It’s Baaack: The Surge in Inflation in the 2020s and the Return of the Non-Linear Phillips Curve

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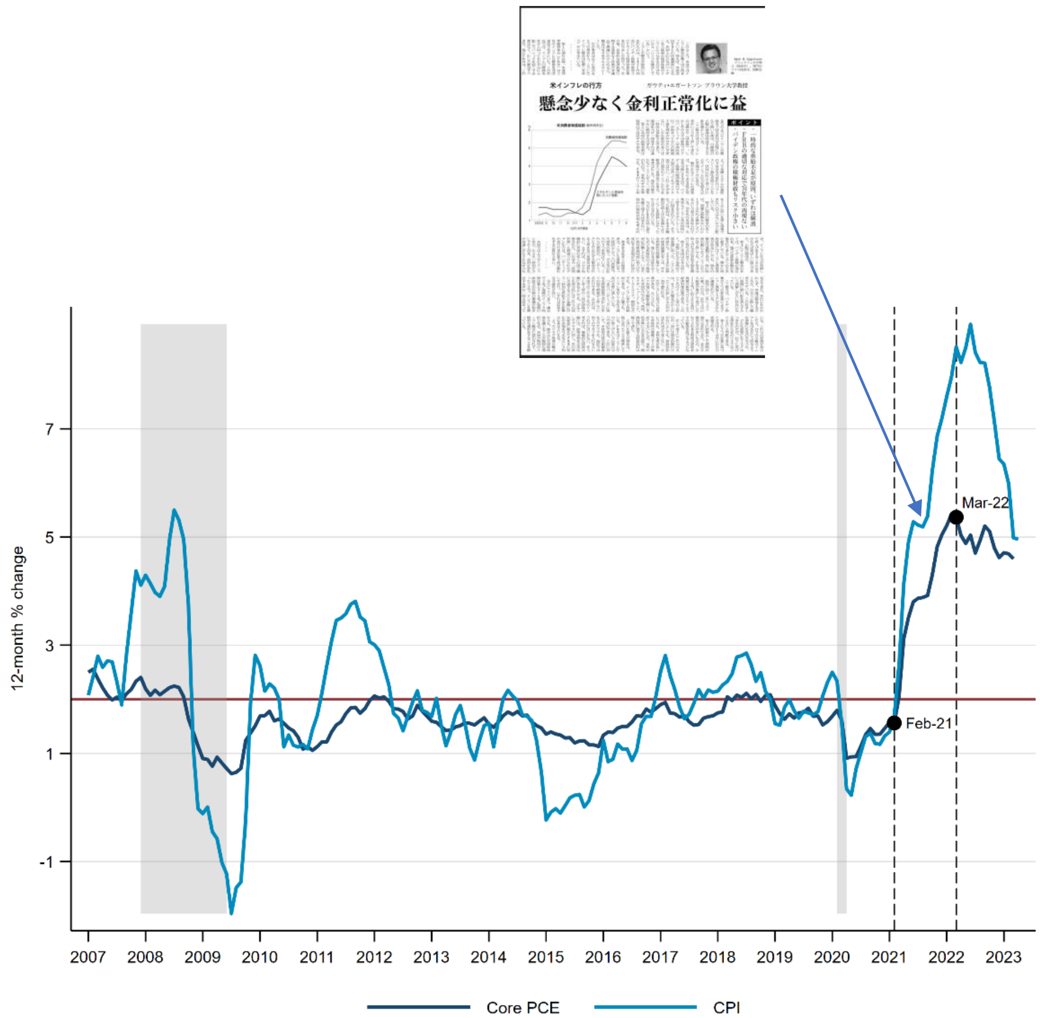
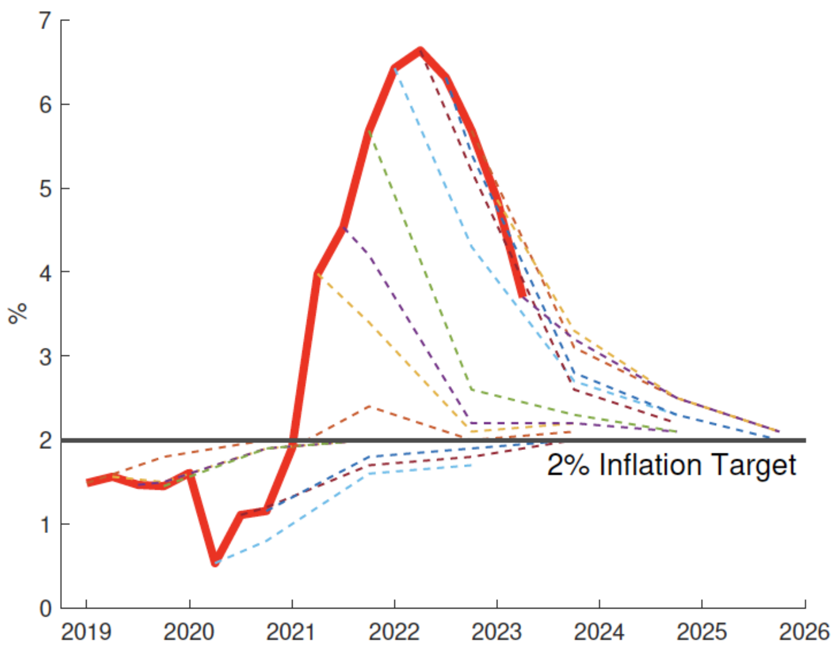
IMF, 2024

We (or at least me) messed up the inflation call in 2021

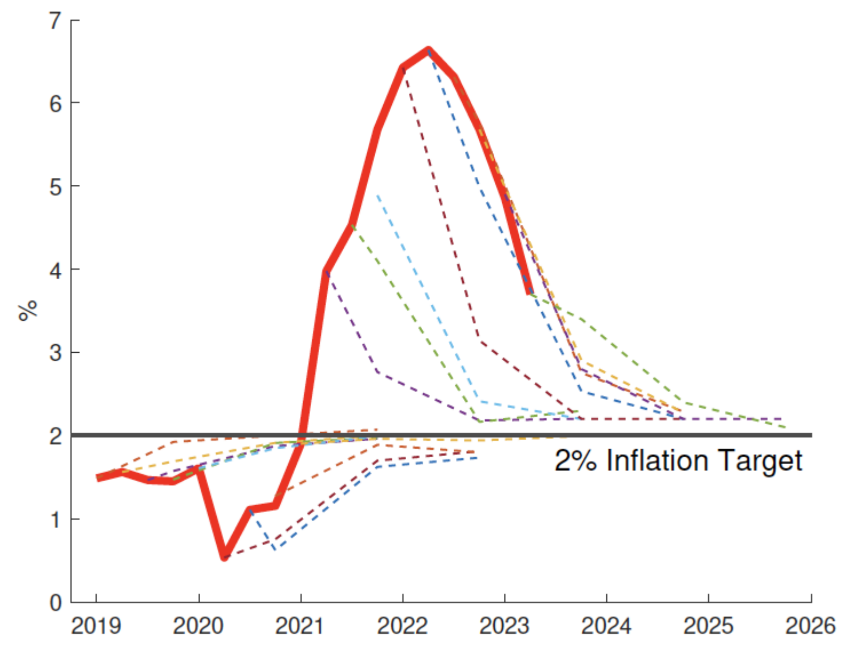


Surprise!

Personal Consumption-Index Inflation: Actual and **Forecasted**:



Federal Reserve Summary of Economic Projections



Survey of Professional Forecasters

Why? Phillips Curve Consensus

$$\underbrace{\pi_t = \kappa x_t}_{\text{Old Keynesian}} + \underbrace{\beta E_t \pi_{t+1} + s_t}_{\text{New Keynesian}}$$

<u>Consensus prior to the run-up:</u>

κ estimated to be **<u>very-very-very</u>** low

Ex: Hazell, Herrano, Steinsson, Nakamura, QJE, 2022:

$u \uparrow 1\% \longrightarrow \pi \downarrow 0.34\%$

Cross sectional U.S. state level data:
<u>1978 to 2018</u>

1970s: Expectations did it!

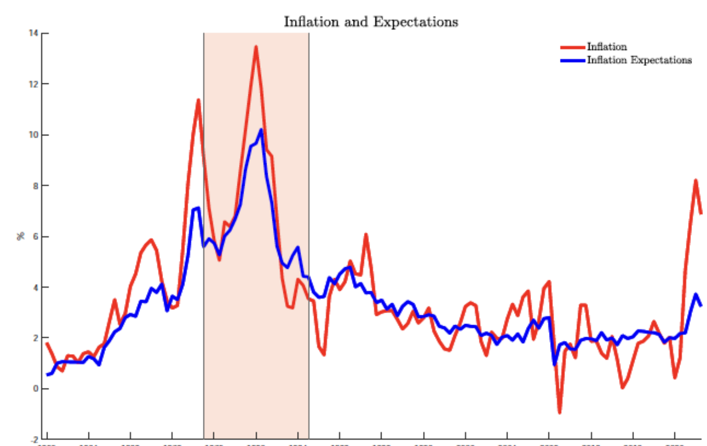


Figure 2: Inflation: CPI inflation rate at annual rates. 12-month Livingston inflation expectations.

Forecast miss 2021. Why?

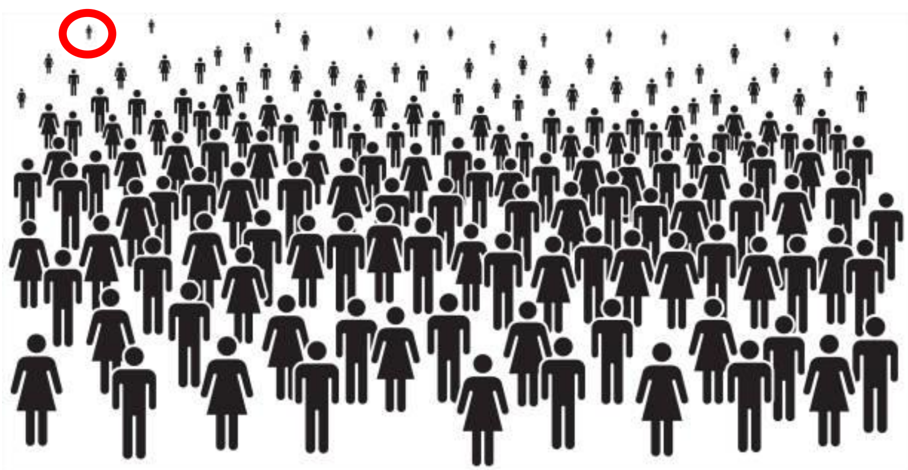
- Inflation expectations were not moving
- κ tiny
- So what's 2 trillion dollar stimulus between friends?
- Worst case scenario: More people employed!
- Inflation?
  - Noting to see here people!
- Keynes: ”When the facts change, I change my mind. What do you do sir?”

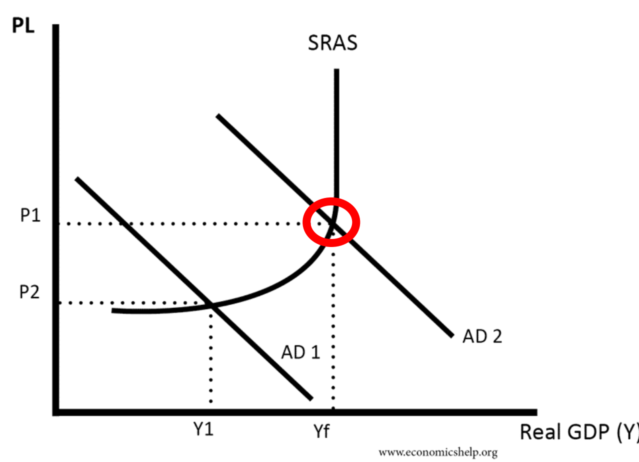
Old-Old strange Keynesian fairy tale that was conventional wisdom long-long time ago

(I learned this in an old textbook …….. University of Iceland late 90's)

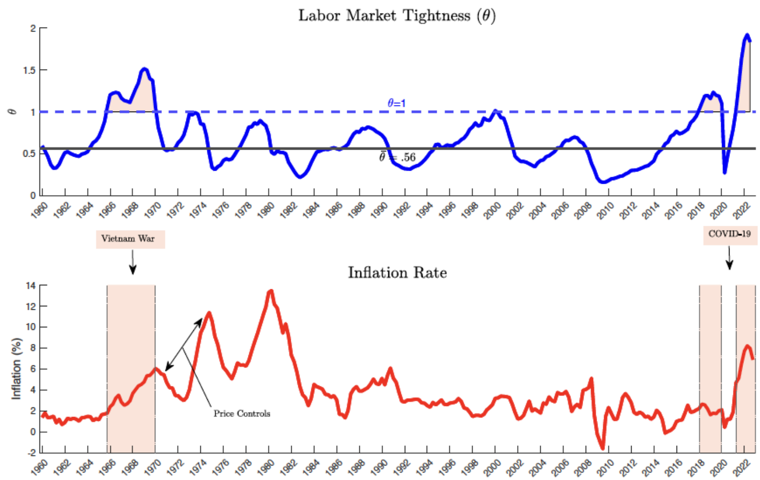
If you increase nominal spending: --> Output up and inflation a little bit to start with.

But! There is only so far you can go! Firms can increase output, but at the end of the day, there will always be one **<u>MAJOR</u>** limiting factor:





What do five inflation surges have in common (apart from 1970's)?



$$\theta = \frac{v}{u} = \frac{vacancies}{unemployment}$$

WWI, v/u=5
WWII, v/u=7
Korean War, v/u=1.5
Vietnam War, v/u=1.5
Post Covid-19, ***v/u= 2***

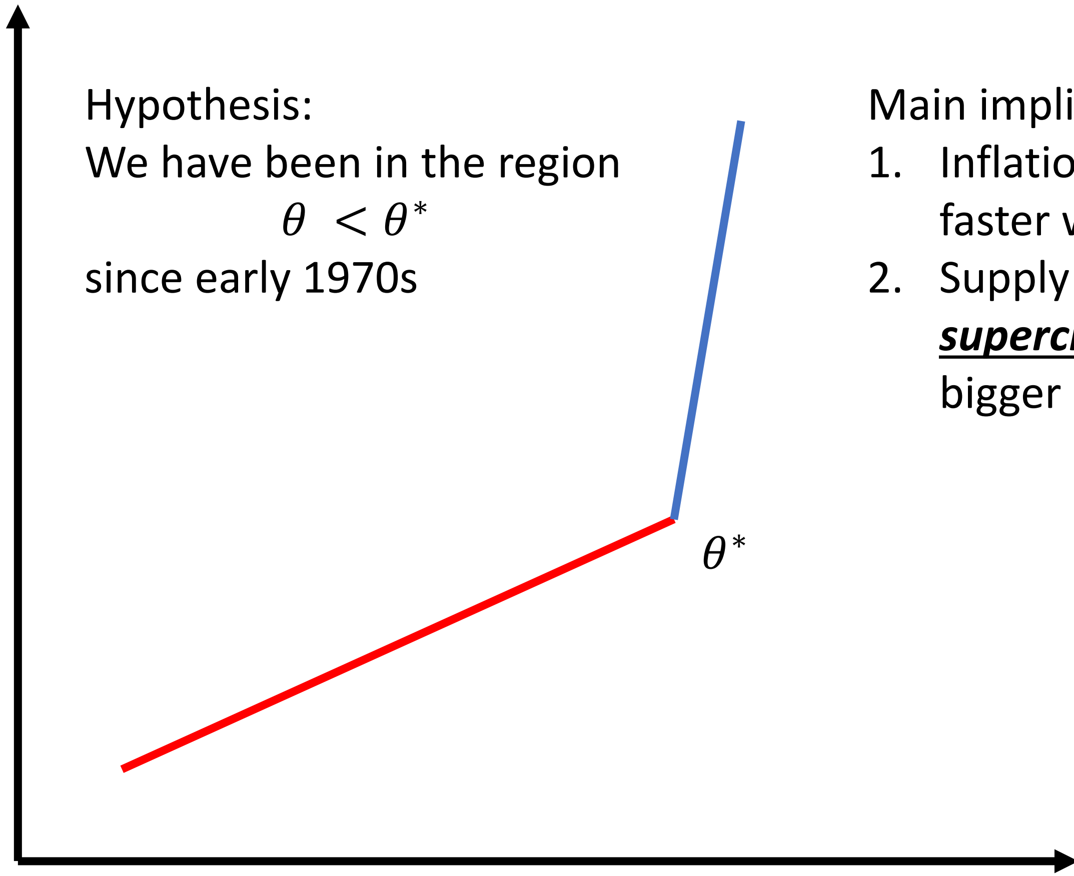
Key Idea

Hypothesis:
We have been in the region
$$\theta < \theta^*$$
since early 1970s

Main implication:

1. Inflation start picking up faster when $\theta > \theta^*$
2. Supply shock become ***<u>supercharged</u>*** and have a bigger effect

Inflation



Labor market tightness $$\theta_t = \frac{Vacancies}{Unemployment}$$

Rest of Talk

1. Empirical Motivation

2. Model

Simple search model of

-- labor force participation

-- search and matching with asymmetric behavior of wage responses as in Phillips (1958)

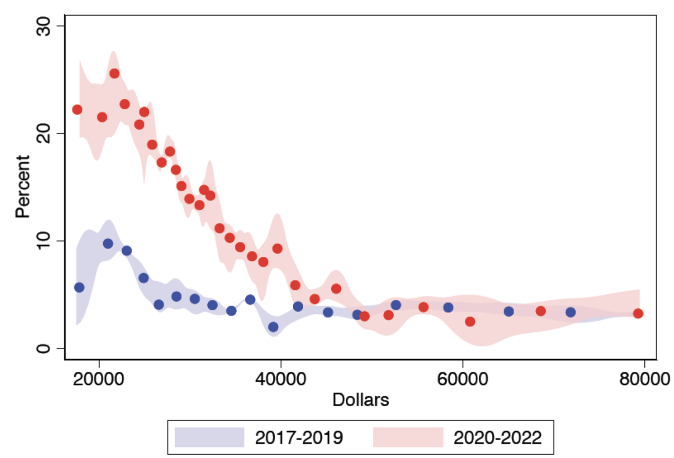
Labor shortage: Evidence

Pennsylvania, May 2021

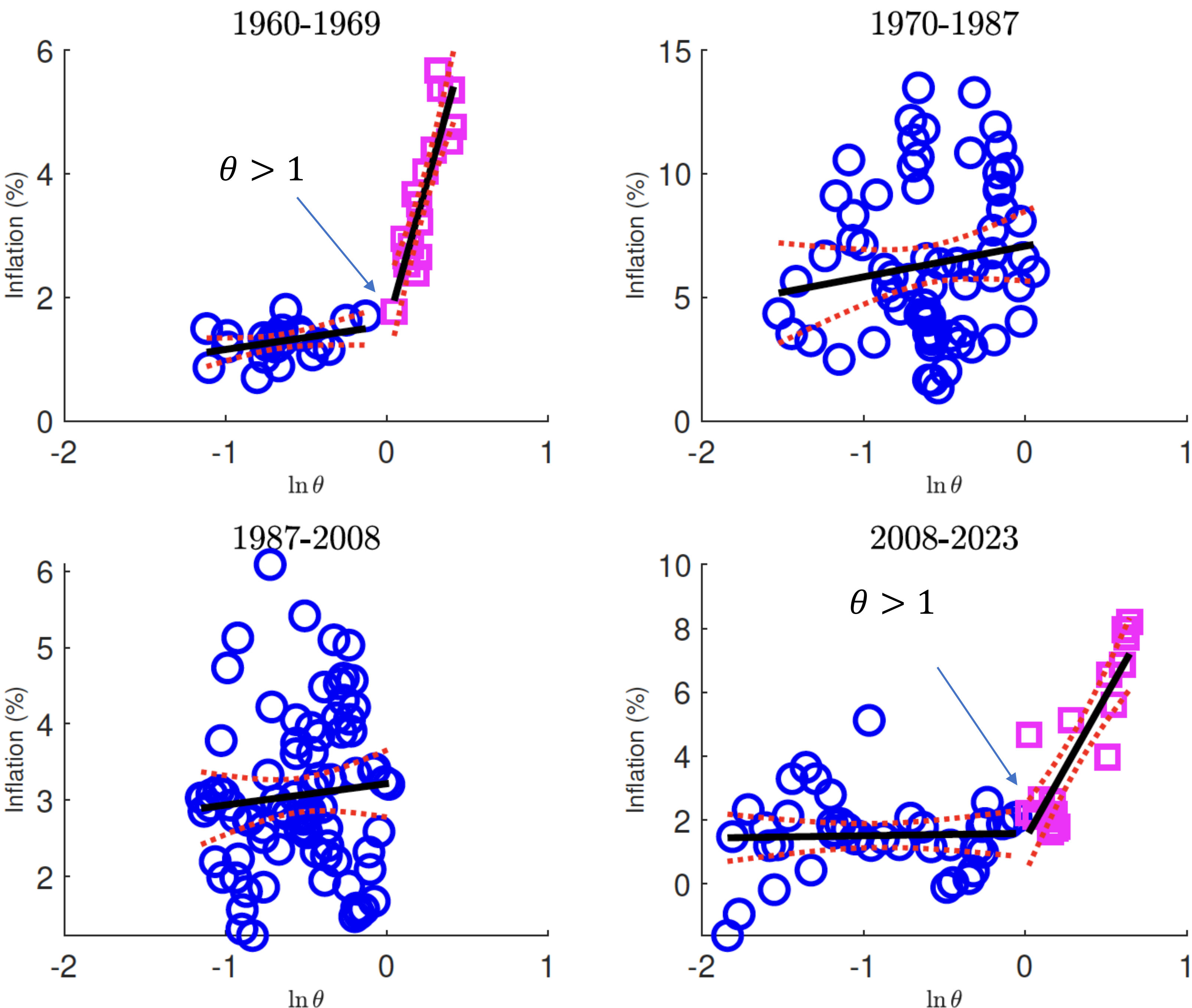
Ohio, June 2021

Virginia, July 2022

2-Year Posted Wage Growth Before and After Pandemic



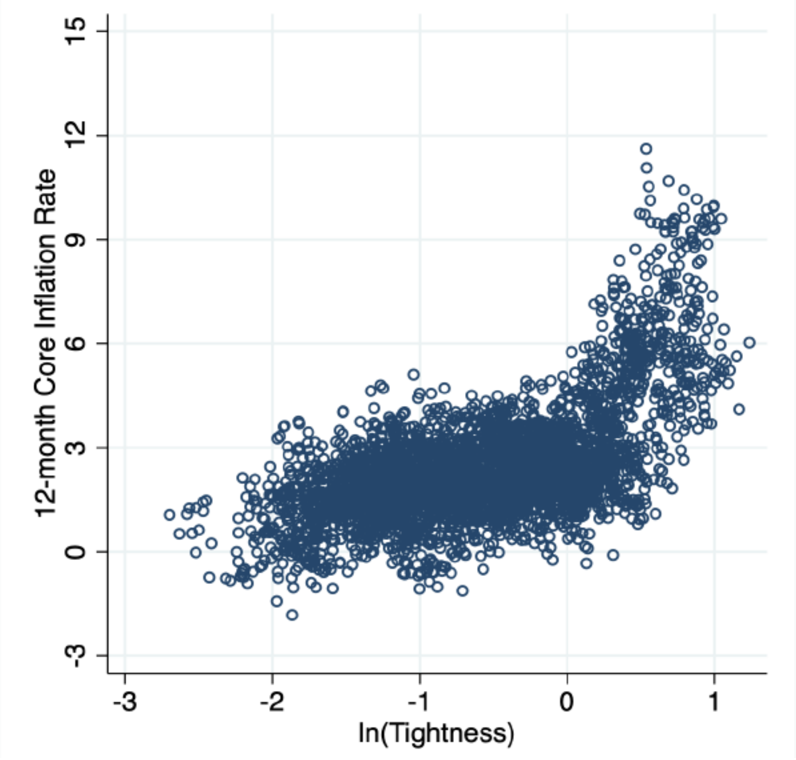
Crump, Eusepi, Giannoni, Sahin (2022)

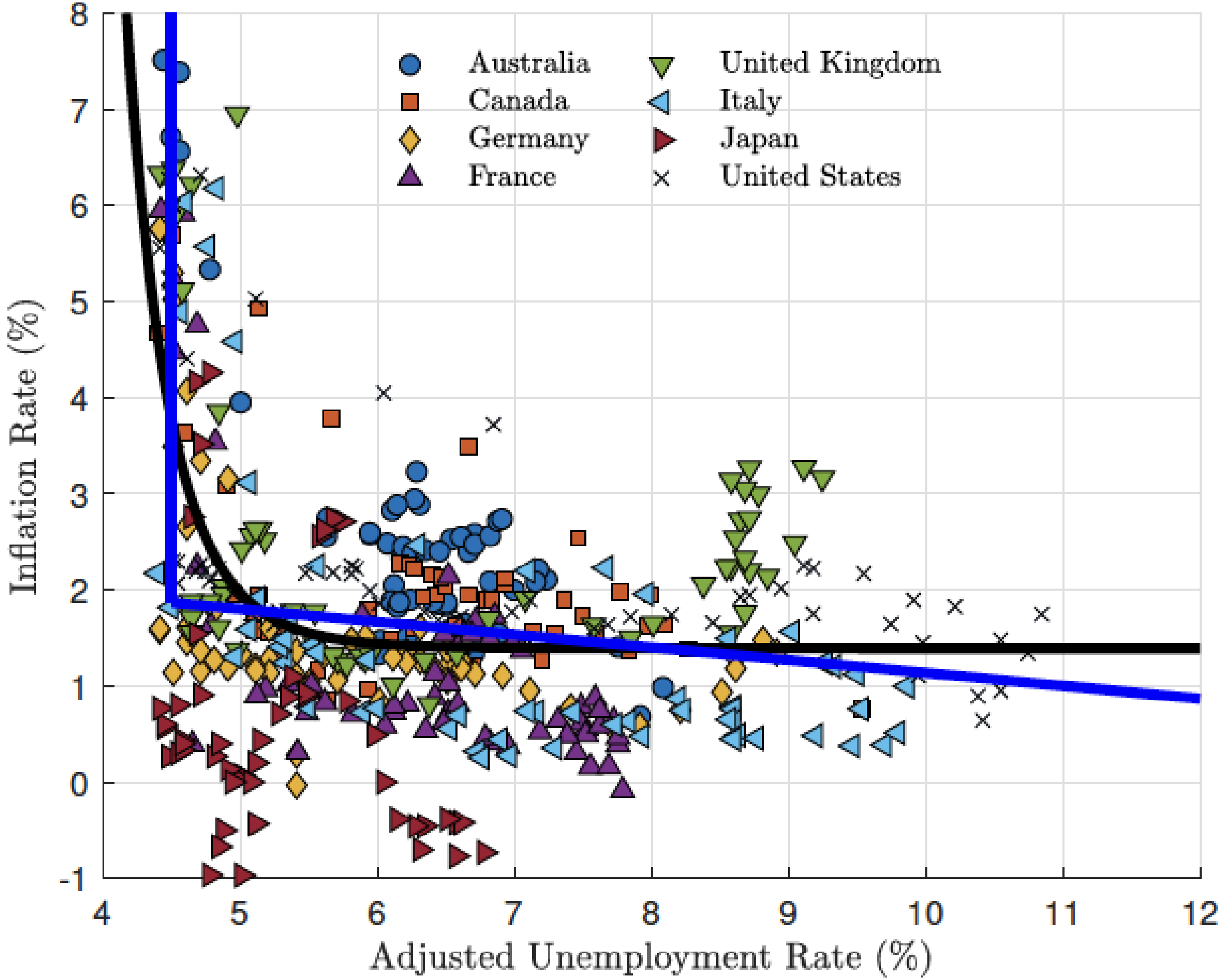


1960-1969
1970-1987
1987-2008
2008-2023
$\theta > 1$
$\theta > 1$
Inflation (%)
$\ln\theta$

Complementary Evidence
from 2011-2023 MSA level data

Giulia Gitti (2023) job market paper. Estimates the slope using IV-approach





Australia
Canada
Germany
France
United Kingdom
Italy
Japan
United States
Inflation Rate (%)
Adjusted Unemployment Rate (%)
8
7
6
5
4
3
2
1
0
-1
4
5
6
7
8
9
10
11
12

Objective: Run the most uncreative regression for Phillips curves which have been run 1000s of times.

Report here just from 2008 onwards, for whole same D's 37

Quarterly Core Inflation Annualized ← Important (Aoki,2001)

$$\pi_t = \beta_c + \beta_\pi \pi_{t-1} + (\beta_\theta + \beta_{\theta_d} D_t) \ln \theta_t + (\beta_v + \beta_{v_d} D_t) v_t + \beta_{\pi^e} \pi_t^e + \varepsilon_t$$

Slope of PC

0.599*
(0.3302)

Steepening when v/u>1

4.1601***
(0.9291)

Effect of supply shock

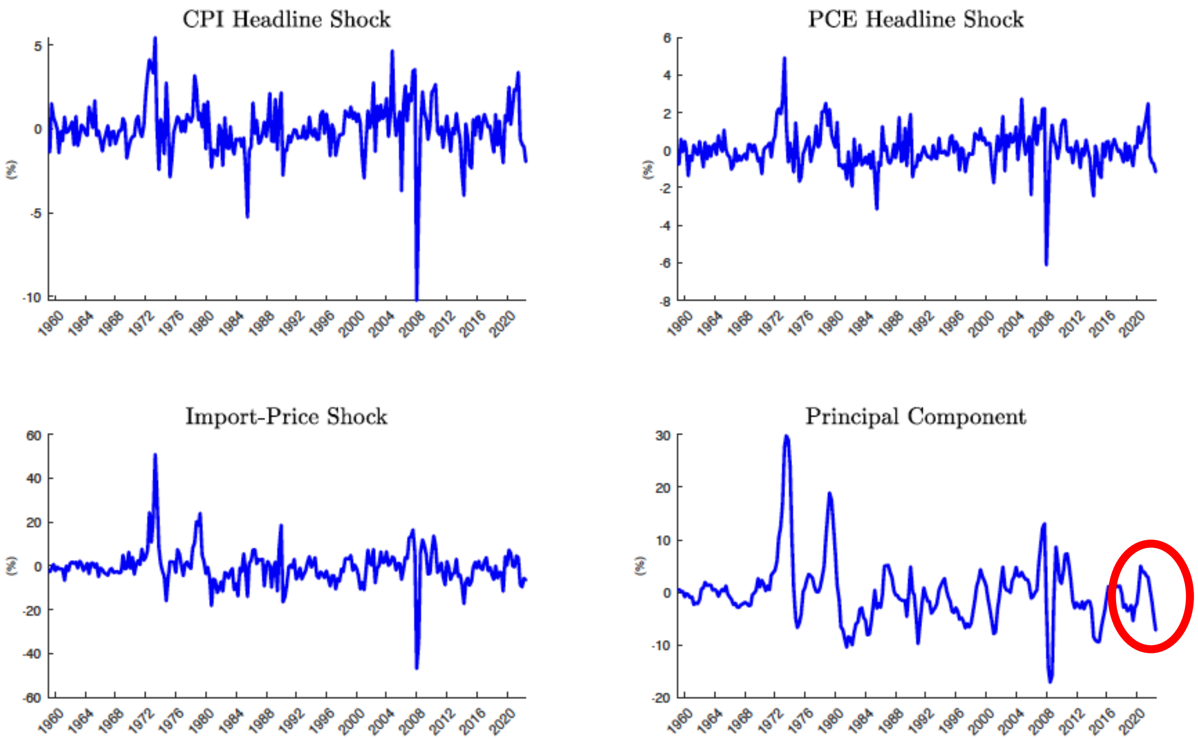
≈ 0

Effect of supply shock when v/u>1

0.2771**
(0.1824)

Moderate Supply Shocks

Yet ***interaction*** of supply shock and *labor shortage* critical



Why not use Global Supply Chain Index?

1. From 1998. Cut the sample in half -- 1960's gone

2. Extremly correlated with θ

Correlation of θ with GSCI: ***0.56***

→ ***Collinearity>0.5***

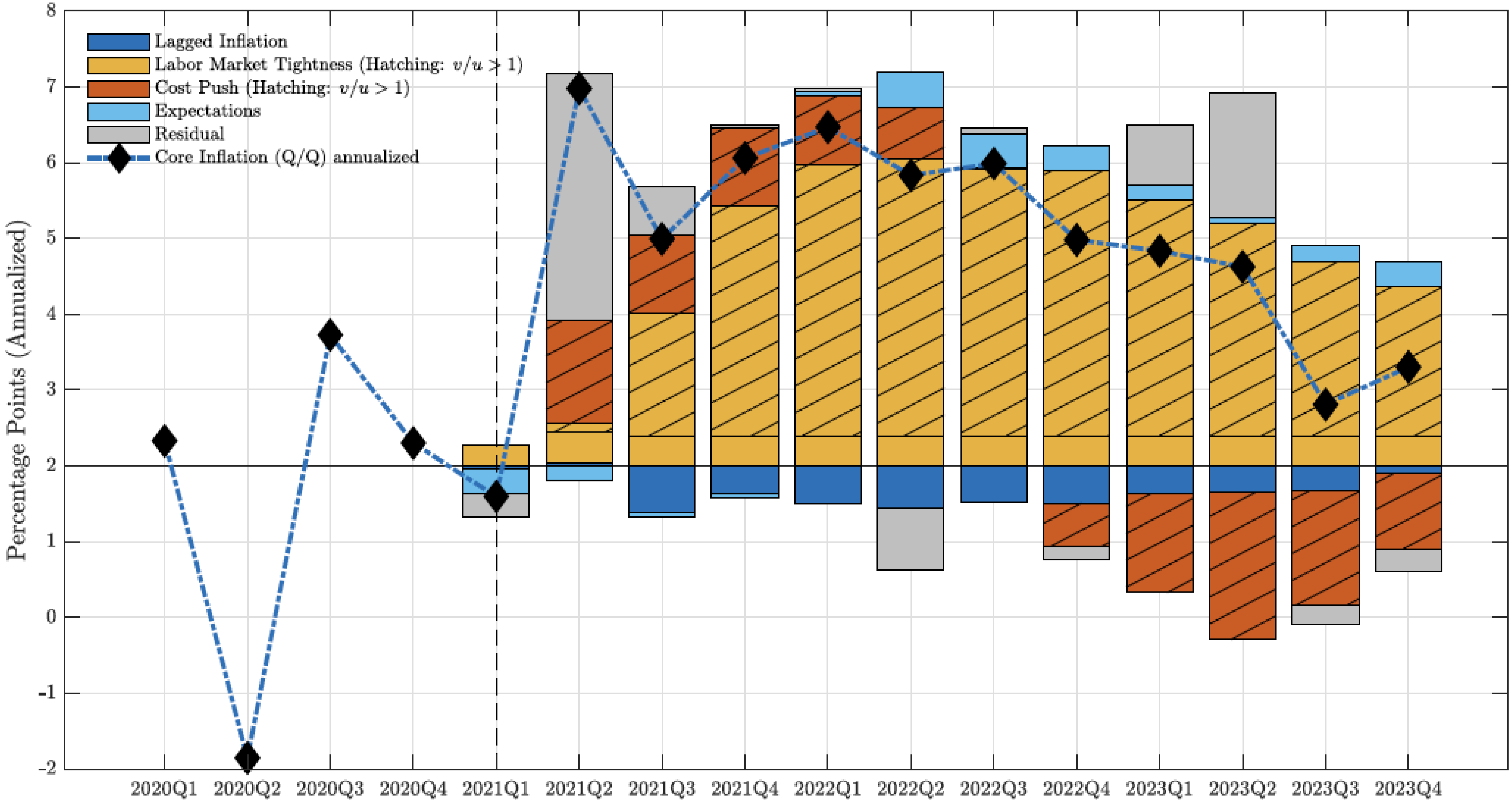
Correlation of θ with our: 0.053

Why this measure of supply shocks?

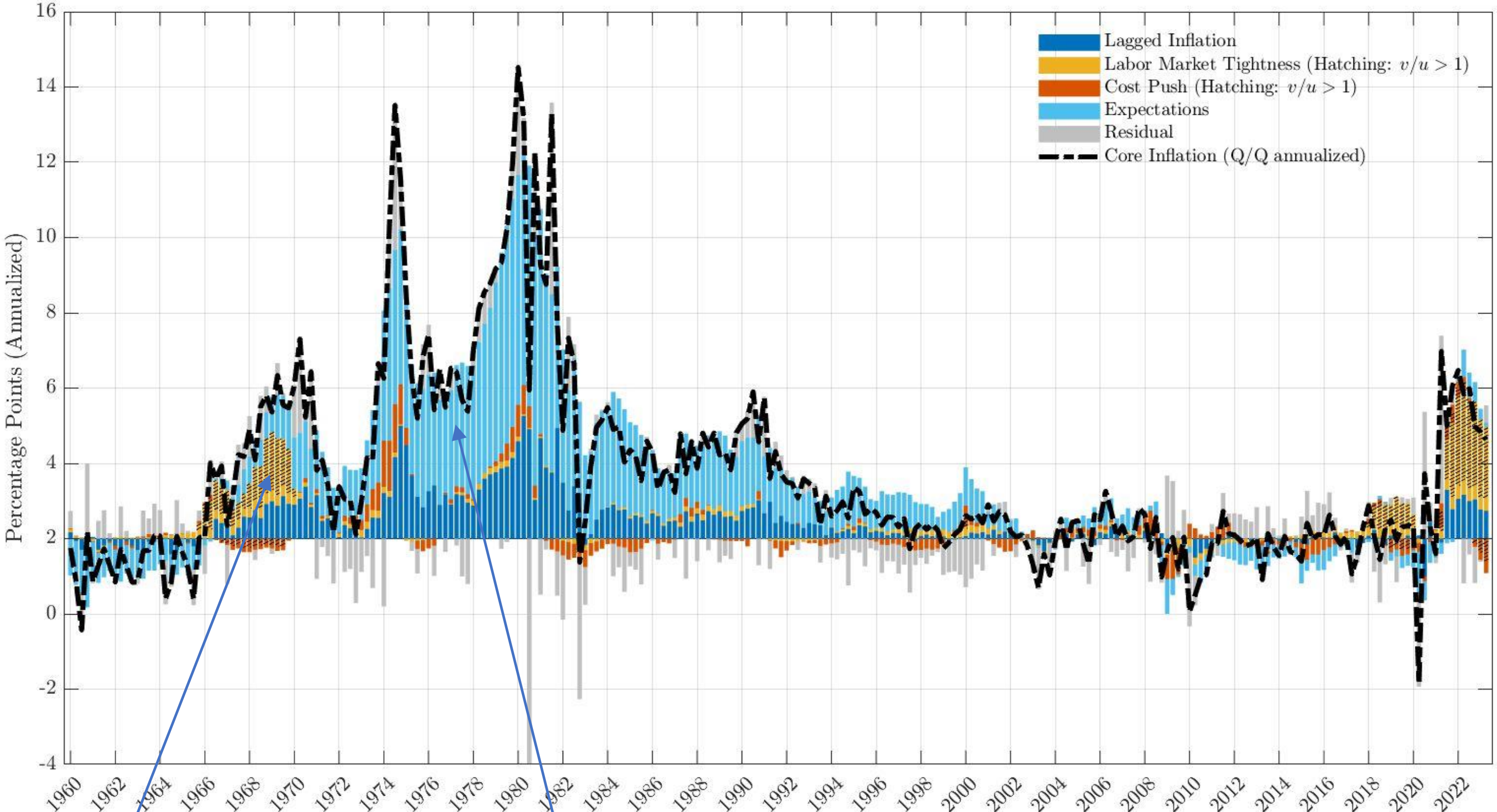
Because this was the standard measure of supply shocks people created ex ante -- ***before*** -- the surge.

There is a myriad of ***EX POST*** measures of supply shocks that "explain" the run-up as justification for why the inflation surge was out of the control of the Fed.

Regression Decomposition



The 1970’s: Expectations did it!



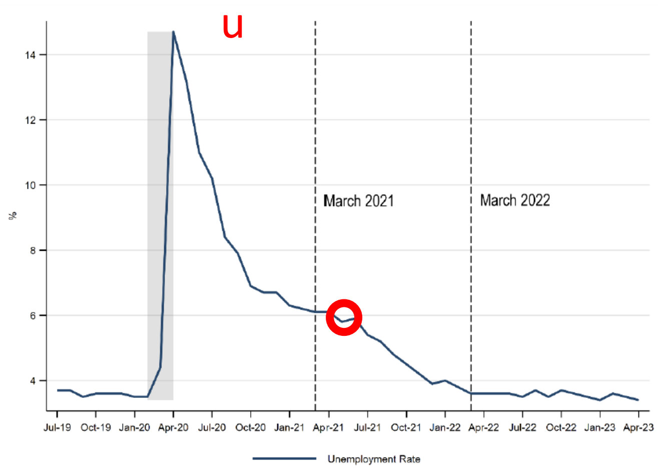
Labor tightness
AND beginning of
unanchoring of expectations

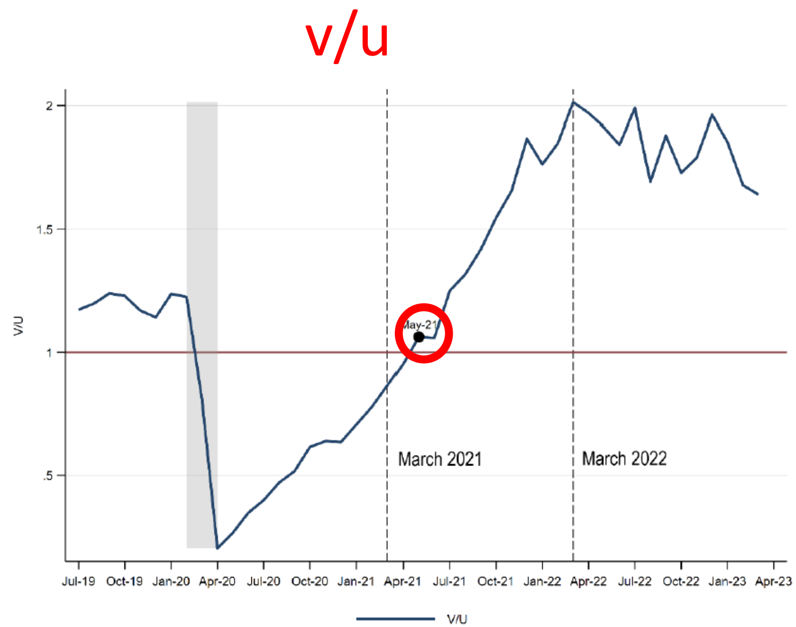
Unanchored Expectations

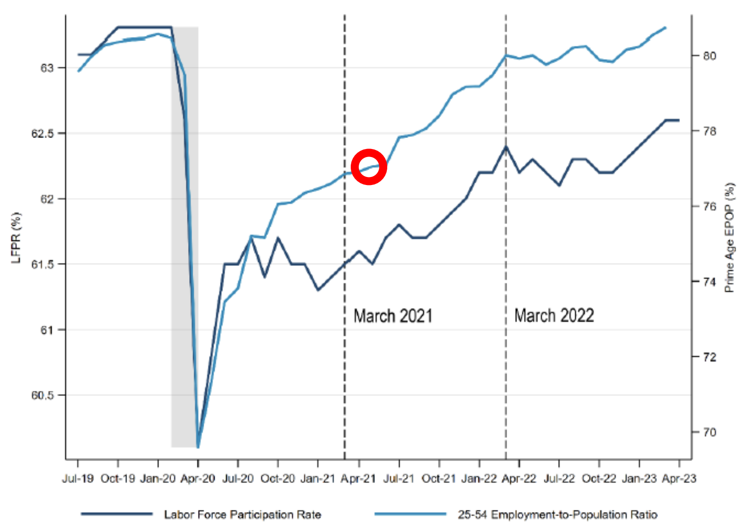
Other

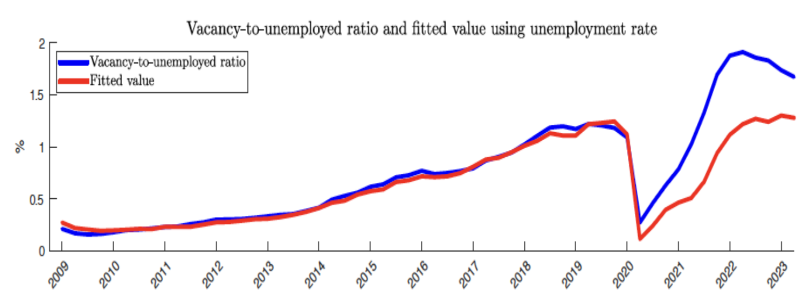
- All coefficient time varying: Estimate using Kalman Filter with time varying coefficients/
  - →Results have similar flavor (weight on v/u increases, and supply shocks)
- 10 tables with robustness variation
- Can do infinite variations.
- Can we do sector Phillips Curves:
- Key challenge: What is a reasonable sectoral measure of θ?
  - Need an explicit model of sector heterogeneity and cost of moving from one sector to another (theory is not there yet)

Importance of v/u

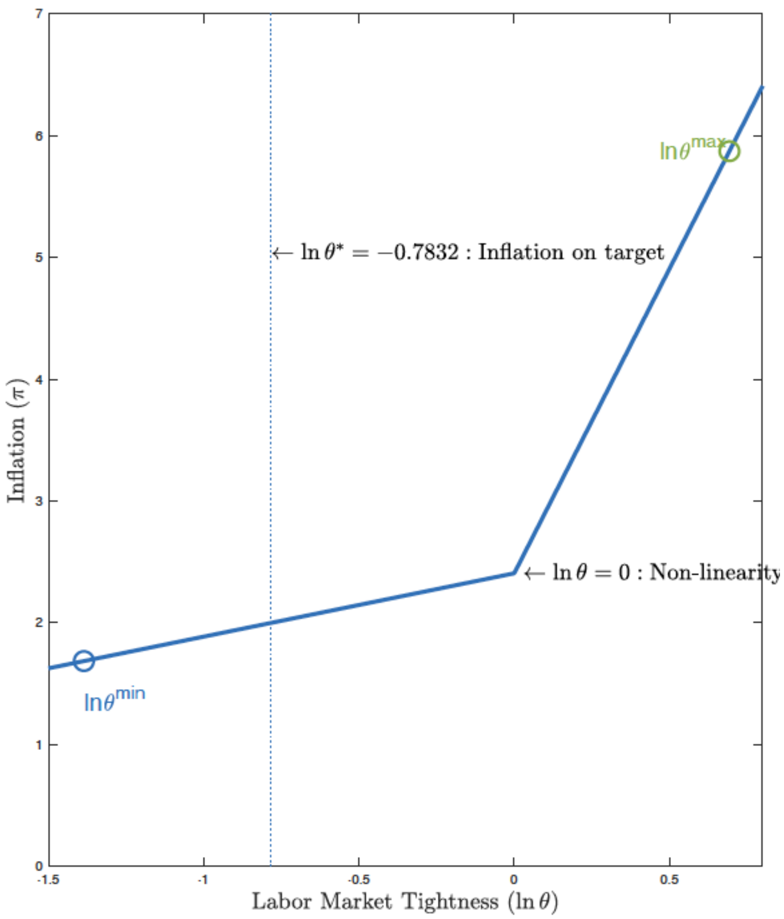








Model: Bottom-line



Going from $\theta = 0.456$ consistent with 2 percent target to $\theta = 1$ generates only 2.4 percent inflation.

Going from from θ=1 to 2 generates 5.8 percent inflation

$$\pi_t = \begin{cases} \kappa^{tight}\hat{\theta}_t + \kappa_\varrho^{tight}\hat{\varrho}_t^{tight} + \beta E_t \pi_{t+1} \\ \\ \kappa_w \hat{w}_{t-1} + \kappa\hat{\theta}_t + \kappa_\varrho \hat{\varrho}_t + \kappa_\beta E_t \pi_{t+1} \end{cases}$$

Model: Households

Household maximizes utility by choosing consumption (C) and labor **force participation** (F)

F_t

Attached to existing firms earning W_t^{ex}

Unattached to existing firms earning W_t^{new} if they find a job

1-s

s

Unattached to existing firms earning W_t^{new} if they find a job

$$M_t = m_t U_t^{\eta} V_t^{1-\eta}$$

Firms

$$y_t(i) = \left(\frac{p_t(i)}{P_t}\right)^{-\epsilon_t} Y_t$$

$$y_t(i) = A_t N_t(i)^{\alpha} O_t(i)^{1-\alpha}$$

Variable input (oil?) in elastic supply with an exogenous price q_t

$$E_t \sum_{T=t}^{\infty} Q_{t,T} \left\{ p_T(i) y_T(i) - W_T^{ex} N_T^{ex}(i) - \gamma_t^b W_T^{new} N_T^{new}(i) - P_t q_t O_t(i) - \frac{\varsigma}{2}\left(\frac{p_T(i)}{p_{T-1}(i)} - 1\right)^2 P_T Y_T \right\}$$

$$N_t^{ex}(i) \leq N_t^E$$

You can only retain as many existing workers as remain attached to your firm

Our Phillips Curve

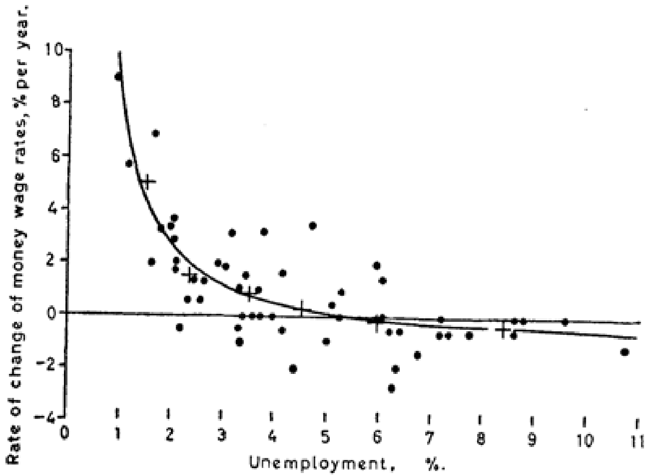
$$\pi_t = \kappa\alpha(\underbrace{\hat{\gamma}_t^b + \hat{w}_t^{new}}_{\text{Marginal Cost of Labor}}) + \kappa(\underbrace{\hat{\mu}_t - \hat{A}_t + (1-\alpha)\hat{q}_t}_{\text{Cost Push Shocks}}) + \beta E_t \pi_{t+1}$$

Key difference between this and the standard New Keynesian Phillips Curve

- Only the wages of NEW hires appear
- The parameter γ_t^b captures firm's hiring cost
- The non-linearity arise due to ***WAGE SETTING***.

Wage Setting: Phillips is back

- People are "reluctant to accept wages lower than the **existing wage**" -- which falls only slowly.
- People are always happy be paid more!



$$W_t^{new} = \max\{W_t{}^{ex}, P_t w_t^{flex}\}$$

Existing,Normal

Labor "shortage"

Yet if markets sufficiently tight "we should expect employers to bid up wages quite rapidly"

Modeling *flexible* wages

- A continuum of employment agencies that screen workers.
- Post vacancies as long as marginal cost exceed marginal benefits.
- If wages rigid, MB>MC, will elastically post how much workers are demanded by firms.

$$w_t^{flex} = \frac{\gamma_t^c}{\gamma_t^b} \frac{1}{m_t} \theta_t^{\eta}$$

Modeling existing wages

- Existing wage evolve with flexible wages acting as an *attracting force*.

$$W_t^{ex} = (W_{t-1}^{ex}(\Pi_{t+1}^e)^{\delta})^{\lambda}(P_t w_t^{flex})^{1-\lambda}\phi_t$$

$$w_t^{new} = \begin{cases} w_t^{flex} & \text{for } \theta_t > \theta_t^* \\ \left(w_{t-1}^{ex}\frac{(\Pi_{t+1}^e)^{\delta}}{\Pi_t}\right)^{\lambda}(w_t^{flex})^{1-\lambda}\phi_t & \text{for } \theta_t \leq \theta_t^*. \end{cases}$$

$$\theta_t^* = \frac{\gamma_t^b}{\gamma_t^c} m_t \left(w_{t-1}\frac{(\Pi_{t+1}^e)^{\delta}}{\Pi_t}\right)^{\frac{1}{\eta}}(\phi_t)^{\frac{1}{\lambda\eta}}$$

Phillips Curve with kink

Labor shortage

$$\pi_t = \kappa^{tight}\hat{\theta}_t + \kappa_{\varrho}^{tight}(\hat{v}_t + \hat{\vartheta}_t^{tight}) + \beta E_t \pi_{t+1}$$

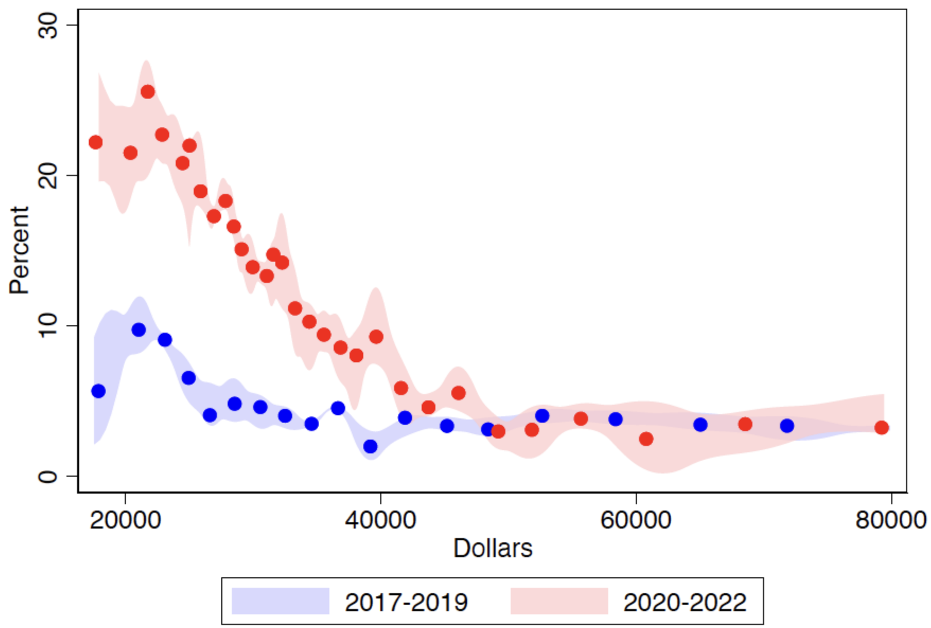
θ^*

Normal

$$\pi_t = \kappa_w \hat{w}_{t-1} + \kappa \underbrace{\hat{\theta}_t}_{\text{tightness}} + \kappa_{\varrho}(\underbrace{\hat{v}_t}_{\text{cost-push}} + \underbrace{\hat{\vartheta}_t}_{\text{matching}}) + \kappa_{\beta} E_t \pi_{t+1}$$

Mechanism: Inflation surge travels through wages of new hires AND supply shocks

2-Year Posted Wage Growth Before and After Pandemic



$$\pi_t = \kappa\alpha(\underbrace{\hat{\gamma}_t^b + \hat{w}_t^{new}}_{\text{Marginal Cost of Labor}}) + \kappa(\underbrace{\hat{\mu}_t - \hat{A}_t + (1-\alpha)\hat{q}_t}_{\text{Cost Push Shocks}}) + \beta E_t \pi_{t+1}$$

From Crump, Eusepi, Giannoni, Sahin (2023)

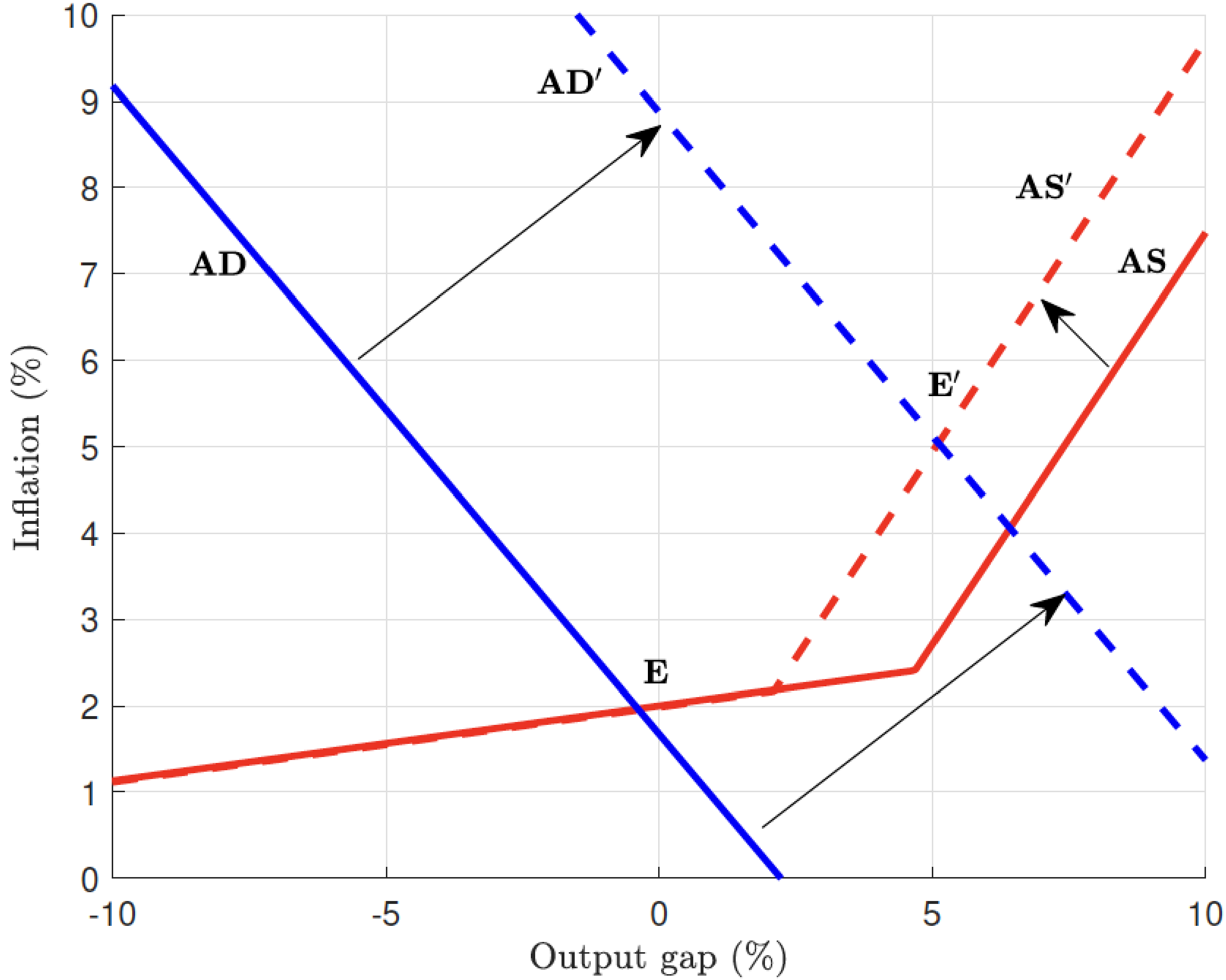
Figure 10. Posted Wage Growth Comparisons This figure presents nonparametric estimates of the conditional median function of two-year posted wage growth given initial wage level, based on data from Burning Glass Technologies. Posted wage growth is constructed by matching posted wages for the same job listings at two-year intervals. See Appendix for further details. The nonparametric curve estimates rely on Cattaneo et al. (2021b) and Cattaneo et al. (2021a). Shaded regions denote 95% confidence bands.

AS-AD with two state Markov

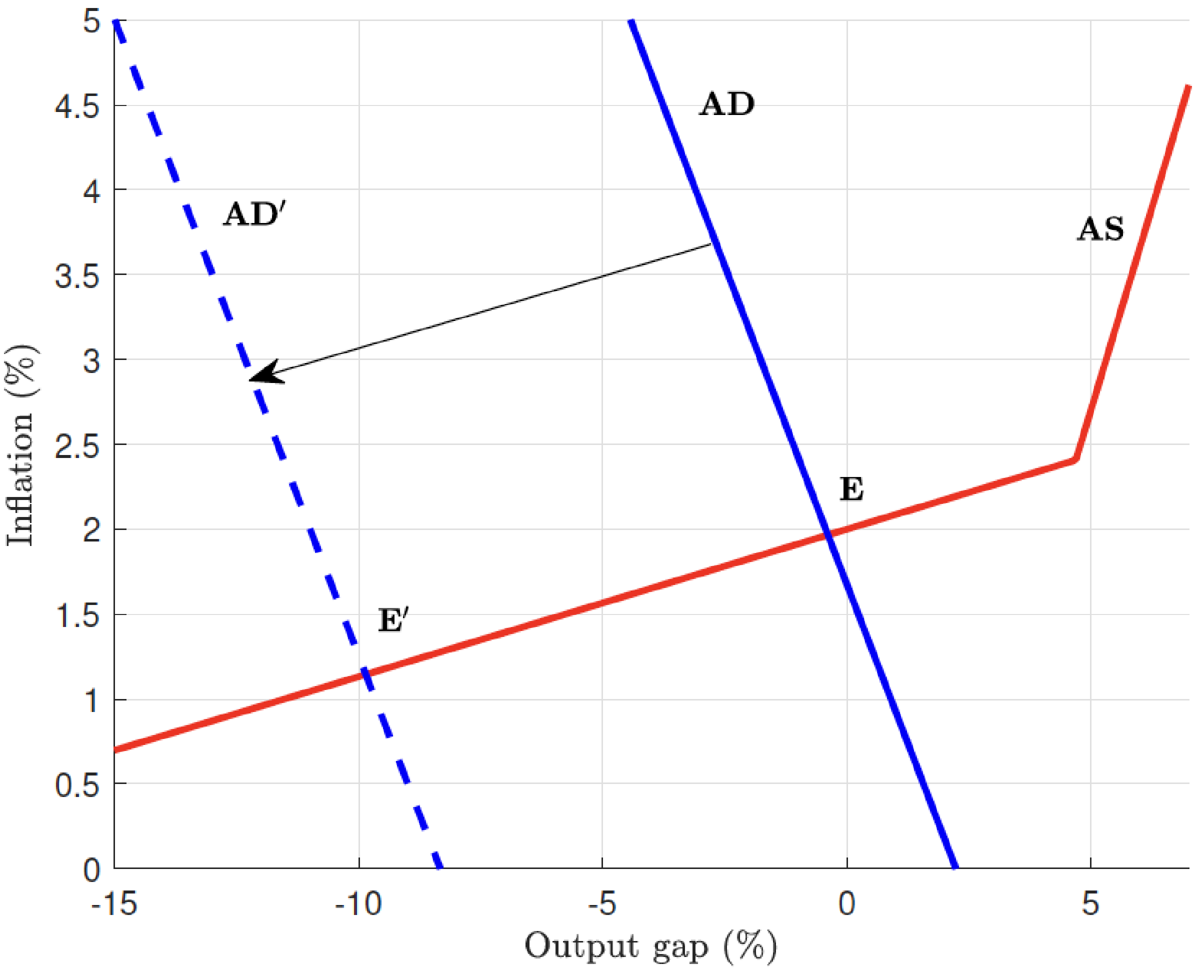
$$\hat{Y}_t - \hat{G}_t = E_t \hat{Y}_{t+1} - E_t \hat{G}_{t+1} - \sigma^{-1}(\hat{\imath}_t - E_t \pi_{t+1} - \hat{r}^e_t)$$

$$\pi_t = \begin{cases} \tilde{\kappa}^{tight}\left(\hat{Y}_t + \frac{\alpha}{\omega}\hat{\chi}_t\right) + \tilde{\kappa}_v^{tight}\hat{v}_t + \tilde{\kappa}_\beta^{tight} E_t \pi_{t+1} & \text{if } \hat{Y}_t > \hat{Y}_t^* \\ \\ \tilde{\kappa}\left(\hat{Y}_t + \frac{\alpha}{\omega}\hat{\chi}_t\right) + \tilde{\kappa}_v \hat{v}_t + \tilde{\kappa}_\beta E_t \pi_{t+1} & \text{if } \hat{Y}_t \leq \hat{Y}_t^*, \end{cases}$$

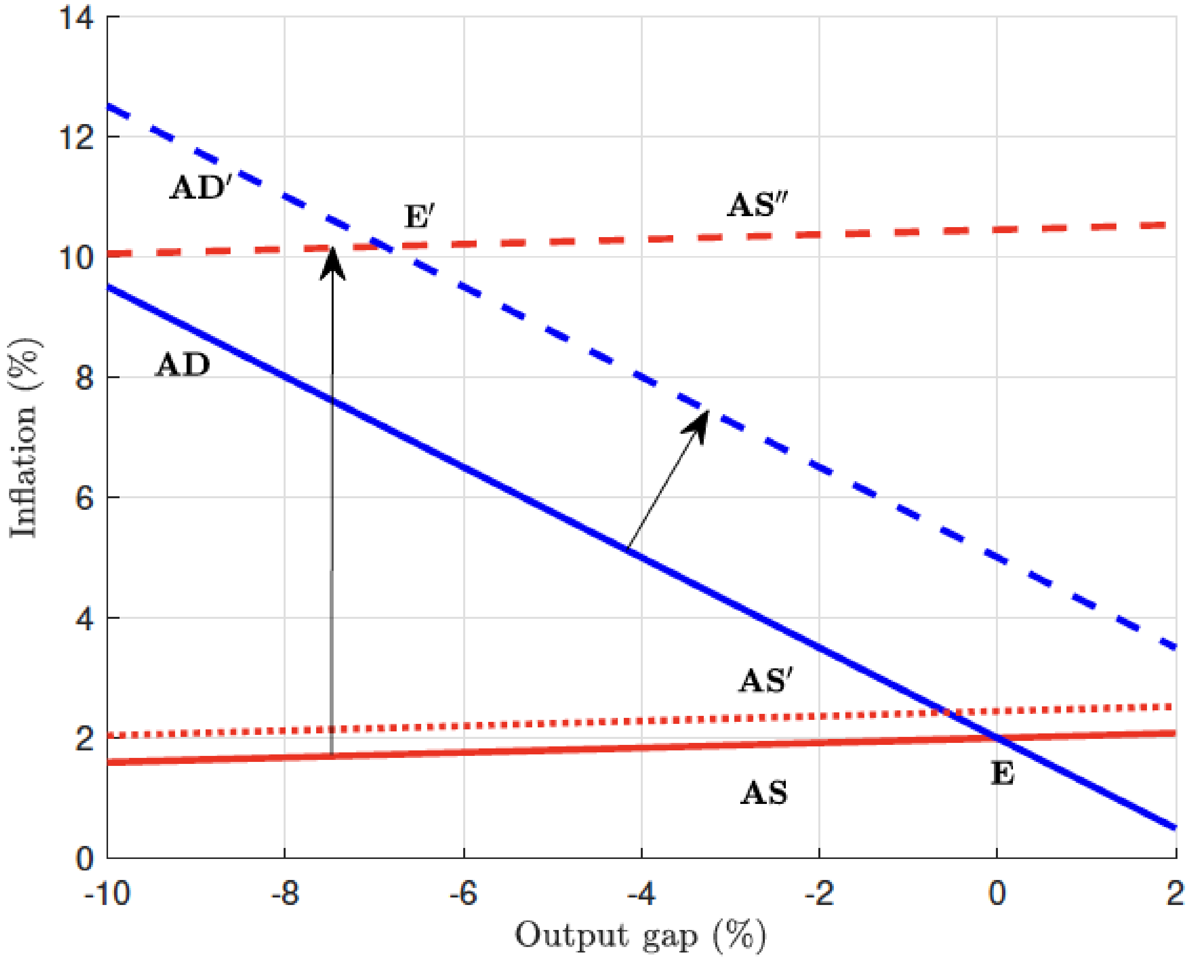
Today's inflation spike



Missing Deflation after 2008



The Great Inflation of the 1970's



Implications for policy

- Easy up – easy down
- Provided the Fed does not overtighten, a key prediction is a “soft landing”.
- Does not suggest that the Fed should not tighten.
- Instead: Tightening does and falling inflation does not need to lead to sharp reduction in output or increase in output (just fall in vacancies).

Conclusion

- New Framework to understand inflation spike replacing the NK Phillips Curve with the INV-L NK Phillips Curve with θ_t

- Some suggestive evidence

- Interesting Policy Implications