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Why Did (Almost) Nobody See It Coming and What Does That Mean for What's Next?

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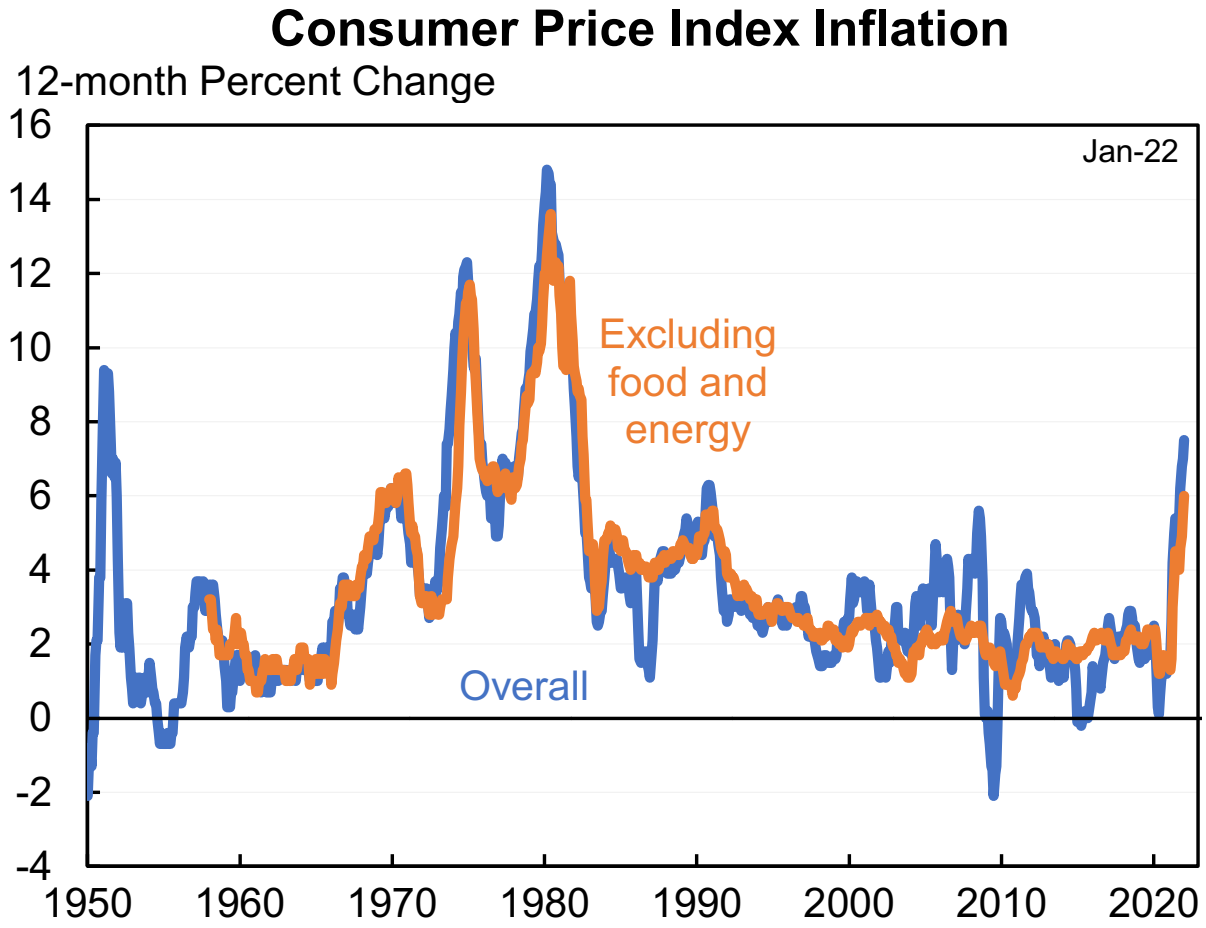
Harvard University

Macroeconomics Policy Seminar

February 8, 2022

(Slides lightly revised on February 10, 2022)

Inflation is running at the fastest pace in decades



Source: Bureau of Labor Statistics; Macrobond.

Why did (almost) nobody see it coming?

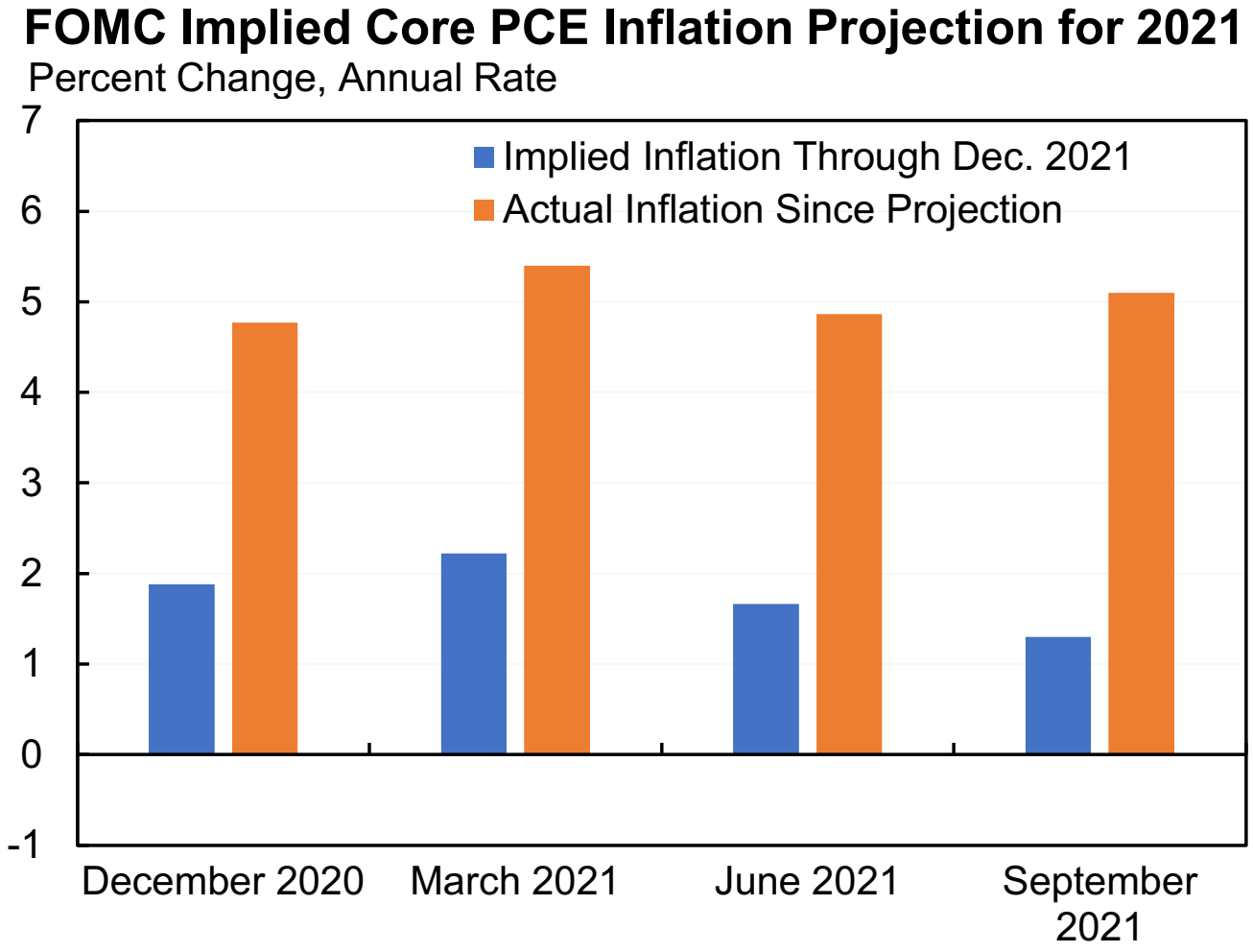
Source: The Royal Household.

Forecasts for 2021 (Q4/Q4) inflation

	Measure	Q1	Q2	Q3	Actual
SPF	Core PCE	1.8%	2.3%	3.7%	**4.6%**
FOMC	Core PCE	2.2%	3.0%	3.7%	**4.6%**
CBO	Core PCE	1.5%		2.4%	**4.6%**
FRBNY DSGE	Core PCE	1.4%	2.2%	3.8%	**4.6%**
OECD	Core CPI		3.0%		**5.0%**
IMF	CPI*		2.3%		**7.0%**
Market-based	CPI	2.7%	2.9%		**6.7%**

Note: IMF forecast is Dec/Dec.
Source: Organizations listed; author's calculations.

Forecasters kept expecting inflation to slow the rest of the year, but it never did



Note: Actual inflation since projection through December 2021. Assumes that actual values were known through month prior to forecast.
Source: Bureau of Economic Analysis via Macrobond and via Federal Reserve Bank of St. Louis, ALFRED; Board of Governors of the Federal Reserve System; author's calculations.

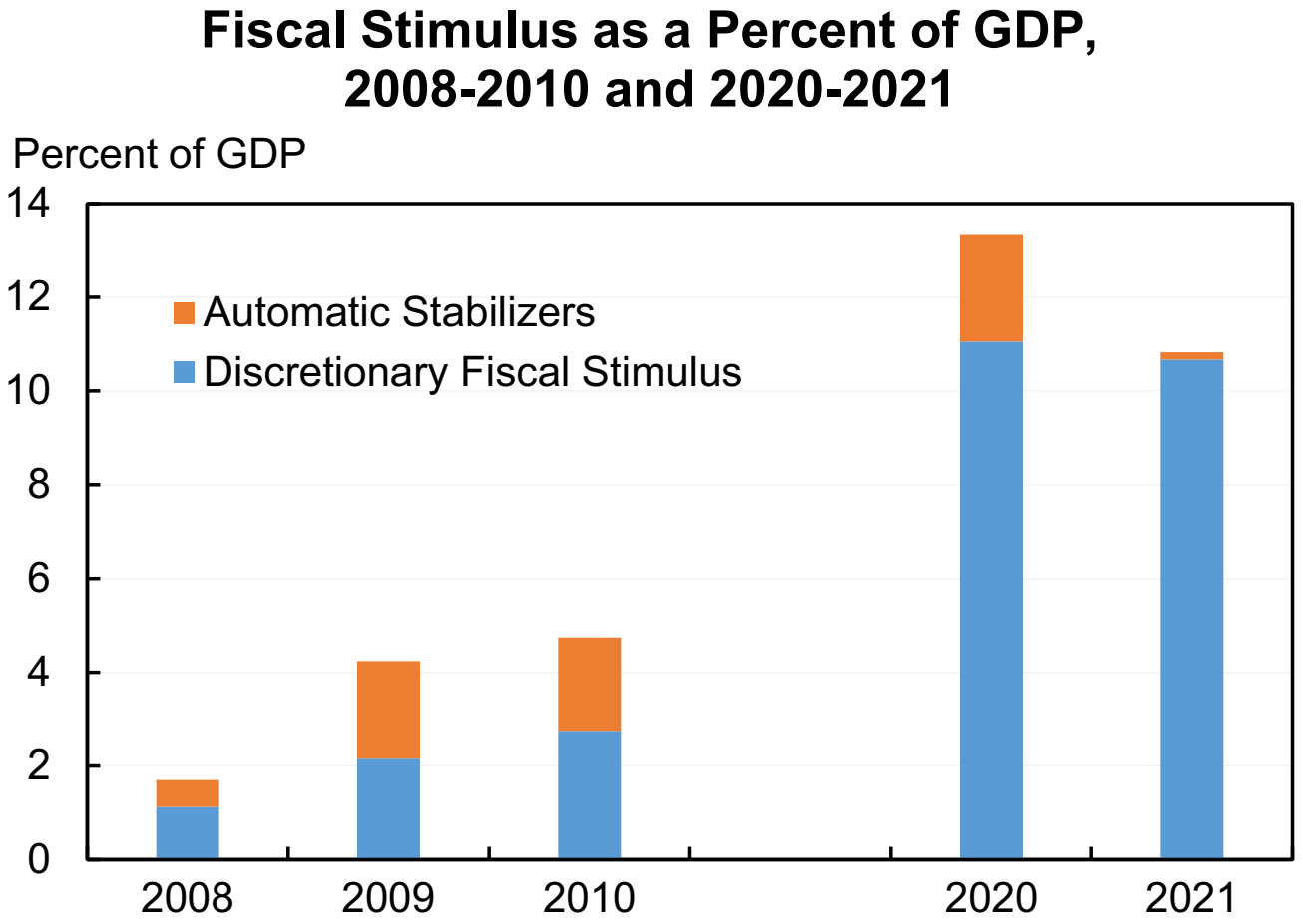
A partisan echo chamber does not explain the dismissal of inflation

"[T]he ARP is poorly timed, ridiculously scaled, and horrifically designed and targeted…

Perhaps [overheating and inflation] would happen, but I doubt it. A lesson from the great inflation of the 1970s is that you have to run the economy very hot for a long time to generate significant inflation."
--Doug Holtz-Eakin

Source: American Action Forum, Inflation and the Stimulus Debate.

Largest U.S. fiscal response to an economic crisis ever



Note: Calendar year.
Source: Calculations based on Council of Economic Advisers (2014); Congressional Budget Office; Office of Management and Budget; Bureau of Economic Analysis.

Forecasters barely updated their forecasts for the American Rescue Plan

IHS Markit®

Forecast issued on February 8, 2021

Forecast overview

More fiscal stimulus, upward revisions in GDP growth, earlier Fed "lift-off"

- We've revised up our forecast for year-over-year real GDP growth in 2021 from 4.0% to 5.7%.[1]

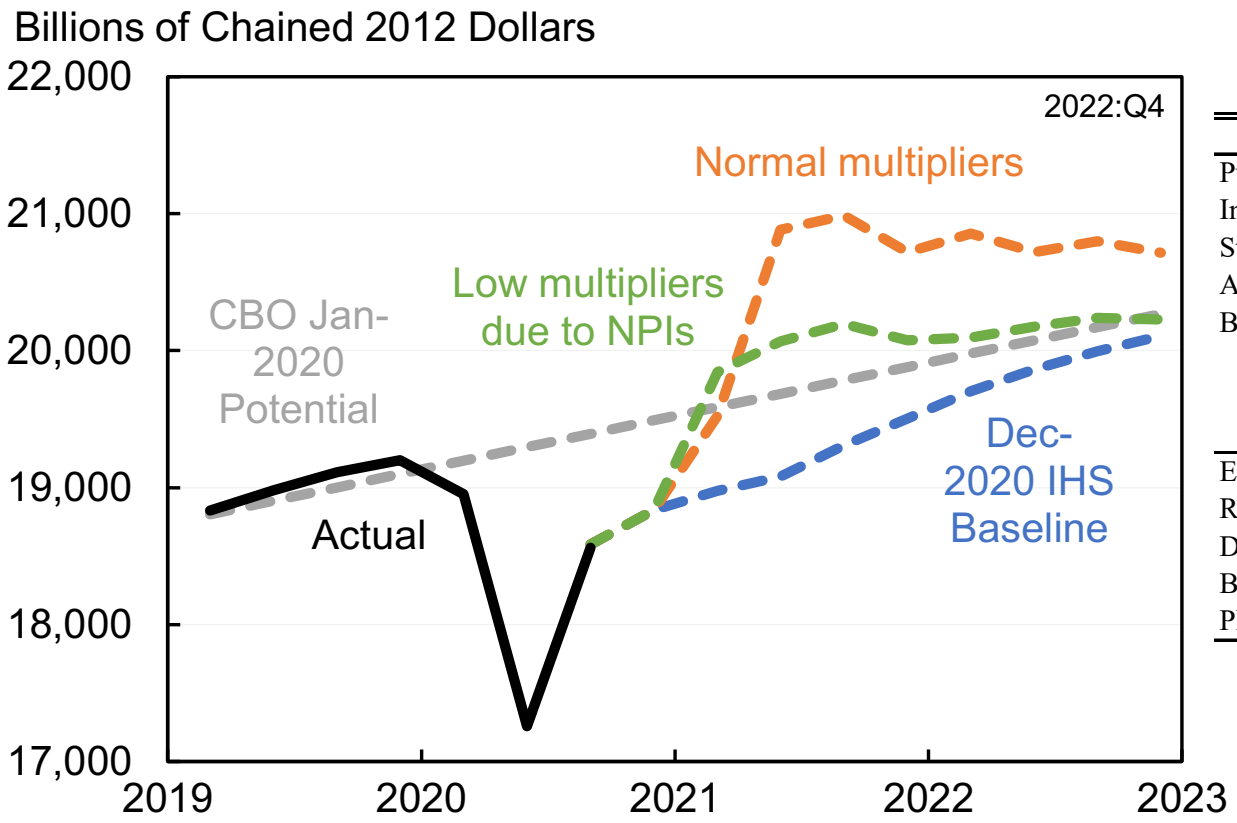
What, no inflation?

- Despite additional fiscal stimulus, core PCE inflation remains below 2% through mid-2024.
- Reasons: our "Phillips Curve" is linear and flat even at low unemployment; higher yields raise the dollar, weakening import prices; inflation expectations remain anchored at 2%.

Source: IHS Markit (2021): "Executive Summary: US Economic Outlook"

Standard multiplier models predicted a *huge* increase in output

Estimated Effect of December and March Fiscal Stimulus on Real GDP



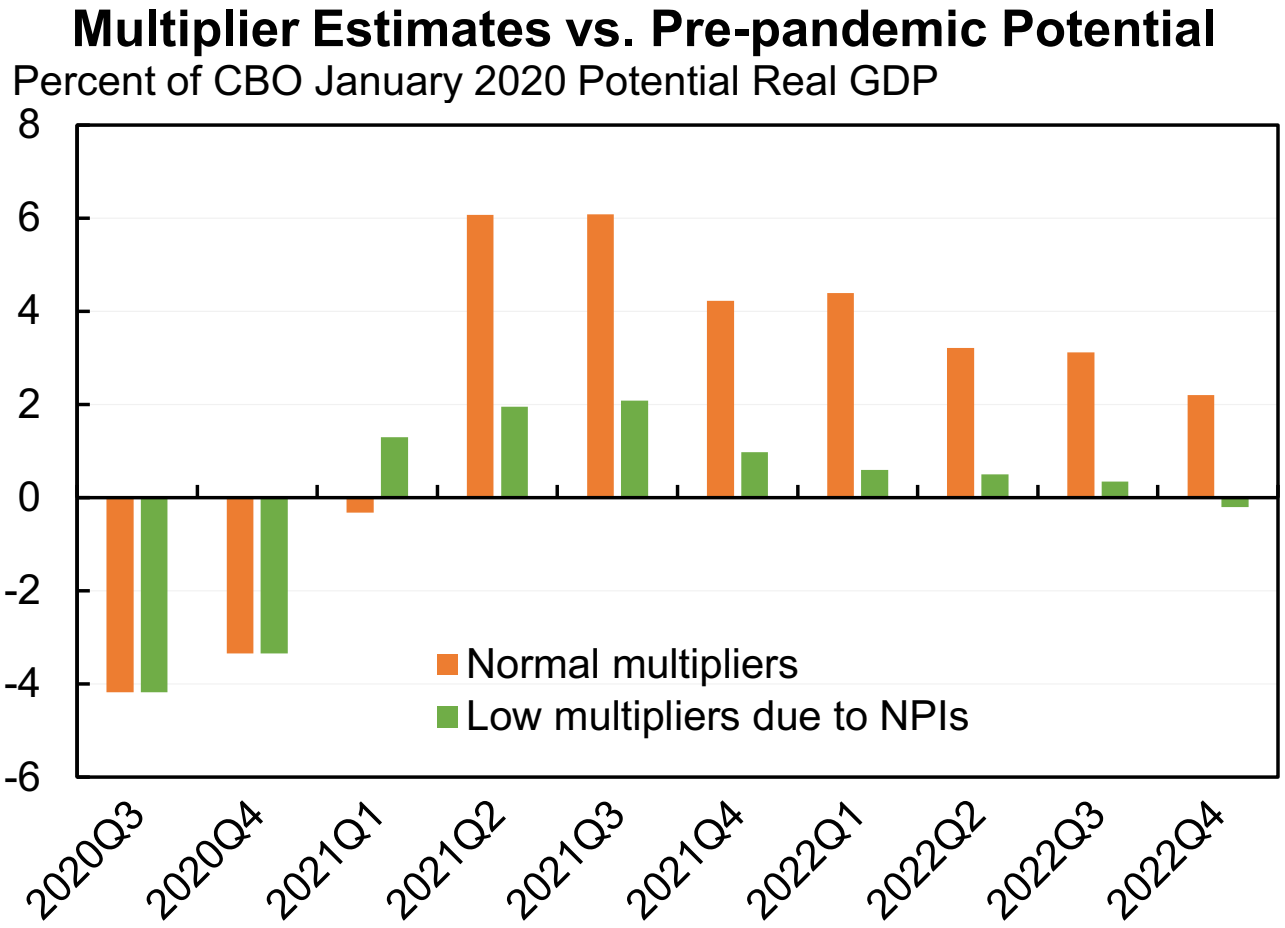
Cumulative 4 Quarter Multiplier

	Normal
Public Investment Outlays	1.44
Individual Tax Cuts	0.66
State Fiscal Relief	0.98
Aid to Directly Impacted Individuals	1.44
Business Tax Incentives	0.08

	Low due to NPIs
Enhanced Unemployment	0.66
Recovery Rebates	0.44
Direct Assistance to State and Local Govt	0.59
Business Tax Provisions	0.07
PPP	0.27

Note: Normal multipliers based on CEA (2009, 2014); low multipliers based on CBO (2020).
Source: Congressional Budget Office; IHS Markit; Council of Economic Advisers; Bureau of Economic Analysis, Macrobond; author's calculations.

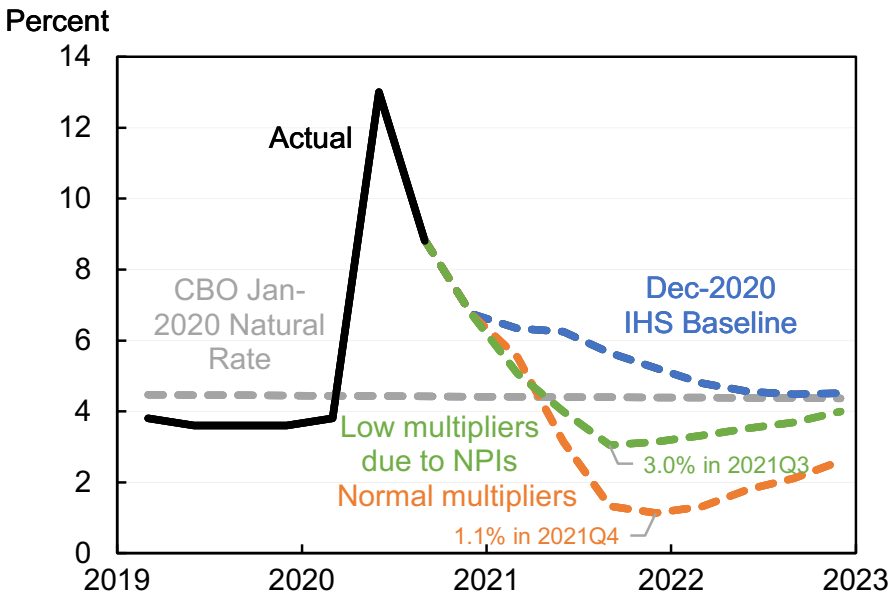
Predicting output would be well above pre-pandemic projections of potential



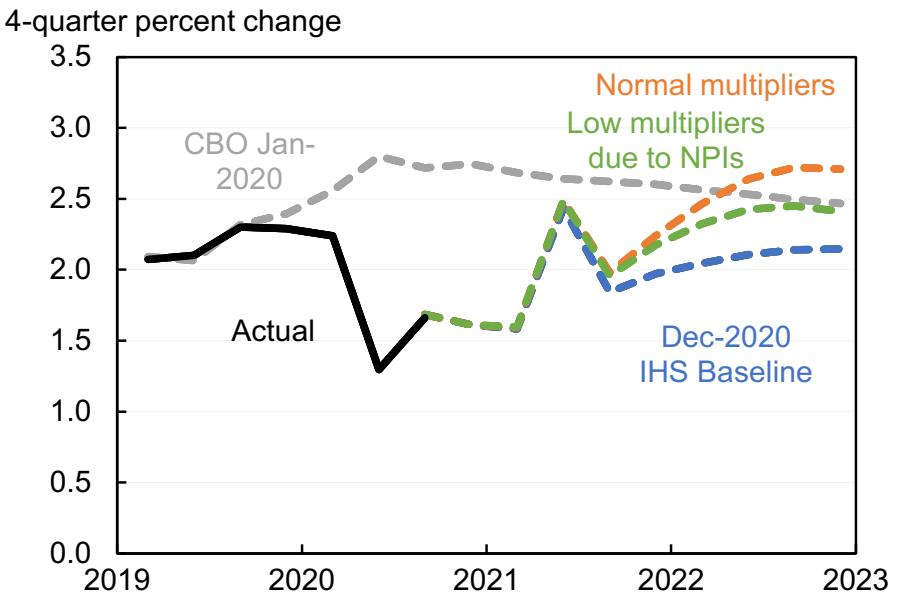
Note: Normal multipliers based on CEA (2009, 2014); low multipliers based on CBO (2020).
Source: Congressional Budget Office; IHS Markit; Council of Economic Advisers; author's calculations.

This is the associated path of the predicted unemployment rate and inflation rate

Estimated Effect of December and March Fiscal Stimulus on the Unemployment Rate



Estimated Effect of December and March Fiscal Stimulus on Core CPI Inflation



Phillips curve slope = -0.17 from Ball, et. al (2021)

Note: Normal multipliers based on CEA (2009, 2014); low multipliers based on CBO (2020).
Source: Congressional Budget Office; IHS Markit; Council of Economic Advisers; Ball, et al. (2021) author's calculations.

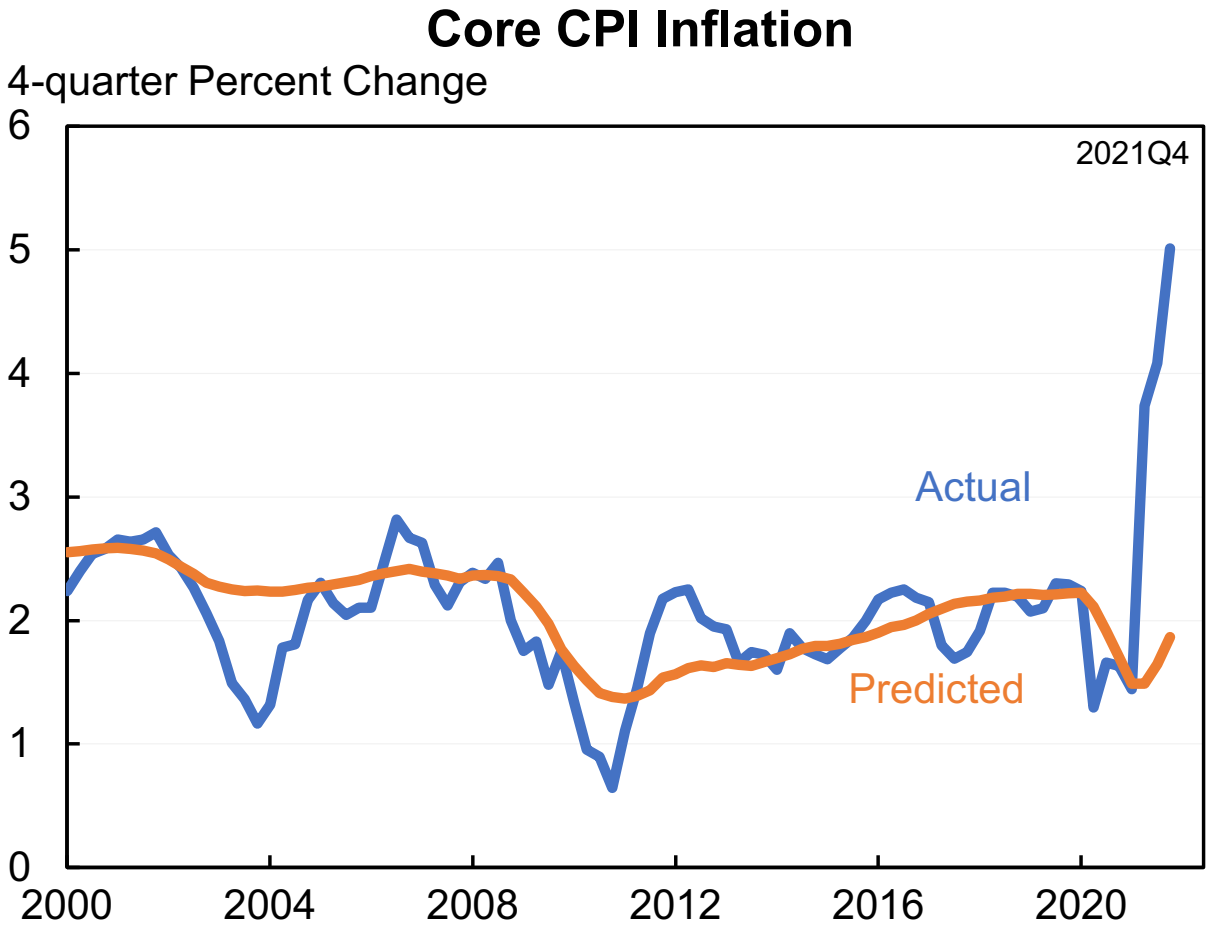
Aside: Forecasters actually assumed very high productivity instead of unemployment < 3.5%

	2021-Q4 IHS Markit June 2021 forecast relative to December 2019 forecast	Actual 2021-Q4 relative to IHS Markit December 2019 forecast
GDP	+2.1%	-0.9%
Employment (NFB)	-3.2%	-3.2%
Total Hours (NFB)	-2.1%	-2.6%
Productivity (NFB)	+5.4%	+2.4%
CPI	+0.9%	+4.2%

Note: Most forecasts had this property. The OECD, IMF and FOMC median (among others) projected 2021-Q4 GDP would be higher than pre-COVID projections but 2021-Q4 employment would be lower than pre-COVID projections.

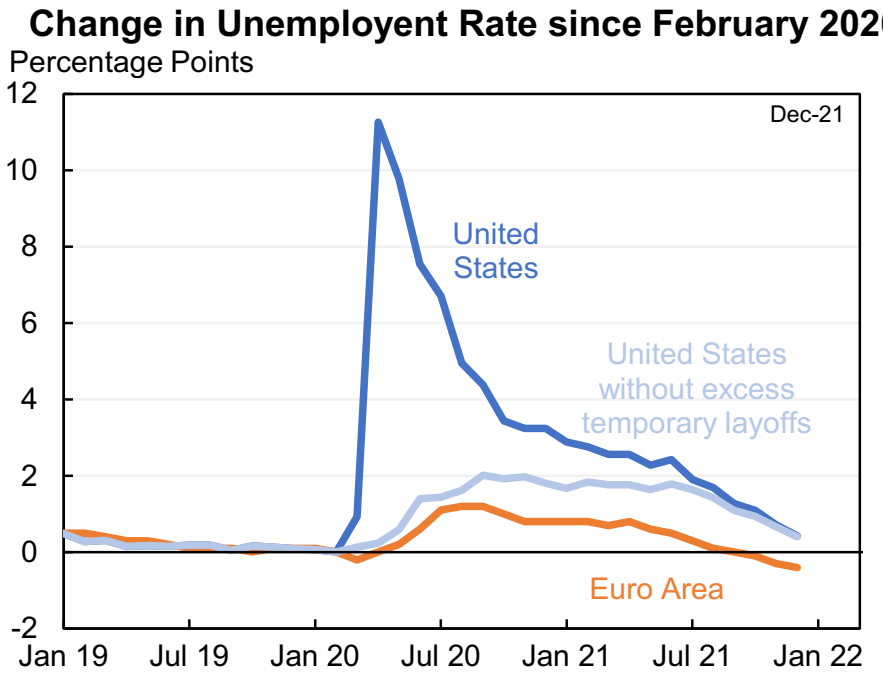
Source: Bureau of Labor Statistics; Bureau of Economic Analysis; Macrobond; IHS Markit; author's calculations

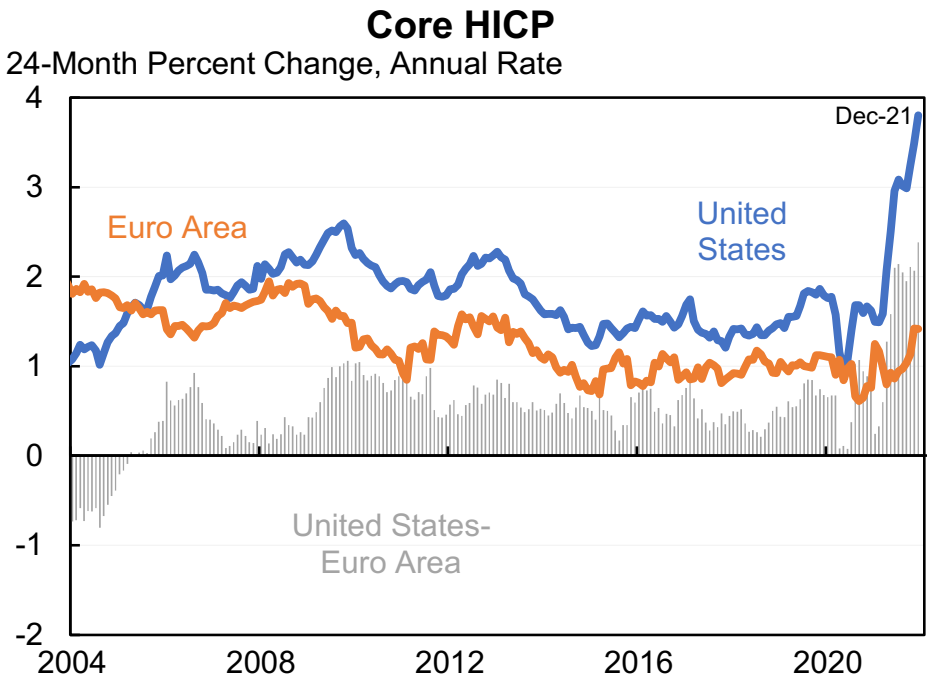
Using the actual path of the unemployment rate you would have predicted even less inflation



Note: Predicted based on Phillips curve model from Ball, et. al; (2021).
Source: Bureau of Labor Statistics; Congressional Budget Office; Federal Reserve Bank of Philadelphia, Survey of Professional Forecasters; Macrobond; author's calculations.

As an aside, Europe had lower unemployment rates but also lower inflation





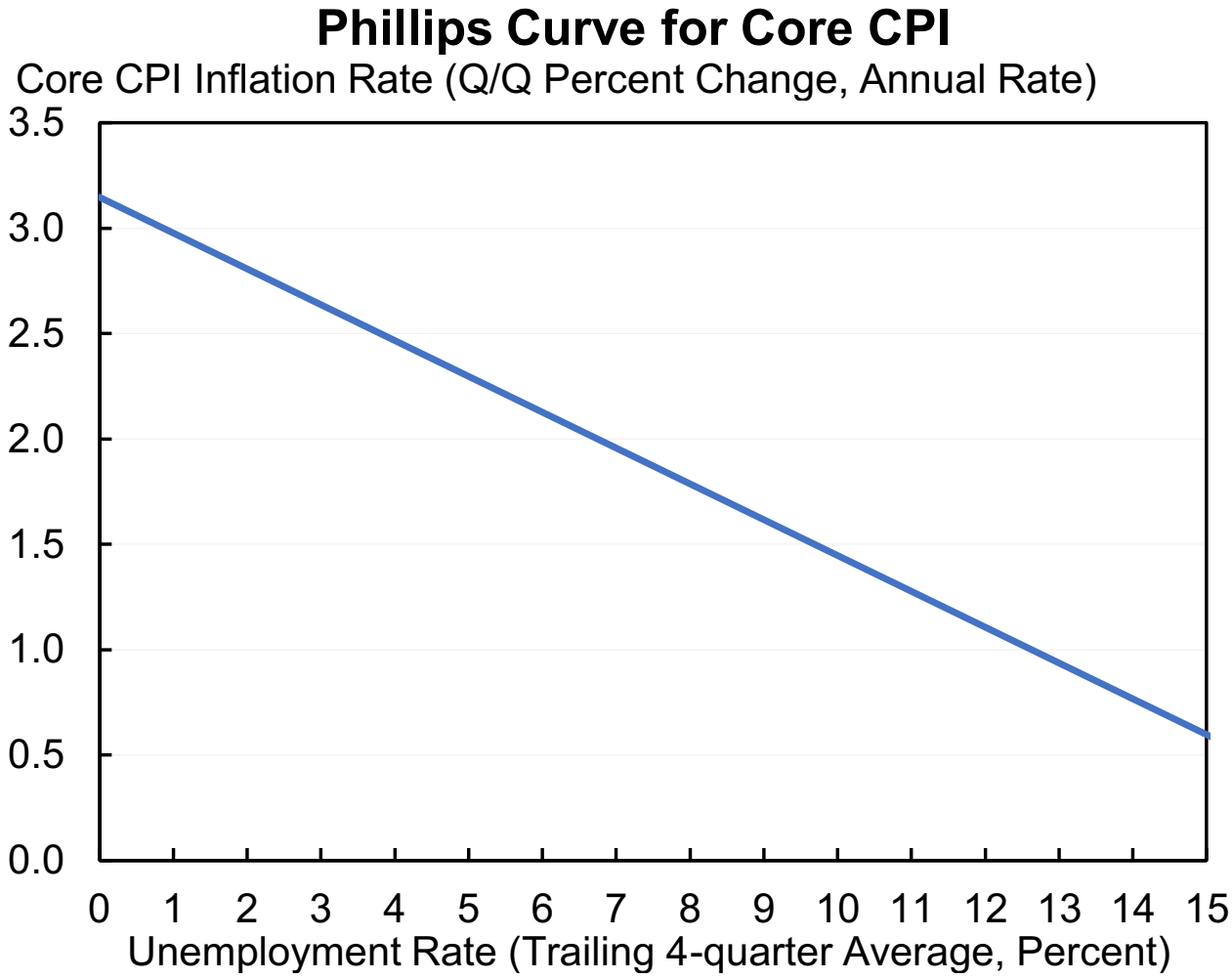
Note: HICP excluding food and energy for United States. HICP excluding energy, food, alcohol & tobacco for Euro Area.
Source: Eurostat; Bureau of Labor Statistics; Macrobond; author's calculations.

The root of the issue is that you cannot get a lot of inflation out of the standard Philips curve

$$\pi_t = E_t\pi_{t+1} - \theta(u_t - u_t^*) + \epsilon_t$$

If u^* = 3.5% and θ = 0.17 then even an unemployment rate of 1% only gets you an extra 0.4 percentage point of inflation—all else equal.

The linear & flat Phillips curve cannot generate much inflation even from low unemployment



Note: Based on parameters from Ball, et. al; (2021) with long-term inflation expectations of 2.5 percent and natural rate of unemployment of 4.5 percent.
Source: Calculations based on Ball, et. al; (2021).

Possible ways to get more inflation

1. Developments We Didn't (or Couldn't) Expect

ϵ_t : Supply shock developments we didn't or couldn't expect.

2. Tweaks to the Phillips Curve

High θ

u_t^* temporarily higher

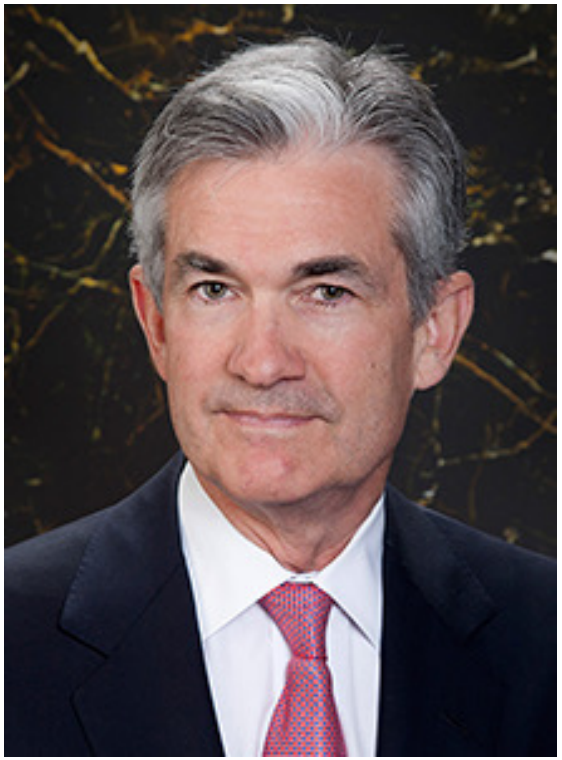
Nonlinear Phillips curve or Δu_t matters (i.e., "speed limit")

Alternative measures of show less slack

3. An Alternative Model

Can think of it as what determines $E_t \pi_{t+1}$

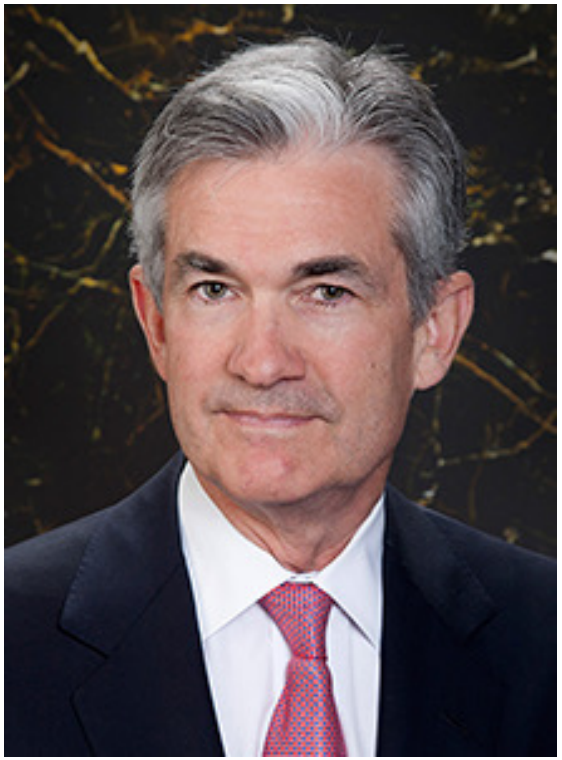
1. Developments we didn't (or couldn't) expect: A. Delta slowing the reopening of the economy



"We know that we were on a path to a different place, as I mentioned, **when Delta arrived**. And Delta stopped, it stopped job creation. It stopped that transition away from a goods-focused economy where there's excess demand for goods because there—services are not available. People are not traveling. That transition itself could help bring inflation down."
--Jerome Powell
November 3, 2021

Source: Board of Governors of the Federal Reserve System.

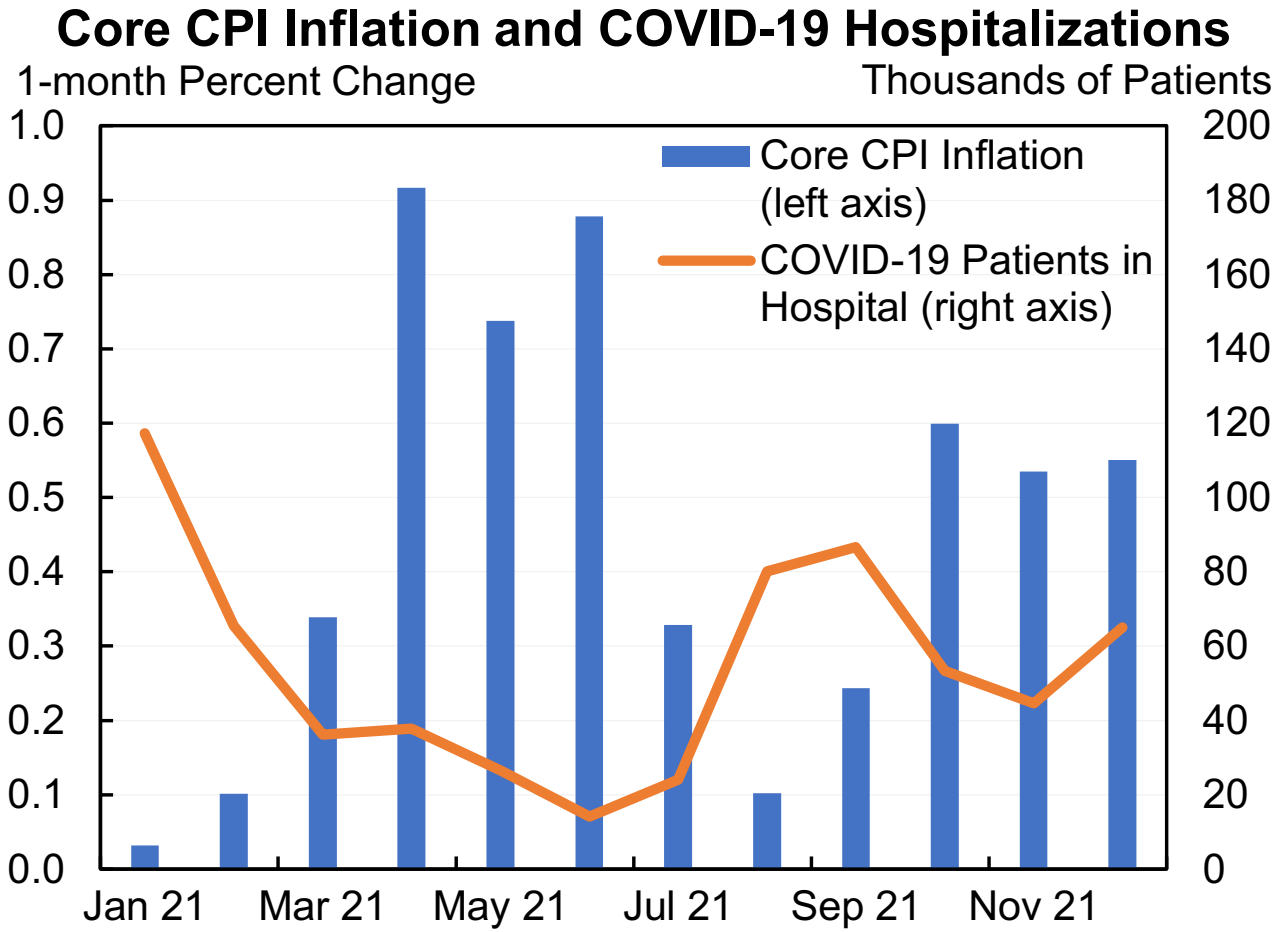
1. Developments we didn't (or couldn't) expect: A. But also vaccines speeding the reopening??



"So if you look, again, if you look at the, the most recent inflation report, what you see is that it came in significantly higher than expected. But essentially all of the overshoot can be tied to a handful of categories… And each of those has a story attached to it that is—that **is really about the reopening of the economy**."
--Jerome Powell
July 28, 2021

Source: Board of Governors of the Federal Reserve System.

If anything, seems to be negative relationship between virus and inflation



Source: Bureau of Labor Statistics; Our World in Data; Macrobond; author's calculations.

My own impression: Delta more likely slowed inflation than increased it

Delta raised goods inflation and lowered services inflation.

The net is ambiguous.

But more likely it lowered inflation:

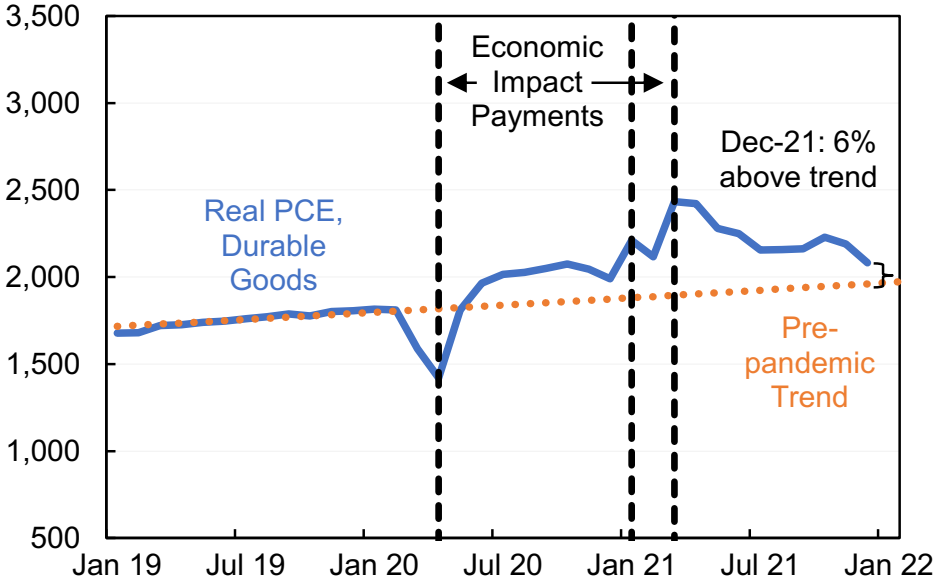
- That's what happened in the initial 2020 wave
- Was the *ex-ante* analysis as Delta emerged
- Services prices 5X as important as goods prices
- Gasoline prices very sensitive to virus
- Omicron event study on TIPS market predicted this

Regardless, likely not a very large positive or negative for inflation.

1. Developments we didn't (or couldn't) expect: B. Shift of consumption from services to goods

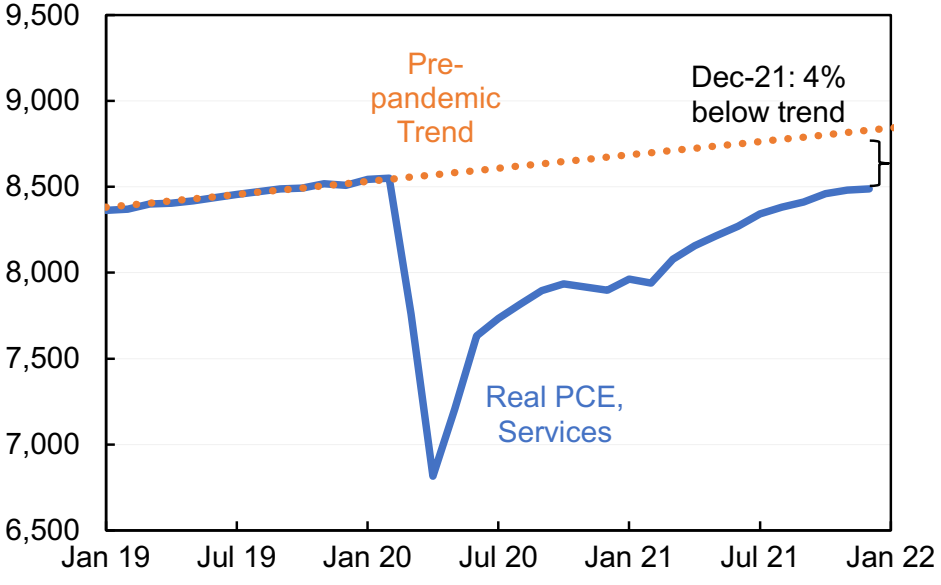
Real Personal Consumption Expenditures, Durables

Billions of Chained 2012 Dollars, Annual Rate



Real Personal Consumption Expenditures, Services

Billions of Chained 2012 Dollars, Annual Rate



Likely caused some temporary elevation of inflation but: (1) much of higher goods consumption appears to be due to stimulus checks not a COVID taste shock and (2) only higher inflation to the degree goods supply is more inelastic than services supply.

Note: Pre-pandemic trend based on log-linear regression for Jan-18 to Dec-19.
Source: Bureau of Economic Analysis; Macrobond; author's calculations.

1. Developments we didn't (or couldn't) expect: C. Supply chains

ECONOMY

Shortage of semiconductors, dubbed the 'new oil,' could dent GDP growth, boost inflation

PUBLISHED THU, APR 22 2021•4:55 PM EDT

Jeff Cox
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@JEFFCOXCNBCCOM

Widespread Commodity Shortages Raise Inflation Fears

For products as diverse as lumber and microchips, price increases are filtering through the economy.

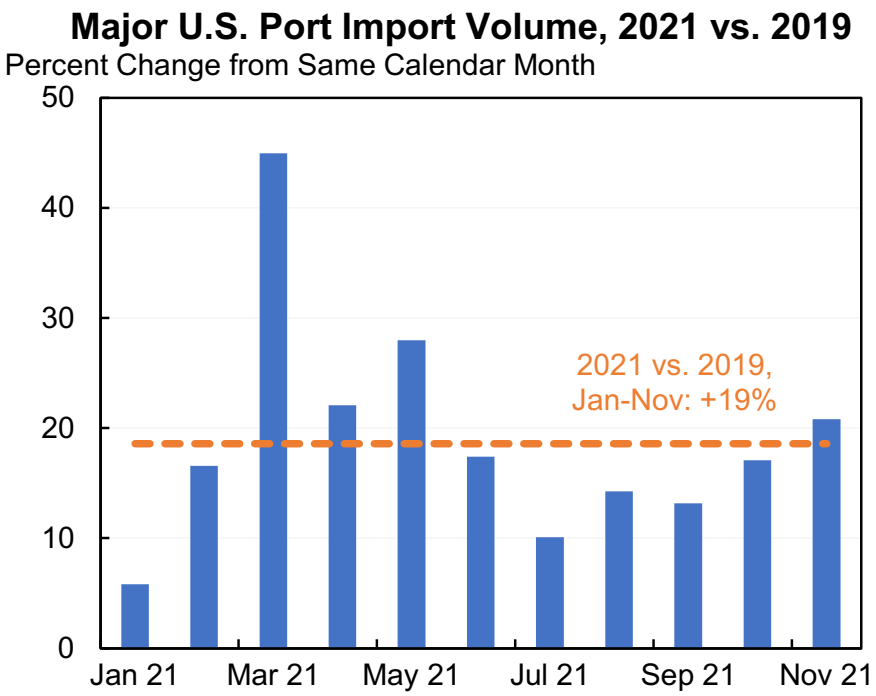
Supply Lines

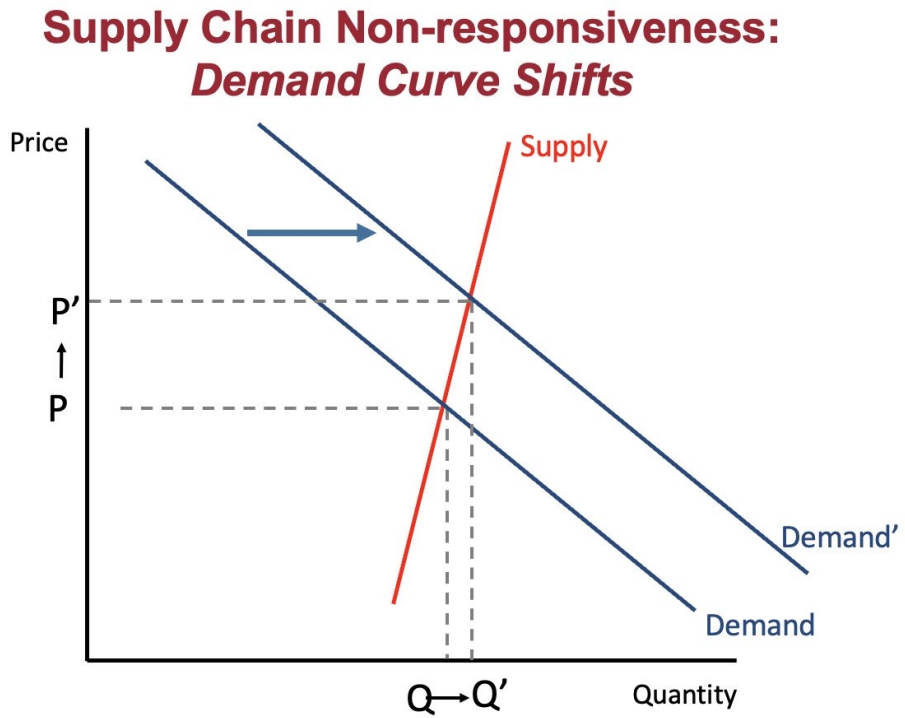
Freight Rates on Every Mode of Transport Are Boosting Inflation

By Vince Golle
December 20, 2021, 7:00 AM EST

Source: CNBC; The New York Times; Bloomberg.

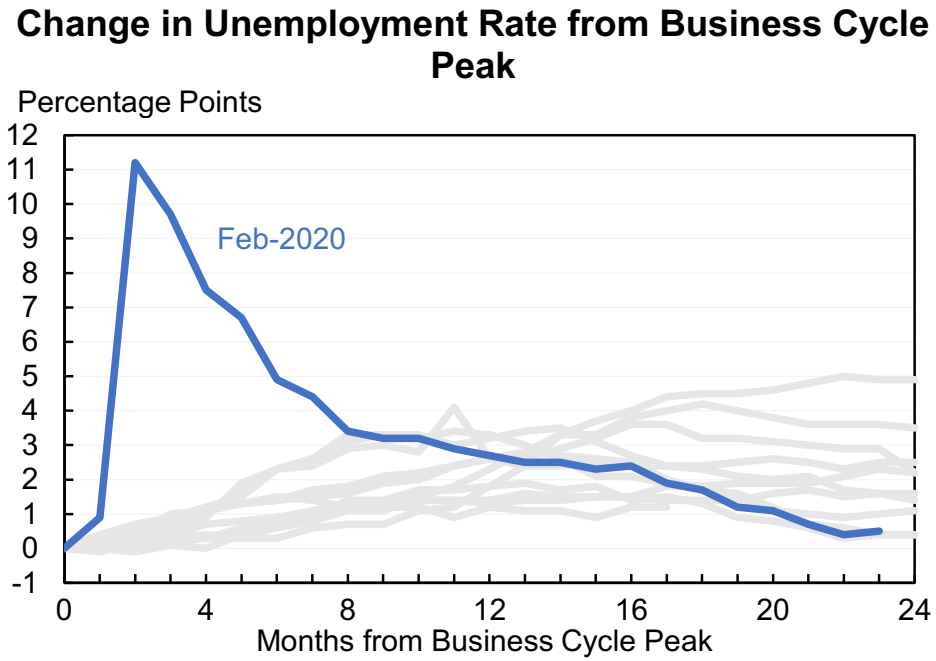
But supply generally increased—really is more of a demand shock than a supply shock

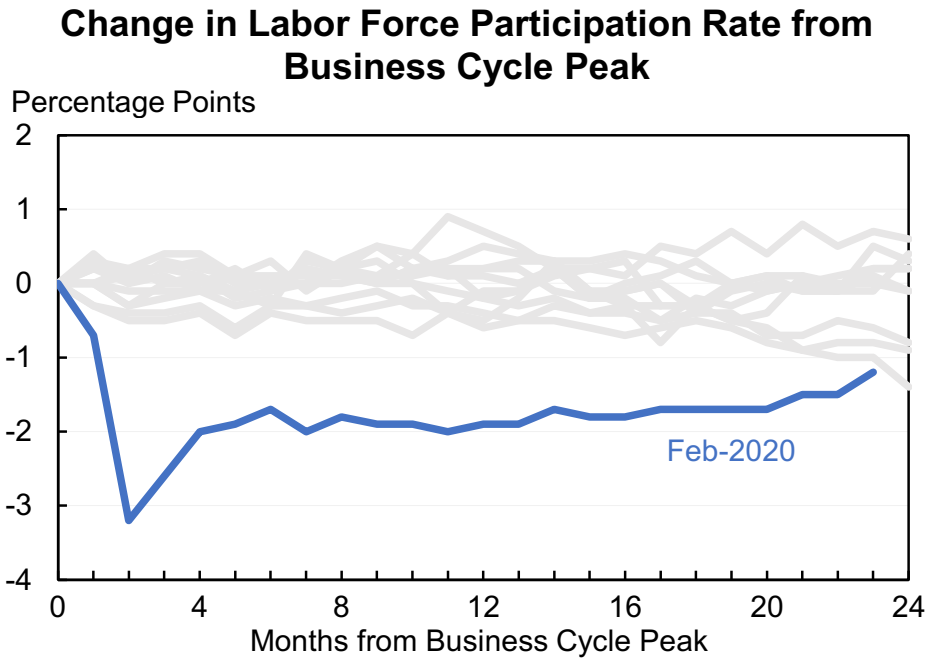




Note: Full and empty container imports for Ports of Los Angeles, Long Beach, New York & New Jersey, Savannah, and Seattle & Tacoma.
Source: Ports authorities; Macrobond; author's calculations.

1. Developments we didn't (or couldn't) expect: D. The "Great Resignation"





Note: Gray lines depict paths in prior recessions since 1948.
Source: Bureau of Labor Statistics via Macrobond; Dynan and Powell (2022).

Possible ways to get more inflation

1. Developments We Didn't (or Couldn't) Expect

ϵ_t : Supply shock developments we didn't or couldn't expect.

2. Tweaks to the Phillips Curve

High θ

u_t^* temporarily higher

Nonlinear Phillips curve or Δu_t matters (i.e., "speed limit")

Alternative measures of show less slack

2. Tweaks to the Phillips Curve: Steeper curve or temporarily higher NAIRU

Steeper Phillips Curve

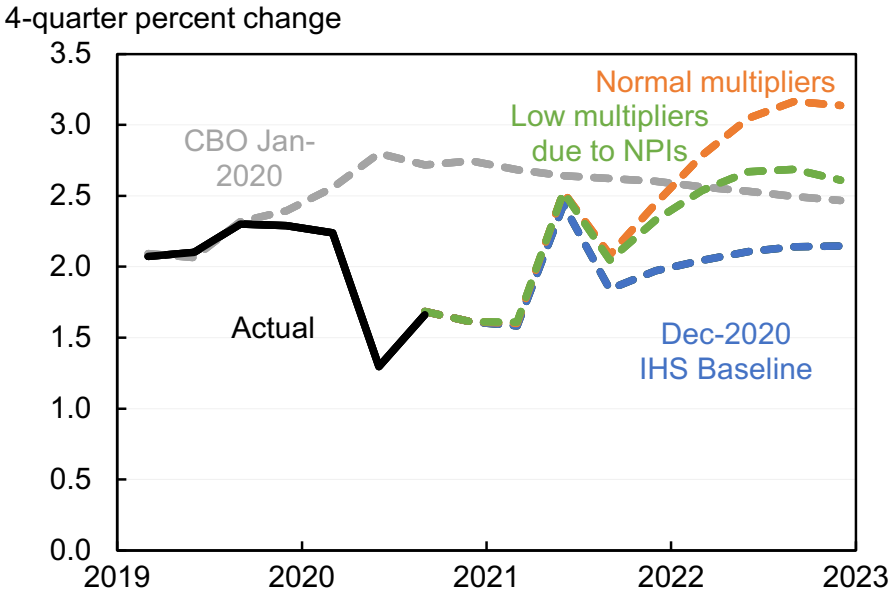
- Maybe flatness is conflating systematic changes in expected inflation with genuine flatness, local Phillips curves generate steeper estimates (e.g., Struyven 2017 and Hazell, Herreño, Nakamura, and Steinsson 2021)

Temporarily higher NAIRU

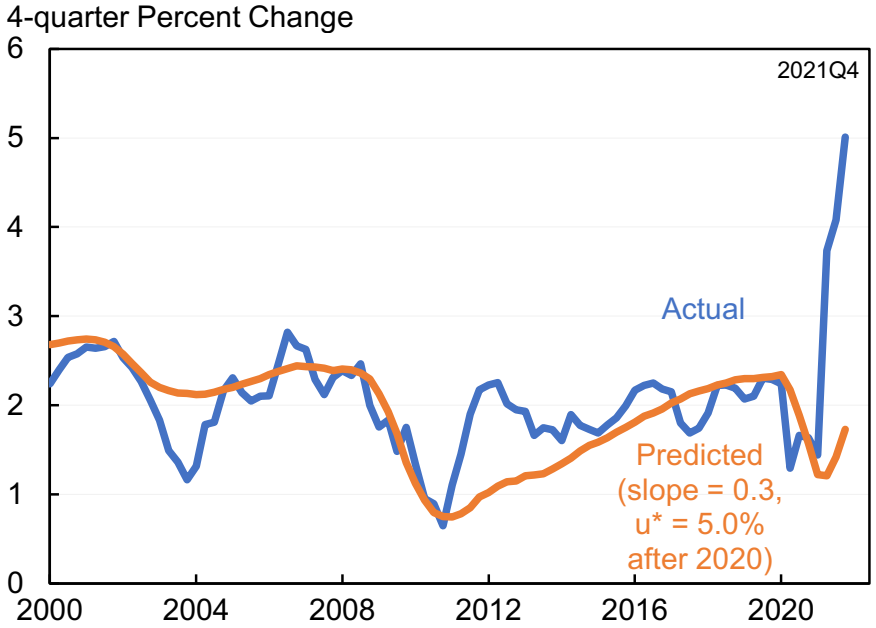
- Even if the true pre-pandemic NAIRU was 3.5 percent could not have gotten to 3.5 percent inflation in, say, April 2021.
- Hysteresis temporarily raises the NAIRU
- Pandemic-specific factors, generous unemployment insurance, and jobs resorting also temporarily increased the NAIRU.

Steeper Phillips curve (θ = -0.3) & temporarily higher u_t^* ($u_t^* = 5.0\%$)

Estimated Effect of December and March Fiscal Stimulus on Core CPI Inflation with Slope of 0.3



Core CPI Inflation

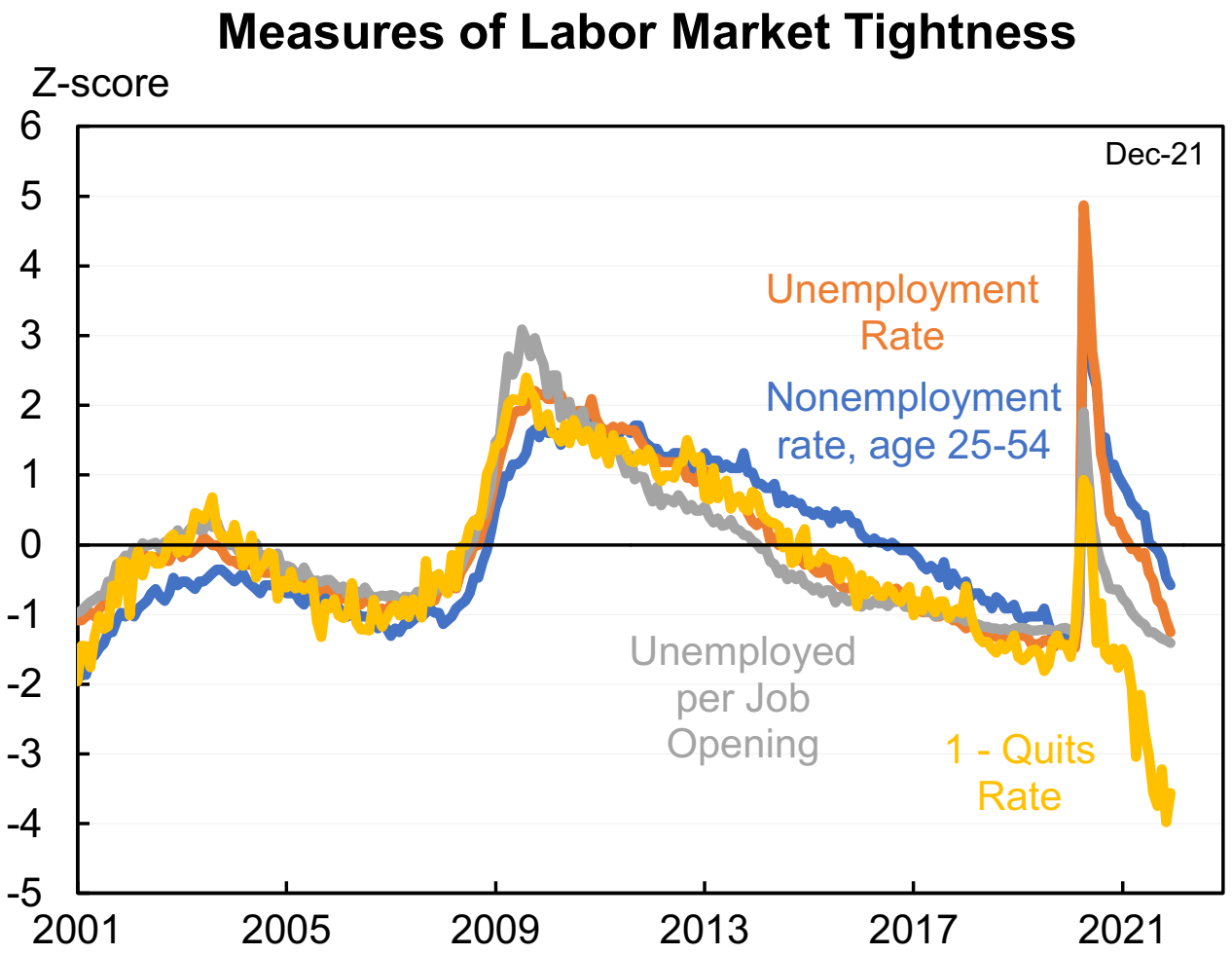


Source: Bureau of Labor Statistics; Congressional Budget Office; Federal Reserve Bank of Philadelphia, Survey of Professional Forecasters; Macrobond; author's calculations.

2. Tweaks to the Phillips Curve: Nonlinear or speed limit

- Some research has found this (e.g., Nalewaik 2016 and Fair 2021).
- An unsatisfying way to generate precise predictions. Why have we not hit it before when the unemployment rate has fallen gradually?
- Maybe a good reason to expect higher inflation than the basic Phillips curve would give you?
- *Note: can think of a speed limit as isomorphic to a temporary increase and gradual decline in the NAIRU.*

2. Tweaks to the Phillips curve: Alternative measures of slack



Note: Measures standardized using mean and standard deviation from 2001 through 2018. Prime-age nonemployment is the share of the civilian population aged 25-54 that is not employed. Unemployment rate is the U-3 unemployment rate. The quits rate is quits divided by total nonfarm employment.
Source: Bureau of Labor Statistics via Macrobond; author's calculations.

The prior two decades *should* have told us to pay attention to alternative slack measures

Predictor	Predicting Core CPI: Adjusted R^2 from Phillips Curve Regression
Quits	47%
Unemployed / Job Opening	45%
Unemployment Rate	35%
Prime-age Employment Rate	22%

Note: Shows prediction for year-ahead core CPI inflation regressed on last year's core CPI inflation and the current value of the predictor variable. See paper for more analysis.
Source: Furman and Powell (2021), https://www.piie.com/blogs/realtime-economic-issues-watch/what-best-measure-labor-market-tightness.

Possible ways to get more inflation

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Alternative measures of show less slack

3. An Alternative Model

Can think of it as what determines $E_t\pi_{t+1}$

3. An alternative model
A thought experiment

- Suppose you gave everyone a helicopter drop of $1,000,000.
- IF you used a Phillips curve with unchanged inflation expectations at most this would lead you to predict about 3 percent inflation.
- Is it better to think of this policy as changing inflation expectations than operating through supply and demand in the labor market?

In general, inflation rates vary a lot across countries and over time in ways not at all related to the degree of slack.

Model nominal GDP + real GDP inelastic, prices are the residual

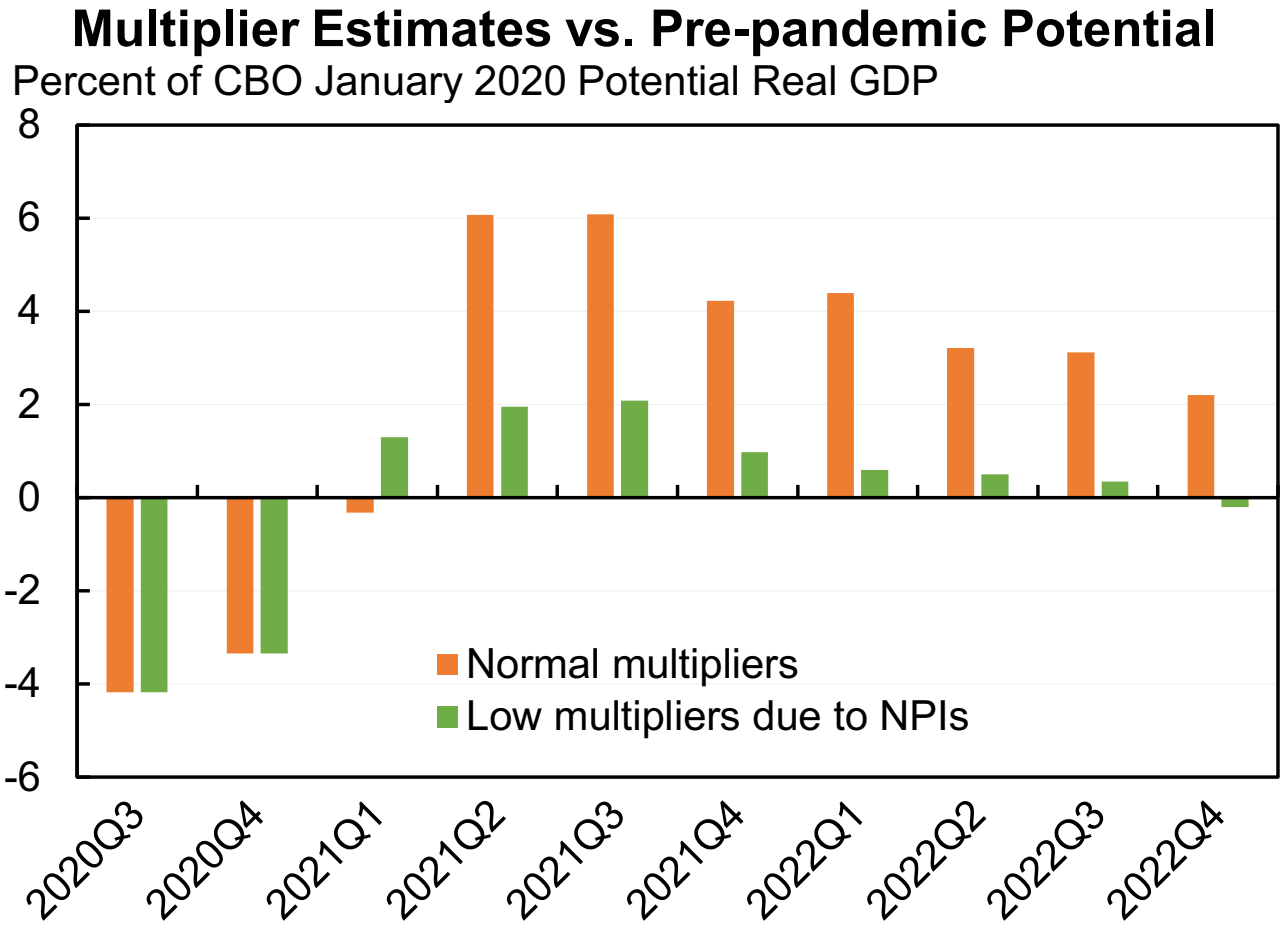
A simple model for 2021:

1. Use multipliers and other standard methods to predict *nominal* GDP

2. Use productive capacity of the economy adjusted down for pandemic to predict *real* GDP (simplification assuming real GDP is inelastic)

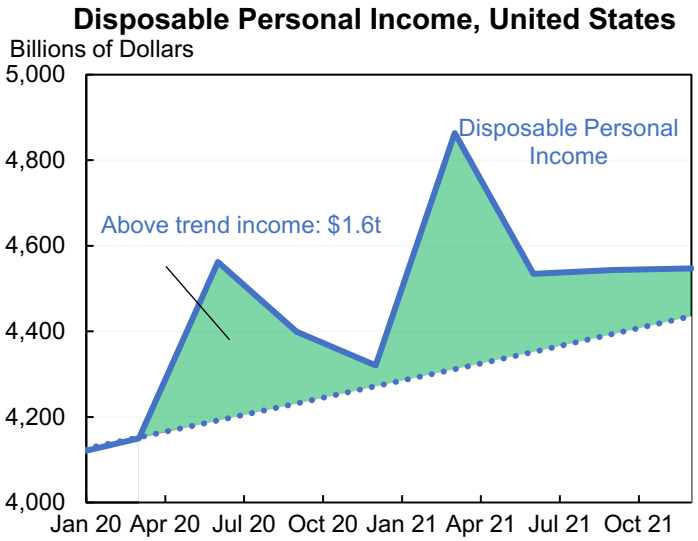
3. Price increases are the residual

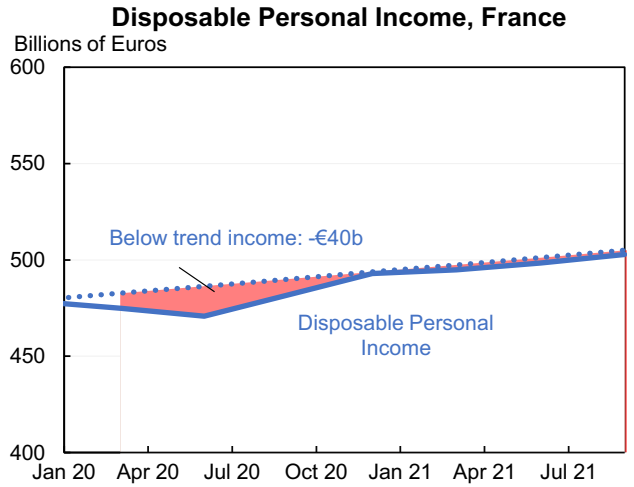
Quantifying: Inflation ~1-4pp higher in 2021 and ~0-2pp higher in 2022???

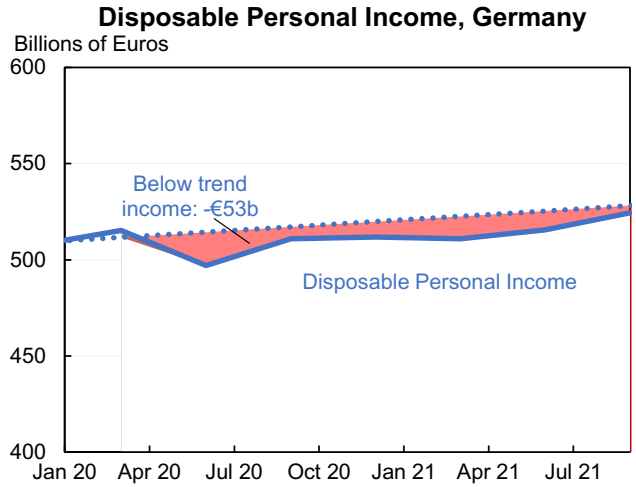


Note: Normal multipliers based on CEA (2009, 2014); low multipliers based on CBO (2020).
Source: Congressional Budget Office; IHS Markit; Council of Economic Advisers; author's calculations.

As an aside, Europe appears to have had much less fiscal stimulus



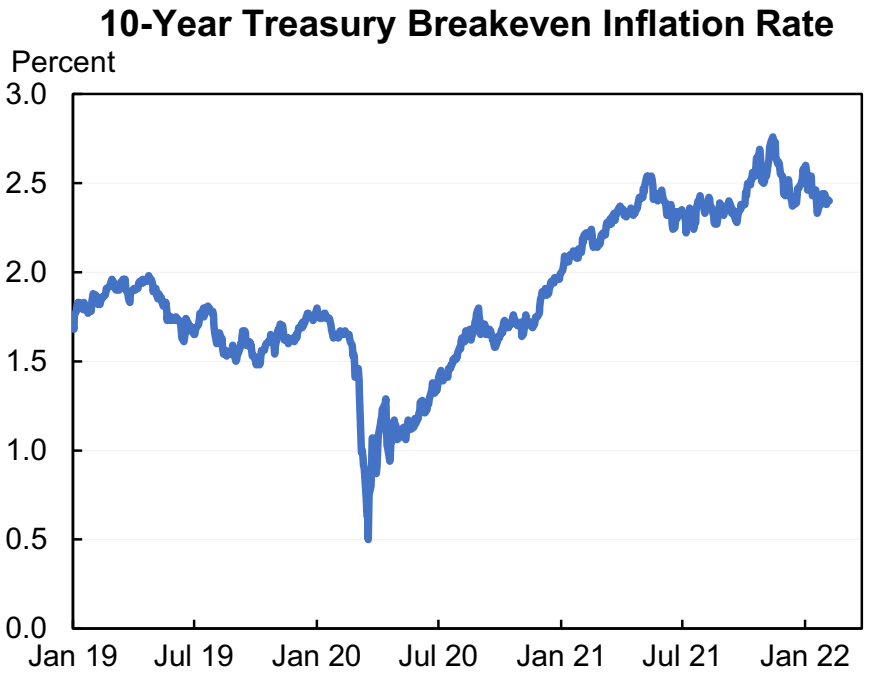




Note: Pre-pandemic trend based on log-linear regression for 2018Q1 to 2019Q4.
Source: Bureau of Economic Analysis; INSEE; Statistisches Bundesamt; Macrobond; author's calculations.

Should we think of this as a model of $E_t\pi_{t+1}$?

- Sticking with the Phillips curve can think of this as a model for expected inflation, maybe the fiscal theory of the price level?
- But, hard to have specific predictions from this approach. And why would it change the rate not the level?
- Plus, expectations have not shifted very much.
- *So maybe best to think of this as mapping in to a nonlinear Phillips curve after all.*



Source: Macrobond.

Bottom line

- Inflation was likely higher because of unexpected factors but probably not much higher.
- Tweaks to a Phillips curve could generate a little more inflation (e.g., steeper curve, alternative measures of slack).
- In general a nonlinear Phillips curve is fragile and hard to use for prediction, but with very large changes it is reasonable using a model where fiscal stimulus raises nominal GDP, real GDP can only rise so far, and the residual is prices.

Looking forward:
Four reasons for inflation to moderate

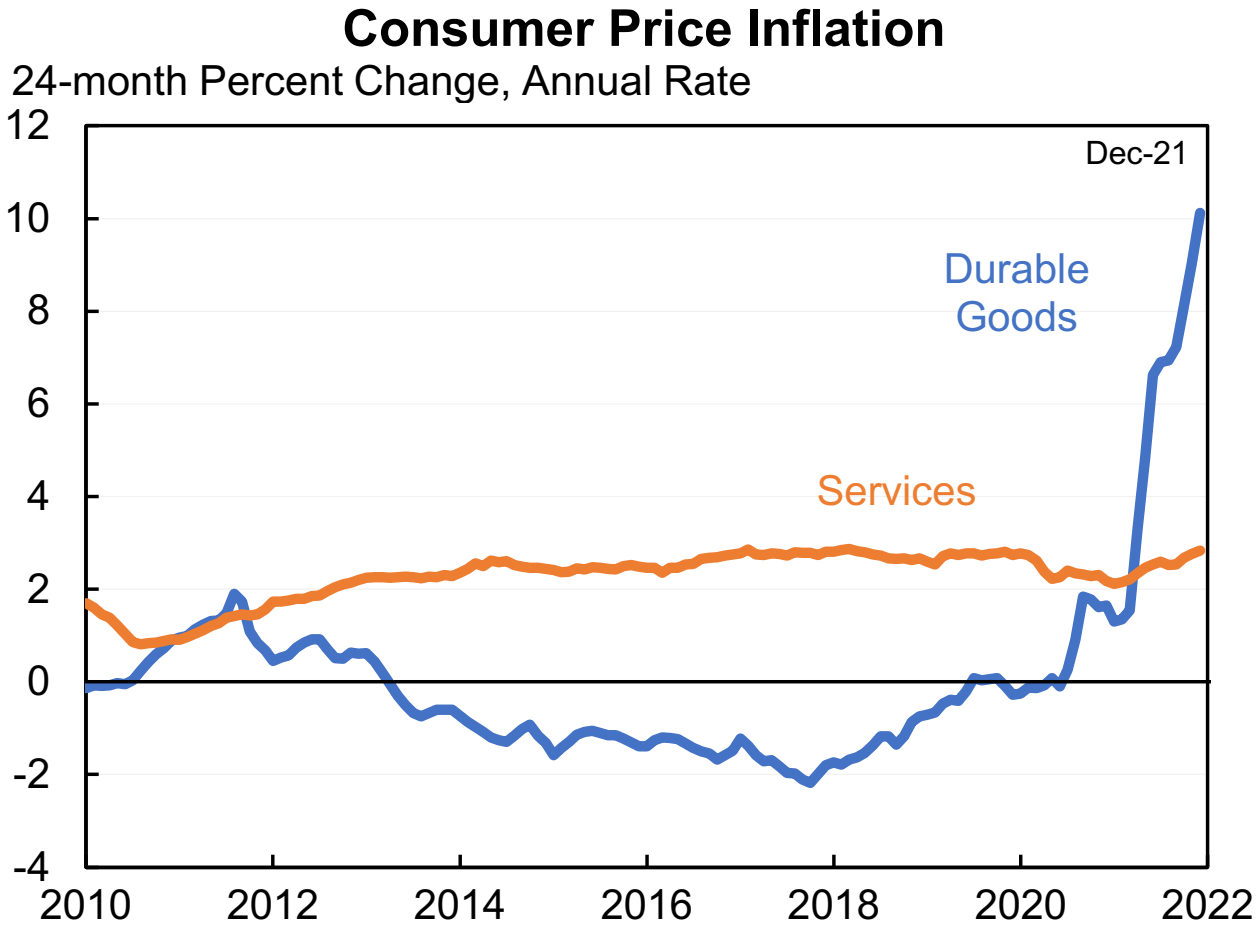
1. People shift from buying goods to services

2. People return to the workforce

3. Global supply chains unsnarl

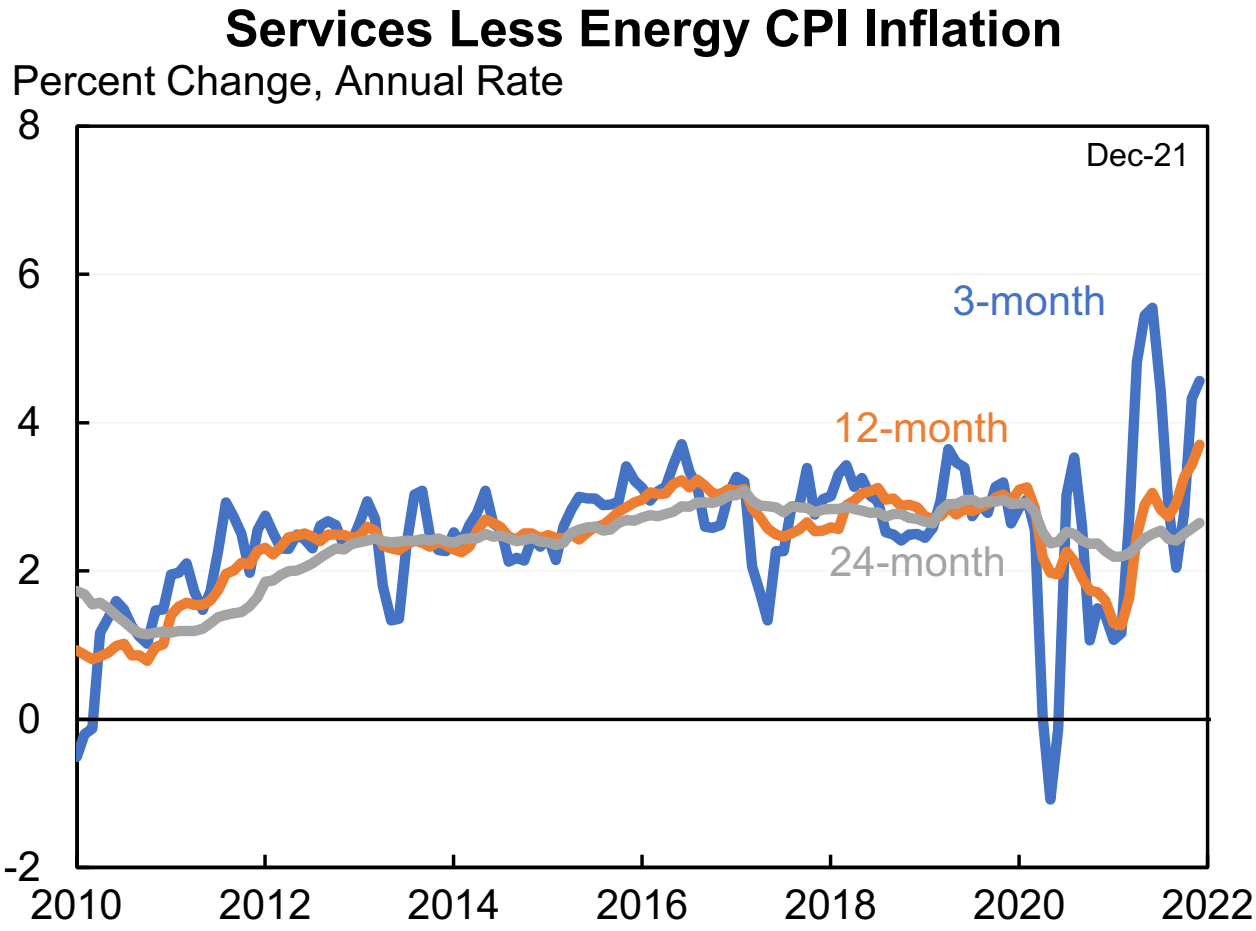
4. Major monetary/fiscal support over

We have mostly had goods inflation



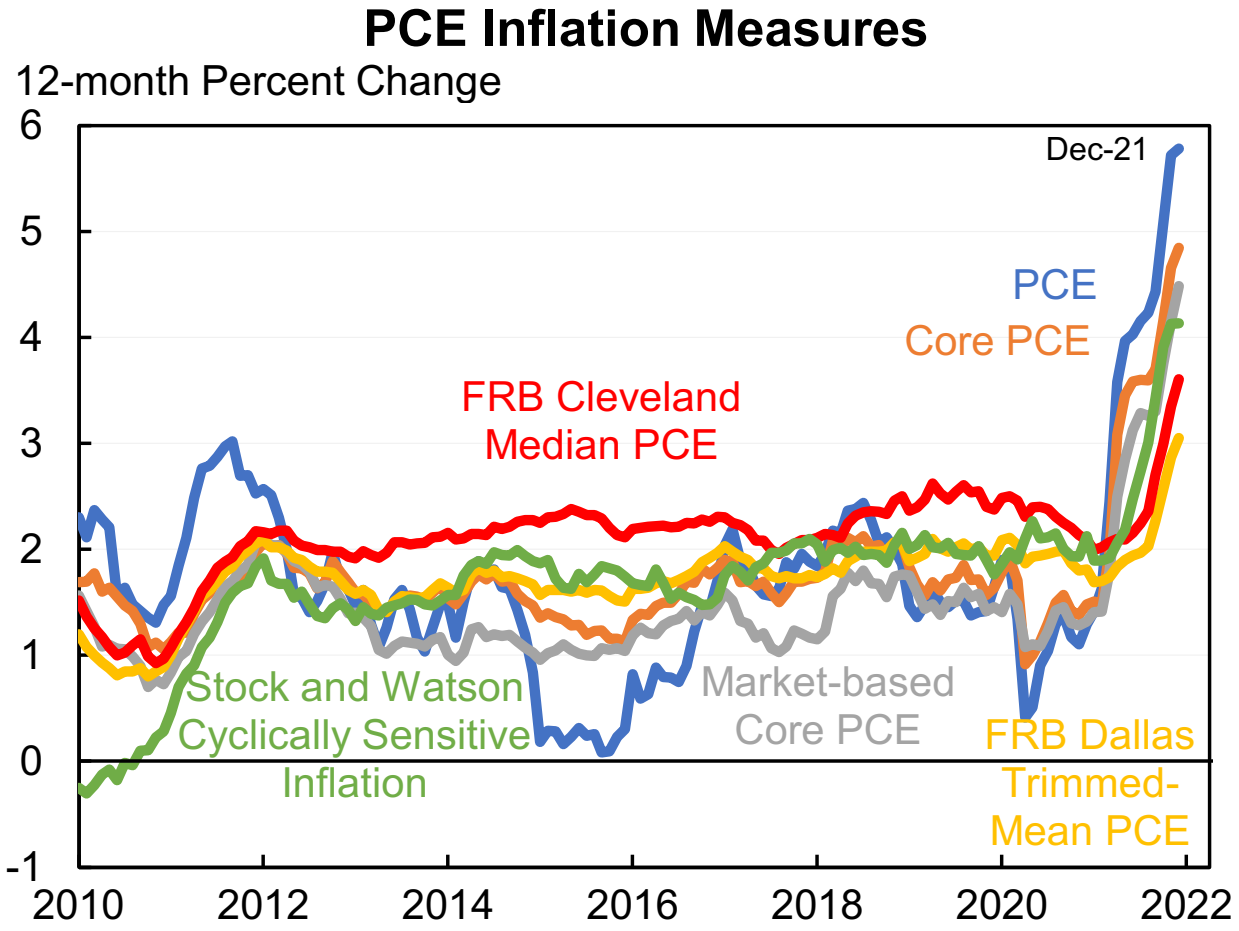
Source: Bureau of Labor Statistics; Macrobond; author's calculations.

But services inflation is picking up



Source: Bureau of Labor Statistics; Macrobond; author's calculations.

A broader set of inertial measures of inflation are also picking up



Source: Bureau of Economic Analysis; Federal Reserve Banks of Atlanta, Dallas, and Cleveland; Macrobond; author's calculations.

Returning to the workforce may not be a panacea

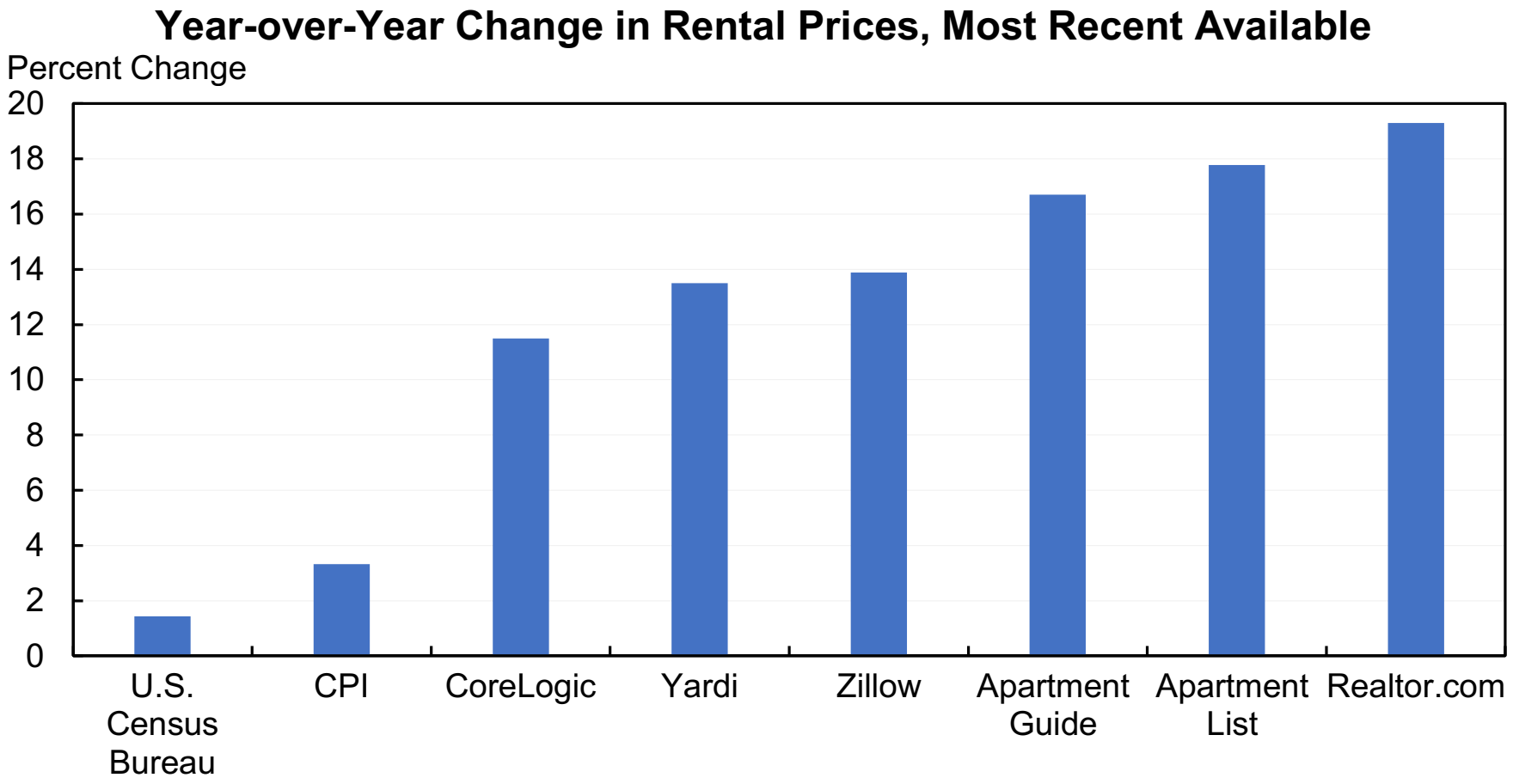
If the age-adjusted labor force participation rate rises to its pre-pandemic value by December 2022 then:

- The labor force participation rate would rise by ~0.9 percentage point.
- For context, the labor force participation rate rose by an average of 0.8 percentage point annually from December 1975 to December 1978.
- To the degree the increase is all labor supply could think of this as the NAIRU falling by a small amount with translates into a relatively small downward pressure on inflation.

Five reasons for inflation to increase

1. Other micro stories playing out like shelter

Price of shelter and other services set to rise



Note: Data for January 2022, except for Apartment Guide; CPI; Realtor.com, Yardi, and Zillow (December 2021), CoreLogic (November 2021), and U.S. Census Bureau (2021Q4).
Source: Apartment List National Rent Report, Bureau of Labor Statistics (CPI, Rent of Primary Residence), U.S. Census Bureau (Median Asking Rent), Zillow Observed Rent Index via Macrobond; Apartment Guide Rent Report (2-bedroom); CoreLogic Single-Family Rent Index; Realtor.com Median Rent; Yardi Multifamily Average Asking Rents; author's calculations.

Five reasons for inflation to increase

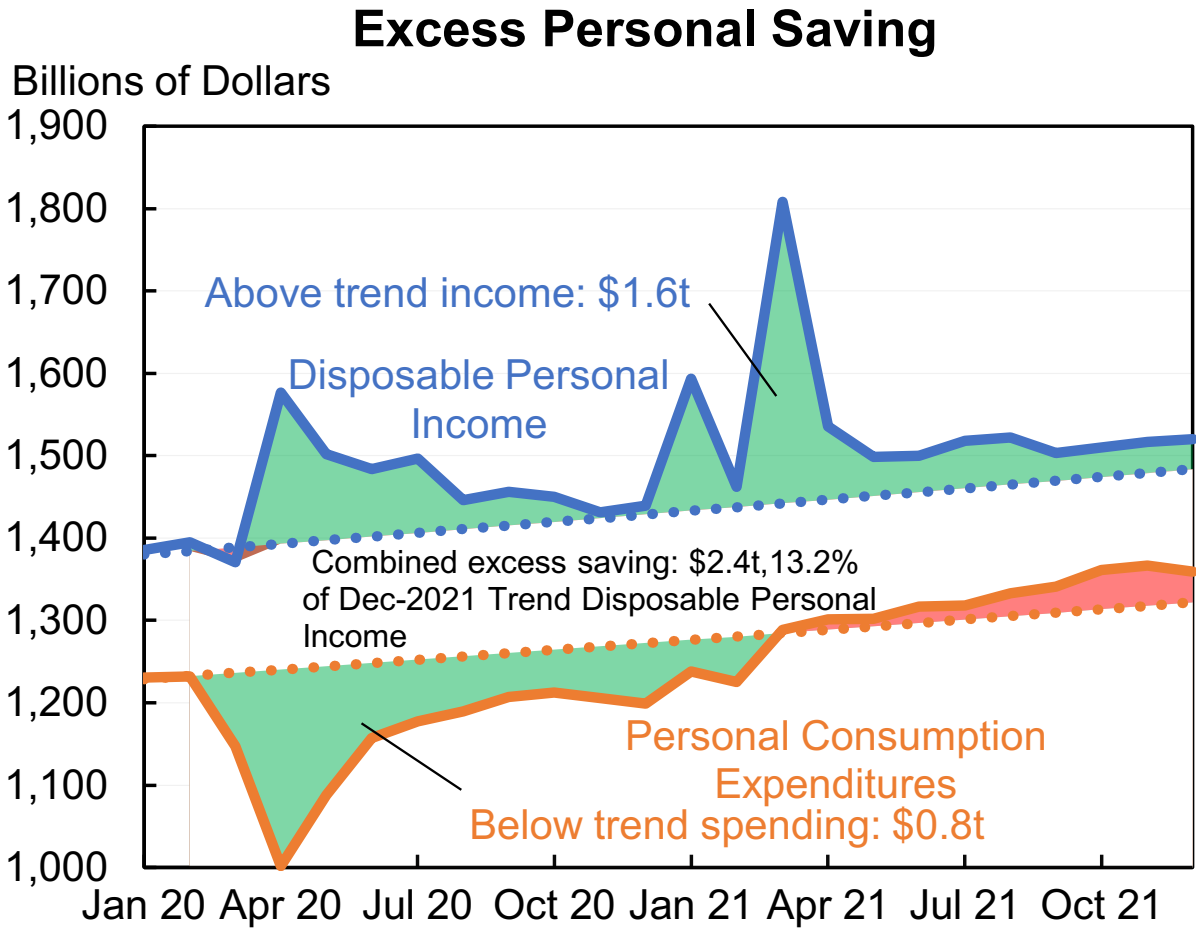
1. Other micro stories playing out like shelter

2. Labor markets have tightened
   - An additional ~0.5 p.p. more in inflationary pressure
   - Nominal wages growing at 5+ percent

3. Inflation expectations higher
   - Expectations 1 to 3 p.p. higher

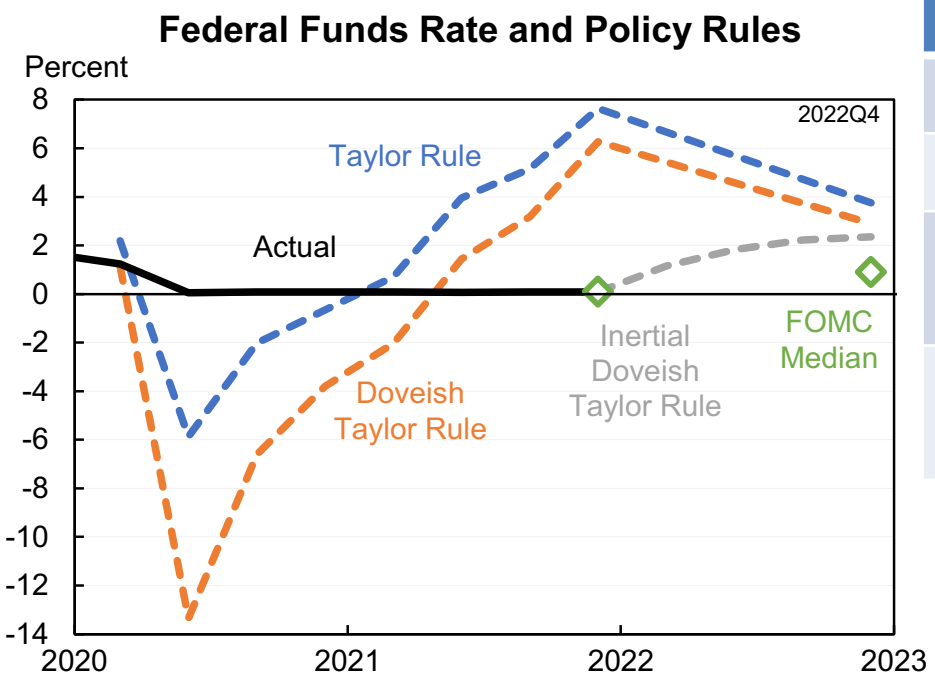
4. Demand continues to be above trend and supply below trend (COVID reduction could boost demand more than it increases supply)

Still a lot of excess savings



Note: Pre-pandemic trend based on log-linear regression for Jan-18 to Dec-19.
Source: Bureau of Economic Analysis; Macrobond; author's calculations.

Monetary policy is much looser than a Taylor Rule



	Taylor	Doveish	Inertial Doveish
r*	0.5%	0.0%	0.0%
u*	4.0%	3.5%	3.5%
Inertia Parameter	0.0	0.0	0.8
Weight on Output Gap	0.5	1.0	1.0

Q4 Forecast	UR	π
2022	3.5%	2.6%

Source: Federal Reserve Bank of Cleveland; Federal Reserve Bank of New York; Board of Governors of the Federal Reserve System; Bureau of Labor Statistics; Bureau of Economic Analysis; author's calculations.

Five reasons for inflation to increase

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5. Manageable endemic COVID in United States plus COVID-zero in China as inflationary???

But I'm very uncertain: my subjective probability distribution for 2022 core PCE

Core PCE (2022-Q4/Q4)	Probability
< 1%	3%
1 – 2%	12%
2 – 3%	23%
3 – 4%	32%
4 – 5%	20%
> 5%	10%
Mean	**3.3%**

Will inflation be higher in 2023 relative to 2022?

Reasons inflation could be lower

- Less loose monetary policy and further removed from fiscal policy lags
- Potential could expand as supply chains solved and labor returns

Reasons inflation could be higher

- Inflation could be artificially lowered in 2022 by supply shocks (e.g., some mean reversion in car prices).
- Could have tighter labor markets and higher inflation expectations

The near universal assumption of forecasters is that inflation in 2023 < inflation in 2022. I would put less than 40 percent of that. This could matter a lot.

My ranking of outcomes from best to worst

Smooth transition to a higher inflation target. Inflation ends up around 3 percent, nominal wage growth rises commensurately, Fed updates framework.

Smooth transition to 2% inflation. What the Fed believes will happen.

Inflation < 2%. Long-term structural forces mean inflation falls below the Fed's 2 percent goal.

Inflation sustained above 4%. No happy ending in this scenario.

Fed causes a recession to get inflation back to 2%. A lot of historical examples of this.

HARVARD
UNIVERSITY

Why Did (Almost) Nobody See It Coming and What Does That Mean for What's Next?

Jason Furman

Harvard University

Macroeconomics Policy Seminar

February 8, 2022

(Slides lightly revised on February 10, 2022)