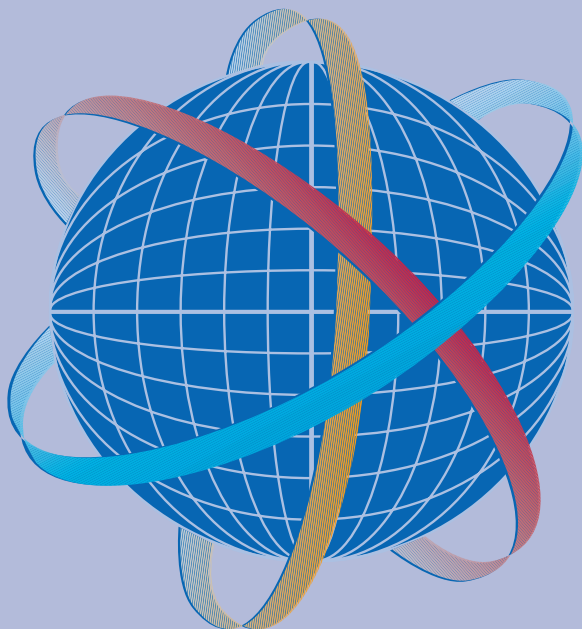


49<sup>th</sup> OeNB Economics Conference  
and 35<sup>th</sup> SUERF Colloquium 2022

THE RETURN OF INFLATION



# Contents

About SUERF – The European Money and Finance Forum	7
Three inflation cycles, a persistent challenge for central banks <i>Manoj Pradhan</i>	8
On the psychology of inflation and its implications <i>Pascal Blanqué</i>	14
ECB can gain credibility by explaining its monetary policy strategy to the public <i>Michael Ehrmann, Dimitris Georgarakos, Geoff Kenny</i>	20
Subjective inflation expectations of households and firms <i>Michael Weber</i>	26
Opening remarks at the OeNB monetary policy panel <i>Andrew Bailey</i>	34
Remarks given at the OeNB monetary policy panel <i>Joachim Nagel</i>	36
Climate change, climate protection and inflation <i>Elga Bartsch</i>	40
Climate change and inflation in the euro area <i>Christiane Nickel</i>	44
The fight against climate change and economic performance <i>Luiz de Mello</i>	52
Inflation and globalization <i>Harold James</i>	60
What can stockouts tell us about inflation? Evidence from online micro data <i>Alberto Cavallo, Oleksiy Kryvtsov</i>	76
What micro price data teach us about the inflation process: web-scraping in PRISMA <i>Chiara Osbat</i>	82
What micro price data teach us about the inflation process: analyzing scanner data in PRISMA <i>Fabio Rumler</i>	88
What can we learn from 60 years of PCE inflation data? <i>Raphael Schoenle, Dominic Smith</i>	94

# 49<sup>th</sup> ECONOMICS CONFERENCE 2022



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# About SUERF – The European Money and Finance Forum

SUERF stands for “Société Universitaire Européenne de Recherches Financières”, the original name under which SUERF was established in 1963 in France. It is an independent and non-partisan member association, whose strength lies in bringing together three pillars of members: central banks and supervisors, financial industry representatives and academic researchers. For more than 50 years, SUERF has been dedicated to the analysis, discussion and understanding of European financial markets and institutions, the conduct of financial regulation, financial supervision and monetary policy. SUERF’s main activities are events, publications and the support of young researchers, and is governed by its Council of Management, which includes senior representatives from central banking, the financial industry and academia. The Oesterreichische Nationalbank has hosted the SUERF Secretariat at its premises in Vienna since April 1, 2000.



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Manoj Pradhan

Chief Economist  
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# Three inflation cycles, a persistent challenge for central banks

The pandemic has catapulted the global economy into a world of labor shortages after the world had gotten used to basking under the glow of the greatest ever positive labor shock that lasted more than three decades. Such a global, supply-driven approach to understanding inflation has been particularly useful precisely because we have seen inflation in economies that have seen dramatic monetary and fiscal easing (the US, in particular, among the advanced economies) and in economies that had very little of either or even both (emerging economies). In our March 2020 VoxEU column and the postscript of our book “The Great Demographic Reversal,” Charles Goodhart and I argued that this sudden reversal could generate inflation of the order of “5%, even 10%.”

Now that we have neared those heights, both markets and central banks are remarkably comfortable with a return of inflation to within touching distance of the inflation targets.

This confidence is very likely to be misplaced.

There are three inflation cycles playing out beneath the surge in inflation that the world has been going through.

First, the obvious mismatch between demand that has more than normalized, and supply that has not been able to keep up thanks to successive waves of the pandemic. The war in Ukraine has since created an outright supply shock. The result has been a surge in food, energy and housing costs, exactly the kind of goods that affect the poor disproportionately. The political consequences are universal.

Second, the end of a demographic sweet spot has been pushing the global

economy out of the disinflation over the last three decades or so, into a more inflationary regime. That turn in itself should be enough to destabilize the properties of cyclical inflation that we have all gotten used to.

How does demography (a real variable) create inflation (a nominal phenomenon)? Two transmission channels, one specifically related to the political economy of indebtedness, and the other an intergenerational friction between the young and the old, will do the trick.

An inflation revival of this nature would have been five, perhaps ten, years into the future. The pandemic, however, has changed that timeline dramatically. The structural transition to an aging society has coincided with a deep, episodic supply shock that will fast-track inflation. It already has.

Third, the love-child of structural and pandemic-driven forces, the Phillips curve has been resurrected. The Phillips curve has been so universally acknowledged to have flattened that very few, if anyone, have given it another look. There is every reason to believe that it had flattened and been put into a coma by China. The waning of China’s influence and the shock of the pandemic have revived the Phillips curve.

## 1 The demographic sweet spot is turning sour

### 1.1 The rise of China and the global demographic sweet spot

The single most important economic development over the years from 1990 to 2018 was the rise of China and its integration into the global trading economy. The integration of China into the global manufacturing complex by itself

more than doubled the available labor supply for the production of tradeable products among the advanced economies. The rise of China, as well as the return of Eastern Europe to the world trading system, provided an enormous positive supply shock to the available labor force in the world's trading system.

The global supply of labor was further boosted by two other demographic features, both domestic in origin in the advanced economies. The first of these demographic features is the continuing decrease in the dependency ratio during these years, i.e. a rise in the number of workers, defined as those aged 15 to 64, relative to dependents. And the second is the rise in the proportion of women in the working age group taking paid jobs.

The combination of all of these factors meant that the effective labor supply force for the world's advanced economy trading system more than doubled over these 27 years, i.e. from 1991 to 2018.

These deflationary forces have been so aggressive that they have caused inflation to remain at, or more recently below, central bank targets, mostly set at about 2% over the decades from 1990 onward. Even massively expansionary monetary policies and fiscal policies which have resulted in the largest and most persistent rise in public-sector debt ratios ever during periods of general peacetime had little success in reflating the global economy.

But the future will not be like the past. Indeed, in many crucial respects there will be a major reversal of past trends.

### **1.2 The sweet spot is turning sour**

Over the next three or four decades, the steady decline in birth rates, starting in the 1950s in many advanced economies, notably in Europe, to below the

rate at which the population is self-sustaining, will bring about a sharp reduction in the growth of the labor force in many countries. There will be an absolute decline in the labor force in several countries – in the key economies of Japan, China and most of North Asia as well as in several countries in continental Europe, such as Germany, Italy, Spain and Poland. Meanwhile, rising life-expectancy, combined with improvements in morbidity and mortality rates, will lead to a rapid increase in the number of retirees over 65.

## **2 From demography to inflation: channels of transmission**

The arguments around demography and its historic impact are unlikely to be controversial, but how these real variables will create a sustained nominal effect remains a point to debate.

There are two channels through which this transformation will take place. First, through the political economy of debt, and second, through inter-generational friction caused by the consumption and production mismatches between the working population and older persons.

### **2.1 The political economy of financing aging-related debt**

If the demographic profile of our aging societies is a worry, then the political economy of caring for the growing ranks of older people in our populations is going to be outright frightening.

The pandemic has already shown us that caring for older persons is not a process that can be ignored by society and the body politic. Even though the pandemic disproportionately affected older persons, the interactive sectors in our economies were closed down until vaccines became available, and rightly so.

That same ethical prerogative will propel our governments to ensure care



for an aging population. The Congressional Budget Office of the US estimates (CBO, July 2022) that U.S. debt held by the public will nearly double as a share of the economy by 2052, rising from the current level of 98% to 185% of GDP. Estimates in other aging economies, especially in the advanced economies that have been able to borrow without impediment in the past, face similar trajectories.

#### *How is this debt to be financed?*

Higher growth would do the trick, but Economics 101 tells us that raising growth when the labor force is shrinking means that productivity growth has risen faster than the slowdown in labor supply. Now, productivity growth is likely to rise structurally, but the advanced economies would do very well to match the output per worker that Japan showed over the last couple of decades. Even that, unfortunately, will not be enough to raise overall growth substantially.

Raising the retirement age would do the trick, but that is a political minefield. Every administration that has tried to substantially raise the retirement age has faced angry, often violent, protests. What is more, people are already working till much later in their lives. Participation rates for the over 65s have been rising for the last two decades, but the level of participation among the over-65s has varied proportionally to the generosity of the national pension system in each case. In the clearest example of this relationship, participation rates in the critical pre-retirement cohort (55-64 year-olds) rose strongly from 2004 onward as an instant response to the pension reforms of 2003 that transferred the burden from the state to the public. Put differently, raising the participation rate substantially will need an equally sub-

stantial cut in pension benefits, which would bring us right back to the political minefield.

Well, taxes then? If retirement is a political minefield, then raising taxes is political suicide. Carbon taxes, a levy that every economist on the planet would probably agree with, unleashed a fierce political storm in France.

That leaves us with what Milton Friedman called “taxation without legislation,” inflation.

## **2.2 Intergenerational friction: a Stolper-Samuelson type transmission channel**

Intergenerational friction generates inflation because the consumption/production profiles of workers and dependents differ markedly.

Dependents consume but do not produce. Unlike the young, the older persons do not have an opportunity to finance their consumption by going (back) into the labor force. In other words, dependents create net excess demand for goods and services, and are inflationary. Had the older generation saved enough in the past to finance their increased life-expectancy, we would be in the clear. But they have not, and neither have our institutions.

Workers consume and produce, and are disinflationary for two reasons. First, the overwhelming majority of workers are paid a wage that is less than their marginal product (there would not be any point in employing them otherwise). From the wage they receive, workers need to save for the future. That leaves an excess of production over the paid wage, and an excess of the paid wage over consumption on the table. The result is a net excess supply.

For the last three decades, workers have outstripped dependents, which means excess supply (created by workers) has outstripped excess demand (of



dependents) – the result has been disinflation. Over the next few decades, the opposite will happen. The growth in the number of dependents will outstrip the increase in workers, with the key thrust coming from older persons who will not re-enter the workforce. The net excess demand created by older persons will increasingly outstrip the supply impulse from a shrinking workforce – the result will be inflation!

*Won't central banks simply control inflation? Don't they have full control over the long-term rate of inflation?*

There are two dimensions to this critical question.

First, central banks may have less control over inflation than many believe. If enough of our narrative around demography and inflation is correct, then central banks have had less to do with the disinflation of the last few decades than is popularly believed. It also means that the demographic reversal of the next few decades will prevent central banks from having adequate control over inflation in the future.

Second, even if central banks have complete control over inflation in the long run, they may acquiesce to allowing inflation to remain high over the medium term. Why? The political economy of financing debt will create clear incentives for the central bank

to tolerate higher inflation over the medium term. Fighting inflation would most likely result in a shortfall in both growth and (to a lesser degree) employment, and also worsen the fiscal position. Even if the central bank stuck with the long-term 2% target, it might be under steady (financial stability) pressure to allow inflation somewhat above target in order to support growth and to stabilize the real burden of debt at the same time. Particularly while growth remains weak and debt/GDP accelerates in our aging societies, the central bank will find restraining inflation a significant threat to financial stability.

### 3 The revival of the Phillips curve

Structural inflection points tend to generate surprises even at the cyclical horizon. Combined with some “help” from the pandemic, one such surprise is likely to be the revival of the Phillips curve.

The relationship between unemployment (or growth) and price inflation has undoubtedly weakened over the last couple of decades. Strong growth and low unemployment have not generated inflation. The response of inflation to unemployment has become weaker since the mid-1990s until it became so weak by the mid-2000s that the relationship can be said to have little, if any, forecasting power. In other words, the Phillips curve can be empirically shown to have flattened (Engemann, 2020).

However, the Phillips curve is almost always estimated as a “reduced form” model, i.e. there is no search in the data about where the inflation comes from.

A *structural* inquiry into the Phillips curve that examines the genesis of inflation might generate more interesting results.

The period over which the Phillips curve estimate shows a significant flattening broadly coincides with the integration of China's labor supply into the global workforce. It therefore stands to reason that the disinflation that followed this massive positive labor supply shock is what is reflected in the data. If China has helped push US inflation (and inflation in most other economies) relentlessly lower over the last three decades, then it must also mean that China's disinflationary footprint will have desensitized US inflation to local growth conditions.

In section 1, we argued that China's disinflationary global impulse is now more or less behind us. Its ability to sustainably keep global inflation low, and less sensitive to domestic conditions in the advanced economies, has dimmed. That argument by itself is enough to tell us that inflation in the advanced economies is far freer to respond to strong domestic growth in a way that it could not over the recent couple of decades.

The pandemic, however, has made matters even more extreme.

China is now one of the two big reasons that supply cannot keep up with demand, the other being the war in

Ukraine. Not only are China's domestic supply chains under stress because of the national zero-COVID policy, but firms are rethinking the geography of global supply chains. Over the last year and change, India has been a huge recipient of foreign direct investment, and China's firms themselves have opened up manufacturing units in Vietnam and Mexico.

Put differently, China has gone from being a structural drag on global inflation to being one of two prime drivers behind the inflation surge. That is a change the global economy is simply not equipped to handle. What is more, given that both legs of China's impact on inflation are on the supply side. That means central banks are not really equipped to handle that change either.

*In summary*, the end of the demographic sweet spot spells an end to the anchor that did not let inflation rise much over the business cycle. As structural, cyclically and COVID-related forces push inflation higher, a very difficult future lies ahead. It is impossible to have a high degree of confidence about what that future will look like. One thing is sure, the future will be nothing like the past.

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# On the psychology of inflation and its implications

*In the first months of 2022 we have witnessed a profound change in the global macrofinancial regime. Inflation is the order of the day, but its seeds were sown long ago. Over and above the monetary dynamics, analysts, commentators and investors should look to understand the psychological dimension that underpins an inflationary spiral and contributes to the self-fulfilling phenomenon. In addition, policymakers have to adjust their reaction patterns to the new framework. The era of the “Great Coincidence” in the policy mix and ultra-cheap money is coming to an end at a time of looming stagflation. New dynamics are emerging among monetary and fiscal authorities, as they simultaneously attempt to grapple with inflation and meet critical public expenditure requirements arising in connection with the COVID pandemic, the conflict in Ukraine and the green transition. All of these elements contribute to the greater narrative of an ongoing regime shift, with profound consequences for investors.*

## The monetary side of the inflation equation

In the first half of the year, inflation data exceeded the expectations of many analysts and commentators. Annual consumer price inflation figures reached their highest levels in decades, both in developed (DM) and emerging markets (EM), with some variation across regions. Within this context, public attention has shifted to understanding the mechanisms that underpin inflation. In particular, *inflation has two main dimensions: It is as much a monetary phenomenon as it is a psychological one.* In this paper I will address each of these components, and explore how they are interconnected.

Looking at the monetary side first, the velocity of money – the rate at which money supply is transacted for goods and services in an economy over a given time – has been declining since the 1990s. This downtrend was exacerbated by the COVID-19 pandemic and is a result of lower activity levels as well as monetary and budgetary support. At the same time, increased asset prices show that velocity in the financial sphere has trended higher. Hence, *consolidating the real and financial spheres into a unique notion of velocity, an inflationary*

*process has effectively taken place.* In fact, excess liquidity in the real sphere typically occurs at the bottom of the activity cycle, and monetary accommodation helps transfer this surplus into the financial sphere. Therefore, a holistic notion of velocity should consider both real and financial transactions per unit of money.

In general, higher velocity in one sphere comes at the expense of a slowdown in the other, although periods of simultaneous expansion or contraction can also occur. The strong link between the two realms is also the reason why a financial crisis often leads to an economic recession. Household savings feed financial markets, while divestments and investment payments related to financial assets (i.e. dividends, coupons) transfer money back into the real economy, where it can either be spent or channeled into markets again. For some time, deceleration in money velocity masked inflation in the real sphere. However, an inflationary process was actually taking place in the financial world and is now moving back into the real economy, as a consequence of the ongoing regime shift. On top of this, *inflation may become a self-fulfilling phenomenon due to its psychological dimension.*

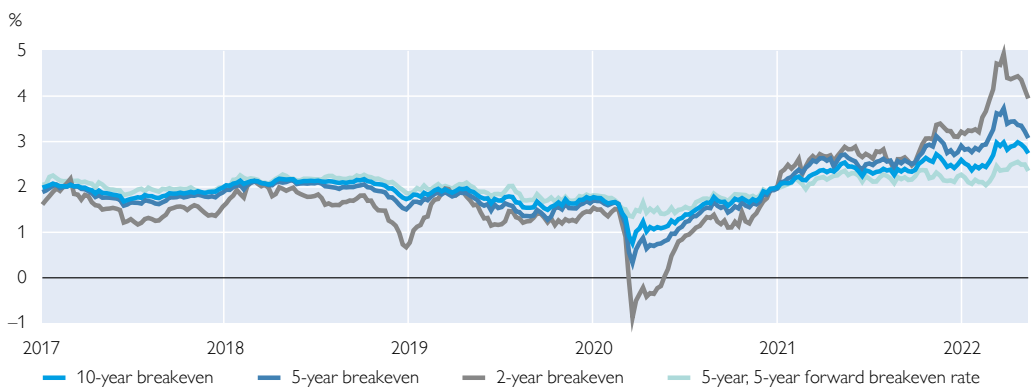
## Inflation's powerful hereditary traits

*An expansion in the monetary base alone cannot trigger an inflationary spiral: A shift in the psychological framework, or psychological referential, must simultaneously occur. This referential is based on the link between long- and short-term memory, and forgetfulness. Inflation is a discovery process of memory awakening and adaptive expectations; people anticipate the future in much the same way that they remember and forget. A sudden shift in data (increasingly higher inflation rates each month) builds up the public's short-term memory that brings the long-term reference back to the forefront. This is what happened over the past year or so. Perceived inflation is a memorized variable with powerful hereditary traits. By raising public awareness of existing inflation by regularly publishing rate hikes, the existence of the threat is recognized and the inflationary process is thereby accelerated. In this sense, inflation is a self-propelling phenomenon. Moreover, psychology and inflation are intrinsically interrelated: Time appears to fly during periods of inflation, in both the real and financial spheres. For example, one hour in normal circumstances may seem like one day under hyperinflation.*

As inflation persists and experience of the past decade (memories of disinflation/deflation) gradually fades, market attention will revert to the long-term reference (the 1970s or stagflation). Short-term inflation rates currently overshoot the long-term average by the widest margin since the 1980s. In the past, this has been accompanied by higher inflation expectations. Another intrinsic element of the regime shift is that the process is self-sustaining – there is inflation when people believe there is inflation. In fact, *public memory plays a fundamental role. History does not repeat itself but, rather, the psychology of people remains relatively constant.* Only few people today have a vivid recollection of the great inflation in the 1970s, and they have not faced a sustained period of rising prices. *The past decade of secular stagnation has fostered a widespread belief that post-COVID inflation would be short-lived, whereas this is not the case.* Major (historical) core narratives are blurred by a coefficient of forgetfulness: The longer the event dates back, the greater the coefficient. Through sudden non-linear jumps, a short term event can reinvigorate dormant memory patterns which trigger inflation in the real sphere. This is most probably where we are today.

Chart 1

### US market inflation expectations are awakening



Source: Amundi Institute on Bloomberg data, as of May 11, 2022.

*Narratives also play an important role in spreading inflation. Mathematically, narratives behave like a virus, turning inflation into a mass phenomenon with feedback loops and self-fulfilling prophecies.* Evidence of this can be seen in inflation in areas not hit by bottlenecks, but where inflation is caused simply by broadcasting talks, narratives and stories on TV. The dissemination of inflation narratives in the media has created anxiety and fear. *Social worries have risen rapidly, as the poorest are often hit the hardest, and pre-existing social divides have been unveiled.* Moreover, the power of the media today is clearly greater than ever, and this too is an important dimension. Interestingly, there is a discrepancy between (academic and non-academic) expert opinion and the public's perception about inflation. Whereas experts agree that a Fed rate hike is deflationary, the public believes that a central bank rate hike is an infla-

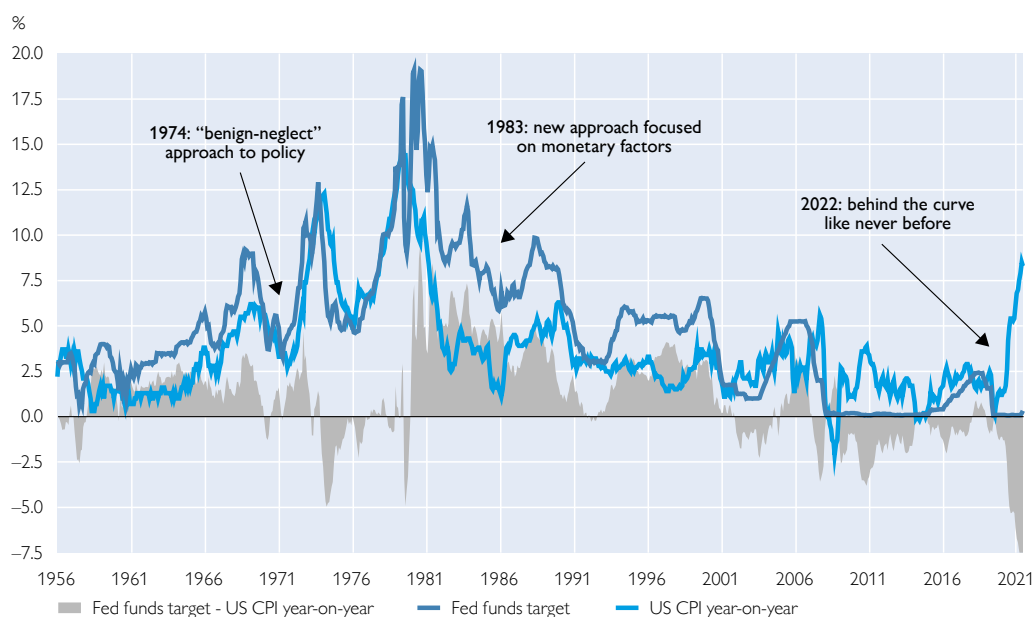
tionary move<sup>1</sup> which has implications on personal expenditures (higher cost for mortgages, loans etc.) and consequently results in higher wages in a negative feedback loop for higher prices. This is a critical consideration in terms of central bank (CB) action and self-fulfilling expectations.

### The Fed behind the curve

In the current inflationary environment there is a high pressure on policymakers to provide protection and mitigate the effects by e.g. imposing price caps and providing subsidies or fiscal transfer payments. *Inflation often leads to more fiscal accommodation rather than less, which in turn contributes to the dynamics of inflation itself through both real and psychological channels.* Lately, CBs have been criticized for having fallen behind the curve on inflation. Now, they are caught in the crossfire between killing

Chart 2

### The Fed and the historical precedents of 1974 and 1983



Source: Amundi Institute on Bloomberg data, as of April 27, 2022.

<sup>1</sup> Andre, P., C. Pizzinelli, C. Roth and J. Wohlfart. 2022. *Subjective models of the Macroeconomy: Evidence from Experts and Representative Samples.* *The Review of Economic Studies*, pp. 1–34.

inflation at the risk of triggering a recession, or letting it run to stimulate nominal growth with a hefty price to be paid later on.

*By any reasonable measure, the Fed has fallen behind the curve on inflation.* A Taylor-type monetary policy rule points to a gap of approximate 300 basis points. Likewise, a forward guidance approach corroborates that the Fed is behind (although relatively less than the Taylor rule suggests), since markets have already moved ahead of the bank's effective action. Two historical precedents – where core personal consumption expenditures (PCE) was as high as today – come to mind. In 1974, the Fed downplayed the monetary factors that contribute to price increases and kept the policy rate low, causing higher inflation, economic volatility and multiple recessions. In 1983, it had learned its lesson and raised rates despite falling inflation, stabilizing the economy until the 1990–1991 recession.

Although the jury is still out, today we are closer to a 1974-style scenario; the initial “behind the curve” gap is similar, and the Fed is less hawkish than it says. *The longer the Fed delays taking severe action, the higher the terminal policy rate will have to be. Nevertheless, it is unlikely that a full policy normalization will occur because of the recessionary risk that it entails.* The consequences of a conservative policy stance will be higher, persistent and self-perpetuating inflation. The ex post rate will remain relatively low for some time, but nominal rates will trend upward, with no way to stabilize volatility in the real economy. The epilogue will nevertheless be a recession which, while it can be delayed, cannot be avoided altogether.

As we move toward a new economic and financial regime, governments will assume control of money while main-

taining double-digit monetary growth for several years, thus facilitating the transition from free market, independent CB rule-based policies toward a command-oriented economy. *Additionally, extensive fiscal accommodation is required to finance the post-COVID recovery as well as the energy transition in the fight against climate change;* the need for independence in the field of energy supply was further accentuated by the conflict in Ukraine. Fiscal expansion must necessarily come from a continuation of the financial repression environment, with CBs staying behind the curve to allow further debt expansion at sustainable costs. This could build the conditions for the simultaneous financing and expansion of the real and financial spheres, leading to temporary increases in the prices of assets, goods and services.

### **The end of the “Great Coincidence” in the policy mix**

Overall, we are reaching the end of the great monetary consensus. The independent CB model (“one tool, one objective”) is no longer applicable in an increasingly fragmented world; hyperbolically, there are as many policy reaction functions as there are countries facing inflation. While the public debate has focused on the monetary side, *we should look at the overall policy mix in order to understand the novel role of monetary policy.* The current popular consensus is that certain critical needs must be covered from public funds. However, the widespread belief that fiscal spending is effectively unlimited (i.e. the fiscal “free lunch”) is going to be severely tested in the new macrofinancial regime. Moving forward I see three possible scenarios for the policy mix:

1. *Continued fiscal expansion and monetary normalization. This is difficult, insofar as monetary normalization is a*



*fiscal space “killer”, making large debt burdens unsustainable. Moreover, policymakers should consider a safety net for maneuvering further in case of a recession. The main risk factor here is timing: Monetary authorities could turn off the taps too quickly; and fiscal authorities could intervene too late. In the markets, this option implies further repricing (downward) of risky assets, particularly of interest-rate sensitive stocks.*

2. *Central banks remain behind the curve for some time in order to accommodate a renewed fiscal impulse. This is the best way to balance the growth/inflation trade-off and to engineer a controlled economic slowdown. Here, investors should look to combat inflation by focusing on dividend equity and real assets.*
3. *Fiscal expansion and complete CB accommodation, uprooting all inflation expectations, to levels most people today have never been confronted with before. Think of this as a 1970s style regime, with high inflation, nominal growth, market-led corrections in nominal rates, adjustments in all risk premia and valuations at equilibrium. Investors will have few places to hide except in cash and real assets.*

While public opinion is mostly focused on the first option, I believe the second or third are more likely. *Fiscal spending must target new sets of critical public goods (the energy transition, social and strategic autonomy) and central banks will have to accommodate these priorities. This is particularly true in Europe, where the monetary authorities have to fill the void left by the lack of credible budgetary rules. The worst-case scenario is full-blown stagflation. If nothing is done on the fiscal side, then mechanically there will be a tightening in the policy mix, reversing the trend of the past few years.*

## **A new regime: implications for investors**

*In the current and uncertain environment, a global repricing of risk is underway. It started with bonds, particularly on the short end of the yield curve, but has since paused; this should remain paused or even retreat as the central bank delivers less than required, feared or priced into the market. The final leg of this repricing process will occur with additional pressure at the long end, via a steepening of the curve, signaling an inflection point for risky assets and a preference for bonds. Large insurers and pension funds will play an important stabilizing role in this respect. Another consequence of the inflationary regime is a change in correlation dynamics; higher inflation is turning the correlation of equity and bonds positive, challenging basic portfolio composition tenets.*

In general, the performance of equities and bonds will deteriorate or even reverse, provoking widespread underperformance. The repricing point in equities should see a tilt toward value and quality (away from tech and more “glamorous” but less solid business models), while the lagging repricing of credit should catch up and could finally close the gap. Further repricing in equities and credit would provide a more comfortable signal that it is time to increase risk: That is, in order to consider adding more risk, we would want to see the 10-year portion of the curve plateau. *Overall, investors should aim to preserve the purchasing power of their portfolios, building upon the “real concept”, and searching for additional sources of diversification in real and alternative assets. The aim of the game is to think hard about what risk premia and valuations could look like at equilibrium in the new regime: The ones we have seen in the past 35 years or so are no longer available in the current environment.*

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# ECB can gain credibility by explaining its monetary policy strategy to the public<sup>1</sup>

*With the rapid increase in euro area inflation, it is ever more important that the European Central Bank (ECB) maintains its credibility, also among the wider public. Although it is hard to reach out to this group, our recent research (Ehrmann, Georgarakos and Kenny, 2022) shows that explaining and communicating key elements of the ECB's new monetary policy strategy can enhance the perceived credibility that price stability will be maintained. In particular, randomized information treatments in the new Consumer Expectations Survey reveal that effective communication about the symmetric inflation target can raise credibility among survey respondents, especially if the stabilizing role of monetary policy is also explained. However, the communication of a decision to take better account of climate considerations and a promise to better capture housing costs in inflation measures yield neither marginal credibility gains nor losses.*

JEL codes: E52, E58, E31

Keywords: Consumer Expectations Survey, central bank communication, credibility, inflation expectations, randomized control trial

## Introduction

Central banks have traditionally focused their communication on expert audiences, and in particular on financial markets. Communication with non-experts, in contrast, has long been considered to be less relevant. Only recently has this changed: Following the global financial crisis and the extensive deployment of unconventional monetary policy tools, central banks and their policies became the subject of an often-controversial debate that saw the involvement of larger parts of the general public (Blinder et al., 2017). Against this background, many central banks have strengthened their efforts to communicate with the general public. As described in Assenmacher et al. (2021), the European Central Bank (ECB) has also recently evaluated its communication policies in the context of its strategy review. As part of the outcome of this strategic review, the ECB has decided to improve communication with the wider public, including the regular conduct of outreach events to help ensure “public understanding of and trust in the actions of the ECB” (ECB, 2021a).

Arguably, communicating with the general public has become even more important for the ECB given the current inflationary environment. Inflation in the euro area has increased sharply over the course of 2022 and it is now well above the ECB's target of 2%. Some people are even warning that we might see a repeat of the persistent inflation experience of the 1970s. To avoid such a scenario, inflation expectations need to remain well anchored. Indeed, several factors suggest that inflation expectations are more firmly anchored today than in the 1970s – not only in the euro area, but in advanced economies more generally. For example, central banks nowadays have a much better track record as inflation fighters, and they have made substantial efforts to communicate their inflation targets and strategies.

Experts, of course, are well aware of these efforts. But what about the wider public? The general public has less background knowledge in economics and often is not informed about the central bank's target or its monetary policy strategy. Would efforts to communicate more effectively with the general

<sup>1</sup> The views expressed herein are the authors' personal opinions and do not necessarily reflect the views of the ECB or the Eurosystem.

public help anchor inflation expectations and ensure that central banks maintain high levels of credibility in their commitment to maintain price stability? In a recent study (Ehrmann, Georganakos and Kenny, 2022), we highlight the challenge posed to central banks in reaching non-experts. Yet we also identify the significant potential credibility gains that might be achieved if central banks are able to channel critical information about their monetary policy to consumers.

### Challenges and potential gains for central banks in reaching non-experts

On July 9, 2022, the ECB announced a change in its inflation target and its monetary policy strategy following an extensive internal review (see ECB, 2021a). However, in our recent study, we find that the outcome of the strategy review seems to have gone largely unnoticed by consumers. Using the ECB's Consumer Expectations Survey (CES), we asked consumers in September 2021 whether they had heard about the ECB in the course of the summer.<sup>2</sup> The majority of respondents made clear that they had not. Also, among those who did hear something about the ECB, most did not recall what they had heard. Only about 10% of consumers answered that they had heard about a new strategy.

That the ECB's communication largely went unnoticed following a major strategy review announcement is sobering and points to the need to reassess both the channels and nature of communication with the public. What if the ECB had been able to more effectively communicate the outcome of its new strategy to the public? What might be the potential benefits of a public that is more informed about monetary policy?

To get at the answers to these questions, again using the CES, respondents were given different "information treatments", an approach also used in medical trials. One random group, the "control group", did not receive any specific information "treatment" (similarly to the group that receives a placebo treatment in a clinical trial). Four other treatment groups received certain different pieces of information. Specifically, a first treatment group was informed that the ECB aims for a 2% inflation target that is symmetric, meaning that inflation may sometimes be slightly above it or below. The precise information provided was the following: "The ECB aims for a 2% inflation target over the medium term as the best way to maintain price stability. The target is symmetric: inflation may sometimes be slightly above it or below. The ECB looks through short-term deviations. Persistent negative and positive deviations are regarded as equally undesirable."

A second treatment group was given the above information, but was also provided with more information on the economic background, explaining how an inflation target helps in stabilizing the economy and contributing to economic growth and employment. In particular, this group was given the following additional explanation about the functioning of the inflation target: "A target of 2% has an important function: it creates space so that monetary policy can have its stabilising effect. In bad times, such as during the pandemic, monetary policy stimulates the economy through low interest rates and so has significant favourable effects on economic growth and employment. This may also imply a transitory period in which inflation is moderately above the target of 2%."

<sup>2</sup> ECB (2021b) and Georganakos and Kenny (2021) provide a detailed overview of the CES dataset.

Two more groups also received the basic information about the inflation target and were in addition told about two concepts in the new strategy that consumers might particularly relate to. One of these treatments referred to the role of climate change in the new strategy, pointing to its importance for the ECB’s mandate and the need for the ECB “to account explicitly for the implications of climate change and the carbon transition.” Lastly, a fourth treatment group was provided with information about the ECB’s plan to better capture housing costs in inflation measurement. This information treatment represents a promise by the ECB to “work towards” a better coverage of housing costs and thus left somewhat open the eventual outcome or its timing. These information treatments are described in more detail in Ehrmann, Georgarakos and Kenny (2022).

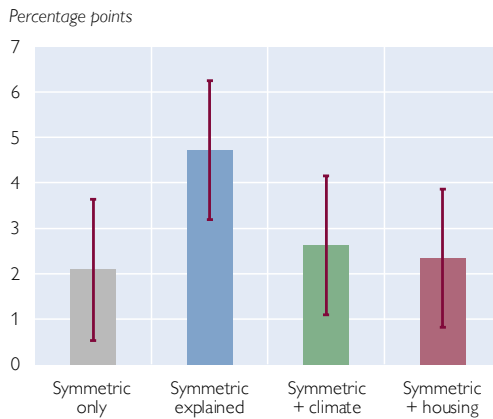
### Evidence of credibility gains among non-experts

To measure the effects of the above information treatment on credibility we asked all groups the following question: “How likely do you think it is that the ECB will maintain price stability in the euro area economy over the next 3 years?” The replies can then be compared across the control and treatment groups, thus providing a clear measure of how communicating the key outcomes of the strategy review impacts on the perceived ECB credibility or likelihood of price stability being maintained.

The outcome of our information experiment demonstrates that successful communication with the general public can enhance the ECB’s credibility. Chart 1 shows the immediate effect of the treatments in September 2021. All estimated effects represent changes compared to the control group that has not received any information. The chart

Chart 1

### Effects on the likelihood that the ECB delivers price stability relative to control group



Source: ECB Consumer Expectations Survey (CES) – September 2021.

Note: Regression estimates and 95% confidence intervals per treatment group.

shows that credibility is enhanced for all four treatment groups, and much more so for the second group that received the information about the symmetric inflation target plus the additional background explanation about the functioning of the target and the stabilizing role of monetary policy. For this group, the probability that the ECB will achieve price stability over the next three years increases considerably, by 4.5 percentage points. For the two other information treatments about the role of climate change and envisaged improvements related to the measurement of housing costs, the effects are almost identical to receiving only the information about the symmetric target on its own. Hence, the communication of these decisions did not appear to either enhance or diminish the credibility that price stability would be achieved over the coming three-year period.

Chart 2 shows the same results but splitting the CES sample into consumers with relatively high (above median) and relatively low (below median) levels of financial literacy. The financial literacy

indicator follows measures described in Lusardi and Mitchell (2014) based on the number of correct answers to a set of four standardized questions about financial concepts that respondents are asked in the background questionnaire when joining the CES panel. The results in chart 2 show that most of the credibility improvements are driven by consumers who are more financially literate, highlighting the additional challenge central banks face in reaching out to consumers with relatively lower levels of financial literacy. However, credibility among consumers with low levels of financial literacy is gained only if they receive the background explanation provided to the second treatment group. Providing people with some background explanation thus appears to be very important to generate positive effects on credibility.

Interestingly, we also repeated the above analysis in subsequent survey rounds, including in March 2022, a period when inflation had already started to accelerate significantly in the euro area. By then, the effect of the information treatment had effectively disappeared for most groups, highlighting

how central banks need to maintain persistent and open lines of communication with the public to ensure their messages are not lost. However, an exception is the second treatment group, which had benefited from getting a more complete explanation. This illustrates how important it is to give such broader explanations about monetary policy when communicating with the public.

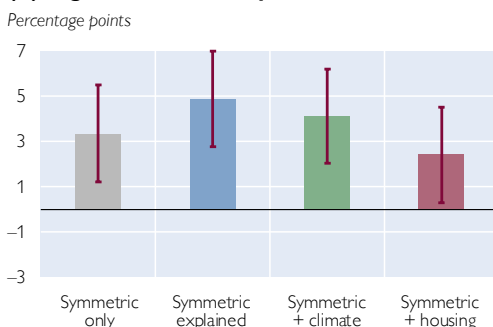
### Conclusions

Our results offer significant endorsement of the potential benefits to central banks from efforts to enhance their communications with non-experts. By working to raise awareness about the inflation target and its relevance in the current economic context, such efforts can yield a clear payoff by contributing to raising the public’s perception that price stability will be maintained in the future. Of course, for such a payoff to be achieved, the ECB will need to identify the most effective communication channels that can support this endeavor. In addition, it will face important – but not insurmountable – challenges particularly when it comes to its communication with less financially literate consumers.

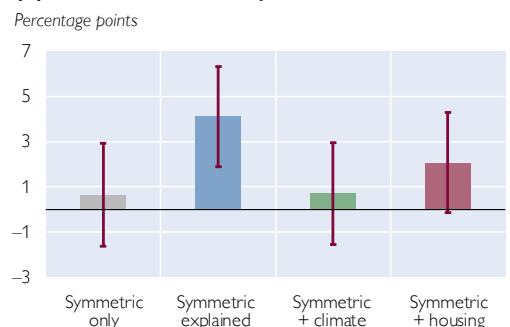
Chart 2

### Effects on the likelihood that the ECB delivers price stability relative to control group

#### (A) High financial literacy



#### (B) Low financial literacy



Source: ECB Consumer Expectations Survey (CES) – September 2021.

Note: Regression estimates and 95% confidence intervals per treatment group.

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# Subjective inflation expectations of households and firms

*Inflation expectations of households and firms are central determinants in all dynamic macro-models. Yet, empirical evidence suggests these decision-makers form expectations in a way that deviates from the assumptions in these models: On average, inflation expectations are biased upward, are substantially dispersed across individuals and co-move strongly with the prices of selected goods such as milk or gas. In this brief, I discuss several stylized facts on subjective inflation expectations, their determinants, and how inflation expectations shape individuals' consumption, savings and investment decisions. Finally, I review the recent literature on how central banks should communicate with the general public and highlight the role of the policy message, the messenger and the medium for the effectiveness of central bank communication.*

JEL codes: D1, D2, D8, D9, E2, E3, E4, E5, E7, J1

Keywords: macroeconomics, intertemporal choice, consumption, savings, surveys, monetary policy, fiscal policy, experiments, financial decision-making, cognition, communication

## Whose inflation expectations?

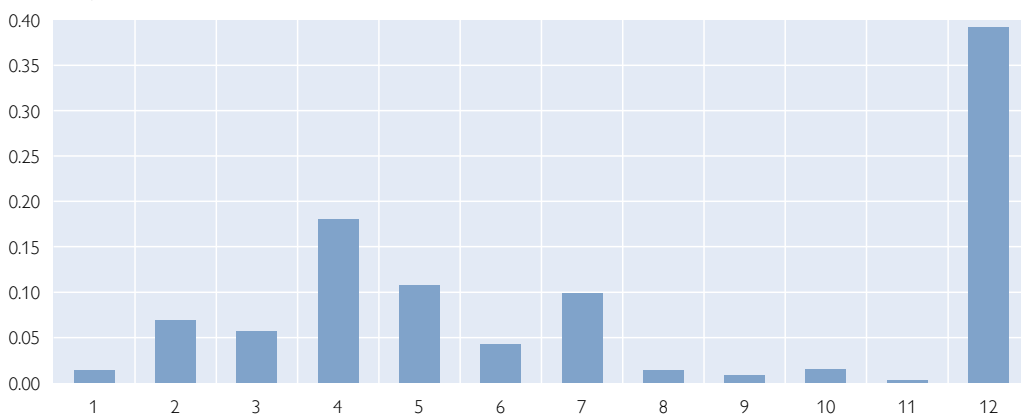
The expectations of households and firms determine virtually all forward-looking choices actual decision-makers do. Inflation expectations take a special role, because they shape households' consumption and savings decisions (D'Acunto et al., 2022a), households' wage bargaining and labor supply (D'Acunto et al., 2022b), but also the investment and leverage choices (Hackethal et al., 2022a,b). On the firm side, inflation expectations shape managers' investment, hiring and price-setting decisions (Weber et al., 2022). A leading

explanation for realized inflation dynamics, the New Keynesian Phillips curve, also prescribes an important role to inflation expectations. Hence, it is not surprising that policymakers watch them closely and Jerome Powell (2021) recently argued, "Inflation expectations are terribly important. We spend a lot of time watching them." Yet, for many decades after the rational expectations revolution, academic economists had lost interest in studying how actual decision-makers form expectations, because the model directly implied the expectations of the representative agent. Moreover,

Chart 1

## Perceived inflation target of Fed

Share of responses



Source: Author's compilation.

traditionally, central banks typically focus on the inflation expectations of professional forecasters and financial markets. However, it is households and firms in our models whose decision central banks aim to influence and, empirically, inflation expectations are dispersed, upward biased relative to ex post realized inflation, and systematically related to characteristics of households and firms (D’Acunto et al., 2021a,b, forthcoming). In this brief, I review the recent, growing body of work that documents stylized facts on the formation of subjective inflation expectations, their determinants, and how they shape real decisions. I will focus on households but argue at the end that most points apply equally to firms.

### **What do households know and how do they actually form expectations?**

A conventional policy narrative pertains that inflation expectations are well anchored so that changes in nominal policy rate transmit one-for-one to perceived real interest rates via the Fisher equation. Yet, when we asked in Coibion et al. (2022) 25,000 Americans in 2018 what they thought the average inflation rate was that the Federal Reserve tried to achieve over longer periods of time, only less than 20% of the survey participants answered a number around 2%, whereas almost 40% reported a number larger than 10% (see chart 1). Not only do most ordinary households not have well-anchored expectations, they typically also overestimate future inflation relative to ex post realizations. Using data from the New York Fed Survey of Consumer Expectations, in D’Acunto et al. (2021a) we find that men on average expected an inflation rate of around 4% over the next 12 months during a sample period between 2011 and 2018 when realized inflation averaged below

2%, whereas women on average expected a rate of more than 6%. To dig deeper into the possible driving forces of this “gender gap” in inflation expectations, we fielded our own survey on the Nielsen homescan panel, which allowed us to survey male and female household heads at the same time. This within-household analysis made it feasible to keep constant many things that typically vary across survey participants like housing tenure, savings and other determinants of inflation expectations. But even within households, we found that women on average expect higher inflation than men. Yet, when we split households based on the distribution of grocery duties across female and male household heads, we found that the gender gap was only present, and in fact 50% larger, in “traditional households” in which the male household head declared to never do any grocery shopping. In households in which the male household head instead stated to at least occasionally go grocery shopping, the gap disappeared because the male household heads also had higher inflation expectations. Hence, exposure to the volatile price changes during grocery shopping trips appear to manifest themselves in elevated inflation expectations of the grocery shoppers.

To better understand why this association appears in the data, we fielded another survey in D’Acunto et al. (2021b), in which we directly asked survey participants which sources of information were most important to households when forming inflation expectations. Consistent with the seminal Lucas (1972) island model, we found that households rank “own grocery shopping experiences” as by far the most relevant source of information, before “family and friends,” “TV and radio,” “newspapers,” or other sources (see chart 2). To directly establish a link between

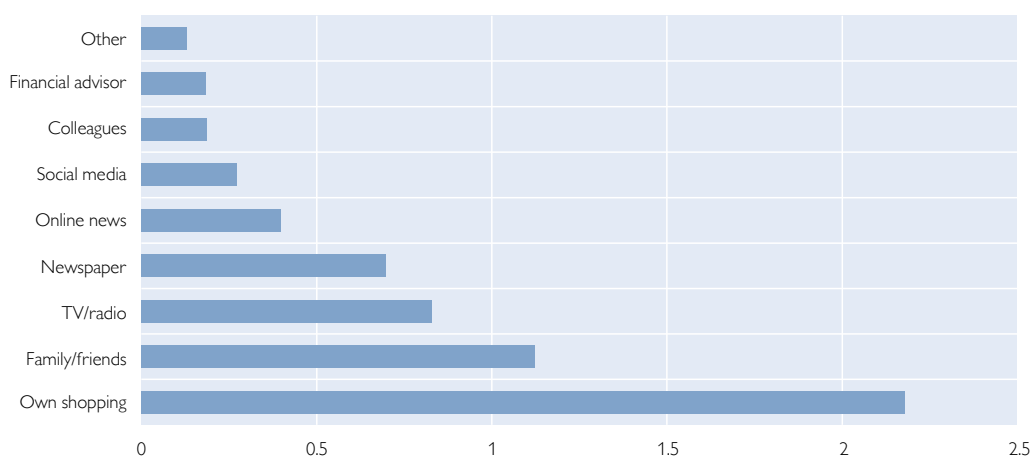
price changes observed while grocery shopping and inflation expectations, we levered the Nielsen homescan panel that allowed us to observe at the weekly frequency for 50,000 households the goods these households bought, where they bought them, which prices they paid, whether they purchased these goods on discounts or whether they used coupons. We then followed statistical agencies to create a chained Laspeyres price index but using household-specific consumption bundles and prices instead of the bundle of a representative household. Households with the highest realized inflation at the household level on average expected an inflation rate that was higher by 0.7% than households with the lowest realized inflation rate over the previous 12 months. We can directly rule out that households might be forecasting their own inflation rate because we can observe their future realized household-level inflation rate.

In the Nielsen panel, we only observe around 25% of the overall consumption bundle for the average household. The fact that we can find a strong association between realized inflation at the household level for this subset of the

bundle and overall inflation expectations suggests that grocery prices have a strong impact for how individuals think about inflation. At the same time, this finding also suggests that not all price changes are created equally for households. When we weight price changes by frequency of purchase rather than expenditure share, we find that this “frequency CPI” drives the association between realized inflation and inflation expectations. In addition to putting larger weight on the price changes of frequently purchased goods, households also overweight positive relative to equal-sized negative price changes. These results can also explain why households immediately updated their inflation expectations in the summer of 2021 when most central banks still sang the gospel of temporary inflationary pressures in narrow categories. If these initial price spikes occur in categories that are salient to consumers, like rental cars, we can witness immediate increases in overall inflation expectations, and workers in the US indeed immediately bargained for higher wages. These findings, however, also imply that even if central banks were successful in curbing realized inflation in the near term,

Chart 2

**Information sources for inflation**



Source: Author's compilation.

household inflation expectations would still take time to come down again because ordinary consumers pay less attention to price cuts compared to price hikes.

To better understand which role limited cognitive abilities might play for the focus on a handful of price changes to form expectations for overall inflation, in D’Acunto et al. (2019, 2022c, forthcoming), we use data from Finland. Specifically, we were able to merge at the individual level measures of IQ for all men in Finland from the Finnish Defense Forces, income, wealth and debt from annual registry data, as well as inflation and other expectations from the European Commission Consumer Survey for Finland. Empirically, we find that men in Finland at the bottom of the IQ distribution have mean absolute forecast errors for inflation of about 4.5%. Forecast errors monotonically decrease in measured IQ and are smaller by a factor of 2.5 for men in the

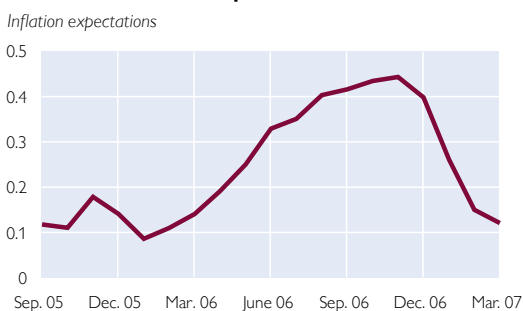
top of the IQ distribution. It is also only men above the median IQ that increase their consumption spending when expecting higher inflation consistent with the consumer Euler equation. In D’Acunto et al. (2022c), we show that men at the top of the IQ distribution are also more than twice as likely to take advantage of government subsidies like car scrappage schemes or to adjust their debt holdings to changes in interest rates. These results hold when we condition on education, income and other observables and suggest that cognitive abilities are a central driving force for inflation expectations and their association with real economic choices.

The important role of cognitive abilities suggests that policy complexity might play an important role for the effectiveness of economic policies, especially those that operate through household expectations. In D’Acunto et al. (2022a), we compare the effectiveness of uncon-

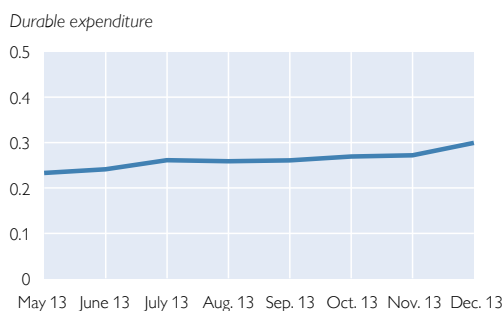
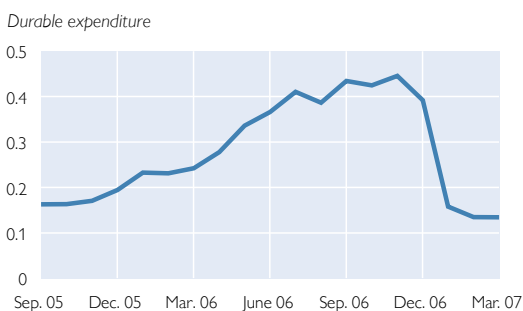
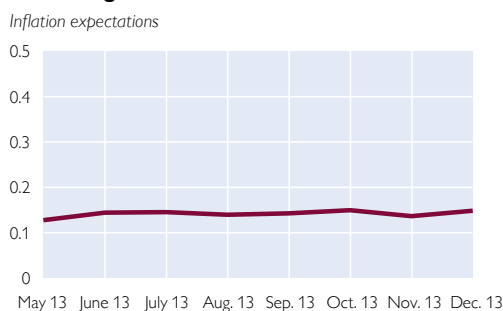
Chart 3

### Inflation expectations and spending

#### Unconventional fiscal policies



#### Forward guidance



Source: Author’s compilation.

ventional fiscal policies, preannounced increases of future consumption taxes that generate a predictable increase in future prices with forward guidance. Both policies, through the lens of the New Keynesian model, operate through inflation expectations and the consumer Euler equation. Yet, the policies differ quite substantially in their complexity and required understanding of economics to be effective. And indeed, when we compare their effectiveness using the microdata from the German version of the European Commission Consumer Survey, we find Germans only updated upward their inflation expectations and spending plans after the announcement of former Chancellor Angela Merkel in November of 2005 to increase consumption taxes by three percentage points in January 2007 (left-hand panels in chart 3). Instead, Germans on average did not update neither their inflation expectations nor their consumption plans when former ECB President Mario Draghi for the first time explicitly used forward guidance as a policy tool in the summer of 2013 and firmly reiterated to keep interest rates at current or lower levels for an extended period of time (right-hand panels in chart 3).

### How should central banks communicate with the general public?

Given these findings, we studied in a series of papers how central banks should communicate to reach ordinary households who ultimately make consumption, savings and debt decisions. In D'Acunto et al. (2022d), we perform an information provision experiment on a customized survey with several thousand participants in Finland. In this survey, we first elicited individuals' prior income change expectations and several sociodemographics. We then

split the sample in three groups, a control group that did not receive any additional information and two treatment groups. We provided these groups with truthful information of policy actions by the ECB in the spring of 2020 keeping constant the sender, Olli Rehn, Governor of the Finnish central bank, and the medium, his official Twitter account, but varied the content. One group received a “target” communication, that is, a message that specifies the aim of a policy without detailing which measures the central bank would implement to achieve it. Another group received information about the “instrument,” the specific policy that was implemented to achieve the goal. The target group received the announcement that the ECB will do whatever is necessary so that no Finn will suffer any economic harm from the pandemic. The instrument group, instead, read a sentence about the announcement of the Pandemic Emergency Purchase Programme. Finally, all survey participants answered the same questions again including the posterior elicitation of income change expectations. Empirically, we find that only the target communication is effective in improving individuals' income expectations. The effect is concentrated within individuals with lower measures of cognitive abilities and who were unaware of the respective policies.

In Coibion et al. (2022), we instead focus on the medium of the message. In another information provision experiment, we find that simple messages like current inflation, the inflation target or the inflation forecast are most effective in managing individuals' inflation expectations. Reading the official statement of the Federal Open Market Committee (FOMC) resulted in forecast revisions for inflation of similar magnitudes, even though it contained substantially more information and context. The

coverage of the same FOMC meeting in newspapers, which are written for a lay audience and in substantially simpler language compared to the FOMC statement, instead, resulted in forecast revisions of only half the size. In the survey, we also elicited survey participants' rating of the credibility of different news sources and found that households in the US on average rate newspapers the lowest in terms of credibility when it comes to information about the macroeconomy, whereas social media and Twitter in particular ranked highest. While possibly stronger in the US, these findings caution against purely relying on the media as a means of transmission of monetary policy announcements to households. In the paper, we also show that individuals with exogenously higher inflation expectations increase their subsequent spending, both in survey data but also in actual spending data, which we observe via the Nielsen homescan panel.

Finally, in D'Acunto et al. (2022e), we document that also the identity of the sender of the message matters for the effectiveness of monetary policy communication. Specifically, we find in an information provision experiment in which we keep constant the message, forecasts for inflation and unemployment from the Summary of Economic Pro-

jections, that women and black survey respondents are substantially more likely to incorporate these forecasts into their own subjective expectations when we make salient the presence of Mary Daly or Raphael Bostic, a female and black male regional Fed president compared to making salient the presence of Thomas Barkin, a white male regional Fed president. We show in the paper that making salient the female or black male presence on the FOMC increases the level of trust women and black survey participants have in the Fed. In terms of mechanism, our results hint toward a taste for diversity channel, that is, preferring the representation of underrepresented groups on the FOMC relative to the majority of white men.

Finally, in Weber et al. (2022a), we show that when individuals update their short-run inflation expectations, they also update their long-run inflation expectations in a similar fashion. These findings cast doubt on the idea that individuals temporarily change their short-run expectations due to shocks but these changes do not transmit to the long-run expectations. Moreover, in Weber et al. (2022b) we show that the stylized facts I discuss in this brief hold equally for firms. Other recent reviews of this literature are D'Acunto et al. (2022g), Weber et al. (2022b) and Weber (forthcoming).

### Taking stock

Taken together, these results show that individuals in general do not have well-anchored inflation expectations, that they focus on the price changes of salient, individual goods when forming inflation expectations, that households pay more attention to price increases relative to cuts, but also that central banks can manage the expectations of households if they use simple messages. Yet, also the medium via which the message



is transmitted and the identity of the messenger matters for the effectiveness. The biggest challenge for central banks remains reaching ordinary households who typically do not follow official releases and barely read the section on monetary policy in newspapers. More creative means of communications are called for.

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# Opening remarks at the OeNB monetary policy panel

## Remarks

This is a time of very large economic shocks, and particularly very large external shocks, most recently from Russia's invasion of Ukraine. I say that as someone who wholeheartedly supports the cause of Ukraine and the assistance we must give.

We are in a period of rapidly rising energy, goods and some food prices. These are the most visible prices too. This is by far the main cause of high inflation, and is painful, particularly for those less well off.

What can and should monetary policy do? There is a very important distinction between whether monetary policy can anticipate and stop the effects on inflation of shocks; and, if not, whether it should respond when they happen.

With shocks such as pandemics and wars, the answer to the first question is more likely to be "no," But the answer to the second is very much "yes, monetary policymakers can and must take the actions needed to return inflation to target over a period that avoids unnecessary volatility in the economy."

It is domestic actions that have to get us back to price stability. For monetary policy, the choice of policy actions is influenced by the nature of the shock we are facing.

In the UK we are facing a very big negative impact on real incomes caused by the rise in prices of things we import, notably energy. We expect that to weigh heavily on demand. We judge the appropriate degree of monetary tightening taking that into account.

What I reject is the argument that in our response to COVID-19 the Bank of England's Monetary Policy Committee let demand get out of hand and thus

stoked inflation. The facts simply do not support this. On the latest number, UK gross domestic product (GDP) in March was only 0.6% above its pre-COVID level, and it is substantially below the path it was expected to follow pre-COVID.

What we do have is a very tight labor market. But that does not look like a story about rapid demand growth.

The labor force has shrunk by around 1% since the onset of COVID-19. It looks much more like an impact from the supply of labor.

The job of the Bank of England is to return inflation to target at a time when a very large headwind from external shocks, and an internal shock from a fall in the labor force, are reducing real incomes but risk leading to persistence in domestic wage and price setting, so-called second-round effects.

The Bank of England will, as always, take monetary policy decisions to ensure that the inflation target is met over the medium term.

We have raised the official rate four times so far and have made clear that in order to bring inflation down to target we are prepared to do so again based on the assessment at each of our meetings.



Joachim Nagel  
President  
Deutsche Bundesbank



# Remarks given at the OeNB monetary policy panel<sup>1</sup>

*The ECB's new monetary policy strategy allows the Eurosystem to deal with the effective lower bound of policy rates and persistently low inflation in a much better way than the old framework. At the same time, the new strategy remains well-suited to ensuring price stability in the medium term if inflation is above target. In line with its symmetric target, the Eurosystem must continue to demonstrate its commitment to its inflation target and respond appropriately to changes in the medium-term inflation outlook. The persistence and the extent of recent inflation surprises have been a game changer for the Governing Council's monetary policy assessment. At the moment, there are worrying signs suggesting that the high inflation rates seen at present might translate into elevated medium-term inflation expectations across financial investors, households and firms. For this reason, it has become even more imperative to adapt the monetary policy stance to the changed environment.*

JEL codes: E52, E58

Keywords: monetary policy strategy, ELB, inflation, target, inflation expectations, monetary policy stance

## 1 Did recent reviews of major central banks' monetary policy strategies focus too much on a state of the world with persistently low inflation?

No, I do not think that such a criticism of the strategy review is appropriate. In my view, it creates a false dilemma between two requirements. The first is how to cope with being at the effective lower bound (ELB) of policy rates, an experience that certainly was a key motive for the strategy. The second is handling situations where inflation is above target, and possibly significantly so. As I see it, the new strategy addresses both requirements convincingly: It allows us to deal with the ELB in a much better way than the old framework and is also well-suited to ensuring price stability in the medium term if inflation is above target.

The Eurosystem's strategy review of 2020 and 2021 took place at a time when the euro area (and other currency areas) had been predominantly concerned with inflation rates that were persistently too low over several years.

This is why the new framework includes, for example, an asymmetric reaction function. It implies that, in the event of strongly negative inflation shocks, the monetary policy instruments are to be deployed particularly forcefully. If the policy rates are close to the ELB, the Governing Council can also deploy its instruments more persistently.

Nonetheless, the Governing Council was well aware that the new strategy had to be of a universal nature, and this requirement was considered in the decisions regarding the new strategy. This is reflected most prominently in the decisions on the level of the inflation target and its symmetry.

First, price stability is best maintained by aiming for an inflation rate of 2% over the medium term. This inflation target is only negligibly higher than the policy aim of the previous strategy. While a higher inflation target generally has the potential to provide a larger safety margin for protecting against the risk of deflation and ensuring the effectiveness of monetary policy in response to disinflationary shocks, the Governing

<sup>1</sup> Policy panel "Monetary policy, policy interaction and inflation in a post-pandemic world with severe geopolitical tensions".

Council deliberately decided against an inflation target higher than 2%. There was a clear awareness and broad consensus that a higher inflation target, and hence higher average inflation rates, would entail costs that could outweigh the benefits.

Second, the inflation target is symmetric, meaning that downward and upward deviations from the target are equally undesirable. On the one hand, this means that the Eurosystem takes into account the implications of the ELB in order to avoid negative deviations from the inflation target becoming entrenched. On the other hand, and this particularly applies to the current situation, inflation rates above 2% are to be avoided, and, if they persist, this is incompatible with the goal to ensure price stability.

Thus, the new strategy clearly does not neglect upward risks to medium-term inflation. On the contrary, it provides the necessary framework for the Governing Council to act swiftly and resolutely in inflationary environments and is therefore suitable for, and applicable to, the current period of high inflation rates.

## **2 Why do central banks seem so hesitant to tighten their monetary policy stance when it comes to fighting rising inflation?**

The Governing Council's decision to hold policy rates at the ELB for such a long time must be viewed against the backdrop of a prolonged period during which inflation was too low. As central banks typically have limited power to stimulate the economy at the ELB, a symmetric target requires especially persistent monetary policy action when faced with large adverse shocks. That means, after undershooting our target for a while, the Governing Council would be willing to accept a temporary

overshooting. But the Governing Council would not aim for such an overshooting, which should be moderate and short-lasting anyhow.

In line with our symmetric target, the Eurosystem must constantly demonstrate its commitment to its inflation target and respond appropriately to changes in the medium-term inflation outlook. This also applies when the inflation rate is too high. Otherwise, we risk longer-term inflation expectations becoming entrenched above target.

Earlier this year, there were two main arguments against a faster withdrawal of monetary stimulus. First, the shocks causing the inflation rate to rise were thought to be only temporary in nature. Second, the upside surprises in inflation rates were mostly attributed to supply shocks, such as the supply bottlenecks related to the pandemic and the high energy prices due to the war in Ukraine. Supply shocks induce a policy trade-off and therefore typically require only partial accommodation. However, even if recent developments are seen in that light, monetary policy must react to supply shocks within an environment of catching-up demand and when inflation is already high. The more persistent the shock, the stronger the subsequent price pressure, and the stronger the required reaction.

When I took office as President of the Deutsche Bundesbank in January, I expressed my concerns that elevated inflation could prove more persistent than many expected. In the course of the first quarter, the high inflation became increasingly entrenched, indeed. The persistence and the extent of the inflation surprises have been a game changer for the Governing Council's assessment. Moreover, incoming data have supported the view that price pressures have become more broad-based and longer-lasting.

At the moment, there are worrying signs suggesting that the current high inflation rates might translate into elevated medium-term inflation expectations across financial investors, households and firms. For this reason, it has become even more imperative to adapt the monetary policy stance to the changed environment.

As we all know, a firm anchoring of inflation expectations is crucial for

monetary policymakers to be able to steer aggregate demand effectively. This is a prerequisite for fulfilling the mandate of price stability. Therefore, in my view, we should start hiking policy rates soon. Otherwise, there is a risk that we may fall “behind the curve” and longer-term expectations could become less anchored. In that case, the costs of fighting inflation (and re-anchoring expectations) would be much higher.

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# Climate change, climate protection and inflation

## Overview

We have already entered a new inflation regime: one where supply constraints are becoming the driving force behind inflation. A world shaped by unusually low supply has major implications for monetary policymakers. Climate change is a key aspect in a world shaped by supply as the climate transition may add to, and extend, the supply constraints currently driving inflation. Like the pandemic, the climate transition will bring about pronounced sectoral shifts, albeit stretched over a longer timeframe. These sectoral shifts argue for greater inflation tolerance. A world driven by supply also brings about more macro volatility. This can be expected to enhance central banks' willingness to live with higher inflation. All these developments will have profound consequences for the policy landscape. Monetary policy is limited in its ability to bring down supply-driven inflation, unless central banks are prepared to destroy demand and let unemployment surge across the economy to contain inflation pressures.

## A new inflation regime

The post-pandemic activity restart provided a first glimpse of the power that supply shifts have in shaping the macro environment. Even though the post-COVID activity restart will eventually be completed, this will not be the end of the era of supply constraints. The climate transition to net zero will have effects similar to an activity restart drawn out over many years. The reallocation of resources between sectors necessary to achieve the climate transition is likely to cause additional supply constraints. These will push up inflation through broad-based macro and

through sector channels. The International Monetary Fund (IMF) estimates that over 2% of the global workforce will ultimately need to change sector. If demand shifts faster than resources, the resulting mismatch will push inflation higher. A disorganized transition characterized by delayed, abrupt policy changes will be materially more inflationary than an orderly transition process driven by credible long-term policy commitments.

It has to be borne in mind that a major requirement for the transition to be successful is to consider and include the costs of climate change in all economic decisions. These costs can be reflected or accommodated in different ways: carbon taxes, emission permits, government regulations or shifts in consumer preferences. Independent of how exactly the costs of climate change are accommodated, we will likely see a broad-based impact on inflation due to increasing energy costs. Estimates vary widely depending on the assumptions used for the carbon price and the timeframe. Not including (internalizing) the costs of climate change will also be inflationary since not addressing climate change will hit economies much harder in the long run. As a result of climate change, crop yields will decline and food price inflation will rise. The frequency of extreme weather events and natural disasters is expected to increase, resulting in bottlenecks in global supply chains. Rising average temperatures will lower labor productivity. All in all, climate change is likely to cause inflation to be higher and more volatile.

So, we are in a new inflation regime, and due to the ongoing war in Ukraine and the West's desire to wean

itself off Russian energy supply, the risk of inflation expectations de-anchoring and central banks being forced to step on the monetary policy brakes have risen. Central banks may be forced into a painful destruction of demand and jobs by raising interest rates beyond their neutral level and pushing monetary policy into restrictive territory.

### **A world shaped by supply**

Supply-driven inflation presents central banks with a fundamental dilemma. Monetary policy simply cannot stabilize inflation and activity at the same time anymore, an important departure from, say, dealing with an overheating or undercooling economy. Central banks have to choose between inflation and growth. In order to limit growth volatility, central banks will probably be inclined to live with somewhat higher inflation if it is supply-driven – provided that inflation expectations remain anchored.

A key aspect of the new era shaped by supply is that there are not only supply constraints at the aggregate macro-level, but also very sizable shifts between sectors due to changing consumer preferences. We have seen the impact of such sectoral shifts already during the pandemic when consumer spending shifted toward goods and away from services. This shift created severe bottlenecks in some places and spare capacity in others. As prices tend to rise faster in response to bottlenecks than they fall in response to spare capacity, sectoral shifts can propel overall inflation even when aggregate activity has not fully recovered.

The transition to net zero is expected to materially reinforce sectoral shifts in coming years, if not decades, as demand increasingly switches to

lower-carbon activities. Accommodating higher inflation of this type in monetary policy decisions yields better economic outcomes, by facilitating a swifter reallocation of resources toward the new economic structure. If central banks were insisting instead on pushing inflation back to target this would lead to overly tight monetary policy. It would not only actively destroy demand but also make the transition more costly in terms of job losses and in terms of adjusting the stock of physical capital.

### **Rethinking central bank frameworks**

Given the likely persistence of such supply constraints in the future, further adjustments to central bank inflation-targeting frameworks might be necessary – despite the Fed and the European Central Bank (ECB) having only recently overhauled their policy frameworks. For starters, pursuing price stability as the only goal of monetary policy might imply greater output volatility in a world shaped by supply as divine coincidence would no longer hold. Greater macro volatility could also mean increased financial stability risks. In addition, an empirical evaluation of existing inflation targets could be warranted to assess whether they provide sufficient breathing space for the necessary adjustment in relative prices that would need to be facilitated in the course of decarbonization. Finally, the strict application of average inflation targeting, or even price level targeting, would not be suitable as it would impose an excessively tight policy well into the future after a period of supply-driven inflation overshoot. A flexible application of average inflation targeting with the ability to look through an inflation overshoot on a discretionary basis



would seem more suitable in case of inflation pressures primarily being caused by sectoral shifts.

### Conclusion

We are in the midst of a new era driven by supply which is producing higher rates of inflation and higher macro volatility. These trends will be reinforced by the transition to net zero. And the stepped-up efforts to foster energy security in the West is likely to cause the transition to be reinforced in Europe, and also more divergent globally. The new regime challenges current central bank policy frameworks and could question the status of government bonds as safe assets. Faced with higher inflation trends and higher interest-rate volatility,

the term premium is likely to widen and could eventually move into positive territory. From a financial-stability point of view, government bonds are likely to struggle to provide effective ballast.



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# Climate change and inflation in the euro area<sup>1</sup>

*The European Central Bank (ECB) has committed to taking the impact of climate change into consideration in its monetary policy framework. Both climate change and its mitigation can impact relative prices and inflation. Headline inflation increased considerably in recent months, mainly reflecting the surge in energy prices. To date, climate policies have played only a limited role for inflation dynamics. Looking ahead, the energy transition may add inflationary pressures, but there is uncertainty about the magnitude and timing. In the longer run, these pressures could potentially ease or even reverse. To live up to its commitments, the ECB has been working on capturing the impact of climate change policies in the Eurosystem/ECB macroeconomic projections and, accordingly, in the medium-term inflation outlook.*

JEL codes: E31, Q4, Q54

Keywords: climate change, climate change policies, energy transition, energy prices, inflation

## 1 Introduction

*Addressing climate change is a global challenge and a policy priority for the European Union.* While governments and parliaments have the primary responsibility to act on climate change, the Governing Council of the European Central Bank (ECB) has committed, in its strategy review concluded last year, “to further incorporating climate considerations into its monetary policy framework” (ECB, 2021a). This is particularly important, as climate change and climate policies affect the outlook for price stability through their impact on macroeconomic indicators, financial stability, and the transmission of monetary policy (ECB, 2021b).

*Both climate change and its mitigation can impact relative prices and inflation (ECB, 2021c).* On the one hand, climate change shocks – especially if materializing in the form of simultaneous extreme events and compound risks – may prove increasingly challenging to respond to. On the other hand, the transition may add pressure on prices,

but there is uncertainty about the magnitude and the timing. In addition, these pressures could potentially ease or even reverse in the longer run, as the economy is expected to develop in line with the green transition.

## 2 Energy markets are already under pressure

*Pressures on energy commodity prices resulted from a rebound in demand after the pandemic, coupled with supply constraints and the impact of the Russian invasion in Ukraine.* Energy commodity prices have increased to levels far beyond their long-term averages and are expected to stay at elevated levels in the foreseeable future (chart 1, left-hand panel). In particular, European natural gas prices reached an all-time high, contributing in turn to record-high wholesale electricity prices (ECB, 2022a,b).

*Rising energy commodity prices had a large impact on consumer prices in the euro area, with strong contributions of energy inflation to headline inflation (chart 1,*

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The views expressed in this article do not necessarily reflect those of the ECB.

The views expressed in this article reflect my assessment presented at the 49<sup>th</sup> OeNB Economics Conference and 35<sup>th</sup> SUERF Colloquium. Later developments are not necessarily fully reflected here.

right-hand panel). The current energy price shock is unprecedented in terms of magnitude and breadth in the euro area: While increases in crude oil prices had reached similar magnitudes in the past, consumers today face not only an oil price shock but also a considerable rise in gas and electricity prices, which has not been observed before in this dimension. Government compensatory measures eased some of the upward pressure on consumer prices, yet price levels continue to be elevated.

### 3 The role of climate change mitigation policies for inflation

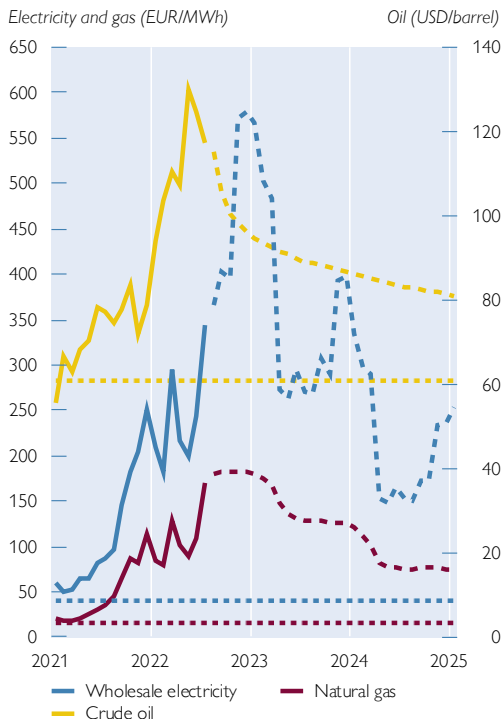
*The role of the energy transition and climate change mitigation policies, including car-*

*bon taxes, for inflation is subject to large uncertainties in terms of sign, size and timing. To consider potential effects and impact channels of the green transition on inflation, it is useful to distinguish between different periods. The recent past and near-term future are characterized by large global shocks including the pandemic recovery and impacts of the Russian invasion of Ukraine, which largely overshadow any potential impacts of climate policies. In the medium-term, price pressures might become largest as the transition picks up in speed, but with decreasing costs of sustainable alternatives it is possible that price pressures ease or even reverse in the medium to long run.*

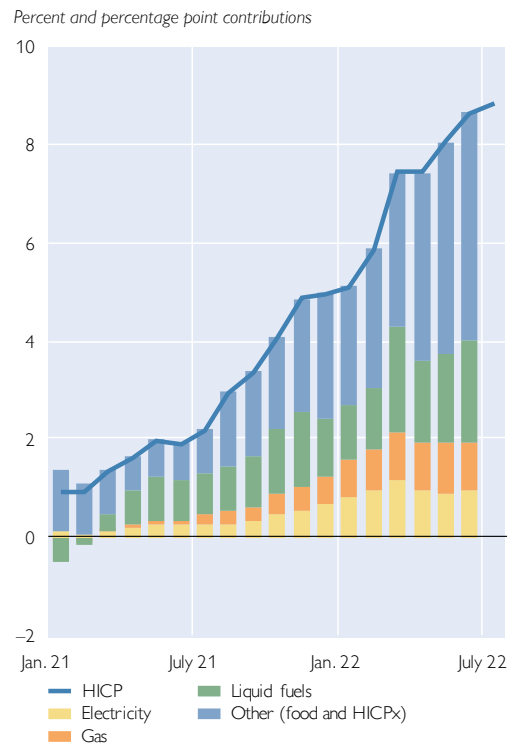
Chart 1

## Energy markets are already under pressure from the pandemic and the war in Ukraine

### Energy commodity spot and futures prices



### Developments in HICP and energy components



Sources: Refinitiv, Eurostat and ECB calculations.

Notes: Left-hand panel – futures price curves as of June 21, 2022. Future prices are dashed. Futures prices include for gas the TTF Dutch Gas Futures and for electricity a weighted average (weighted by net electricity generation) of prices in the five biggest euro area economies. Averages from 2014 to 2020 are added as dotted lines.

Right-hand panel – latest observation from July 2022 (flash).

HICP – harmonized index of consumer prices.

HICPX refers to HICP inflation excluding energy and food.

To date, climate policies have played only a very limited role for inflation. Though carbon prices under the EU emissions trading system (ETS) have increased strongly since the beginning of 2021 (chart 2, left-hand panel), their impact on inflation so far was limited. Overall, around 40% of emissions in the EU are subject to carbon prices under the EU ETS (chart 2, right-hand panel; European Commission, 2022), but more than two-thirds of those emissions are still covered by free allowances (ECB, 2021d). Electricity and heat production have so far been the main activities for which emissions had to be covered by allowances purchased on the market. However, the impact of carbon prices on wholesale electricity prices – and consequently also on consumer prices – has been largely overshadowed by the unprecedented increases in natural gas prices. Natural gas prices have been the main driver of wholesale electricity prices in the last months of 2021 and at the beginning of

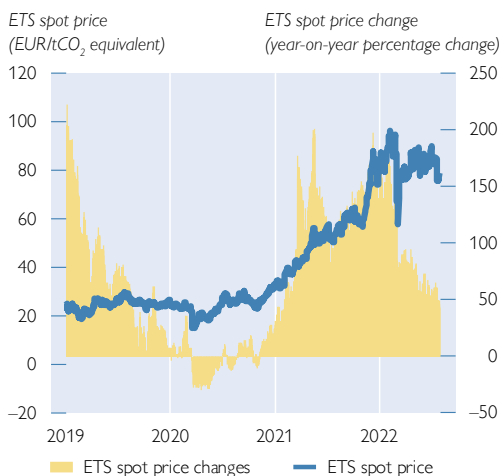
2022 (ECB, 2022a). Similarly, national carbon pricing schemes, covering up to 65% of individual countries' emissions not falling under the EU ETS, have contributed to, or are expected in the near term to contribute to, a limited extent to price developments in euro area countries (World Bank, 2022; Bundesbank, 2021; Oesterreichische Nationalbank, 2022).

Going forward, there is evidence that the transition may add to some upward pressures on inflation and to heightened price volatility. ECB staff performed a sensitivity analysis of euro area inflation to an increase in effective carbon taxes (chart 3, left-hand panel; ECB, 2022c). The results point to limited but non-negligible effects on inflation in the gradual adjustment scenario until 2024. The scenario assumes a gradual and linear increase in carbon taxes until 2030, consistent with a pathway to reach net zero emissions by 2050. The impacts would be amplified in the case of the front-loaded carbon pricing scenario,

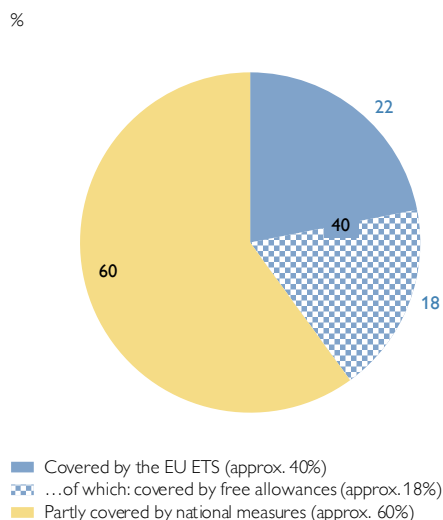
Chart 2

## To date climate policies have played only a very limited role for inflation

### Developments in EU ETS prices



### Total EU emissions covered by the EU ETS



Sources: Refinitiv, European Environment Agency, European Commission, ECB calculations.

Notes: Left-hand panel – latest observation on June 21, 2022;

Right-hand panel – the share of free allowances is based on 2021 data, obtained by the ratio of total free allowances and total emissions under the EU ETS. The share of total emissions covered by the EU ETS is taken from European Commission (2022). The illustration does not consider proposed EU policies under the “Fit for 55” package.

where the same increase in carbon prices already takes place by 2024, i.e. in a much shorter time horizon than currently assumed in EU policy proposals. Therefore, these results can be seen as upper bound estimates. Results also suggest that recycling the additional revenues would increase the inflationary impact of increasing effective carbon taxes but could mitigate negative effects on output. The results are subject to a number of important methodological caveats, which illustrates the uncertainty surrounding such estimates currently.

*Increased cost pressures during the green transition are also expected by a recent survey among large nonfinancial corporations* (chart 3, right-hand panel; ECB, 2022d). Among the 90 large nonfinancial companies surveyed, a large majority expects slightly or significantly increasing input costs during the transition and resulting pressures on selling

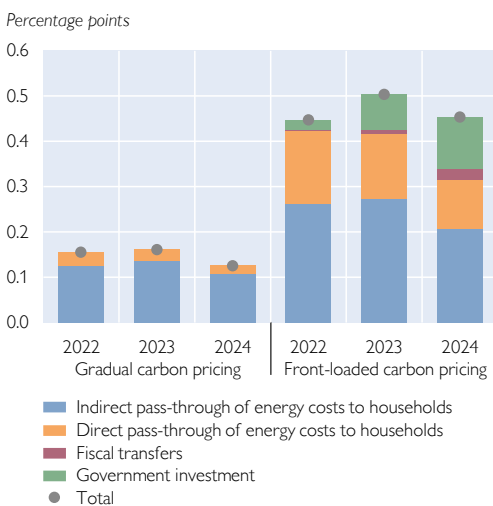
prices. However, after the transition only a small share of respondents expects cost and price pressures to remain significantly higher.

*While these survey results suggest that these pressures on prices are likely to ease in the longer run, it may well be possible that they even reverse as clean technology matures.* One important example are energy prices: Under policy measures proposed by the European Commission – notably the Fit for 55 package, but more recently also the RePowerEU proposal – cheaper renewable sources of energy are expected to increasingly contribute to meeting energy demand (chart 4, upper panel). It is likely that effects will materialize first for electricity prices, which could decline as electricity demand is increasingly met by cheaper renewable electricity toward the end of this decade. Even though costs increased recently, already today

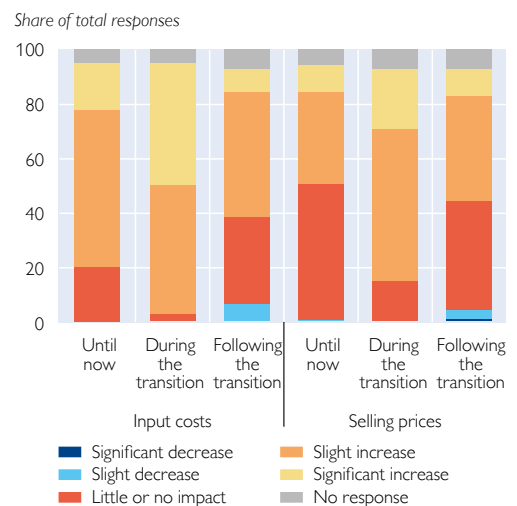
Chart 3

**Going forward, the transition may add to pressures on energy prices and inflation**

**Impact of an increase in effective carbon taxes on euro area inflation**



**Overall impact of climate change and climate policies on input costs and selling prices**



Sources: Left-hand panel – OECD and ECB calculations (ECB 2022c); Right-hand panel – ECB (2022d).

Notes: Left-hand panel – the simulations are based on the ECB’s New Multi-Country Model (NMCM). In the “frontloaded carbon pricing” scenario, the amount of transfers to households equals the revenues collected from taxes paid by consumers. The amount of government investment equals the revenues collected from the carbon taxes paid by companies. The simulations are conducted under exogenous monetary policy, without automatic fiscal stabilizers, and without additional trade spillovers.

Right-hand panel – 90 respondents in total. The respondents consist of large and mostly multinational companies engaged in a wide range of nonfinancial business activities. Firms were asked to compare to a hypothetical baseline without climate change.

onshore wind and solar photovoltaic ventures are offering long-term contracts that are below the wholesale price averages over the last few months (IEA, 2022; chart 4, right-hand panel). In addition to decreasing costs of solar and wind energy, the unit costs of batteries used in passenger electric vehicles have fallen, notably by around 85% between 2010 and 2019 (chart 4, lower panel; IPCC, 2022). Furthermore, it is likely that increased energy efficiency may dampen pressures on energy prices. However, fossil fuels are expected to play a role in the energy mix for some decades to come (chart 4, upper panel), as will consequently crude oil and natural gas prices for total energy prices.

#### 4 Conclusion

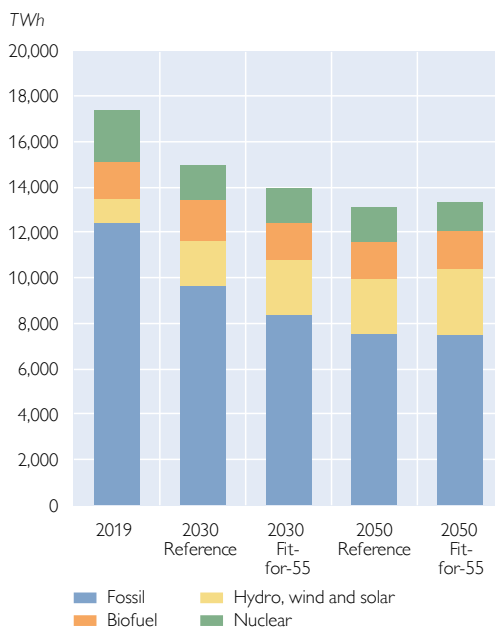
There is a lot of uncertainty around the magnitude and timing of the impact of climate change and climate change mitigation on inflation. Nevertheless, it is possible to lay out the possible channels through which the energy transition and carbon taxes could have an effect. Impacts depend on the way the transition progresses, i.e. on whether policy stringency and carbon prices are increased gradually and in a coordinated manner

(“orderly transition”; NGFS, 2021), or the transition is further delayed and then implemented in an abrupt and uncoordinated fashion (“disorderly transition”). It also depends on the pace of technological

Chart 4

### A successful transition could lead to downward pressures on prices in the long run

Energy consumption and mix in the EU – scenarios



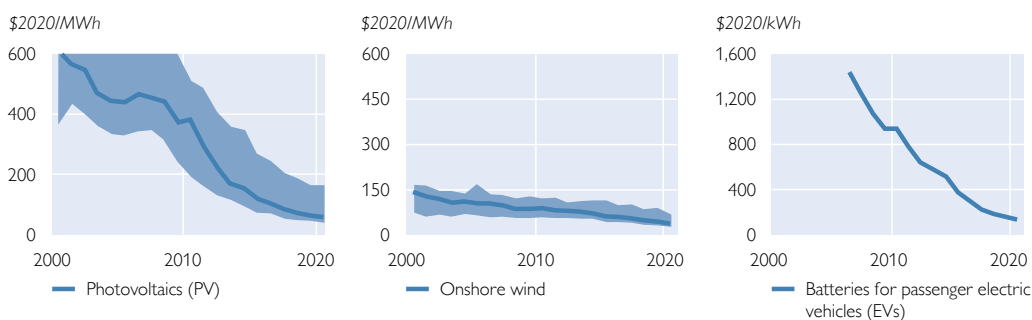
Sources: ECB staff calculations based on European Commission.

Notes: Scenarios include a reference with current policies, and the “Fit for 55 MIX” scenario. “Fossil” includes gas, oil, coal and waste.

Chart 4 continued

### A successful transition could lead to downward pressures on prices in the long run

#### Costs for renewables



Sources: IPCC, 2022a.

Notes: Photovoltaics and onshore wind are costs and batteries for passenger electric vehicles is Li-Ion battery packs.



progress and the availability of key technologies to decarbonize the emission-intensive sectors, such as carbon capture and storage technologies (IEA, 2021). Impacts on the macroeconomy and inflation more specifically will depend on the way governments support more vulnerable households or sectors to weather the transition (ECB, 2022c). Overall, however, there is clear evidence

of the catastrophic impacts of unmitigated climate change (IPCC, 2021; IPCC, 2022b), underlining the urgency of forceful action to transition to carbon-neutral economies.

*In its 2021 strategy review, the ECB Governing Council agreed on a roadmap on climate change, which also proposes further work on the above-mentioned questions. In particular, the ECB Governing Council has committed to expanding its analytical capacity in macroeconomic modeling with regard to climate change, including conducting scenario analyses regarding transition policies (ECB, 2021a). The ECB is also working on capturing the impact of climate change policies in the Eurosystem/ECB macroeconomic projections and, accordingly, in the medium-term inflation outlook, which is particularly relevant for monetary policy considerations.*

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# The fight against climate change and economic performance<sup>1</sup>

## 1 Introduction

The war in Ukraine has put energy markets in considerable distress, leading to a sharp rise in both the level and volatility of energy prices that are putting upward pressure on inflation around the world. These developments have drawn renewed attention to the economic implications of changes in the price of energy for the transition to a low-carbon economy, which is instrumental to ensure attainment of agreed climate change targets. Two interrelated aspects are particularly important; first, the policy instruments that can be deployed to support the low-carbon transition; and second, the effects of decarbonization on economic performance and prices over the short and

long term. This note discusses briefly both aspects in the light of recent analysis and empirical evidence.

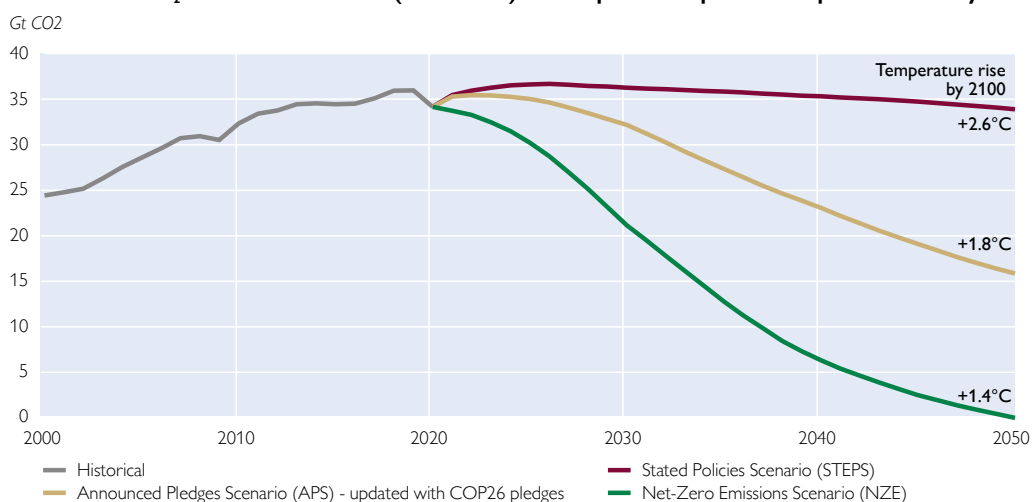
## 2 Policy options to support the low-carbon transition: what can be done?

Countries have made ambitious pledges to reduce emissions of greenhouse gases and announced climate change mitigation strategies to honor those commitments. Judging by publicly announced long-term commitments and goals, policymakers appear to be taking this seriously: Over 140 countries have so far adopted or announced targets of climate neutrality (Climate Action Tracker, 2021). Nevertheless, policy action remains out of step with stated ambitions, making it

Chart 1

### Global emissions of greenhouse gases, 2000–2050

Scenarios of CO<sub>2</sub> emissions over time (2000–2050) and respective expected temperature rise by 2100



Sources: IEA (2021), CO<sub>2</sub> emissions in World Energy Outlook scenarios over time, 2000–2050, IEA, Paris; IEA (2021), Temperature rise in 2100, by scenario, IEA, Paris; and IEA (2021), World Energy Outlook 2021, IEA, Paris.

Notes: The Announced Pledges Scenario (APS) is updated with COP26<sup>1</sup> pledges as of November 3, 2021; the Net-Zero Emissions Scenario (NZE) shows the global energy-related emission pathway developed by the International Energy Agency (IEA) where technology, investments and policies are deployed in line with the objective of reaching net-zero emissions by 2050. Expected temperature rises by 2100 are relative to pre-industrial levels, and are subject to an upward risk due to uncertainties in the estimate and possible future changes in policy.

<sup>1</sup> COP26 stands for the 26<sup>th</sup> UN Climate Change Conference of the Parties that took place in Glasgow from October 31 to November 13, 2021.

<sup>1</sup> This note is based on a presentation made at the 49<sup>th</sup> OeNB Economics Conference and 35<sup>th</sup> SUERF Colloquium “The Return of Inflation” that took place in Vienna on May 24, 2022. The analysis and opinions reported in this note are the author’s own and do not necessarily reflect those of the OECD or its member and partner countries.

unlikely that the 2015 Paris Agreement’s goal of keeping the rise in world temperature to “well below 2°C above pre-industrial levels” will be met within relevant timeframes (*chart 1*). Given current policies, average temperatures are still expected to rise by about 2.6°C, increasing the likelihood of catastrophic impacts for societies and economies (IPCC, 2022).

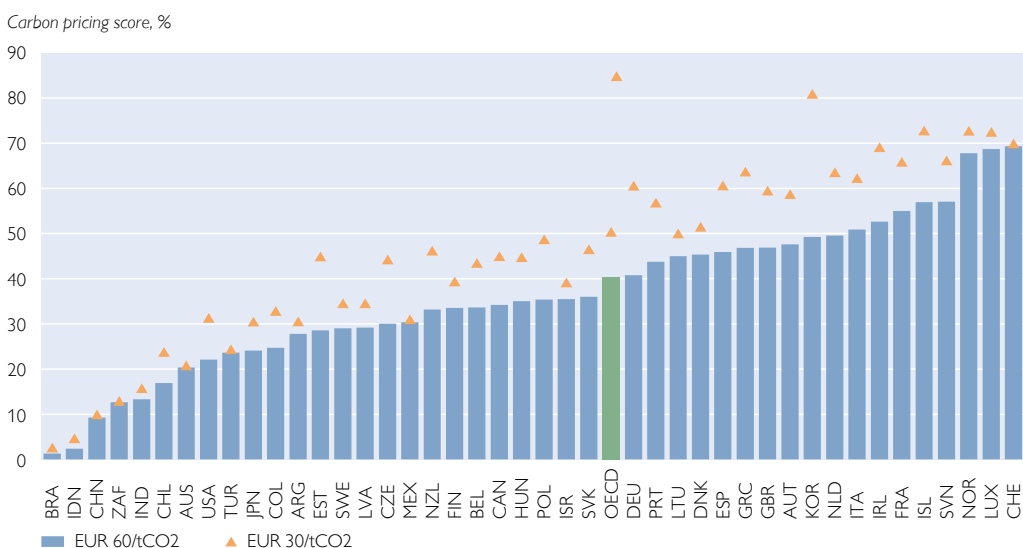
To redress this situation and ensure attainment of agreed climate change targets, steadfast policy action will be needed in the years to come. Success will depend largely on how well and how far policymakers use the policy instruments at their disposal, bearing in mind that countries differ in their economic structure, social preferences and political constraints, which influences policy choices. Rather than relying on a single instrument, given the complexity of the objective to be achieved, comprehensive

decarbonization packages will be necessary to combine cost-effectiveness with social acceptability of the needed reforms (D’Arcangelo et al., 2022).

Decarbonization policy packages need to include a variety of mitigation instruments, such as market-based levers (i.e. carbon pricing and emission trading schemes) and non-market ones (i.e. subsidies, standards and regulations). These instruments have different abatement potential and associated costs that need to be quantified to the extent possible to inform policy choices. For example, carbon prices remain low around the world, in part due to concerns about their distributional implications, which motivates public opinion resistance (*chart 2*). Indeed, climate policies are more likely to be publicly supported if they are perceived to be effective at reducing emissions while not imposing higher burdens on low-income households.<sup>2</sup>

Chart 2

### Carbon pricing, 2018



Source: OECD, Effective Carbon Rates 2021 Database.

Notes: The carbon pricing score (CPS) measures the extent to which countries have achieved the goal of pricing all energy-related emissions for carbon costs, at certain benchmark values. For example, a CPS of 100% against a benchmark of EUR 60 per ton of CO<sub>2</sub> means that the country prices all energy-related carbon emissions in its territory at EUR 60 or more. In practice, EUR 60 is a midpoint estimate for carbon costs in 2020, and a low-end estimate for 2030. Pricing all emissions at least at EUR 60 in 2020 shows that a country is on a good track to reach the goals of the Paris Agreement to decarbonize by mid-century.

<sup>2</sup> For evidence on public opinion support for climate change action, see A. Dechezleprêtre, Fabre, Kruse et al. (2022); further information is also available on the project website: <https://www.oecd.org/climate-change/international-attitudes-toward-climate-policies/>

Policy instruments also differ in their impact on government budgets along the low-carbon transition path.

Non-market instruments, such as standards, regulations and subsidies, can effectively complement carbon pricing and other market-based policies. Non-market instruments include a variety of mechanisms, such as emission quotas, green certifications, technology mandates and others. They also need to be designed appropriately to avoid blurring price signals, blunting economy-wide incentives and complicating performance monitoring. These instruments are particularly useful in situations where firms and households do not respond strongly to explicit price signals. The costs associated with these non-market instruments can be seen as implicit prices on emissions and need to be quantified.

Comprehensive decarbonization packages also need to include policy instruments that can lower the economic and social costs of transition. This is because, as will be discussed below, these costs are heterogeneous among industries, firms, households and locations. A steady reduction of abatement costs driven by progress in low-carbon technology is moreover necessary to ensure that market-based mitigation policies are effective (D’Arcangelo et al., 2022). For example, new technologies may reduce the costs of abatement and can be supported through research and development (R&D) and innovation incentives. These incentives can take the form of grants, tax credits or innovation prizes. They can also be delivered through demand-side policies, such as public procurement. Appropriate regulation of product markets is essential to create an environment of contestability that is, in turn, crucial for business dynamism and the adoption and diffusion of innovation.

At the same time, safety nets and labor market policies will have to respond

to the specific needs of those adversely affected by the transition. Low-income households are the most exposed to hikes in the price of goods produced using carbon-intensive technologies. In addition, workers in declining carbon-intensive (“brown”) sectors may face persistent joblessness and earnings losses, whereas firms in expanding low-carbon (“green”) activities may have to deal with shortages of workers with the necessary skills.

Policy action will therefore be needed in the form of education and training/retraining programs, as well as by making sure that labor mobility and market competition are not thwarted by ill-conceived regulation and other policy-related impediments. The same is true for active labor market policies and appropriate social safety nets for the most vulnerable. By emphasizing protection for workers, rather than jobs, these interventions have the additional merit of helping to muster public opinion support for climate change mitigation initiatives.

Leveraging the private sector will also require policy support, given the sheer volume of investments needed to finance the transition and adapt to climate change. In particular, green investments need transparent and consistent disclosure standards, as well as appropriate labels, taxonomies and rating methodologies to come to fruition. There are indeed many investment opportunities that could support a low-carbon transition, including in power system flexibility, public transport infrastructure, energy-efficient retrofitting of buildings, carbon capture facilities and renewable energy deployment. The financing needs for these investments are large and far outweigh the wherewithal of government budgets.

Effective strategies for the transition to a low-carbon economy will require international policy coordination. This is key, not only because the climate change mitigation goals are global in nature and

scale, but also because the risks of carbon leakage are required to be reduced, as countries pursue different standards with different levels of ambition and conviction.

The war in Ukraine has brought to the fore the heavy reliance of many countries, especially in Europe, on fossil fuel energy with a high risk of price shocks and even shortages (OECD, 2022). Redressing this situation requires policy action to improve the security of energy supply, encourage through appropriate incentives a move away from fossil fuels, boost investment in clean energy and energy efficiency, and support innovation to develop the green technologies needed to underpin the low-carbon transition.

### 3 What are the effects of climate change mitigation and environmental policies on economic performance and prices?

Environmental policy stringency has been tightened over time among OECD

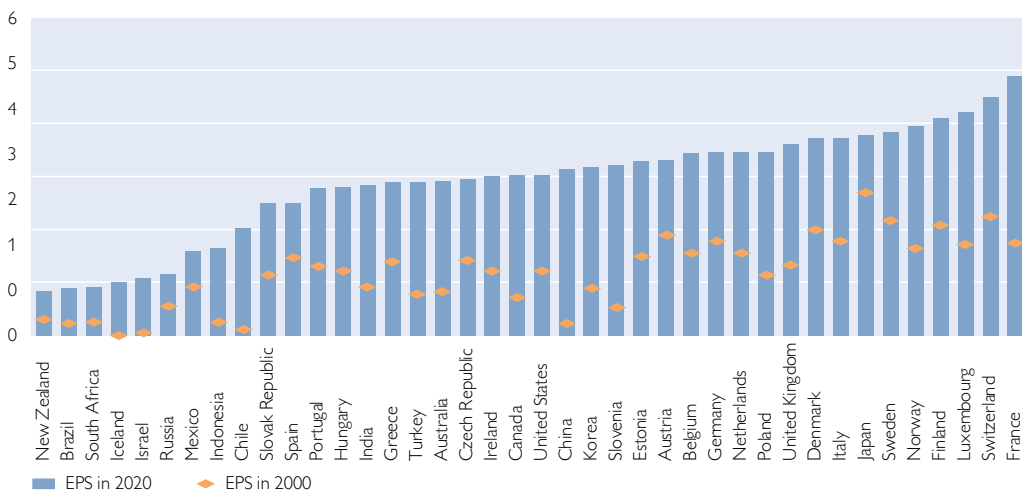
countries, albeit at different rates (chart 3),<sup>3</sup> raising concern about possible adverse effects on economic performance, such as productivity, competitiveness, employment and inflation. Adoption of more stringent environmental policies over the years has so far had limited adverse effects on aggregate economic performance, despite achieving clear environmental benefits, even though there are heterogenous effects that can generate winners and losers across industries, firms and locations (OECD, 2021).

In the case of trade, for example, empirical evidence shows that increasing the stringency of domestic environmental policies does not have a significant effect on overall imports and exports of manufactured goods, but it tilts the comparative advantage away from carbon-intensive industries (Kozluk and Timiliotis, 2016). In the case of productivity, empirical evidence shows that a tightening of environmental policy is associated with productivity gains in the most technologically advanced industries and

Chart 3

#### OECD Environmental Policy Stringency (EPS) index, 2000 and 2020

0-6 scale in ascending order of stringency



Source: OECD.

Note: The index covers 40 countries and 13 policy instruments over three decades (1990–2020).

<sup>3</sup> The OECD has been developing proxies of environmental policy stringency (EPS) based on the measurement of implicit or explicit costs of environmentally harmful behavior. For more information, see E. Botta and T. Kozluk (2014) and T. Kruse et al. (2022).

firms (Albrizio et al., 2014). An example is the introduction of the EU Emissions Trading Scheme – the largest trading scheme in the world – which has reduced emissions by about 10% between 2005 and 2012, without an assessed detrimental effect on the economic performance of the regulated firms (Dechezleprêtre, Nachtigall and Venmans, 2018).

As for prices, carbon taxes account for a small increase in energy prices. Analysis carried out by the IEA shows that supply and demand factors play a key part in explaining changes in energy prices over time (IEA, 2021 and 2022). The sharp increase in prices over the last few months is due to several factors, including primarily a strong rebound in demand post pandemic coupled with a decline in fossil fuel energy investments and an insufficient scale-up in clean energy sources over the past years. Unforeseen maintenance and repair works at liquefied natural gas (LNG) plants and weather-related factors (e.g. lower-than-average wind generation capacities in Europe) are additional culprits, in addition to low levels of gas storage and lower supply from Russia since the onset of the war in Ukraine.

More generally, the effects of decarbonization on prices vary along the low-carbon transition path and once it is achieved. During the transition, upward pressure on prices can come from the substitution of carbon-intensive (“brown”) technologies, such as coal-powered plants, by new “green” ones, such as wind farms. This substitution may create frictions in global value chains that can lead to higher producer prices. Cost pressures can also arise from shortages of labor with the necessary skills to operate in a greener economy, as well as frictions in the reallocation of workers from more- toward less-polluting sectors and activities.

In the longer run, the transition to a low-carbon economy can affect prices

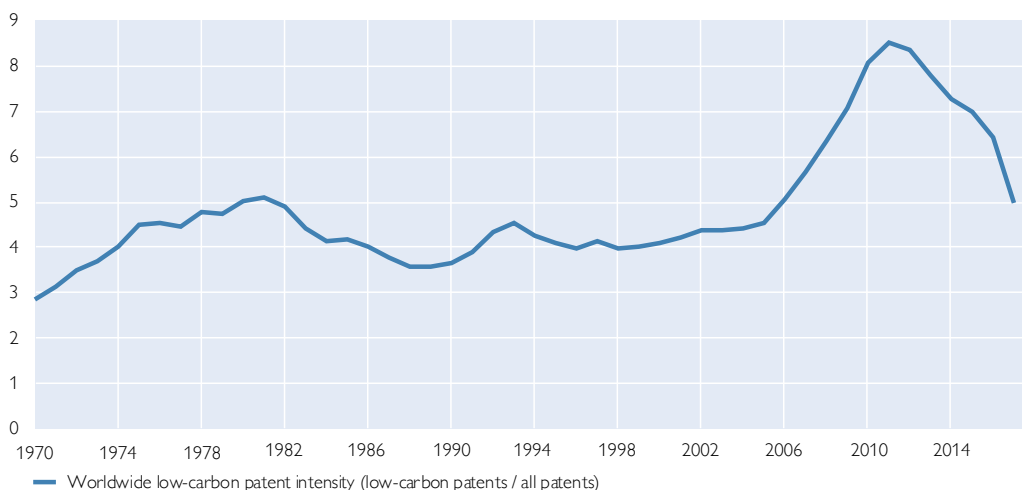
predominantly via supply and demand factors. A successful transition can actually lead to lower energy prices to the extent that new, greener technologies reduce production costs, as well as lower energy demand, as a result of efficiency gains associated with innovation and technological change. The transition can also lead to more resilient energy supply chains to the extent that renewable energy resources (RES) intermittency is addressed and climate-related shocks that also tend to put upward pressure on prices (e.g. food shortages) become less frequent and intensive as a result of appropriate mitigation and adaptation policies.

As noted above, support for innovation is an essential element in comprehensive decarbonization packages. Innovation can do much to reduce pressures on prices by lowering the cost of clean technologies relative to that of carbon-intensive alternatives, which facilitates the adoption and diffusion of clean technologies. However, patent filings in low-carbon technologies – one indicator of clean innovation activity – have declined over recent years (*chart 4*). This trend suggests that additional policy support may be needed to accelerate innovation in low-carbon technologies.

Along with innovation, cost differentials between carbon-intensive and clean technologies can be reduced through investment in clean technologies. The IEA estimates that clean energy investments need to increase more than threefold to reach USD 4 trillion annually by 2030 to put the world on track for net-zero emissions by mid-century (IEA, 2021). However, policy uncertainty can undermine investors’ appetite for clean technologies, in particular in carbon-intensive industries. Empirical evidence indeed shows a negative relationship between frequent climate policy reversals and green investment (Dechezleprêtre, Kruse and Berestycki, 2022).

### Worldwide low-carbon patent intensity, 1970–2018

Share of low-carbon patents in total patent filings, in %



Source: OECD based on PATSTAT.

Clear policy trajectories are therefore needed to provide longer-term investment horizons to firms to shift to clean technologies, thereby reducing cost pressures along the transition path. This is consistent with the evidence reported by the European Central Bank (ECB) that well-designed climate policies with clear price trajectories can do much to mitigate inflationary pressures (ECB, 2021).

### 3 Conclusion

The social and economic transformation of the scope and depth required to secure a smooth transition to a low-carbon global economy will create leaders and laggards, across and within countries. To be successful in terms of minimizing adverse economic and social effects

while ensuring attainment of agreed climate change targets within relevant timeframes, the transition will require diligent use of policy tools in comprehensive decarbonization packages at the national level, as well as effective international cooperation. Policies that can reduce the cost of clean technologies relative to carbon-intensive alternatives (i.e. support for innovation), foster adoption and diffusion of these technologies (i.e. pro-competition product market reforms) and facilitate the reallocation of capital and labor toward greener industries and firms (i.e. education and training/retraining and labor activation) will be instrumental to buttress economic performance while containing price pressures during the transition.



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# Inflation and globalization

## SUERF Robert Marjolin lecture 2022

It is a great honor to have been invited to deliver the SUERF Robert Marjolin lecture. Robert Marjolin was a great economist and politician, who as Vice-President of the European Economic Community (EEC) Commission in October 1962 inspired the Action Programme for the second stage of the Community, a document which led the way to a new institutionalized cooperation between European central banks, which paved the way to eventual monetary union. But not everything goes smoothly, and by 1975, in the midst of high inflation and exchange rate instability, Marjolin was convinced that the movement was going backward, if at all. He blamed “unfortunate events, a lack of political will and insufficient understanding” (James, 2012, p. 136). At the moment, with the reappearance of inflation, we are at a similar moment of hesitation regarding the course of globalization and the future of multilateralism.

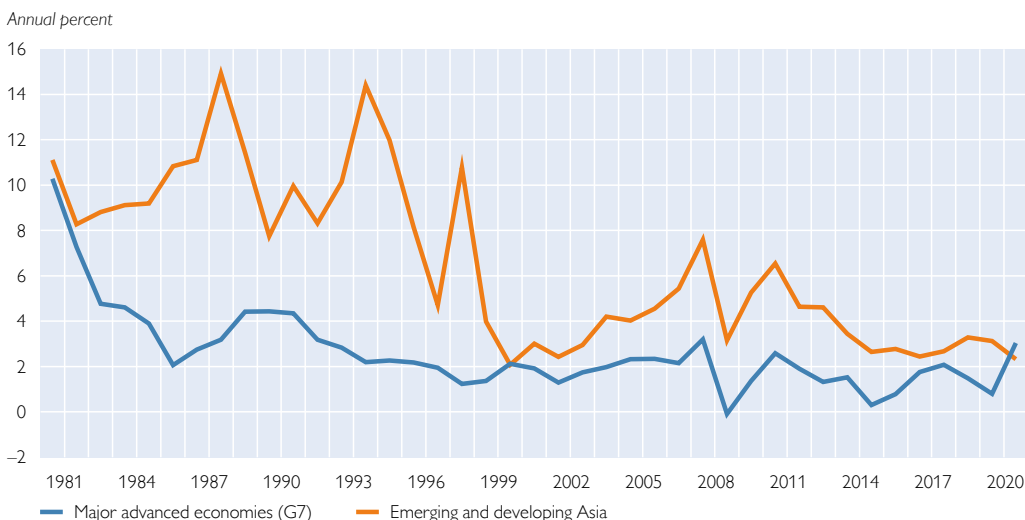
What if the Great Moderation of the 1990s and 2000s was less the product of brilliant legislative or institutional design and followed simply from chance, good fortune, or the force of an eternal factor, globalization? Would then a deglobalization threaten a return of the inflationary specter? And then can a new sort of globalization reappear as a controller or moderator of the new inflationary pressures?

Two related propositions appear as self-evident in modern thinking about monetary policy, whether among academics or policymakers. The first is that inflation is traumatic and undesirable. There is no doubt that extreme inflations or hyperinflations lead to a collapse in trust and social disintegration. The monetary mechanism appears as one in which redistributive claims are fought out between powerful interests,

and the marginal become more vulnerable. In federal structures, such as Germany in the Weimar Republic, the Soviet Union or the Yugoslav federation, there is the additional suspicion that the center, Berlin, Moscow or Belgrade, exercises a tight political control over the distributive levers, and hence that for the regions, separation and monetary autonomy become ever more attractive. And even moderate inflation drives class war. Profits have been surging in the recent inflationary uptick, and companies are amply using their pricing power. Just one example of the result: US Senator Elizabeth Warren likes to quote the allegedly grasping chief executive of the grocery chain Kroger, “a little bit of inflation is always good for us” (Warren, 2022).

Second, and following on from the first proposition, the primary purpose of a modern central bank is to push back on all the inflationary pressures, and deliver price stability. Specific mandates, often in connection with a further but secondary mandate of maintaining full employment, or securing maximum output, or simply acting in conformity with the overall objectives of government policy, are embodied in legislation or, in the case of the European Central Bank (ECB), a treaty. Judged by these criteria, central banks, and governments more generally, have been highly successful over the last 30 years. Across the world, a transition to low-inflation regimes occurred, first in rich industrial countries, but then in emerging markets, first in Asia but ultimately also in Latin America, where inflation had been a way of life (chart 1: Global CPI inflation rates 1980–2021). This beneficent picture was sometimes referred to as NICE (non-inflationary constant expansion, or alternatively,

## Consumer price inflation



Source: International Monetary Fund, *World Economic Outlook (IMF WEO)*.

nearly international competitive equilibrium). There are two views currently on the low inflation era. The first, that it is under threat. The second, that it is definitively over.

If it is correct – as I believe it to be – that the twin COVID-19 and Russia-Ukraine crises mark a fundamental cesura or structural break in the world economy, then the mission of central banks will necessarily become controversial, and perhaps also politicized. First, because full employment becomes elusive when there are major shifts in the labor market, with large areas of economic activity subject to offshoring or automatization. In the last 30 years of globalization, technology and trade led largely to a loss of manufacturing jobs, and a displacement of manual workers. Many interpret the social turmoils and the political radicalization of the 2010s as responses to those forces. But we are now seeing, in part driven by pandemic-era shifts, a displacement of service jobs: administrative office jobs can be done remotely, but also by algorithm. Telemedicine, and remote

learning, will displace workers in hospitals, schools and universities (incidentally, rising medical and educational expenses were major drivers of increases in the cost of living over recent decades). There will be new and disconcerting types of unemployment in services and white-collar work. Fiscal packages, which were seen as the cure for a threat of secular stagnation, will not help unless they are designed as precisely targeted mechanisms for facilitating a structural transformation.

Second, price stability is problematical when there are major structural shifts, as relative prices should be expected to move dramatically. In these circumstances, measurement will be controversial, and the calculation of cost increases will seem idiosyncratic. The pandemic also coincides with an altered awareness of our relationship with the environment. The year 2021 was not only a year of viral devastation, but also of unique environmental catastrophes, and the issue of financing a transition to green or clean energy became more urgent. In adjusting to the new challenge,

and not just to the short-term dislocation of Russian gas supplies, energy costs should rise in relation to other prices.

Third, the balance of risk is different to that of 2008 or 2010, when central banks mounted heroic rescue operations and were able to prevent a new Great Depression. Instead of a worry about debt, there is perhaps too much confidence that high levels of government debt can be sustainably financed, and too much belief that governments can find solutions. COVID-19 has led to a push for governments to do more, and at the same time increased the extent of fiscal strain. Greater military expenditure, price surges, shortages, scarcities and the need to deal with the humanitarian challenge of large refugee movements, will all add to the strain. The effect of the past decade, as well as the new extent of the strain, leads to the assumption that central banks will be pushed by politics to fall in line.

But there is a profound challenge, as the successes of the 2010s rely on the assumption that government debt in advanced countries and also in many (but not all) key emerging markets is practically free from inflation risk, and that governments will in consequence be able to borrow from investors at a lower rate than the investors themselves use to discount the future. This can be thought of as the extraordinary (perhaps exorbitant) privilege of the safe asset. It is being challenged by disruptive forces.

### **The intellectual problem: design or chance?**

What accounts for the changing character of the policy problem? First, then the globalization link. By the early 21<sup>st</sup> century, some commentators thought they could detect a relationship between globalization and price movements. Strikingly, the clearest early articula-

tions of this view came from policymakers rather than academics. Fed chairman Alan Greenspan explained in 2005 that globalization and technical innovation “would appear to be essential elements of any paradigm capable of explaining the events of the past ten years,” i.e. the Great Moderation (Greenspan, 2005). Claudio Borio observed that “we may be underestimating the influence that real factors have on inflation, even over long horizons.” (Borio, 2017, p. 1).

This view gradually also gained, rather late in the day, some prominence in academic literature (Forbes, 2019). Both production factors, capital and labor, play a role. Charles Goodhart and Manoj Pradhan list globalization along with underlying structural trends, demography, and the macroeconomic balance between savings and investment as the “interacting forces” that produced the inflation outcome (Goodhart and Pradhan, 2020, p. 69). The savings-investment balance crucially might be a global one, not a national peculiarity. Moreover, a global labor market conditioned national labor market responses. A paper for the recent ECB strategy review concludes that “Headline inflation rates have become more synchronized globally, largely because commodity prices are increasingly determined by global factors.” (ECB, 2021).

There are variants or nuances in this position. A materialist position held that inflation reduction came about because of the globalization – in trade and migration – generating consistent downward pressure on wages. The alternative, an ideas-focused or neo-Weberian analysis, would see the outcome as the product of an intellectual shift, the victory of an idea, the so-called “neoliberalism” that was then spread around the world as the Washington Consensus. Both camps agreed that global influ-

ences were dominating both monetary policy and monetary behavioral outcomes.

Neither interpretation was widely shared, at least until recently when there was widespread bewilderment about why the post-Global Financial Crisis orientation of monetary policy had persistently and singularly been unable to raise inflationary expectations. Both the suggestion that global forces or global policy ideas were pushing disinflation encountered a substantial pushback. Laurence Ball, who restated the mainstream position, usefully broke the discussion into three questions: “Has globalization reduced the long-run level of inflation? Has it affected the structure of inflation dynamics, as summarized by the Phillips curve? Has it contributed substantial negative shocks to the inflation process?” and then provided a pithy response: “a short summary of the answers is no, no, and no.” (Ball, 2006)

This debate about the causes of disinflation was fundamentally truncated because it does not adequately take into account the historical periodization, in particular the relationship of inflation and globalization at the *outset* of the

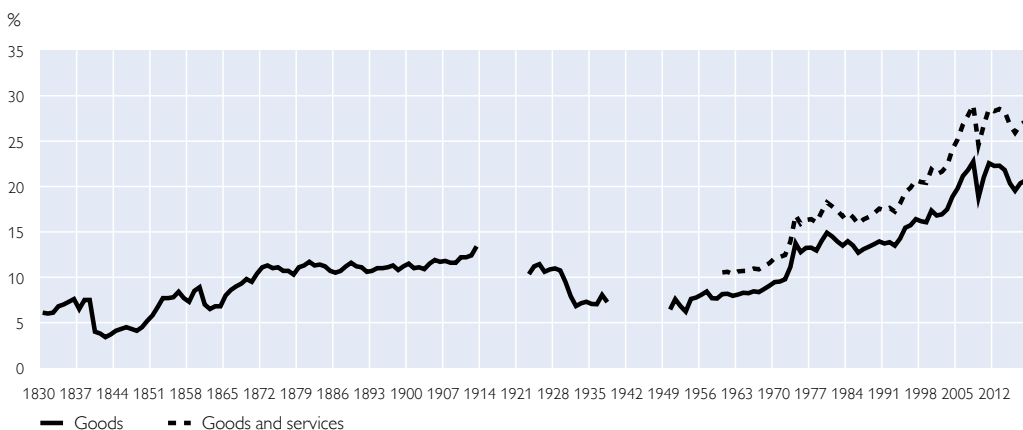
new globalization process, and hence does not think about the social and intellectual history that might chart the transmutation of an intense concern with prices into a broad psychological and political shift.

The modern assessments depended on the assumption that recent globalization (defined as the increased flow of capital, goods and people) only really came in the 1990s or the 2000s, and a date for the beginning was often set as China’s entry into the World Trade Organization (WTO) in 2001. This was after a transition to a monetary policy regime that revolved around a low inflation target in most industrial countries. But, as Ball correctly noted, the major surge of world trade as a share of output occurred in the 1970s, in a high-inflation era. Such a redating of the globalization story, however, would lead to a different set of answers to the Ball questions: yes, yes, yes.

Modern globalization appears as two, or perhaps two and a half, distinct episodes (chart 2: Ratio of global exports to GDP). What is usually thought of as the first age of modern globalization began in the middle of the 19<sup>th</sup> century. It was interrupted by the First World

Chart 2

### Ratio of global exports to GDP



Source: Catão and Obstfeld, 2019.

War, after which there was a desperate attempt to revive globalization – with a more robust institutional framework – in a “half episode” that quickly failed with the Great Depression or what I have called “The End of Globalization” (James, 2001). And then a new globalization took off in the 1970s.

The antithesis of globalization can be found in periods of conflict and war, when economic advantage appears as a zero-sum game, and a fiscally driven inflation drives up prices. This was the background of the great 16<sup>th</sup> century price inflation, dominated by the clash of Habsburg and Valois, but also of the great wars of the mid-19<sup>th</sup> century, Crimea and then the wars of German, Italian and US unification. Twentieth century world wars interrupted globalization. Recent commentators like to redescribe interwar catastrophe as the “global thirties”, but it should really be clearly stated that it was violence, war and deglobalization that in that decade became globally compelling political phenomena (Patel, 2016; Matera and Kent, 2017; Link, 2020). There are legitimate fears that Putin’s onslaught on Ukraine might produce another such catastrophic interlude of conflict and deglobalization.

Globalization then operated to reduce inflation levels: both in the 19<sup>th</sup> century, when there is a stark contrast between the third quarter of the century, with dramatic price surges during business cycle upturns, and the generally deflationary and subdued experience of the period from 1873 to 1896; and in the late 20<sup>th</sup> century. It profoundly but confusingly altered the Phillips curve dynamics of a trade-off between inflation and employment. The move to global markets in fact resulted in price pressures that constituted a substantial favorable or “positive” supply shock that generated disinflationary pressures.

History can illuminate the stages of the disinflationary process and its mechanisms. Both the mid-19<sup>th</sup> century and the late 20<sup>th</sup> century globalizations may be explained as technologically driven, and some of the most important productivity gains involved the cost of transport. It was the steam engine that drove both the opening up of continents (with railroads) and oceans (with steamships). It was the container that reduced the cost of transporting goods after the 1970s. But both innovations substantially predated the moment at which they were economically transformative: Matthew Boulton and James Watt were creating operational steam engines in the 1770s, and the Autocarrier, usually thought to be the first container ship, was launched in 1931. It required a specific set of circumstances to realize the transformative character of the innovations: That was the environment that price disruptions produced. Policy choices were involved: The removal of impediments to commerce, but also a consensus around a stable and internationally applicable monetary framework, whether the gold standard or a modern inflation targeting regime.

In each case the transformation, the beginning of the globalization push, was driven by a fear of scarcity, and its political consequences. The 1840s provided the initial spur to modern globalization. After the 1970s, a new globalization based on complex supply chains developed.

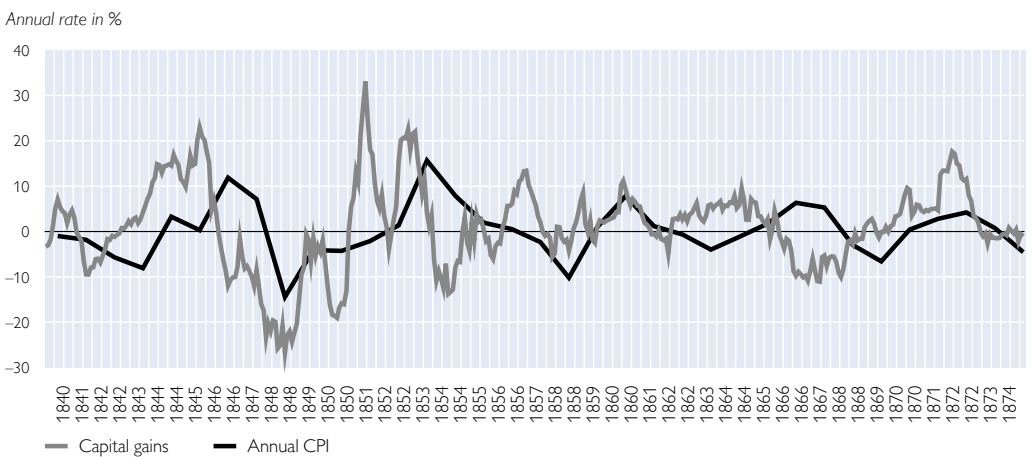
The mid-19<sup>th</sup> century upheavals began with a dramatic negative supply shock: weather-induced harvest failures all over Europe in the mid-1840s, supplemented by the effects of the potato blight, and then widespread epidemic disease, typhus and cholera. It led to political revolution throughout the continent. The longer term response in-

volved a dramatic transformation of politics and business. There was a revolution in government, when public authorities took on many more tasks concerned with managing the economy, including guiding the course of trade liberalization. Business was also revolutionized through new corporate forms, the limited liability joint stock company as well as universal banks that mobilized capital in innovative ways. The combination of new gold supplies and

banking innovation produced monetary and price surges that were closely correlated with the business cycle, with dramatic spikes in 1852–53, 1860–61, and 1866 that were also reflected in asset prices (chart 3: UK asset prices and CPI 1840–1873, chart 4: CPI inflation 1840–1900). Higher prices drove investment and innovation, and thus laid the path for a way out of the scarcities and shortages of the mid-century.

Chart 3

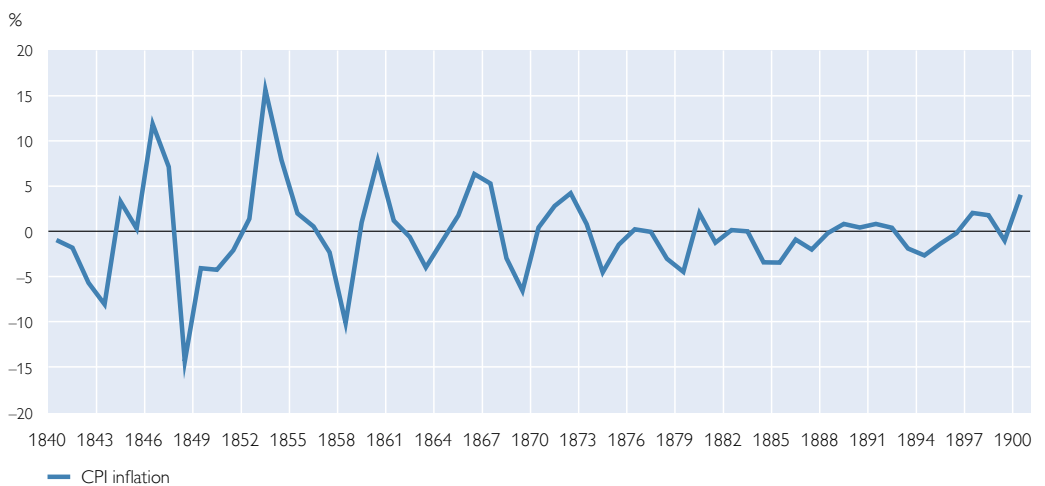
### Asset prices and CPI in UK 1840–1873



Source: Bank of England, Millennium of Macroeconomic Data; Campbell, Grossman and Turner, 2021.

Chart 4

### UK CPI inflation 1840–1900



Source: Bank of England, Millennium of Macroeconomic Data.



That inflationary experience in price surges in the 1850s and 1860s contrasts strikingly with the world after 1873, when price spikes (for instance in 1880) were extremely modest. Globalization then altered price variability. The new stability was additionally bolstered by the near universal move to the gold standard, as countries sought a credibility mechanism that would allow them to attract capital inflows, or to globalize further.

The dynamic was repeated a century later, again with a supply shortage and scarcities at the focus of attention. Everyone remembers the oil crisis and the “panic at the pumps” (Jacobs, 2016). But the defining economic parameters that bred 1970s pessimism and malaise lay domestically, in the combination of high inflation with high unemployment and low growth. The driver was a widespread belief in the capacity of economic growth to raise productivity, make more growth, and push down prices as a consequence of productivity gains. An influential model evolved by Nicholas Kaldor looked at the long-term relationship between technical progress and the rate of growth and derived a “technical progress function” (Kaldor, 1957). An increased manufacturing sector would lead to a self-sustaining virtuous cycle of higher rates of growth and hence also of higher wages. The influential economist Roy Harrod then drew the logical consequence that stronger demand growth might reduce inflation (Harrod, 1972). These optimistic expectations were severely disappointed.

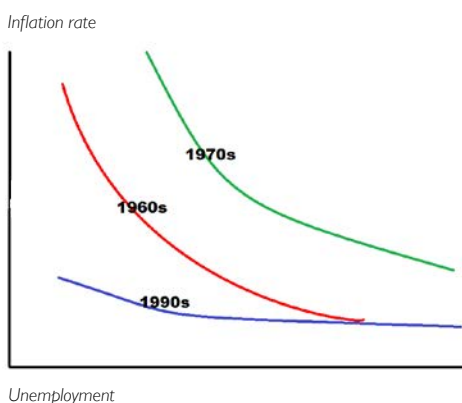
The position of the Phillips curve relating inflation and output shifted. In the 1970s, as nominal wage illusion faded, the curve shifted upward and to the right. After the 1980s, however, with output no longer determined in a purely national context, increased demand no

longer necessarily pushed prices up. The curve flattened and moved downward. In the longer term, however, some commentators would extrapolate the new logic with the claim that there was a natural rate of unemployment, consistent with any level of inflation, and thus that the curve was in fact *vertical*. Central bankers spent long hours in mystification at the apparent flatness of the curve and the difficulty in estimating it. The confusion between short-term reactions and long-term theories led to the conclusion that the curve was dead: Either the flat position or the vertical versions simply reflected rigor mortis (chart 5: Phillips curves). There was further uncertainty as calculations of a natural or non-accelerating rate of unemployment showed a steep fall in the 1990s, with the suggestion that technical shifts would alter the dynamics of the labor market.

The new Phillips relationship was also a consequence of an under-appreciated consequence of transformative technical and economic change. New technologies allowed new production, as well as a shift to services in rich countries. But the labor for the new activities was not instantly available, and a substantial transfer of people from one area to another

Chart 5

### Phillips curves



Source: Author's drawing.

was incompatible with the policy emphasis on full employment. The problem was most acutely diagnosed, not in the case of western market economies, but in the world of Soviet planning, where the great Hungarian economist János Kornai analyzed how there could be no real economic system from which both “excess demand and excess supply had been eliminated: ‘Optimization,’” he wrote, “is not possible: we want full employment, but we do not want labor shortage. They are joint products, which, it seems, necessarily appear together.” (Kornai, 1980).

In fact, attempts to represent the Phillips curve looked more and more confusing. This might have been because the key underpinning of the verticality thesis, the constancy of the natural (or non-accelerating inflation) rate of unemployment, looked ever more problematic, with estimates varying between 5% and 2%. It is not surprising that particular microeconomic factors might play a role: What was the labor force trained to do? Italian clothing and textile workers thus were famously much more vulnerable to a globalization impact than workers in precision engineering trades. The same globalization effect might also explain why calculations of any output gap are so unreliable, and so prone to later revision (Orphanides and van Norden, 2002).

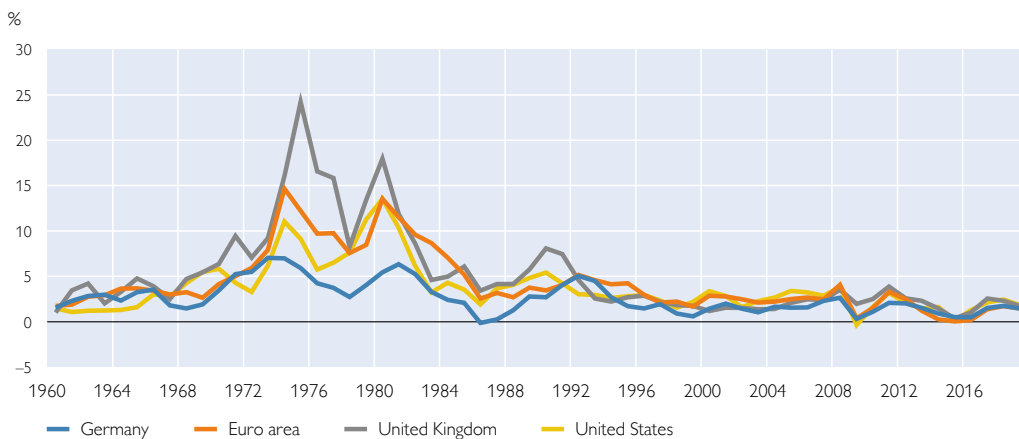
The most dramatic impact on inflation expectations of the 1970s came from commodity prices, and in particular from the two oil shocks of 1973–74 and 1979. Negative supply shocks may just be temporary, in which case we may expect a short surge in inflation, then a deflationary interlude, and a relative return to normalcy or the pre-shock pattern of price behavior. They may be persistent, with expectations that the price of the scarce good will be

permanently high: Modeling of that scenario suggests that the long-term effect, after an initial spike, on underlying or core inflation would be a small augmentation. Finally, the shock may be the beginning of a long-term continued upward movement in the price of the scarce good, and in this case the modeling would suggest that the core rates of inflation continue to rise (Blinder and Rudd, 2013). The shock of the early 1970s was a response to strong global demand and can thus be considered initially as a strong globalization headwind.

The higher oil price might be regarded as the imposition of a new (wealth and income-reducing) tax; and thus the industrial countries mostly decided not to adjust immediately (Kilian, 2009). The immediate response in most countries was to accommodate the shock by using government spending as a shock absorber, as well as pushing expansive monetary policy. The fiscal and monetary accommodations pushed up inflation, which rose to 11.0% in the United States in 1974 (and then, after a second oil shock, to 12.0% in 1980), and to higher levels in some other countries: in the UK, CPI inflation in 1975 was 24.2%, and in 1980 18.0% (see chart 6: Comparative CPI inflation 1960–2022). Countries then employed differing strategies to reduce their fuel imports: France pushed nuclear energy as an alternative to carbon, the UK developed oil and gas fields in the North Sea, Germans and Japanese accepted greater fuel economy: The United States alone thought it did not need to act until a fuel economy campaign was belatedly launched in the late 1970s.

It appears paradoxical that the oil shock in the end created more globalization rather than a turn to economic nationalism. One mechanism that

Chart 6

**CPI inflation 1960–2020**

Source: World Bank Data.

drove the new linkages was a financial revolution, which transferred the large surpluses accumulated by oil producers into lendable funds in big international banks. The development of international capital markets, offshore and thus largely free of direct government control, was the major financial innovation of the period. The availability of money made resources available for governments all over the world that wanted to push development and growth, and international demand thus surged. The alternative strategies, such as Labour's siege economy, now looked like a mechanism that would cut off access to markets and prosperity.

All these expansions, liberalizations and openings were launched with relatively high levels of inflation, produced by expansionary fiscal and monetary policies as well as by financial innovation. Inflation may indeed initially have made adjustments in production easier, because relative prices could move easily without provoking fears of price and wage cuts, at least as long as some degree of nominal wage illusion remained. Once that wage illusion disappeared, inflation only generated confusion about

prices and uncertainty about investment for the future. Fighting inflation then soon came to be the major policy issue for the industrial world: a test of competence and of the capacity of governments to manage the benefits of openness.

Higher demand was then met by supplies produced by a global labor pool (that constrained labor bargaining power). Interest rates were then at the same time pushed down by a global capital pool. Responding to these two phenomena raised new questions about how policy should be formulated.

**The choice of inflation**

Does scarcity inevitably produce inflation? Of course not. It dramatically changes relative prices, but not the overall price level. But then inflation is repurposed as a policy solution, an attractive way of meeting the challenges of scarcity. It is true that inflation is "always and everywhere a monetary phenomenon," but we need to explain more (Friedman, 1968). Just as good policy is not the sole driver of good inflation performance, higher inflation cannot simply be ascribed to bad policy or

flawed economic paradigms. The mid-19<sup>th</sup> century inflation was in part a consequence of the expansion of gold production, above all from California; but it was also driven by financial innovation. Inflationary surges went along with business cycle upswings and asset price surges.

The great inflations of the 20<sup>th</sup> century, occurring also at moments of scarcity in and after the First World War, as well as in the 1970s, in the aftermath of a long economic boom that drove up commodity prices, can be explained easily in terms of a modern theory of *fiscal dominance*. The budget of the state is so committed to a large amount of debt service that it compels the monetary authority to monetize debt and drive down interest rates. That logic is most apparent in cases of major military conflict, when monetary policy becomes subordinated to overriding national priorities. It is also in evidence after the substantial expansion of government debt in response to the 2008 Global Financial Crisis, which has set a trap from which escape is difficult. But there is also a parallel operation which is sometimes termed *financial dominance*, where the financial sector – or the business community – has amassed so much debt that monetary authorities are compelled to monetize in order to prevent an avalanche of corporate bankruptcy and failure. This additional driver of inflation was especially a phenomenon of the recent wave of financialized globalization, and was exemplified by the Greenspan put: the idea that the stock market provided a central guide for Fed policy.

There might then be a strong case to be made on causality: that inflation helped create a new policy environment. As the costs of inflation became clearer, and the policy choice politically costly, looking for ways of calming inflationary

pressures became more attractive, but the disinflationary cure was inevitably temporarily uncomfortable. Milton Friedman put the point like this: “Inflation is just like alcoholism. In both cases when you start drinking or when you start printing too much money, the good effects come first. That is why, in both cases, there is a strong temptation to overdo it to drink too much or to print too much money.” (Friedman, 1980). How to wean the patient off the bottle? Would a change in what the monetary policy doctor prescribed suffice? Globalization – and that includes looking at the experience of others – came like a cold water bath as a way of tackling a bad hangover.

There is thus a need to think of much broader forces that make for particular inflation outcomes. It may be that the best explanations lie in the concept of a social pact that requires inflation, in that inflationary outcomes are initially seen as a cheap or convenient way of defusing social tension: generating or preserving employment in a politically fragile setting, as in Europe after the First World War, or in a global crisis of democracy and legitimacy in the 1970s. Perhaps it is then appropriate to think of a third explanatory category of *social dominance* (Hirsch and Goldthorpe, 1978).

### Alternative tasks

Deglobalization may be an initially appealing way of responding to supply shocks. But it raises costs, and cannot really solve the underlying problems. Just now, for very particular reasons, the philosophy of trading as much as you can, and with as many peoples as you can, looks hopelessly naïve. In an economy impacted by pandemic-induced scarcities, it looked suddenly attractive to use control of raw material supplies as a way of applying political pressure.

The Soviet Union had bound central and eastern Europe by cheap energy in the 1970s and 1980s; Russia took on that tradition as a way of tying in European states. But the model is contagious: Algeria has raised the threat of cutting Spain off from its gas supplies as a way of punishing Morocco and supporting the Sahrawi independence movement in the Western Sahara.

The vulnerability that energy supplies may create was highlighted by the coincidence of the finishing of the Nord Stream 2 gas pipeline from Russia to Germany and the Russian invasion of February 24, 2022. It is easy to heap opprobrium on the German drivers of the project, especially on the unrepentant former chancellor Gerhard Schroeder, who defiantly refuses a *mea culpa* and still is proud of his role as a board member of Gazprom and a potential mediator between Russia and the West. But the mistake lay not in the building of the pipeline, but rather with the other energy decisions that made for a one-sided dependence: the abrupt exit from atomic energy after the Fukushima catastrophe, the turn to wind and sun sources of renewable energy that could not supply consistently and hence needed to be supplemented by imported gas, and the failure to construct liquefied natural gas (LNG) terminals to import liquified natural gas from the US or the Middle East. Any supply thinking needs to focus on resilience. Dependence on one source makes for vulnerability.

Here lies the key: Trade may indeed be pacifying, commerce might create better relations, but for that course to succeed, a multilateral system with multiple sources is much more effective than the cultivation of bilateral relations. At the beginning of a European wave of revolutions in 1848, at a moment of acute ideological polarization, the greatest 19<sup>th</sup> century British foreign

policy thinker and statesman, Lord Palmerston, formulated the philosophy that his country had no eternal allies and no perpetual enemies, but rather eternal and perpetual interests.

This maxim is just as surely true in the 21<sup>st</sup> century as it was in the 19<sup>th</sup>. It is impossible to predict quite how the domestic politics of countries will develop, and how such developments might affect their trade relations. We might think more about the double shock of 2016, when the countries that had been the leading lights of multilateralism, the UK and the US, turned away with Brexit and Trump. Who can guarantee that there may not be a new Trumpist administration in 2024? Or who can be sure that Russia will not embark on a profound political reorientation, even a democratization, in the wake of a disastrously mishandled war that was brutally destructive of Russian as well as Ukrainian lives?

Trying to identify friends will always be a deeply problematical exercise. There is dismay in Washington and Europe about the long list of countries that did not support censure motions in the United Nations General Assembly. But it would be unwise, and costly, to let those votes influence the future direction of trade. Trading with the enemy legislation makes sense in all-out conflict. In dealing with common problems – diseases, carbon dioxide emissions that move across borders and between continents – there are however no enemies, but necessary partners. The same is true for the global threat of hunger that has been the terrifying outcome of Russia's actions. Friend-shoring, as recently advocated by US Treasury Secretary Janet Yellen, will not feed people: And it is likely to make many, many enemies (Yellen, 2022).

In the new environment, some of the old arguments around central bank

independence (CBI) will appear again. In the aftermath of the First World War, central banks that continued a monetary accommodation of fiscal dominance had justified their policy as a patriotic necessity. Central banks fundamentally controlled the cost of government debt, and hence they were subject to irresistible pressure. The language of patriotism was also enunciated as the Truman administration sought to persuade the Fed not to push too hard against an inflationary surge in the midst of the Korean war. When Truman received the entire Federal Open Market Committee (FOMC) he started with an amazingly explicit explanation of US foreign policy. He “emphasized that we must combat Communist influence on many fronts. He said one way to do this is to maintain confidence in the Government’s credit and in Government securities. He felt that if people lose confidence in Government securities all we hope to gain from our military mobilization, and war if need be, might be jeopardized.” (Eccles, 1951). It is striking that former chairman of the Fed Marriner Eccles, the major dissident who was now very hawkish on inflation, also laid out an alternative view of foreign policy: He did not like the Korean war, and worried that the US “was stumbling into an uncharted Asian morass without reckoning the costs.” (Hyman, 1976, p. 339).

What is the modern equivalent of that argument about national security? In some countries the language of the hyperinflation German central banker Rudolf von Havenstein or of Truman about defense and national interest appears. That is dramatically evident in the statements of Turkey’s president Erdogan about the high interest rates as “the mother of all evil,” orchestrated by “Turkey’s enemies, who are hiding behind currency rate speculators, the interest

rate lobby, or credit rating agencies.” The push to control interest rates – the motivation of Havenstein or Truman – is evident in the dismissal of central bank governor Naci Agbal, after he put interest rates up by 2%.

Before February 24, 2022, European countries and European politicians would not have argued in Erdogan terminology about national needs. But they do point to a further set of policy desiderata – the 21<sup>st</sup> century equivalent to overriding national interest – in making the case that the existential threat of climate change requires a new orientation of the central banking framework, and a new element of fiscal-monetary interaction. The ECB has been especially innovative in this regard, but also runs into the difficulty that some of the bonds taken in the asset purchasing program (from airlines and other carbon producers) do not look climate neutral. On the other side of the Atlantic, the Fed is increasingly thinking about policy measures that can counteract racial inequalities. And then, after February 2022, central banks are being harnessed into a sanctions regime that is pushing an incipient deglobalization. In all these issues, the priorities of central banks in tackling pressing policy questions cannot be isolated from more general orientations of government policy.

The wider activity of central banks, the expansiveness of their mission, points in one direction: They need to be more firmly embedded in the overall institutional framework of a democratically elected government. With such ambitious tasks, with broad and potentially unknown and unknowable political and social implications, they cannot be left as a delegated operation focusing on one narrow goal, monetary stability. And yet there is a social need for monetary stability too: the central function of the new understanding of central banks.

Money may become divisive. Some conservatives are beginning to argue that blockchain offers a more stable – or deflationary – monetary order. The Republican challenger Josh Mandel in Ohio for instance defines his position as “pro-God, pro-family, pro-Bitcoin” (Independent, 2021). It is possible to imagine extended “optimal digital currency areas,” where like-minded people with similar consumption and behavioral patterns interact with money as a binding common language, independent of state frontiers. This might be a benign future of self-realization; but it is also possible to see it as the promoter or accelerator of a new sectarianism and new divisions. Indeed, the American right is starting to think of an alternative metaverse, in which there are separate dating networks (“The Right Stuff” funded by Peter Thiel because “Conservatives deserve an easy way to connect.” Axios, 2022; separate communications platforms, with the video-sharing Rumble replacing YouTube, and the messaging services Parler and Gab instead of Twitter); and finally money, where a blockchain MAGAcoin has been launched as a stable, indeed deflationary, option for the MAGA community, with the intention of also using the resources generated to finance MAGA activities. And there will be left-wing variants: Indeed existing blockchain systems have different political flavors, with Ethereum and XRP more to the left than the more conservative/libertarian bitcoin. So will politically motivated subunits with cross-border ties choose different inflation rates, in the way that countries’ monetary regimes responded differently to the challenges of the 1970s. There is then a risk of political societies breaking apart, divided by different moneys, with fragmented subunits measuring their strength by their relative exchange rates.

There is thus a strong argument for providing a standardized public currency that does not depend on credit: We could think of it as based on tokens. Existing notes and coins do this, but they cannot be used in as many transactions or as conveniently as bank transfers. This is thus the case for the provision of central bank digital currencies (CBDC), as laid out very clearly by Markus Brunnermeier and Jean-Pierre Landau (2022) in their report for the European Parliament.

Reflecting on the world in the aftermath of severe supply shocks – such as that of the 1840s, or the 1970s, or again in the scarcities induced first by COVID-19 and then by the Ukraine war – is liable to make for gloom, and to conclusions that the world is going backward or deglobalizing. There is an initial inclination to take protectionist measures. But this is exactly the moment when effective and credible policy is needed. A key test of the effectiveness and the credibility of central banks will thus derive, not from their ability to manage the credit-based economy, but also increasingly from the demand of citizens for stability and for an alternative to the yo-yo instability of the credit economy and the inherent divisiveness of private currencies: for a center of stability in a world of radically changing expectations.

Secondly, we might reflect that higher inflation is not necessarily a sign that globalization is on the retreat; it is rather an indication that more opening or more globalization is required. Perhaps I should even go further and make the observation that inflation is providing a signal that more rather than less globalization is on the way. But as in previous globalization surges, it will take a different form than the last globalization push.

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# What can stockouts tell us about inflation? Evidence from online micro data<sup>1</sup>

## The issue

Rising inflation in 2021 spurred a lively debate on its causes. COVID-related supply disruptions and cost pressures are often mentioned by policymakers and economists as playing a role, but little is known empirically about their actual impact on prices. The rich variation of prices and shortages during the pandemic provides a good opportunity to analyze their mutual relationship.

## Data

In this paper, we provide a direct high-frequency measure of consumer product shortages during the pandemic. The measure captures product unavailability in the microdata collected on a daily basis from the websites of 70 large retailers in seven countries – the United States, Canada, China, France, Germany, Japan, and Spain – from November 1, 2019 to July 26, 2022. The dataset spans a wide range of consumer goods, including food and beverages, household, health, electronics and personal care products, covering between 62% and 80% of the goods consumption weights in the consumer price index (CPI) baskets of these countries. The dataset contains prices for almost two million products, allowing us to evaluate the rich time and cross-section details to assess the inflationary effects of shortages.

## Stockout dynamics

There are three distinct patterns of stockout behavior that are common across most sectors and countries

during this period. First, there was a widespread increase in shortages early in the pandemic affecting nearly all categories of consumer goods. In the United States, in particular, our aggregate measure of stockouts using CPI category weights rose from a pre-pandemic level of around 10% in 2019 to over 40% in May 2020. Initially, the stockouts impacted health and personal care goods, but quickly spread to other categories, with increases ranging from 23 percentage points for “furnishings and household” goods and over 60 percentage points for “food and beverages.” The level of aggregate US stockouts recovered gradually over time and by January 2022 they were about 15 percentage points above their pre-pandemic levels. Other countries exhibit similar stockout dynamics, but the US had the most persistent stockouts.

Second, the composition of shortages changed significantly over time. Temporary stockouts, which are more visible to consumers because they are flagged by retailers with an out-of-stock indicator, rose sharply in most sectors and countries early on and then recovered rather quickly. By the end of 2020, they had fallen below their pre-pandemic levels for most countries in our sample. By contrast, permanent stockouts – measured by net discontinued products – remained elevated in some countries throughout the pandemic. In the US, they were still at half their peak levels by January 2022.

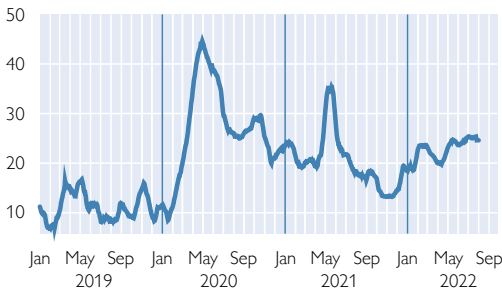
<sup>1</sup> See Cavallo and Kryvtsov (2021). The updated paper is available on the authors' websites. Alberto Cavallo is a shareholder of PriceStats LLC, the private company that provided proprietary data used in this paper without any requirements to review the findings. The views expressed here are ours, and they do not necessarily reflect the views of the Bank of Canada.

Chart 1

### Stockouts in the United States, 2019–2022

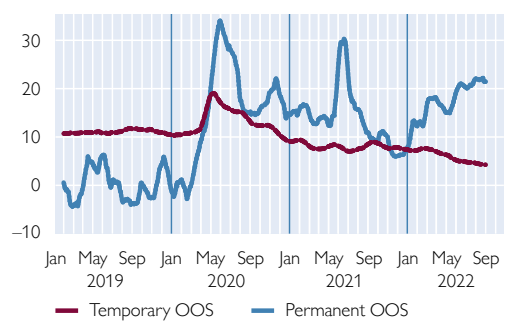
#### (a) All stockouts

Percentage points, 30-day moving average



#### (b) Temporary and permanent stockouts

Percentage points, 30-day moving average



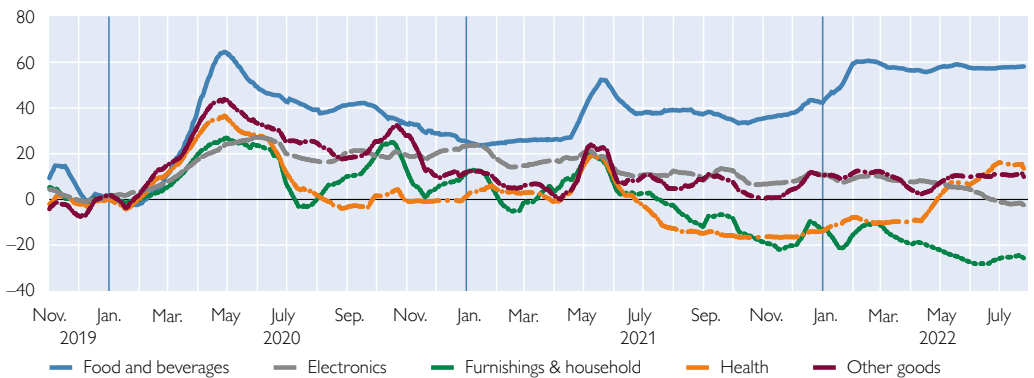
Note: OOS - out-of-stock.

Source: Cavallo and Kryvtsov (2021). The updated paper is available on the authors' websites.

Chart 2

### All stockouts in US sectors

Percentage points, 30-day moving average

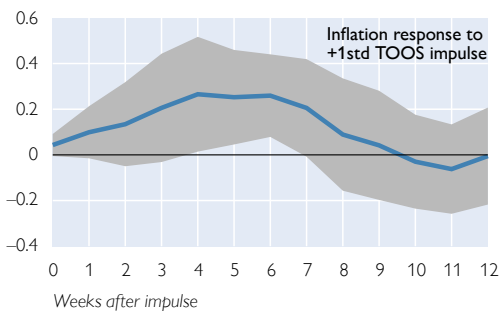


Source: Cavallo and Kryvtsov (2021). The updated paper is available on the authors' websites.

Chart 3

### Responses to a stockout shock in a three-digit sector in seven countries

Inflation response, annual percentage points



Source: Cavallo and Kryvtsov (2021). The updated paper is available on the authors' websites.

Note: std – standard; TOOS – temporary stockout.

Third, stockouts became increasingly concentrated in fewer product categories over time. In particular, in the United States stockouts remained persistently high for the "food and beverages" category, but returned to pre-pandemic levels in other major categories.

### Stockouts and inflation

Next, we show that these product shortages were associated with rising prices in most sectors and countries. The magnitude of the dynamic inflationary effect of shortages is statistically and economically significant. We estimate

that an unexpected doubling of the weekly temporary stockout rate from 10% to 20% brought about a 1.5 percentage-point increase in the annualized inflation rate in a three-digit sector. The inflation response takes about a month to reach its peak and lasts approximately three months.

### International trade and stockouts

To investigate whether the inflationary effects are associated with global supply bottlenecks, we study the behavior of imported products and import-intensive sectors. First, using microdata from one large US retailer with country-of-origin information for all individual goods, we show that imported products experience both longer stockouts and higher inflation rates than domestically produced goods. After a temporary stockout, prices of domestically produced products quickly return to average levels, whereas prices of imported goods continue to rise for several weeks.

Second, when we compare sector responses to temporary stockout disturbances, import-intensive sectors experience larger and more persistent inflation, with roughly twice the impact of domestic goods after six weeks. Overall, this evidence suggests that costs associated with supply-chain disruptions during the pandemic led to significant

increases in both product shortages and price increases.

### Inventory costs, prices and stockouts

In the final part of the paper, we estimate the cost of replenishing inventories by explicitly accounting for the endogeneity of stockouts. The influence of inventories on prices is especially strong in recessions. Building on Kryvtsov and Midrigan (2013), we develop a model of joint dynamics of stockouts and prices in a sector facing exogenous demand and cost disturbances, and use it to derive an empirical specification for estimating the underlying costs. We then construct empirical responses of sector stockouts and inflation to the estimated cost shocks.

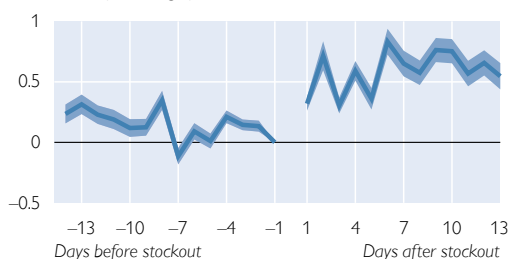
Our estimation results imply a statistically and economically significant link between costs, temporary stockouts and inflation. The estimated cost dynamics resemble those from observed stockout behaviors, validating the idea of using shortages for gauging the emergent cost pressures. Furthermore, accounting for the endogeneity of stockouts makes the estimated inflationary effects stronger immediately after the cost shock, but also less persistent. We also find that both inflation and stockouts are more responsive in trade-intensive

Chart 4

### Price levels before and after a stockout for a large US retailer

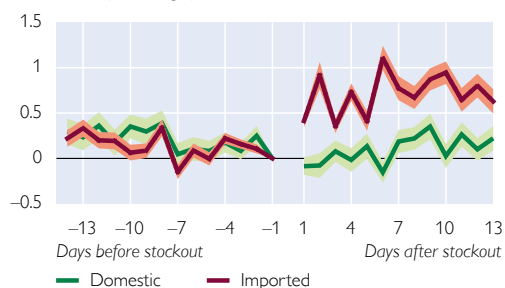
#### (a) All price changes

Price-relative, percentage points



#### (b) Domestic versus imported goods

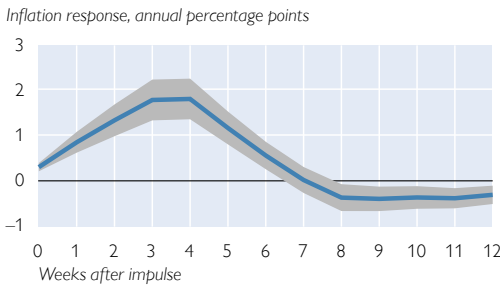
Price-relative, percentage points



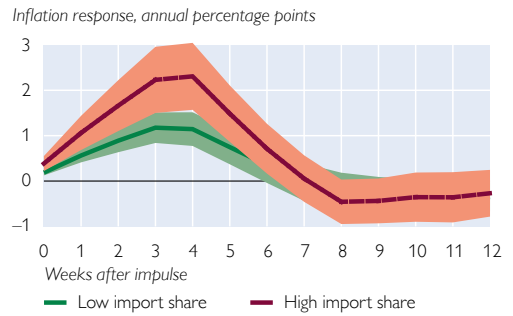
Source: Cavallo and Kryvtsov (2021). The updated paper is available on the authors' websites.

**Responses to real replacement cost shocks in three-digit sectors, in seven countries**

**Inflation response to +1 standard deviation real cost impulse (TOOS)**



**Inflation response to +1 standard deviation real cost impulse (TOOS)**



Note: TOOS – temporary stockouts.

Source: Cavallo and Kryvtsov (2021). The updated paper is available on the authors' websites.

sectors, suggesting that retailers more exposed to international trade experienced higher cost pressures during the pandemic.

**Conclusions**

Product shortages likely reflect emergent cost pressures due, in part, to supply bottlenecks. Unexpected shortages are quickly followed by inflation. During a protracted event, such as a global health pandemic, the shortages are temporary at first but gradually become more permanent in nature and increasingly

concentrated in some sectors. Persistently high inflation rates in these sectors can be explained by a series of adverse cost shocks, for example, due to recurring waves of virus infections. As cost pressures dissipate, the inflation outlook will increasingly depend on other factors, such as the effect of the fiscal stimulus, the adjustment of inflation expectations, geopolitical shocks and the diffusion of cost pressures via domestic and international production networks.

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**Kryvtsov, O. and V. Midrigan. 2013.** Inventories, Markups, and Real Rigidities in Menu Cost Models. *Review of Economic Studies*, 80(1). 249–276.



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<sup>1</sup> Based on contributions by Lukas Henkel, Bruno Fagandini, Bernhard Goldhammer, Teresa Messner, Fabio Rumler, Pawel Macias, Damian Stelmasiak and Karol Szafranek



# What micro price data teach us about the inflation process: web-scraping in PRISMA

*PRISMA (Price-setting Microdata Analysis Network) is a research network set up by the European System of Central Banks. It was established to deepen the understanding of price-setting behavior and inflation dynamics in the EU, with a view to gaining new insights into this key element of monetary policy transmission. It collects and studies various kinds of microdata: Official data underlying official price indices (CPI and PPI), scanner data and online prices. These sources are very complementary, each has advantages and disadvantages.*<sup>2</sup>

*Online data offer advantages over standard statistical series. One of the advantages is that they are available at high frequency: Typically daily, but in principle prices can be scraped also intradaily, for example to study dynamic pricing. Online data are also timely: Yesterday's data are available for analysis today. They are precise, as they report the price of a given product rather than unit values as in scanner data. In addition, online data also include metadata (e.g. if a price is discounted) as well as product and shop characteristics and have large coverage for a given shop (prices for all products available on a given website can be collected).*

*However, online data also have disadvantages. One of them is that they are not always representative. Some online shops refer to a specific zip code, and dynamic pricing makes it possible to even tailor the price to a specific customer or category of customers, e.g. those accessing the shop from specific kinds of mobile devices. This is not only a problem with online price data: Big data in general are not collected according to the principles of statistical sampling used in surveys so they cannot*

*support inferential statements on the reference population. The ad-hoc nature of their collection can induce various biases. Selection bias may result from the self-selection of retailers that are present online, e.g. in the case of food, large distributors will be sampled but corner shops will not. The choices the researcher makes when deciding which data to web-scrape can also induce biases. Furthermore, not all products are sold online. Another disadvantage of online data is the effort needed to harmonize the collected data. The information contained on each website is non-homogeneous (each website contains different information, and when the scraping is done in "bulk", the products must be classified and mapped to a common classification system). The large quantity of information makes these data richer, also in terms of information that can be used for classification, but also challenging to manage.*

*Web-scraped data is far from a few clicks away: Scraping itself has become largely a commodity service, but analyzing these data involves a substantial investment in pre-processing. As a first step, conceptual definitions are necessary, i.e. a harmonized data model has to be created and meaningful aggregation rules have to be developed. Then a pipeline for collecting, validating and storing the data and metadata must be established, together with a process and code for monitoring the daily data flow in the most automated way possible.*

*An important part of the data pipeline is the classification to a common classification system (European Classification of Individual Consumption according to Purpose – ECOICOP). This has an analytical aspect, which involves developing artificial*

<sup>2</sup> For a detailed description and links to PRISMA research output see [https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher\\_prisma.de.html](https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_prisma.de.html)

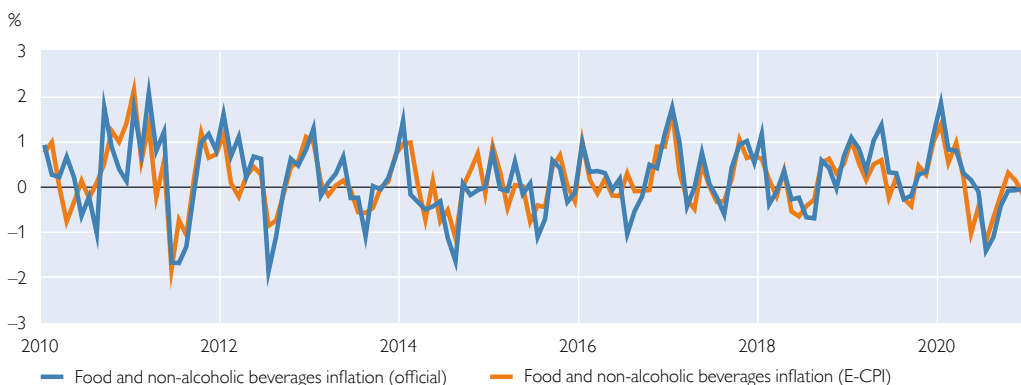
intelligence (AI) classifiers that can handle multilingual information. For this purpose, resources are also needed to manually classify a training sample for each language. In addition to the scientific aspect of developing multilingual classifiers, such as the method proposed by Lehman et al. (2020), there are the machine learning operations (MLOPs) aspects of continuously developing,

monitoring, maintaining and deploying the classifiers.

Once we have put the data in a structured form based on the appropriate data model, how can we use them? Web-scraped data have been used for *research on price-setting* (Cavallo, 2018), on *nowcasting* (see Powell et al., 2018; Macias et al., 2022) and to investigate aspects of *inflation* measurement (see

Chart 1

**Comparison of official CPI and online prices (based on official product selection and aggregation, month-on-month %)**



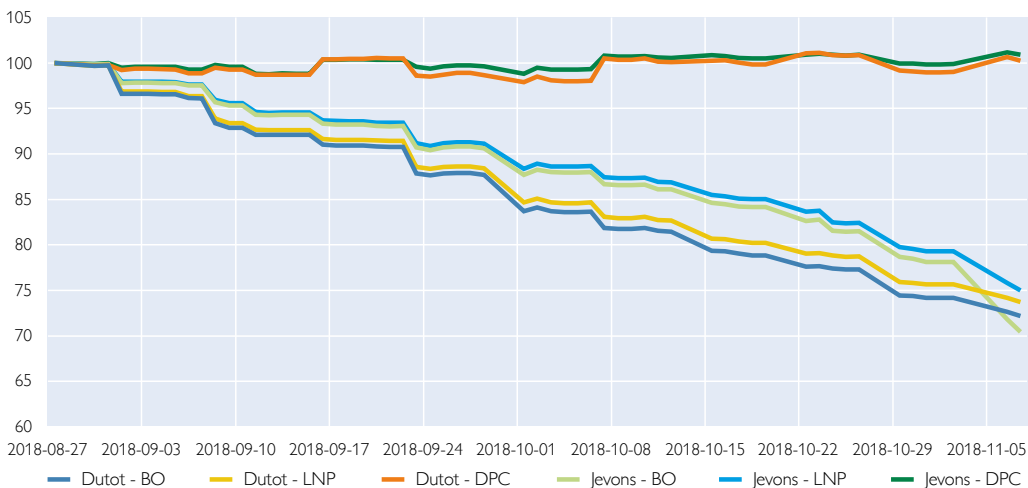
Source: Macias, Stelmasiak and Szafranek (2022).

Note: E-CPI refers to the CPI compiled using online price data, as described by Macias et al. (2022).

Chart 2

**Test calculations for different quality adjustment methods**

Index, 08/27/2018 = 100



Source: Goldhammer, Henkel and Osiewicz (2019).

Notes: DPC: direct price comparison; LNP: link-to-show-no price change; BO: bridged overlap.

e.g. Cavallo, 2013). These uses were very well explained and documented in Cavallo and Rigobon (2016).

The data can also be used to monitor inflation, both as regards understanding current macroeconomic developments and detecting behavioral changes. In particular, a change in the price-setting behavior of firms could be expected in times of large cost shocks as observed since 2021, and would give rise to a nonlinear response of consumer price inflation.

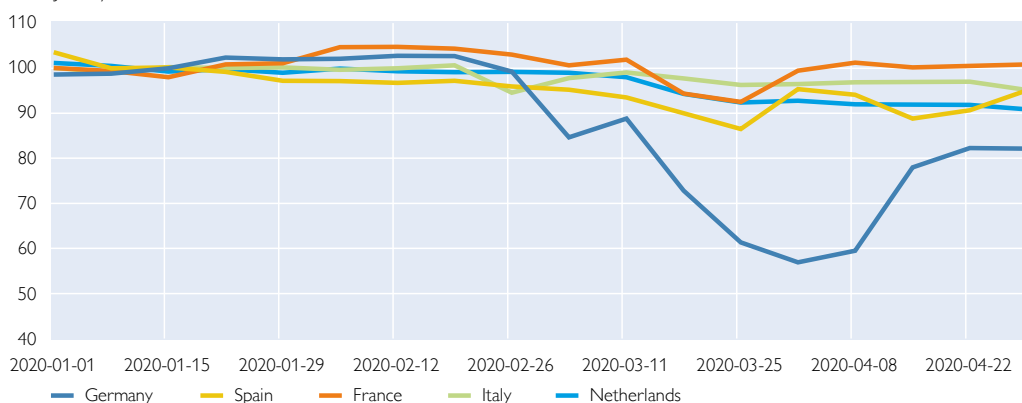
On nowcasting, in their 2022 paper entitled “Nowcasting food inflation with a massive amount of online prices,” PRISMA network members Macias, Stelmasiak and Szafranek found that using online data led to a substantial and statistically significant reduction in the nowcasting errors with respect to popular benchmarks, and that having a large volume of data helps to improve performance but a lot of work must go into the ECOICOP classification, the

Chart 3

### Number of distinct products available online by country and annual percentage change in the share of products offered at a discount

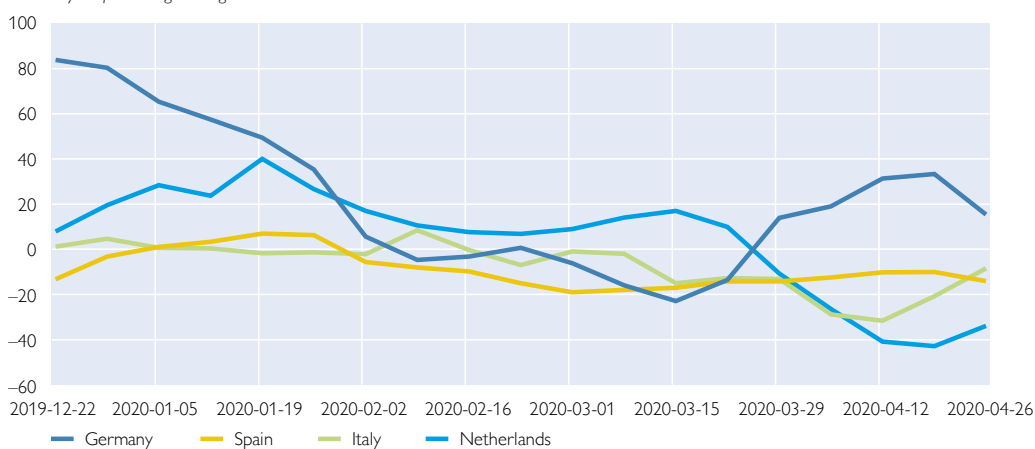
#### a) Number of distinct products available online

Index, January 2020 = 100



#### b) Change in share of products offered at a discount

Year-on-year percentage change



Source: PriceStats, web-scraped price data.

Notes: Reproduced from ECB, Economic Bulletin, Issue 1/2021. Microdata on online prices provided by PriceStats for one online supermarket per country. Panel a shows a weekly index of the number of products available online by country, computed as the ratio of the weekly median of the number of distinct products to the median number of products in January 2020. Panel b shows the five-week moving average of the year-on-year percentage change in the weekly median of the share of products offered at a discount. France is excluded from the analysis of temporary discounts, as no information on temporary discounts was available from the French online supermarket. Latest observations: April 30, 2020.

choice of products and the precise application of the official CPI methodology (see chart 1). They also found that during 2020 the accuracy of their baseline model increased with respect to the benchmark.

On inflation measurement, Goldhammer, Henkel and Osiewicz in their 2019 study “Bias related to the Bridged-overlap- and Link-to-Show-No-Price-Change Method” looked at the implications of using one of three implicit quality adjustment methods in the event of product replacements. They found that disregarding price changes at the time of replacement can lead to a downward drift in a price index. This points to the paramount importance of checking the assumptions underlying each method.

Web-scraped data have also been used to monitor inflation in real time, looking at special events such as the temporary VAT change in Germany, the stock-outs during the early stages of the COVID pandemic (see chart 3), and recently the

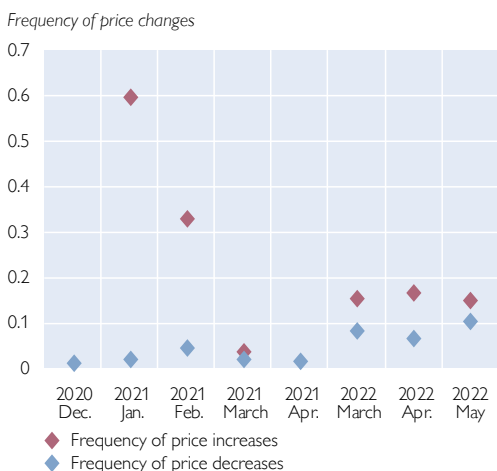
price-setting behavior in periods of low and high inflation.

Using online data to look at the frequency and size of price changes by looking at different shops highlights an apparent change of behavior from 2021 to 2022 in terms of the frequency of price changes (see chart 4). Understanding what could drive this heterogeneity, for example in terms of market power, is a central question in understanding inflation dynamics.

This is where the complementarity between online and scanner data shines: While online data are very timely and can point to interesting facts, scanner data are usually available with a lag of years but they contain much richer information that can help us to study heterogeneity in pricing behavior more deeply. For example, retailer scanner data contain information on the quantities sold in each shop of each kind of retailer, which allow to estimate price elasticities or to consider market shares.<sup>3</sup>

Chart 4

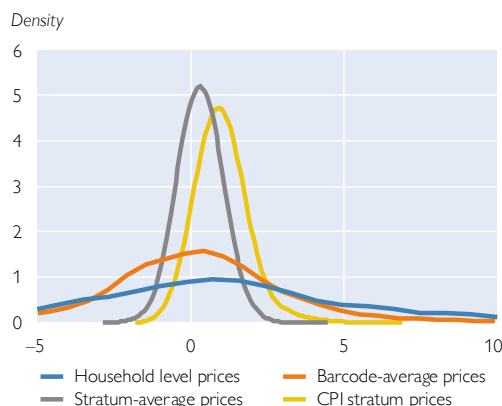
**Germany: frequency of price increases and decreases during VAT change and in 2022**



Source: ECB staff calculations based on daily online price data.  
Notes: Web-scraped data from a German online supermarket. Products on sale are excluded. Latest observation: May 16, 2022.

Chart 5

**Distribution of Austrian household-level inflation rates in a typical quarter (Q4 2018)**



Source: Messner and Rumler (2022).  
Notes: The chart compares the distributions of inflation rates using different sets of price information. Kernel density estimates using Epanechnikov kernel function with a bandwidth of 0.5 on 100 points. Data include 2,365 households with at least five matched barcodes between Q4 2017 and Q4 2018. The plot is truncated at -5% and 10%.

<sup>3</sup> For example, using IRi scanner data Dedola et al. (2022) find that the pass-through of corporate taxes to consumer prices varied by retailer type.

Household panels also contain information about who buys which products, shedding light on the heterogeneous behavior on the part of consumers and on the heterogeneity of experienced inflation across different demographics.

*Analyzing household scanner data helps to understand the heterogeneity of experienced inflation* across different demographics and countries. For example, in line with evidence for the United States (Kaplan and Schulhofer-Wohl, 2017, and Argente and Lee, 2021), PRISMA network members Messner and Rumler (2022) showed that Austrian households experience very heterogeneous inflation rates, as shown in chart 5.

The chart shows the distribution of inflation rates across households together (in blue) next to counterfactual distributions that would arise if all households paid the average prices according to various strata, or the average price paid for each product variety (identified by barcode). The latter approximates the

actual inter-household distribution best, showing that inflation heterogeneity results from differences in products bought and prices paid but cannot be fully explained by household characteristics, such as household income and size. In aggregate the study does find that lower-income households experience higher inflation rates when inflation is high, but the gap in inflation rates between lower- and higher-income households varies over time and is not always positive.

The conclusion of this short overview is that web-scraped data are very useful for monitoring inflation in real time, both for nowcasting and for observing changes in price-setting patterns. This in itself is very valuable, but online data also offer a laboratory to observe patterns and formulate research questions that can then be answered by other kinds of data, such as those contained in retailer or household scanner datasets.

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# What micro price data teach us about the inflation process: analyzing scanner data in PRISMA<sup>1, 2</sup>

Research conducted within the PRISMA research network draws on three types of micro price data: data underlying the official price indices (i.e. consumer price and producer price indices), scanner data and (web-scraped) online prices. This contribution discusses the role of scanner data in the analysis of price and inflation dynamics at the micro-level and presents some results from analyses based on scanner data.<sup>3</sup>

There are two main kinds of scanner data: retail scanner data (i.e. data of all products being scanned at the cashier's desks of supermarkets) supplied by the market research institute IRI and household scanner data (i.e. data of products bought and scanned by households) supplied by the market research companies GfK and Kantar. Each data type can be used to address different questions. They both cover only fast-moving consumer goods (FMCG), broadly speaking food, personal care and household convenience products, whose weight in the harmonized index of consumer prices (HICP) basket amounts to around 20%. For an overview of the main differences of the retail and household scanner data see table 1.

The retail scanner dataset available to PRISMA has a very high coverage of sales data of several supermarkets in four euro area countries: Germany, France, Italy and the Netherlands. It contains the revenue in euro and the units sold of about 400,000 to 800,000 products in 6,000 to 15,000 stores

(depending on the country) recorded on a weekly basis from 2013 to 2017. Stores in the dataset include supermarkets, discounters and drugstores/chemists. The dataset contains information on private label products and also the location of the store (identified by the two-digit ZIP code).

The household scanner dataset covers 16 countries over several years and contains information on the goods bought by households participating in the survey during regular shopping trips. As such, the dataset comprises information on prices paid and quantities bought by households, on the retailer where the products were bought, and most importantly, it contains information on household characteristics, such as the age of the household head, the size of the household, income and the location of the household's residence.<sup>4</sup> The sample coverage in terms of time, products and number of households varies across countries. The main advantage of such data is that they allow to examine actual prices paid and quantities of products purchased in relation to household characteristics. Given that shopping trips of households are infrequent and made at irregular intervals, time-aggregation is needed to calculate price changes of identical products and ultimately household-level inflation rates.

The unique properties of the scanner data with information on the price, quantity and on the precise product identifier (i.e. barcode) allows PRISMA

<sup>1</sup> Fabio Rumler (based on contributions to the Price-setting Microdata Analysis [PRISMA] Network)

<sup>2</sup> I would like to thank Teresa Messner (OeNB) for valuable feedback and input to this note.

<sup>3</sup> For a review of other data sources used in PRISMA, see Chiara Osbat's contribution.

<sup>4</sup> However, the availability of this demographic information is heterogenous across countries.

researchers to analyze a range of questions that are central in the literature on price-setting and inflation determination and thus relevant for monetary policy. The questions addressed include questions on inflation heterogeneity across households and countries, on consumer behavior, product substitution, differences between online and offline prices, the degree of state dependence in price-setting, the pass-through of shocks to consumer prices, etc. (see Kiss and Strasser, 2022; Messner and Rumler, 2022; Messner et al., 2022; Strasser and Wittekopf, 2022; Ampudia et al., 2022; Karadi et al., 2022; Dedola et al., 2022). The usefulness of these data will be demonstrated by two particular PRISMA projects in the remainder of this note; there is, however, a plethora of studies drawing on scanner data. For further fields of application, analyses and research projects please refer to the PRISMA report which will be published in the fall of 2022.

Despite covering only a small part of overall household consumption (FMCG), Messner and Rumler (2022)

show for Austria that inflation based on a price index calculated from these data is broadly correlated with the overall CPI and more closely correlated with the CPI for food and beverages (chart 1, left-hand panel).

Calculating inflation rates for each household in the panel, they document that households experience widely differing rates of inflation. Looking for household-specific determinants of this heterogeneity, they find that, overall, there appears to be little difference between income groups, with lower income groups facing only marginally higher inflation rates than higher income groups (chart 1, right-hand panel). While this finding is at odds with part of the existing literature on inflation heterogeneity using disaggregate CPI data, which documents a significantly negative relationship between income and inflation (see e.g. Fessler and Fritzer, 2013, for Austria), it is in line with studies also using household scanner data such as Kaplan and Schulhofer-Wohl (2017) for the US and Ampudia et al. (2022) for European countries.

Table 1

**Main differences of retail and household scanner data in PRISMA**

	Supermarket scanner data	Household scanner data
Data provider	IRi	GfK
Collection point	store	household
Frequency	weekly average quite regular	transaction infrequent
Period	2013–2017	2005–2018 (max.)
Future updates	yes, with delay	no
Number of markets	Germany, France, Netherlands, Italy	16 European countries
Region detail	two-digit zip	varies
Store coverage	participating chain	all
Product coverage	only FMCG	broader, dominated by FMCG
Barcodes	masked EANs/SKUs	EANs/SKUs
Quantities	yes	yes
Store characteristics	store ID, chain, type	chain only
Household characteristics	no	yes
Coupon use/ sales flag	no	no

Source: Author's compilation based on IRi and GfK data.

Note: EANs – European article numbers; SKUs – stock keeping units.

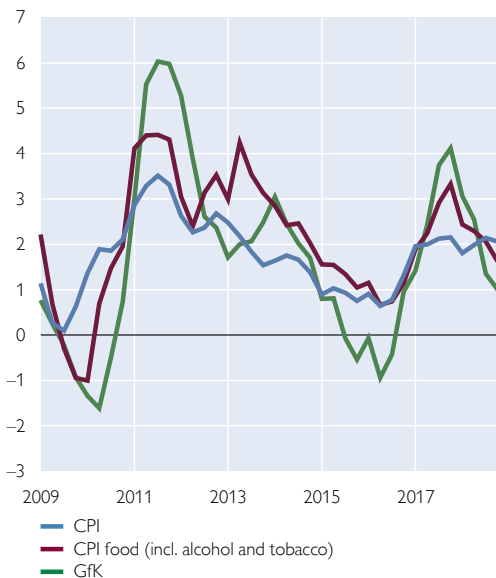


Chart 1

### Inflation rates in Austria based on household scanner data

#### Overall inflation rates

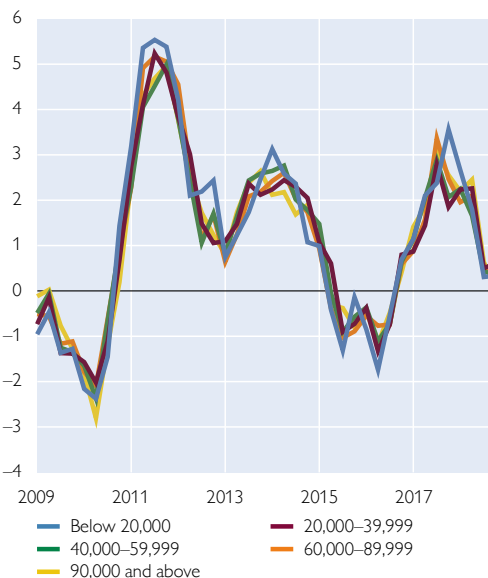
Year-on-year change in %



Source: Statistik Austria, GfK, author's calculations.

#### Inflation rates by income group

Year-on-year change in %



Source: GfK, author's calculations.

However, a negative relationship between income and inflation is found to arise in Austria in high-inflation periods (in line with Argente and Lee, 2021, for the US).

Scanner data are also informative when comparing inflation and price developments across countries. Even in an ideal setting where neighboring countries are economically and culturally perfectly integrated, like Austria and Germany, and the law of one price could be expected to apply across borders, Messner et al. (2022) find that prices and inflation rates at the product level can differ quite substantially. Comparing more than 300,000 indi-

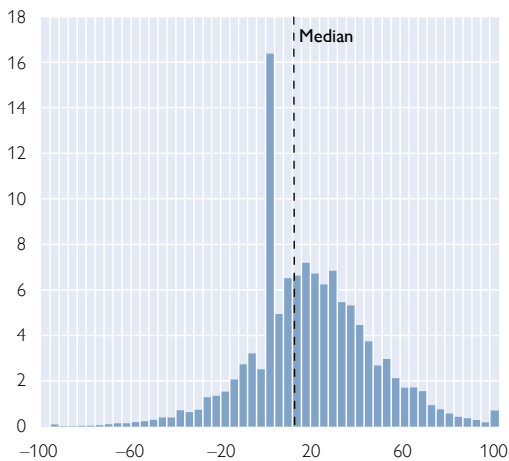
vidual products which are available on both sides of the Austrian-German border, they find that on average prices are higher on the Austrian side with a wide distribution of price differences in both directions (chart 2, left-hand panel shows the distribution of price differences subtracting German from Austrian prices). As is clearly visible from the chart, the mass of cross-border price differences is close to zero, but in absolute terms prices differ on average by about 20% across the border (right-hand panel of chart 2) which is an order of magnitude higher than price differences within each country.

Chart 2

### Price differences (in %) of identical products across Austrian and German border regions

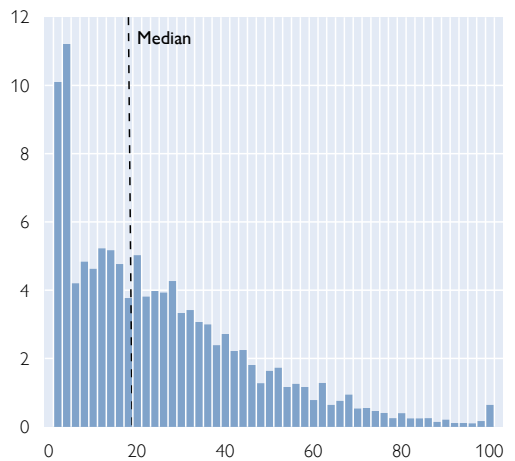
#### Price differences

Frequency in thousands, difference in %



#### Absolute price differences

Frequency in thousands, difference in %



Source: GfK, author's calculations.

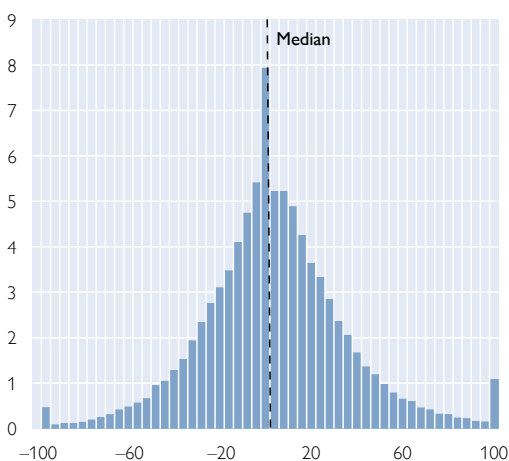
Note: Observations are winsorized at +/- 100.

Chart 3

### Price change differences (year-on-year, in %) of identical products across Austrian-German border regions

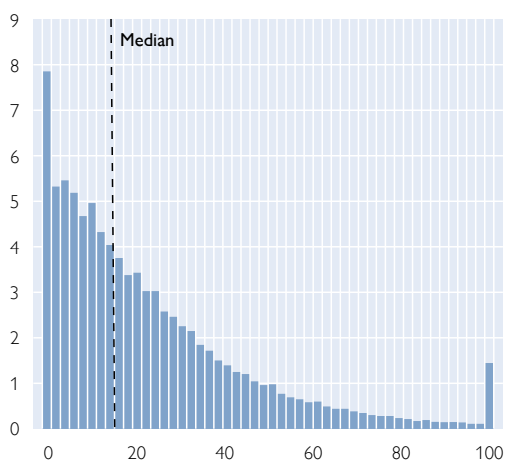
#### Price change differences

Frequency in thousands, difference in percentage points



#### Absolute price change differences

Frequency in thousands, difference in percentage points



Source: GfK, author's calculations.

Note: Observations are winsorized at +/- 100.

In contrast, differences in year-on-year price changes derived from the same products across the Austrian-German border (chart 3) tend to be more balanced than differences in price levels.

This indicates that for the products considered there is no overall inflation difference found between Austrian and German border regions (left-hand panel).

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# What can we learn from 60 years of PCE inflation data?

*The distribution of disaggregated personal consumption expenditure (PCE) category inflation rates has been subject to systematic changes between 1960 and 2021. Pre-1990, extreme positive tails characterize the distribution, which moderate post-1990 while more negative tails appear. The distribution is granular, with an increasing importance of granularity over time. The ranking of mean inflation versus robust measures of inflation – medians and trimmed means – inverts several times over time. The covariance of disaggregated inflation rates decreases more than the variance over time. Our empirical results point to the use of multisector models when analyzing stabilization properties of monetary policy. In an application to oil price shocks, we show how the choice of policy regime interacts with the distribution of inflation rates and the measure of aggregate inflation.*

JEL codes: E31, E32, E52

Keywords: PCE inflation distribution; multisector models; stabilization policy

## Introduction

Inflation experienced large swings during the post-war period, oscillating between poles of double-digit rates in the 1970s and 1980s, and periods of low and stable rates, for example following the Great Recession. Hidden behind these swings in headline inflation, however, were significant changes in the distribution of inflation rates in disaggregated categories. We provide new theoretical and empirical insights into these changes. We analyze detailed US Personal Consumption Expenditure Price Index (PCEPI) data and find that the cross-sectional distribution of disaggregated inflation rates systematically changed between 1960 and 2021: First, extreme increases in inflation have become rarer, and extreme decreases have appeared. Second, inflation is granular, and the importance of granularity has increased over time. Third, the ranking of headline inflation versus robust measures of inflation inverts several times in our data. Fourth, the covariance of inflation rates decreases more than the variance over time. These empirical findings provide important modeling guidance to policymakers suggesting that the inflation-

ary process post-1990 has been driven by granular, idiosyncratic shocks rather than by aggregate shocks.

A heterogeneous production model with idiosyncratic shocks is needed to match these facts. Using this framework provides new insights into the stabilization properties of monetary policy. In such a framework, the choice of policy regime interacts with the distribution of inflation rates and the choice of aggregate inflation measures. To demonstrate the importance of this interaction, we analyze the interaction of average inflation targeting (AIT), as well as a Taylor-type monetary policy rule, with a particular measure of aggregate inflation – core inflation – in a calibrated version of the model subject to an idiosyncratic shock in the oil-producing sector. We find that in such a scenario targeting core inflation under a Taylor-type rule, rather than headline inflation, achieves much of the inflation stabilization gained from AIT. However, the stabilization gains of switching from a Taylor-type rule to AIT and focusing on core rather than headline inflation are additive. We show that such additive gains generally arise for an appropriately defined monetary policy

regime in the face of any idiosyncratic shock.

### Changes in the cross-sectional distribution of inflation rates

Our analysis begins by presenting new facts about the distribution of highly disaggregated inflation series that underlie the aggregate inflation process. As a basis for this analysis, we choose a consistent set of 183 disaggregated PCE inflation rates. These data go back to 1960 and cover 95% of the aggregate consumption basket. The headline PCE inflation rate is the primary series the Federal Reserve Open Market Committee uses to judge the rate of inflation. We calculate annual inflation as

$$\pi_t^{12} = \left( \sum_i w_{it-12} \left( \frac{p_{it}}{p_{it-12}} - 1 \right) \right) * 100.$$

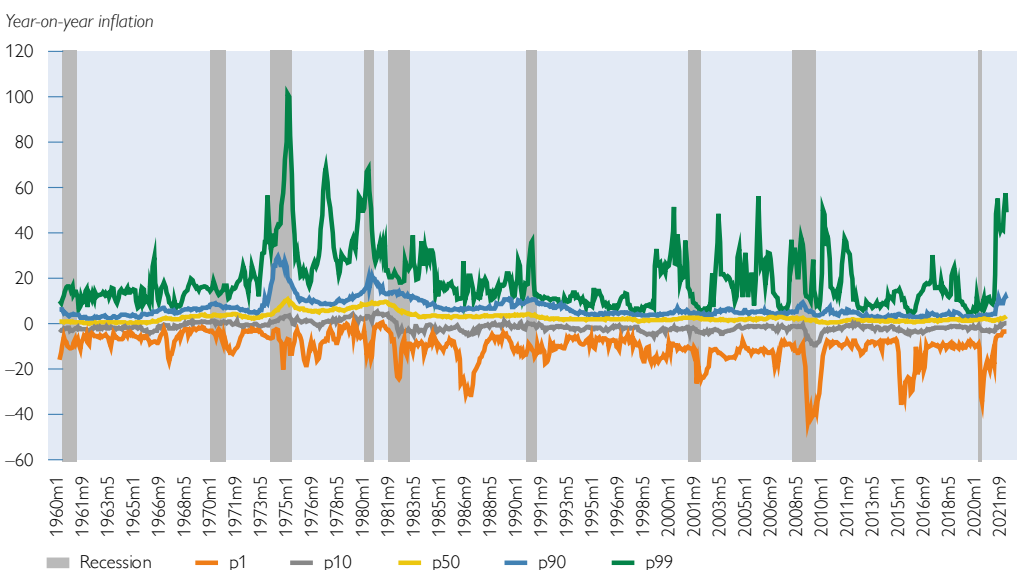
First, our analysis shows that changes in the cross-sectional distribution appear quite evidently at the ex-

tremes: Extreme increases in inflation rates have become rarer, and extreme decreases have appeared over time. Before 1990 there were large positive shocks to inflation. The 99<sup>th</sup> and 90<sup>th</sup> percentiles experienced periods of very high inflation. The 1<sup>st</sup> and 10<sup>th</sup> percentile of inflation were fairly constant and rarely very negative. After about 1990 this pattern changed with the larger percentiles of the inflation distribution becoming smaller, particularly the 90<sup>th</sup> percentile. The 1<sup>st</sup> percentile of inflation saw large declines becoming negative.

Second, a few series have a disproportionately large impact on inflation: inflation is granular in the sense of Gabaix (2011). The top 10 of 183 PCE categories accounted for 68% of PCE inflation in 2019. Fat tails – which statistically encapsulate granularity – characterize the distribution of category inflation rates, with fat tails on the positive side before 1990 and on the negative side after 1990, in line with

Chart 1

### Cross-sectional inflation percentiles



Source: Authors' calculation from PCEPI data.

Note: Each percentile X represents the year-on-year inflation rate in each month such that X percent of consumer spending is on goods with a weakly lower rate of inflation and 1-X percent of spending is on goods with a weakly higher rate of inflation. Shaded areas represent recessions as defined by the National Bureau of Economic Research (NBER).

the swings observed for the extremes of the distribution. Over time, granularity has increased. Tails of the distribution have not only become fatter, but the quantitative impact on headline inflation has also increased. We show this trend using a time-series decomposition into an equal-weighted component and a granular residual as in Forester et al. (2011) as

$$\pi_t = \underbrace{\sum_{i=1}^N \frac{1}{N} \frac{p_{it}}{p_{it-12}}}_{\text{Equal weights}} + \underbrace{\sum_{i=1}^N \left( w_{it} - \frac{1}{N} \right) \frac{p_{it}}{p_{it-12}}}_{\text{Granular residual}} .$$

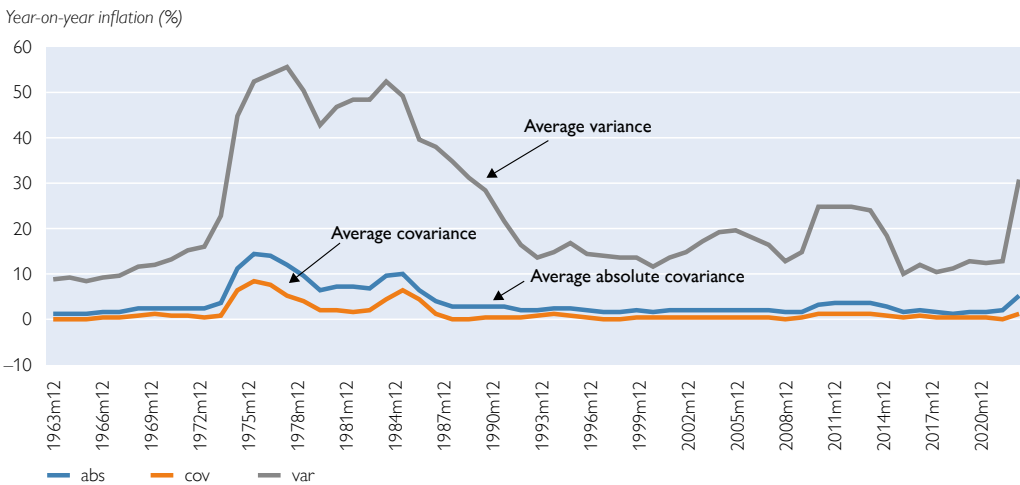
In the 1970s and 1980s, the equal-weighted component—which is large when aggregate shocks are important—was the dominant contributor to headline inflation. During the same period, the granular residual—which is large when a few observations are dispropor-

tionately influential—accounts for only 5% of aggregate inflation. However, between 1990 and 2019, its contribution rises to 36%, and to 62% in 2020 to 2021. This rise in importance suggests a heightened importance of idiosyncratic components to the inflationary process.

Finally, a systematic change in the variance/covariance structure complements the characterization of changes in the distribution of inflation rates over time: The covariance of disaggregated inflation rates has decreased more than the variance over time. These results follow from a decomposition of the variance in headline inflation into two components. The first is the variance of disaggregated inflation rates and the second is the covariance of inflation terms. We find that the covariance of disaggregated inflation rates has substantially declined over time and then exhibits a stable distribution for the last 30 years. While the overall variance has also declined, its decline has been less than the decline of the covariance.

Chart 2

### Moving average variance and covariance of inflation series



Source: Authors' calculation from PCEPI data.

Note: The numbers represent 60-month moving averages. The average variance is computed by calculating the variance of 12-month inflation rates for individual series and then averaging across series. Average covariance represents the covariance between each pair of inflation series. Average absolute covariance represents the average covariance if the absolute value of each pairwise covariance is taken before averaging.

Taken together, these findings suggest that granular, idiosyncratic shocks have been playing an increasingly important role for the inflationary process over time, and for the readings of inflation from various aggregate measures.

### Modeling inflation fluctuations

A heterogeneous production model with idiosyncratic shocks can rationalize these facts, while also providing new insights into the stabilization properties of monetary policy. We show these two results based on a model following Pasten et al. (2020). In this setup, sectors differ in size, the degree of price rigidity and input/output linkages. Sectors may be subject to idiosyncratic as well as an aggregate productivity shock. Monetary policy follows a Taylor-type monetary policy rule that targets headline inflation. We set the same parameters for the economy as in Pasten et al. (2020) and run two model exercises. The first exercise establishes that a model with idiosyncratic shocks is needed to match the four facts presented. The second exercise then shows how both the choice of monetary policy rule and measure of aggregate inflation can affect the distribution of inflation rates, and lead to different, but additive stabilization gains.

The first exercise establishes the need to use a heterogeneous, multisector model of the economy with idiosyncratic shocks to match the four facts presented. We analyze several different calibrations to arrive at this result. Each calibration represents a combination of an aggregate shock and/or idiosyncratic shocks that hit either one, all, or a subset of sectors. We find that only the inclusion of idiosyncratic shocks allows us to match all four facts. By contrast, there is no need to include aggregate shocks. In fact, aggregate shocks alone cannot replicate two facts, namely the fat tails in the distribution, and the larger drop in the covariance than the average variance. A direct implication of these exercises is that a conventional (one-sector) model with an aggregate shock cannot replicate the features of the inflationary process as in the data.

The second exercise shows the importance of these insights for modeling the inflationary process and for the strategies monetary policymakers may pursue when they face a cycle driven by select idiosyncratic shocks. Building on a setup with idiosyncratic shocks, we show how, both individually but also in combination, two choices in particular affect the distribution of inflation rates

Table 1

### Idiosyncratic shocks are needed to match facts

	Agg	Idio all	Idio 1-ind	Oil
Fat tails		X	309	X
Mean and median flip	X	X	341	X
Granular residual	X	X	341	X
Important granular residual	X	X	191	X
Larger covariance drop		X	158	X

Source: Authors' compilation.

Note: Each row represents a test which verifies if the model can reproduce one of the corresponding empirical facts. Columns represent different structures on the shocks in the model, "Agg" denotes a calibration with an aggregate shock only, "Idio all" a calibration with 341 independent sectoral shocks, "Idio 1-ind" a set of 341 calibrations with one sector receiving a shock at a time, and "Oil" a common shock to the subset of oil-producing sectors. The fat tails test requires the 1<sup>st</sup>, 5<sup>th</sup>, 95<sup>th</sup>, and 99<sup>th</sup> percentiles to exceed what would be expected with a normal distribution. The granular residual test is passed if the granular residual is non-zero. It is considered important if the variance of the granular residual is at least 20% of the variance of headline inflation. The larger covariance drop test requires that as the size of shocks changes the covariance should fall by more than variance.



and the stabilization of inflation through monetary policy. These choices concern the policy regime – a Taylor rule versus AIT – and the measure of aggregate inflation – headline versus core inflation. Our analysis in particular focuses on a shock to oil-producing sectors. We find three results: First, AIT stabilizes the distribution more than a Taylor-type policy rule, especially by compressing the center of the distribution more. Moving from a Taylor-type rule to AIT reduces inflation volatility overall by about 50% while keeping inflation fluctuations stable. Second, we find that stabilization of core inflation – ignoring the shocks to the oil-producing sectors and only reacting to their complement – achieves most of the benefits for inflation stabilization as AIT, while leaving consumption volatility unchanged. The reason is that the focus on the complementary sectors embodies a muted, indirect reaction to the shocks from the sectors subject to

shocks, emulating the smoothing properties of AIT. Third, stabilization of core inflation and shifting to an AIT regime creates additive inflation stabilization benefits.

## Conclusion

Our analysis has shown that the cross-sectional distribution of disaggregated PCE inflation rates systematically changed between 1960 and 2021. A multisector heterogeneous production model with idiosyncratic shocks is needed to replicate the changes observed in the data. Moreover, in such a model, the monetary policy regime and measures of aggregate inflation interact through the distribution of inflation rates. In a particular application to an important idiosyncratic shock – to the oil-producing sector – we find that targeting core rather than headline inflation reduces inflation volatility and under AIT may create additive inflation stabilization benefits beyond AIT.

Table 2

### Policy interaction with measures of inflation

Inflation measures	Policy rule	Inflation impact	Standard deviation inflation	Standard deviation consumption
		%		
Headline	Taylor	3.9	0.192	0.0036
Headline	AIT	1.7	0.189	0.0028
Core	Taylor	2.2	0.189	0.0038
Core	AIT	1.3	0.188	0.0025

Source: Authors' compilation.

Note: This table shows responses of inflation and consumption under various combinations of inflation measures and policy rules. The Taylor rule strictly targets inflation with a systematic response of 1.5 to the inflation measure, while AIT responds with the same coefficient to an equal-weighted average of inflation and six of its lags.

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