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Inflation in the Time of Corona and War

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ABSTRACT

Reliance on established macroeconomic thinking is not of much use in trying to understand what to do in response to the constellation of forces driving up inflation in these times of COVID-19 and war. This paper attempts to reduce the heat and turn up the light in the debate on the return of high inflation and looming stagflation—by providing evidence-based answers to the main (policy) questions concerning the return of high inflation: is the increased inflation due to (global) supply and/or demand factors? Is the inflation in the US exceptional or are other OECD and emerging economies experiencing similar inflationary pressures? Is the increase in inflation permanent or transitory? Can the Fed safely bring down inflation? Is fiscal policy the underlying cause of inflation? Are there alternative, less socially costly, ways to bring inflation down? And what will happen to inflation in the longer run, when the US and other economies will face the impacts of global warming?

JEL Codes: E0; E5; E6; E62; O23.

Keywords: Monetary policy; inflation targeting; fiscal policy; inflation; global supply chains; COVID-19 crisis; stagflation; spill-over effects to emerging economies.

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Table of Contents

"There have been as many plagues as wars in history; yet always plagues and wars take people equally by surprise." ― Albert Camus (1948), *The Plague*.

"What cannot be cured must be endured."
—Robert Burton (1621), *The Anatomy of Melancholy*.

1. Introduction

Following the sharp economic downturn in the second quarter of 2020, the US economy recovered at a pace that consistently exceeded the expectations of experts, forecasters and authorities. US real GDP grew by 5.7 percent during 2021, the largest annual increase since 1984. US unemployment plummeted from 14.7% in April 2020 to just 3.6% in April 2022. The unexpected strength of the economic recovery was, in large measure, the result of the enormous legislative response to the COVID-19 health crisis.[1] Congress enacted about $6 trillion—one quarter of annual US GDP—in fiscal support, with a sizeable part centered around 'stimulus checks' which "provided much-needed relief to millions of families and helped bolster the economy at a critical juncture in the recovery" (Sahm 2021, p. 3).[2]

However, these positive developments have been put in the shade by the recent resurgence of inflation—from 1.2% in November 2020 to 6.3% in April 2022 (measured in terms of the *price index of Personal Consumption Expenditures*[3] (PCE)). The surge in inflation—and the accompanying specter of stagflation—is rattling financial markets, worrying central bankers and causing considerable economic hardship for low-income as well as middle-income households, which experience drastic declines in real incomes and expenditures due to the large increases in the prices of especially energy and food (Giles 2022). The hike in inflation is also a deeply troubling development for President Biden and his administration. Rapid increases in the cost of living erode consumer confidence and demand, which is stifling economic growth, stoking fears of stagflation (Domash and Summers 2022a, 2022b) and creating a growing political backlash against the administration's economic policies. Inflation is rapidly—and strategically—becoming a political blame game that will almost certainly figure importantly in the US mid-term elections in November 2022.

A growing number of economists and commentators consider current inflation as a problem of *excess demand*, arguing that the fiscal relief packages were too big, increasing incomes and demand too much (Summers 2021, 2022). These pundits are calling on the Federal Reserve to

[1] This response included laws passed in 2020 and 2021 by Congress, chief among them the Coronavirus Aid, Relief, and Economic Security Act (CARES Act), the Consolidated Appropriations Act, and the American Rescue Plan Act (ARPA).

[2] However, as Ferguson *et al*. (2021, p. 22) point out, the bailouts still helped Wall Street considerably more than 'Main Street': "even the parts of the package that were supposed to be reserved for small businesses went heavily to affluent clients of major banks responsible for making the loans. The result was [……] gains to billionaires' wealth and income" and "rising unemployment, small business shutterings, and COVID ravaging through low income and minority communities and nursing homes. Statistics compiled by the Federal Reserve indicate the extent of the upward shift in wealth to the 1% that ensued."

[3] The (core) PCE inflation rate is the Fed's preferred inflation indicator.

raise interest rates to fight inflation, in the hope that the Fed can engineer a 'soft landing', *i.e.,* bring down inflation without hurting economic growth. Until the end of 2021, the Fed resisted such calls, arguing that the inflationary surge was transitory, but it has since publicly acknowledged that high inflation will be around for some time—which has become only more likely in light of the reinstatement of lockdowns in China[4] and the recent surge in global energy and commodity prices following Russia's war in Ukraine.[5]

On March 16, 2022, the Fed raised the interest rate by a quarter percentage point, from 0.25% to 0.5%—the first interest rate increase since 2018. And on May 3, 2022, it raised its benchmark rate even more, namely by half-a-percentage point; the last time the FOMC decided to raise interest rates by half a percentage point in one meeting was twenty-two years ago. "We have to reassure people we are going to defend our inflation target and we are going to get inflation back to 2%," *St. Louis Federal Reserve* President James Bullard said recently, adding that "our credibility is on the line here" (Egan 2022). Bullard doubled down on his view by recommending that the Federal Open Market Committee (FOMC) should shoot for a policy rate above 3% this year—which is in line what financial markets are currently expecting.

However, fears are growing that the Fed is behind the curve and not moving fast enough in response to the surge in inflation (Reifschneider and Wilcox 2022; Irwin 2022). Hence, demands for an even more aggressive tightening of monetary policy are growing louder. Lawrence Summers (Klein 2022b) agrees with Bullard that the Fed's credibility as an inflation-fighter is at risk, but he insists that in order to regain credibility, the nominal interest rate needs to be increased to at least 5% to bring inflation under control:

> "My sense of this is that given the likely paths of inflation, we're likely to have a need for nominal interest rates, basic Fed interest rates, to rise to the 4 percent to 5 percent range over the next couple of years. If they don't do that, I think we'll get higher inflation. And then over time, it will be necessary for them to get to still higher levels and cause even greater dislocations" (Klein 2022b).

Channeling former Fed chair Paul Volcker, Summers claims that the cost of sharply increasing the interest rate will be temporary increases in unemployment—and he argues that bearing this non-trivial (temporary) cost will be preferable to suffering from the (permanent) cost of inaction, which he predicts will lead to "stagflation and the associated loss of public confidence in our country".

Summers' position is not different from views held by the financial sector (El-Erian 2022). To illustrate, according to Goldman Sachs Group President John Waldron, "we might need to bring back Paul Volcker" (Natarajan and Reyes 2022). Summers and Waldron are putting serious

[4] Following an outbreak of corona (omicron), millions of Chinese citizens were living under lockdown in March 2022. The lockdowns in Shenzhen, Zhejiang, Shanghai, Jilin, Suzhou, and Guangzhou disrupt container movement within China and in Chinese ports, upsetting global supply chains and raising shipping costs. Ninety percent of China's electronics manufacturing comes from the region around Shenzhen and passes through the port at Shenzhen.

[5] Russia is the world's biggest exporter of oil and gas and a ban on energy imports from Russia will raise energy prices and inflation. According to Fed chair Powell, the Fed estimates as a rule of thumb that every $10 increase in the price of oil adds 0.2 percentage point to inflation and subtracts 0.1 percentage point from economic growth (Dunsmuir 2022). Russia and Ukraine also export more than a quarter of the world's wheat and Ukraine is a major corn exporter.

pressure on the Fed to act more strongly, but it appears unlikely that the Fed will go ballistic and resort to Volcker's approach in the early 1980s, when interest rates were jacked up to 22%, if only because doing so will come with massive collateral damage. Just for the record, Volcker's disinflation drive helped spark two painful back-to-back recessions in the US, pushed up US unemployment to almost 11% in November 1982, contributed to the thrift crisis of the early 1980s, and triggered a painful global recession, the Latin American and African external debt crises and more than a 'lost decade' for economic development for many industrializing low-income nations (Martin 2022). Paradoxically, most macroeconomists concur with Summers and consider Volcker's disinflation policy a 'success story'—which, I think, is illustrating the strained and tangled relationship that most economists entertain with economic reality.

Other economists who are less involved in the financial sector, are cautioning that (drastically) raising rates would be a bad idea, because the collateral damage of inflation control to the real economy might well be larger than the damage done by rising inflation. Bringing back Volcker might, therefore, not be a good idea. To be clear, however, the Fed hardly ever managed to guide the economy to a soft landing with interest rate increases.[6] For one, small interest rate hikes do not reduce inflation (see **Section 8**). It takes large interest rate hikes, but those come with massive collateral damage. The only possible way in which monetary policy can (indirectly) affect inflation is by significantly slowing down the economy, lowering demand and raising unemployment to alleviate wage and price pressures (Storm and Naastepad 2012).

The distributional effects of this kind of inflation targeting will not just smother the economic recovery, but also raise the-already-problematically-high level of inequality. Interest rates are a socially very costly tool to 'control' inflation—especially when its sources lie in an unprecedent constellation of (mostly) supply-side bottlenecks which are driving up prices. In these extraordinary times of COVID-19 and war, the more appropriate strategy to fight inflation would be to work to alleviate critical supply-side constraints, which, in turn, requires first and for all, bringing the pandemic under control. Despite a lot of rhetoric, the Biden administration is failing to do so. As Thomas Ferguson, Paul Jorgenson and Chen (2021, p. 63) wrote presciently:

> "Though it is spending a lot of money, when it assumed power, it failed to prioritize cheap, accessible tests open to anyone who needs them, left too much basic data gathering to scholars or the media, and made at best half-hearted pushes in favor of improved ventilation, air filters, and other obvious steps that would minimize indoor COVID problems, especially in schools. It also did essentially nothing to put reliable face masks in the hands of the population and failed even to set standards for advertising and sales of facemasks, leaving a vast market to charlatans. It still has no program in place for large scale random testing that can swiftly identify new variants and it has failed to create an effective national set of statistics with public dashboards anyone can access. Essentially it has staked everything on vaccines that will need regular, costly

[6] According to Alan Blinder, a former vice-chair of the Federal Reserve, the Fed managed to achieve a soft landing in exactly two out of 11 tightening cycles since World War II: the first one occurred in 1966 and the more recent soft landing happened in 1994. That makes one success story in the past 50 years (Mason 2022).

updates in a country with no national healthcare system. It is obvious that the administration's hopes for an end to the COVID nightmare are premature."

Key supply-side bottlenecks underlying the current bout of inflation will disappear only when COVID-19 is brought under control, and this needs much more work and intentionality than a decision to increase the interest rate by a half a percentage point or more by the FOMC—more importantly, it requires thinking outside the narrow confines of establishment macroeconomics, which is mistakenly centered around the false belief that a powerful central bank is capable of using the interest rate to stabilize inflation at the inflation target without unnecessarily imposing considerable costs on the economy and society. Instead, other instruments must be considered to deal with the current bout of inflation, including coordinated interventions to ease supply bottlenecks, rent controls, controls on energy prices, price caps or targeted stimulus cheques (see **Section 11** of this paper). But any—necessary—discussion on planning and strategic price controls is beyond the pale for 'Serious Macroeconomists', as is illustrated by the way these economists, including a Nobel laureate, responded to Isabella Weber's (2021) sensible proposal to use price policy to fight the inflation (Galbraith 2022).

This paper attempts to recover the lost plot, arguing that the recent inflation has mostly supply-side origins, caused by the COVID-19 crisis, and has been enabled by wrong past and current macroeconomic policy choices. The next section (**Section 2**) takes a closer look at the current inflation, showing that it is not due to a generalized co-movement of (all) prices, but to a number of sector-specific price increases in industries strongly affected by global commodity-chain disruptions. The corona-crisis has been seriously stress-testing the resilience of the global supply chains that have developed during three decades of neoliberal globalization—and the system has been found wanting. **Section 3** considers the global supply side of US inflation in more detail and investigates how global supply chain disruptions and higher global commodity prices have raised US import prices; we find that higher import inflation has been directly responsible for almost one third of the increase in the PCE inflation rate during 2021-2022.

Section 4 presents data on accelerating inflation in the rest of the world. These data underline the fact that the rise in US inflation is by no means exceptional: almost all other economies are experiencing similar surges in (consumer price) inflation as the US. Inflation is running well above central bank inflation targets in almost all advanced economies. In most of the economies, central banks have so far reacted to the increase in inflationary pressures with a gradual response, tapering off unconventional monetary policy support introduced during the pandemic and (in some cases) raising policy rates. Differences in the magnitude of fiscal relief responses to the corona-crisis between countries are not showing up in (statistically significant) differences in CPI inflation rates. This suggests that fiscal policy is a not a key driver of inflation (differences).

The impacts of the global supply shock were amplified by supply-side bottlenecks *within* the US economy (**Section 5**), including inefficiencies in US ports and a shortage of long-haul truck drivers. However, the most important domestic supply constraint triggered by COVID-19 arose from the sharp decline in the (effective) labor force of the US: the employment-population ratio declined by 9 percentage points in early 2020.

For many workers, the coronavirus outbreak was the main reason for quitting a job—directly, because doing the job had a high risk of getting infected, but also indirectly, because the job offered no or insufficient health insurance, lacked flexibility to choose when to put in one's

hours, did not allow for working remotely, or did not offer adequate child care support. In Spring 2022, there are still around 1 million "persons not in the labor force, who did not look for a job in the last 4 weeks because of the coronavirus pandemic", and around 3 million workers decided to retire (temporarily or permanently), primarily because of COVID-19. As a result, in March 2022, the US labor force still has 4 million fewer workers than in the 'no-corona' counterfactual. The sharp decline in the effective labor force has led to a *tightness* of the US labor market which is showing up in higher nominal wages—and yes, this adds to the inflationary build-up. However, the wage-price inflation is not caused by excess demand, but by a COVID-19 driven decline of the effective labor force.

Section 6 addresses the issue how much of the recent US inflation is due to excess demand. The answer is important for monetary policy-making, because higher interest rates could—in principle, but with a cost—remove the demand-pull component of aggregate inflation. I find that demand pressures can only explain around 20% of the increase in PCE inflation. Supply-side bottlenecks have thus been of overwhelming importance to the acceleration of PCE inflation in the US. **Section 7** looks at (longer-term) inflation expectations and wage-price dynamics in order to address the question whether the increase in inflation will be transitory or permanent. A fair assessment of what has happened during 2020-22 is that US inflation has been driven less by (nominal) wage increases and more strongly by increases in profit mark-ups—and fears of a building wage-price inflationary spiral appear to be misplaced.

Section 8 asks the question: can the Fed *safely* bring down inflation? The answer is negative: the empirical evidence is clear that small increases in the interest rate do not have much of an effect on inflation. Large—Volcker-like—increases in the interest rate are off the cards, because the resulting collateral damage is prohibitively high. The key reason is that more than a decade of extraordinarily low interest rates has led to a significant increase in corporate and public debts and an unsustainable bout of asset price inflation in the housing market, the stock market and almost all other financial markets. A large interest rate hike will create a financial crash. The Federal Reserve recognizes these non-negligible downward risks of monetary tightening to the American economy in its *Financial Stability Report* of May 2022.

In **Section 9**, I consider the issue to what extent we can blame US inflation on fiscal policy. Since inflation cannot be brought down by higher interest rates alone, calls are growing to tighten fiscal policy as well. The strongest call for fiscal consolidation is coming from proponents of the 'fiscal theory of the price level'—which (as I argue in **Section 9**) is a fallacious 'theory' which is theoretically problematic and empirically empty. Austerity is not the solution to rising inflation in a time of corona and war.

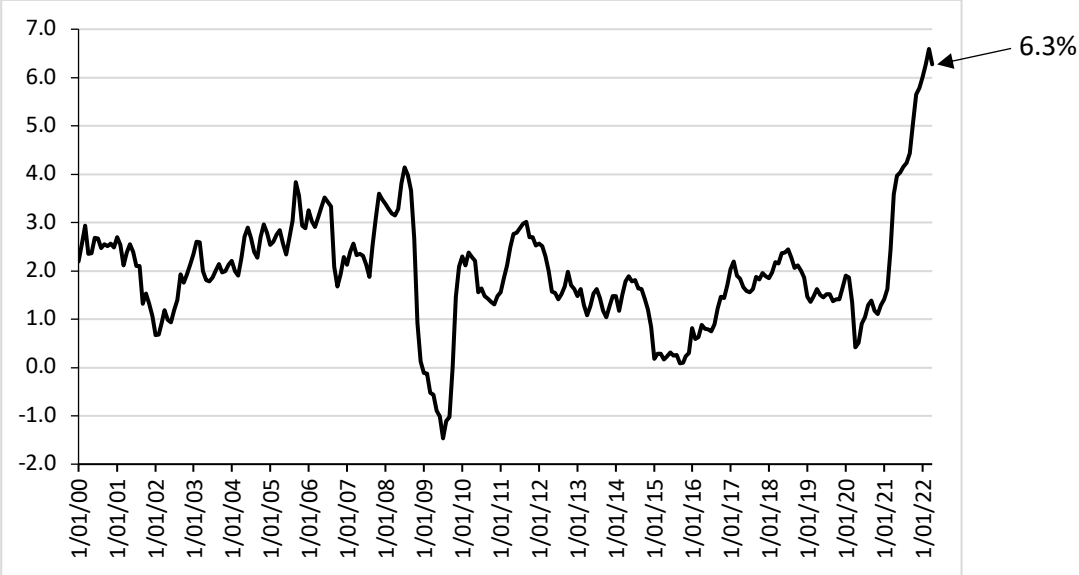
In **Section 10**, alternative ways to bring inflation down are briefly discussed including the much-maligned strategic price controls, a tightening of position limits and an increase in margin requirements to eliminate commodity-market speculation, measures to remove some of the domestic supply-side bottlenecks in the US itself, and fiscal interventions to shield vulnerable households and firms from the negative impacts of high inflation.

Finally, in **Section 11**, I consider the long-run context and focus specifically on the unavoidable inflationary impacts of global warming, climate policy, and the transition to a net-zero economy. Monetary policy has to be reimagined to make it support the climate/energy transition—rather than obstruct it (as is the case now).

2. US inflation: a closer look

In March 2022, inflation in the U.S., measured by changes in the PCE Price Index, climbed to its highest level in 40 years—overall consumer prices jumped 6.6% on a twelve-months basis, while PCE inflation was just 1.4% during 2020 (**Figure 1**). PCE inflation came down to 6.3% in April 2022. The recent inflation figures are only a foretaste of higher prices to come as these do not factor in the impacts of the Ukraine war, the bans on Russian energy and commodity imports and tightened oil supplies that are sending energy and commodity to record levels. As inflation pressures are spreading across the economy, it is important to understand how and why it started.

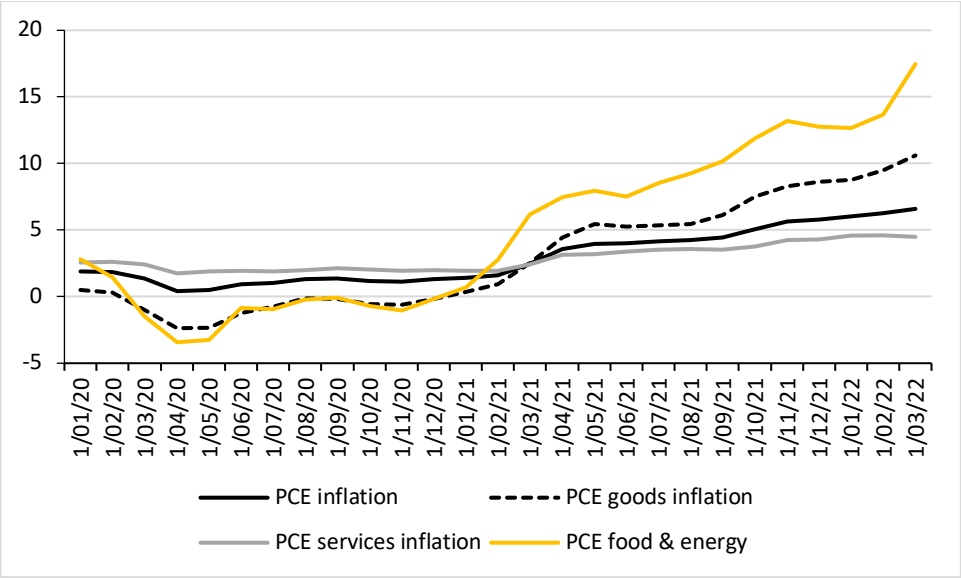
Figure 1
Personal Consumption Expenditures: Chain-type Price Index
(12-months' growth rate), January 2000 – April 2022
(*Percentage change from a year ago*)



Source: FRED Database (series: PCEPI).

A first point to note is that the recent inflation is caused mostly by price increases for *goods*, rather than for *services* (**Figure 2**). During March 2021 and March 2022, the average price increase for goods was 10.6% compared to an average price rise for services of only 4.2%. Prices of energy & food rose by 17.5%.

Figure 2
PCE inflation rates: goods *versus* services
January 2020 – March 2022 (percent change from a year ago)



Source: BEA, Table 2.4.4U. Price Indexes for Personal Consumption Expenditures by Type of Product.

Goods account for 35% of personal consumption, but have been responsible for 54% of the PCE inflation rate during March 2021-March 2022. **Table 1** offers a closer look at (just) ten consumption items (with a combined weight of 20.3% in the PCE price index), which together account for 54% of the PCE inflation rate during March 2021-March 2022. It can be seen that the surge in inflation is primarily due to price increases for new and used motor vehicles (which have a weight of 5% in the PCE price index, but are responsible for 15% of the aggregate inflation) and energy (which has a weight of 4% in the PCE price index but accounts for 22% of aggregate inflation).

Rapidly rising prices for just these items (with a combined share in consumption of 9%) account for 37% of aggregate PCE inflation (**Table 1**). Excluding motor vehicles and energy (gasoline), the PCE inflation rate (based on price changes for the remaining 91% of consumption items) would have been only 4%.

Much of the rise in energy prices must be attributed to *geopolitical issues*, such the decision by OPEC+ nations to cut production when demand for oil plunged in the first six months of the COVID-19 crisis. More recently, prices on the world's energy and commodity markets have skyrocketed, because of Russia's war in Ukraine, but also because of the financialization of commodities (IPES 2022).

Table 1
PCE inflation during March 2021-March 2022:
a decomposition into sector-specific contributing price increases

		Weight in PCE	Share in PCE inflation	Price increase
	PCE inflation rate	100.0	100.0	6.1
	increase in prices of goods	35.3	56.8	10.6
	increase in prices of services	64.7	38.9	4.5
	Motor vehicles and related services	**5.1**	**15.0**	**19.3**
1	New motor vehicles	2.4	4.9	13.1
2	Net purchases of used motor vehicles	1.5	7.5	33.5
3	Motor vehicle parts and accessories	0.6	1.1	11.7
4	Motor vehicle leasing (services)	0.4	0.9	14.5
5	Motor vehicle rental (services)	0.2	0.6	23.6
	Energy	**4.2**	**22.4**	**34.8**
6	Gasoline and other energy goods	2.6	19.1	48.3
7	Electricity and gas (services)	1.6	3.3	13.3
	Other items	**10.9**	**16.6**	**10.1**
8	Furnishings and durable household equipment	3.0	5.5	12.1
9	Other purchased meals (services)	4.8	5.5	7.6
10	Final consumption expenditures of non-profit institutions serving households (NPISHs)	3.1	5.6	11.9
	Total of 10 PCE items	**20.3**	**54.0**	**17.6**

Source: Bureau of Economic Analysis, *Table 2.4.4U*. Price Indexes for Personal Consumption Expenditures by Type of Product; and *Table 2.4.5U*. Personal Consumption Expenditures by Type of Product. *Notes*: The price increase have been calculated as the weighted average of the rates of change of the constituent components.

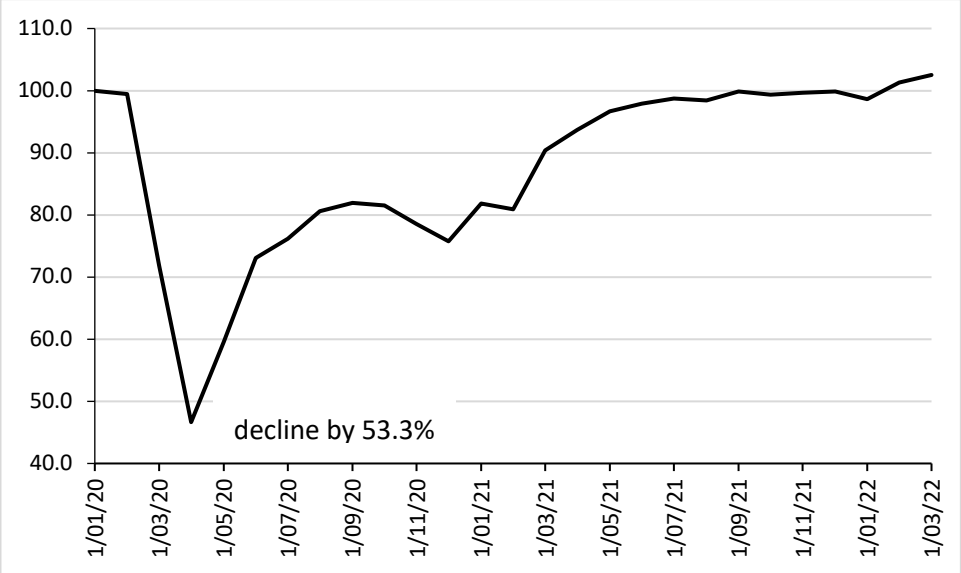
The surge in the prices of goods was also caused by a drastic change in the *composition of consumer demand* (**Figure 3**). The fraction of consumer spending on goods increased from 30.8% (in March 2020) to almost 36% (in March 2021)—and, correspondingly, the proportion of consumer spending on services dropped from 69.2% to 64%. This change in the composition of consumption expenditures has been caused by the COVID-19 health crisis.

On the one hand, consumers responded to the coronavirus emergency by drastically lowering their spending on in-person, close-contact services such as food services & accommodations, gyms and personal services; as is shown in **Figure 4**, real consumer spending on hotels and restaurants dropped by more than 53% between January and April 2020, and only by February-March 2022 did spending on food services & accommodations recover to its level in January 2020. Similar declines in expenditure can be observed for other close-contact services.

Figure 3
Personal Consumption Expenditures: Goods/Personal Consumption Expenditures, January 2000 – March 2022 (Percent)

Source: FRED Database https://fred.stlouisfed.org/graph/?g=LnYU

Figure 4
Collapse of Personal Consumption Expenditures on Food services and accommodations, January 2020 – March 2022 (January 2020 = 100)



Source: Derived from Bureau of Economic Analysis, *Table 2.4.4U*. Price Indexes for Personal Consumption Expenditures by Type of Product; and *Table 2.4.5U*. Personal Consumption Expenditures by Type of Product.

On the other hand, mostly on account of the public health concerns arising from COVID-19, US consumers reallocated spending from (close-contact) services to *durable consumer goods*, such as cars and furnishing & durable household equipment. By working from home and

spending more time at home, US consumers reduced travel, cut back on eating at restaurants, and exercised at home instead of the gym. This way, the corona-crisis has led consumers to *substitute* services with durable goods, needed to create 'home offices', improve internet connections, upgrade kitchen appliances and electronics and install sports equipment.

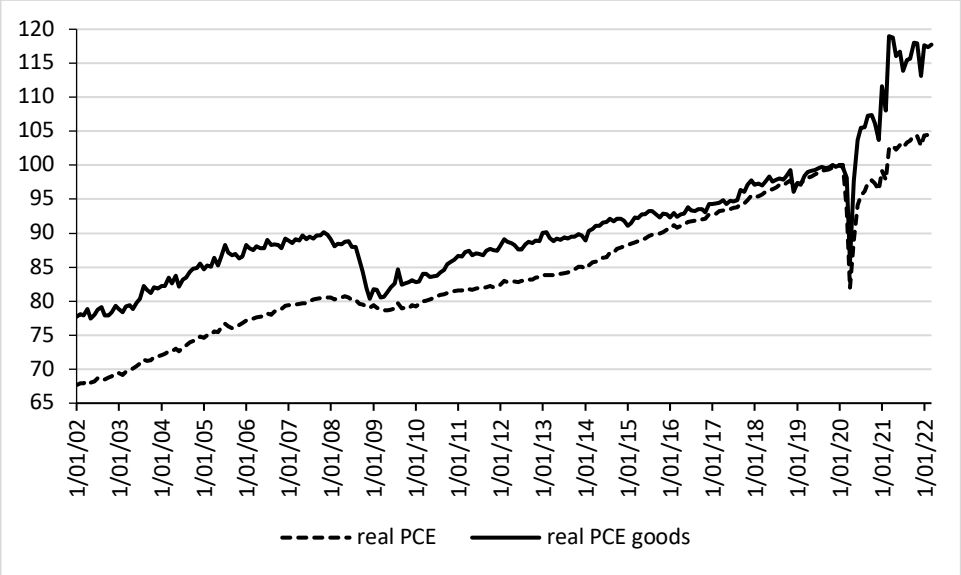
The drastic shift in consumer spending has led to a sharp increase in demand for the goods (and their components including computer chips and electronics), as is shown in **Figure 3** and **Figure 5**. While real personal consumption expenditure rose by 5% during January 2020-January 2022, real consumption expenditure on goods increased by 18%; actual consumer spending on goods in January 2022 exceeded counterfactual spending (assuming the absence of the corona-virus crisis) by more than $0.8 trillion.[7]

The increase in goods demand, in turn, has put pressure on suppliers and global commodity chains; containerized retail imports were almost 20% higher during 2021-22 than in 2019 (**Figure 6**). This occurred right at the time when these global supply chains were hit by manifold corona-lockdowns and upsets. As a result, suppliers were unable to meet the increase in demand. Global supply-chain disruptions led to shortages of computer chips, semiconductors, components and other (electronics) parts, forcing automakers and other manufacturers around the globe to temporarily halt production. The reduced automobile production has affected both the prices of new and used cars. The supply of other (durable) consumer goods producers is negatively affected as well by COVID-related disturbances, such as pandemic-related worker shortages in factories and in transportation (discussed below).

The inflation of 2021-22 thus began as the result of sector-specific price rises, but because these specific price increases, especially for energy and food, raise production costs for firms and the cost of living for households, they are now feeding a more generalized inflationary process—as other prices and nominal wages have started to rise as a result.

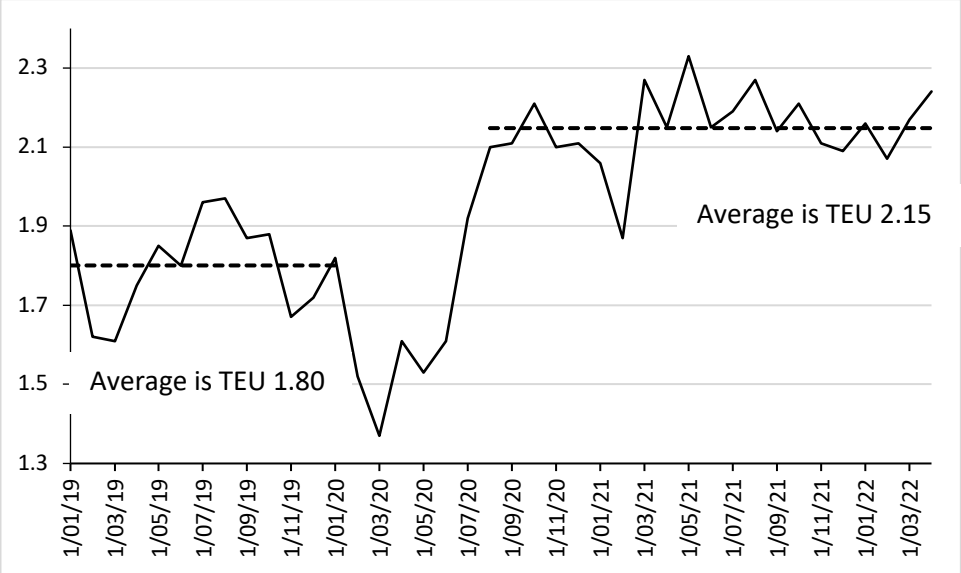
[7] The counterfactual has been estimated based on a linear time trend using monthly data for the period January 2002-January 2020.

Figure 5
Real Personal Consumption Expenditure and Real Personal Consumption Expenditures on Goods, January 2002 – March 2022 (January 2020 = 100)



Source: FRED Database (series PCEC96 and DGDSRC1_PCE).

Figure 6
US Retail imports, January 2019 – April 2022 (millions TEUs)



Source: NRF/Hackett Associates Global Port Tracker, https://nrf.com/topics/economy/trade/global-port-tracker . *Note*: A TEU or Twenty-foot Equivalent Unit is an exact unit of measurement used to determine cargo capacity for container ships and terminals. This measurement is derived from the dimensions of a 20ft standardized shipping container.

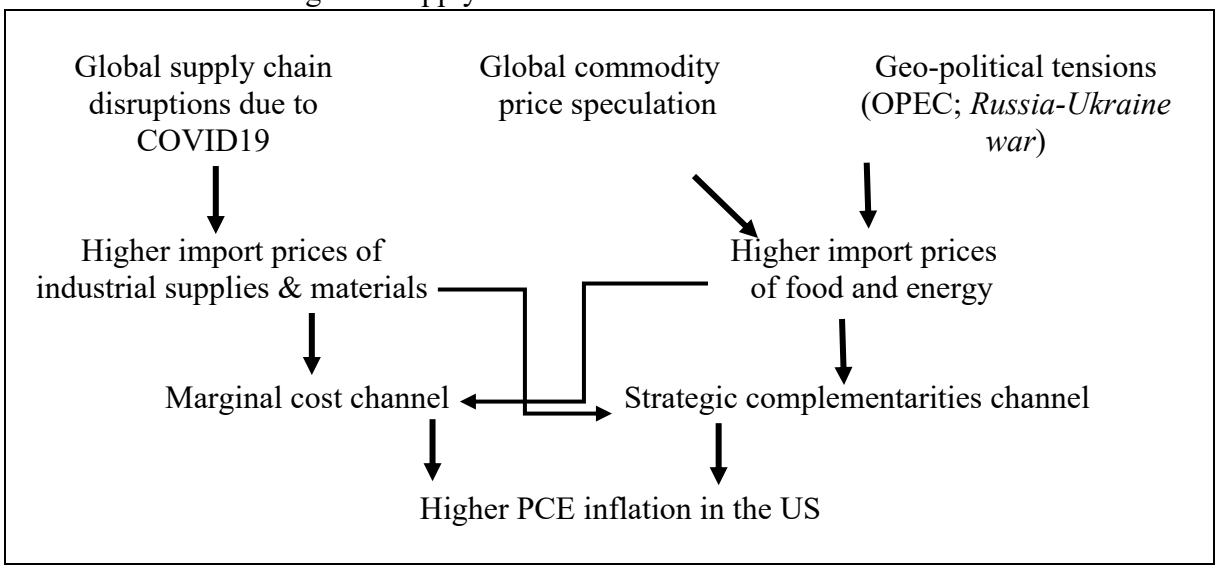
However, the sources of the sector-specific price changes (which kick-started the inflationary surge) overwhelmingly lie in *persisting* COVID-19-induced disruptions in global supply chains

and an *escalating* geopolitical crisis. It follows that, deep down, most of today's inflation is coming from sources that interest rate hikes will do relatively little to control.

3. The global supply side of US inflation

Figure 7 presents a schematic summary of which global supply-side factors have contributed to the recent increase in PCE inflation in the US. First, COVID-19 related *disruptions of global commodity chains* have created shortages of (critical) industrial components and materials, leading to higher import prices for these intermediate inputs and higher prices in the US (**Section 3.1**). Second, *geo-political factors* have contributed to higher prices for energy and food, and commodities in general; this has raised import inflation as well (**Section 3.2**). Finally, an *increased risk appetite of global commodity speculators* has amplified the rise in global commodity prices (**Section 3.2**).

Figure 7
The global supply side of recent PCE inflation in the US



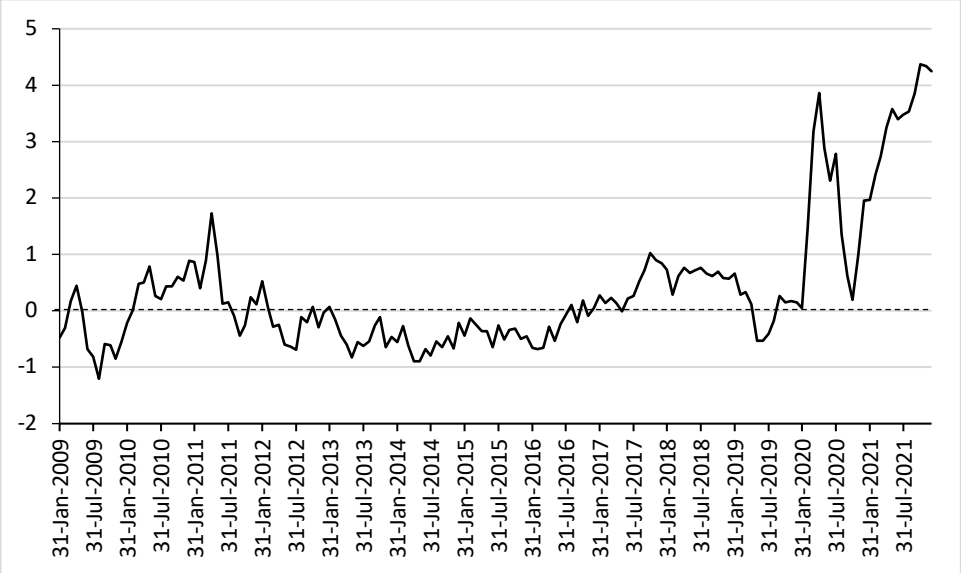
Source: Author's construction. *Note*: Following Amiti *et al*. (2021), changes in import prices can affect domestic prices through two channels: (1) the *strategic complementarities* channel; and (2) the *marginal cost* channel.

3.1 Global supply-chain disruptions and import inflation

A key driver of rising US inflation has been the breakdown of global supply chains. Global commodity chains rely on a complex, global network of transportation services, primarily container shipping, to move intermediate goods between multiple countries for processing before they are shipped globally as final goods. The pandemic has disrupted—and continues to upset— regular trade flows, when various Asian countries (including China) locked down factories and ports and reopened these at different times. The Asian lock-downs led to seaport congestions globally—and in the US.

Evidence of global supply-chain disruptions appears in **Figure 8** which shows the *Global Supply Chain Pressure Index* (GSCPI), developed by the Federal Reserve. The GSCPI integrates a number of commonly used metrics on global supply chains which concern the cost of shipping raw materials and containers, and supply management data on delivery times, backlogs and inventories. The index is normalized such that a zero indicates that the index is at its average value with positive (negative) values representing how many standard deviations the index is above (below) this average value.

Figure 8
The Global Supply Chain Pressure Index (GSCPI):
The US economy (January 2009 – December 2021)



Source: Benigno *et al.* (2022).

The GSCPI increased by almost four standard deviations in April 2020, after which supply-chain problems eased for a brief while; but during November 2020 and October 2021, the GSCPI again increased to more than four standard deviations above the long-term average. The supply-chain disruptions across logistics networks, increases in shipping costs and longer delivery times, caused by the COVID-19 crisis, are unprecedented.[8]

These global supply-chain pressures are showing up in higher import prices, as is shown in **Figure 9**. The overall price index of US imports increased by 10.8% during January 2021 and January 2022, and around half of this increase is due to the substantial rise in the prices of imported industrial supplies and materials, up nearly 35 percent during the same period. Rising prices of imported intermediate inputs, such as industrial supplies and materials, are having amplified effects through the US economy by increasing the production cost of goods and

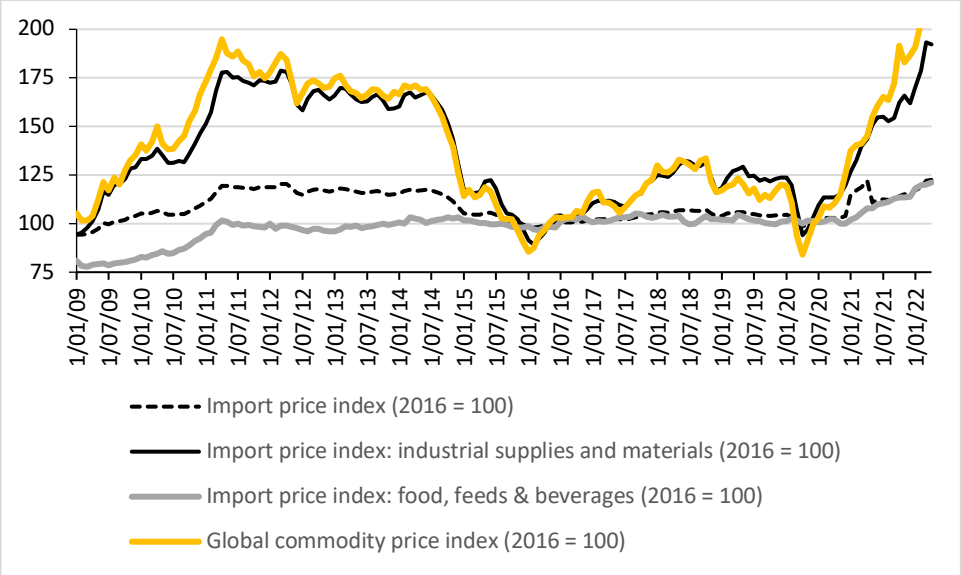
[8] A recent IMF study finds, based on data from 143 countries over the past 30 years, that shipping costs are an important driver of inflation around the world: when freight rates double, inflation picks up by about 0.7 percentage point. Most importantly, the effects are quite persistent, peaking after a year and lasting up to 18 months. This implies that the increase in shipping costs observed in 2021 could increase inflation by about 1.5 percentage points in 2022. See Carrière-Swallow et al. (2022).

services that, through backward production linkages, rely heavily on these inputs (Amiti *et al*. 2021).

Higher import prices feed into US higher inflation—via two separate channels (see Amiti *et al*. 2021):

- the *marginal cost channel*, which captures how much domestic prices change in response to changes in the cost of imported intermediate inputs. For example, when the prices of imported steel go up, the cost of producing cars increases and this feeds through to higher prices of domestically produced cars. According to estimations by Amiti *et al*. (2021), the marginal cost channel accounts for around 70 percent of the effect of higher import prices on US inflation.
- the *strategic complementarity channel,* which captures how much US firms adjust their prices in response to changes in the prices charged by their foreign competitors. For example, if the price of imported cars increases, domestic car producers can also increase their prices. The strategic complementarity channel has been estimated to account for circa 30 percent of the effect of higher import prices on US inflation (Amiti *et al*. 2021).

Figure 9
Monthly import prices: general; industrial supplies & materials;
and food, feeds & beverages (2016 = 100),
January 2009-April 2022

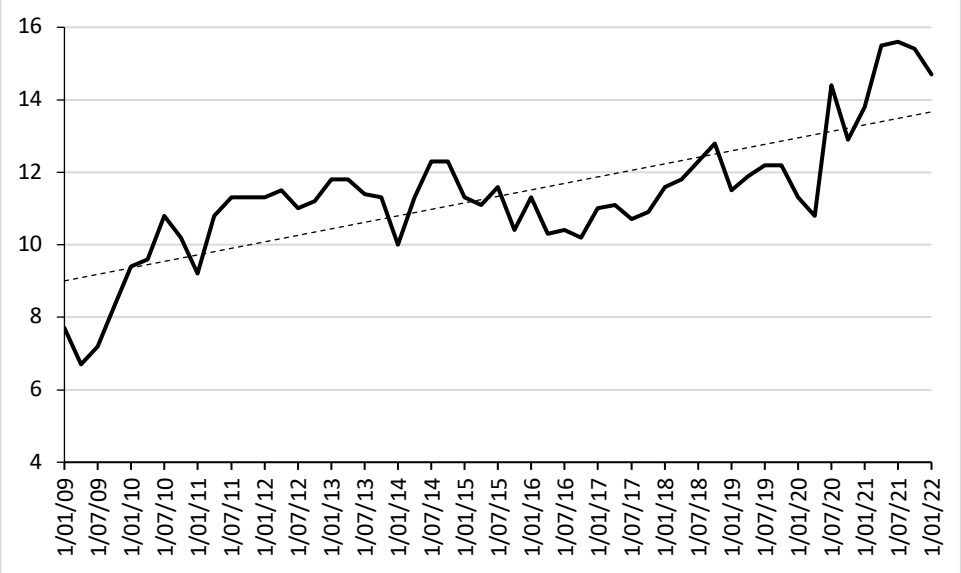


Source: FRED Database (series IR, IR0, IR1 and PALLFNFINDEXM). *Note*: The linear regression coefficient of global commodity price index on US import prices (during January 2009-January 2022; monthly data) is 0.26 (*t*-value = 34.3; R^2-adjusted = 0.88). The increase in the global commodity price index by 53.5 points during January 2020 and January 2021 is associated with an increase in the index of US import prices by 13.8; during this period, the actual increase in the import price index was 13.6.

The *strategic complementarity channel* does help to explain the profiteering by large US corporations which have been able to raise their profit margins to the highest level in 70 years. Using inflation as an excuse and helped by algorithmic pricing and AI, mega-corporations are choosing to raise prices to increase their profit margins – and they hold enough market power to do so without fear of losing customers to other competitors.

As is shown in **Figure 10**, the non-financial corporate profits per unit of real GDP have increased from 10.8% in 2020Q2 to 15.6% in 2021Q3 during the corona-period. Nominal growth of corporate profits (by 35%) during 2021 has vastly outstripped nominal increases in the compensation of employees (10%) as well as the PCE inflation rate (6.1%). According to *The Wall Street Journal,* nearly two out of three of the biggest US publicly traded companies had larger profit margins this year than they did in 2019, prior to the pandemic (Broughton and Francis 2021). Nearly 100 of these corporations did report profits in 2021 that are 50 percent above profit margins from 2019. Evidence from corporate earnings calls shows that CEOs are boasting about their "pricing power," meaning the ability to raise prices without losing customers (Groundwork Collaborative 2022; Perkins 2022). Even the Chair of the Federal Reserve, Jerome Powell, has weighed in on this issue, stating that large corporations with near-monopolistic market power are "raising prices because they can." These profit increases have contributed to a process of profit-price inflation (see Section 3.3).

Figure 10
Profit per unit of real gross value added of non-financial corporate business: Corporate profits (after tax with IVA and CCAdj); 2009Q1 – 2022Q1



Source: FRED Database (series A466RD3Q052SBEA).

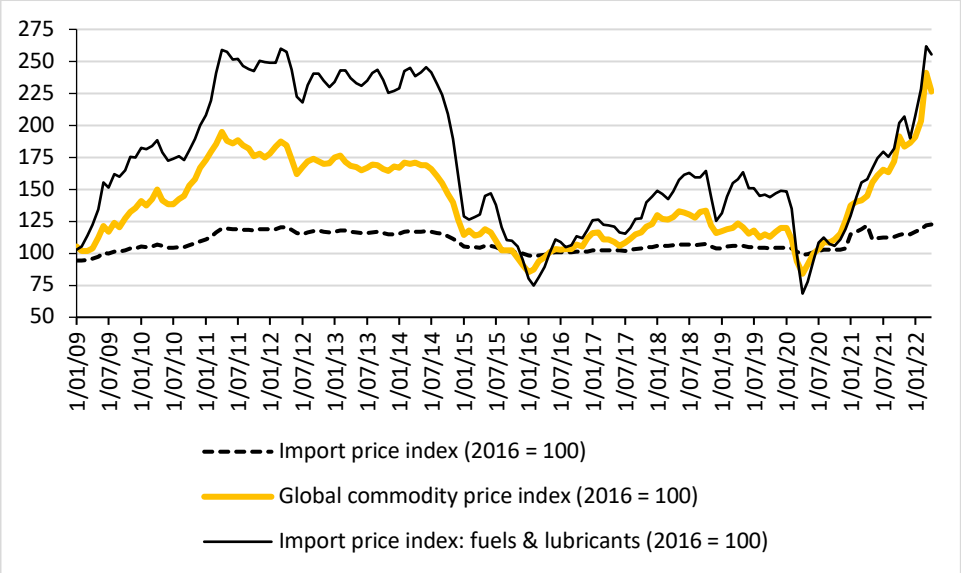
3.2 Global commodity prices, import prices and PCE inflation

Movements in the US import price index are strongly correlated with movements in global commodity prices (r = 0.91; see **Figure 9**). During January 2021-April 2022, higher global commodity prices have pushed up import prices of *food, feed & beverages* (which account for about 7% of US merchandise imports) by 19% (**Figure 9**) and import prices of *fuels &*

lubricants (which account for around 5% of US merchandise imports) by almost 100% (**Figure 11**). According to estimates by Fed economist Kevin Kliesen (2021), commodity price changes and PCE inflation are highly correlated: the average correlation of the four main commodity price indices and (headline) PCE inflation is 0.7.

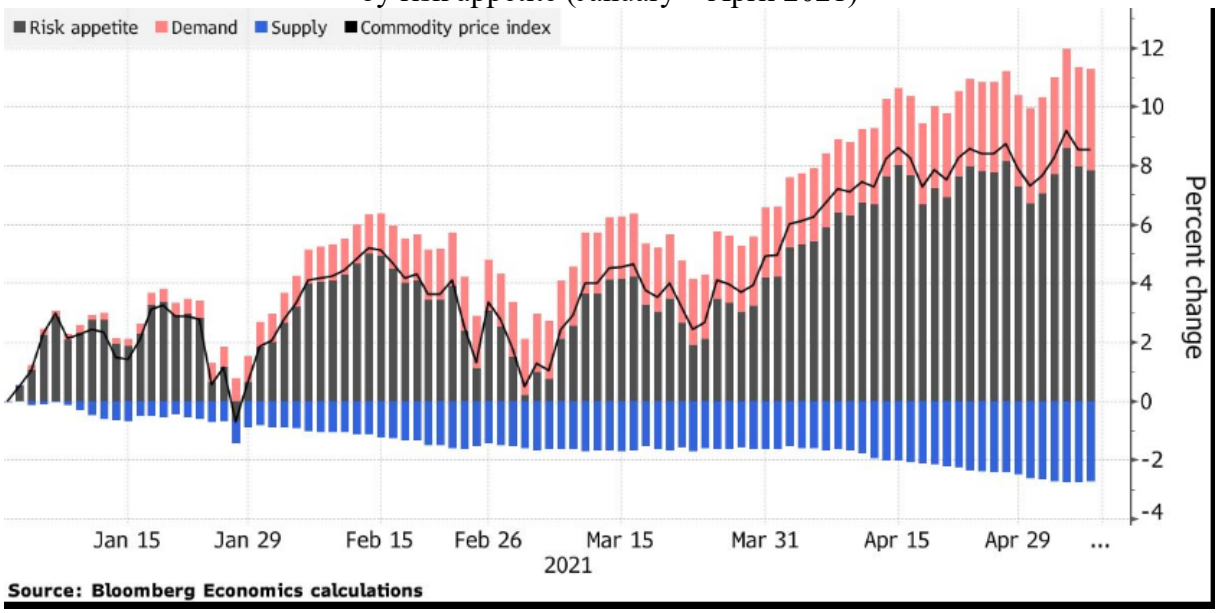
The rise in commodity and energy prices is spurred by a recovery in mobility (post-corona), worries over spare capacity among key producing nations, historically low inventory, slow progress in getting Iran's sanctions lifted, and now, conflict in Ukraine. However, the rise in (industrial) commodity prices during 2021 is not only driven by fundamental changes in demand or shortages of supply, but also by *speculation* on a continued increase in inflation (**Figure 12**). This is a self-fulfilling, reflexive, process: in commodities generally, price movements respond to speculative activity rather than the other way around. As a result, when financial investors expect inflation and commodity prices to increase, they will invest in commodity (futures) markets driving up commodity prices as well as inflation. This *reflexively* reaffirms the initial belief that inflation is likely to go up—and as result, more money will be poured into commodity markets. This herd-like behavior is visible in the 'growing risk appetite' of commodity investors in **Figure 12**. It is a non-trivial driving force of the commodity price surge in 2021.

Figure 11
Monthly import prices: general; fuels & lubricants
(2016 = 100), January 2009-April 2022



Source: FRED Database (series IR, IR10 and PALLFNFINDEXM).

Figure 12
Taste for commodities: Global price increases have been mainly driven by risk appetite (January – April 2021)



Source: Van Roye and Orlik (2021).

Regulators such as the CFTC could insist on higher margin requirements and tighten position limits so as to discourage commodity price speculation (see **Section 11.2** for a discussion). But in the absence of tighter position limits and higher margins, commodity speculators will continue to exploit the market disruptions—to great private benefit but much greater social cost.

Russia's invasion of the Ukraine (on February 24, 2022) has led to a renewed surge in global commodity markets, as anxiety is growing that supply will fall short in everything from wheat to natural gas. The resulting commodities chaos reverberates through the global economy, creating new commodity supply shortages and pushing up commodity prices and inflation even further. These resulting inflationary pressures will last until long after Russia's war in Ukraine will be brought to an end.

3.3 The global supply side of US inflation

It is evident that the global supply-side constraints listed in **Figure 7** and the effects of financial speculation in commodity markets have contributed to the increase in US inflation. It is difficult to quantitatively estimate the contribution of these global drivers to US inflation, because it is not easy to estimate the impacts of commodity speculation on prices or to determine how much US firms adjust their prices in response to changes in the prices charged by their foreign competitors. It is possible, however, to estimate the impact of higher import prices in the PCE inflation rate.

Figure 13
Import price inflation versus PCE inflation: the US economy
(January 1990 – April 2022)

Source: FRED Database (series IR and PCEPI_PC1). *Note*: The linear regression coefficient of import price inflation on the rate of PCE inflation (during January 1990-April 2022) is 0.14 (*t*-value = 23.7; R^2-adjusted = 0.59).

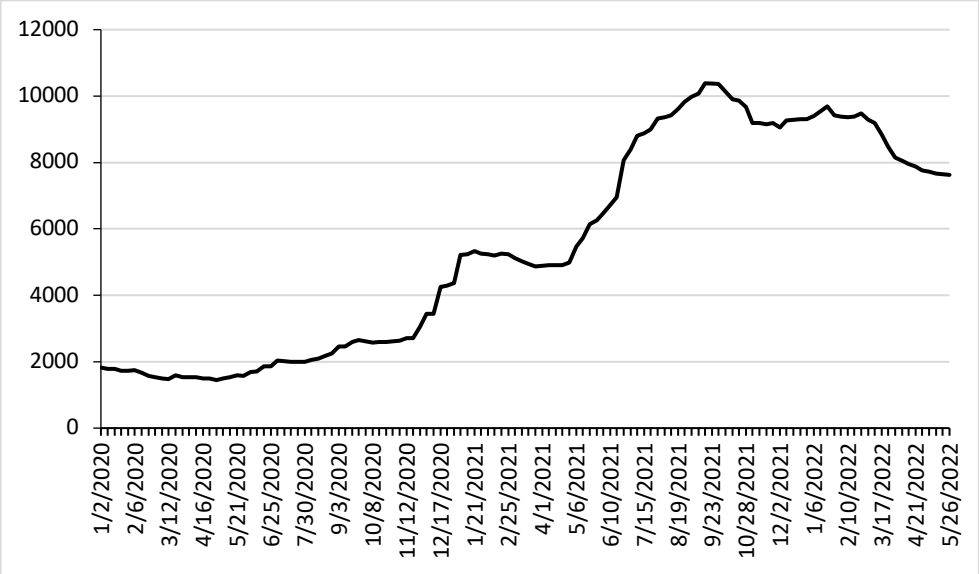
Figure 13 presents the scatter-plot of import price inflation against the PCE inflation rate (based on monthly data for the period January 1990 – March 2022; n = 388). The US import inflation rate increased from 1% during January 2020-January 2021 to 12% during January 2021-March 2022. Using the estimated slope coefficient of the regression line (of 0.14) in **Figure 13**, it follows that the increase in import inflation raised the PCE inflation by 1.3 percentage points during January 2021-January 2022; this means that higher import inflation has been responsible for 32 percent of the increase in the PCE inflation rate during these 12 months. Put differently, almost one-third of the increase in US PCE inflation comes from abroad.

4. Inflation in the rest of the world

Precisely because the sources of rising prices lie in COVID-19-induced disruptions in global commodity chains and the war in Ukraine, the sudden surge in inflation is not unique to the US. All other economies in the world suffer from rising energy and food prices, delayed supplies, more costly (container) transportation and long-lasting shortages of components and industrial consumer goods.

To illustrate, the global *cost of container shipping* (which accounts for 17% of total seaborne trade volume) has soared: during the first four months of 2022, the average composite index of *Drewry's World Container Index* is $8661 per 40ft container (**Figure 14**), which is $5429 higher than the five-year average of $3232 per 40ft container during 2016-2021. This surge in container rates could send consumer prices 1.5% higher over the next year, according to the Review of Maritime Transport 2021, published by UNCTAD;[9] even if the exact impact on consumer prices will vary by country and product, it is likely to be very significant.

Figure 14
Drewry's composite World Container Index (US$/40ft)
(January 2, 2020 – May 26, 2022)



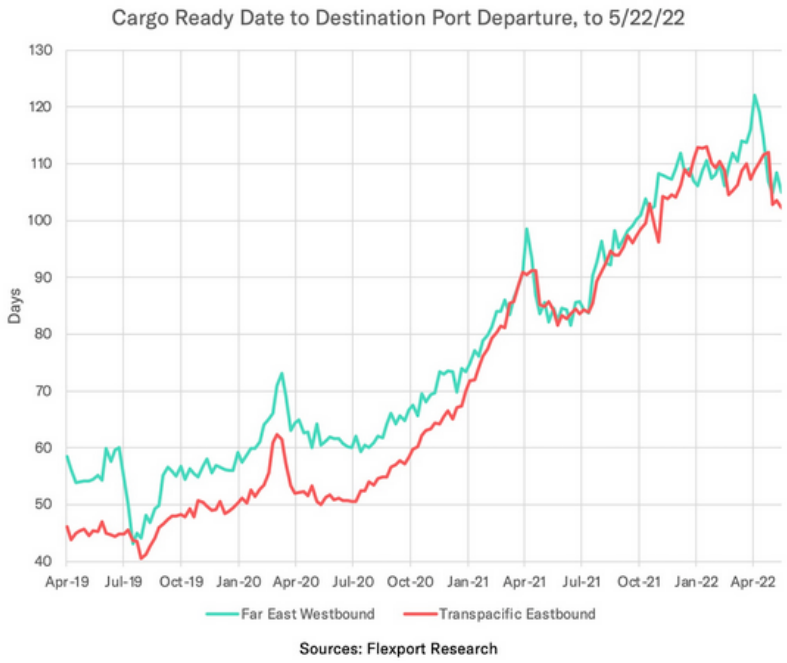
Source: World Container Index, Drewry Supply Chain Advisors

In addition, *delays in container shipping* have reached record levels (**Figure 15**). Before September 2020, it took around 60 days (on average) to bring container cargo from China to Europe, but China-Europe container transport is taking 123 days in Spring 2022. Likewise, whereas trans-pacific container transport from China to the US (West Coast) took around 50 days (on average) before September 2020, it is taking 109 days in April 2022. The doubling of container transportation time is due to COVID-19 lockdowns in China which have led to factory closures in Shenzhen and Shanghai and increased handling times in China's ports. The steadily mounting delays in supplies of key industrial supplies and consumer goods are constraining

[9] By product, electronics, furniture, and apparel would see the greatest price increases—of at least 10% globally (UNCTAD 2021).

(goods) supply (relative to goods demand) and will be contributing to inflation across the globe for a long time, even if after the COVID-19 lockdowns will have become a thing of the past.

Figure 15
Ocean Timeliness Indicator (OT):
Cargo ready date (at exporter's gate) to destination port departure
(April, 2019 – May 22, 2022)



The ramifications of these disruptions of global commodity chains and of the Ukraine war are felt globally. This **Section** looks more closely at rising inflation in a number of key OECD economies—in order to put the US experience in a more global context. For a start, **Figure 16** presents the monthly Consumer Price Index (CPI) inflation rates for the US, the EU, France, Germany, the UK and Canada during January 2019 and March 2022; the monthly inflation rates express the increase in the CPI as the percentage change over the preceding 12 months.

Inflation has been highly correlated across OECD economies (Schnabel 2022b). However, following the corona crisis, inflation in the US has increased more than in the EU, the UK and Canada. The rate of CPI inflation in the US increased from 1.5% in January 2019 to 8.6% in March 2022; CPI inflation in the EU rose from 1.4% in January 2019 to 6.4% in February 2022. In March 2022, the CPI inflation rates for Germany, France and the UK are 7.6%, 5.1% and 6.2%, respectively, while Canada's inflation rate in February 2022 was 5.7%. In all these cases, COVID-19-caused jams in global supply chains and rising commodity (and energy) prices are the main drivers of resurgent inflation (Schnabel 2022b). As is shown in **Figure 16**, in all cases, the CPI inflation rates in which energy price increases have been excluded, are considerably lower than the (headline) CPI inflation rate.

However, what is striking is that the 'gap' between the headline CPI inflation rate and the 'CPI inflation rate excluding energy' is smaller for the US, the UK and Canada than for France, Germany and the EU. For the US, for example, headline CPI inflation is 8.6% in March 2022, whereas 'CPI inflation excluding energy' is 6.8%. For Germany, in contrast, headline CPI inflation is 7.6% in March 2022, but Germany's 'CPI inflation excluding energy' is 'only' 3.7%. This suggests that US firms have transferred the increases in the (energy) cost of production more quickly and more broadly onto the prices of their final products than German firms; US corporations operate in more concentrated markets (relative to the EU) and have increased their market power over time (Philippon 2018; De Loecker, Eeckhout and Unger 2020).

Much of the recent CPI inflation in these OECD economies is imported: during January 2019 and February 2022, import prices increased by around 10% in France, Germany and the EU, by 11.5% in the UK and by 45.5% in Canada; US import prices rose by 20% over the same period (**Figure 17**). Higher import prices are very strongly correlated with higher rates of CPI inflation in all the countries included in **Figure 17** — and import price inflation explains around 28% of British inflation, around 40% of inflation in Canada, France and the EU, and 80% of German inflation.

Figure 16

The rate of consumer price inflation in the U.S., the E.U., Germany and France (January 2019-March 2022)

(*Percentage change from a year ago*)

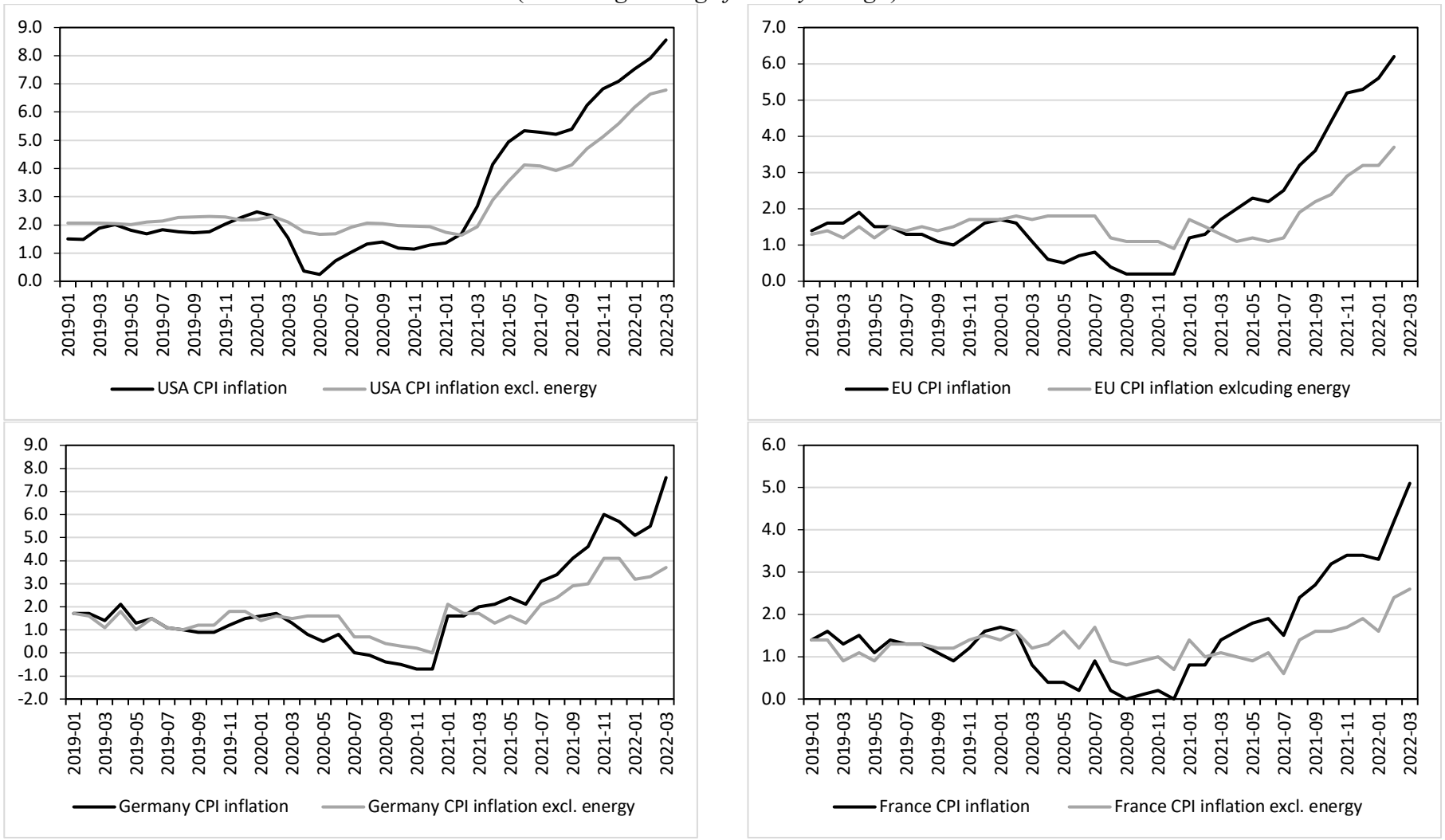
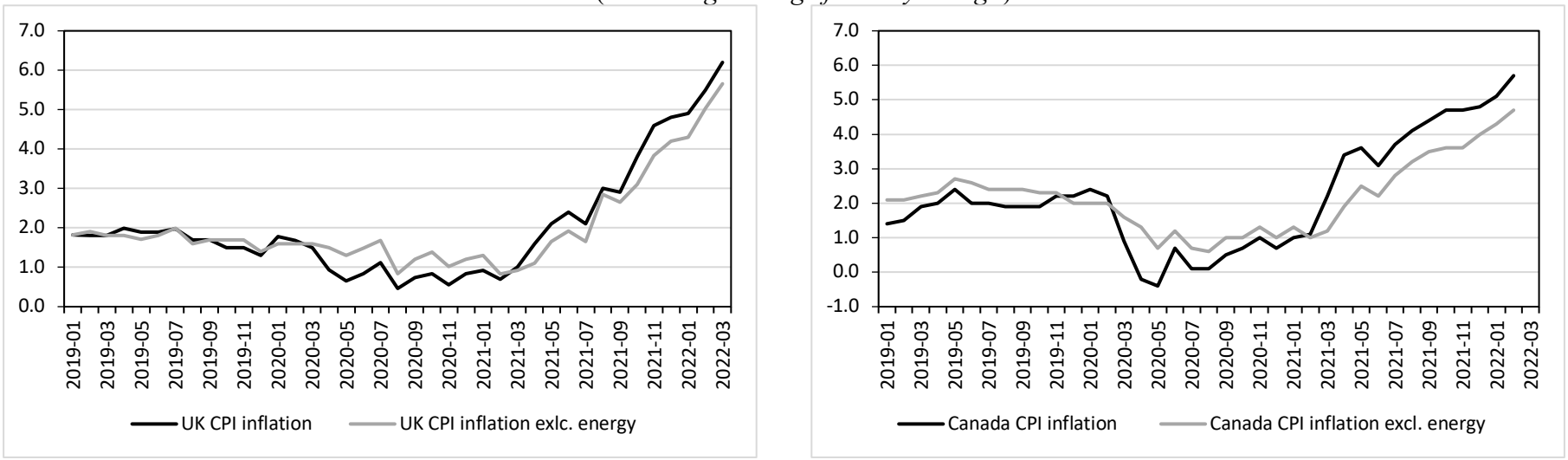


Figure 16 (continued)

The rate of consumer price inflation: the U.K. and Canada (January 2019-March 2022)

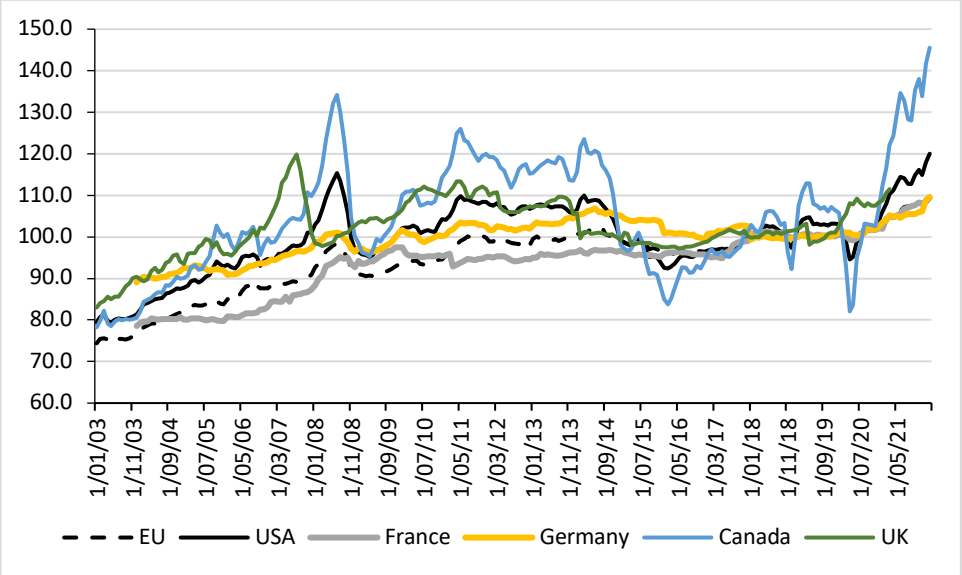
(*Percentage change from a year ago*)



Sources: for the US: FRED data (*series* CPIAUCSL_PC1); for the EU-27, France and Germany: Eurostat HIPC monthly data (annual rate of change); for the UK: Office for National Statistics: Consumer price inflation data; and for Canada: Statistics Canada: 12-month change in the Consumer Price Index (CPI) and CPI excluding gasoline.

While the import inflation is likely to subside in the near future (even if import prices continue to remain high)[10], higher import costs are contributing to rising prices and nominal wages in the countries concerned. In the EU, where most wages are determined by longer-term collective wage agreements, the nominal wage adjustments take longer to materialize than in the US, where nominal wages are quicker to respond. This may explain why CPI inflation in March 2022 is higher in the US than in the EU (**Figure 16**).

Figure 17
Monthly import prices (all industries)
(January 2003 – February 2022; January 2019 = 100)



Sources: FRED database. *Notes*: The correlation coefficient between the CPI inflation rate and the change in the import price index (during January 2019-February 2022; n= 38) is 0.65 (t-value = 5.1) for France; 0.69 (t-value = 5.7) for Germany; 0.59 (t-value = 4.4) for the UK; 0.66 (t-value = 5.3) for the EU; and 0.79 (t-value = 7.8) for Canada.

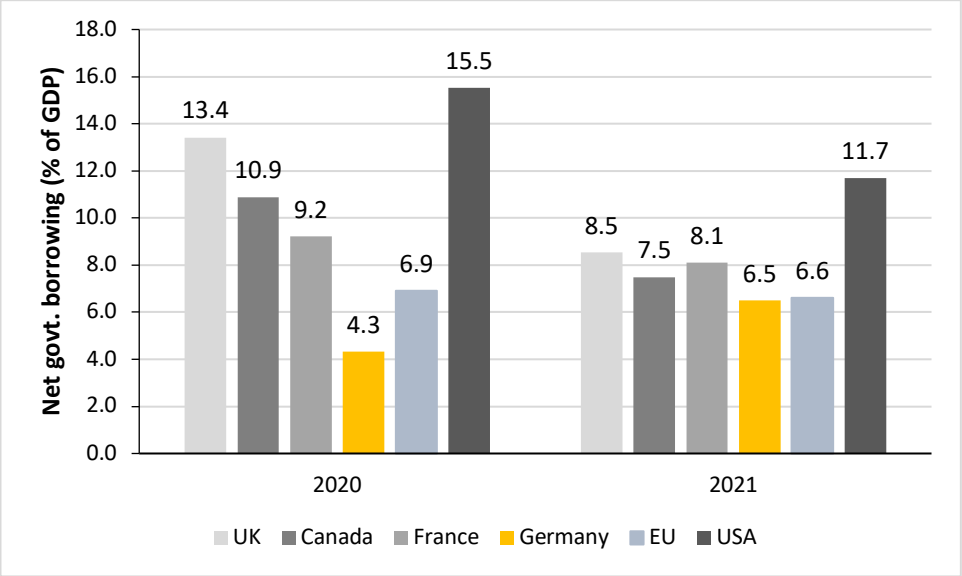
In response to the COVID-19 crisis, the governments of Canada, France, Germany, and the UK introduced fiscal support and relief measures to households, workers and firms. The (extraordinary) extent of fiscal support is illustrated in **Figure 18**: the government deficit of the UK amounted to 13.4% of GDP in 2020 and 8.5% of GDP in 2021, while the average public deficit in the EU was 6.9% of GDP in 2020 and 6.6% in 2021 (which is much higher than the 3% deficit norm set in the Growth and Stability Pact). The fiscal response of the US government stands out: it is considerably larger (as a percentage of GDP) than the fiscal reactions in Europe and Canada during 2020 and 2021.

However, the differences in the magnitude of fiscal responses to the corona-crisis are not showing up (yet) in differences in CPI inflation rates. This is shown in the scatter-plot of **Figure 19** which plots net borrowing of the government (as a percentage of GDP) against the CPI

[10] Energy and commodity prices are unlikely to rise by 50% or more per annum for many years in a row.

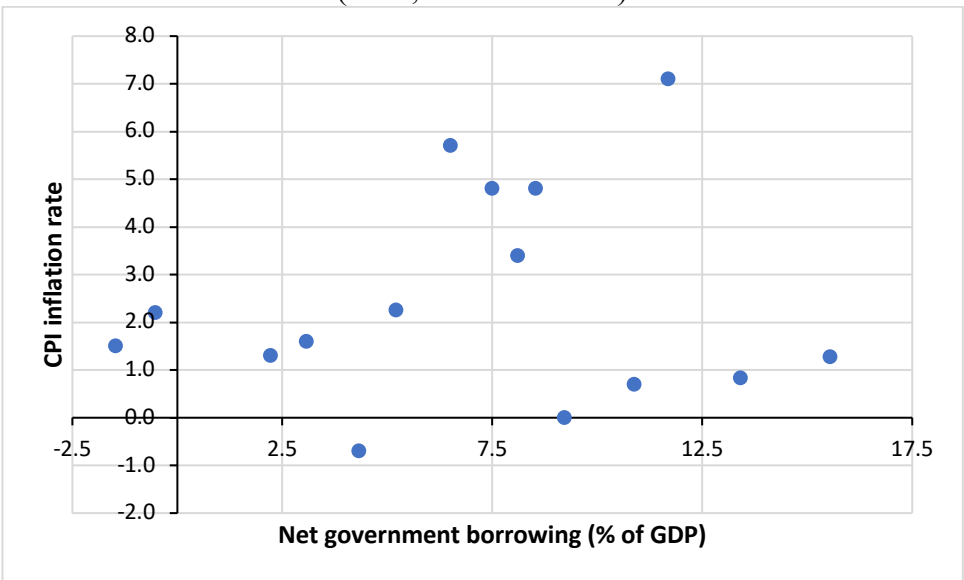
inflation rate during the years 2019-2021. The correlation coefficient between net government lending and the CPI inflation rate is 0.14 and not statistically significant.

Figure 18
Net government borrowing (% of GDP),
2020 and 2021



Sources: for the US and Canada: FRED database; for the EU, France and Germany: AMECO database; and for the UK: Office for National Statistics.

Figure 19
Scatter-plot of net government borrowing (% of GDP)
and the CPI inflation rate in Canada, France, Germany, the UK and the USA
(2019, 2020 and 2021)



Sources: see Figures 16 and 18.

5. Supply constraints in the US economy

Returning to the US economy, we must note that the impacts of the *global* supply shocks were amplified by supply-side bottlenecks *within* the US economy, including inefficiencies in US ports (CSR 2021). It did not help that the seaborne imports into the US are heavily concentrated in just a few ports which have the facilities to dock the ever-larger container vessels. The concentration of 40% of all US container imports in Los Angeles and Long Beach constituted a major bottleneck. While it was unusual, before the pandemic, for more than one ship to wait for a berth, by early January 2022, 105 container ships were awaiting docking space off the cost of California—as a large proportion of dockworkers was unavailable for COVID-related reasons. The unprecedented back-log, in turn, has been causing shortages for retailers and factories with ripple effects throughout the US economy.

An already existing truck driver shortage contributed to the supply chain problems, as deregulation in the 1980s and 1990s turned steady, well-paying jobs into gig work, characterized by long hours, poor working conditions, unpaid waiting times and inadequate wages (Viscelli 2016). Long-haul truck drivers are typically paid on a per-mile basis, rather than per hour worked, and are also exempt from receiving overtime pay under the *Fair Labor Standards Act*. That means drivers are only earning money when they are actively driving and not when they are waiting for cargo to be ready for pickup, or while the truck is loaded or unloaded.

> "Port truckers are often paid by the trip, so the long wait they typically experience outside port gates reduces their earnings. Truckers often face long waits to deliver loads at inland warehouses, where personnel are not ready to unload their trucks. This largely unpaid "detention time" counts toward the maximum hours they can drive each day, reducing drivers' income." (CSR 2021, p. 3).

As a result, annualized job turnover rates for port truckers are high and the already existing truck driver shortage hit a historic high of 80,000 drivers in 2021 (American Trucking Associations 2021)).

However, the most important supply constraint triggered by COVID-19 arose from the sharp decline in the (aggregate) labor force of the US. This can best be seen by looking at the (monthly) employment-population ratio (**Figure 20**).

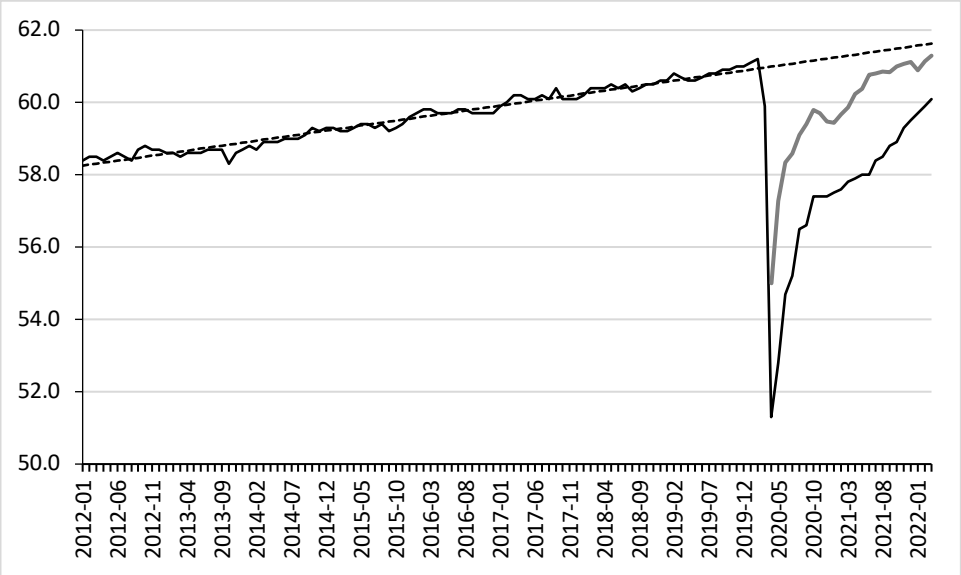
The employment-population ratio steadily increased from 58.4% in January 2012 to 61.2% in February 2020, but it sharply dropped to 51.3% in April 2020 and 52.8% in May 2020 in response to the arrival of SARS-Cov-2 in the US. More than 21 million workers temporarily withdrew from the labor force, as the US labor force shrank by 9% in Spring 2020. The average monthly employment shortfall was around 8 million persons during 2021 (see **Figure 21**).

Even though the employment-population ratio climbed up again to 60.1% in March 2022, it continues to remain below what it would have been without the COVID-19 shock. The estimated employment shortfall in March 2022 (relative to the counterfactual) is 4 million workers (**Figure 21**).[11] BLS data show that during the period May-December 2020, more than 40% of the estimated employment shortfall was caused by "persons not in the labor force, who did not look for a job in the last four weeks because of the coronavirus pandemic".

[11] See Saunders (2022) for a similar analysis of the employment shortfall in the UK during 2020-22.

During 2021, around 28% of the employment shortfall must be attributed to persons dropping out of the labor force because of the coronavirus pandemic. The COVID-19 health crisis is the primary cause of the labor supply shock during 2020-2022.

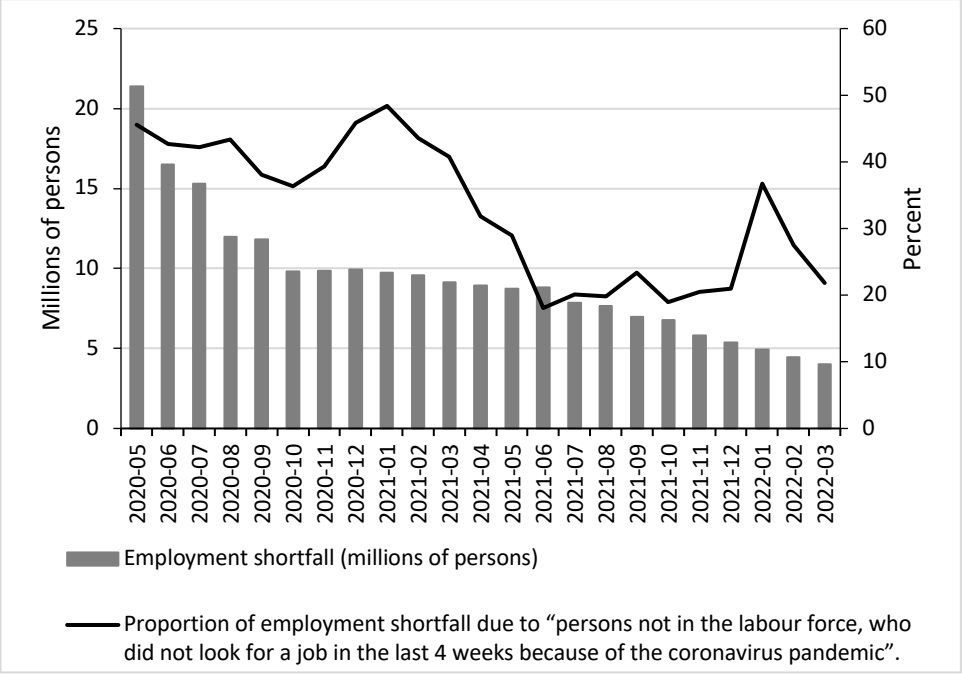
Figure 20
The employment-population ratio,
the US economy (January 2012 – March 2022) (percent)



Source: Bureau of Labor Statistics. *Notes*: The dashed line is the counterfactual in which it is assumed that the employment-population ratio continues to grow at its trend rate (during January 2012-January 2020). Population is the civilian non-institutional population, *i.e.*, people 16 years of age and older who are not inmates of institutions (penal, mental facilities, homes for the aged), and who are not on active duty in the Armed Forces. The employment shortfall in March 2022 (relative to the counterfactual) is 4 million workers. The grey line indicates the decline in the employment-population ratio due to "persons not in the labor force, who did not look for a job in the last 4 weeks because of the coronavirus pandemic".

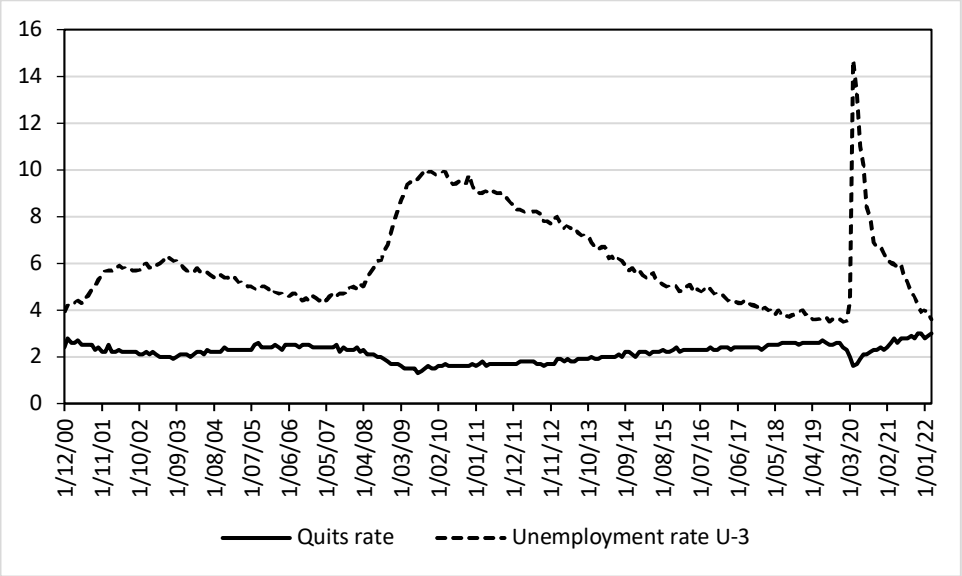
The COVID-19 crisis led to an unprecedented shake-up of the US labor market. Widespread job losses in 2020 gave way to tight labor markets in 2021, driven in part by what's come to be known as the 'Great Resignation'. The nation's quits rate, defined as the number of quits as a percent of employment, increased from 1.7 in April 2020 to 3.4 in November 2021 (which is a 20-year high, see **Figure 22**). For many workers, the coronavirus outbreak was the main reason for quitting a job—directly, because doing the job had a high risk of getting infected, but also indirectly, because the job offered no or insufficient health insurance, lacked flexibility to choose when to put in one's hours, did not allow for working remotely, or did not offer adequate child care support (Parker and Menasce Horowitz 2022).

Figure 21
The employment shortfall, the US economy (May 2020 – March 2022)



Source: Calculated based on data from the Bureau of Labor Statistics.

Figure 22
The private-sector quits rate and the unemployment rate,
the US economy (January 2012 – March2022)

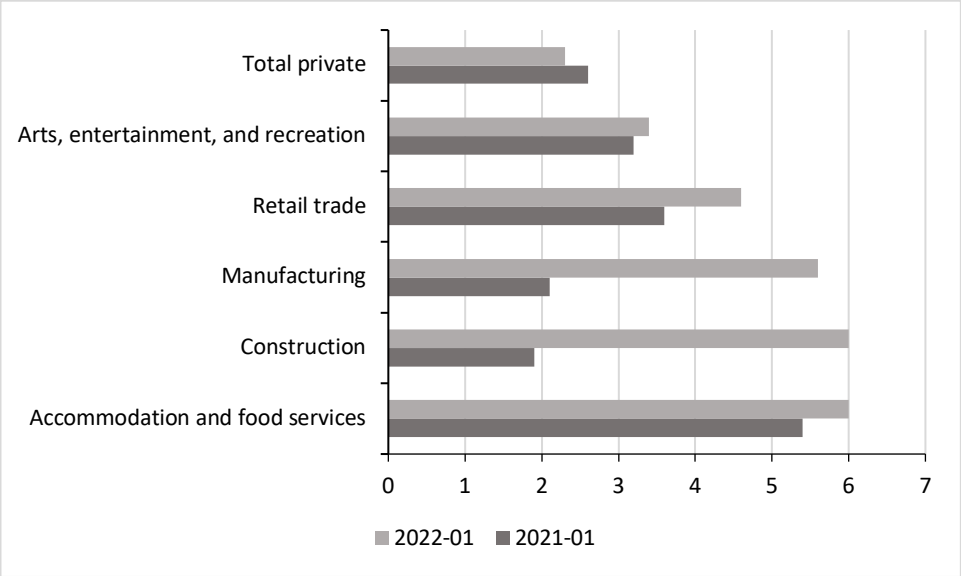


Source: FRED database (series JTS1000QUR and UNRATE). *Note*: The quits rate is defined as the number of quits during the entire month as a percent of employment.

Accordingly, the disengagement from the labor force is for millions of workers not based on a voluntary decision, but rather it is an unfree 'survivalist' outcome, forced upon them by the imperatives of living through the COVID-19 crisis with family and children. In March 2021, after the US child care sector had collapsed in 2020, almost 1.5 million fewer mothers of school-aged children were actively engaged with the labor force than in February 2019, (Heggeness *et al*. 2021; Lim and Zabek 2021; Goldin 2022).[12, 13]

A majority of workers who quit a job in 2021 report that low pay (relative to health risks) was a (major) reason (Parker and Menasce Horowitz 2022). The largest rises in quitting occurred in accommodation and food services (restaurants), arts entertainment and recreation, and retail trade (**Figure 23**), which are all low-wage and close-contact services sectors where under-paid (often female) workers face the highest COVID-19 risks; these jobs do not lend themselves to working remotely (Goldin 2022).

Figure 23
Quits by industry, seasonally adjusted, by key industries and ordered by the percent change in January 2022.



Source: Bureau of Labor Statistics.

However, there is additional channel through which the COVID-19 crisis led to a decline in the effective labor force and a rise in the quits rate: cumulatively, the corona-crisis led to the early retirement of more than 3 million Americans during 2020-2021 (Faria-e-Castro 2021). The

[12] Goldin (2022) notes that the labor force participation of mothers of school-aged children had increased notably in 2019; many of the newcomers disengaged from the labor force in 2021.

[13] The vast majority of US women 25 to 54 years old are in the labor force—76% were in 2019—and half of them have children younger than 18 years old (Goldin 2022, p. 4). The absolute time demands on mothers were extraordinary. Estimates by Goldin (2022) show that childcare (including education) time increased from 8.7 hours per week, before the pandemic, to around 22.4 hours per week, by fall 2020, for college-graduate women (who were full-time workers with elementary school-aged children in two-parent households).

increase in retirement (in excess of that predicted by the demographic shift of baby boomers into retirement) is concentrated among workers aged 65 to 74, led by white women without a college education; in contrast, the retirement rate among those aged 55 to 64 did not exhibit a rising trend during the pandemic (Rodgers III and Ricketts 2022). There is little indication that the people who retired during the corona crisis saw retirement as their best fall back option—and many older (vaccinated) workers have already returned to the labor force (Casselman 2022), or are planning to return once COVID-19 has been brought under control (Quinby, Rutledge and Wettstein 2021).

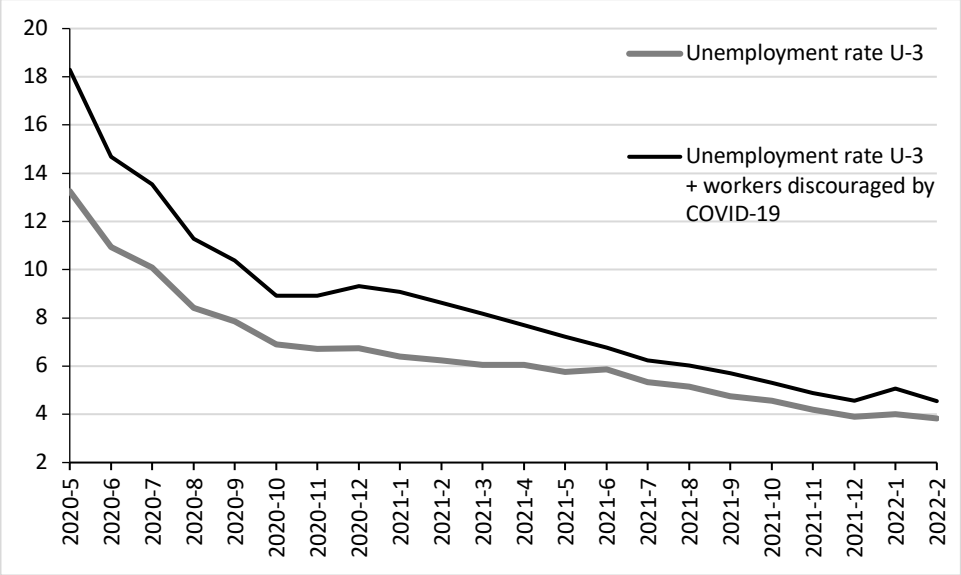
Finally, by mid-March 2022, more than 965 thousand individuals had died because of COVID-19. More than 240,000 of these COVID-deaths were persons aged 18-64 and more than 217,000 deaths were individuals aged 65-74. As a result, COVID-19 directly lowered the employment-population ratio, because many of 457,000 COVID-deaths were workers, often employed in close-contact activities such as health care, leisure, meat processing and packaging, restaurants, and bus and taxi transportation. It is estimated that anywhere between 5% to 30% of those infected by SARS-CoV-2 are affected by Long COVID (Couzin-Frankel and Vogel 2022)—which has obviously lowered the capacity to work of millions of US workers.

In effect, in January 2022, the US labor force still has 4.5 million fewer workers than in the 'no-corona' counterfactual (**Figure 20**). Around 1 million workers are "persons not in the labor force, who did not look for a job in the last 4 weeks because of the coronavirus pandemic", and around 3 million workers decided to retire (temporarily or permanently) because of COVID-19. The sharp decline in the *effective* labor force has led to a *tightness* of the US labor market (Barnichon *et al*. 2021; Domash and Summers 2022a, 2022b).

This is illustrated in **Figure 24** which compares the official unemployment rate (U-3) and a broader measure of the unemployment rate which includes the millions of US workers discouraged by COVID-19 in the numerator and denominator. In May 2020, the official unemployment rate peaked at 13.3% and the broader unemployment rate at 18.3%. During the first six months of 2021, the broader unemployment was on average 2 percentage points higher than the official unemployment rate, and even in January-February 2022, broader unemployment is around 1 percentage point higher than measure U-3. This indicates that there is some slack in the labor market, provided the health emergency can be brought to an end.

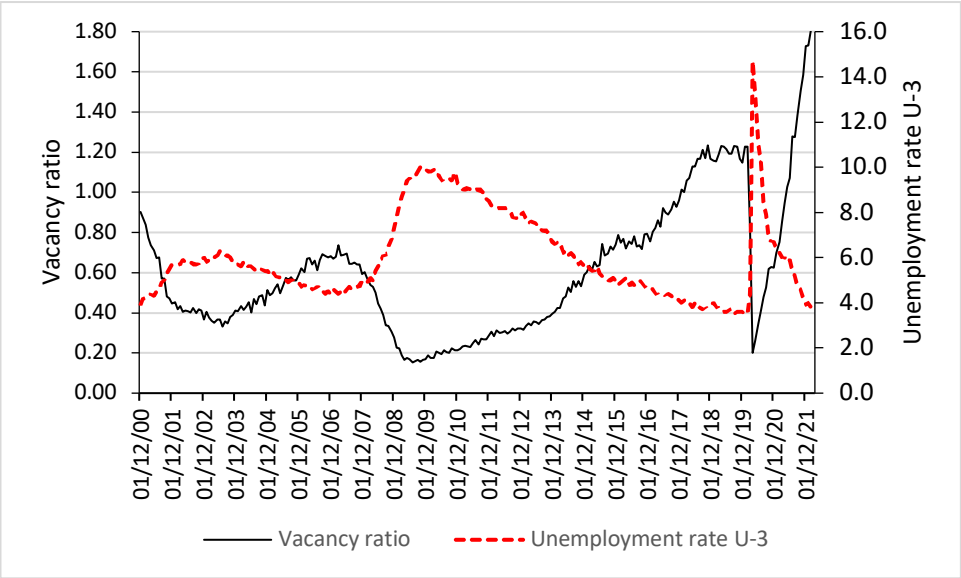
However, as long as COVID-19 continues to pose a significant health risk, the US labor market remains 'tight'. This tightness is shown by the vacancy ratio, the ratio of job vacancies to official unemployment (**Figure 25**). Slack in the US labor market was highest in July 2009, when there were only 0.15 vacancies per unemployed person. The vacancy ratio next increased to around 1.2 vacancies per unemployed worker during July 2017 and February 2020, but then dropped, following the COVID19 recession, to a mere 0.2 jobs per unemployed person in April 2020. In March 2021, the vacancy ratio had already recovered to 0.86 jobs per unemployed worker—and nine months later, in December 2021, the vacancy ratio stood at 1.73. This is a historically high level, suggesting considerable labor market tightness—note that the long-run average level of the vacancy ratio (during 1960-2020) is around 0.60 (Barnichon *et al*. 2021).

Figure 24
The US unemployment rate: U-3 versus the unemployment rate including workers discouraged by COVID-19 (May 2020 – February 2022)



Source: Calculated by the author based on BLS data.

Figure 25
The vacancy ratio and the unemployment rate (U-3): December 2000-March 2022



Source: Bureau of Labor Statistics; and FRED Database.

In response to the tightness of the labor market, nominal wages for the median US worker increased by 4.7% during April 2021 and April 2022 (**Figure 26**). It is not a secret that the substantial increase in nominal wage growth followed decades of low wage growth. Importantly, however, nominal wages have gone up the most at the bottom of the wage distribution—median nominal wage growth in the 1st quartile of wage earners increased by

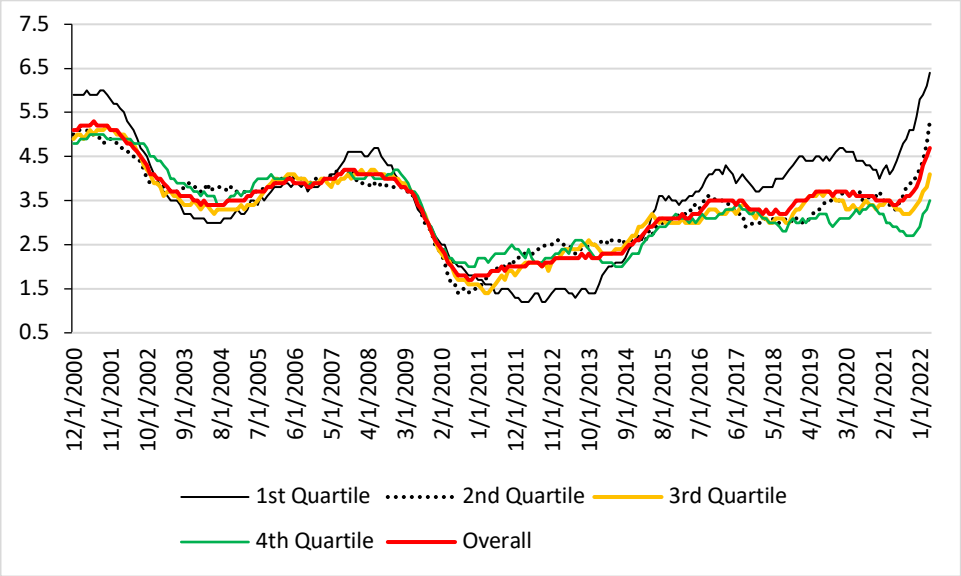
6.4% and nominal wages in the 2nd quartile rose by 5.3%, compared to 4.1% and 3.5% increases for the 3rd and 4th quartiles, respectively (**Figure 26**).

This may look like relatively good news, but on a closer look, it isn't. Nominal wage growth of American workers is not keeping up with accelerating PCE inflation, and hence, median real wage growth in the US became negative in April 2021 (**Figure 27**). One year later, in April 2022, annual median real wage growth in the US is -2.1%. Real wage growth has been declining for the 2nd, 3rd and 4th quartiles of wage earners from April 2021 onwards; real wage growth of workers in quartile 1 has been negative since November 2021 (**Figure 27**). After mid-2020, median real wage growth rates in the US have fallen off a cliff—and as is shown in **Table 2**, real wage growth has been negative in almost all industries and occupations.

It is important to emphasize that the numbers underlying **Figure 27**, which have been calculated using the average PCE inflation rate for all wage earners, are overestimating real wage growth for wage earners in quartiles 1 and 2. The reason is that wage earners in the first two quartiles are facing a significantly higher-than-average inflation rate, because they are spending a higher-than-average proportion of their budgets on items such as energy, car fuel, groceries and housing rents, for which prices have increased the most.

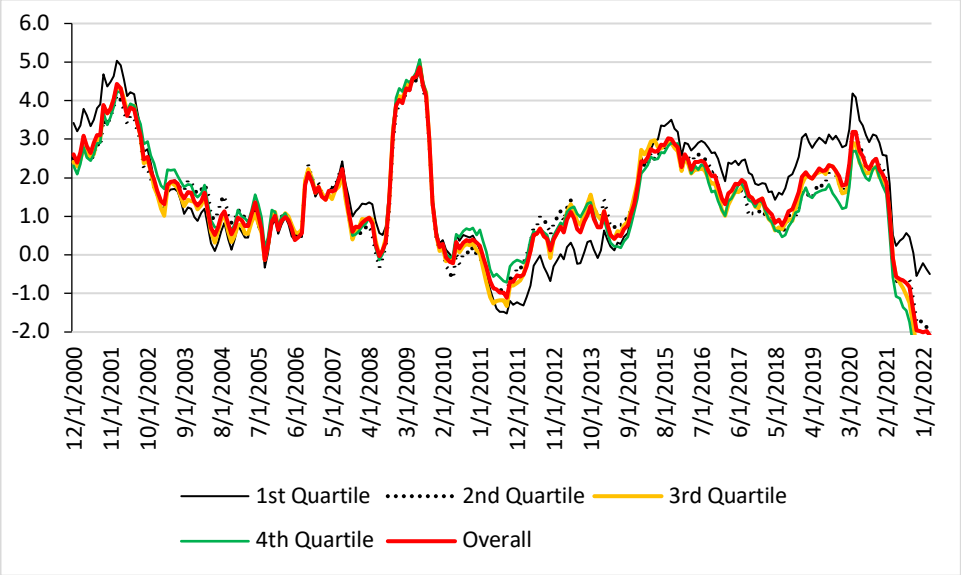
An analysis by BLS economists Klick and Stockburger (2021) finds that between 2003 and 2018, inflation was consistently higher for the lowest-income households. Weber, Gorodnichenko and Coibion (2022), who analyzed the prices which about 43,135 US households paid for food, beverages and some small household goods during the 12 quarters from 2018Q1 to 2020Q4, report that households earning less than $30,000 a year consistently faced higher inflation than those earning more than $100,000 a year. Higher inflation rates for the lower-income households have more than eaten up the higher nominal wage growth these wage earners experienced during the previous two years. American reality is even more dismal than what is suggested by **Figure 27**.

Figure 26
12-month moving average of median nominal wage growth by wage quartile, Hourly data (December 2000 – April 2022)



Sources: *Current Population Survey*, Bureau of Labor Statistics, and Federal Reserve Bank of Atlanta Calculations. See https://www.frbatlanta/chcs/wage-growth-tracker

Figure 27
12-month moving average of median real wage growth by wage quartile, Hourly data (December 2000 – April 2022)



Sources: *Current Population Survey*, Bureau of Labor Statistics, and Federal Reserve Bank of Atlanta Calculations. See https://www.frbatlanta/chcs/wage-growth-tracker . Nominal wage growth was deflated using the 12-month growth in the PCE price index (FRED *series* PCEPI_PC1).

Table 2

Nominal and real wage growth by industry and occupation, March 2021 – March 2022 (per cent)

	Nominal wage growth	Real wage growth
All workers	4.1	-2.4
Private industry workers	4.3	-2.2
Public sector workers	3.1	-3.2
Industry (private sector)		
Goods-producing industries	4.4	-2.1
Manufacturing	4.9	-1.6
Construction	3.4	-3.0
Trade, transportation, and utilities	5.9	-0.6
Wholesale trade	6.4	-0.2
Retail trade	7.0	0.4
Transportation and warehousing	3.9	-2.5
Utilities	3.3	-3.1
Information	4.0	-2.4
Financial activities	1.2	-5.1
Professional and business services	4.5	-2.0
Service-providing industries	4.5	-2.0
Education and health services	4.5	-2.0
Health care and social assistance	5.1	-1.4
Hospitals	4.9	-1.6
Nursing and residential care facilities	6.4	-0.2
Leisure and hospitality	8.4	1.7
Accommodation and food services	8.8	2.1
Public sector	3.1	-3.2
Education and health services	2.6	-3.7
Schools	2.3	-4.0
Health care and social assistance	4.5	-2.0
Hospitals	4.5	-2.0
Public administration	2.9	-3.4
Occupational groups		
Management, professional, business and financial	3.8	-2.6
Professional and related	3.7	-2.7
Sales and office	4.3	-2.1
Office and administrative support	4.7	-1.8
Construction, extraction, farming, fishing, & forestry jobs	4.3	-2.1
Installation, maintenance, and repair	3.8	-2.6
Production, transportation, and material moving	5.6	-0.9
Transportation and material moving	5.6	-0.9
Service occupations	6.9	0.3

Source: Bureau of Labor Statistics, Employment Cost Index for total compensation, by occupational group and industry (seasonally adjusted). *Note*: nominal wage growth has been deflated using the PCE price index increase of 6.6% during March 2021-March 2022.

It must further be noted that the relatively high nominal wage growth in the 1st quartile of wage earners is, to a large degree, due to the fact that the considerable health risks posed by COVID-19 have led to a '*re-pricing*' of jobs, especially those jobs in essential close-contact services (such as care, hospitality and cleaning) that were (and still are) undervalued and underpaid by the proverbial market. According to survey data collected by the Bureau of Labor Statistics (2022) from July 27 through September 30, 2021, 14.5% of private-sector establishments increased base wages as a result of the coronavirus emergency; forced by the circumstances, establishments in accommodation and food services, retail trade, healthcare and social assistance, and manufacturing increased base wages at a higher rate than average. Many businesses offered (temporary) monetary bonuses for working during the pandemic and/or began to offer more flexible working hours.

The increase in nominal wages leads to higher prices, when profit margins are kept unchanged. But we have already seen that corporate profit margins increased significantly during the corona-crisis years (**Figure 10**).

To gauge the inflationary impact of higher nominal wages—and of higher profit mark-ups—we look at the *producer price index* which measures the price that producers get for their output. We assume that firms determine the producer price by adding a profit mark-up to unit production cost which includes the unit cost of domestic and imported intermediate inputs and unit labor cost; more details can be found in the notes to **Table 3**. Using aggregate numbers for these cost items as well as for the profit mark-up (based on the BEA input-output table for 2020), the inflationary impacts of wage and profit increases have been estimated; the results appear in **Table 3**.

As shown in column (2), an increase in the nominal wage by 4.3% (which is the actual increase for private sector workers during March 2021-March 2022) raises the producer price index by 3.8%. However, the increase in net profits per unit of gross output from 0.108 to 0.156 (which is the actual increase in the profit margin during 2020Q2—2021Q3; see **Table 10**) raises the producer price index by 12.6%.

The actual producer price index increased by 36% during April 2020—January 2022 (**Figure 28**). Taken together, higher wages and higher profit margins have pushed up the producer price index by 17%, explaining almost half of the price increase. But the hike in profit margins has contributed far more to the surge in prices than the increase in nominal wages—the contribution to inflation of higher profit margins is more than three times as large as that of higher nominal wages.

Table 3

The impacts of wage growth and higher profit margins on US producer prices

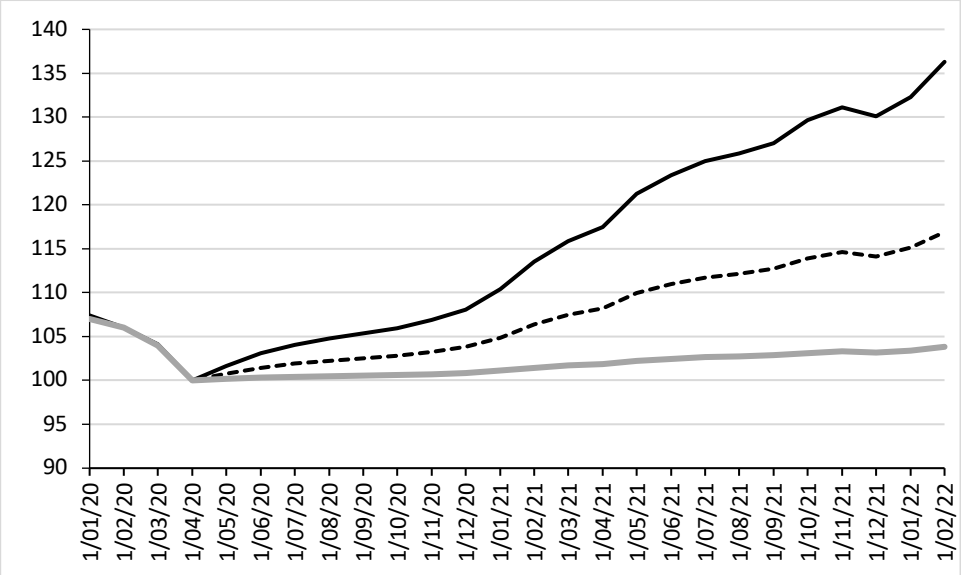
	(1)	(2)	(3)	(4)
Domestic intermediate input cost ($\alpha\ p$)	0.416	0.432	0.468	0.486
Imported intermediate input cost ($\mu\ p_M$)	0.038	0.038	0.038	0.038
Wage cost per unit of output ($\lambda\ w$)	0.317	0.331	0.317	0.331
Depreciation rate (δ)	0.127	0.127	0.127	0.127
Profit mark-up (π)	0.140	0.140	0.209	0.209
Net indirect tax rate (τ)	0.024	0.024	0.024	0.024
Gross output price (p)	1.000	1.038	1.126	1.169

Source: based on BEA input-output data for 2020. *Notes*: Column (1) is the base-line in which all prices and the nominal wage (per hour of work) are equal to 1 ($p = p_M = w = 1$). In column (2), the nominal wage has been raised by 4.3%. In column (3), profits per unit of output are increased from 0.108 to 0.156. In column (3), the nominal wage is raised by 4.3% and profits per unit of output are increased from 0.108 to 0.156. The mark-up price p is determined as follows: $p = (1+\tau) \times (1+\pi+\delta) \times (\alpha\ p + \lambda\ w + \mu\ p_M)$, or: $p = \frac{(1+\tau)\times(1+\pi+\delta)}{1-(1+\tau)\times(1+\pi+\delta)\times\alpha} \times (\lambda\ w + \mu\ p_M)$. Domestic intermediate inputs per unit of gross output $\alpha = 0.416$; imported intermediate inputs per unit of gross output $\mu = 0.038$; hours worked per unit of gross output $\lambda = 0.317$; the depreciation rate $\delta = 0.127$; the net profit mark-up $\pi = 0.143$; and the net indirect tax rate $\tau = 0.022$. Net profits per unit of gross output are equal to $\xi = \frac{\pi}{1+\pi+\delta}$. Using empirical values for δ and ξ, π be determined as: $\pi = \frac{\xi\ (1+\delta)}{1-\xi}$.

Similar evidence has been provided by Bivens (2022). I have updated Bivens' analysis to 2022Q1 and the results appear in **Table 3**. More than 38% of the rise in the US inflation rate during 2020Q2 – 2022Q1 has been due to fatter profit margins, with higher unit labor costs contributing around 19% of this increase. Using Bivens' approach, the contribution to inflation of higher profit margins is found to be two times as large as that of higher nominal wages. As Bivens (2022) notes, this is not normal. During 1979 to 2019, profits only contributed about 13% to price growth and labor costs 56.1%.

The historically high profit margins in the economic recovery from the COVID-19 crisis are difficult to square with explanations of recent inflation based purely on macroeconomic overheating. We have already seen (in **Figure 27**) that real wages are declining. And what **Figures 28** and **29** suggest, is that recent US inflation has been caused more by a *profit-price spiral* than by a wage-price spiral (as nominal wage growth is lagging behind profit growth).

Figure 28
Producer price index (January 2020-January 2022):
Simulated contributions of wage growth and profit growth (April 2020 = 100)



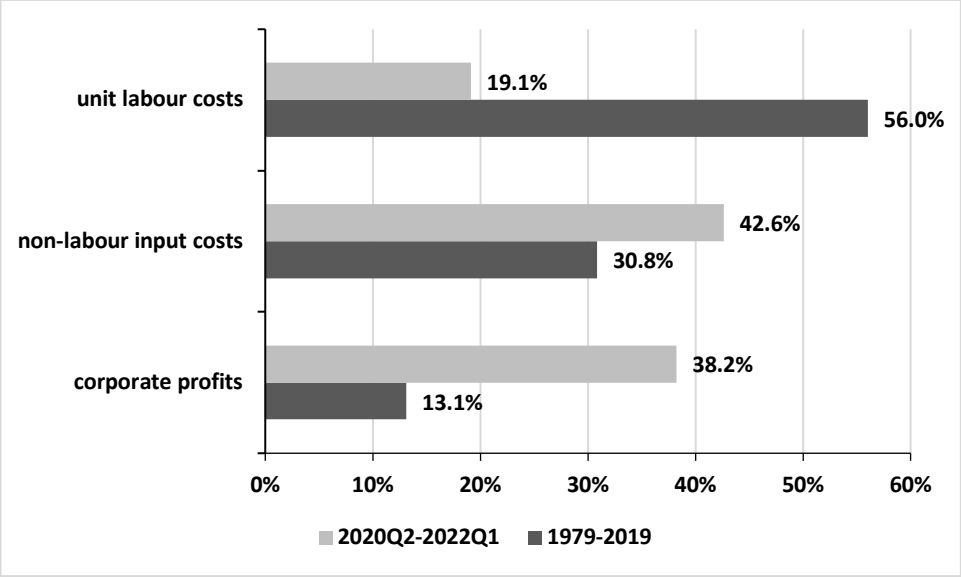
the producer price index increases by 36 %-points

contribution of the increase in profit margins is 12.6 %-points

contribution of the increase in nominal wages is 3.8 %-points

Sources: Data on the producer price index are from the FRED database (*series* PPIACO). The contributions of wage growth and profit growth have been estimated by the author; see notes to Table 3.

Figure 29
Contributions to growth in unit prices in the nonfinancial corporate sector (1979-2019 *versus* 2020Q2-2022Q1)



Source: Based on Bivens (2022). Calculated using data from Table 1.15 from the National Income and Product Accounts (NIPA) of BEA.

6. Is the increased inflation due to demand?

A dominant view holds that the COVID-19 relief spending[14] has been too large, leading to an overheating of the economy and a consequent increase in inflation. Policymakers had been warned, prominently by Lawrence H. Summers, who, on February 4, 2021, well before inflation began its rise, predicted that

> "there is a chance that macroeconomic stimulus on a scale closer to World War II levels than normal recession levels will set off inflationary pressures of a kind we have not seen in a generation" (Summers 2021).

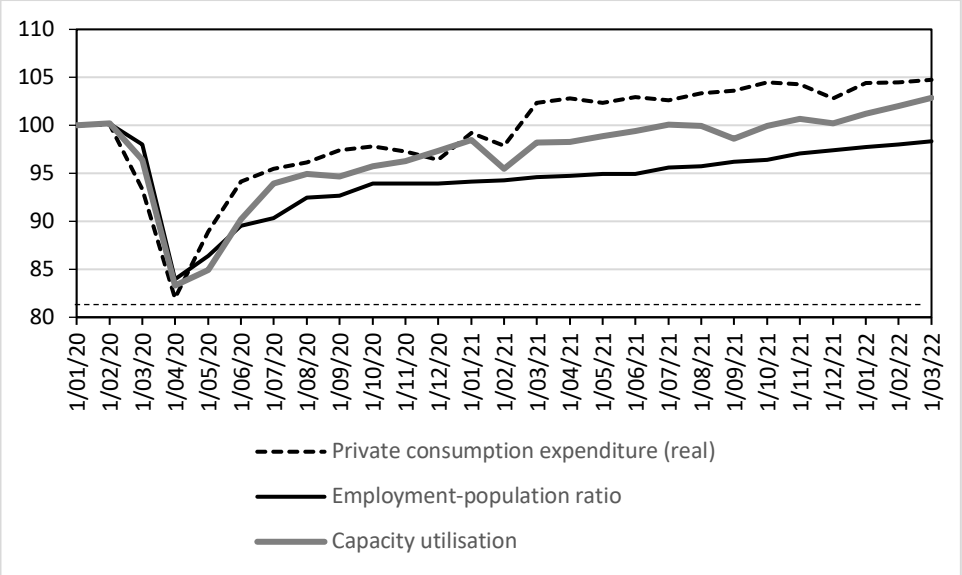
The US labor market is showing signs of overheating (see **Figure 25**). However, the labor market tightness is caused by the fact that the demand side of the US economy has rebounded faster than the supply side, which remains constrained by the decline in the effective labor force, due to COVID-19 (**Section 5**).

This divergence—between the rapid recovery of demand and continuing supply-side problems—is illustrated in **Figure 30**. Starting from a level of 100 in January 2020, real personal consumption expenditure declined by 18 percentage points, the employment-population ratio fell by 16 percentage points and capacity utilization (which accounts for both supply- and demand-side influences) declined by 16.7 percentage points in April 2020. The order of magnitude of the collapse in demand (personal consumption spending) was comparable to that of the decline in supply (the employment-population ratio and utilization).

Then the recovery of the demand side set in and as a result, real personal consumption expenditure is 4.7% higher in March 2022 than it was in January 2020. However, the supply-side recovery is lagging behind: the employment-population ratio is still 1.6% lower in March 2022 than in January 2020, while capacity utilization is 2.9% higher in March 2022 than two years before. Therefore, what **Figure 30** shows is that the overheating of the US economy is primarily caused by the failed recovery of the economy's supply side in general and of its effective labor force in particular.

[14] In particular the American Rescue Plan Act (ARPA) is singled out for being 'excessively large'. ARPA amounted to a stimulus of around 8% of US GDP.

Figure 30
The COVID-19 shock: personal consumption expenditure,
the employment-population ratio and capacity utilization
January 2020-March 2022 (January 2020 = 100)

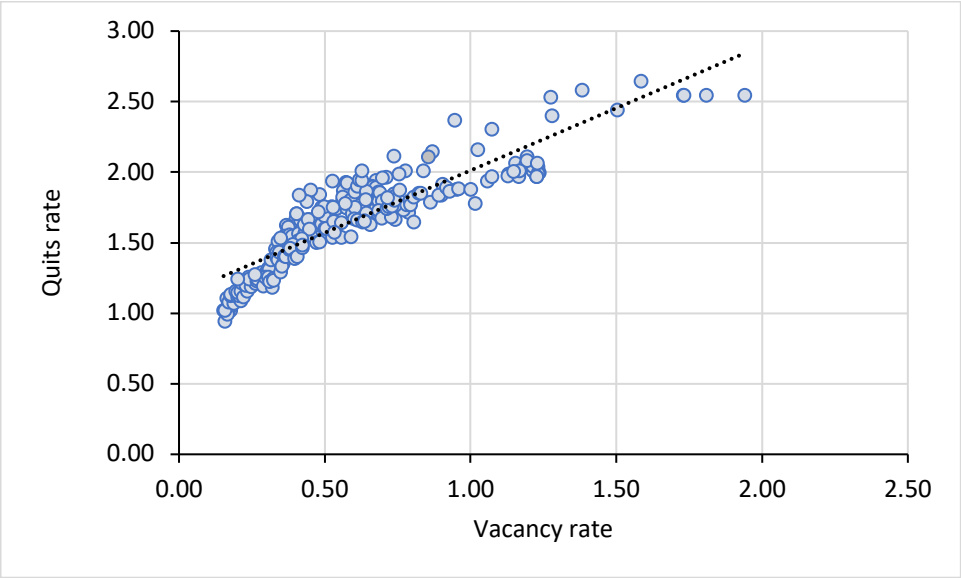


Source: FRED database; series PCEC96_NBD20200101 Real Personal Consumption Expenditures, Monthly, Seasonally Adjusted; EMRATIO_NBD20200101 Employment-Population Ratio, Monthly, Seasonally Adjusted; TCU_NBD20200101 Capacity Utilization: Total Index, Monthly, Seasonally Adjusted. All indicators are indices with January 2020 = 100.

Based on an econometric analysis, Domash and Summers (2022a) argue that the vacancy and quits rates currently experienced in the US correspond to a degree of labor market tightness previously associated with below 2% unemployment rates. Such tightness, they warn, will make for "*extremely* rapid growth in nominal wages" (Domash and Summers 2022a, p. 32). Specifically, "nominal wage growth […] is projected to increase *dramatically* over the next two years, surpassing 6% wage inflation by 2023 …." (p. 21). This is serious stuff—notice the use of the words "extremely" and "dramatically" in these sentences.

However, the econometric evidence provided by Domash and Summers (2022a) is not convincing on a closer look. I have four specific concerns. A *first problem* concerns the fact that the two indicators of labor market tightness used in the analysis—the vacancy ratio and the quits rate—are strongly correlated (see **Figure 31**). The correlation coefficient between the two indicators (using monthly data for December 2000 – March 2022) is 0.89.

Figure 31
The US vacancy ratio and quits rate:
December 2000-March 2022



Source: FRED Database (series JTSJOL and JTS1000QUL).

Domash and Summers nevertheless include both indicators (as independent variables) in some of their regressions, and as a result, these particular findings suffer from multicollinearity. This is clear from the fact that their estimated coefficients on the vacancy ratio, lagged unemployment and lagged inflation change rather drastically when the quits rate is added to the equation; likewise, coefficients that were significant in regressions that exclude the quits rate, turn statistically insignificant once the quits rate is included. The evidentiary base of Domash and Summers' (2022a) conclusions is not robust enough to draw out strong (policy) conclusions.

Secondly, the estimated coefficient on the vacancy ratio turns out to be not statistically significant in 7 out of the 14 regressions in Tables 2 and 3 of Domash and Summers (2022a). In the 7 regressions in which it is significant, the coefficient on the vacancy ratio takes an average value of 0.7.[15] This means that the increase in the vacancy ratio from 0.86 to 1.94 jobs per unemployed worker during March 2021 and March 2022 must have increased nominal wage growth by 0.76 percentage points. If we assume that firms have the market power to transmit the higher nominal wage costs onto higher prices, keeping their profit margins constant, the PCE inflation rate must have risen by 0.76 percentage points as well. This is a relatively minor impact, explaining less than one-fifth of the actual rise in PCE inflation by 4.1 percentage points during March 2021 and March 2022. Even if the US vacancy ratio increases to 2.1 in 2022-23 (as in the worst-case scenario according to Domash and Summers), the impact would be to raise

[15] The findings of Domash and Summers (2022a) are consistent with the results of Barnichon *et al*. (2021), researchers at the *Federal Reserve Bank of San Francisco*, who estimate the association between the vacancy ratio and the PCE inflation rate using quarterly data for 1960-2021. They find that an increase in the vacancy ratio by 0.6 jobs per unemployed worker increases the (core) PCE inflation rate by 0.3 percentage points.

the PCE inflation rate by 0.9 percentage points relative to March 2021. The inflationary impact of the 'extreme tightness of the US labor market' thus turns out to be less extreme.

This brings me to the *third problem* with the analysis of Domash and Summers (2022a): their regression analysis does not include relevant variables controlling for the supply-side constraints that are contributing to the recent inflation. **Table 4** presents the regression result for the PCE inflation rate (during January 2004-December 2021) as a function of the vacancy ratio, the global price index of all commodities (which captures imported inflation) and capacity utilization (which reflects both supply and demand influences); the regression model includes the one-period lagged dependent variable and corrects for first-order autocorrelation.

The estimated coefficient on the vacancy ratio is 0.33, and the long-run impact of a change in the vacancy ratio on the PCE inflation rate is 0.64[16]; this is comparable with the estimated coefficients of Barnichon *et al.* (2021) and Domash and Summers (2022a). The coefficients of global commodity prices and capacity utilization are also statistically significant and have the expected sign—both higher commodity prices and higher capacity utilization are associated with higher US inflation. Overall, the equation 'explains' around 85% of the variance in the PCE inflation rate.

Table 4

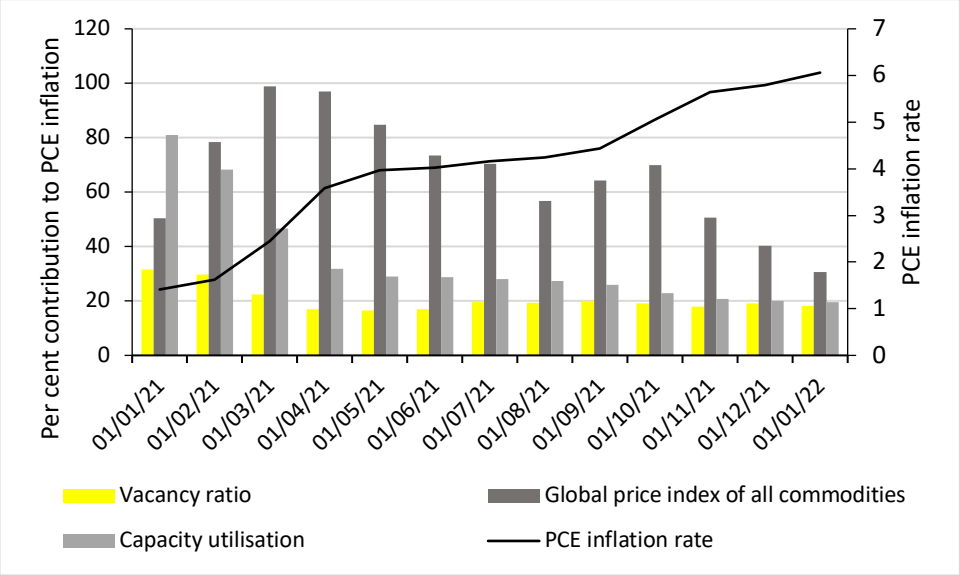
PCE inflation on the vacancy ratio, global commodity prices and capacity utilization (monthly data, January 2004-December 2021).

Dependent variable:	PCE inflation rate
independent variables:	
vacancy ratio	0.33***
	(2.86)
global price index of all commodities	0.02***
	(9.67)
capacity utilization: total industry	0.01***
	(5.03)
one-period lagged PCE inflation rate	0.48***
	(8.12)
ar(1)	0.66**
	(8.42)
σ	0.20***
	(17.74)
number of observations	215
Wald χ^2	3018.36

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[16] The long-run impact of a change in the vacancy ratio on the PCE inflation rate includes the impact operating through the lagged PCE inflation rate and is calculated as [0.33/(1 – 0.48)].

Figure 32
The PCE inflation rate: per cent contributions of the vacancy ratio, global commodity prices and capacity utilization (January 2021-January 2022)



Source: Author's estimations based on the econometric results in **Table 4**.

Figure 32 presents the per cent contributions of the vacancy ratio, global commodity prices and capacity utilization to the PCE inflation during January 2021-January 2022. On average, 20.5% of (rising) PCE inflation can be attributed to the (rising) vacancy ratio (as a proxy of labor market tightness). However, global commodity prices and capacity utilization play more prominent roles and account for 67% and 35% of PCE inflation. Hence, labor market tightness does contribute to US inflation indeed, but supply-side constraints play a more important role.

Besides, the labor market tightness itself is caused by the fact that labor demand has recovered more quickly than the effective labor force, as is illustrated by the fact that by October 2021, capacity utilization had recovered to its level of January 2020, while the employment-population ratio is still 1.6% lower in March 2022 than in January 2020, while capacity utilization is now 2.9% higher than two years before (**Figure 30**).

The *fourth and final problem* with the analysis of Domash and Summers (2022a) is that the increased wage inflation in their scenarios is driven not so much the tightness of the labor market, but rather by the partial indexation of nominal wage growth to (lagged) inflation. In their forecasts, Domash and Summers assume that the 3-year weighted lagged inflation rate rises to 3% by the end of 2022 and to 5% by the end of 2023, and the higher inflation is pushing up nominal wages (and inflation in the next year).

However, the regression results of Domash and Summers (2022a) show that such inflation indexation is far from perfect: in 14 out of 21 regressions (reported in their Tables 2 and 3), the coefficient of lagged inflation on nominal wage growth is *not* statistically significant. Higher prices reduce real wage one-for-one. In the remaining 7 regressions, the coefficient of lagged inflation on nominal wage growth takes an average value of 0.35. Hence, even when US labor markets are extremely tight, US workers are unable to protect their real wages—as their nominal wages grow only one-third as fast as the general price level. Higher inflation is extremely costly to workers, therefore. To single out higher nominal wages as a main *cause* of

the increase in US inflation is not just incorrect, because wage growth is partially *following* (not leading) inflation, but quite a stark example of blaming the victim.

Central bankers are taking heed. For instance, Andrew Bailey, the £575,000-a-year Bank of England Governor told British Members of Parliament that British workers should "think and reflect" before asking for pay rises: "I'm not saying nobody gets a pay rise, don't get me wrong, but I think, what I am saying, is we do need to see restraint in pay bargaining otherwise it will get out of control" (Inman 2022). Likewise, Fed Chair Powell (2022), who earns only around $203,500 per year, singled out nominal wage growth as a driver of inflation in a press conference on May 4, 2022:

> "…. by moderating demand, we could see vacancies come down, and as a result—and they could come down fairly significantly and I think put supply and demand at least closer together than they are, and that that would give us a chance to have lower—to get inflation—to get wages down and then get inflation down without having to slow the economy and have a recession and have unemployment rise materially. So, there's a path to that."

Domash and Summers (2022c) take the argument one further step, claiming that it is not in the interest of US workers to demand higher nominal wages (as compensation for the sharply rising costs of living). Their argument is that claiming higher nominal wages is a self-defeating strategy, because individual gains in nominal income will be eroded by the consequent increase in aggregate inflation. Domash and Summers illustrate the point by using the following football analogy (made by Arthur Okun):

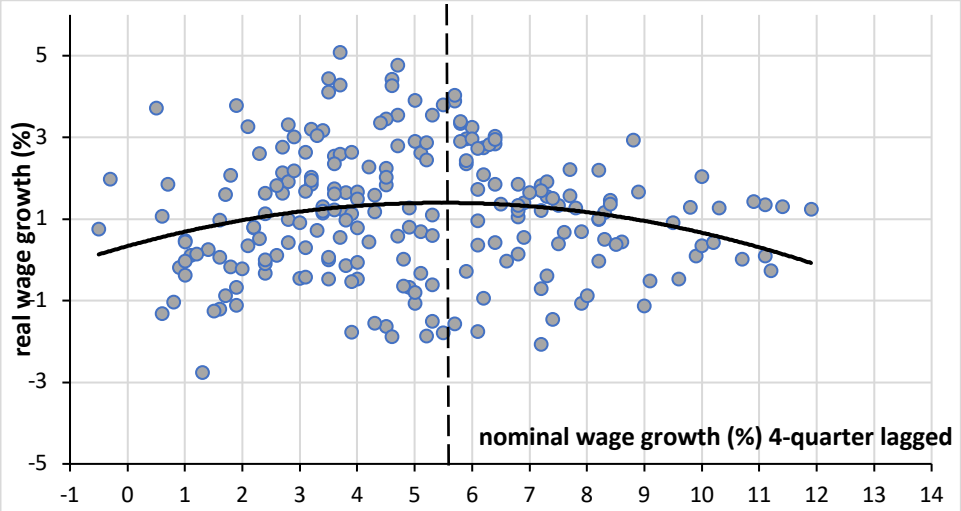
> "When an individual football fan stands up in the crowd, he can see the football game better. But if everyone in the crowd stands up, then nobody sees any better, and everyone is made less comfortable and worse off."

The same is claimed to hold true for nominal and real wages. This claim is a clear instance of what Albert Hirschman (1991) called the 'rhetoric of reaction', and more specifically, of the 'perversity trope': the claim that some purposive intervention to improve some feature of the political, social or economic order only serves to worsen the condition one wishes to ameliorate (Storm 2019).

To buttress their point, Domash and Summers (2022c) present a clear (statistically significant) parabolic relationship between US nominal wage growth and real wage growth: as nominal wage growth rises from a low level, real wage growth rises as well—up until nominal wage growth reaches about 5 percent, and falls thereafter.

I have replicated their analysis (**Figure 33**) and also obtain a parabolic—inverse U-shaped—relationship between lagged nominal wage growth and real wage growth in the US during 1965Q1-2019Q4. The parabola has a turning point at a nominal wage growth rate of 5.6% (which is similar to the findings of Domash and Summers); real wage growth peaks at 1.44%. If we take **Figure 33** seriously, this would mean that average US real wage growth will decline from its peak level of 1.44%, the more US workers manage to push nominal wage growth above the threshold of 5.6%. Real wage growth will even turn negative once nominal wage growth exceeds 11.4%.

Figure 33
Real compensation growth versus nominal compensation growth,
US non-farm employees (1965Q1-2019Q4)



Source: Author's estimations based on BLS data via FRED. *Notes*: Nominal (real) compensation growth is calculated as the 4-quarter percent change in the hourly nominal (real) compensation for non-farm employees from the BLS. The estimated relationship between nominal wage growth W and real wage growth w is: $w = 0.508\,W - 0.045\,W^2$. Coefficient 0.508 has a t-value of 8.63 and coefficient -0.045 a t-value of -5.87; $\bar{R}^2 = 0.37; F = 64.9; n = 216$. The coordinates of the turning point are: $W = \frac{0.508}{2\times 0.045} \approx 5.69\%$; $w \approx 1.44\%$.

Domash and Summers (2022c) make it clear that it is not appropriate to interpret the parabolic relationship between nominal and real wage growth in causal way. After making this caveat, they nevertheless offer a causal explanation:

> "Both nominal wage growth and real wage growth reflect a variety of economic forces. Our suspicion about the best way to understand the documented relationship is that in environments of stable inflation, increases in wages are primarily driven by increases in productivity growth, which justify higher real wages. But past a certain point, it is likely that most increases in wages are driven either by adverse supply shocks or by increases in nominal aggregate demand, both of which are naturally associated with decreases in real wages." (Domash and Summers 2022c).

US workers be warned: nominal wage growth (calculated as the 4-quarter percent change in the hourly nominal compensation for non-farm employees from the BLS), running at 6.5% in the first quarter of 2022, has already passed the turning point of **Figure 33**, and hence, US real wage growth will only decline. It follows that nominal wage growth restraint will 'lead to' *higher* real wage growth, because it will help cool down the overheated US economy.

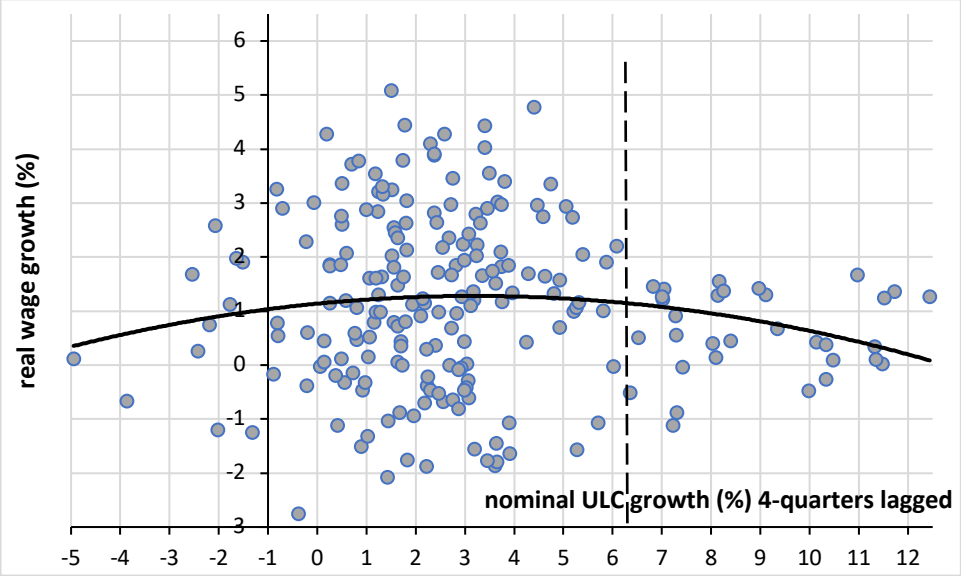
The 'perversity trope' used by Domash and Summers (2022c) can only work, however, if higher nominal wage growth raises the growth of nominal unit labor cost (ULC) and firms shift the higher ULC on to prices. Nominal unit labor cost growth is, by definition, equal to the difference between nominal wage growth and labor productivity growth. It follows that an increase in nominal wage growth that is accompanied by a similar increase in labor productivity growth does not raise nominal ULC growth and inflation. Hence, the correlation between nominal wage growth and real wage growth in **Figure 33** is somewhat misleading, because

higher nominal wage growth will only impact inflation and real wage growth if it exceeds labor productivity growth and raises ULC growth.

Therefore, in **Figure 34**, I plot the 4-quarters lagged growth of nominal ULC against real wage growth. Nominal ULC growth is a more relevant explanans than just nominal wage growth, because it also includes labor productivity growth;[17] nominal ULC growth is what matters for inflation. I obtain a parabolic relationship between ULC growth and real wage growth in the US during 1965Q1-2019Q4. The parabola has a turning point at a nominal ULC growth rate of 6.2%; real wage growth peaks at 2.5%.

What does this finding mean for nominal wage growth and the warning by Domash and Summers? Note first that labor productivity growth in the US during 1965Q1 and 2019Q4 was 1.9% on average per year. This implies that a nominal wage growth rate of 8.1% is consistent with a growth rate of nominal ULC of 6.2%. In other words, using nominal ULC growth instead of nominal wage growth, I find that the turning point after which nominal wage growth is associated with declining real wage growth is 8.1% rather than 5.6% (as argued based on Domash and Summers (2022c)). With US nominal wage growth running at 6.5%, which is firmly on the upward-sloping left-side of the parabola in **Figure 34**, it still makes good sense for US workers to push up nominal *and* real wages—completely in line with the basic logic proposed by Domash and Summers.

Figure 34
Real compensation growth versus nominal unit labor cost growth (ULC),
US non-farm employees (1965Q1-2019Q4)



Source: Author's estimations based on BLS data via FRED. *Notes*: The estimated relationship between nominal ULC growth ULC and real wage growth w is: $w = 0.421\,ULC - 0.034\,ULC^2$. Coefficient 0.421 has a t-value of 6.61 and coefficient -0.045 a t-value of -4.39; $\bar{R}^2 = 0.21; F = 29.2; n = 216$. The coordinates of the turning point are: $ULC \approx 6.24\%$; $w \approx 2.53\%$.

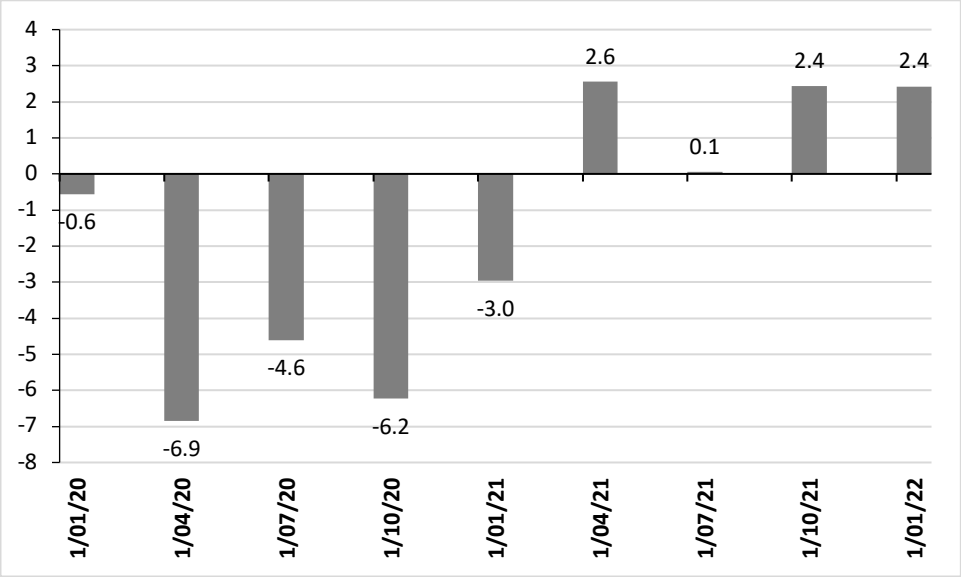
[17] This is acknowledged by Domash and Summers (2022c) who write: "wage growth that runs too far ahead of productivity can contribute to underlying inflation and reverse the very gains in worker purchasing power that we are trying to achieve."

However, Domash and Summers are right when they write that the parabolic relationship is not meaningful in a causal way, because "nominal wage growth and real wage growth reflect a variety of economic forces." As is shown by the adjusted R^2's reported in the notes to **Figures 33** and **34**, the parabolic relationships explain only around one-third of the variance in real wage growth—which means that two-thirds are left unexplained.

Finally, I investigated how the relationship between nominal and real wage growth, as proposed by Domash and Summers (2022c) and replicated in **Figure 33**, performs out of the sample period 1965Q1-2019Q4. I have used the estimated coefficients (reported in the notes to **Figure 33**) to calculate the 'predicted' real wage growth during the nine-quarters period 2020Q1 – 2022Q1, using actual (realized) 4-quarters lagged nominal wage growth. The out-of-sample prediction errors, which are defined as the difference between predicted real wage growth and actual (realized) real wage growth, appear in **Figure 35**.

It can be seen that predicted real wage growth was much lower than actual real wage growth during 2020Q1-2021Q1 (when inflation was still low), whereas it was much higher than actual real wage growth during 2021Q2-2022Q1 (when inflation was rising). The parabolic relationship between nominal and real wage growth that has been estimated using data for the period 1965Q1-2019Q4, does a poor job in forecasting actual real wage growth during 2020Q1-2022Q2. Other factors—unprecedented lockdowns, labor market withdrawals and global supply-side shocks—did upset the US economy, and past performance provides surprisingly little guidance to foretell the future.

Figure 35
Out-of-sample prediction errors for US real compensation growth
(2020Q1-2022Q1)



Source: Author's calculations based on the parabolic relationship given in **Figure 39** and actual BLS data on nominal compensation growth during 2020Q1-2022Q2. *Note*: The prediction error is defined as the difference between predicted real wage growth and actual (realized) real wage growth.

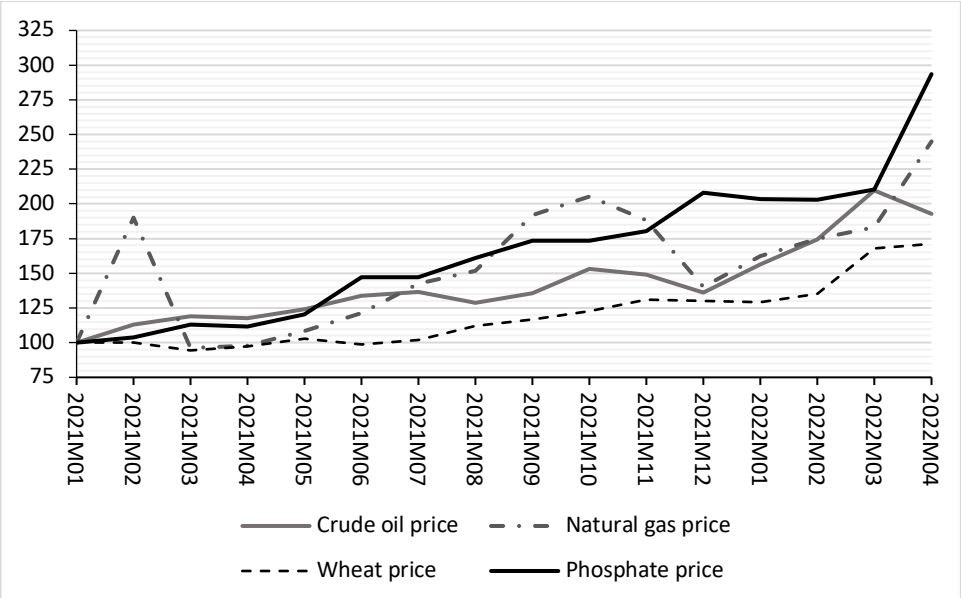
The greatest weakness of the argument put forward by Domash and Summers (2022c), however, is that it presupposes that US workers have sufficient bargaining power to obtain higher and higher nominal wage increases. Structural evidence provided by Summers in an earlier incarnation (Stansbury and Summers 2019) shows that this presupposition is empirically incorrect. Nominal wages are chasing inflation, which is mostly due to higher import prices and higher profit markups—*Alice's Red Queen* was wrong, however: even if workers do all the running they can do, their nominal wages keep lagging behind the inflation rate and their real wages are going down.

7. Is the increase in US inflation permanent or transitory?

Fed officials acknowledge that the US inflation is becoming more durable than anticipated. According to *St. Louis Federal Reserve* President James Bullard (Egan 2022), his business contacts worry that COVID-19-caused supply chain disruptions will last into 2023. These worries were expressed before the Ukraine war started and led to soaring prices of energy, fertilizers (phosphate) and food across the world. Crude oil prices and prices for natural gas have increased by 93% and 145%, respectively, during January 2021-April 2022, while the price of wheat rose by 71% and the price of phosphate (a main element of fertilizers) almost trebled (**Figure 36**). The *FAO Food Price Index* reached an all-time high in April 2022 and is expected to rise considerably more.

In today's deregulated commodities markets, in which financial speculators dominate price formation, just the traders' anticipation of future commodity shortages and chaos is enough to bring about price increases as traders overreact and immediately "price in" the perceived risk. Perceived (expected) shortages turn into real (immediate) price changes. Inflationary pressures will last as long as SARS-Cov-2 continues to upset global supply chains, the Russia-Ukraine war continues to disrupt global commodity markets, we allow speculators to rig the commodity markets, and climate problems continue to increase.

Figure 36
Major commodity prices, January 2021-April 2022
(January 2021 = 100)



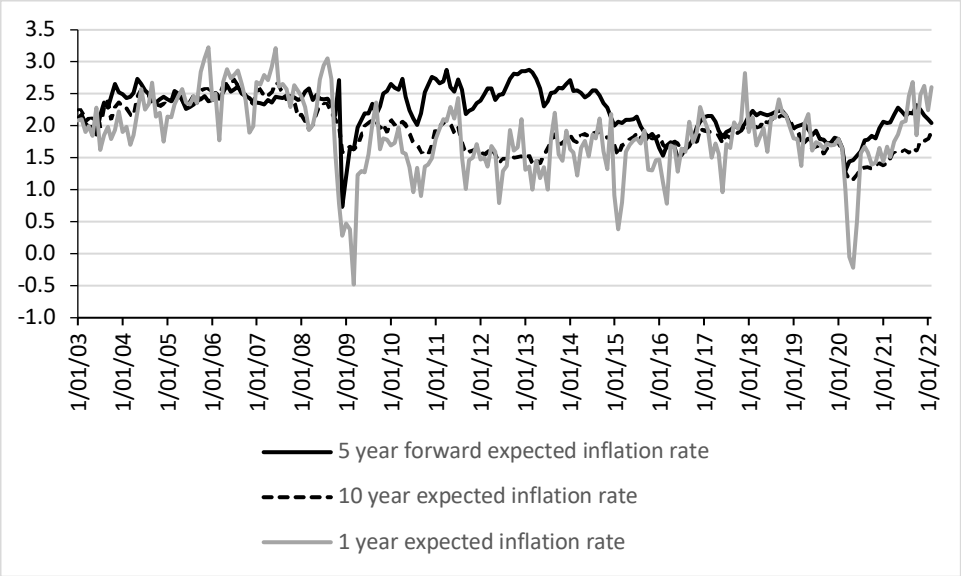
Source: World Bank Commodity Price Data (The Pink Sheet).

However, there is a growing (monetary policy) concern (Summers 2022) that these disruptions of global supply chains will last for a time long enough to re-establish the long-gone wage-price spiral, which will embed high inflation in the macro system (similar to what happened during the 1970s), especially once expectations of longer-run inflation begin to drift upwards.

Such a wage-price spiral will arise if (*a*) labor market conditions are very tight for a longer period of time; (*b*) workers possess sufficient wage bargaining power to effectuate large enough nominal wage increases to offset the increase in the cost of living; and (*c*) inflation expectations become 'unanchored', because the public is no longer convinced that the Federal Reserve remains committed to keeping inflation close to the inflation target (or 'anchor') of 2%.

We have already seen that the US labor market is very tight (see the vacancy ratio in **Figure 25**), which means condition (*a*) has been satisfied. Let us next (briefly) consider the 'un-anchoring' of inflation expectations (condition (*c*)). So far, both survey and market-based measures of longer run inflation expectations look pretty stable (**Figure 37**)—although there has been a notable uptick in longer run inflation expectations in the very recent past. Hence, until now, an unhinging of longer-run inflation expectations has not contributed to a self-fulfilling process of inflation.

Figure 37
Inflation expectations:
One-year, five-year and ten-year ahead expected inflation rate (%)
(January 2003 – February/April 2022)



Source: FRED database (series EXPINF1YR, EXPINF10YR and EXPINF1YR).

However, it is easy to put too much value on the meaningfulness of these expected-inflation indicators (Rudd 2021). A study Coibion, Gorodnichenko and Weber (2021) illustrates the point. Coibon *et al.* asked approximately 20,000 respondents to identify the inflation rate targeted by the Fed and found that "Less than twenty percent of respondents correctly answered 2%. Barely 50% answered a number ranging from 0% to 5%. Strikingly, almost forty percent answered that the Federal Reserve was targeting an inflation rate of 10% or more**,** which suggests a pervasive lack of knowledge on the part of households about the objectives of the

Federal Reserve" (Coibon *et al*., 2021, p. 12). If the general public is this far off on the Fed's targeted rate, does it really matter if the Fed raises or lowers it? The point is that these indicators are based on flimsy measurements and can change rather rapidly and drastically:

> "people have trouble with this question: "If inflation goes from 3% in year one to 2% in year two, have prices gone up, down or stayed the same?" The answer is they have risen, but at a slower rate. People struggle when asked what the inflation rate is, and usually overestimate it." (Blanchflower 2021)

What about condition (*b*)? As is shown in **Table 2**, US nominal wages have failed to keep up with inflation and real wages have declined across-the-board. According to the estimates of Domash and Summers (2022a), the coefficient of lagged inflation on nominal wage growth takes an average value of only 0.35 and is not significant in more than half of their regressions. The indexation of US nominal wages to US inflation is imperfect. Hence, notwithstanding a very tight labor market, US workers have been unable to effectuate large enough nominal wage increases to offset the increase in the cost of living.

The reason is, of course, that US workers have suffered a long-term structural loss of bargaining power, due to declining unionization and globalization (outsourcing). As Anna Stansbury and Lawrence H. Summers (2020, p. 2) write, strong worker bargaining power "gives workers an ability to receive a share of the rents generated by companies operating in imperfectly competitive product markets, and can act as countervailing power to firm monopsony power." Stansbury and Summers (2020a, p. 2) identify three main causes for the structural decline in worker power in the US:

> "First, *institutional changes*: the policy environment has become less supportive of worker power by reducing the incidence of unionism and the credibility of the "threat effect" of unionism or other organized labor, and the real value of the minimum wage has fallen. Second, *changes within firms*: the increase in shareholder power and shareholder activism has led to pressures on companies to cut labor costs, resulting in wage reductions within firms and the "fissuring" of the workplace as companies increasingly outsource and subcontract labor. And third, *changes in economic conditions*: increased competition for labor from technology or from low-wage countries has increased the elasticity of demand for U.S. labor, or, in the parlance of bargaining theory, has improved employers' outside option." (*Italics added*)

Stansbury and Summers (2020, p. 5) argue that "the decline in worker power [is] consistent with another highly salient aspect of the macro experience of recent decades: the substantial decline in both average unemployment and average inflation." Based on their analysis, the authors (2020, pp. 7-8) explicitly call for "institutional changes that enhance workers' countervailing power – such as strengthening labor unions or promoting corporate governance arrangements that increase worker power"—which is just another way of stating that, today, US workers almost completely lack the power to redistribute product market rents from capital owners to labor and, therefore, are in no position whatsoever to kickstart a wage-price inflation spiral.

However, as was shown in **Figures 28** and **29**, US inflation is also being driven by the pricing power and higher profits of corporations—a claim that Lawrence Summers rejected on Twitter as a form of 'science denial'. But (as discussed earlier) there is evidence that corporations with

pricing power are using the current inflationary environment as a pretext to raise prices more than necessary, because they do not have competitors to drive them to keep prices down. Companies are being rewarded by higher revenues and higher earnings when they increase their profit margins. Corporate profiteering is contributing to the inflation problem.

To conclude, even if the PCE inflation is transitory, it may last for two or more years, because the supply chain disruptions and Russia's war with Ukraine will push up energy and commodity prices for a long time. As a result, nominal wages will (and must) rise to help US workers and households deal with the much higher cost of living. Higher corporate profit margins of profiteering corporations are adding to the inflationary pressures for no good reason.

A renewed wage-price inflation spiral in the US appears unlikely, precisely for the reasons given by Stansbury and Summers (2020): absent institutional changes that enhance workers' countervailing power—such as strengthening labor unions or promoting corporate governance arrangements that increase worker power—US workers remain powerless and incapable of maintaining their real wages in this inflationary era.

8. Can the Fed safely bring down inflation?

All eyes are now on the Federal Reserve: after all, 'controlling inflation' is traditionally what the central bank is supposed to be doing. "We have to reassure people we are going to defend our inflation target and we are going to get inflation back to 2%," *St. Louis Federal Reserve* President Bullard (Egan 2022) said recently, adding that "our credibility is on the line here." And in a *Washington Post* article of March 15, 2022, Summers (2022) warns that "[t]o avoid stagflation and the associated loss of public confidence in our country now, the Fed has to do more than merely to adjust its policy dials — it will have to head in a dramatically different direction."

The Fed has two instruments to tame prices—namely, rolling back its pandemic-era emergency stimulus measures and, most importantly, raising interest rates to lower the aggregate-demand pressure and stop the overheating in the economy. Raising interest rates should take the heat off prices, but doing so comes with three—non-trivial—problems.

First, the effects of higher interest rates come with a time-lag and the (gradual) impacts (on PCE inflation) will not be felt for months or longer. Interest rate hikes do not constitute a *direct* way to immediately bring down inflation.

Second, an interest rate increase is a *generic* (blunt) intervention, which will affect inflation by depressing aggregate demand and economic activity, but which cannot be targeted to contain sector-specific price increases, which are of overwhelming importance to the current bout of PCE inflation. Put differently, higher interest rates will achieve nothing (let me repeat: *nothing*) in terms of lowering the price rises driven by supply-chain disruptions and/or geopolitical tensions, which are responsible for more than half of today's PCE inflation. "Yanking down on aggregate demand level by raising rates would be a machine gun approach to something that needs a scalpel," said Josh Bivens (Isodore 2022), director of research at the *Economic Policy Institute*.

Third, and this will come as a shock to most 'Serious Economists', the impact on inflation of an increase in the interest rate is, as a matter of fact, quite limited. This goes against established macro theory. After all, most macroeconomists believe in a fairy-tale world of monetary policy

rules, in which the central bank is capable of keeping inflation (and inflation expectations) close to the chosen inflation target (generally 2%) by raising (lowering) the interest rate when the economy is overheating (in a recession), as is indicated by the 'fact' that actual unemployment is below (above) the NAIRU.

In this 'magical world', central banks know the value of the 'neutral rate of interest', at which savings are equal to investment in the loanable-funds market, the actual unemployment rate equals the NAIRU and the inflation rate is at the target. In this parallel universe, the interest rate assumes a pivotal role in determining demand, the level of economic activity, unemployment and inflation—and because the central bank has the power to set the interest rate, it falls to central bankers to use the interest-rate magic wand to stabilize inflation, by keeping actual unemployment at the NAIRU.

An interesting recent illustration of this kind of miraculous thinking is provided by the following excerpt from an interview by Ezra Klein with Jason Furman:

> "JASON FURMAN: Yeah, so there's something called the neutral interest rate. We don't directly observe it. We don't quite know exactly what it is. But it seems to be maybe the Fed thinks around 2.5 percent. I wouldn't be surprised if it was lower than that. If your interest rates are set to that, then in a normal economy at full employment, where everything is synced up the way it's supposed to be, the amount that people want to save will equal the amount that businesses want to invest and credit markets will clear. [……] When you lower the interest rate below that neutral rate — and certainly zero is below any estimate of the neutral rate — you essentially have the accelerator on. You're pushing businesses to invest more, households to borrow more. And when you're above that neutral rate — I don't know, 4 percent would certainly be above it — it's like having the brakes on and you're slowing the economy down." (Klein 2022).

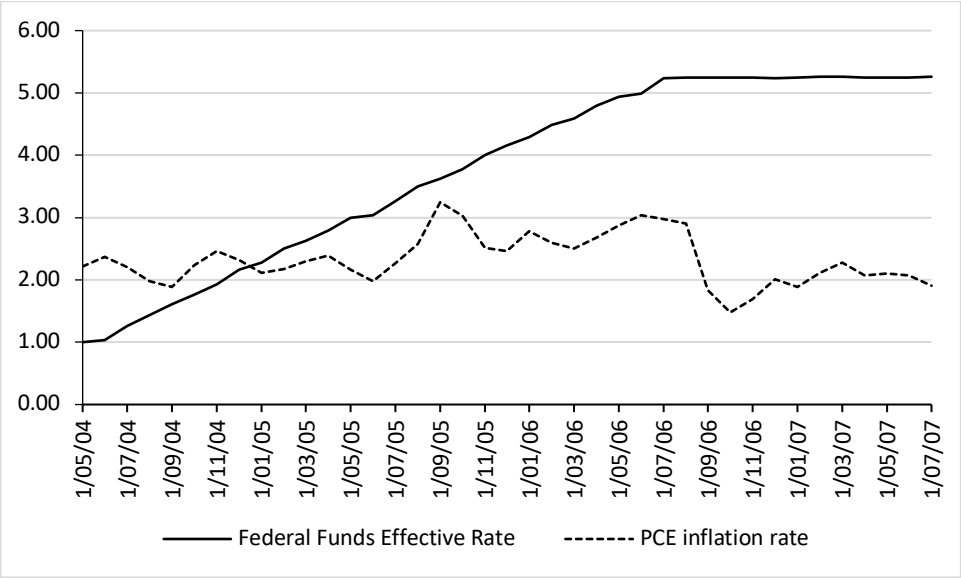
There are two deep problems with this kind of thinking, which unfortunately is rather representative of the dominant discourse in macroeconomics.

First, none of the concepts used to build what looks like an argument, exist: the loanable-funds market is a notion bereft of any real-life meaning (Storm 2017); the neutral rate of interest is not observable, it is an understatement that "we don't quite know exactly what it is". Likewise, the NAIRU is not directly observable and empirically empty (Storm and Naastepad 2012). Macroeconomists cannot openly say this and, hence, hide behind euphemisms, such as this one: "[e]stimates for the [NAIRU] are highly uncertain" (Domash and Summers 2022a, p. 3); what these authors mean to say is that NAIRU estimates are useless if one wants to measure labor market conditions. In the real world, unlike the fantasy world of modern macroeconomics, loanable-fund thinking, neutral interest rates and the NAIRU do not and cannot offer meaningful guidance to the policy decisions of central bankers—but these obscurantist notions do help "to provide an apologetics for a criminally oppressive, unsustainable, and unjust social order" (Rudd 2021, p. 1, *fn* 2).

The second non-trivial problem is empirical. In a structurally low-inflation economy, the impact on inflation of modest increases in interest rates is relatively limited (Ahmed *et al*. 2021). Very large increases in the interest rate, such as those imposed by Volcker, may bring down inflation, but kill the economy in the process. Let us consider two recent historical episodes in which the Federal Reserve increased the interest rate in an attempt to bring down PCE inflation.

In the first episode (**Figure 38**), which concerns the period May 2004 – July 2007, PCE inflation rose to above 2% in May 2004 and climbed up further to 3.2% in September 2005; inflation remained close to 3% until August 2006. The FOMC began to increase the Fed Funds rate in June 2004 and ramped it up from 1% in May 2004 to 5.25% in August 2006. What **Figure 38** shows is that this gradual but steady increase in the interest rate—by 4.25% percentage points during 27-months—was not enough to bring the inflation rate down to its target of 2%.

Figure 38
The Federal Funds Effective Rate and PCE inflation:
May 2004 – July 2007 (percent)

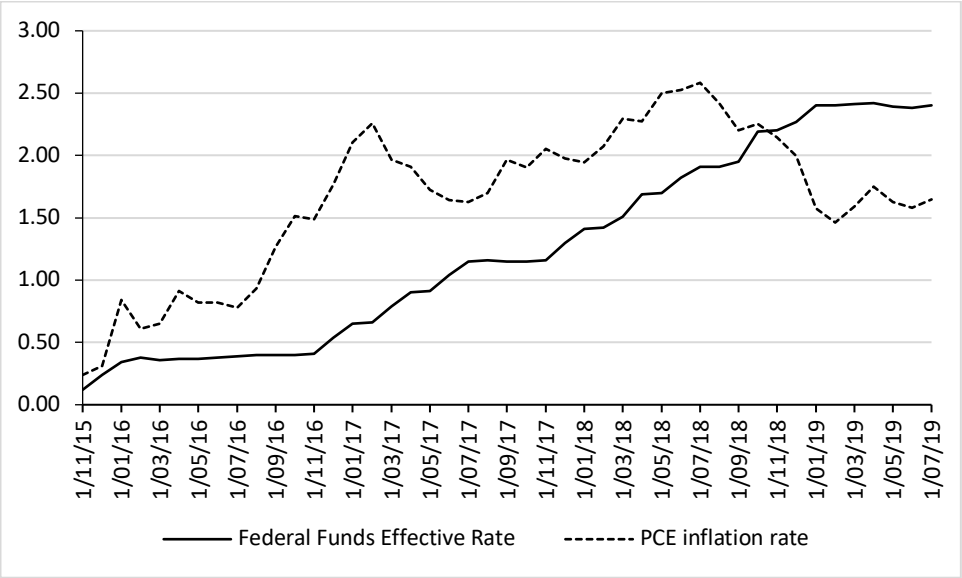


Source: FRED Database (series FEDFUNDS and PCEPI).

Of course, it can always be argued that PCE inflation would have been much higher without the non-trivial tightening of monetary policy and that there were relevant factors, beyond the Fed's control, which offset the deflationary impact of the higher interest rate. All this may well be true, but the episode does illustrate that there is only so much the Federal Reserve can do when it attempts to 'control' the inflation rate.

The second episode refers to the period November 2015 until July 2019 (**Figure 39**). PCE inflation was low (0.24%) in November 2015, but began to rise and peaked at 2.6% in July 2018; PCE inflation next dropped to 1.6% by mid-2019. The Fed Funds was very low at the start (0.12%); it was ramped up to 1.91% in July 2018 and further to 2.4% during January-July 2019. During the first 32 months (November 2015-July 2018), when the interest rate was raised by 1.79 percentage points, PCE inflation continued to rise—by almost 2.4 percentage points. It is only from August 2018 onwards, that the inflation goes down. Inflation control is by no means straightforward.

Figure 39
The Federal Funds Effective Rate and PCE inflation:
November 2015 – July 2019 (percent)

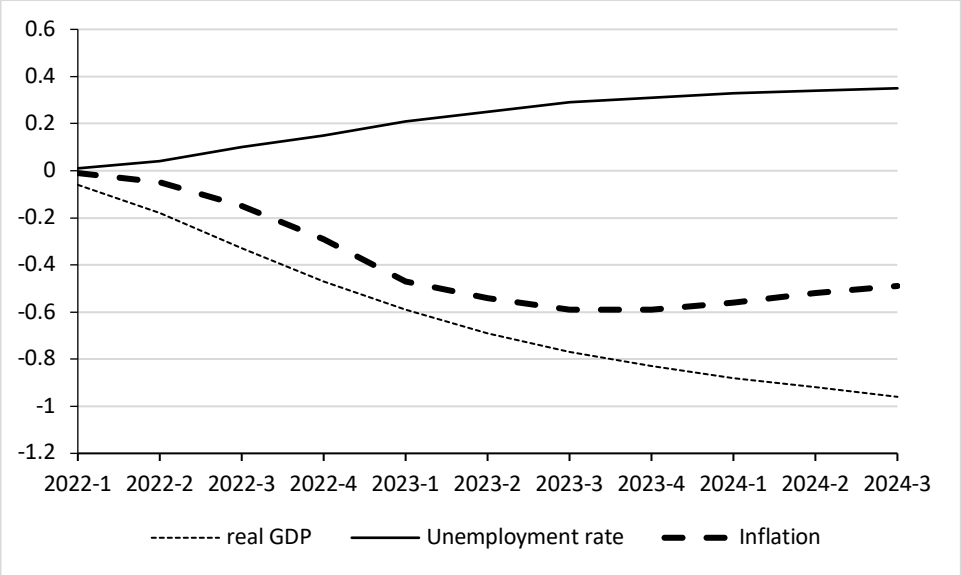


Source: FRED Database (series FEDFUNDS and PCEPI).

To get a much more structural sense of how effective monetary policy is in changing the inflation rate, real GDP, and the unemployment rate, we can do no better than consider **Figure 40**, which presents recent econometric-model forecasts for the US economy of a one-percentage-point increase in the interest rate for the forecast period 2021Q2 – 2023Q4 by Ray C. Fair. Fair finds that after 11 quarters, a one-percentage-point increase in the interest rate results in a decrease in the inflation rate by 0.5 percentage points, a decline in real GDP of almost 1 percentage point, and an increase in the unemployment rate by 0.35 percentage points. Fair (2021, p. 24) concludes:

> "The effects on inflation are [….] about a half percentage point fall for a percentage point increase in [the interest rate], but it takes about 5 quarters to achieve this."

Figure 40
The impact of a 1%-point increase in the interest rate on real GDP, the unemployment rate and the inflation rate: predictions for 11 quarters

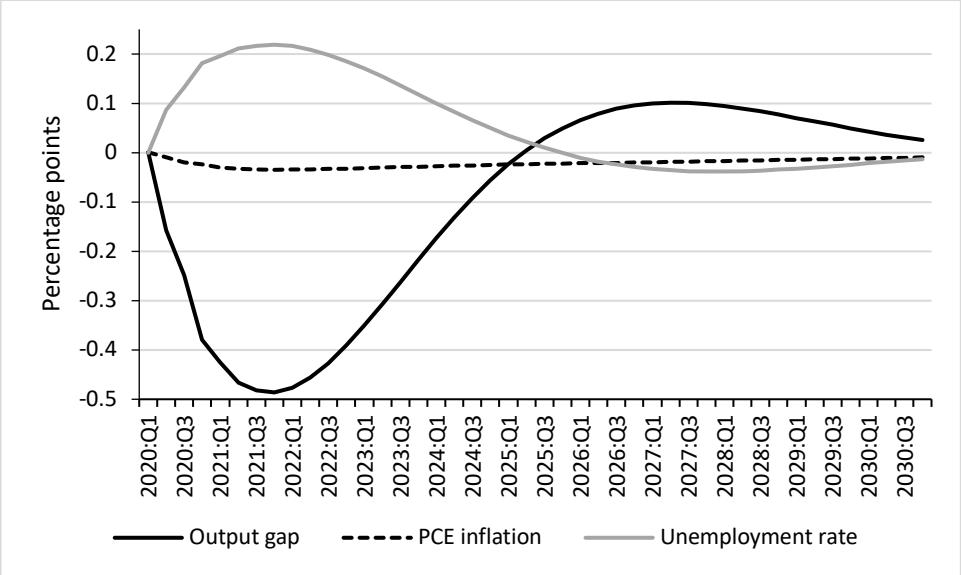


Source: Fair (2021).

Fair's findings are helpful. Suppose the Federal Reserve follows Furman's advice and ramps up the interest rate from 0.5% to the totemic 'neutral interest rate' of 2.5% in the expectation that this will return the US economy to a stable-inflation equilibrium, Fair's estimates tell us that this will not happen. Raising the interest rate to the 'neutral rate' will lower PCE inflation by only 1 percentage point—from 6.1% in January 2022 2021 to 5.1% in June 2022. The collateral damage of this failed attempt at inflation control will be non-negligible: after 11 quarters, real GDP will be lower by 1.9 percent and the unemployment rate will be higher by 0.7 percentage points.

The Fed's own predictions based on its FRB/US model suggest even smaller impacts of monetary tightening. The FRB/US model predictions appear in **Figure 41**. The impact on the PCE inflation rate of a percentage-point increase in the Fed's Fund Rate is highest after 11 quarters—and manages to lower the inflation rate by less than 0.04 percentage points. A percentage-point increase in the Fed's Fund Rate will raise the unemployment rate by 0.22 percentage points after 11 quarters. This underscores the fact that monetary tightening is not up to task of safely bringing down inflation: (*i*) the peak effects of monetary tightening come with an unknown time lag (five quarters according to Fair and 8 quarters according to the FRB/US model); and (*ii*) the peak effects of monetary tightening on the inflation rate are very small.

Figure 41
The impact of a 1%-point increase in the interest rate on the output gap, the unemployment rate and the inflation rate: predictions for 44 quarters



Source: FRB/US model with VAR-based expectations.

To bring inflation down by (say) 3.5 percentage points would require an interest rate rise by 7 percentage points (according to Fair)—which will lead to collateral damage not seen since Volcker's intervention. Such a substantial increase in the interest rate must cause massive job losses and wage losses. John H. Cochrane (2022, p. 9) sums it up rather well:

> "The Fed likes to say it has "the tools" to contain inflation, but never dares to say just what those tools are. In recent U.S. historical experience, the Fed's tool is to replay 1980: 20 percent interest rates, a bruising recession hurting the disadvantaged especially, and the medicine applied for as long as it takes. Will our Fed really do that? Will our Congress let our Fed do that? Can you deter an enemy without revealing what's in your arsenal and whether you will use it?"

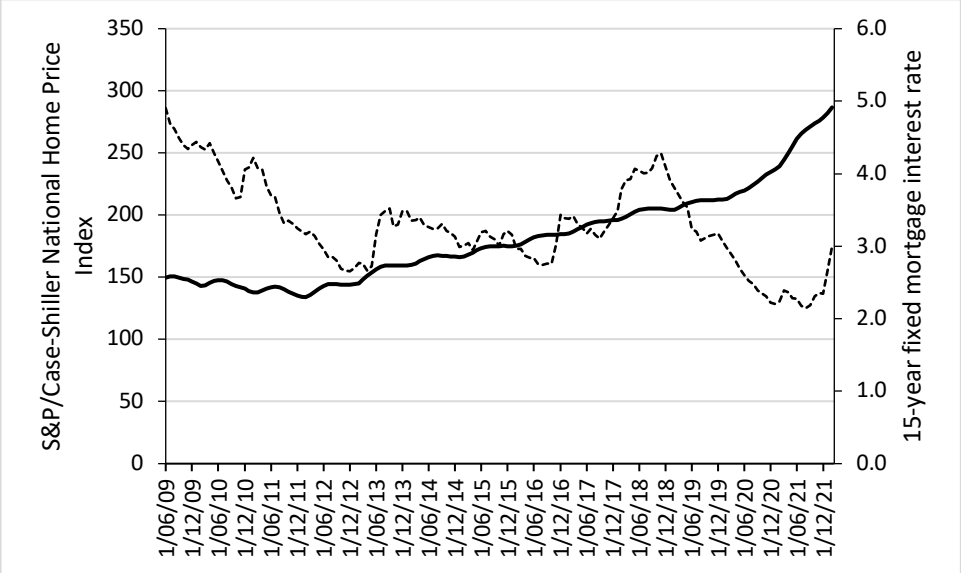
There are reasons to believe that the collateral damage wrought by substantially higher interest rates will be even higher today than in 1980. The key reason is that more than a decade of extraordinarily low interest rates has led to a significant increase in corporate and public debts and an unsustainable bout of asset price inflation in the housing market, the stock market and almost all other financial markets. **Figures 42**, **43** and **44** illustrate what happened.

Average US home prices rose by 91% during June 2009 and February 2022—according to the S&P/Case-Shiller National Home Price Index which increased from 150 to 287 over this period (**Figure 42**). The long-term (15-year fixed) mortgage rate dropped from 4.9% in June 2009 to 3% in February 2021. Lower mortgage rates contributed to the housing price inflation: the statistical association between the declining mortgage rate and rising home values is very significant (see the note to **Figure 42**).

It follows that higher interest rates will slow or even reverse the house price inflation, which would be good news for prospective home buyers, but bad news for indebted homeowners. We

know from experience that any time housing prices fall, consumption expenditure gets reduced, because homes are such a big part of household wealth. Economic growth will be hurt. Worse, higher interest rates risk, in a more extreme scenario, punctuating the ongoing housing bubble and triggering a deep recession.

Figure 42
The S&P/Case-Shiller National Home Price Index and the 15-year fixed mortgage rate, the US economy (June 2009-February 2022)



Source: FRED Database (series CSUSHPINSA and MORTGAGE15US). *Note*: The linear regression coefficient of the long-term interest rate on the ratio of the S&P/Case-Shiller National Home Price Index (during June 2009-February 2021) is —31.2 (*t*-value =-7.3; R^2-adjusted = 0.26). A decline in the 15-year fixed mortgage rate by 1 percentage point is associated with an increase in the S&P/Case-Shiller National Home Price Index by 31 points.

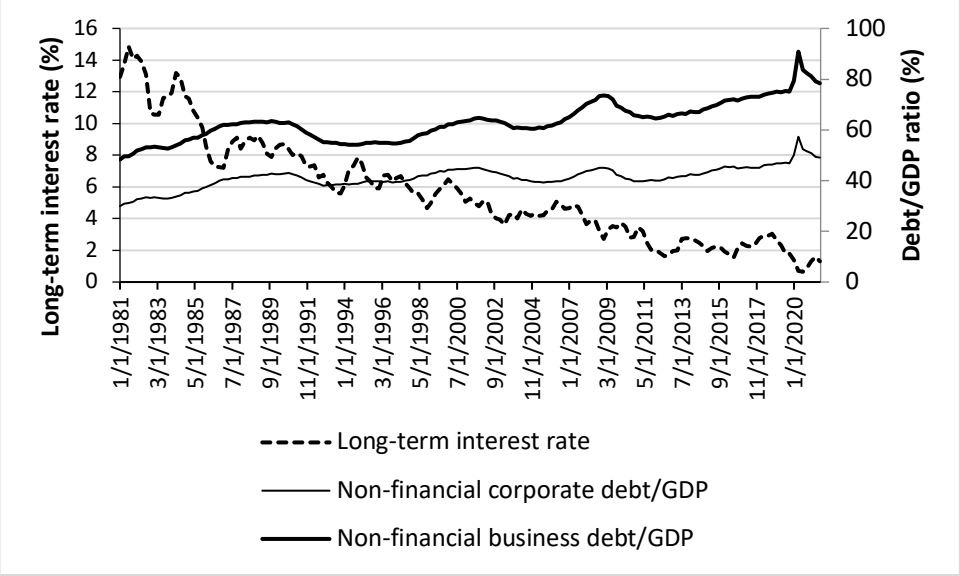
Lower long-term interest rates are also associated with a rising non-financial business debt-to-GDP ratio (**Figure 43**). US non-financial business debt (as a share of GDP) has been steadily rising from 55% in 1996 to 75% by the fourth quarter of 2019—and to more than 90% in the first quarter of 2020. US business debts rose by $7.7 trillion from $10.5 trillion in 2009Q2 to $18.2 trillion in 2021Q3. The corporate overleverage has become so worrisome that the Office of the Comptroller of the Currency (OCC) felt obliged to issue a report, in June 2021, with the Orwellian title "High Business Debt Does Not Represent a "Bubble". We know better.

There exists a highly significant statistical association between rising business (and corporate) indebtedness and the falling long-term interest rate (see the note to **Figure 40**). Interest rates have fallen so low that corporate managers have been incentivized to borrow billions of dollars to buy back shares, thus cannibalizing their companies and their workers (Lazonick 2017). These corporate buybacks through issuing debt are propping up the stock market. It should be noted that 57% of corporate debt is at the BBB-level, or one level above junk (OCC 2021). As the OCC (2021, p. 4) writes:

> "The relative increase in BBB-rated issuance is largely attributable to the historically depressed interest rate environment that enabled even lower-rated companies to borrow cheaply and lengthen the maturity of their debt. And strategically, even higher-rated firms have often aggressively pursued mergers, acquisitions, and increased dividend pay-outs unconcerned about slightly higher funding costs if downgraded to BBB."

Business (corporate) overborrowing makes it vulnerable to higher interest rates. It is reasonable to expect a flight to safety by foreign buyers of corporate debt, pension funds, and financial institutions. This will trigger re-financing problems for businesses, and hurt stock prices, because share-buybacks can no longer be used to artificially prop up share prices. An orderly, well managed unravelling of the business debt bubble appears unlikely.

Figure 43
US Non-financial business debt/GDP, non-financial corporate debt/GDP and the long-term interest rate, the US economy, 1981Q1-2021Q4 (percent)



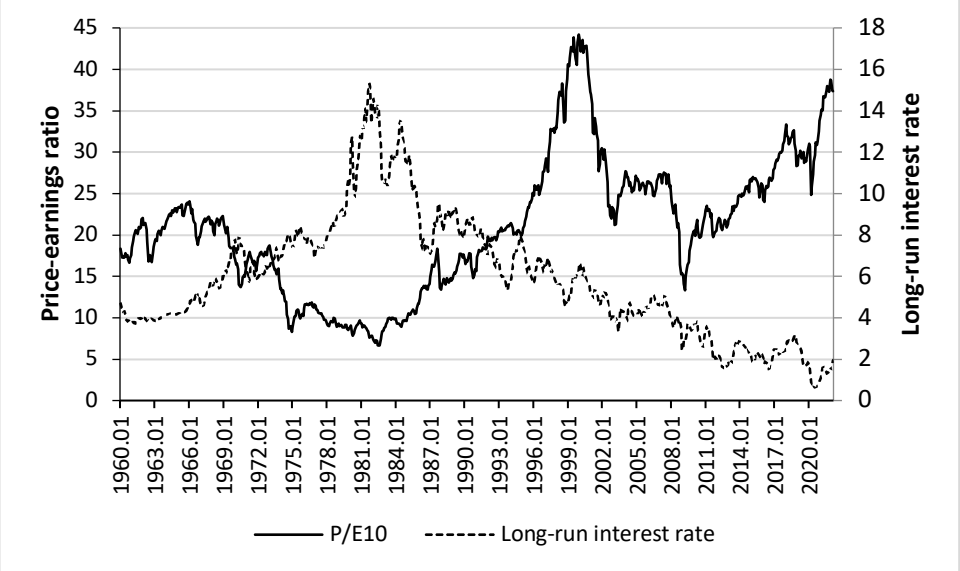
Source: FRED Database (series BCNSDODNS_GDP, TBSDODNS_GDP and IRLTLT01USM156N). *Note*: The linear regression coefficient of the long-term interest rate on the ratio of non-financial corporate debt to GDP (1981Q1-2021Q4) is —1.78 (*t*-value =-15.5; R^2-adjusted = 0.60). A decline in the long-run interest rate by 1 percentage point is thus associated with an increase in the business debt/GDP ratio of 1.78 percentage points.

Finally, low interest rates have contributed to one of the longest bull markets in history which started in March 2009 and, when looking at the price-earnings ratio, has been continuing (with some interruptions) until now (see **Figure 44** and accompanying note). Debt-financed corporate stock buybacks have been one driver of the sustained rise in the stock price relative to earnings in the past decades.

Another major factor propping up stock prices has been the backstop to financial markets and corporate bonds provided by the Federal Reserve since 2009. Financial investors have grown

accustomed to counting on the Federal Reserve to backstop financial markets, rescuing their investments from serious downturns and effectively putting a floor beneath asset prices. The Fed is now beginning to tighten monetary policy and started to phase out the backstop—which is bound to create nervousness and higher volatility in financial markets.

Figure 44
The Cyclically-Adjusted Price-Earnings Ratio and the long-term interest rate, January 1960-January 2022 (percent)



Source: The figure shows monthly data on Robert Shiller's cyclically adjusted price-earnings ratio (CAPE) and the long-term interest rate (measured by the yields on 10-year government bonds) during January 1960-January 2022. The data are available from Shiller's website (http://www.econ.yale.edu/~shiller/data.htm). *Note*: The price-earnings ratio is evaluated over earnings per share over the past 10 years. The linear regression coefficient of the long-term interest rate on CAPE (January 1960-January 2022) is —1.85 (*t*-value =-24.7; R^2-adjusted = 0.45). A decline in the long-run interest rate by 1 percentage point is therefore associated with an increase in the price-earnings ratio by 1.85 percentage points.

The bottom line is this. First, raising interest rates is too crude a tool to bring down inflation. Modest increases in interest rates will fail to lower inflation in any meaningful way, while large—Volcker-like—rises will lower inflation, but kill the US (and world) economy. Second, the Federal Reserve faces tight constraints on how much and how fast it can raise interest rates without provoking unacceptable collateral damage, because the US business sector is heavily over-indebted and the US home market and the stock market are severely over-inflated.

The Federal Reserve recognizes the risk to the American economy of raising the interest rate. "Further adverse surprises in inflation and interest rates, particularly if accompanied by a decline in economic activity, could negatively affect the financial system," the Federal Reserve (2022, p. 56) writes in its *Financial Stability Report* of May 2022 (Smith and Platt 2022). Household balance sheets might be hit by job losses, higher interest rates and lower house prices (caused by higher mortgage rates), the Federal Reserve (2022, p. 56) cautions, with businesses

facing "higher delinquencies, bankruptcies, and other forms of financial distress". Additionally, "a sharp rise in interest rates could lead to higher volatility, stresses to market liquidity, and a large correction in prices of risky assets, potentially causing losses at a range of financial intermediaries, reducing their ability to raise capital and retain the confidence of their counterparties" (*ibid*. p. 56).

The Fed's financial stability report also highlights the risks posed to the US economy by the ongoing interest rate hikes by central banks in many emerging economies. Higher interest rates in the emerging economies will tighten financial conditions, lowering global economic activity, and make it more difficult for these economies to repay (and service) their external debts. Widespread and persistent stresses on the emerging economies may adversely affect the US financial system, primarily through indirect channels, via effects on US businesses and banks with strong links to the emerging economies (Federal Reserve 2022, p. 57). All this means that the Federal Reserve cannot safely bring inflation down using the interest rate.

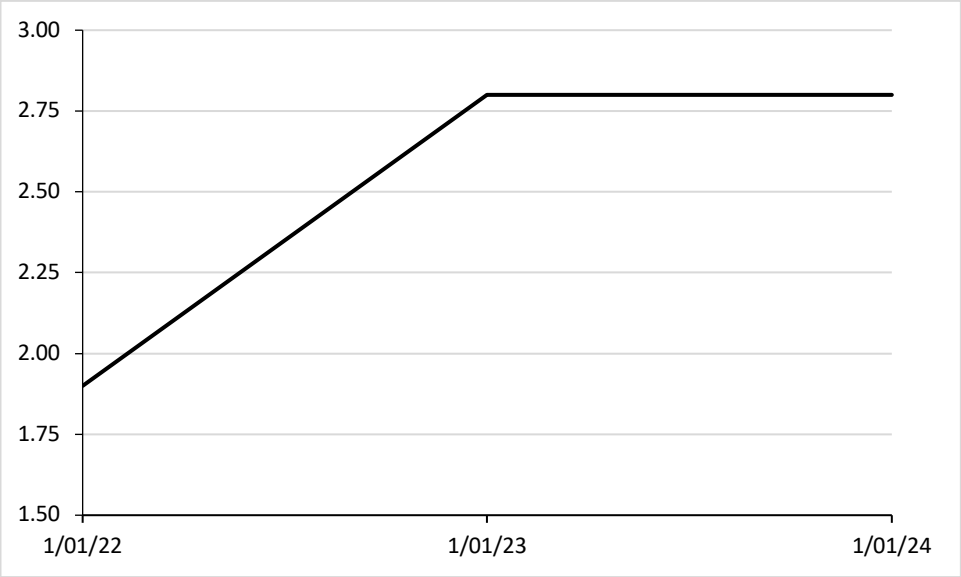
However, if the interest rate cannot do the job, what about *forward guidance*? Forward guidance is the regular issuance by the Fed of public statements by Fed governors and Chair Powell himself concerning the likely future settings of its policy instruments with the intention to influence longer-run expectations, long-term (market) interest rates and aggregate demand. The idea behind it is that credibly signaling what you want to do bolsters the effectiveness of what you actually do *before* you do it. This idea has taken off to the extent that forward guidance has become commonplace among erstwhile tight-lipped central bankers.[18] The new practice of explicit signaling has also sparked a large, fanciful, literature investigating the properties and implications of forward guidance. It is fair to conclude that while forward guidance has been found to be a powerful monetary policy tool in empirically sterile DSGE models (Rudd 2021; Storm 2021), it has proven to be far from easy to implement effectively in practice.

In practice, beginning in 2012, the Fed has released its "dot-plot" which presents the individual views of the FOMC members as to what the Fed Funds rate will be over the next couple of years and beyond. Market participants have come to view the *median* 'dot' as the Fed's policy intent over that time period. Based on the median 'dot', market participants see the Fed moving to a policy rate around 2.5%-2.75% by the end of 2022 (see **Figure 45**), but statements in the minutes indicate that the FOMC is prepared to raise interest rates more. The FOMC also indicated its intention, starting in June 2022, to reduce the central bank's $9 trillion balance sheet consisting mostly of Treasuries and mortgage-backed securities.[19] This constitutes the first tightening cycle in the new era of 'forward guidance' where there is accelerating inflation. Because inflation has so quickly become the key concern for US workers, households, businesses and policy-makers, the Fed is jawboning around their resolve to reduce it.

[18] Forward guidance constitutes a break with the approach during 1987-2006 of former Fed Chair Alan Greenspan, summarized by the legendary quote: "Since I've become a central banker, I've learned to mumble with great incoherence. If I seem unduly clear to you, you must have misunderstood what I said." (Coibon *et al.*, 2021).

[19] The intended reduction is $95 billion/month ($1.14 trillion/year) for three years, with $35 billion/month of sales of Mortgage-Backed Securities (MBS), a policy which will put even more upward pressure on mortgage interest rates in an already fragile US housing market.

Figure 45
Forward guidance:
FOMC summary of economic projections for the Fed Funds Rate, median
(01-01-2022 to 01-01-2024)



Source: FRED (*series* FEDTARMD). *Note*: The projections for the federal funds rate are the value of the midpoint of the projected appropriate target range for the federal funds rate at the end of the specified calendar year. Each participant's projections are based on his or her assessment of appropriate monetary policy. The graph represents the median value of the range forecast established by the FOMC.

Financial markets responded by immediately pricing-in the 'terminal rate' (of 2.75% by the end of 2022). Mortgage lenders have significantly raised mortgage rates during mid-March and mid-May 2022. In response to prospect of higher interest rates, the US dollar rose in value, which by making US imports cheaper will help to lower inflation. The stock markets took a hit and the hike in interest rates gave bond markets the worst start to the year in decades, as bond prices fell. Bond interest rates (or 'yields') rose in response to the monetary tightening, but yields on longer-term bonds did rise less than those on short-term bonds.

As Fed forward guidance is becoming more and more hawkish with incoming inflation data, markets adjusted shorter-term rates to the expected faster pace of tightening. The difference between the interest rates on 10-year Treasury bonds and 2-year Treasury bonds declined sharply as a result (**Figure 46**) and the two- and 10-year Treasury yield curves even 'inverted' in the first week of April. These inversions in the bond market[20] often signal a looming recession—and this time, it reflects the concern of financial investors of a 'hard landing', *i.e.*, the fear that the Fed raises interest rates too aggressively to tame inflation and triggers a recession. Hence, the result of the Fed's forward guidance is that financial markets appear to

[20] Short-term bond yields are normally lower than long-term yields. Investors expect a bigger reward for lending their money for a longer time, giving the 'yield curve' an upward sloping shape.

have rapidly toughened financial conditions to a Fed end-state tentatively intended for 2023-24.

Figure 46
Yield curve: 10-year Treasury constant maturity *minus*
2-year Treasury constant maturity (01-01-2022 to 01-01-2024)

Source: FRED (*series* T10Y2Y).

It thus appears that the Fed is able to influence financial markets via forward guidance. To some observers, all this constitutes proof of the Fed's ability to keep things under control and evidence of how forward guidance strengthens the impacts of a sequence of interest rate rises. But how strong and long-lasting are the financial market effects of forward guidance? The empirical evidence is sobering.

For example, Kool and Thornton (2015) find no evidence that forward guidance by the Fed improved market participants' ability to forecast future short-term and long-term rates (relative to several benchmarks). Sutherland's (2020, p. 42) baseline result is that, "in response to a change in forward guidance, forecasters revise their one-year forecasts of the policy rate in the intended direction by about five basis points." The impact is miniscule, in other words. One problem of forward guidance is that the same policy message may induce different responses from market actors: 'pessimist' forecasters may see the Fed announcements as signaling a deteriorating outlook, whereas optimists may interpret the guidance as a promise of monetary stimulus, lowering their expectations for future interest rate rises (Andrade *et al*. 2018; Lunsford 2020). Hence, the effects of forward guidance are difficult to reliably foretell.

To underscore this point, Lunsford (2020, p. 2924) finds that an *increase* in the forward-guidance path of the Fed funds rate was associated with *higher* CPI inflation during February 2000–June 2003, but CPI inflation was unresponsive to an increase in the forward-guidance path of the Fed funds rate during August 2003–May 2006. According to estimations by Greenlaw *et al*. (2018), "Fed actions and announcements were not a dominant determinant of

10-year yields and […] whatever the initial impact of some Fed actions or announcements, the effects tended not to persist." Greenlaw and co-authors (2018, p. 1) conclude that "the most important and reliable instrument of monetary policy is the short-term interest rate". This means that it is much more important to watch what central bankers *do*, not what they *say*.

Macroeconomists, in general, ascribe far too much clout and aptitude to Fed policymakers. As I argued in this **Section**, the macroeconomic effectiveness of interest rate policy and forward guidance is surprisingly limited. Central bankers are mostly groping in the dark, but "in regione caecorum rex est luscus", as Desiderius Erasmus Roterodamus already wrote back in 1500.[21] However, the only viable way to lower inflation will be to get the global COVID19 health crisis under control—because only this will end the supply-chain disruptions and (global and domestic) labor shortages.

9. Is fiscal stimulus the underlying cause of inflation?

Since the inflation cannot be brought down by monetary tightening alone, calls are growing to tighten fiscal policy as well. The idea is that public spending has to be scaled down in order to reduce the excess aggregate demand and excess labor demand, created by the fiscal relief spending that was (arguably) larger than the COVID-19 crisis required.

A return to austerity may well succeed in bringing inflationary pressure down, but it will lead to sizeable collateral damage including job losses, economic stagnation and debt-service problems for households and firms—especially when it is combined with higher interest rates. The million-dollar question is whether this collateral damage is a price worth paying for lowering inflation. If the inflation is transitory, driven by supply bottlenecks not directly amenable to fiscal and monetary policy, and sector-specific (in origin), then the fiscal tightening needed to lower inflation will be large and this will cause substantial collateral damage, particularly for low-income households and small businesses.

However, demands for fiscal austerity are growing louder—and critical COVID-relief measures such as the expanded child tax credit and funding for free school meals have already been discontinued; as a result, 3.7 million US children have fallen into poverty since December 2021 (Parolin *et al*. 2022). One of the loudest and most-publicized proponents of a return to 'fiscal health' (and a 'healthy economy' in general) is John H. Cochrane (2021, 2022). Cochrane's point is that the current surge in prices represents 'fiscal inflation', because it is due to an erroneous overly expansive fiscal policy, which will not be paid off by (promises of) raising tax revenues and/or expenditure cuts.

With a stunning disregard for the empirical evidence, Cochrane dismisses any role for global supply-chain disruptions in driving up the general price level:

> "What about "supply shocks?" What about a shift of demand from services to durables? Much analysis misses the difference between relative prices and inflation, in which all prices and wages rise together. A supply shock makes one good more expensive than others. Only demand makes all goods rise together. There wouldn't be "supply chain" problems if people were not trying to buy things like mad! A shift in demand from services to durables can make durable prices go up. But it would make services prices

[21] "In the land of the blind, the one-eyed man is king." A quote from Erasmus' book *Adagia* (first published in Paris in 1500), III, IV, 96.

> go down. And let us not even go down the ridiculous path of blaming inflation on a sudden contagious outbreak of "greed" and "collusion" by businesses from oil companies to turkey farmers, needing the administration to send the FTC out to investigate." (Cochrane 2022, p. 6)

In Cochrane's thinking, the inflation is caused by the $6 trillion of public spending COVID-19 relief packages, which (according to his calculations) raised the nominal public debt by 38%. The relief spending constituted "an immense fiscal helicopter drop of money" which was immediately spent, "raising all prices and wages together" (which we have seen is evidently not the case). Applying his 'fiscal theory of the price level' Cochrane predicts that the US price level may rise by as much as 38% (*i.e.*, in line with the relative increase in public debt), if "people do not expect that any of that new debt will be repaid" (Cochrane 2021, p. 19).

Cochrane's argument is different from the traditional Monetarist claim that monetary financing, by increasing money supply, must raise the general price. Inspired by Milton Friedman, Monetarists based this claim on the Quantity Equation which states that $M \times v = P \times y$, where M = money stock (M2), v = velocity of money circulation, P = the general price level, and y = real GDP. According to Friedman, the demand for money is stable and therefore the velocity of money circulation is constant. Friedman then inferred that the rate of inflation $\hat{P}$ must, in the long run, increase if money supply growth $\widehat{M}$ exceeds the growth of real GDP $\hat{y}$, because $\hat{P} = \widehat{M} - \hat{y}$. Monetary financing of public spending therefore raises inflation, in Friedman's framing, because it raises money supply growth $\widehat{M}$, but not real GDP growth $\hat{y}$, which is assumed to be at its long-run potential. In Friedman's 'model', inflation is therefore "always and everywhere a monetary phenomenon".

Friedman believed that central banks could and should control inflation by directly controlling money supply growth (relative to potential real GDP growth). However, because money supply is *endogenous*, direct money supply control proved a complete and utter failure in the US and the UK in the early 1980s. Friedman's brand of Monetarism has been falsified[22]—and the consensus academic and central banking views are that monetary policy works through changes in interest rates and that monetary quantities such as M2 are irrelevant in conducting monetary policy (Stella, Singh and Bhargava 2021). As Claudio Borio (2019, p. 14) writes:

> "...once we recognize that money is fundamentally endogenous, analytical thought experiments that assume an exogenous change and trace its impact are not that helpful, if not meaningless. They obscure, rather than illuminate, the mechanisms at work."

Even Friedman himself acknowledged the failure of traditional Monetarism: "The use of quantity of money as a target has not been a success. I'm not sure I would push it as hard as I once did."[23]

Cochrane wisely stays away from old-school Monetarism. Instead of blaming inflation on increases in money supply (relative to potential real GDP) and monetary financing, Cochrane attributes inflation to increases in public indebtedness as such. That is, Cochrane argues that the higher public debt may lead to an increase in the rate of inflation, even if it has not been monetized. In terms of the Quantity Equation $M \times v = P \times y$, this means that if the price level

[22] For confirmation, see the paper by Fed economists Ihrig, Weinbach, and Wolla (2021): 'Teaching the linkage between banks and the Fed: R.I.P. Money Multiplier'.

[23] Friedman, interview with Simon London, *Financial Times Magazine* (London), June 7, 2003.

P goes up (caused by higher public debt), either money stock *M* or velocity *v* will rise (or *M* and *v* will both increase). Causality in Cochrane's model runs from *P* on the right-hand side of the equation to *M* and/or *v* on the left-hand side—which is the exact opposite of causality in Friedman's model.

So, how does the price level *P* get determined? Cochrane's starting point is the analogy between the pricing of equity (stock) and the pricing of government bonds. The analogy is as follows (Rogers 2005). Suppose we are able to determine the real value of stock-market shares as:

$$real\ value\ of\ shares = expected\ present\ value\ of\ all\ future\ dividends \quad (1),$$

then we should also be able to determine the real value of public debt as:

$$\frac{nominal\ value\ of\ public\ debt}{price\ level} = expected\ present\ value\ of\ future\ primary\ surpluses \quad (2)$$

Equation (2) allows us to determine the price level, if we know the nominal value of public debt and the expected present value of primary surpluses:

$$price\ level = \frac{nominal\ value\ of\ public\ debt}{expected\ present\ value\ of\ future\ primary\ surpluses} \quad (3)$$

Cochrane thus uses the government's intertemporal budget constraint (equation (2)) to determine the general price level. He finds that the general price level adjusts so that the real value of nominal public debt equals the present value of real primary government budget surpluses. It follows that an increase in the nominal value of public debt in the US by 38% will increase the price level by 38%, if we assume that people expect that there will be no increase in primary surpluses, because the government will not increase taxes and/or lower spending.

For these equations to work, a large number of unrealistic and restrictive assumptions need to hold. Cochrane is assuming that there is no (fundamental) uncertainty, all future states of the world are known, and the representative agent is infinitely-lived and can on average correctly predict the future. Like a fish that does not know it is in water, Cochrane takes the presence of these restrictive assumptions for granted. He can do this, because most of the other fishes he is talking to, are swimming in the same pond of unquestioned beliefs, cognitive biases and mind-guards.

However, the *internal validity* of Cochrane's model has been criticized. A first major problem arises because, in Cochrane's frictionless general equilibrium model, only relative prices can be determined. The general price level can only be determined in terms of a *numéraire* price—but as Colin Rogers (2005, p. 6) argues, numéraire prices are arbitrary and have no economic significance:

> "Defining the price level in terms of numeraire prices is possible but the price level defined in this way is not determined by the model—it is as arbitrary as the numeraire prices of goods and has no analytical significance. This explains Buiter's

> characterization of the [Fiscal Theory of the Price Level] as an attempt to determine the price of a non-existent entity like phlogiston."

Equation (3) therefore does not and cannot determine the general price level, but instead determines the relative price of bonds in terms of a *numéraire* price. This 'accounting price' has no operational significance in terms of the general price level. This led Willem Buiter (1999, p. 1), in an early review of Cochrane's model, to the following conclusion:

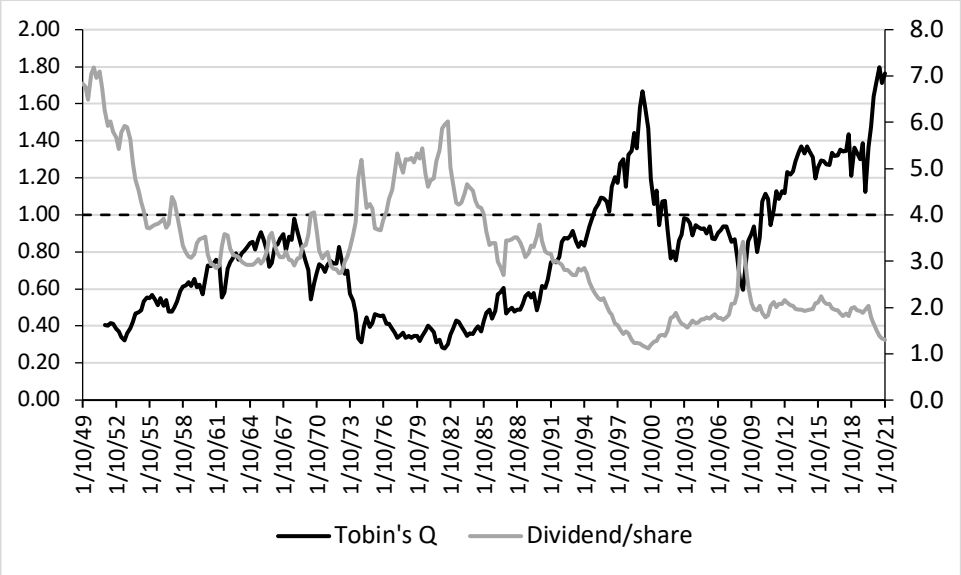
> "It is not common for an entire scholarly literature to be based on a fallacy, that is 'on faulty reasoning, misleading or unsound argument'. The recently revived 'fiscal theory of the price level' is an example of a research program that is fatally flawed, conceptually and logically."

A second problem with Cochrane's model is that his outcomes turn out to be sensitive to minor changes in the model assumptions. For instance, Farmer and Zabczyk (2019) offer a "*Requiem for the Fiscal Theory of the Price Level*", showing that when they introduce more generations of representative agents into a model similar to Cochrane's, the standard conclusions break down. Another example of an internal critique comes from Niepelt (2004) who argues that the assumption of a non-zero initial nominal public debt is inconsistent with the assumption of rational expectations: the infinitely-lived representative agent would not have bought (as much) nominal debt in the first place if she/he could not expect it to yield the required (average) rate of return. True, even if these internal 'debates' mostly resemble the discussions between Tweedledee and Tweedledum, they do illustrate the point that Cochrane's model is not internally consistent even on its own (narrow) terms.

In addition, Cochrane's approach has no *external validity*—his conclusions do not hold outside the narrow assumptions on which his model is built. The problems already start with equation (1), in which it is assumed that the real value of shares is equal to the present value of an infinite stream of future dividends.[24] As is shown in Figure 34, the real share value, here defined in terms of Tobin's Q, has fluctuated considerably during 1951-2021, but in recent times, Tobin's Q has steadily increased—from 0.6 in 2009Q1 to 1.71 in 2021Q1. Based on equation (1), this would imply that financial investors are expecting an increasingly higher growth rate of dividends—which is strange, because dividends per share have been going down since 2009Q1 (**Figure 47**). Hence, the steady rise in the real value of shares is not based on higher dividends (per share) and we cannot determine the real value of stock-market shares using equation (1). This falsifies the first part of Cochrane's analogy—which means the analogy is false.

[24] The real stock value v, defined as the present value of an infinite stream of future dividends, can be calculated as: $v = d_1/(r - g)$, where d_1 = the real value of the dividend received in the next year; r = the discount rate; and g = the growth rate of dividends.

Figure 47
Tobin's Q: the US non-financial corporate sector and real dividends per share
(1951Q4-2021Q4)



Sources: FRED database. Calculated as the ratio of (*a*) Nonfinancial Corporate Business; Corporate Equities; Liability, level, and (*b*) Nonfinancial Corporate Business; Net Worth, Level. See: https://fred.stlouisfed.org/series/NCBEILQ027S#0. Data on dividends come from Shiller's website (http://www.econ.yale.edu/~shiller/data.htm).

However, the second part of the analogy—given by equation (2)—is also fundamentally flawed. Equation (2) is based on the faulty, time-worn assumption that the US government is like the average US household and faces an intertemporal budget constraint—which means that debts in period 1 must be repaid (out of higher taxes or by lower spending which result in primary public budget surpluses) in period 2. To be clear, this is another instance of an entire scholarly literature based on a fallacy.

Suppose a single household decides to cut back spending by 10%. This will have no noticeable impact on the macroeconomy. But if the US government reduces spending by 10%, this will affect the level of economic activity and employment both in the short and in the long run. The negative impacts of fiscal consolidation are so large that austerity often fails as a strategy to lower the public debt to GDP ratio. Fatás and Summers (2018), for example, observe that "[a]ttempts to reduce debt via fiscal consolidations have very likely resulted in a higher debt to GDP ratio through their long-term negative impact on output."

Another difference between the US government and households is that the government has the powerful backing of a central bank behind it. In times of crisis, the Federal Reserve can act as a lender of resort and it can also help lower the interest rate – *i.e.*, the borrowing costs – of the government (which is what the central bank of Japan has done). This means that, unlike the average household, a monetary sovereign government has considerable influence over its own borrowing costs.

It is a historical fact that governments generally do not repay their debts (quite like most corporations which also generally roll over their debts). The US government has reduced the federal debt on only seven occasions during two-and-a-half centuries (1776-2022):

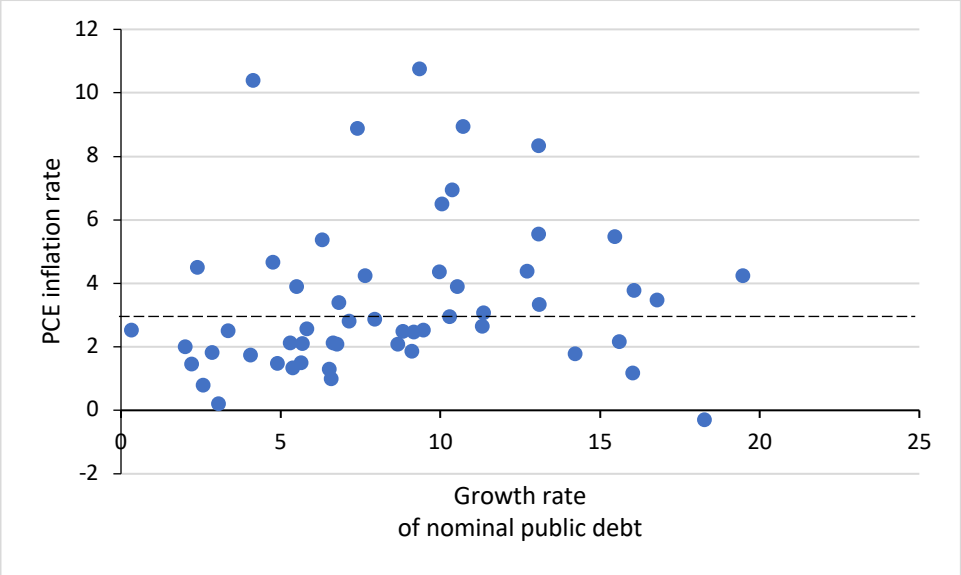
> "The national debt fell by 29 percent from 1817 to 1821, and was eliminated in 1835 (under President Jackson); it fell by 59 percent from 1852 to 1857, by 27 percent from 1867 to 1873, by more than 50 percent from 1880 to 1893, and by about a third from 1920 to 1930. Of course, the last time we ran a budget surplus was during President Clinton's second term. Has any household been able to run budget deficits for approximately 190 out of the past 230-odd years and accumulate debt virtually nonstop since 1837?" (Nersisyan and Wray 2010).

Furthermore, empirically, the average annual rate of inflation and the growth of public debt are not statistically significantly correlated—as is shown by **Figure 48**. Leon Podkaminer (2020) offers more sophisticated econometric evidence (based on Granger causality tests) for the US and Japan during 1980/81-2019 and for 27 countries (1995-2019) that shows that the claim that expanding public debt is associated with rising inflation is unfounded.

It is interesting to look at this more closely. As is clear from **Figure 48**, under the high-spending Reagan and Bush administrations (1981-1992), nominal US public debt increased by almost 14% on average per year; the absolute cumulative increase in nominal government debt exceeded $3 trillion during this period. Reagan and Bush were licensed 'military Keynesians' and wasted government funds on unnecessary wars and the military, instead of on infrastructure and productive purposes. But notwithstanding this long-lasting fiscal profligacy, the PCE inflation rate decreased from 9% in 1981 to 2.7% in 1992. "Reagan proved deficits don't matter," is what former vice-President Richard Cheney said in 2014.

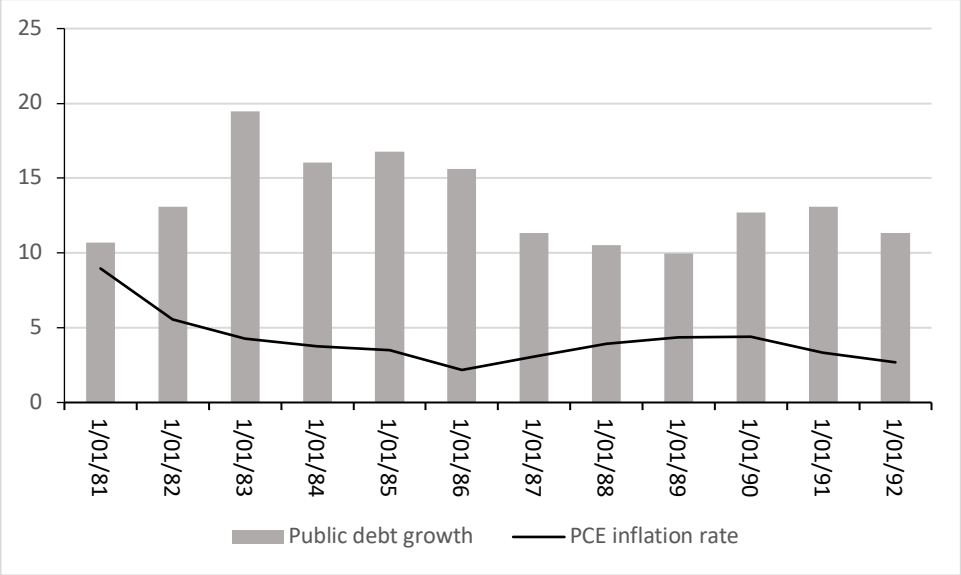
During the post-financial crisis period 2008-2020, US public debt rose by 8% on average per annum (in nominal terms), while the PCE inflation rate hovered around an average of just 1.5% (**Figure 49**). The nominal debt of the US government rose by $16 trillion in cumulative terms during these years, without inducing a noteworthy uptick in inflation. This time, most of the public money was spent on bailing out big banks, financial firms and bankrupt financialized corporations which had been responsible for the financial crash; hardly any money was spent on supporting workers, small firms or families. Again, deficits didn't matter for inflation.

Figure 48
The growth of nominal public debt and the PCE inflation rate,
the US economy, 1966-2021 (percent)



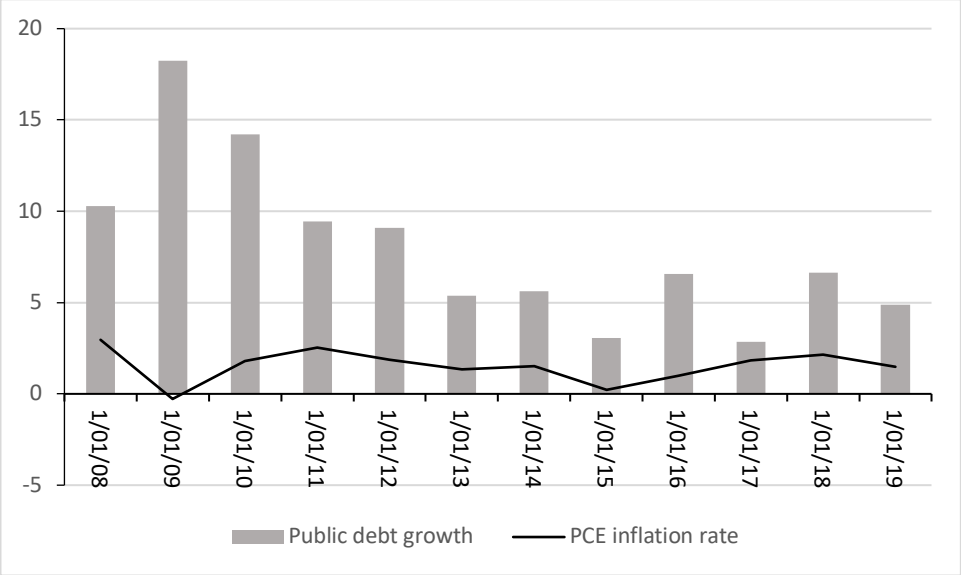
Source: FRED Database (series GFDEBTN and PCEPI_PCH). *Note*: The linear regression coefficient of the growth of nominal public debt on the rate of PCE inflation is 0.08 (*t*-value = 1.1; R^2-adjusted = 0.00).

Figure 49
The growth of nominal public debt and the PCE inflation rate during the Reagan and Bush administrations, the US economy, 1981-1992 (percent)



Source: FRED Database (series GFDEBTN and PCEPI_PCH).

Figure 50
The growth of nominal public debt and the PCE inflation rate during the Obama and Trump administrations, the US economy, 2008-2020 (percent)



Source: FRED Database (series GFDEBTN and PCEPI_PCH).

To Cochrane, however, the empirical evidence of **Figures 48**, **49** and **50** will do nothing to invalidate his theory. So, how does he square the empirical facts that ostensibly contradict his

theory with his thinking? Cochrane's solution is to invoke the following auxiliary hypothesis (based on equation (3)):

> "*The price level will only increase in response to an increase in the nominal value of public debt if the public expects that future primary surpluses remain the same*."

When confronted with **Figures 49** and **50**, Cochrane will argue that the American public did *expect* the Reagan-Bush as well as the Obama-Trump debts to be repaid—and, therefore, inflation did not rise (in a structural sense). The crux of Cochrane's theory, therefore, resides in this auxiliary hypothesis and the adjective '*expected*'. If the public expects that primary surpluses will not be increased (to pay off a higher debt), it will expect prices to rise—and people will then spend their given money balances and prices will rise, until expectations again change.

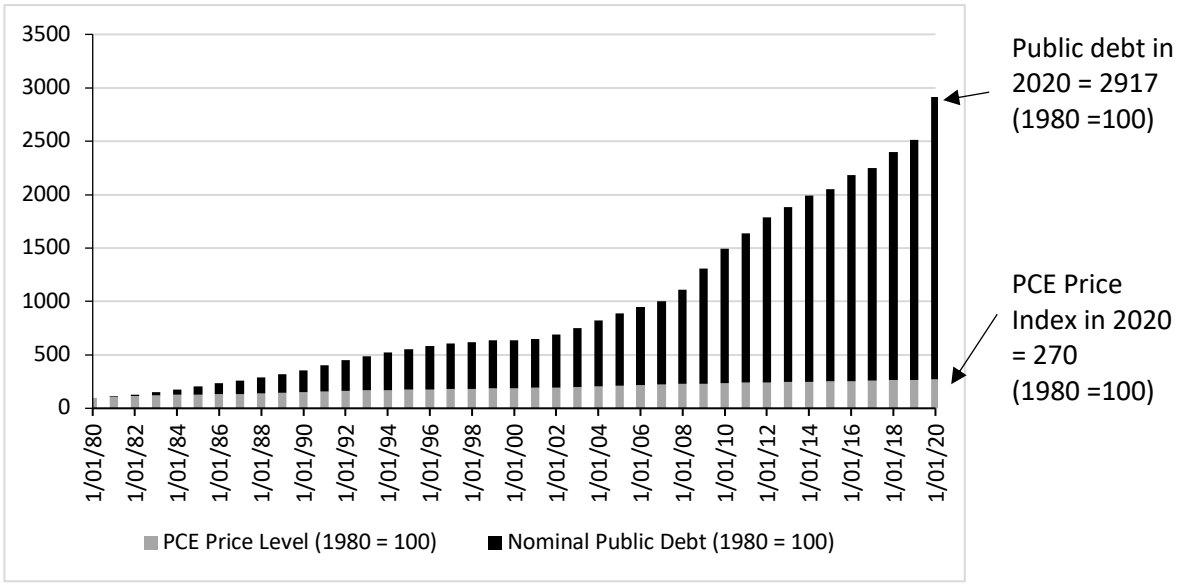
As a result of the auxiliary hypothesis, Cochrane's 'model' becomes non-falsifiable: if we see higher public debts but no increase in inflation, it must be true (as a matter of 'revealed preferences') that the public is expecting that the debt will be repaid. However, if we see higher public debts and an increase in inflation, it must be true that the public is expecting that the debt will not be repaid. *Ergo*: the 'Fiscal Theory of the Price Level' holds true always—it cannot be refuted, because there is no direct way of knowing what the public expects the future primary surpluses to be.

Figure 51 illustrates the point. The size of the nominal public debt of the US (with base-year 1980 = 100) increased to 2917 in 2020. The PCE price level (1980 = 100) increased to 270 in 2020—which is 90 percent less than the nominal public debt increase. Using Cochrane's approach, this means that the American public must have been expecting that 90 percent of the accumulated public debt during 1980-2020 would (or will?) be repaid—even when it is evident that this did not happen except (briefly) during President Clinton's second term. It thus appears that Abraham Lincoln was wrong when he said that "you can fool all the people some of the time, and some of the people all the time, but you cannot fool all the people all the time."

It is not clear how one can square a decades-long evidently false belief (that the US government will repay its debt) with the 'rational expectations' of the model's representative agent. Cochrane's theory holds no water—neither theoretically nor empirically. His inflation prediction—that inflation may go up by as much as 38% because the public debt rose by 38% in 2021 and the public is (for unexplained reasons) no longer convinced that the extra debt will be repaid—must be taken for what it is: an artefact of magical thinking.[25]

[25] The reality is that the Reagan and Clinton reforms have benefited the rich who reinvested in political candidates who favored pushing down the tax rate on them. No one believes that the public debt will be repaid—the argument is mostly meant to crush public expenditure.

Figure 51
Nominal public debt and the PCE price level (1980 = 100)
for the US economy, 1980-2020



Source: Based on FRED Database (series GFDEBTN and PCEPI_PCH).

There is no doubt that austerity will bring inflation down, but at a non-negligible societal cost. Will it be worth to engineer a recession and stagnation in order to bring inflation down, a year, or two years earlier than would have happened without the fiscal consolidation? We have to be honest and ask ourselves whether there are other means to bring down inflation which will be effective, but at a lower social cost; alternative measures may include imposing price controls, using strategic energy reserves and public support to unlock messed-up supply chains.

10. Are there other ways to bring down or manage inflation?

The resurgence of inflation in the US is due to extraordinary circumstances: our globalized and deregulated world economy, built on just-in-time supply chains and cheap, flexible and abundant labor, has broken down under the combined weight of the consequences of the COVID-19 pandemic and the Russia-Ukraine war. Both demand and supply collapsed in response to the public health emergency, but as demand has recovered faster than supply, the US economy is now 'overheating', not at full capacity, but at a level of output and employment considerably below long-term potential (**Figure 30**).

Economists are debating whether it is preferable to use monetary policy to lower demand to the (depressed) level of supply or, alternatively, to use alternative tools to eliminate the supply constraints and to speed up the recovery of the economy's supply side (in a one- or two-year time frame). Lawrence Summers (2022) is firmly in the first camp, arguing that it is not remotely realistic to think that public policies are going to increase supply in a relevant horizon for the current inflation. Instead, he argues,

> supply is what it is. Monetary policy can't change it. Fiscal policy can't change it, except in the long-run. And so given what supply is, it's the task of demand to balance supply. And if demand is greater than supply, then you're going to have excess inflation and you're going to have the problems of financial excess. […..] So, the job of the demand managers, principally the Fed, is to judge what supply is and calibrate appropriately. It's not an excuse for inflation to blame it on supply. It's a reality in the environment that you have to deal with. And so, the job is to look for measures of overheating, and when you see measures of overheating, to apply restraint.

Summers thinks that the Federal Funds rate has to be raised to 5% in the next couple of years to bring inflation down to the inflation target of 2%. But Fair's model tells us that this is wishful thinking: the proposed increase in the interest rate by 4.5 percentage points will likely lower PCE inflation (now running at 6.6%) by 2.25 percentage points (after five quarters)—and if the monetary tightening happens too quickly, it risks triggering a financial crisis and recession. We are in uncharted territory: conventional instruments of macroeconomic policy that were used to some effect in stable times, are no longer of use in this era of upheaval and uncertainty.

To underscore the point that we are not in Kansas anymore, let me recapitulate the paper's main argument and findings. First, around 30% of US PCE inflation is due to higher import prices and global shortages and hence originates from abroad (**Figure 13**); it is not just rising commodity prices that matter, but also rising (container) shipping costs (Carrière-Swallow et al. (2022)). Second, due to the Russia-Ukraine war and the sanctions on Russia, global energy and food prices have increased and are expected to remain elevated; this raises US prices via the *marginal cost* and the *strategic complementarity channels*. As for the latter channel, so far, the increase in corporate profit margins has contributed three times as much to US inflation than the increase in nominal wages (**Figure 28**). Note that real wages of US workers have declined (**Table 2**) and that drawing historical parallels between the current inflation and the stagflation of the 1970s is not helpful; unlike in the 1970s and after decades of labor market deregulation and union bashing, US workers are relatively powerless and incapable of protecting their real wages in this inflationary era (Stansbury and Summers 2020). Third, well-connected *commodity-market speculators* with QE-enabled cheap credit and with privileged information make prices move by betting they will move, and are thus contributing to higher

commodity and energy prices (**Figure 12** and **Section 3.2**). The Russia-Ukraine war turned commodity-price speculation into a one-way bet.

The evidence provided in **Section 4** shows that the inflationary shock has occurred in essentially all rich economies around the world in similar ways—country-specific policies do not 'explain' differences in country-specific rates of inflation. US inflation is not special, but d*omestic supply-chain bottlenecks* within the US have contributed to supply shortages and rising inflation (**Section 5**). Shortage of (long-haul) truck drivers and dock workers constitute a major domestic hold-up.

Macro-economically more important is the fact that, helped by the fiscal relief measures, the demand side of the US economy has managed to recover rather quickly from the COVID-19 shock, but the recovery of the supply side of the economy continues to lag (**Figure 30**). The biggest supply-side constraint in the US is the *decline in the effective labor force*, mostly because millions of US workers continue to stay away from the labor market because of the COVID-19-related health risks. The US labor market will remain tight for as long as the health emergency is not brought under control. The labor market tightness does contribute to US inflation (via higher nominal wages), but supply-side constraints and corporate profiteering play an overwhelmingly more important role.

Monetary tightening cannot *safely* reduce US inflation, because most of the inflation originates from (global) supply-side problems and because the Federal Reserve faces tight domestic constraints on how much and how fast it can raise interest rates without provoking unacceptable collateral damage to the economy (**Section 8**). Forward guidance by the Fed is also very unlikely to play a significant role in containing inflationary pressures and bringing about a 'soft landing'. Fiscal austerity will lower demand and create a recession, but will not necessarily bring down inflation as long as the supply-side drivers of the price increases remain in place (**Section 9**).

Monetary tightening and fiscal austerity are non-rational responses to the present problem of inflation. The rational response to the current imbalance between (recovered) aggregate demand and (still depressed) aggregate supply would be to attempt to eliminate the COVID-19-related constraints on supply, rather than hiking up the interest rate and/or cutting (essential) public expenditure so as to lower demand to the impaired level of supply (**Figure 30**).

All this means that the Federal Reserve and the government cannot bring inflation down by means of monetary and/or fiscal policy. The only viable way to lower inflation will be to get the global COVID19 health crisis under control—because only this will end the supply-chain disruptions and labor shortages.

In the meantime, and for as long as it takes, the US will have to use other instruments to bring down inflation as well as complementary policies to manage and soften and manage the societal consequences of high inflation as well as possible.

10.1 Strategic price controls

The surge in inflation is mostly due to the rapid run-up of prices in the goods sector (particularly durable goods). The COVID-19 shutdowns shifted demand, sustained in part by the corona stimulus checks, out of services and into goods (**Figure 3**), while at the same time, causing a

collapse of global supply chains in durable goods and industrial components. Hence, as we have seen, the supply-side bottleneck in meeting the surge in goods demand was largely not a shortage of labor, but rather shipping capacity, shipping costs and lockdown-related delays. Higher global energy and commodity prices are fueling inflation further.

Oligopolistic firms, often endowed with enormous pricing power vis-à-vis their customers, are making use of the (temporary but long lasting) shortages, production cost increases and market chaos by raising their profit mark-ups; corporate profit rates have increased to their highest level since World War II (**Figure 10**). The increase in profit mark-ups and profit rates is not due to some (unexplained) sudden rise in market power of US corporations. Rather, the hike in profit mark-ups reflects the fact that markets, deeply upset by the COVID-19 related distortions, offer already powerful firms more space to exert their pricing power—raising profit margins and being able to get away with it (Bivens 2022).

Supply-side bottlenecks are making it impossible for supply to meet demand, creating socially undesirable opportunities for corporate profiteering that is driving up prices. In these circumstances, temporary strategic price controls (Galbraith 1980), accompanied by supply-enhancing policy measures, can be used to eliminate corporate profiteering and prevent key prices (of energy and food) from shooting up. As Isabella Weber (2021) argues, such "price controls would buy time to deal with [supply-side] bottlenecks that will continue as long as the pandemic prevails. Strategic price controls could also contribute to the monetary stability needed to mobilize public investments towards economic resilience, climate change mitigation and carbon-neutrality." Price controls should be accompanied by—what US Treasury Secretary Janet Yellen has called—'modern supply-side economics' (Omeowkwe 2022).

Price caps on fuel, energy and basic food items will bring about a redistribution through the regulated price to lower-income consumers, and so achieve not just a more equal distribution of essential consumer goods, but also a more efficient allocation of resources than could be achieved in a non-regulated market (Dworczak, Duke Kominers and Akbarpour 2021). Price controls do not eliminate the root causes of inflation, but the unwanted effects of rising prices can be contained. There is no doubt that we need energy price policies, because the entire economic system must be transformed to lower carbon emissions and mitigate climate change.

In response to the COVID-19 inflation, many governments in Europe, including those of Belgium, Hungary, Poland, Spain, Portugal and the UK, have resorted to regulating retail energy prices in order to protect consumers from rising energy prices (Sgaravatti *et al*., 2022). The European Union is close to imposing a maximum regulated price for natural gas delivered to European consumers and companies in an attempt to deal with the expected "full disruption of Russian gas supplies" (Simon 2022). Price controls are widely employed in the emerging economies, especially in energy (electricity) and (basic) foodstuffs. The Chinese state has been imposing price controls on iron ore, copper, grain, meat, eggs and vegetables in its 14th five-year plan for 2021-25 to address abnormal fluctuations in prices, while also controlling electricity prices in ways to promote carbon reduction (Zhang *et al*., 2021).

Strategic price controls are controversial. However, the key argument *against* (temporary) price controls is surprisingly weak (Tucker 2021). The standard (microeconomic) idea is that price controls block the market mechanism from doing what it is supposed to be doing: creating the ('socially efficient') relative price signals that reflect relative scarcities and trigger a

reallocation of resources in favor of the production of those goods and services that are in excess demand. The problem with this conventional micro view is twofold.

First, it is based on the evidently false assumption that the prevailing market prices are socially efficient, which is not the case in an economy with oligopolistic markets. Accordingly, since the prevailing prices are in no way 'socially efficient', there is no à priori reason for believing that government controls will distort them; price controls could even 'improve' them (Galbraith 1980). Second, a reallocation of resources (driven by relative price signals) will take a considerable length of time in effecting adjustments to changes in supply or demand conditions, even if we assume that the price mechanism is capable of bringing it about. During this long period of market-led adjustment, the cumulative social and economic cost of high inflation, particularly of basic items such as food and energy, will be large, especially for the lower and middle-income groups. Worse yet, there are good reasons to assume that the proverbial market mechanism will be incapable of eliminating the sources of today's inflation, which are lying in the COVID-19 caused disruptions of supply chains and the Ukraine war.

Economists who are calling on the Federal Reserve to raise interest rates in order to prevent inflation from spiraling out of control, implicitly recognize that the market mechanism cannot remove the excess demand quickly enough, so that inflation expectations may become unanchored and high inflation becomes entrenched, at great social and economic costs. To avoid this undesirable outcome, the Federal Reserve has 'to do whatever it takes': raising interest rates by as much as is necessary to stop inflation and keep inflation expectations anchored at 2%. It is somewhat ironic that the Fed's control over the interest rate, a 'macro price', is not generally considered to be instance of price control.

However, the collateral damage of raising interest rates, which is both a blunt and relatively ineffective instrument to control inflation, will be unnecessarily large—as has been argued in this paper. Worse, monetary tightening cannot remove the supply-side bottlenecks driving the inflation. As the Bank of England governor, Andrew Bailey (2021), pointed out, "monetary policy will not increase the supply of semiconductor chips, it will not increase the amount of wind […] and nor will it produce more [Heavy Goods Vehicle] drivers. Moreover, tightening monetary policy could make things worse in this situation by putting more downward pressure on a weakening recovery of the economy."

Let me be clear: this is not an argument for general price controls, but for regulation of the prices of essential goods or services in response to the specific shock of COVID-19. And yes, price controls will have negative side-effects and unintended consequences, just like any other intervention. But the collateral damage of temporary and strategic price controls will be smaller than that of generic monetary tightening, and what is more: the burden will fall more heavily on the strongest shoulders (profiteering corporations and the rich) rather than on the weakest (workers losing their jobs).

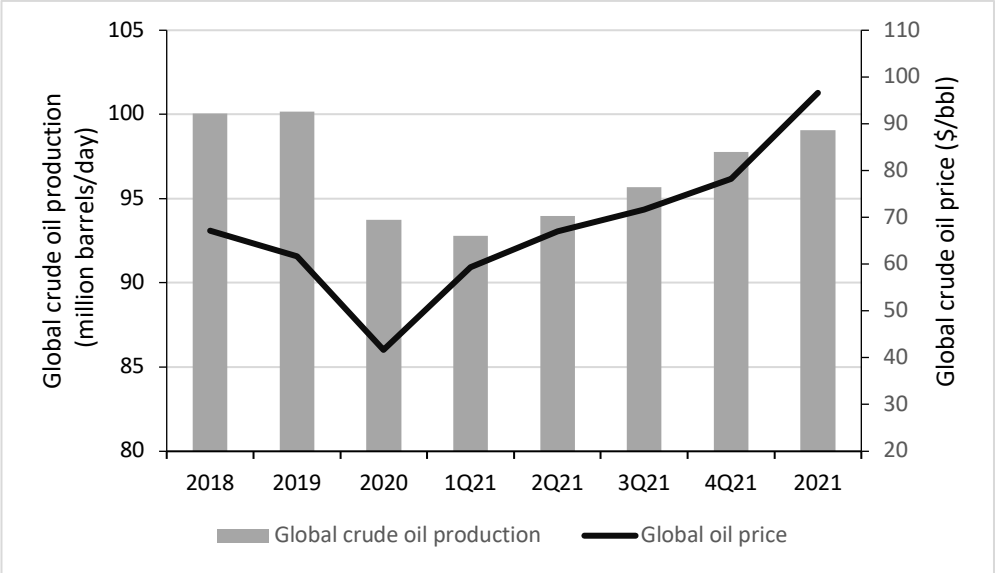
10.2 Cracking down on commodity and energy price speculation

Rising energy (oil) and commodity prices are key drivers of accelerating inflation. Speculation is pushing up energy and commodity prices—as we have seen in **Section 3**. Measures to strengthen commodity market regulations in the US and EU are needed to eliminate these

perverse sources of commodity price inflation (Larsen 2022). Let us consider global oil prices and prices of wheat in more detail.

Global oil prices have increased during 2021-22 even if global oil production is 6 million more barrels a day in 2022Q1 than in 2021Q1 (**Figure 52**). The reason is that oil prices are not driven by scarcity ('fundamentals'), but by speculative trading in commodity (futures) markets. The virtual trade in oil futures has come to dwarf the physical trade of oil in spot markets: about a billion barrels of oil a day get traded, while the actual production is only around 100 million barrels per day (**Figure 52**). Hence, more than 10 times the physical amount of crude oil is traded in future contracts. As a result, the futures trade now determines the price of oil. All the major oil companies, leading US banks, and private energy trading houses led by Vitol, Trafigura, Mercuria, and Glencore, are involved in speculative energy trading (Juhasz 2022).

Figure 52
Global crude oil production (million barrels per day)
and average global crude oil price ($/barrel), 2018-2022Q1



Source: OPEC (2022) Monthly Oil Market Report, April 2022;
and World Bank Commodity Price data (The Pink Sheet).

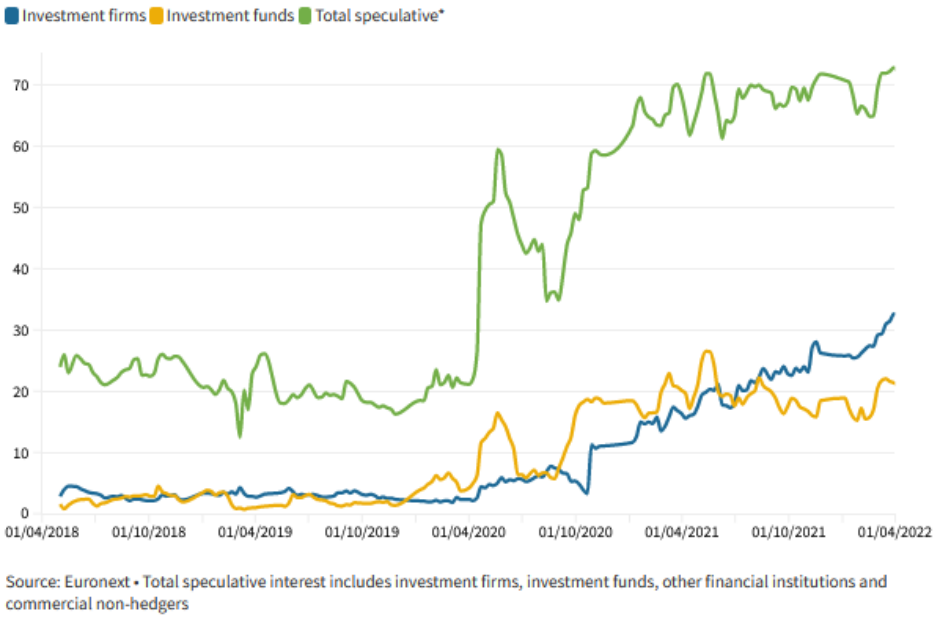
Likewise, speculative activity by hedge funds, investment banks and pension funds has driven up wheat prices—prices of (soft red winter) wheat, the supply of which is affected the most by the war in Ukraine, rose by more than 100% between January and April 2022. Wheat prices increased notwithstanding the fact that the wheat shortfalls due to the Ukraine war are likely to be made up by other countries (including the US, Canada and Argentina) and comfortably high global wheat stocks (IPES 2022). Fundamentals cannot explain the sharp rise in wheat prices, but excessive speculative activity can (Kornher *et al*. 2022).

On the supply side, four private corporations—Archer-Daniels Midland, Bunge, Cargill, Dreyfus, the 'ABCD' of grain trading—account for 70-90% of global grain trade and have a clear incentive to hold stocks back until prices are perceived to have peaked (IPES 2022). On the demand side, financial speculators rushed into wheat futures, commodity swaps and agriculture-linked exchange traded funds (ETFs), immediately following the invasion of Ukraine. The share of speculators in buy-side wheat futures contracts has increased from 23%

of open interest in May 2018 to 72% in April 2022 (Agarwal, Win and Gibbs 2022), as is illustrated by **Figure 53**. By April 2022, seven in ten buyers of futures wheat contract were investment firms, investment funds, other financial institutions and commercial non-hedgers whose aim was to profit from the rise in prices; Agarwal *et al*. (2022) find that investment firms increased their presence in the buy side of the wheat futures market in Paris from 4% of open interest in 2018 to 25% in April 2022, and investment funds increased their presence from 1% to 21% of open interest.

Data from the CFTC also show increased speculative activity in wheat in the Chicago Board of Trade (CBOT), as is clear from the strong growth in Exchange Traded Funds (ETFs) linked to agricultural commodities in 2022. Financial investors are cashing in on rising food prices. "Managed money has been buying long futures contracts of Soft Red Winter wheat following Russia's invasion of Ukraine. Together with swaps dealers, they owned 58% of long futures-only contracts, their highest combined share since 2014, just as Chicago wheat hit its peak in early March," conclude Agarwal *et al.* (2022).

Figure 53
Composition of open interest in long (buying positions)
in the Paris wheat market (as percent of total open interest)



Source: Agarwal, Win and Gibbs (2022).

The speculation-driven rise in energy and commodity prices has been facilitated by a failure of regulatory bodies including the *Commodity Futures Trading Commission* (CFTC), the main regulator of US energy markets, and the European Securities and Markets Authority (ESMA), to enact the rules they have been tasked with in the face of intense lobbying and opposition against these rules by the financial sector. But Wall Street firms are exploiting loopholes in the regulation of complex financial trades related to commodities like oil and wheat. One example of such a regulatory loophole concerns (commodity) swaps, which are essentially bets on commodity prices. Wall Street firms can escape CFTC regulation of its swaps simply by trading

them via overseas affiliates; the reason they can do so is because footnote 563 of the *Interpretive Guidance and Policy Statement Regarding Compliance with Certain Swap Regulations* (CFTC 2013) states that CFTC regulations do not apply if non-U.S. traders explicitly affirm that the swaps are not financially backed, or guaranteed, by a US firm. As pointed out by Michael Greenberger (2018), footnote 563 was added after a great deal of lobbying by Wall Street firms. As a result, most of Wall Street's swap deals went overseas. Speculative commodity swaps are currently driving up commodity prices (Larsen 2022).

However, the CFTC and ESMA do have instruments to protect the futures markets and swap markets from excessive and socially costly speculation. For one, the CFTC can discourage speculators by tightening position limits in energy futures markets to discourage speculative, market momentum-based speculators, *i.e.*, limiting the number of shares or derivative contracts that a trader, or any affiliated group of traders and investors, may own. Position limits on oil, gas and key agricultural commodities which currently are too high to make a meaningful difference, have to be tightened and the enforcement of these tighter limits needs to be enforced. On top of raising position limits, the CFTC should increase margin requirements, forcing a trader to hold larger capital reserves for a given number of positions, making it much more expensive to corner the market and gain from speculation.

In addition, "financial institutions should step back from selling agricultural commodity ETFs and CIFs at times of heightened food prices and mounting speculation. The potential to discourage financial speculation through a tax on commodity index funds and other derivatives trades should also be explored, building on calls for a Financial Transaction Tax in the wake of the 2007-2008 economic crash, and more recent demands in the US and UK for a windfall tax on fossil fuel companies profiting from the current crisis" (IPES 2022, p. 22).

This way, financial regulation cracking down on excessive speculation in energy and commodity markets can contribute to lowering inflationary pressures.

10.3 Removing domestic supply-side bottlenecks

The primary domestic supply-side bottleneck constraining US production is the decline in the effective labor force. The labor shortage is felt at the aggregate level as well as in specific key occupations which deliver essential services to the economy. A major example of the latter is the structural shortage of (long-haul) drivers which is contributing to a shortage of consumer goods and industrial inputs. The shortage of drivers can be eased by a drastic, and overdue, reform of the working conditions of truckers, which transforms their jobs into steady, well-paying ones. This requires that (*a*) truckers get paid for all the time they are at a shipping's location, (*b*) payment is by the hours worked (rather than by the mile), and (*c*) truckers get organized in unions which represent them in collective bargaining (Viscelli 2018). Better, more stable and more elevating working conditions will help to attract additional drivers and reduce the driver shortage.

The same holds true for other occupations. Low and stagnant pay relative to increased health risk was a major reason for US workers to disengage from the labor force—through (involuntary) 'early retirement' (for those workers who could afford this) or forced upon them by the imperatives of living through the COVID-19 crisis with family and children. For many workers, the coronavirus outbreak was the main reason for quitting a job—directly, because

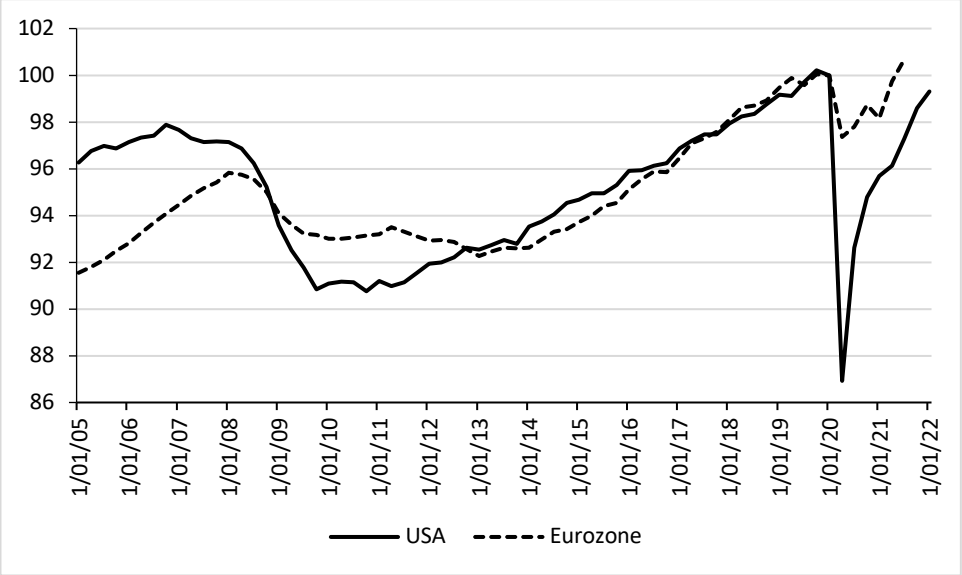
doing the job had a high risk of getting infected, but also indirectly, because the job offered insufficient health insurance, did not allow for working remotely, or did not offer adequate child care support.

The higher health risks associated with 'essential' close-contact jobs including those of nursing assistants, personal care aids, food-service workers, teachers and cleaners, has led to a 're-pricing' of work—and to a restructuring of working conditions which have to be made safer (*think*: adequate ventilation and free testing for COVID-19) and more flexible for workers (*think*: paid leave policies for workers to take care of sick family members and/or close friends). In addition, coverage of health insurance needs to be expanded to include the 20% of American low-wage workers and the millions of self-employed who are now working without such insurance. Finally, income support and treatment have to be provided to the millions of Americans suffering from long-COVID.

If the proposed reforms succeed in collectivizing the health risks associated with the collective public health emergency caused by SARS-CoV-2 that fall on individual (low-wage) workers and in substantially improving the reward for what are essential jobs, discouraged workers and involuntary retirees will be motivated to return to the workplace—and the effective-labor-force constraint will vanish. The importance of this conclusion cannot be overstated, because the labor shortage and the overheated labor market are considered to be key bottlenecks underlying the rise in US inflation.

A comparison of the drop in the employment-population ratio in the US and the Eurozone (**Figure 54**) shows a remarkable difference: in the US, the employment to working-age-population ratio declined by more than 13 percentage points in Quarter 2 of 2020 (compared to 2020Q1), whereas the employment to working-age-population in the Eurozone declined by less than 3 percentage points. The labor shortage caused by COVID-19 was therefore much less of a problem in the Euro Area than in the US. Moreover, the Eurozone employment-population ratio returned to its pre-pandemic level already in Quarter 2 of 2021, whereas the employment-population ratio in the US was still lower in 2022Q1 than in 2020Q1. I believe that a large part of the difference in the magnitude of the labor supply shock between the US and the Eurozone can be attributed to the fact that the health risks of COVID-19 for Eurozone workers were, on average, more strongly collectivized than for US workers, also because the Eurozone offers a stronger social security safety net to its (furloughed) workers.

Figure 54
The employment-working age population ratio in the US and the Eurozone
(2005Q1-2022Q1; 2020Q1 = 100)



Source: FRED data (series LFWA64TTEZQ647S; LFWA64TTUSM647S; LFEMTTTTEZQ647S; and CE16OV). *Note*: working age population is all persons aged 15-64.

10.4 Shielding the lowest income groups from the inflation

The lowest income households are suffering disproportionally from the current inflation increase, with rising energy prices being the main culprit. Inflation has clear negative distributional effects, not only in emerging economies, but also in the US. One reason is that the degree of unionization is lower for low-wage workers in services activities, who, as a result, experience lower real wages as inflation outpaces their pay rises. The lowest-income workers lack savings to smooth their consumption over time, and instead often hold debts; their debt-service payments will increase following monetary tightening. In addition, the wealth they do have is often held in cash or in low interest rate bank accounts that are not shielded from inflation (while richer households often hold inflation-linked bonds or shares in mutual funds). In addition, the poorest households experience higher inflation, because they spend a larger proportion of their budgets on fuel, energy, and food than the richer households. Rising fuel, energy and food prices disproportionately hurt the lowest income groups—raising inequality in living standards and life opportunities.

Given that most households will not be able to borrow to cover the costs of higher energy bills and food, they will be forced to cut discretionary spending—demand for consumer durables, restaurants and leisure will decline, and the US economy will go into recession. Unemployment will rise and banks will suffer from bad debts. Despite the recession, inflation will not disappear—because most of it originates abroad. Monetary tightening by the Federal Reserve will only deepen the demand shortage and crisis, but with a close to negligible impact on the rate of inflation.

The political consequences of the ‘unmanaged’ stagflation will be tangible: dissatisfaction with the incumbent administration will mount in line with growing anxiety over jobs, incomes and

mortgages, and the number of protest votes in support of the opposition party will grow. Half a century ago, Arthur Okun, coined the term 'misery index'—when the sum of the unemployment and inflation rates hits double digits, it means misery for the party in power. As is shown in **Figure 55**, Okun's misery index has been rising, mostly due to the acceleration in inflation, reached 11% in March 2022 and is on its way to reach the level reached during the Carter administration.

Figure 55
Okun's misery index
(January 1960-April 2022)

Source: FRED data (series UNRATE_PCEPI_CH1).

Because we will have to live with higher inflation for a longer time, it is of critical importance to manage its distributional consequences, shielding vulnerable groups from the higher costs of energy, fuel and basic food. This means that (redistributive) fiscal policy will be crucial. On the one hand, the tax code can be used to provide targeted temporary relief for low-income households coping with much higher energy and food bills—along similar lines as in the American Rescue Plan Act. Complementary measures should focus on financial support for child care, enhancing the child tax credit and making it refundable (again), and tax incentives for (retired) workers re-joining the labor force. The measures should be geared to raising effective labor supply, while at the same time improving the rewards from working in essential occupations, helping workers balance their jobs and childcare, and fairly sharing the burdens associated with the higher occupational health risks.

These relief measures protecting the working-class and middle-class households can be financed out of temporary increases in taxes on the highest income earners and on corporate profits. To illustrate the point, if we assume that the poorest 60% of US households are to receive an emergency subsidy to compensate for the 30% increase in energy prices of $700 for

the year 2022, this would cost the US government around $54.6 billion.[26] The $700 would cover 80% of the average increase in expenditure on energy of the poorest 20% of US households, 54% of the average increase in energy bills of the second quintile of US households, and 38% of the higher energy costs of the third quintile of US households. Corporate profits increased by $ 3.3 trillion in 2021 (compared to 2020). Imposing a temporary windfall tax of just 1.67% on the increase in corporate profits would suffice to provide much needed relief to households struggling with much higher energy prices.

Other ways to manage the distributional outcomes of the surge in inflation include tax rebates for small and medium enterprises and the self-employed, rent relief and offering free school meals to students in eligible schools. The point is that we need 'smart' fiscal policies, instead of misplaced austerity, to enable a fair sharing of the burdens that inflation is imposing on the economy and the society. There is much more at stake in doing this well than the conventional, but narrow, macroeconomic indicators (*e.g.*, the fiscal deficit, public debt and the unemployment rate), because US society appears to be unable to cope with a further increase in (an already intolerably high degree of) inequality.

Mahatma Gandhi was correct when he stated that "the true measure of any society can be found in how it treats its most vulnerable members." This statement has taken on a renewed importance due to the inflation in a time of corona and war.

11. Inflation in the longer run

The alternative interventions to bring down inflation and to manage its distributional consequences (reviewed in **Section 10**) are meant to be temporary—and to last for as long the inflation will last, even if this would be for a few years. These temporary measures cannot, and are not intended to, bring about structural changes that would make the economy more resilient to global supply-chain shocks and less inflation-prone. Such structural change will be necessary, however, because there are clear reasons to expect that inflation will remain higher in the future.

The principal reason is the global climate crisis, which is already harming the US (Milman 2020). For example, Alaska is among the fastest warming regions on earth, and as its (sea) ice and frozen soils are melting, livelihoods, roads and buildings are collapsing. At the same time, the mid-west is suffering from increasing temperatures and more frequent instances of heavy rainfall, causing the erosion of soils and leading to introduction of harmful pests and diseases; overall yields in America's agricultural heartland, are set to decline to levels realized in the 1980s. And while the southeast of the US is experiencing more frequent flooding and the arrival of new diseases, the northwest is suffering from wildfires and smoke pollution. The volume of water in Lake Powell and Lake Mead, two critical catchments in the Colorado river basin, has dropped by half in the past two decades, threatening water supply to 40 million people in seven states in the American southwest.[27]

Estimated damages in the US from storms, floods, wildfires, and other extreme weather events have grown to about $137 billion a year during 2016-2021 (NOAA-NCEI 2022). The year 2020

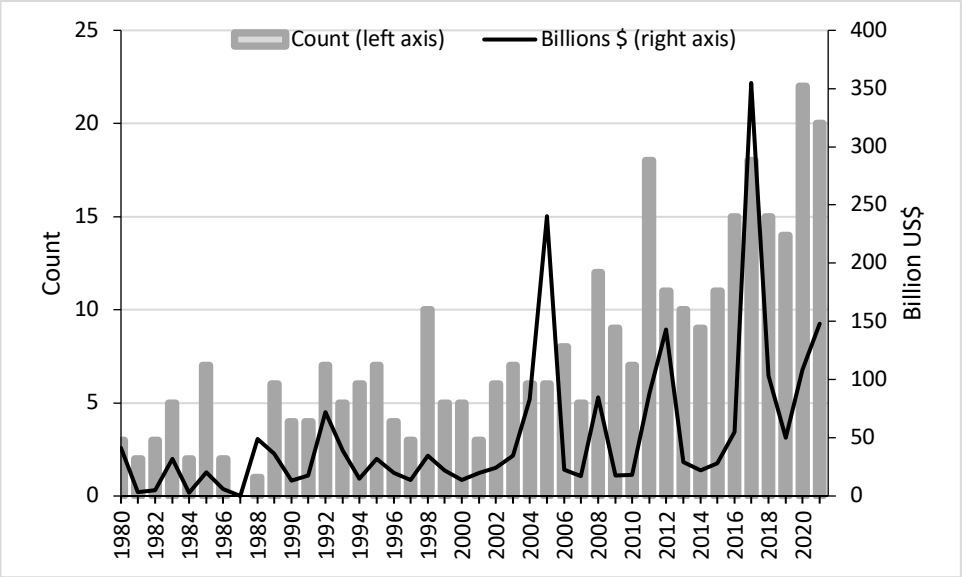
[26] This concerns around 78 million households. My 'rough' calculation is meant to illustrate the order of magnitude of the spending and taxation involved.

[27] This paragraph draws on Oliver Milman's (2020) article 'How the climate crisis is already harming America – photo essay.'

witnessed 22 billion-dollar-or-greater weather and climate disasters, a record number of such events, which caused a combined $109 billion in damages. Moreover, the 2020 experience reflected a long-running trend, as the frequency and costs of severe weather-related events occurring in the US have been rising over the last two decades (**Figure 56**).

The structural, longer-term physical damages due to climate change will likely contribute to elevated prices and higher inflation in the (US) economy—and American workers, households, firms and macroeconomic policymakers will have deal with these.

Figure 56
Billion-dollar Climate and Weather Disaster Events, United States
(1980-2021)



Source: NOAA NCEI (2022), *Billion-Dollar Weather and Climate Disasters*.
Note: Event counts and total cost estimates reflect weather and climate disaster events with costs exceeding one billion in CPI-adjusted 2020 dollars.

11.1 Disruption of global supply chains and higher shipping costs

Climate change poses a structural, slow-moving threat to global supply chains, as, at some point in the future, seal level rises will begin to inundate the world's 2738 coastal ports and coastal infrastructures (Leslie 2022). But already now, climate change is upsetting global supply chains, because more frequent and more severe hurricanes, floods, wildfires, heat waves, and other forms of extreme weather are damaging production and transportation (Leslie 2022). More specifically, estimates for China by Zhang *et al*. (2017) suggest that climate change will reduce Chinese manufacturing output annually by 12% by 2050,[28] and since China is the *de*

[28] Similar findings have been reported by Chen and Yang (2019), whose model projections are that industrial output in China will decrease by 3–36% by 2080 under the slowest warming scenario and by 12–46% under the most rapid warming scenario.

facto factory of the world, considerable losses in the Chinese manufacturing sector will lead to higher consumer prices around the world, including the US.

Shortages of water are already constraining the generation of energy and the production of high-tech items such as semiconductors, the production of which requires large quantities of water for purposes of purification. More than half of the world's semiconductors, which are used in microchips, solar cells, digital circuits and other electronics, are made in Taiwan, most of them by the *Taiwan Semiconductor Manufacturing Company* (TSMC). "TSMC, which uses 37 million gallons of water a day, faced production uncertainty last spring when Taiwan experienced its largest drought in half a century and began rationing water," writes Meyer (2022). Again, any hiccups in semiconductor production will lead to ripple effects in the downstream (electronics-intensive) industries such as car manufacturing.

Shipping costs are bound to remain considerably higher in future than they have been during the heydays of globalization, after China joined the World Trade Organization. The reason is that the merchant shipping industry, which is a major contributor to global warming, has to drastically reduce its CO_2 emissions as part of meeting the goals of the Paris climate agreement. The shipping industry is a critical pillar of global supply chains, with about ninety percent of all globally traded goods carried around the world by sea (Stone 2021). To do this, the shipping industry burns approximately 300 million metric tons of dirty fossil fuels each year and is responsible for three percent of global greenhouse gas emissions (IMO 2020). Global supply chains are free-riding on the climate system, as (container) shipping is not nearly paying the full (social) cost of the global warming damages it has and still is creating. Sadly, the industry is far off track from meeting the goals of the Paris climate agreement: rather than lowering its carbon emissions, shipping saw its global emissions rise by 10% during 2012-18 (IMO 2020). The *International Maritime Organization* (IMO), the UN body that regulates shipping, predicts that in a business-as-usual scenario, the industry's emissions could be 30% higher in 2050 than they were in 2008.

For this to change, tougher energy efficiency regulations and carbon emission standards have to be imposed on the shipping industry, forcing it to lower its greenhouse gas emissions by 2050 in order to stay in line with the Paris climate agreement's 1.5°C global heating target (Stone 2021). The EU is about to regulate shipping emissions under its emissions trading system (ETS), with a phase-in beginning in 2023. As a result, by 2026, shipping companies will have to pay for the greenhouse gases they emit traveling to and from the EU and between EU ports (Stone 2021). In addition to this, the EU is proposing a fuel mandate that would compel the industry to use a progressively greater share of low- and zero-carbon fuels in its ships. And in April 2021, the US committed to pursuing a zero-emissions shipping industry by 2050.

The IMO has introduced carbon standards in terms of a carbon intensity indicator (CII). This 'technology-forcing' regulation is meant to push shipping corporations into investing more in improving the carbon efficiency of their vessels. While the IMO has not explicitly mandated any punishment for violating these carbon standards, and lobbying by the shipping industry has been actively pushing back against the carbon standards, it is widely held that ports and government agencies will reward healthy CII rated ships with preferred port slots, monetary benefits, *etc*. The preferential treatment of carbon-efficient ships will, in turn, force shipping firms to invest in greening their activities (Raza 2022).

However, greening the shipping industry will require decades of billions of dollars of investment and innovation (including in retrofitting old ships and developing alternative fuels), and will burden the industry with stranded assets (because relatively new carbon-inefficient vessels will have to be put out of service). Greening will also lead to a further concentration of the shipping business, because many small ship-owners will not be able to mobilize the necessary investments, unlike the larger companies (Raza 2022). Taken together these developments will lead to shortages of carbon-regulation-compliant vessels and this will raise freight rates (also because the shipping oligopoly will become more concentrated). The leap in the cost of shipping a container across the oceans as a result of the COVID-19 crisis (see **Figure 14**) may suggest what is in store.

11.2 Rising food and commodity prices

Global warming will increase the frequency, duration and intensity of heat-stress-induced failures of crop outputs. For example, a recent attribution study for northwest India and Pakistan by the UK Met Office (Christidis 2022) shows that the *natural* probability of a pre-monsoon heatwave exceeding the record-breaking average temperature in 2010 in the region is once in 312 years; however, accounting for climate change, the probability is found to increase to once in every 3.1 years (Christidis 2022). Climate change is driving the heat intensity of these heatwaves and thus making record-breaking temperatures 100 times more likely.

Most of global cereal production is concentrated in a small number of global 'breadbaskets', which cover 23 percent of total cropland on the planet, but are responsible for 70.3% of global maize output, 69.3% of global wheat output, and 84.5% of global rice output (Janetos *et al*. 2017). These breadbaskets are particularly vulnerable to heat stress and drought, and crop failures in two or more of such areas will create massive global shortages in foodgrains. A simultaneous failure of multiple breadbaskets will disrupt global commodity chains, push up cereal prices and throw millions of people deeper into poverty. The financialized nature of globalized food systems, with highly concentrated oligopolistic markets, will only amplify these vulnerabilities (IPES 2022).

Global agricultural production shortfalls and surges in commodity prices will not only hurt the economies of the countries where the crops are being produced, but will spill over in global food system disruptions, triggering economic crises in the richest economies as well. Econometric estimates for a panel of 75 advanced and developing countries suggests that a 10% increase in global food commodity prices due to extreme weather reduces real GDP on average by 0.53% after one-and-a-half year (De Winne and Peersman 2021). This is a sizeable impact: on its own, the increase of global food prices by almost 40% during January 2021-May 2022 must have depressed global real GDP by 2%. Higher commodity prices also lead to higher food retail prices through the food production chain, and trigger indirect inflationary effects via rising wages and exchange rate shifts. Swings in international food commodity prices have historically accounted for 25-30% of consumer price inflation in the Eurozone (Peersman 2022).

Another concern is that rising heat and rainfall associated with climate change is increasingly degrading land, making soils less productive. This is because the loss of soil nutrients and organic matter and has negative effects on crop yields (Agnolucci and De Lipsis 2020). US

farmers will not be spared the damage that climate change is already beginning to inflict. In fact, the industrial model that dominates US agriculture—a model that neglects soils, reduces ecological diversity, and relies too heavily on fertilizers and pesticides—makes American farms susceptible to climate impacts in the form of soil erosion, water pollution, vulnerability to pests, and chemical pollution (UCS 2019). Reductions to agricultural productivity or sudden losses of crops or livestock will have ripple effects, including increased food prices and greater food insecurity. US farmers will have to invest in new, climate-resilient ways to produce food: building healthier soils; reducing dependence on fertilizers and pesticides; planting trees and native perennials; and shifting to circular farming. However, for farmers in the eastern US, the cost of climate adaptation to 2°C of global warming would largely eliminate profits from the average acre of farmland (Lemoine 2021).

11.3 Climate damage, finance and higher prices

Climate change is affecting productivity and costs in the US high-tech (manufacturing) sectors. As the number of heatwave days per year increase, the higher temperatures are negatively affecting (worker) productivity, damaging climate-sensitive components and electronic equipment, and raising the cost of air-conditioning and insulation (Martinich and Crimmins 2019). Critical (electricity) infrastructures may be damaged and hold up production and distribution of (industrial) goods. Recent estimations by the *Deloitte Economics Institute* (Deloitte 2022) show that, if left unchecked, the cumulative economic cost of climate change in the United States alone could reach $14.5 trillion by 2070. "A loss of this scale is equivalent to nearly 4% of GDP or $1.5 trillion in 2070 alone" writes Deloitte (2022). Supply-side disruptions within the US economy will lead to frequent, temporary bouts of inflation.

In addition, global warming constitutes an increasing threat to US financial stability. For example, insurers of property, hazard, flood, and other property-related risks are directly exposed to the climate-related financial risks. To reduce their potential losses, insurers may seek to increase premiums or withdraw from at-risk markets (FSOC 2021, p. 18).[29] This is happening already. For instance, in 2021, houseowners and businesses in flood-prone areas in the Florida Keys saw their annual flood insurance premiums go up, sometimes by thousands of dollars a year, to account for climate change (Allen 2021). In response to the heightened weather-related risks, many insurance firms are leaving Florida, and larger insurers are cancelling policies among homeowners in the region. Similarly, over 340,000 Californian homeowners lost private property insurance coverage between 2015 and 2018 due to wildfires that are increasing in frequency and intensity, and had to turn to an expensive state-backed insurance program (Johnson 2019).[30]

[29] Insurance against climate-related risks faces three limits (Becketti 2021, p. 15): "insurance cannot provide a solution when (1) the actuarially-fair price of insurance becomes too expensive to purchase; (2) the probability distribution of the event to be insured against is impossible in practice to estimate; or (3) the event to be insured against is no longer a risk, that is, it is a certainty (or near certainty). These limits to insurance apply equally to all other forms of risk sharing and risk transfer."

[30] The insurance industry is a key contributor to global warming. Firstly, "the industry provides insurance for fossil fuel extraction projects, allowing investors to support them by protecting against catastrophic losses. The second way is through its investments. Insurance companies turn a profit in

Homeowners in areas vulnerable to extreme weather events find themselves in a catch-22. The reason is that most mortgage providers require mortgage holders to insure their home in order to maintain the mortgage. Hence, if the insurance company decides that houses in a particular area (prone to flooding or wildfires) have become too risky to insure, then homeowners will lose coverage and likely default on their mortgage. And in case the mortgage is already paid, it may be extremely difficult for the homeowner to sell a house that no one wants to insure.

Not surprisingly, US mortgage bankers are sounding the alarm on climate change (Becketti 2021): as climate change worsens and natural disasters wreak havoc on America's housing stock, homeowners will increasingly default on their mortgages (if only because insurers cancel property insurance). Private sector investors in the housing market will back away from communities facing severe climate risks. The increase in risks and the ballooning financial losses will force mortgage lenders to ratchet up interest rates (Becketti 2021). A higher frequency of mortgage defaults will lower the creditworthiness of mortgage-backed securities and other derivate instruments—putting stresses on the financial system at large. Climate change risks will thus test the limits of insurance and stress the US financial system—and as a result, interest rates and housing costs will be higher.

While none of these longer-run impacts can be predicted with any degree of confidence, the disruptions by unmitigated climate change are very likely to raise the volatility and the level of the US inflation rate.

11.4 'Fossilflation'

Inflation will likely remain higher in the medium run due to—what Schnabel (2022a) has called—'fossilflation': the legacy cost of the economy's dependency on fossil energy sources. As we have seen, higher energy prices accounted for 22.4% of PCE inflation in the US during March 2021-March 2022, even if the share of energy in private consumption is only 4.2% (**Table 1**). Higher prices for fossil fuels are the primary driver of the energy inflation, and hence, the recent surge in inflation is a symptom of our continued dependence on fossil fuels.

Fearing the prospect of trillions of US dollars of stranded assets in fossil fuel reserves and infrastructure, the fossil-fuel oligopolists are doing everything they can to delay the energy transition. They do so, for instance, by promoting the narrative that natural gas can be used as a transitional "bridge fuel" to cleaner energy sources, even if the IPCC is calling for a rapid and substantial reduction of overall fossil fuel use in line with the aim to limit global warming to 1.5°C. According to the International Energy Agency (IEA 2021a), in order to stand a chance of meeting our 1.5°C target, the world must stop building new fossil fuel infrastructure—including gas infrastructure—immediately.

However, the political money of the fossil-fuel industry is so influential that the US continues to over-build gas pipelines, liquefied natural gas (LNG) export facilities (now to export LNG to European countries, which are cutting their imports of Russian gas), and petrochemical facilities to turn gas into plastics. Fossil-fuel producers well understand that natural gas-fired power plants will help lock in future demand for their products. Once these plants are built, they will be used for decades, even if renewable energy is cheaper. The fossil fuel industry and

part by investing their revenues in other companies. Billions of dollars of those investments go to the fossil fuel industry" (Mellins 2021).

its allies also often (and falsely) suggest that climate policies are responsible for driving energy prices higher—while the reality is that clean energy is much less economically volatile than fossil fuels, and its declining costs are not subject to the boom-and-bust cycles that have defined the age of gas and oil. The fossil fuel industry will, of course, claim that a 'temporary' expansion of fossil fuel production will not jeopardize meeting long-term climate targets, but the truth is that doing so will exacerbate the US's exposure to unnecessary economic and geopolitical risks, worsen the energy poverty crisis, and derail climate objectives.

Our continued dependence on fossil-fuel-based energy therefore comes with great costs: "…. an overwhelming share of the recent rise in gas and oil prices over and above their pre-pandemic levels – their "excess" rise – reflects the ability of energy producers to steer supply in an oligopolistic market," writes ECB executive board member Schnabel (2022a), adding that "oil and gas markets are often artificially tight, pushing up prices at the expense of energy importers". As a result, fossil-fuel companies are making billions of dollars of extra profits at the expense of energy consumers.

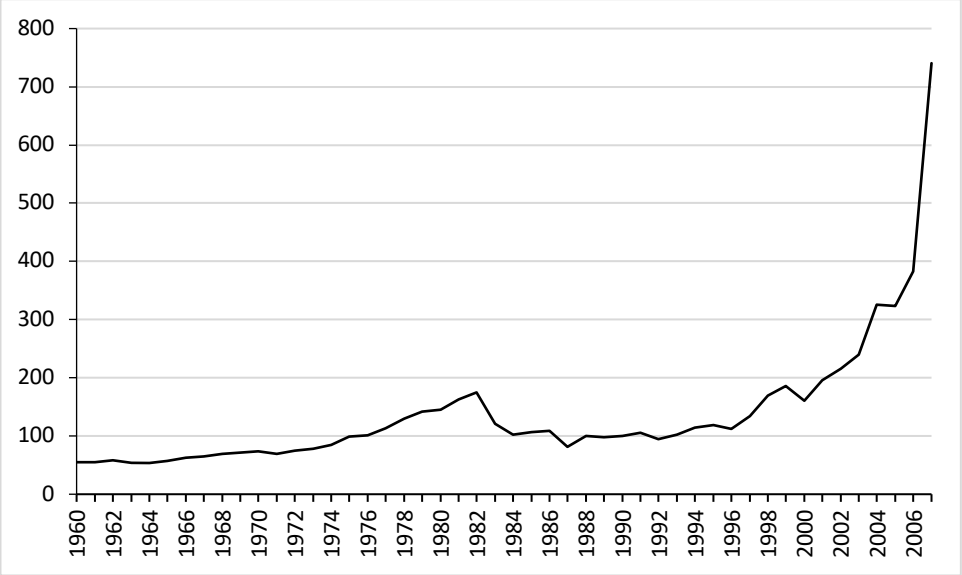
Somewhat ironically, the seeds of today's energy price inflation were sown in oil's golden era between 2010 and 2014, when global oil prices averaged above $100 per barrel. The high oil price and the extremely low interest rates led to an investment boom in shale oil and gas production in the US over that period, while hydrocarbon corporations cut back on investment in conventional oil and gas exploration and generation (Sen 2021). As a result, the number of oilfield discoveries during 2016 and 2021 fell to a record low, while new LNG export projects slowed after a decade of low gas prices caused by a wave of new supply (Sen 2021). Rystad Energy (2020) predicts that the world economy will run out of sufficient oil supplies to meet its needs through 2050, despite the fact that future demand will be lower due to the accelerating energy transition—unless exploration speeds up significantly.

But the cost of drilling for oil and gas has sharply increased over time. Unfortunately, the US Energy Information Agency (EIA) does not publish recent data on the real cost (in 2020 US $) per crude oil, natural gas, and dry well drilled, but the published numbers for the period 1960-2007 show that *real* (*i.e.*, inflation-adjusted) costs per well rose by 640% between 1990 and 2007 (**Figure 57**). These costs must have increased even further in recent years, as the number of oil and gas reserve discoveries is declining and the capital cost of exploration and drilling is rising. Hence, it appears likely that global supplies of oil and gas will continue to fall short of global demand in future.

In line with this, the EIA (2021) predicts that between 2020 and 2050 *real* oil and gas prices in the US (measured in 2020 US dollars per unit) will increase by around 130% and 80%, respectively (**Figure 58**). This means that the average annual increase in oil (gas) prices is predicted to be 2.8 (1.9) percentages higher than the inflation rate. Fossil-fuel energy will remain a driver of overall inflation.

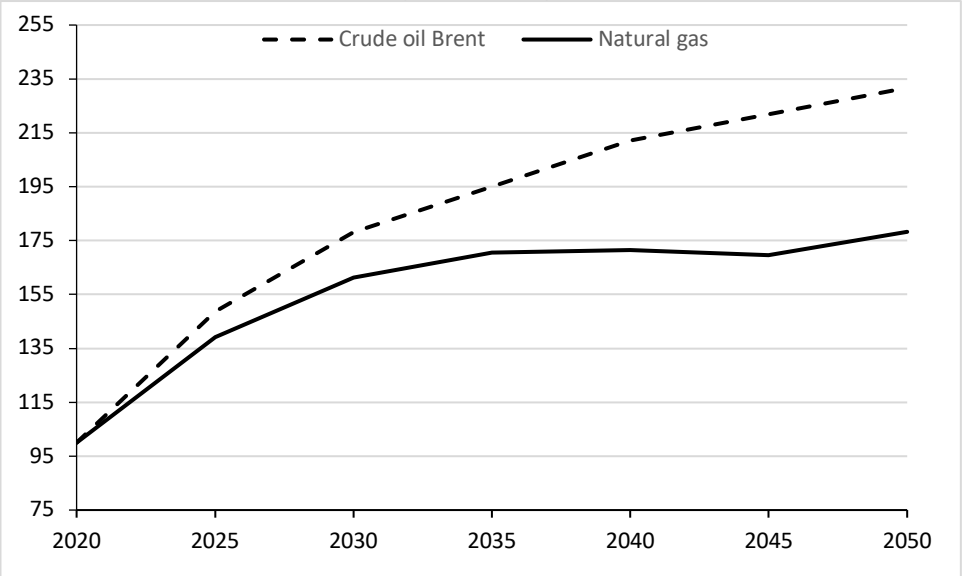
In earlier times, higher prices did lead to a rush to drill more oil and gas, as hydrocarbon companies tried to cash in on the excess demand for fossil fuels. However, this time is different: the supply response of fossil-fuel producers to the higher prices in 2021 and 2022 has been muted and the earlier cycle of disinvestment is only slowly being corrected. Investment by international oil and gas companies has declined in recent years, primarily because funding of new fossil-fuel projects is becoming more difficult.

Figure 57
Real cost (in 2020 US $) per crude oil, natural gas, and dry well drilled
(1960-2007; cost index 1990 = 100)



Source: EIA (2021),
https://www.eia.gov/dnav/ng/hist/e_ertw0_xwwr_nus_mdwa.htm

Figure 58
Price indices of oil and gas (in constant 2020 US dollars)
(2020-2050)



Source: EIA (2021), Table A1.

Many institutional investors in financial markets have begun to reduce their exposures to fossil fuel energy producers:

> "ESG considerations account for much of the decline in capital expenditure by international oil companies in recent years and the investor exodus out of oil and gas markets. It will not end with higher oil and gas prices. Today, investment in fossil fuel

is vilified and financing has become sparse as big western banks withdraw. The International Energy Agency is calling for an end to all oil, gas and coal funding if the world is to reach net zero by 2050." (Sen 2021)

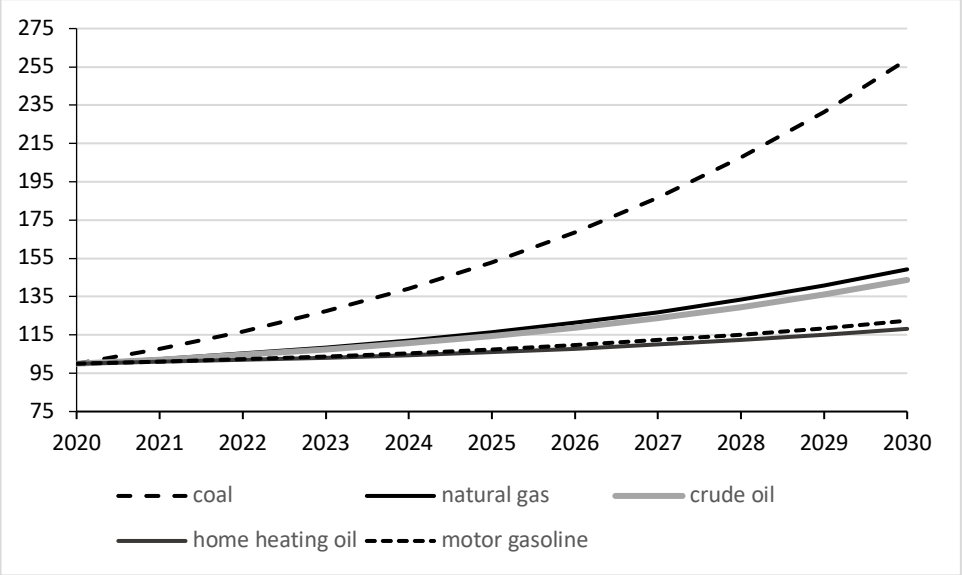
In addition, US shale producers are using the high prices and profits to increase returns to shareholders rather than increase drilling and investment. As a result, fossil-fuel supplies will continue to lag behind demand for the next few years (Schnabel 2022a) and hence, prices of oil and gas will remain elevated—'fossilflation' is here to remain for some time.

11.5 'Greenflation'

Climate policies, and especially such measures as carbon pricing, carbon taxation and standards that are directed at incentivizing or requiring reductions in carbon emissions, will be inflationary during the period of transition to a low or a net zero-carbon economy. The reason is that firms and households cannot immediately and completely substitute more expensive carbon-intensive energy and products with greener alternatives. The higher carbon prices will induce more investment and innovation in low-carbon technologies, but these investments and innovations take time to materialize and to be adopted. Moreover, average capital intensity of low carbon energy is roughly twice that of hydrocarbons—which means the capital cost of energy production will go up.

Accordingly, as the carbon price (or tax) is gradually ramped up over time, prices of carbon-intensive energy and carbon-intensive goods and services will also steadily rise in the short- and medium run. **Figure 59** illustrates the point for the prices of fuels in the US during 2020-2030: a carbon tax of \$25/mtCO_2 in 2020 is gradually raised to \$100/mtCO_2 in 2030, which is consistent with reaching net zero in 2050 and limiting global warming to 1.5°C. (Note that a scenario released by the central banks' *Network for Greening the Financial System* (NGFS 2021) suggests that cutting emissions to net zero by 2050 will require a \$160 per ton carbon price by 2030.) Not surprisingly, the price of coal will increase the most due to the rising carbon tax: by 10% per year during 2020-30. The ramped carbon tax is raising the prices of crude oil and natural gas by 4% per annum, and the prices of motor gasoline and home heating oil by 2% per year. Hence, there will be energy price inflation for as long as levels of carbon taxation or carbon prices are rising—which may well take two decades or more.

Figure 59
Projected increases in US fuel prices, 2020-2030
In line with net zero carbon emissions by 2050 (2020 = 100)



Source: Author's estimations based on CRS (2019), Table 2; and Kaufman *et al*. (2020).
Notes: It is assumed that to reach net zero by 2050, the US has to ramp up the carbon price from \$25/mtCO_2 in 2020 to \$100/mtCO_2 in 2030 (Kaufman *et al*. 2020; this pathway is consistent with limiting global warming to 1.5°C). The values of the 2020 prices for coal, natural gas, crude oil, home heating oil and motor gasoline are derived from CRS (2019). The estimated price increases for each fuel were calculated by multiplying a carbon tax rate by the CO_2 emissions intensities for each fuel. CO_2 emission intensities for each fuel were taken from CRS (2019). The numbers are: coal = 1.8 mtCO2/short ton of coal; crude oil = 0.43 mtCO2/barrel of oil; home heating oil = 0.008 mtCO2/gallon of oil; natural gas = 0.055 mtCO2/thousand cubic feet (mcf) of natural gas; and motor gasoline = 0.009 mtCO2/gallon of gasoline.

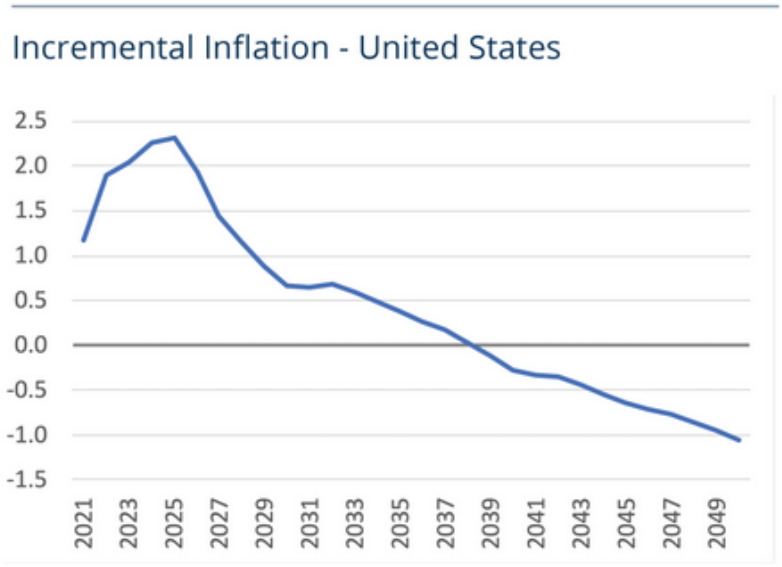
The combination of insufficient production capacity of renewable energy generation, subdued investment in fossil fuels, and rising carbon prices or taxes will mean that the transition to a net zero-carbon economy will be accompanied by 'greenflation' (Schnabel 2022a): upward pressure on inflation during the initial decade of the transition, until the lower levelized costs of renewable energy weigh on prices thereafter.

Higher prices for energy and carbon-intensive products will spread to other prices. This can lead to a broader increase in consumer prices, higher wage demands and rising inflation expectations. Estimates based on the model used by the *Network of Central Banks and Supervisors for Greening the Financial System* (NGFS), and reported by Mark Carney (2022), suggest that the annual inflation impacts of the transition to a net-zero-carbon are significant, pushing up US inflation by between 1 and 2 percentage points in the first eight years, before fading and becoming deflationary (after two decades) as the greater cost competitiveness of clean energy takes hold.

However, the NGFS simulation may underestimate the extent of 'greenflation', because, as Carney (2022) points out, inflation expectations are rather optimistically assumed to remain

well anchored as monetary policymakers draw on a seemingly infinite reservoir of credibility. Central banker Isabel Schnabel (2022a) similarly warns that the net zero transition, especially because of its scale, may lead to a de-anchoring of inflation expectations, in which case inflation rates will increase more and for a longer period of time than is shown in **Figure 60**. This is what central bankers call 'transition risk': the net zero transition poses significant upside inflation risks over the medium term.

Figure 60
Net zero transition is likely inflationary in the medium run,
but deflationary in the long run



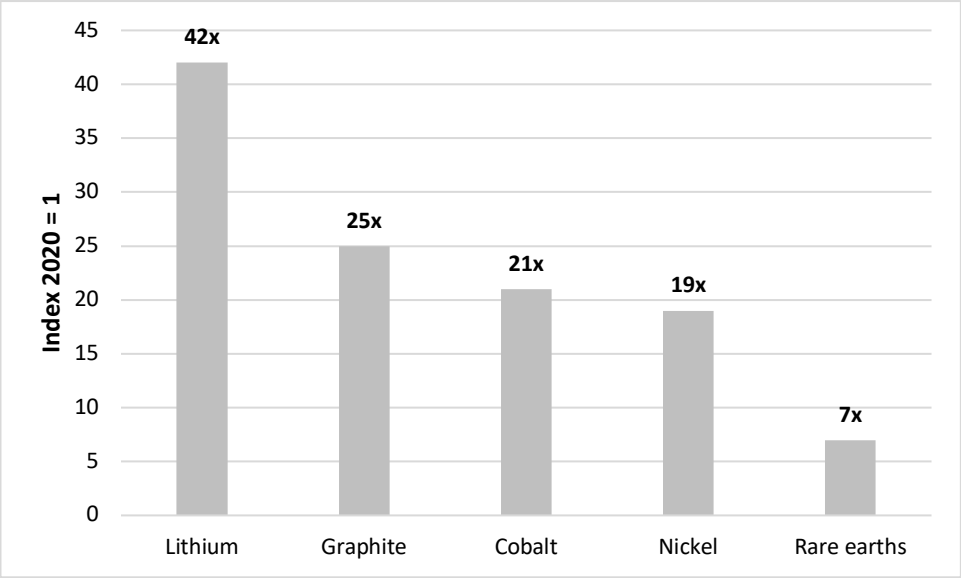
Source: Carney (2022); NGFS Scenario Explorer using Net Zero 2050 (with REMIND-MAgPIE 2.1-4.2 input. The transition to a net-zero economy is consistent with limiting temperature rises to 1.5°C.

There is a further source of 'greenflation': rising prices for critical materials and minerals needed to power clean energy technologies. An energy system based on renewable energy technologies needs significantly more minerals[31] than a system relying on fossil fuels (IMF 2021), notably: lithium, nickel, cobalt, manganese and graphite for batteries; so-called rare earth elements for wind turbines and engines of electric vehicles; copper, silicon and silver for solar PV; and copper and aluminum for electricity networks. Demand for critical minerals is expected to be six times higher in 2040 than in 2020 (IEA 2021b), but demands for individual minerals, led by lithium[32], rise even faster (**Figure 61**). The IEA predicts lithium demand will grow by 4,200 percent by 2040.

[31] According to IEA (2021b), "A typical electric car requires six times the mineral inputs of a conventional car, and an offshore wind plant requires thirteen times more mineral resources than a similarly sized gas-fired power plant."

[32] Lithium is a non-substitutable material in the rechargeable batteries that power electric vehicles and store sun and wind power on renewable grids; given the current state of renewable energy technologies, it is an essential ingredient for the energy transition.

Figure 61
Growth in mineral demand for clean energy technologies
(IEA Sustainable Development Scenario, 2040 relative to 2020)



Source: IEA (2021b).

Current investment plans in the mining and processing of these minerals are geared to a world of gradual (not radical) change; given long leads times for new investment projects, an accelerated energy transition could quickly see demand running ahead of supply, warns IEA (2021b). Shortages are expected already within the next five years. Drastically scaled-up recycling of copper, lithium, nickel and cobalt from spent batteries will help to reduce the global demand-supply imbalances for these minerals, but at a considerable (capital and operational) cost and with a long lead time.

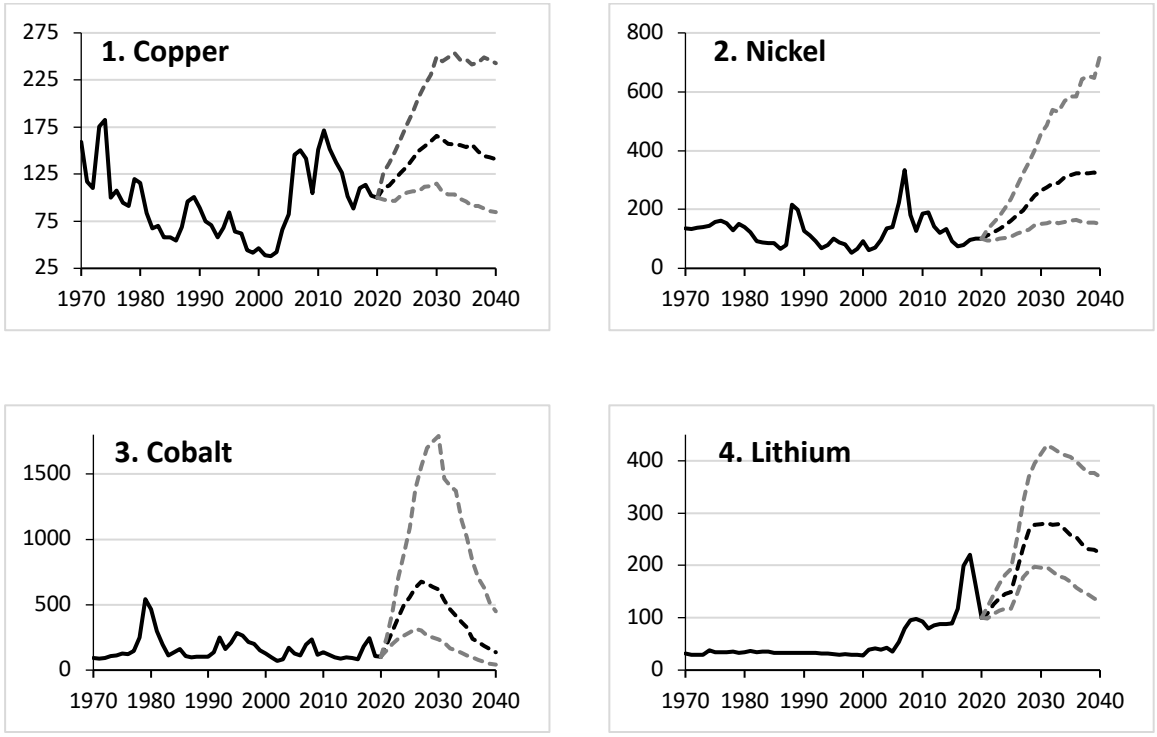
The metals and mining industry is a long lead-time, highly capital-intensive sector[33], and therefore, price surges and bottlenecks will be unavoidable following a concerted push to electrify everything and decarbonize everything. IMF (2021) argues that a multi-year price rally for these 'energy transition metals' is indeed likely, because the demand for these metals is ramping up rapidly (**Figure 61**) while supply is slow to react—and the IMF is concerned that price surges for critical metals will derail or delay the energy transition.

Based on historical data and estimated supply elasticities for selected metals, IMF economists have constructed conditional forecasts for the prices of copper, nickel, cobalt and lithium during the net-zero-carbon transition period 2020-2040 (see **Figure 62**). The price forecasts are adjusted for inflation using the US consumer price inflation index. The (mean) IMF predictions shown in **Figure 62** suggest that the real price of cobalt would rise by more than 570% from its 2020 level, the price of nickel would increase by more than 220% compared to 2020, and the price of lithium may rise by 180% relative to its level in 2020. Prices peak mostly around 2030, because the supply response takes 8-10 years. The IMF forecasts also show that the probability of even higher price increases is larger than that of lower price rises. Accordingly, battery

[33] Copper, nickel, and cobalt are extracted in mines, which take as long as nineteen years to construct. In contrast, lithium is often extracted from mineral springs and brine as salty water is pumped from the earth; as a result, the lead time for lithium production is shorter—up to seven years (IMF 2021, p. 35).

producers, fuel cell manufacturers, electric vehicle producers and others will need to factor in potential resource constraints, with higher and more volatile prices[34]—and the same is true for consumers.

Figure 62
Real Price Scenarios for the IEA's *Net Zero Emissions Scenario*
(real price index 2020 = 100)



Source: IMF (2021), Figure 1.SF.8.
Notes: The prices are forecast under the assumption that the IEA *Net Zero by 2050* emissions scenario is implemented. The IEA's *Net Zero by 2050* scenario assumes that policies and behavioral changes bring carbon emissions to net zero by 2050. Price forecasts are adjusted for inflation using the US consumer price inflation index. The forecasts are subject to high uncertainty, reflected in the large confidence boundaries (indicated by the grey dashed lines). Prices peak mostly around 2030 for two reasons: first, the steep rises in demand are frontloaded in the *Net Zero by 2050* emissions scenario. Renewable energy production uses metals up front; for example, to build wind turbines or batteries. Second, it is assumed that the price boom induces technological progress and a positive supply response, reducing market tightness after 2030.

[34] Leader *et al*. (2019) find that a 100% price increase in lithium prices would lead to an increase in battery cost by approximately 5.1%-8%; similarly, for a 100% increase in cobalt prices, battery cost will rise by between 11.7% and 20%; and for a 100% increase in nickel prices, the projected battery cost increase is in the range of 2.4%-3%.

The sharp increases in metal demand and in metal prices will certainly lead to demand-pull innovation (as argued by Schmookler (1966))—which will help to ease the shortages of critical metals. But technological progress takes time and is hard to predict. Many of the sustainable energy technologies needed to achieve net zero carbon by 2050 do not yet exist on a commercial basis, and outdated laws and regulations stymie innovation. A disorderly transition from fossil fuels to renewables implies periodic supply shortages and even more volatile energy prices. To reduce the uncertainties for firms, IMF (2021) argues in favor of high environmental standards, which will help to (re-)direct investment to sufficiently expand metal supply.

As the US economy has begun to transition—slowly, incompletely—away from fossil fuels, it will be facing a new, more inflationary regime, caused not only by the damages and disruptions caused by ongoing climate change, but also by the policies and responses to it. 'Greenflation' is real, and it is not transitory (Schnabel 2022a).

11.6 Geo-economics and de-globalization

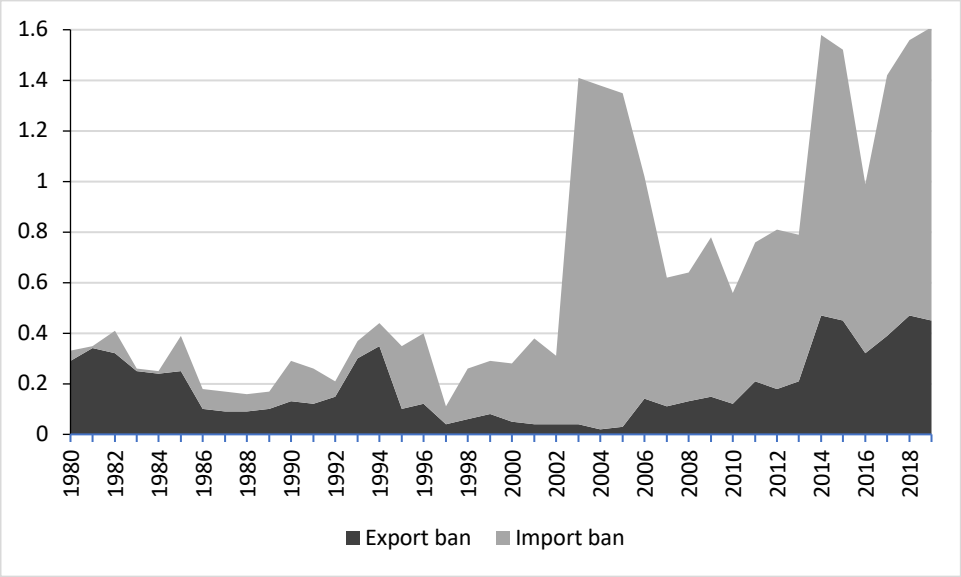
As global demand for minerals critical to the climate transition is bound to grow exponentially, corporations and governments are scrambling the globe to get (privileged) access to these mineral resources, the production and processing of which are geographically concentrated, with the top three producers often accounting for more than 75% of supplies (IEA 2021b). For example, the Democratic Republic of the Congo accounts for about 70 percent of global cobalt output and 50 percent of reserves, while Australia accounts for 49% of lithium output and Chile owns 44% of global lithium reserves (IMF 2021). Other countries that stand out in reserves include Australia (for copper, cobalt and nickel); Chile (copper); and, to lesser extent, Peru (copper), Cuba (cobalt), Indonesia (nickel) and Argentina (Lithium).

As a result, minerals are now the terrain of geo-economics: the intermingling of national security and economic policy (Roberts, Choer Moraes and Ferguson 2019). As Thea Riofrancos (2022) writes, "seen through a geo-economic lens, the supply chains of green technologies such as solar panels and lithium batteries are battlefields of zero-sum interstate competition." As geopolitical tensions over resources are growing, the US and the EU have fallen behind China, the global leader in the mass production of low-carbon energy technologies (Helveston and Nahm 2019). Eager to catch up, the US and the EU are now actively promoting the *onshoring* of critical minerals production. Promoting onshoring is part of a return to zero-sum economic nationalism, which also involves tactics such as trade wars, economic sanctions, export bans, and threats to 'decouple' from Chinese supply chains.

In effect, fragmenting supply chains, de-globalization and a world increasingly divided along geopolitical fault lines looks increasingly likely, when one considers the last four years that have brought an escalating series of disruptions to global trade and global supply chains. Tariffs multiplied during the US-China trade war, initiated by the 'America First' Trump administration. The COVID-19 crisis brought lockdowns, while the Ukraine war led to the imposition of sanctions. Higher commodity prices, droughts and (food) shortages are leading countries facing food and energy shortages to introduce export bans. **Figure 63** illustrates the trend: in the 1990s, only 0.3% of international trade fell under export and import bans; the proportion of international trade under bans increased to 1.45% during 2014-2019. The embargoes triggered by Russia's invasion of Ukraine and moves by countries to protect

domestic consumers by barring sales (of food) abroad—like India's ban on wheat exports in April 2022—have pushed the figure higher still.

Figure 63
Proportion of international trade under export and import bans
(as percentage of global trade), 1980-2019



Source: Global Sanctions Data Base (Felbermayr *et a*l. 2020).

De-globalization, which arguably started with Brexit and Trump's tariff protectionism, constitutes a reversal of decades of neoliberal globalization, during which the US and the EU routinely offshored manufacturing and extraction to the Global South and replaced those activities with services, real estate, and finance at home. The two blocs are now luring extractive firms to come back 'home'—a pivot that is justified because it is claimed to generate jobs, revitalize deindustrialized areas hit hard by free trade agreements, and subject green technologies to rigorous environmental and labor standards from mine to factory (Riofrancos 2022).[35]

Specifically, US and EU agencies are providing lucrative incentives for lithium companies, including fast-tracking permitting processes, subsidies, direct financing, and "de-risking" (public policies that shield investors from financial or political risk; see Gabor 2021). According to Riofrancos (2022),

> "This represents an emerging critical-minerals consensus: the belief that onshoring lithium, paired with similar incentives for battery and electric vehicle firms, will enable end-to-end dominance of the supply chain. A powerful echo chamber has helped consolidate this consensus, which is shared by think tanks, industry groups such as the U.S. National Mining Association, U.S. Zero Emission Transportation Association, and the European Automobile Manufacturers' Association, and the highest echelons of

[35] Reality is different from these claims, however. As Riofrancos (2022) explains, the renewed economic nationalism papers over class conflict, suggesting that there is a supposed national interest above the opposing interests of workers and capital owners. "Yet lithium onshoring, for instance, takes the form of taxpayer-funded handouts to multinational corporations."

policymaking in the United States and EU—and which has been amplified in Western media outlets."

The onshoring of critical minerals production is part of a wider global trend of renewed economic nationalism and 'de-globalization'. "Tensions over trade, technology standards, and security have been growing for many years, undermining growth—and trust in the current global economic system," write IMF directors Kristalina Georgieva, Gita Gopinath and Ceyla Pazarbasioglu (2022). Higher import tariffs, (temporary) import and export bans, and increased geopolitical tensions will accelerate the process of de-globalization and force a re-engineering of global supply chains—to improve their resilience, to reduce unnecessary complexities (*e.g.*, by working with fewer suppliers) and to regain lost cost control (for instance, by onshoring and/or 'near-shoring', *i.e.*, switching to regional suppliers to reduce risk and control cost).[36] IMF research by Cerdeiro *et al*. (2021) estimates that such an undoing of cross-border trade in high-tech goods and services between the US and China will, in the medium run, lead to losses of US GDP, lowering US productivity (because of sectoral misallocation) and raising the price of investment goods. Even if the impact on US inflation is not explicitly analyzed, it is clear that the re-engineering of global production networks as part of a larger process of international fragmentation and 'de-globalization' will lead to higher prices (not just of investment goods).

It is true that the price impacts of de-globalization will be one-off, but because the re-engineering of supply chains and the onshoring happen in real time in a disorderly, non-synchronized manner, the frictions, shortages and higher (investment) costs will likely create inflationary pressures for the US economy over a prolonged period of time.

11.7 Challenges for monetary policy

The inflationary pressures originating from the long-run trends of fragmenting supply chains, rising transportation costs, rising commodity prices, mounting climate damages and risks, 'fossilflation', 'greenflation' and disorderly de-globalization are posing new—and daunting—challenges for monetary policy makers. The key issue facing macroeconomic policy makers is: how to deal with rising prices while also accelerating a green structural economic transition? When addressing this issue, central bankers are stuck between a rock and a hard place.

On the one hand, central bankers will want to maintain confidence in the inflation target (of 2%) at as low a social cost (in the form of lower demand, output and employment) as is possible. High and rising inflation may lead to the de-anchoring of inflation expectations (the central bankers' greatest nightmare) and a corresponding loss of credibility of the monetary authority. The greater the loss of central bank credibility (in keeping inflation close to the inflation target), the greater the real economic costs will be of bringing inflation back down; the social and economic costs of Paul Volcker's disinflation policy still trigger a post-traumatic stress disorder amongst many a macroeconomist (Summers 2022). This shorter-term concern will motivate central bankers to raise interest rates in an attempt to fulfil their mandates as far as price stability is concerned.

[36]To illustrate: the global supply chain of semiconductors is highly concentrated, with 75% of semiconductor manufacturing located in East Asia; a high geographic concentration exposes the industry to single points of failures that could be triggered by extreme weather events, lockdowns, cyberattacks, or geopolitical frictions.

The higher interest rates not only hurt the economy, by depressing demand and employment, but may also derail the transition to a net-zero-carbon economy. Renewable energy sources are relatively capital-intensive and risky, and face high funding costs. As a result, green investments are more sensitive to interest rate rises, and monetary tightening will slow down or even stop the transition process to a net-zero economy. Higher interest rates will also mean high debt-servicing costs for government—hindering urgently needed public investment in decarbonized energy generation, transport systems and housing, as well as investing in 'green-skilling' workers. Strict (and single-minded) inflation targeting will thus likely delay the net-zero transition—and this will mean significantly higher (and unpredictable) physical and monetary damages of (faster) global warming in future. These likely large damages, which will weigh heavily on ourselves and future generations, have to be weighed against the net benefits (if any) of strict inflation control.

On the other hand, however, central bankers acknowledge that a delayed net-zero transition and associated (unmitigated) climate damages will lead to higher food and commodity prices in future (**Section 11.2**; Schnabel 2022a). "… a disorderly transition, where more severe policies are introduced later in the horizon to compensate, could result in both lower growth and higher inflation from rising energy and materials costs in the economy," warns Bank of England chief Andrew Bailey (John and Jessop 2021). And ECB President Christine Lagarde cautions that "disorderly net-zero transition could translate into more volatile and higher average inflation" (John and Jessop 2021).

Central bankers also rightly fear that unmitigated warming will considerably increase the risk of financial and monetary instability in the longer run (Bolton *et al.* 2020). "Climate change poses a major risk to the stability of the US financial system," writes the US Commodity Futures Trading Commission (CFTC 2020, p. i). Concerned about the financial risks of global warming, eight central banks established the *Network for Greening the Financial System* (NGFS) in 2017; the number of members in the NGFS has increased to 48 (including the Federal Reserve). This international group of central banks and financial regulators works to integrate the risks of climate change into their respective supervisory and regulatory regimes, recognizing that "Climate-related risks are a source of financial risk and it therefore falls squarely within the mandates of central banks and supervisors to ensure the financial system is resilient to these risks" (NGFS 2019).

The above suggests that central bankers have to trade off safeguarding future financial stability (by keeping interest rates low today, supporting the climate transition but allowing for higher inflation in the short to medium run) versus bringing down inflation in the short to medium run (raising interest rates, but at the cost of slowing the transition to a net-zero economy and allowing for higher inflation in the longer run). The trade-off is a false one, however. The reason is that slowing the climate transition is not an option: another decade of unmitigated global warming will lock the climate system into an unmanageable self-reinforcing process of climate change which risks putting us—humanity as a whole—on a one-way journey to Hothouse Earth (Schröder and Storm 2020). On that road, inflation rates will rise and become completely uncontrollable.

It is true that policy actions to decarbonize the economy will increase the price of carbon drastically, stranding certain fossil fuel assets and decreasing the value of other assets exposed to the price of carbon. Tooze (2019) estimates that as much as one-third of all equity and fixed

income assets in the world are tied to carbon-sensitive industries. But nonetheless, the problem of stranded assets is orders of magnitude smaller than the damage done to assets, lives and livelihoods of an irreversible shift to Hothouse Earth. In other words, in the face of the growing risk of catastrophic climate change, macroeconomic policy needs to be guided by only one principle: it is better to be safe than sorry. Hence, monetary policy should be made to support the transition to a net zero-carbon economy—and inflation control must be unconditionally subordinated to this overriding aim.

What is more, the reality is that if governments had invested in green energy infrastructure a decade ago, consumer prices would arguably be a lot less exposed to volatile increases in oil and gas prices (Kedward 2022). As Jo Michell (2021) argues:

> "The correct reaction to the current situation is to look to the root cause of shortages and bottlenecks [causing current inflation]: decades of underinvestment in infrastructure, R&D and manufacturing, alongside reliance on fragile global production and distribution chains. Rather than cuts to government spending and rate hikes, the appropriate policy response is to raise investment aimed at the transition to net zero."

Speeding up the climate transition is essential for keeping global warming to below 1.5°C, preventing catastrophic climate damages and welfare losses, as well as for structurally bringing down inflationary pressures in future by delinking economic activity from fossil-fuel energy sources with large price volatility. As Michell (2021) points out, green fiscal policy and green industrial policies will have to do the heavy lifting—but these policies must be supported by (and not undermined by) a sufficiently accommodative interest rate policy. A supportive monetary policy will also include tightening risk and accountability regulations for banks and businesses so as to more rapidly phase out funding for fossil-fuel activities; dual interest rates (by offering a preferential discount rate for green lending; Kedward 2022); tighter regulation to eliminate commodity speculation; and some version of Green QE to help the decarbonization of the economy.

Central bankers have to come down, or be brought down, from their Olympus and act in alignment with the imperative of the net-zero transition. This may well mean that inflation rates should be allowed to be higher (for some time) than the target of 2% and that alternative measures to control inflation and manage the societal and economic impacts of inflation (discussed in **Section 10**) have to adopted. A reimagining of monetary policy making in the face of global warming is long overdue.

Macroeconomists can contribute to this reimagination of macroeconomic policy—but to do so, they will have to fundamentally reconsider their thinking in order to make macroeconomics relevant for the real world (again) and this requires getting rid of their E-DSGE models as soon as possible (Storm 2021). The stakes are very high. Macroeconomists cannot afford to be on the wrong side of history again.

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