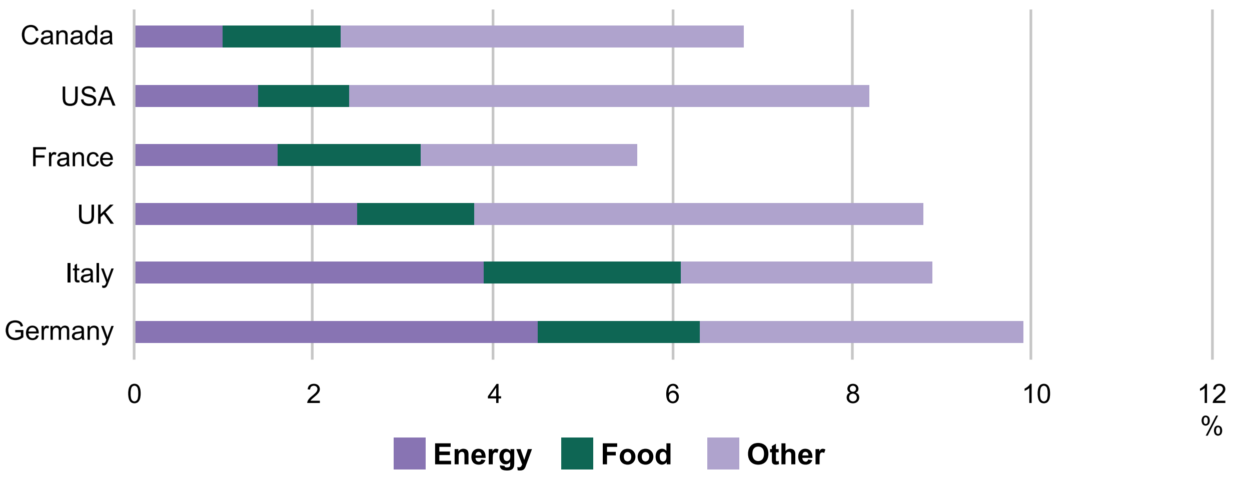
1. Fossilflation: Fossil fuels as drivers of inflation

Throughout 2022 and 2023, high headline inflation figures across the globe were driven primarily by high energy prices, which were already inflated in late 2021 and exacerbated following Russia's invasion of Ukraine. High global energy prices have an immediate direct impact on headline inflation figures as energy goods feature substantially in inflation indices, and contribute to inflation indirectly over time as the vast majority of goods and services require energy throughout the production and transportation process.

1.1. Direct effects of fossil fuels on inflation

In the recent inflationary episode, the energy component of Consumer Price Inflation (CPI) contributed significantly to elevated inflation, which many governments addressed partly through price controls and subsidies.[18] Figure 1 shows this direct contribution of energy to inflation across the G7 countries (excluding Japan, where comparable data is not available) around the peak of the recent inflationary episode in September 2022.[19] Looking at a broader sample of 28 high income countries and 60 low and middle income countries, Barrett (2022) similarly finds that energy, alongside food and transport (both of which rely heavily on energy) accounted for a major share of recent high inflation rates.[20]

Figure 1: *Contributions to the 12-month rate of CPI across G7 countries (excl. Japan), September 2022*



Source: ONS, 2022.

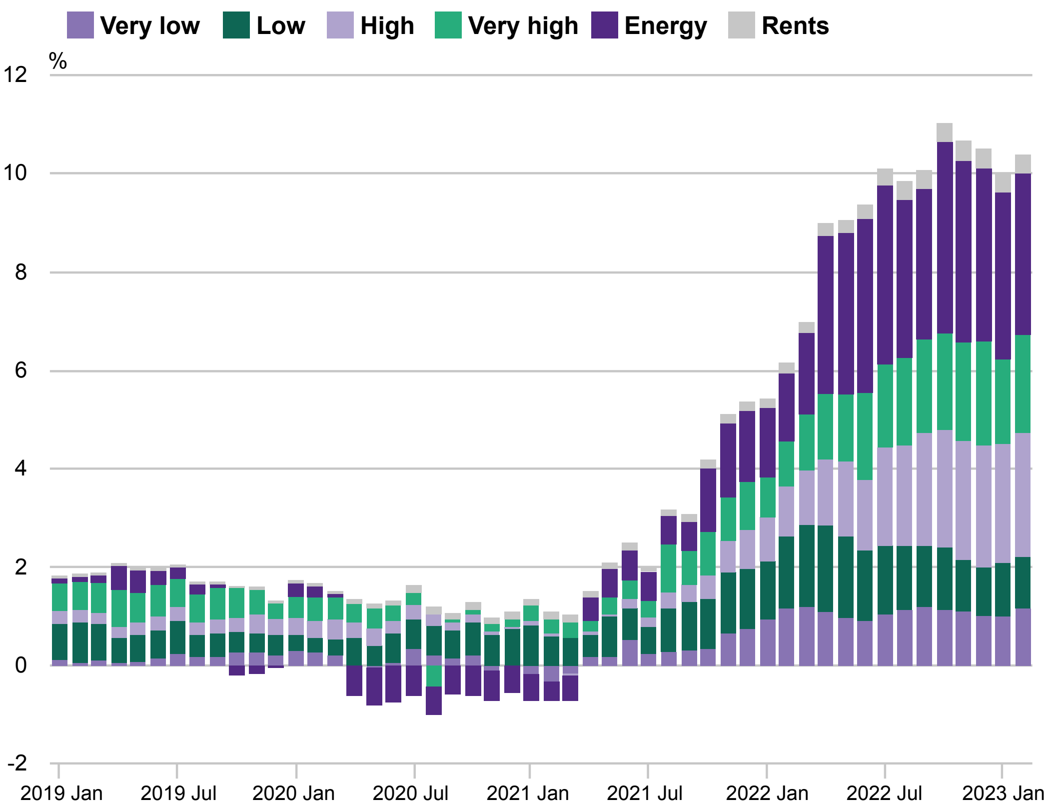
18. Amaglobeli et al., (2023). Policy Responses to High Energy and Food Prices. **19.** ONS (2022b). Global inflation: 1970 to 2022.
20. Barrett, P. (2022). How Food and Energy are Driving the Global Inflation Surge.

Variations in energy's direct contribution to recent inflation are a function of multiple factors, including degrees of dependence on Russian gas, weights of energy in consumer price baskets, and the introduction of energy price caps.[21] Countries that experienced comparatively low headline inflation rates globally tended to be those that had the highest levels of price regulation and/or energy independence. For instance, in Switzerland, where inflation peaked at 3.5% in the summer of 2022, approximately 60% of domestic electricity production is from hydropower and 29% from nuclear power, and 30% of goods and services are subject to price regulations.[22]

1.2. Indirect effects of fossil fuels on inflation

Energy's contribution to inflation is not limited to the direct energy components of CPI. High energy prices can result in broad-based inflation across sectors given that the economy's productive systems rely on energy as a key input. For example, when inflation peaked at 11.1% in the UK, goods and services that have a very high energy intensity (e.g. air and road transport) accounted for 18% of that, and high energy intensity goods and services accounted for a further 22%. Combined with the 35% of inflation accounted for by direct energy components of CPI, this amounts to three quarters of inflation being explained by the direct effects of energy prices and where the indirect effects are largest.[23]

Figure 2: *Contributions to CPI by energy intensity, percentage points, UK, January 2019 to February 2023*

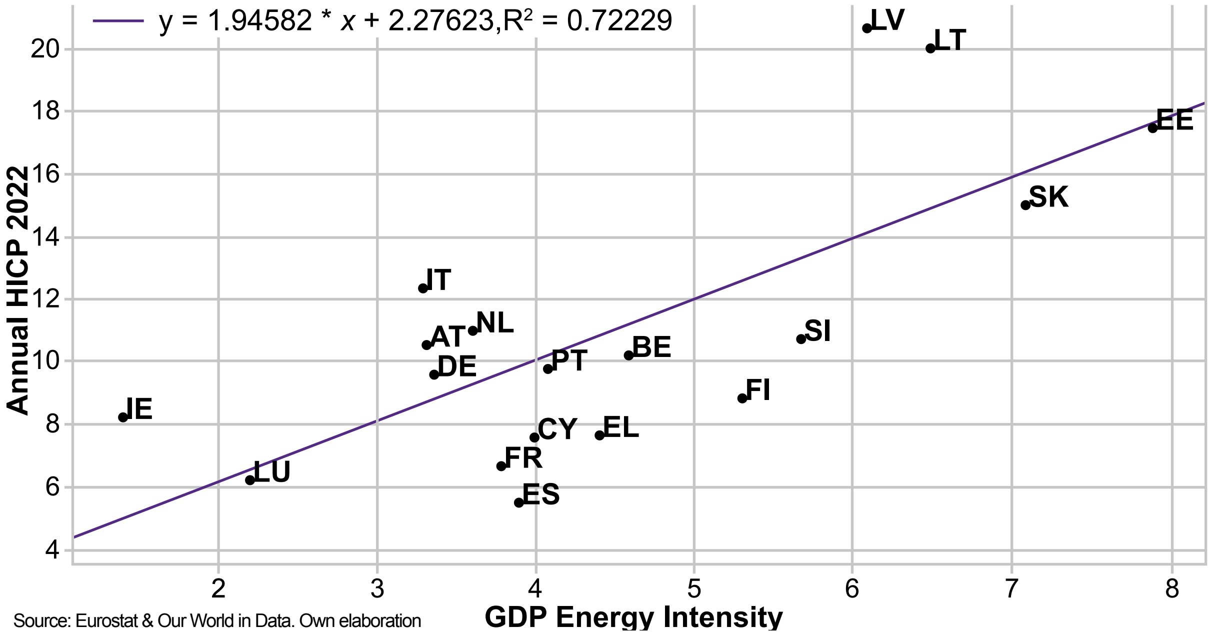


Source: ONS, 2023.

21. ONS (2022b). Global inflation: 1970 to 2022. **22.** Petersen and Schwab. (2022). The Strong Swiss Franc and 5 Other Reasons for Switzerland's Low Inflation. **23.** ONS. (2023). The energy intensity of the Consumer Prices Index 2022.

As shown in Figure 3, the strong correlation between countries' energy intensity and inflation in the Eurozone similarly displays the primacy of energy in driving inflation. Estonia, for example, has the highest GDP energy intensity in the Eurozone and suffered from an inflation rate close to 18% in 2022. Luxembourg, on the other hand, has a GDP energy intensity almost 4 times lower than Estonia's, and its inflation was about 3 times lower, around 6%. According to Neri et al. (2023), the energy shock contributed to approximately 60% of the euro area's peak inflation, through both its direct impact on energy prices and its indirect impact on other goods.[24]

Figure 3: *Energy intensity and inflation in the Eurozone*



Source: Authors' elaboration, based on Eurostat & Our World in Data.

Looking at the US economy, where the direct contribution of energy was relatively small, Weber et al. (2022) find that 'petroleum and coal products' is the sector in which prices are by far the most 'systemically significant'.[25] This means that these prices are volatile, have major effects on other sectors across the economy, and overall have had the largest impact on inflation both in normal times and in the recent inflationary period. Between 2020 Q4 and 2021 Q4, this sector alone contributed close to 1.5 percentage points to headline inflation. 'Oil and gas extraction' also consistently features high on the list of systemically significant prices, having contributed between 0.7 and 0.8 percentage points in the same time period.

24. Neri et al., (2023). Energy price shocks and inflation in the euro area. **25.** Weber et al., (2022). Inflation in Times of Overlapping Emergencies: Systemically Significant Prices from an Input-output Perspective.

1.3. The new geo-economics of fossilflation

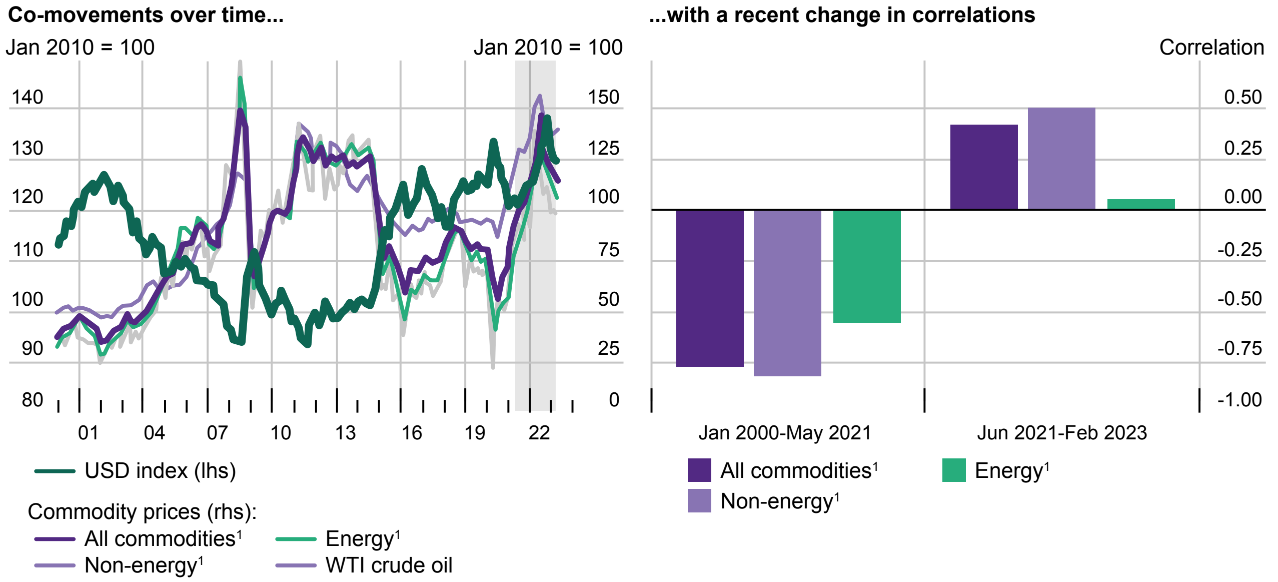
The U.S. recently shifted from being a net-energy-importing economy to a net-energy-exporting one, which has major global implications due to the U.S. dollar's centrality in global trade. Over the past two years, net-energy-importing countries have faced the consequences of both rising commodity prices and an appreciating dollar.

An appreciating dollar alone creates great turmoil in the global economy. Most countries invoice their trade, especially commodities, in dollars,[26] which means that as the dollar appreciates, the price of imports increases, leading to higher prices. An appreciation of the dollar is also associated with tighter dollar credit conditions, the so-called "financial channel": as economic agents around the world are indebted in dollars, an appreciating dollar increases the value of the debt in domestic-currency terms and lowers cross-border lending.[27]

In recent decades, there was a negative correlation between energy prices and the dollar strength: when energy prices increased, the dollar depreciated,[28] since, as a net importer, the US economy was negatively impacted by higher energy (especially oil) prices. A weaker dollar counterbalanced, to some extent, the negative impact of higher energy prices on energy net-importer countries. However, this correlation turned positive in mid 2021 as the US became a net-energy-exporter (see Figure 4). This reversal in the correlation between energy prices and dollar strength has meant that net-energy-importing countries have been hit additionally hard.

26. Gopinath et al., (2020). Dominant Currency Paradigm. **27.** Bruno and Shin., (2019). Dollar exchange rate as a credit supply factor-evidence from firm-level exports. **28.** Hofmann et al., (2023). The changing nexus between commodity prices and the dollar: causes and implications.

Figure 4: *Commodity prices and the dollar*



Source: Hofmann et al. (2023) based on data from Bloomberg and Datastream

This situation has clear winners and losers. On the one hand, fossil fuel multinationals receive high windfall profits from rising oil prices, as was the case in 2022 when oil and gas industry profits reached 4 trillion USD.[29] This does not have a positive effect on workers in oil-exporting countries, as Igan et al. (2022) have shown.[30] Higher oil prices enormously increase profits in net-exporting countries but have no significant impact on wages. On the other hand, higher oil prices reduce wages and consumption in net-importer countries and reduce global GDP. This, then, marks a structural shift in which the dollar system is even more hostile for most workers in low income countries.

29. Adomaitis, N. (2023). Oil and gas industry earned $4 trillion last year, says IEA chief. **30.** Igan et al., (2022). Commodity market disruptions, growth and inflation.

2. Climateflation: Climate change as a driver of inflation

While research on climateflation is relatively nascent, there is an emerging consensus that extreme weather events and rising temperatures cause negative supply-shocks that place upward pressure on inflation, primarily through their impact on food prices. However, the ultimate effect on inflation depends on several variables, including the type and severity of the shock. Looking ahead, climateflation is likely to become an increasingly common and severe phenomenon, given that intense extreme weather events and relatively higher temperatures have a disproportionately high impact on inflation.

2.1. Impacts on food prices

There is a growing evidence base that the impacts of climate change increase food prices, which should come as no surprise given that agriculture is negatively impacted by extreme weather events[31,32] and high temperatures.[33] Single-country studies have found that extreme weather events and shocks have resulted in higher food prices in China,[34] Thailand,[35] Peru,[36] Germany,[37] and the UK.[38]

Cross-country studies also show that temperature shocks[39] and precipitation shocks[40] have already put upward pressure on food prices. Furthermore, Kotz et al. (2023) find that the 2022 hot summer cumulatively increased food inflation by 0.67 percentage points, and it projects that by 2035, higher temperatures will contribute 0.92-3.23 percentage points to food inflation annually[41] A one degree temperature increase during an El Nino cycle has historically resulted in a more than 6% increase in global food prices.[42] An incoming strong el Niño event would raise global commodity prices by 9%.[43]

31. Ali et al., (2020). Human-environment natural disasters interconnection in China: A review. **32.** Mangani et al,. (2018). Modelled impacts of extreme heat and drought on maize yield in South Africa. **33.** Wheeler et al., (2000). Temperature variability and the yield of annual crops. **34.** Bao et al., (2023). The impacts of tropical storms on food prices: Evidence from China. **35.** Jirophat et al., (2022). The Macroeconomic Effects of Climate Shocks in Thailand. **36.** Crofils et al., (2023). The Dynamic Effects of Weather Shocks on Agricultural Production. **37.** Bremus et al., (2020). Price stability and climate risks: sensible measures for the European Central Bank. **38.** Lloyd, T. (2023). Climate, Fossil Fuels, and UK Food Prices. **39.** Mukherjee and Outtara. (2021). Climate and monetary policy: do temperature shocks lead to inflationary pressures? **40.** Kabundi et al., (2022). How persistent are climate-related price shocks? Implications for monetary policy. **41.** Kotz et al., (2023). The impact of global warming on inflation: averages, seasonality and extremes. **42.** Schnabel, I. (2023). The risks of stubborn inflation. **43.** Adolfsen, J. F., & Lappe, M. S. (2023). Risks from global food commodity prices from El Niño.

2.2. Impacts on headline inflation

While there is a unanimous diagnosis that extreme weather events and rising temperatures lead to decreasing yields and rising prices (i.e. negative supply shocks) in the agricultural sector, the final impact on headline inflation is more heterogeneous. Different dynamics can explain this heterogeneity. For example, worsening expectations or reductions in wealth and income levels, leading to a fall in overall demand, can outweigh the initial negative supply-side shock, resulting in a fall in prices. Importantly, this would double down on the negative impact on output, reinforcing the recessionary impact of the initial negative supply shock. Contrarily, reconstruction efforts following a natural disaster, can lead to increased output following such an event, but would increase the short-term inflationary impacts.

The literature on the effect of temperature and precipitation shocks on prices already shows some of these dynamics playing out. For example, Natoli (2023) finds that, for the US, temperature shocks reduced prices and output.[44] Similarly, Bremus et al. (2020) find that extreme rains and droughts in Germany had an overall negative impact on consumer prices despite their positive impact on agricultural prices.[45] On the other hand, cross-country studies find that higher temperatures lead to higher headline inflation.[46,47] Kotz et al. (2023) find that rising temperatures will, by 2035, lead to yearly global price increases of 0.92-3.23 in food prices, and 0.32-1.18 in headline inflation.[48] Hence, studies using a cross-country sample find that rising temperatures lead to increased headline inflation. This same study found that 2022's hot summer caused a cumulative increase in headline of 0.67 percentage points in Europe, with larger impacts across Southern Europe.

Similarly, discrete extreme weather events' ultimate effect on headline inflation is mixed, likely due to differing economic impacts depending on the type and severity of natural disasters, the development level of the affected country, and their heterogeneous impact across sectors.[49,50] Furthermore, the same extreme weather event can have opposite impacts on prices in different periods of time.[51]

Overall, climateflation increases the variability of prices,[52] the direction of which depends on whether the initial negative supply shock, which leads to higher prices, is outweighed by following negative demand shocks, which can lead to falling prices and a recessionary environment. These deflationary dynamics are not desirable either as they result in a rising real value of debt, which can increase the incidence of defaults.[53] This turbulence generated by climateflation hampers central banks' management of the macroeconomy.[54]

44. Natoli, F. (2023). The macroeconomic effects of temperature surprise shocks. **45.** Bremus et al., (2020). Price stability and climate risks: sensible measures for the European Central Bank. **46.** Mukherjee and Outtara. (2021). Climate and monetary policy: do temperature shocks lead to inflationary pressures? **47.** Kotz et al., (2023). The impact of global warming on inflation: averages, seasonality and extremes **48.** Ibid. **49.** Beirne et al., (2021). The Effects of Natural Disasters on Price Stability in the Euro Area. **50.** Kabundi et al. (2022) find that droughts have had a particularly strong upward impact on headline inflation, while storms and floods decreased headline inflation. Heinen et al. (2019) find that hurricanes and floods resulted in higher prices among a sample of Caribbean islands. Parker (2018) finds that natural disasters tend to have a positive impact on food prices and a negative one on house prices, with the inflationary impact being larger for larger disasters. When analysing by type of disasters, Parker (2018) finds that storms have the most significant positive impact on food prices. **51.** See 49 and Kabundi et al., (2022). How persistent are climate-related price shocks? Implications for monetary policy. **52.** Ciccarelli et al., (2023). The asymmetric effects of weather shocks on euro area inflation. **53.** Fisher, I. (1933). The Debt-Deflation Theory of Great Depressions. **54.** Cœuré, B. (2018). Monetary policy and climate change.

2.3. The non-linear and global nature of climateflation

A point of consensus in the literature is that the impact of extreme weather events on prices rises disproportionately with the severity of the events.[55] For example, Faccia et al. (2021) find no significant impact of hot summers on inflation in their baseline estimation, yet, when studying the impact of most severe hot summers, these have a significant impact on prices.[56] Similarly, Parker (2018) finds most natural disasters to be non-significant for advanced economies, yet, once again, this changes as the severity of the disaster increases.[57] This suggests that as temperatures rise and extreme weather events become more frequent and intense, the impact of climateflation is likely to grow disproportionately. Therefore, studies of past events can only offer limited insight into the climateflation that lies ahead.

Furthermore, the studies reviewed above allow us to understand the inflationary impact of climate trends and extreme weather events and shocks at the domestic level, but they elude an investigation of inflation as a global phenomenon. As our economies are increasingly interconnected, global factors have become essential to understanding inflation dynamics.[58,59] A 10% increase in global food prices, for example, is estimated to increase inflation in advanced economies by approximately 0.5 percentage points a year later.[60] This indicates that extreme weather events happening elsewhere in the world can impact a domestic economy's inflation due to close trade interrelationships. Peersman (2021) shows that swings in international food prices explain on average 25%-30% of consumer price volatility in the euro area,[61] and De Winne and Peersman (2021) find that harvest and weather disruptions increase global agricultural commodity prices, reducing real GDP and increasing domestic prices.[62] As our understanding of these international effects deepens, so will our understanding of the severity of climateflation.

55. See 47, Faccia et al., (2021). Feeling the heat: extreme temperatures and price stability., and Parker, M. (2018). The Impact of Disasters on Inflation. **56.** Faccia et al., (2021). Feeling the heat: extreme temperatures and price stability. **57.** Parker, M. (2018). The Impact of Disasters on Inflation. **58.** Auer et al., (2017). The globalisation of inflation: the growing importance of global value chains. **59.** Forbes, K. J. (2019). Inflation Dynamics: Dead, Dormant, or Determined Abroad? **60.** Furceri et al., (2016). Global food prices and domestic inflation: Some cross-country evidence. **61.** Peersman, G. (2018). International Food Commodity Prices and Missing (Dis) Inflation in the Euro Area. **62.** De Winne and Peersman. (2021). The adverse consequences of global harvest and weather disruptions on economic activity.

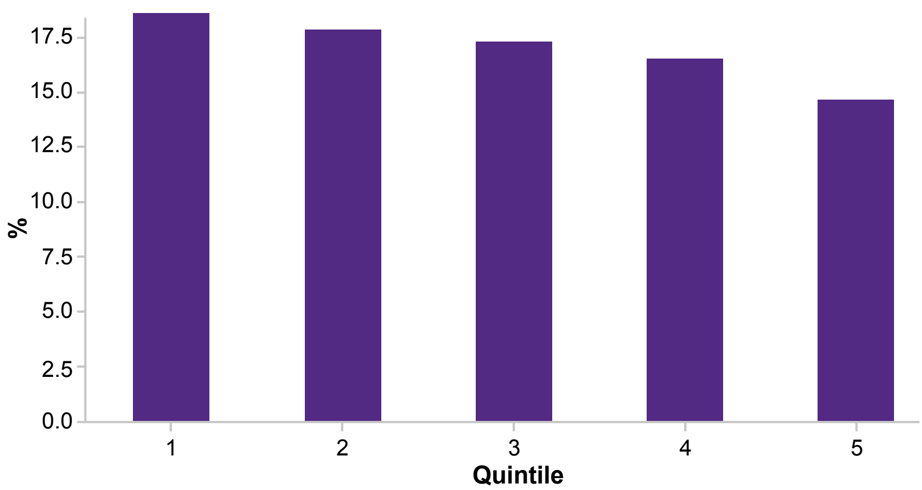
3. The uneven burden of climateflation

Climateflation can have pernicious effects on inequality through multiple mechanisms. First, it risks exacerbating intra-country inequality as low income households spend a bigger proportion of their income on food.[63] Second, inter-country inequality will worsen as the effects of climate change are most concentrated in countries in the Global South, many of which are agriculture-dependent and face the greatest fiscal repercussions from rising food and energy prices. Third, interest rate hikes in response to inflation will further affect both intra and inter country inequality by harming workers and increasing governments' borrowing costs, particularly in the Global South.

3.1. Intra-country inequality

Low income households spend a higher proportion of their income on energy and food than high income households.[64] For example, for the euro area, the poorer quintile's expenditure on food and energy, in proportion to their total expenditure, is higher than that of the richer quintile (Figure 5). This means that fossilflation and climateflation, which are characterised by high energy and food prices, disproportionately affect low income households, who face higher inflation rates than average and have less income and savings to absorb those higher prices. Therefore, as climateflation intensifies, it will become an increasingly prominent driver of inequality within countries. Fossilflation further exacerbates inequality related to food prices given that fossil fuels are a key input into agricultural activity.

Figure 5: *European Union share of food in consumption expenditure by income quintiles (2020)*



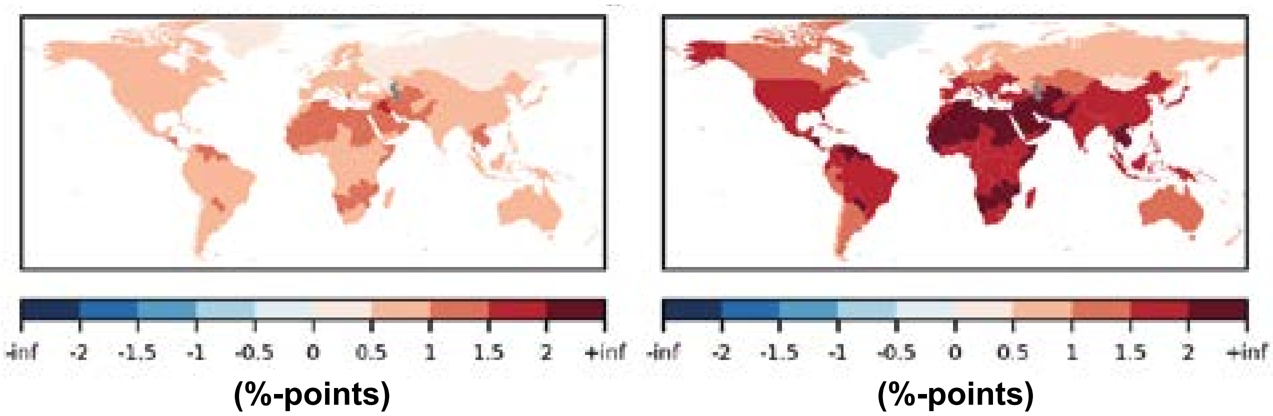
Source: Eurostat. Own elaboration.

63. In high-income economies, energy also constitutes a higher share of low income households' consumption baskets, meaning that fossilflation is also borne disproportionately by low income households. Due to lack of data, it's unclear if this is the case in lower income countries. **64.** Charalampakis et al., (2022). The impact of the recent rise in inflation on low-income households.

3.2. Inter-country inequality

The inflationary impacts of extreme weather events and rising temperatures are particularly pronounced for low income countries.[65,66,67] The ECB's projections show that South America and Africa will be the worst affected by rising prices triggered by future warming.[68] Figure 6 displays these uneven regional effects for both headline inflation (graphic a) and food inflation (graphic b) under a high emission scenario. Rising temperatures also have a far more persistent inflationary effect in low income countries, lasting up to six years, compared to one year in higher income countries.[69]

Figure 6: *Annual impact on headline inflation (left) and food inflation (right) by 2035 under a high emissions scenario*

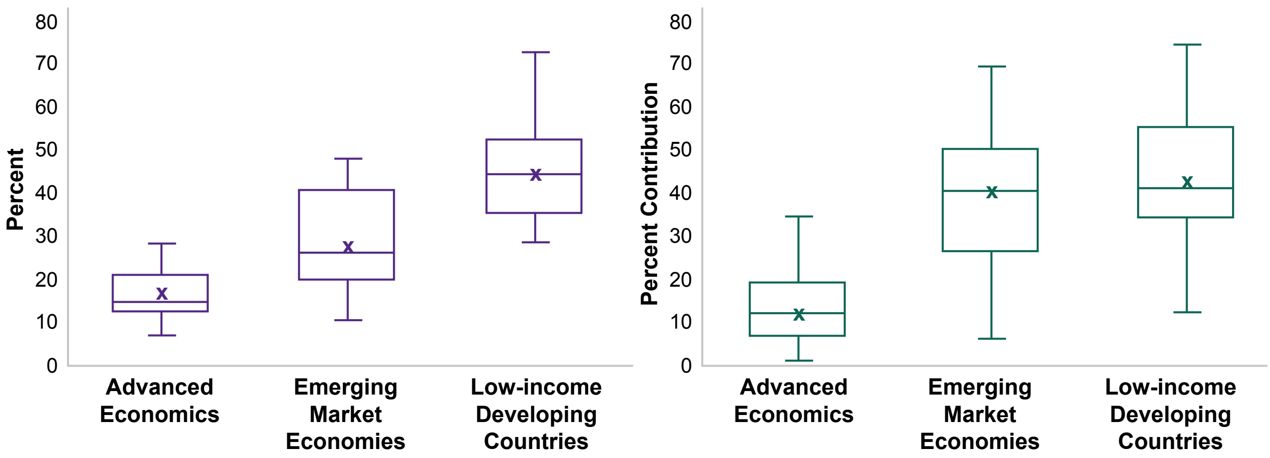


Source: Kotz et al., 2023.

The reasons behind climate change impacting food inflation, and consequently headline inflation, to a greater degree in low income countries are manifold. For example, agriculture accounts for a larger share of GDP in low income countries, the food shares in their consumption baskets are substantially larger (see Figure 7), and they tend to be more closed to trade, hence relying to a greater degree on domestic production. Therefore, domestic shocks that negatively impact the output from the agricultural sector have starker inflationary effects. Even among low income countries, weather shocks have stronger inflationary effects among countries that are more agriculture-dependent.[70] These regional differences highlight yet another feature of global climate injustice, as climateflation has and will continue to disproportionately impact low income countries, despite the fact that they bear far less responsibility for climate change.

65. Faccia et al., (2021). Feeling the heat: extreme temperatures and price stability. **66.** Parker, M. (2018). The Impact of Disasters on Inflation. **67.** Kotz et al., (2023). The impact of global warming on inflation: averages, seasonality and extremes. **68.** Ibid. **69.** Mukherjee and Outtara. (2021). Climate and monetary policy: do temperature shocks lead to inflationary pressures? **70.** Faccia et al., (2021). Feeling the heat: extreme temperatures and price stability.

Figure 7: *Percentage shares of food in CPI consumption basket (left) and percentage contribution to food inflation in 2022 (right)*



Source: Amaglobeli (2022) based on IMF Consumer Price Inflation database.

Furthermore, low income countries' attempts to address the impacts of climate change and transition away from fossil fuels face greater macroeconomic barriers,[71] which are exacerbated by climateflation, as fiscal expenditures tend to rise when food prices increase. For example, during the increase in food prices in 2008, Guayana, Grenada, and Guatemala increased their fiscal spending by 3, 2, and 0.5 percentage points of GDP respectively on food (e.g., subsidies and tax cuts).[72] Therefore, extreme weather events, especially in low income countries, end up increasing inflation (especially in food prices), which raises fiscal expenditures at the same time that government bonds get penalised in international bond markets due to climate vulnerability.[73]

71. Chancel et al., (2023). Climate Inequality Report 2023. **72.** IMF. (2008). Grappling with the Global Financial Crisis. **73.** Kling et al., (2018). Climate Vulnerability and the Cost of Debt.

3.3. Monetary policy's impact on inequality

Finally, the most prominent policy lever used to respond to inflation – interest rate hikes – further exacerbates both intra and inter country inequality. Faced with an extreme weather event whose impact is persistent enough on inflation, central banks operating inflation-targeting and price level targeting regimes will raise rates in response.[74] Such an approach will increase intra-country inequality, as interest rates tame inflation by reducing economic activity, which is particularly damaging for lower income households, who are more likely to enter unemployment and/or face income reduction.[75] The impact of interest rates on inequality is asymmetric, meaning that the negative impact on inequality during the tightening phase is not undone during the monetary easing phase.[76]

Rate increases in response to inflationary pressures on a global scale also exacerbates inter-country inequality, as they disproportionately increase Global South governments' borrowing costs, thereby reducing fiscal space where public investment is most needed. Even if rate hikes originally take place in Global North economies, Global South central banks are often forced to follow suit and increase their own rates to an even greater extent in order to avoid excessive capital outflows and currency depreciation,[77,78] particularly if the Federal Reserve is engaging in rate hikes. As a result, the countries that are least responsible for climate change yet most affected by its consequences (including climateflation), and therefore most in need of green investment, are often those that are the most fiscally impacted by the policy response to inflation, no matter its economic or geographical source.[79] Following the most recent cycle of interest rate hikes, the World Bank (2023) highlighted record debt servicing costs resulting in 60 percent of low income countries being at high risk of, or already in, debt distress.[80]

74. McKibbin et al., (2020). Climate change and monetary policy: Issues for policy design and modelling. **75.** Pereira da Silva et al., (2022). Inequality hysteresis and the effectiveness of macroeconomic stabilisation policies. **76.** Furceri et al., (2018). The effects of monetary policy shocks on inequality. **77.** Ramos, R. A. (2019). A Minskyan account of emerging currencies dynamics. **78.** Kaltenbrunner, A. (2015). A post Keynesian framework of exchange rate determination: A Minskyan approach. **79.** A UNDP report shows that 25 countries are paying more than 20% of government revenue in debt service, which is the highest number since 2000 (Ecker et al., 2023). Paying such great amounts of total government revenue to creditors poses extremely binding limits on what can be spent on socially and ecologically necessary investments. **80.** World Bank. (2023). International Debt Report 2023.

4. Policy implications

This section outlines far-reaching policy implications of our analysis of fossilflation and climateflation. Central banks and other macroeconomic authorities must update their toolkits and strengthen their institutional and policy coordination to navigate supply constraints and shocks driven by climate change, environmental degradation, and volatile energy prices. New forms of macroeconomic coordination at both domestic and international levels will be necessary to secure price stability and scale-up investment in mitigation and adaptation.

4.1. Greening monetary policy

Fossil fuel energy prices exhibit high volatility, subjecting our economies to sudden severe shocks, of which the recent inflationary context was just one of multiple examples. Fossil fuel volatility will keep subjecting our economies to such sudden shifts as long as our productive system relies on them to function. Additionally, this reliance accelerates climate change, which will exacerbate climateflation. To ensure price stability, decarbonisation of our economies is an imperative step. Scaling-up renewable energy sources will entail lower and more stable electricity prices,[81,82,83] and decarbonising our economies is an unavoidable step to reduce the pace of climate change.

Therefore, while the justification for central banks to incorporate environmental considerations into their analyses and operations has typically focused on financial stability and support for government policy priorities, the phenomena of fossilflation and climateflation show the growing relevance of environmental pressures for price stability mandates. This further strengthens the case for central banks to incorporate environmental considerations into their inflation forecasting and macroeconomic models,[84] as well as their monetary policy tools, such as collateral frameworks,[85] asset purchase programmes,[86] and targeted lending schemes.[87]

81. Americo et al., (2023). The energy transition and its macroeconomic effects. **82.** Krahé, M. and Heilmann, F. (2023). Fossil Fuel to the Fire: Energy and Inflation in Europe. **83.** Melodia, L. and Karlsson, K. (2022). Energy Price Stability: The peril of fossil fuels and the promise of renewables. **84.** Boneva, L. and Ferrucci, G. (2022). Inflation and climate change: the role of climate variables in inflation forecasting and macro modelling. **85.** Dafermos et al., (2022b). Greening Collateral Frameworks. **86.** Dafermos et al., (2022a). An environmental mandate, now what? Alternatives for greening the Bank of England's corporate bond purchase scheme. **87.** Senni et al., (2023). The CO2 content of the TLTRO III scheme and its greening.

4.2. Macroeconomic policy coordination

The conventional approach to monetary policy and macroeconomic stabilisation will have to be increasingly re-considered in a world of climate change, environmental degradation, and energy-driven supply shocks, as interest rates are ill-suited to providing stability in such a context. Rising energy and food prices inevitably lead to broader-based inflation, as they filter through to other sectors, yet the source of the problem remains on the supply side. Lowering aggregate demand through interest-sensitive sectors, which are not necessarily the ones being affected by the shocks, is not an effective or just response to a rise in imported prices that already causes strains in households budgets. Furthermore, the transmission of interest rates to the rest of the economy is slow,[88] implying that by the time they have had the desired impact on demand, the exogenous shock may be long over.

Therefore, while central banks can and should expand their price stability toolkits to support green sectors, thereby taming fossilflation and climateflation, their inflation control strategies must be complemented by the tools of other economic authorities. In particular, fiscal policy has a major role to play, making use of tools like targeted price controls,[89,90] taxation, and strategic investment to manage inflation while transforming the productive structures of economies. Institutionalising such a new approach to inflation control should involve a deeper re-consideration of central bank mandates and tools. For example, there is a strong case that as fiscal authorities take on more responsibility for demand management, central banks' should return to playing a greater role in ensuring debt sustainability, facilitating fiscal authorities' capacity to scale-up green public investment.[91]

4.3. International monetary coordination

Not only do rate hikes exacerbate inequality and lack effectiveness in the face of climateflation and fossilflation, they can even be counterproductive as they disproportionately impact green projects, which are highly capital intensive. This is particularly true for low income countries, who have higher costs of capital (CoC) and, due to the hierarchical character of our international monetary system, have to increase their interest rates over and above the rate hikes in the Global North.[92,93,94] These rate hikes also result in higher borrowing costs for governments, which reduces the fiscal space available for green public investment.

88. Deb et al., (2023). Monetary Policy Transmission Heterogeneity: Cross-Country Evidence. **89.** Calvert Jump et al., (2023). Re-sponding to adverse supply shocks with monetary-fiscal policy interaction. **90.** Wildauer et al., (2023). Energy price shocks, conflict inflation, and income distribution in a three-sector model. **91.** Jackson et al., (2022). Beyond the Debt Controversy: Re-framing fiscal and monetary policy for a post-pandemic era. **92.** For example, IRENA (2023) documents that "for a representative solar photovoltaic (PV) project or onshore wind project, the total cost of electricity increases by 80% if the CoC is 10% rather than 2%" and shows that the CoC for solar PV projects in Egypt and Tunisia is 9.7% and 10.7%, respectively, compared to the German CoC of 2.2%. So, even if the former countries face much better climatic conditions for solar energy, their sector can end up being much less competitive due to their cost of borrowing. **93.** Ramos, R. A. (2019). A Minskyan account of emerging currencies dynamics. **94.** Kaltenbrunner, A. (2015). A post Keynesian framework of exchange rate determination: A Minskyan approach.

Therefore, new forms of international monetary coordination are necessary to ensure that low income countries have the domestic policy space necessary to take forward the green transition. Implementing the green transition would alleviate the balance of payments constraint on energy-importing low income countries, which would improve their domestic policy space to finance the green transition through their own means.[95] There is an ecological and a moral imperative for high income countries — which bear the greater responsibility for climate change and are less impacted by its negative consequences — to do everything in their powers to achieve that end goal. Among other things, an increase in issuance and allocations of Special Drawing Rights,[96,97] higher lending by Multilateral Development Banks,[98] an increase in grants, concessional lending, and debt suspension have been proposed as measures to create a less hostile international monetary and financial system in which low income countries are able to bring forward the green transition.

95. Oberholzer, B. (2023). Green Growth and the Balance-of-payments Constraint. **96.** Persaud, A. (2022). Bridgetown Initiative calls for new Global Climate Mitigation Trust financed via Special Drawing Rights. **97.** Pforr et al,. (2022). After the Allocation: What Role for the Special Drawing Rights System? **98.** Zucker-Marques, M., and Gallagher, K. P. (2023). Sustainable future bonds: Boosting multilateral development banks lending and improving the global reserve system.

Conclusion

Intensifying climate change and environmental degradation will become an increasingly significant source of price volatility. Central banks will have to pay increasing attention to these dynamics and adapt their forecasting methods, policy tools and operating frameworks accordingly. In the face of fossilflation and climateflation, interest rate hikes are ineffectual and counterproductive. Greater macroeconomic policy coordination and new international monetary arrangements will be necessary to stabilise prices while facilitating new socially and ecologically responsible investments on a global scale. Furthermore, the growing threat that climate change and environmental degradation pose to price stability strengthens justifications for greening monetary policy in support of a transition.

The scaling-up of renewable energy will ultimately have a stabilising effect on prices, yet the transition to a sustainable economy could have its own adverse implications for price stability, which require further investigation and will need to be anticipated and managed by policymakers. While challenging, the latter will be more feasible than attempting to maintain price stability in the context of recurring, persistent, and escalating supply and demand shocks that will result from intensifying climate change and ecological degradation if governments fail to meet globally agreed upon environmental targets.

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