What caused the U.S. pandemic-era inflation?

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The focus of this paper on the United States.
Ben and I are currently working on applications to other countries with BOE, BOJ, and ECB teams.

(PSE-CEPR conference, June 2023)

The theme.

Major fiscal packages

2020: CARES act (March) 2.2 tr. Covid package (December): 0.9 tr

2021 American Rescue Plan (March) 1.9 tr

Two views at the time, both focused on labor market.

Optimists: Phillips curve flat, expectations anchored.

Pessimists: Given size of package, Phillips curve may steepen, expectations may deanchor.

The outcome: Both views were partly wrong. There was inflation but:

Action came from goods market: commodity prices, other price spikes

What we have experienced

Headline inflation been dominated by price shocks.

Behind the scene, overheating has led to a sustained increase in wage/price inflation

As price shocks recede, headline inflation will decrease (has decreased)

Dynamic effects of overheating in labor market will become dominant

Probably require a substantial decrease in v/u. Implications for u?

The approach.

A simple analytical model. (old fashioned. very much in the Tobin tradition)

- Wage equation, reflecting labor market state, expectations, catch up effects
- Price equation, reflecting cost/profit shocks
- Short and long run inflation expectations

Estimation of the model on pre-covid sample. Same specification, more generous lag structure.

- Conclusions:
- Given labor market state and price shocks, pre-covid relations have held up well
- Little evidence of catch up or deanchoring

Implications, looking at impulse response functions and shock decompositions:

- Strong but short-lived effects of price shocks.
- Sustained direct and indirect effects of overheating
- Increasing role over time of the second relative to the first.

The model

The wage equation

$w = p^e + \omega^a + \beta x$ ω^a aspiration wage. x: labor market variable

$\omega^a = \alpha\, \omega^a(-1) + (1-\alpha)(w(-1)-p(-1)) + z_{w;}$ α catchup coefficient >0: α limited catchup

So: $w-w(-1) = (p^e - p(-1)) + \alpha\,(p(-1)- p^e(-1)) + \beta\,(x - \alpha\, x(-1)) + z_{w;}$

The price equation

$p = w + z_p$ z_p price shock: e.g. energy price/wage or shortage price spike

$p - p(-1) = w-w(-1) + (z_p - z_p(-1))$

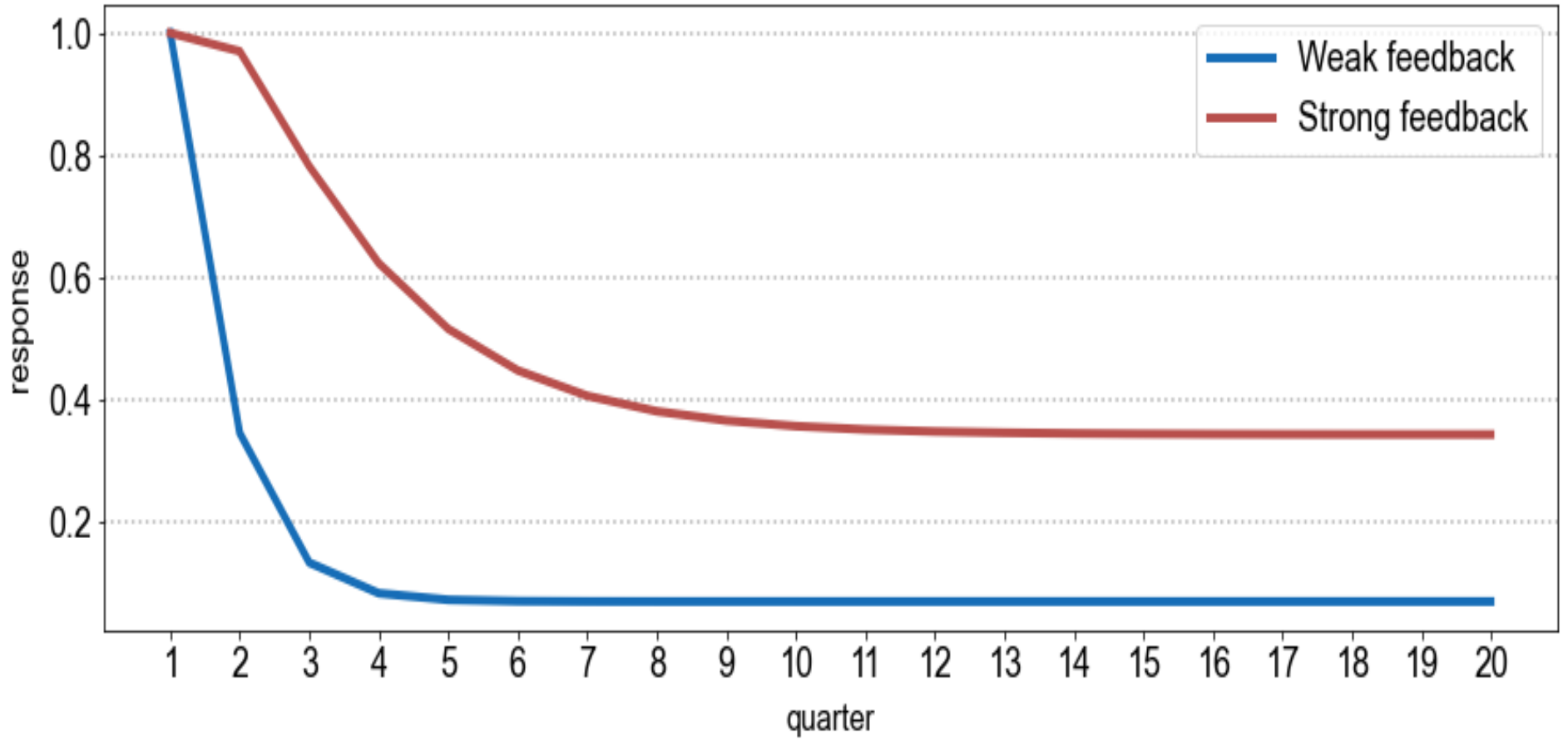
Short run expectation equation

$(p^e - p(-1)) = \delta\, \pi^* + (1-\delta)\,(p(-1)-p(-2))$ π^* long run inflation expectation
δ degree of anchoring of short run expectations

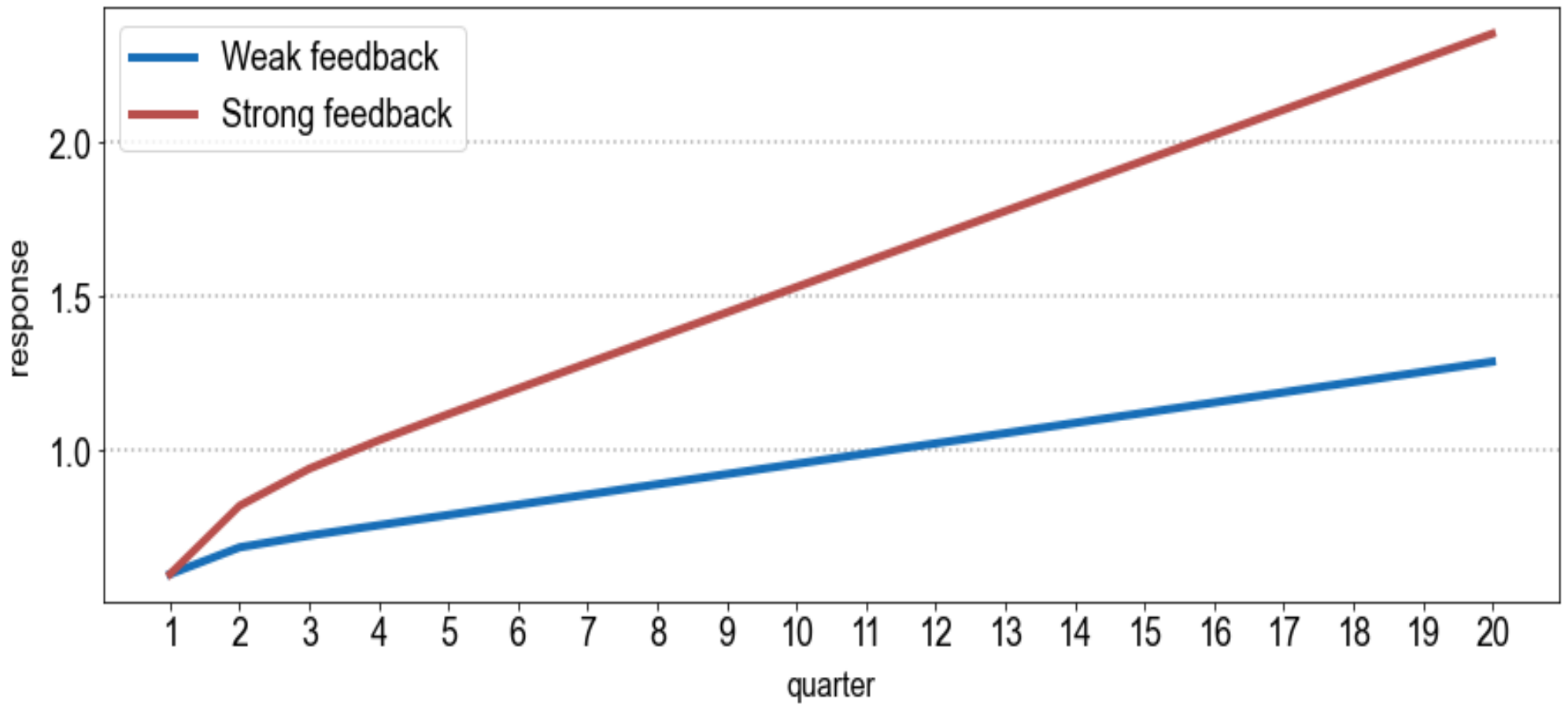
Long run expectation equation

$\pi^* = \gamma\, \pi^*(-1) + (1-\gamma)\,(p(-1)-p(-2))$ γ degree of anchoring of long run expectations

Effect of a permanent increase in zp. (one time rate of change in zp)



Effect of a permanent increase in x.



The empirical model.

Estimate the four equations, using quarterly data, allowing for 4 lags of all included variables.

Identification: Wage inflation responds only to lagged variables.

Sample. 1990: 1 to 2019:4 (except for price equation: full sample. Explained later)

Main variables

Price level: CPI (parallel estimation with PCE)

Wage variable. Employment Cost Index

Expectations: Cleveland Fed measure 1year, 10-year. (parallel estimation with SPF)

Price shocks. CPI energy component, CPI food component.

"Shortage" (from Google trends. Explained later)

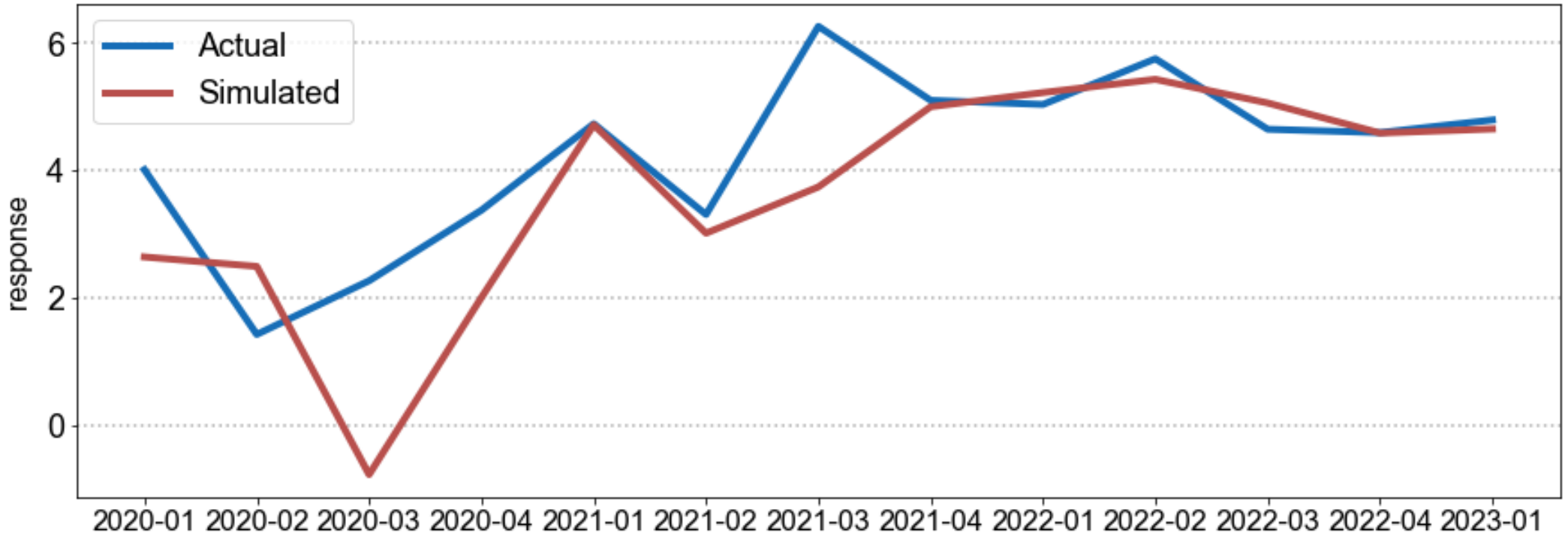
Labor market variable. v/u rather than u. Why?

(Productivity growth. 8-quarter moving average)

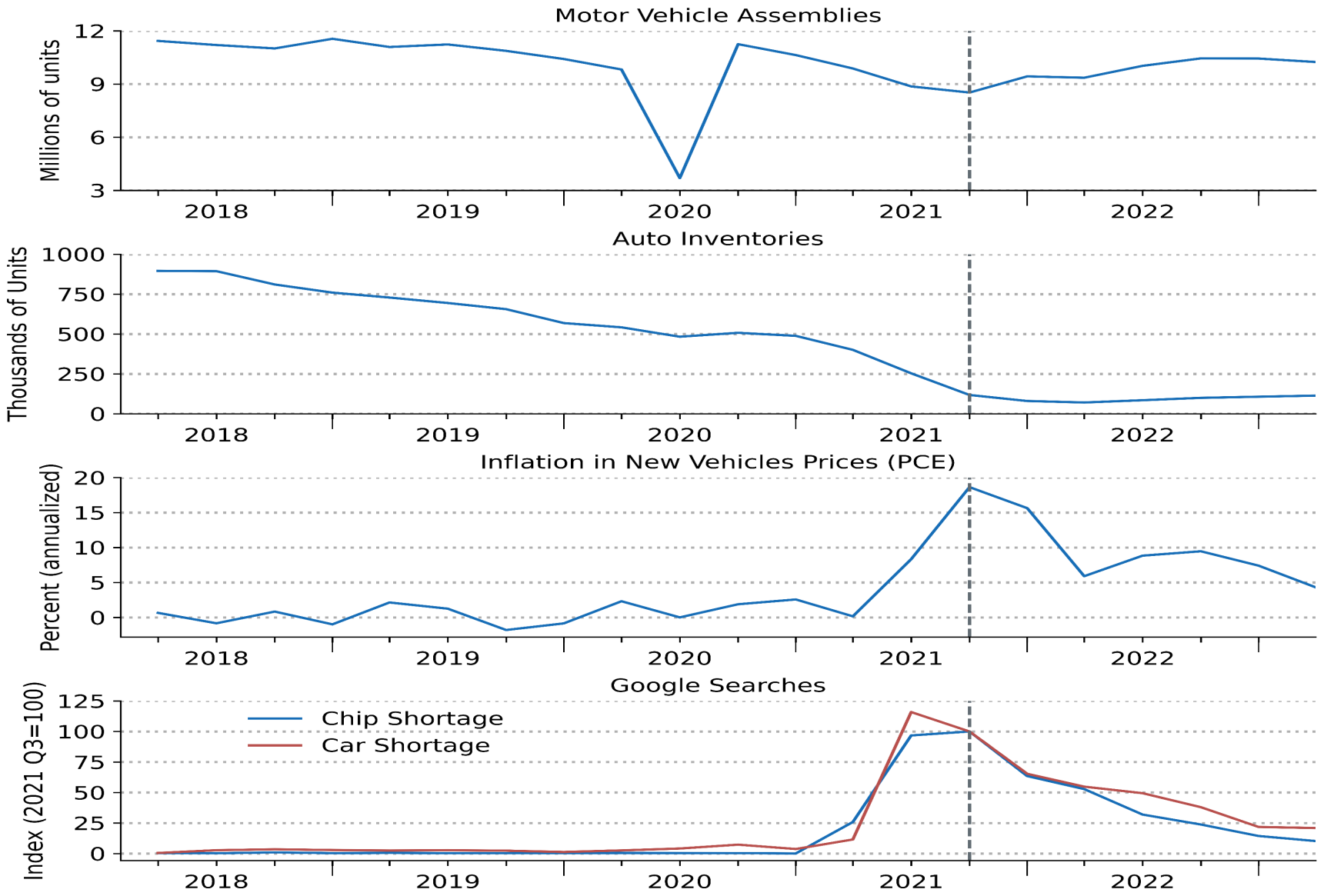
Homogeneity restriction imposed (but easily accepted by the data), implying no long run trade off.

Wage equation. Regression results, actual and predicted values post 2020:1

Independent variable	gw	v/u	catch-up	cf1	gpty
Lags	-1 to -4	-1 to -4	-1 to -4	-1 to -4	-1
Sum of coefficients	0.460	0.693	-0.024	0.540	0.031
p-stat (sum)	0.008	0.030	0.765	0.002	0.608
p-stat (joint)	0.071	0.023	0.994	0.022	0.608
R-squared	0.583				
No. observations	120				

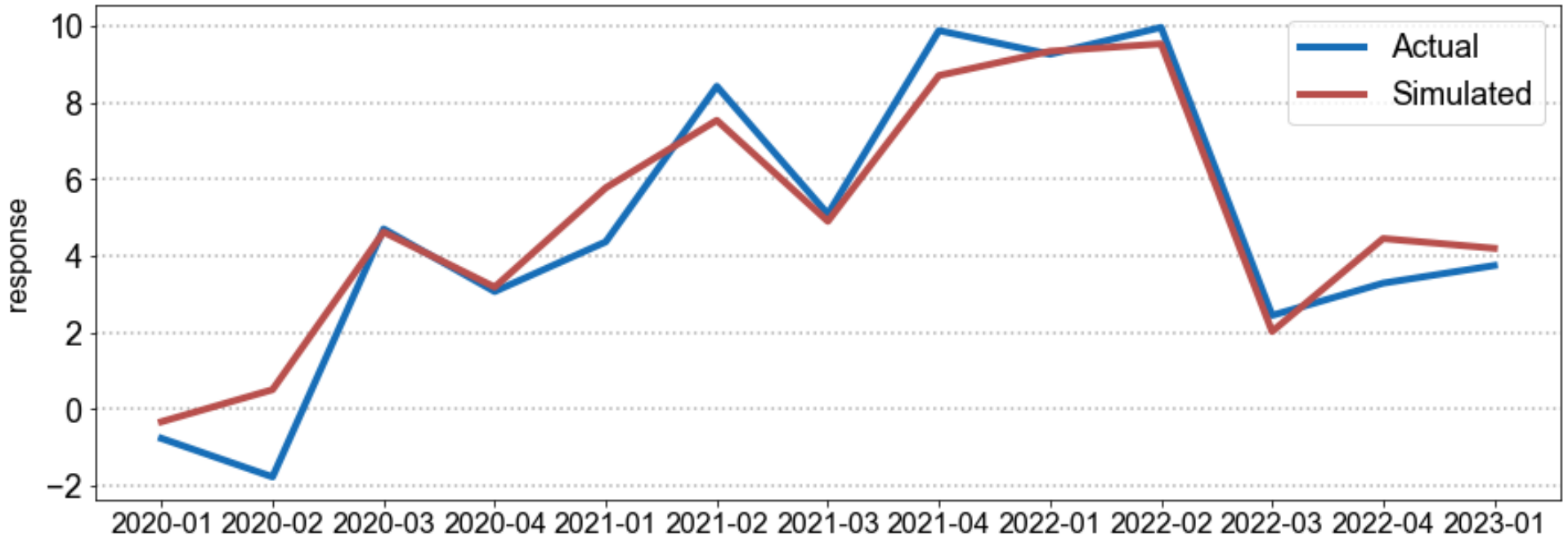


The role of shortages and price spikes. Car industry

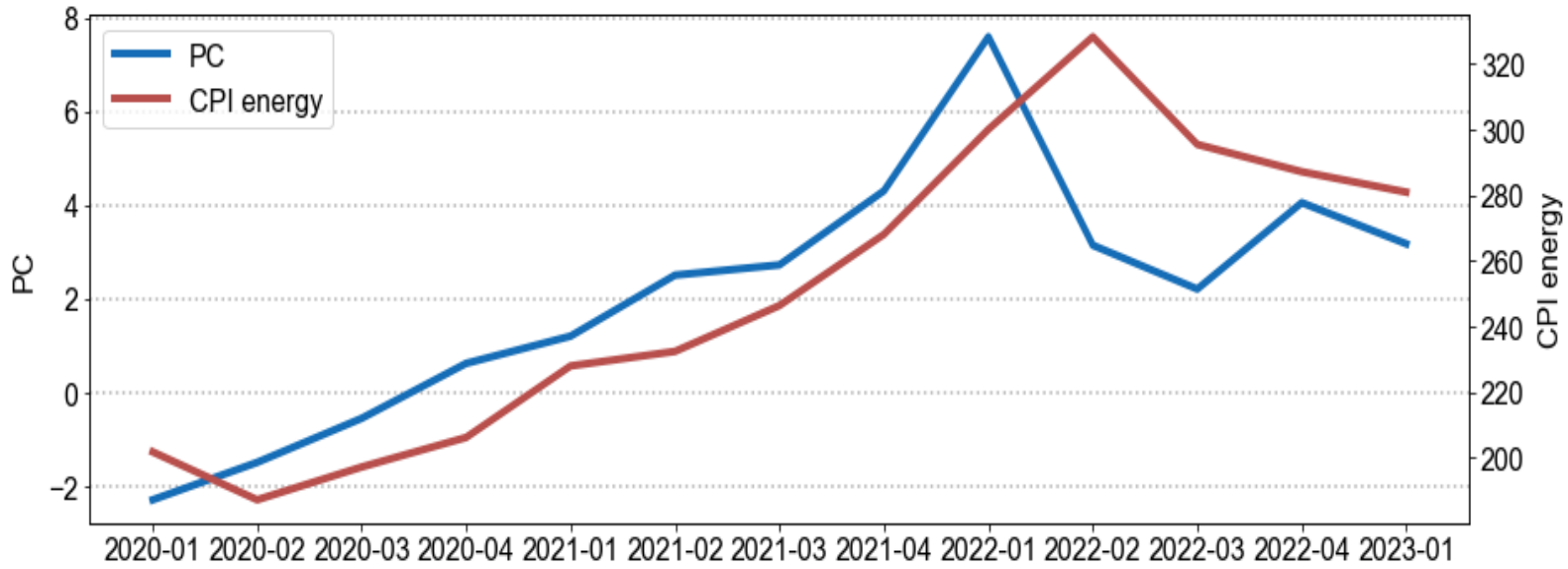


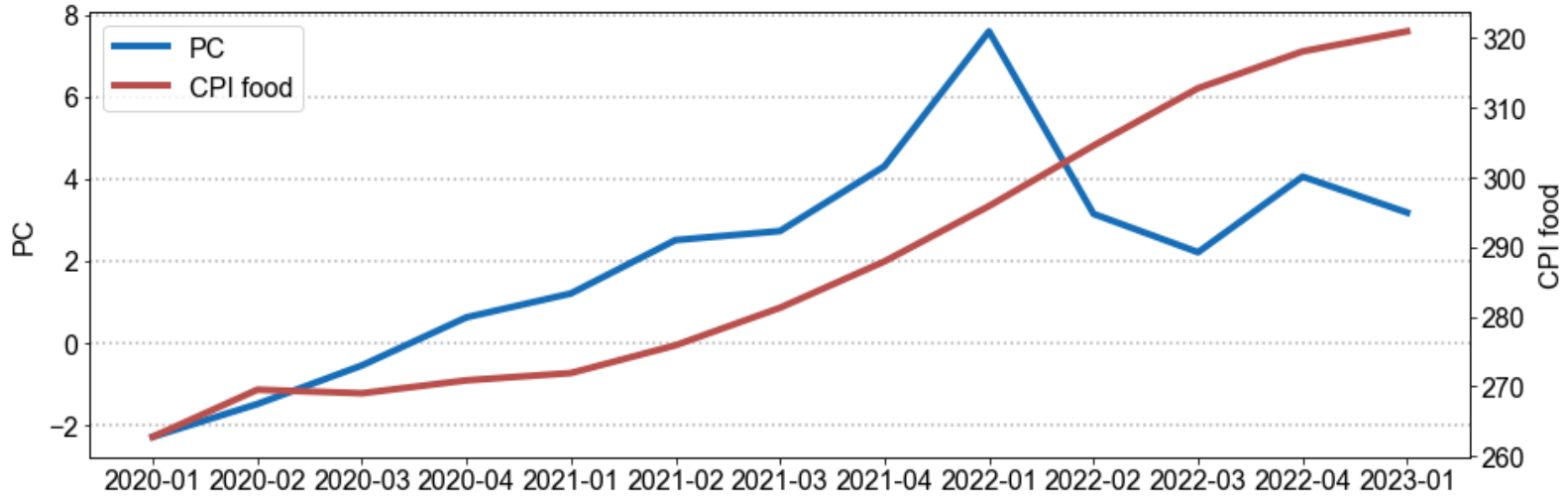
Price equation. Regression results, actual and predicted values post 2020:1

Independent variable	gp	gw	grpe	grpf	shortage	gpty
Lags	-1 to -4	0 to -4	0 to -4	0 to -4	0 to -4	-1
Sum of coefficients	0.335	0. 665	0.066	0.126	0.018	-0.143
p-stat (sum)	0.037	0.000	0.000	0.050	0.281	0.026
p-stat (joint)	0.066	0.000	0.000	0.050	0.000	0.026
R-squared	0.947					
No. observations	133					



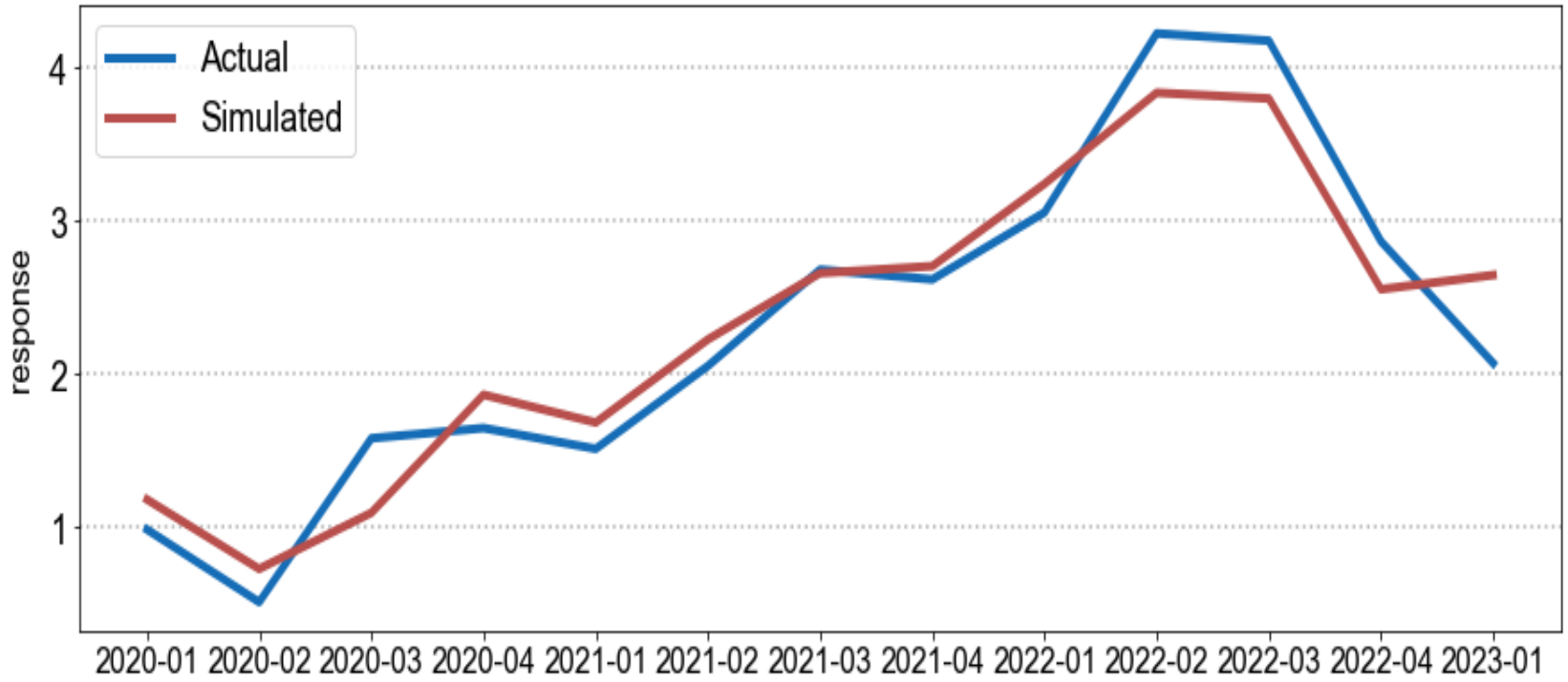
Commodity prices: Coincidence or aggregate demand?





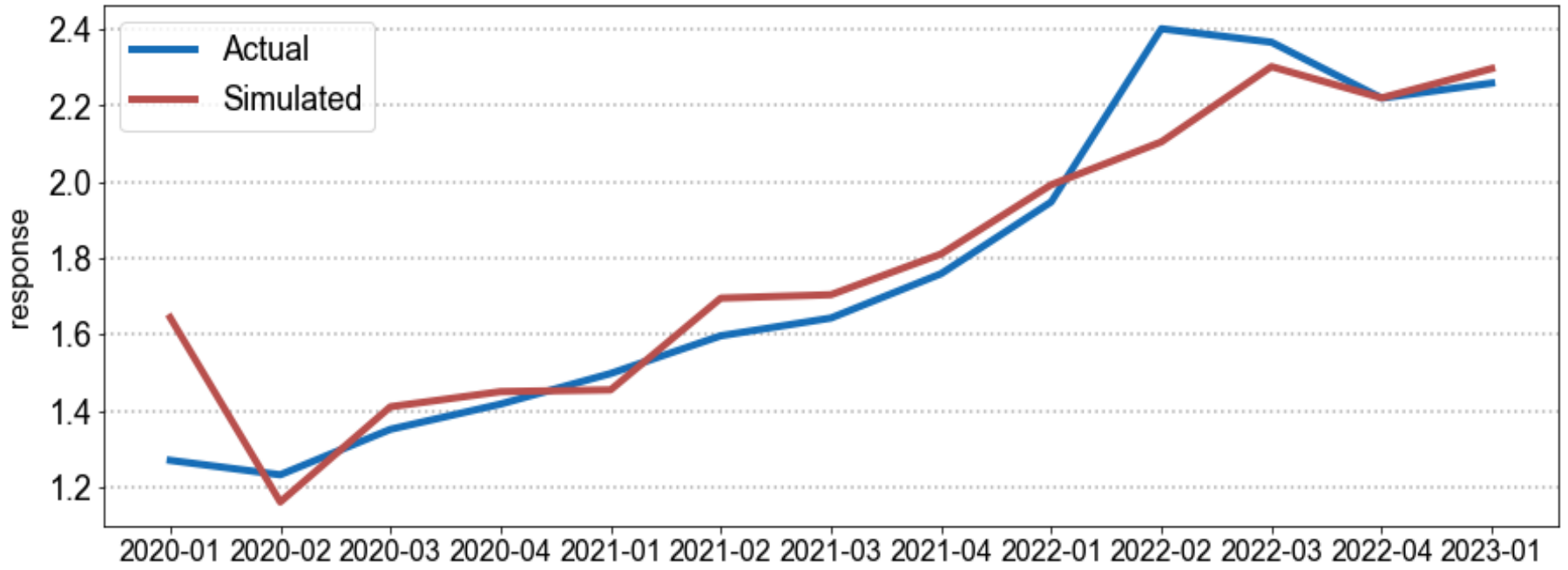
Short run expectations. Regression results, actual and predicted values post 2020:1

Independent variable	cf1	cf10	gp
Lags	-1 to -4	0 to -4	0 to -4
Sum of coefficients	0.369	0.506	**0.124**
p-stat (sum)	0.014	0.000	0.001
p-stat (joint)	0.001	0.000	0.000
R-squared	0.910		
No. observations	120		



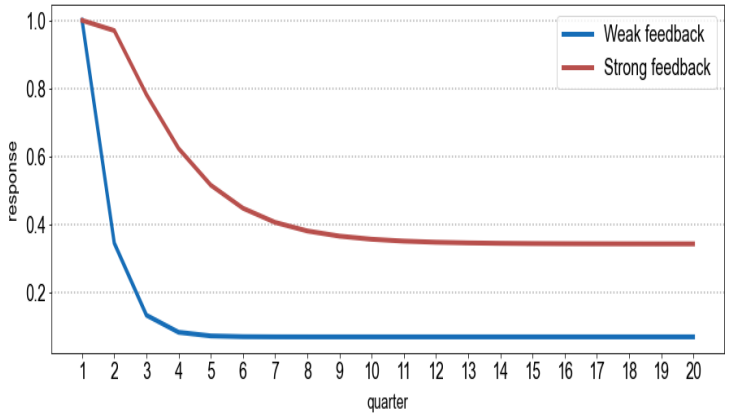
Long run expectations. Regression results, actual and predicted values post 2020:1

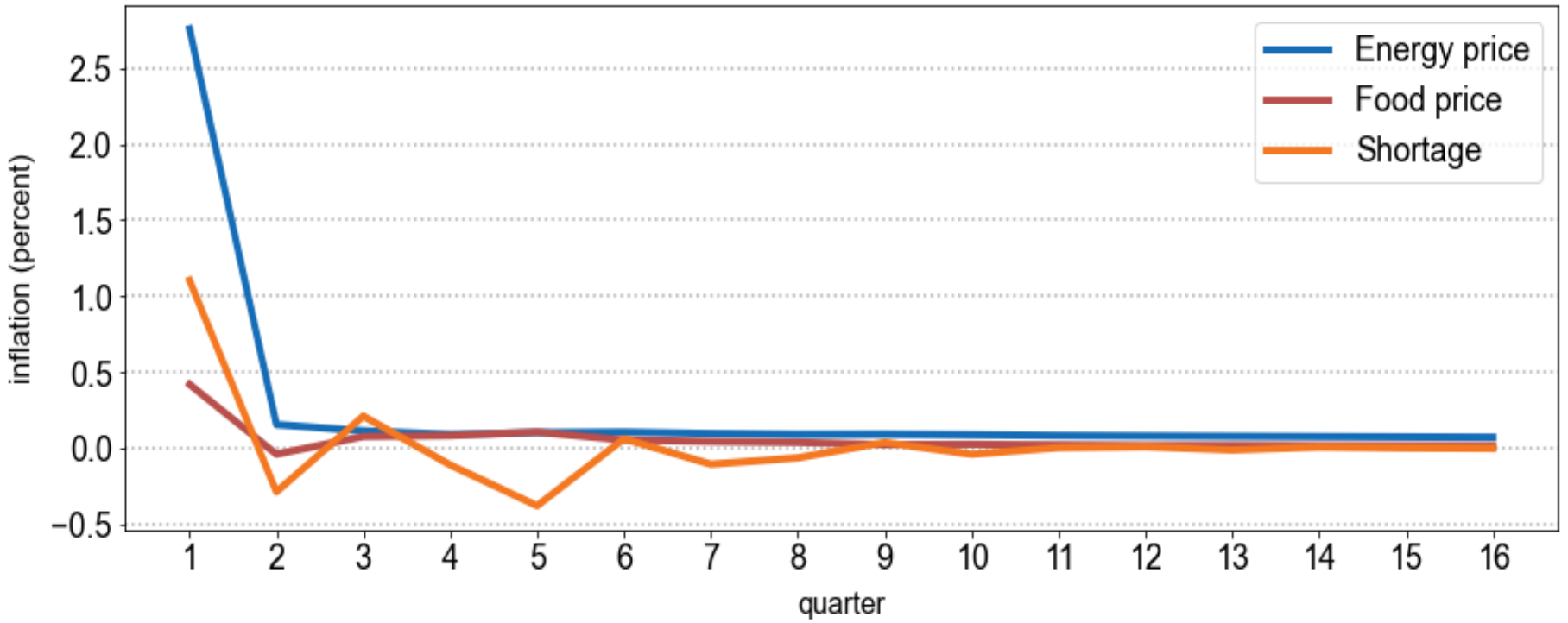
Independent variable	cf10	gp
Lags	-1 to -4	0 to -4
Sum of coefficients	0.975	**0.025**
p-stat (sum)	0.000	0.208
p-stat (joint)	0.000	0.004
R-squared	0.936	
No. observations	120	



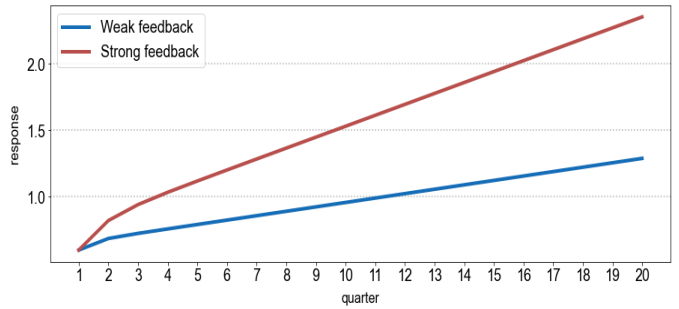
Empirical impulse responses of inflation to a 1 sd price shocks

Small second round effects

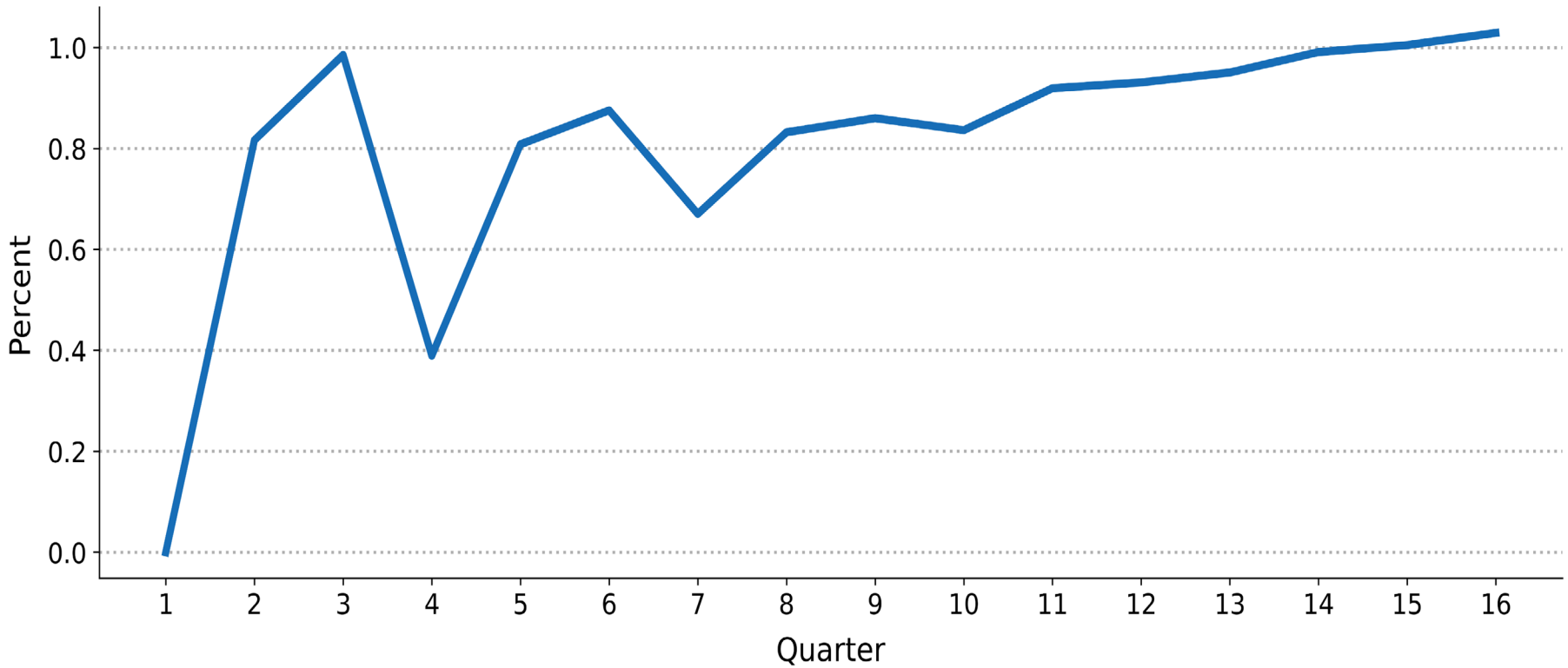




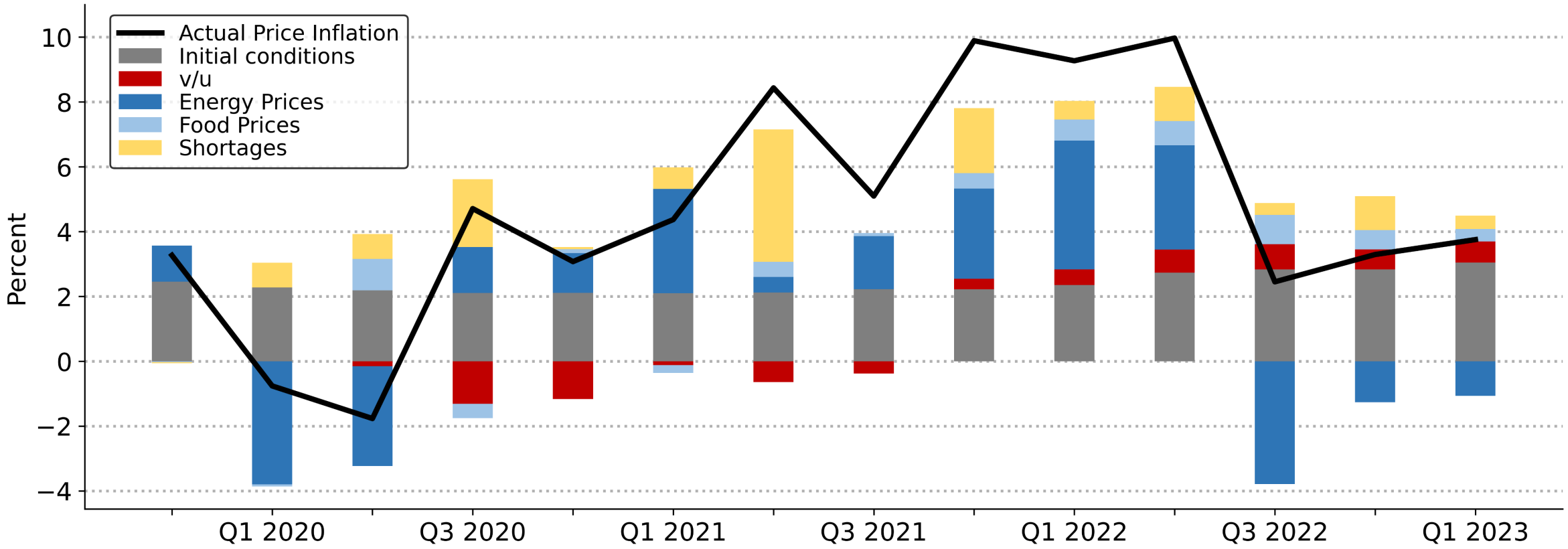
Empirical impulse responses of inflation to a 1 sd permanent increase in v/u



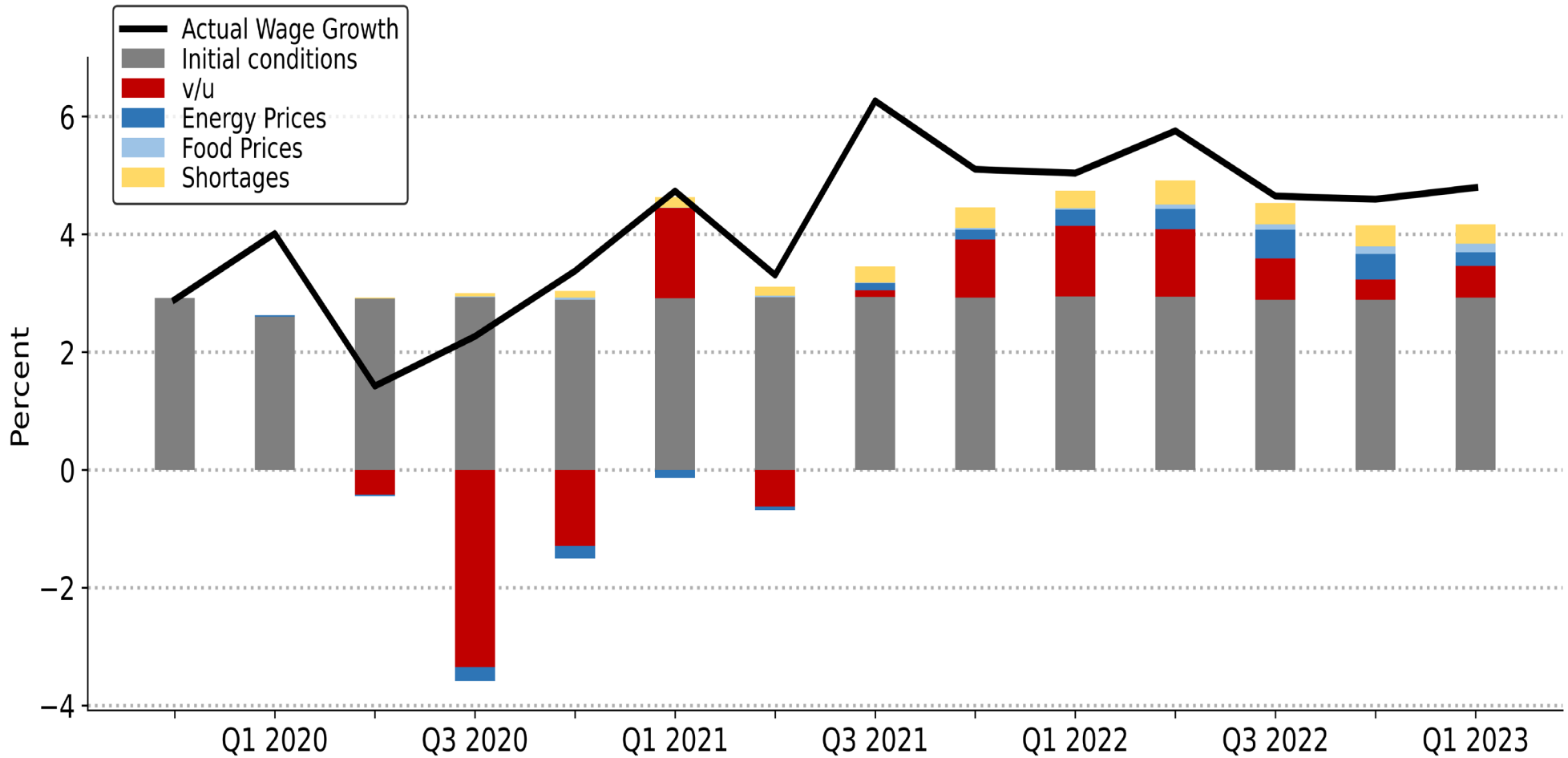
Effects build up but build up slowly.



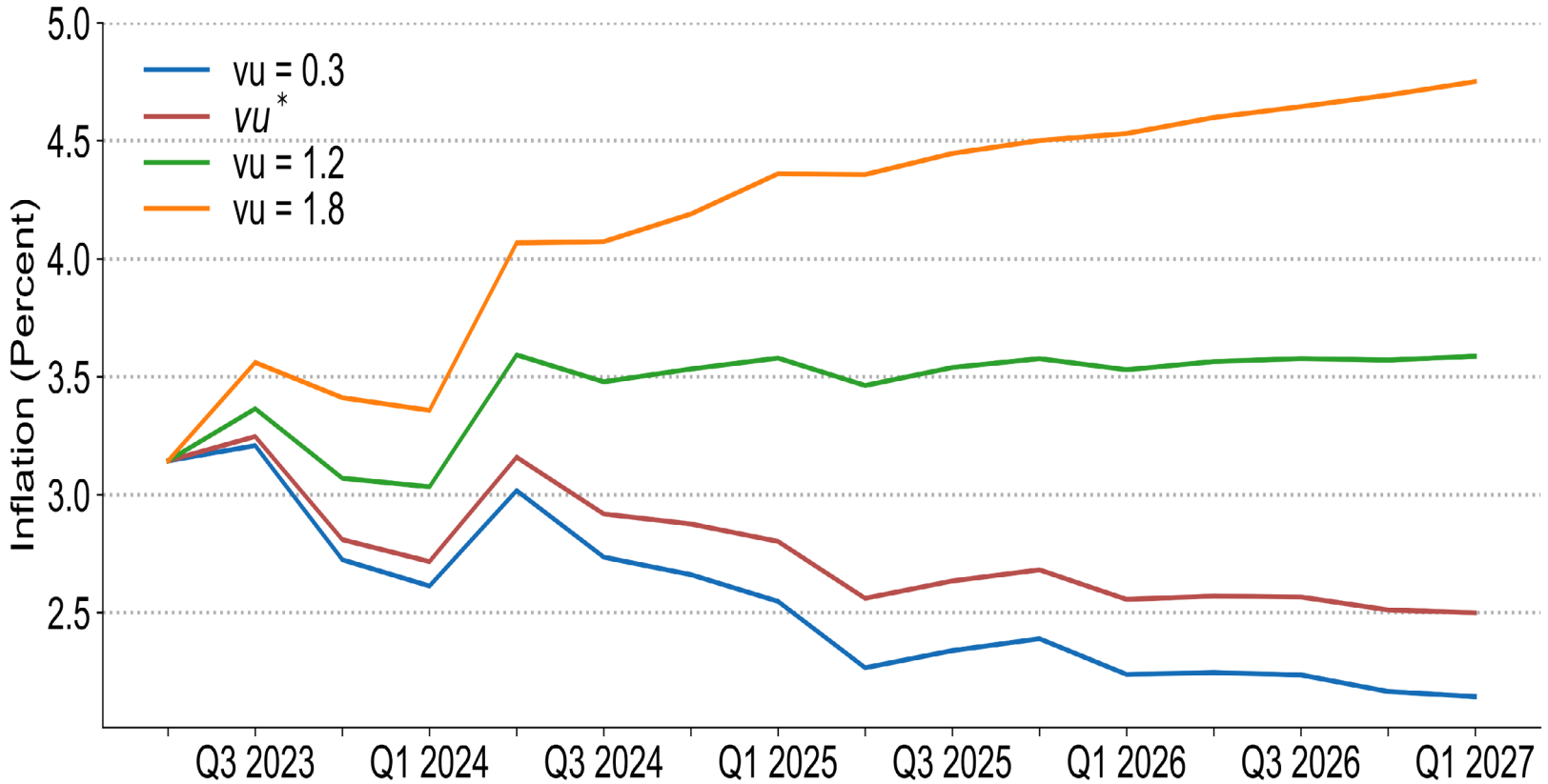
The decomposition of price inflation post 2020:1



The decomposition of wage inflation post 2020:1



Model projections under alternative paths for the ratio of vacancies to unemployment



A first pass at UK and Euro Area results

Common results:

- Most of the action in the price equation
- Slow building of pressure in labor market. Increase in v/u, although less than in the US.
- Expectations, short and long-run surprisingly anchored. No evidence of catchup.
- So same implications: Once price shocks fade, wage and price inflation still too high.

Differences. Specification

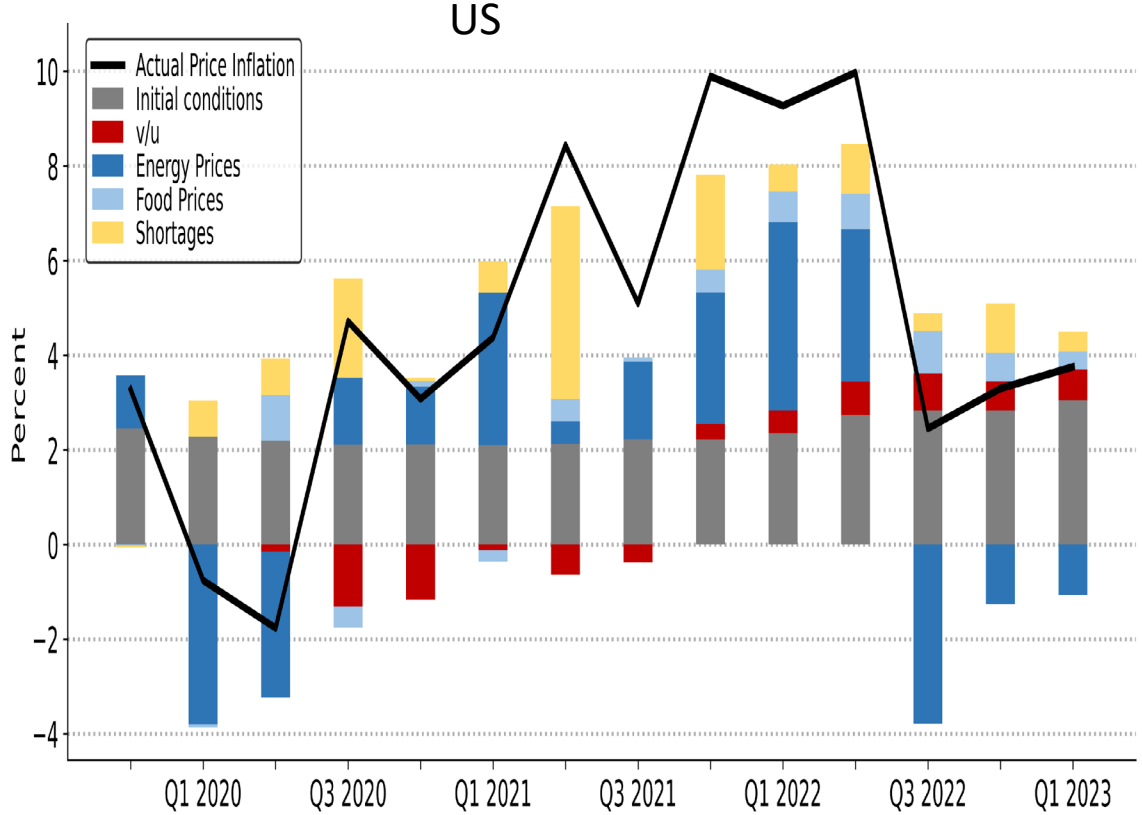
- Wage equation does not work well in EA. Need to explore alternative specifications.
- Price equations work well. Significant effects of shortages.
- Expectation equations extremely similar.

Differences. Shocks.

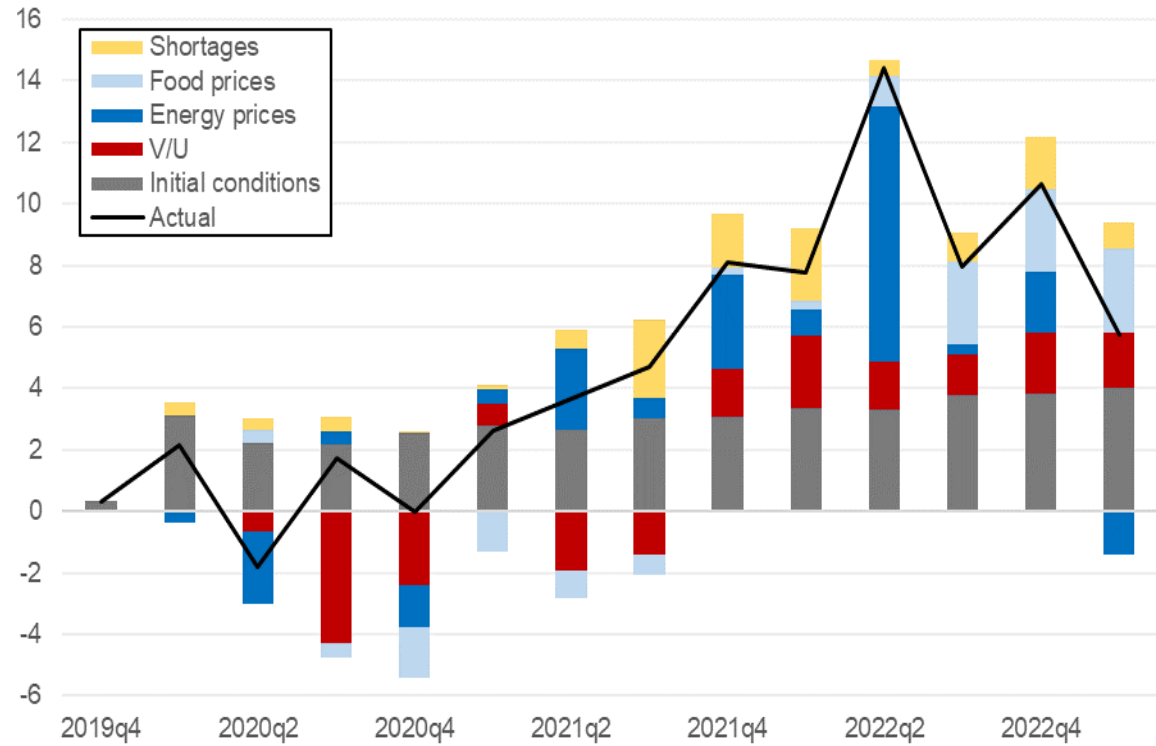
- Larger food and energy shocks. Not surprising, given Ukraine.
- Surprisingly large estimated effect of shortages in EA.

The decomposition of price inflation post 2020:1. US versus UK

US



UK



Conclusions

No need for a major revision of our understanding of inflation. The traditional wage-price analytical framework still works well.

The episode however has shown the complexity of the shocks, and the relevance of both the labor and the goods market in the determination of inflation.

Price shocks in the goods markets have dominated headline inflation, but with mostly short-lived effects. This is good news, in large part due to the anchoring of expectations, and credibility of the Fed.

Overheating in the labor market has played a minor role but an increasing one over time. As price shocks fade, it is likely to be the dominant factor, requiring a slowdown of the economy to return inflation to target.