

Inflation and the distribution of real resources

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Inequality and Big Challenges



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Disclaimer: The views expressed here are mine and not those of the Federal Reserve Bank of Minneapolis or the Federal Reserve Board

Background and questions

- ▷ After being stable and low for many years, in post COVID years inflation in many developed economies has spiked
- ▷ Inflation measures the rate of increase of the price of an average basket of goods and services consumed by households
- ▷ Question: how does these price changes affect the distribution of real resources across households? and what resources?

Channels

- ① Resources whose prices do not fully respond to general price increases lose value with inflation (Bonds, Equity, Wages, Mortgages)
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- ③ If prices of different goods and services increase at different rates inflation engenders a change in relative prices, which can induce behavior changes further affecting inequality
 - ▷ Example: if price of goods increase more than price of labor, inflation can induce workers to work less (or more)

Background literature and plan

- ▷ The empirical research on inflation/monetary policy and inequality is vast, and growing fast
 - ▷ **Monetary policy and inequality** Coibion et al. 2017, Holm et al. 2021, Amberg et al. 2022, **Andersen et al. 2023**, Mckay and Wolf 2023, Del Canto et al. 2025: identify monetary policy shock and trace effect on income/consumption distribution
 - ▷ **Inflation and wealth redistribution** Doepke and Schneider 2006
 - ▷ **Inflation and heterogeneity in consumption baskets** Broda and Romalis 2008, Kaplan and Schulhofer-Wohl 2017, Argente and Lee 2021, **Jaravel 2024**
 - ▷ **Monetary policy, inflation and labor markets** Faia et al. 2022, Cantore et al. 2023, Afrouzi et al. 2024, Graves et al. 2024, Guerreiro et al. 2024
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- ▷ Jaimovich, Perri and Vincent (2025):
 - ▷ focus on inflation shocks (as opposed to **monetary policy**)
 - ▷ focus on income (rather than **wealth** or **consumption**)
 - ▷ simple model of labor markets with sticky wages to understand impact of inflation on labor income (wages and employment) distribution

Monetary policy and income inequality

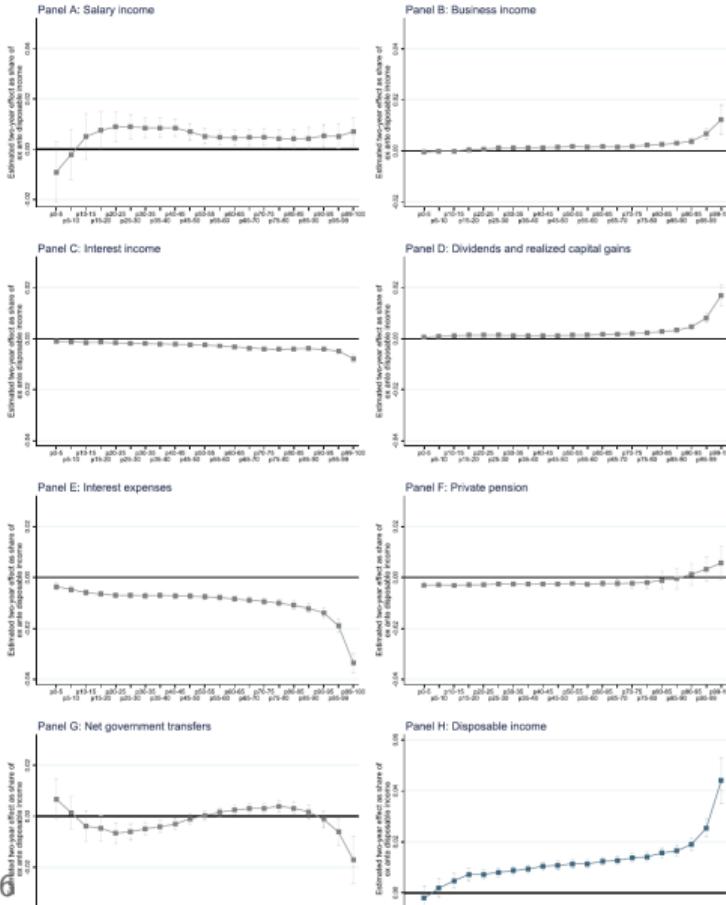
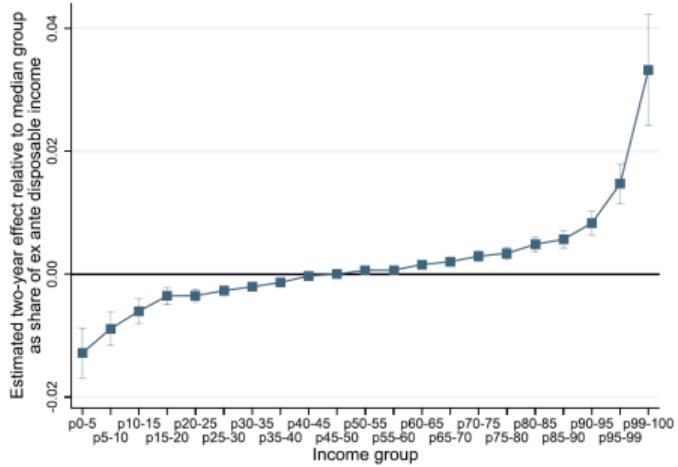
- ▷ *"Inflation is always and everywhere a monetary phenomenon"* (M. Friedman)
- ▷ So before inflation, one can ask what is the impact of a monetary policy change on the income distribution
- ▷ Key empirical challenge: monetary policy changes are endogenous, and respond to macro conditions
 - ▷ If inequality increases in recessions and the monetary authority lowers rate in recessions, one might find that low rates increase inequality but low rates are not the driver
- ▷ Solution: identify exogenous monetary policy *shocks* and measure the response of inequality to these

Monetary Policy and Inequality

Andersen, Johannessen, Jorgensen, and Peydro, Journal of Finance 2023

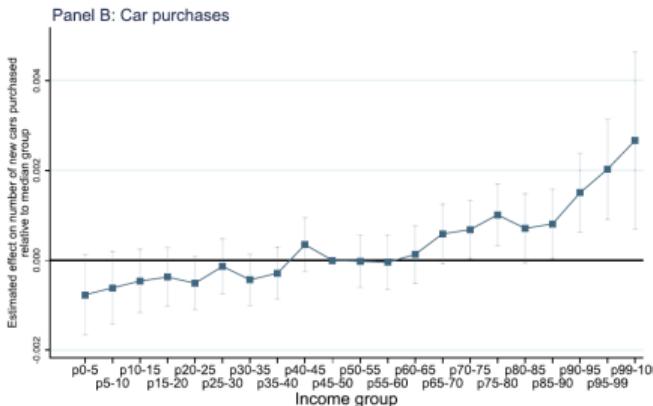
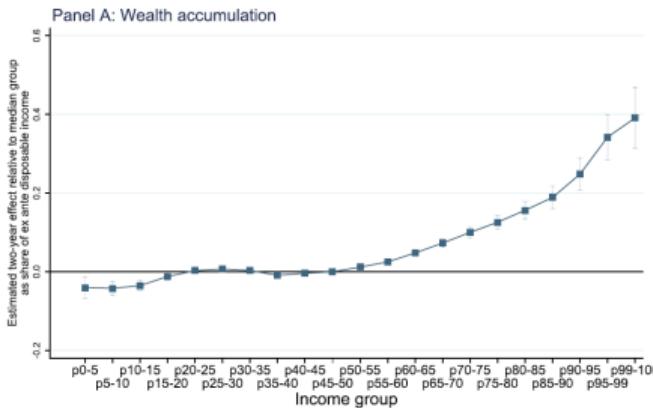
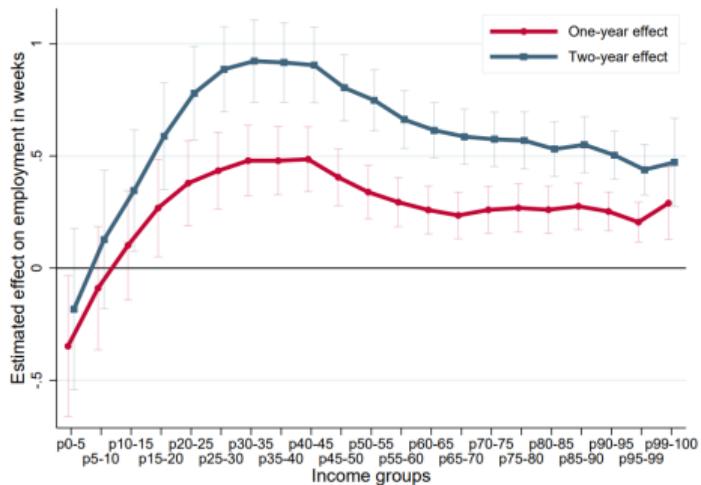
- ▷ Use universe of Danish individual data, 1987-2014
- ▷ Denmark is pegging to the Euro but does not decide Euro Monetary Policy
- ▷ Change in the Euro interest rate can be viewed as an exogenous shock to Danish macro conditions (with some caveat and controls)

Responses of income distribution to a 1% monetary easing shock



- ▷ Low rates increase disposable inequality!
- ▷ Low rates have large positive effect on net capital/business income which is concentrated at the top
- ▷ Positive effects on salary income but not at the very bottom

Responses of employment, wealth and expenditures to a 1% monetary easing shock



- ▷ Negative employment effect at the very bottom. Why?
- ▷ Large increase in wealth (40% of disp income) concentrated at the top of the income distribution, also reflected in higher consumption

Inflation and wealth inequality

- ▷ Now focusing strictly on inflation, the older but classic paper by Doepke and Schneider (JPE, 2006) documents how inflation affects inequality by changing the value of nominal assets and redistributing from nominal lenders to nominal borrowers
- ▷ How much inflation affect the wealth of a given group depends on the net amount of nominal assets held by that group and by assets duration (value of a n year nominal bond is scaled by $\frac{1}{(1+\pi)^n}$)
- ▷ DS consider an experiment in which inflation is at 5% for 10 years

Wealth changes following an inflation episode

- ▷ Across sectors (Flow of Funds)

WEALTH REDISTRIBUTION ACROSS SECTORS AFTER 5 PERCENT INFLATION EXPERIMENT

YEAR	ALL HOUSEHOLDS									
	GOVERNMENT		REST OF THE WORLD		Total		Losses		Gains	
	FS	IA	FS	IA	FS	IA	FS	IA	FS	IA
1989	+13.0	+5.2	-5.2	-3.2	-7.3	-2.2	-15.2	-5.7	+7.9	+3.5
2001	+10.8	+3.6	-7.7	-4.8	-1.2	+1.1	-8.2	-3.6	+7.0	+4.7

NOTE.—Gain or loss of each sector after a 5 percent inflation episode lasting 10 years as a percentage of U.S. GDP under two scenarios, full surprise (FS) and indexing ASAP (IA), and for two baseline years (start of the inflation episode), 1989 and 2001.

- ▷ Early on large transfers to government from households and foreigners. In more recent years mostly from foreigners

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▷ Within households (Survey of Consumer Finances)

1989 WEALTH REDISTRIBUTION ACROSS HOUSEHOLDS AFTER 5 PERCENT INFLATION EXPERIMENT RELATIVE TO AVERAGE NET WORTH IN EACH GROUP

AGE COHORT	POOR		MIDDLE CLASS		RICH	
	FS	IA	FS	IA	FS	IA
≤ 35	+14.4	+.2	+44.9	+18.9	+5.5	+2.1
36-45	+13.3	+4.0	+12.4	+5.8	-1.5	-.9
46-55	+2.2	+.6	+1.9	+1.4	-2.6	-1.6
56-65	-2.9	-.5	-5.5	-1.4	-6.4	-2.4
66-75	-6.9	-1.3	-9.9	-2.7	-6.6	-2.9
> 75	-10.4	-1.0	-15.0	-2.6	-10.8	-4.7

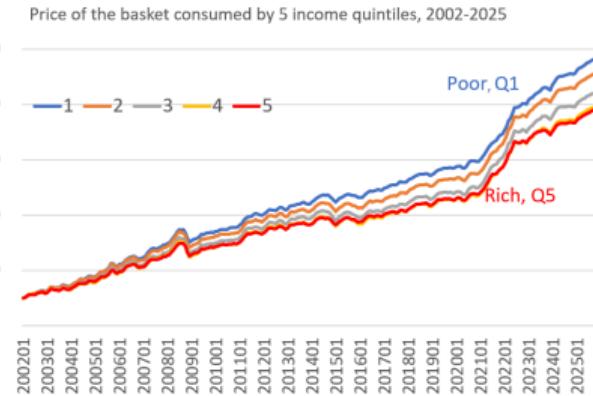
NOTE.—Gain or loss after a 5 percent inflation episode lasting 10 years as a percentage of average net worth in each group under two scenarios, full surprise and indexing ASAP, for baseline year 1989.

- ▷ Large transfers from old to young
- ▷ Bigger losers: old middle class
- ▷ Bigger gainers: young middle class (mortgages)

Inflation and Consumption Inequality: Jaravel, 2023

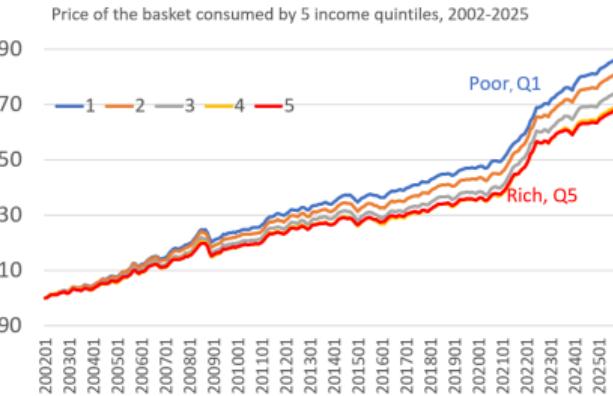
- ▷ Combining data from BLS (price indexes of detailed categories) and data from Consumer Expenditure Services (to construct consumption basket of any given group), Jaravel constructs data of price indexes of the baskets consumed by many different segments of the US population (rich v/s poor, young v/s old, white v/s non white)
- ▷ Very customizable data available at <https://www.xavierjaravel.com/dcpi>
- ▷ Heterogeneity in price dynamics, plus heterogeneity in consumption basket can generate significant differences in the price of consumption basket consumed by different groups
- ▷ Accounting for price differences in different baskets significantly affect fraction of households below/above poverty lines

Example: prices of consumption baskets of 5 income quantiles

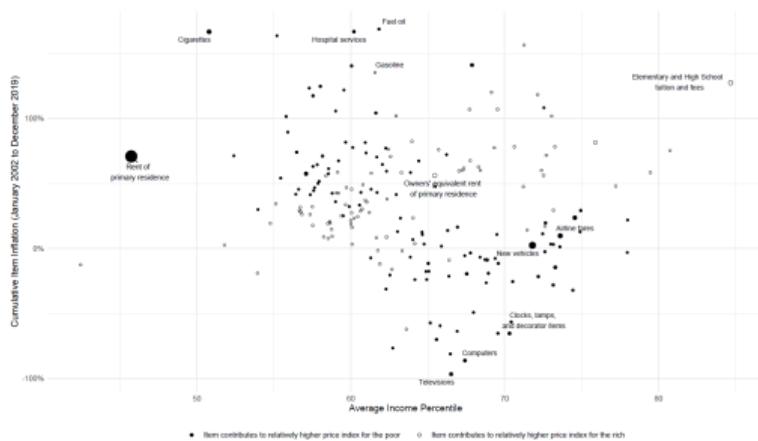


- ▷ Over the period 2002-2025 price of basket consumed by lowest quintile increases 20% more than prices consumed by highest quintile
- ▷ Larger increase in real income inequality $(\frac{Y_H/P_H}{Y_L/P_L} = \frac{Y_H}{Y_L} \frac{P_L}{P_H})$ than in nominal income inequality $(\frac{Y_H}{Y_L})$

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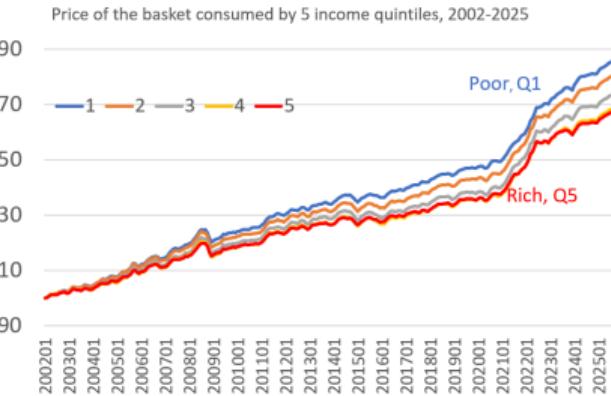


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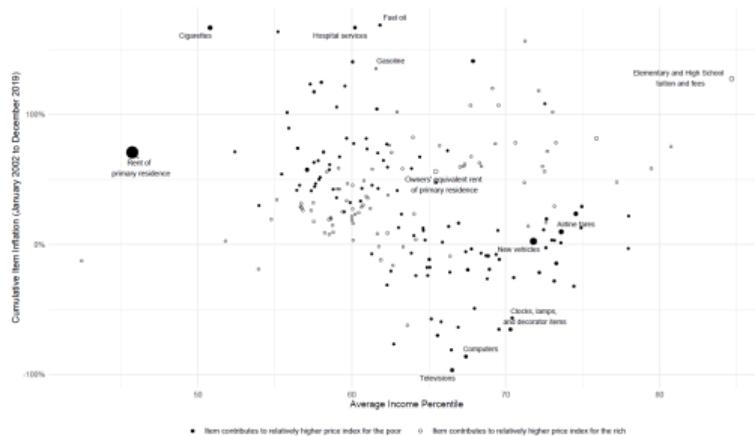


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- Caveat: if relative prices reflect relative values, not entirely obvious whether nominal or real inequality is a better measure



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Takeways so far

- ▷ Low interest rates improve economic conditions, but do more so for the rich (at least in Denmark)
- ▷ Inflation leads to significant redistribution of wealth and purchasing power across households (not neutral)

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- ▷ Inflation leads to significant redistribution of wealth and purchasing power across households (not neutral)
- ▷ Next: zoom in on inflation, income and labor markets

Inflation, income and labor markets: from macro to micro in two ways

- ▷ Macro: different income categories (Labor, Capital, Transfers) co-move differently with inflation
- ▷ Micro: different households have different sources of income, their total income affected differently by inflation.
- ▷ Result: how total income of different groups and inequality change with a $x\%$ inflation shock

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- ▷ Macro: real wages fall with inflation (imperfect indexation)
- ▷ Micro: same fall in wages for different individuals/groups, but different fall in labor supply
- ▷ Result: how labor income and employment of different groups move with a $x\%$ inflation shock
- ▷ Theory: why?

Categories of personal income, NIPA of United States

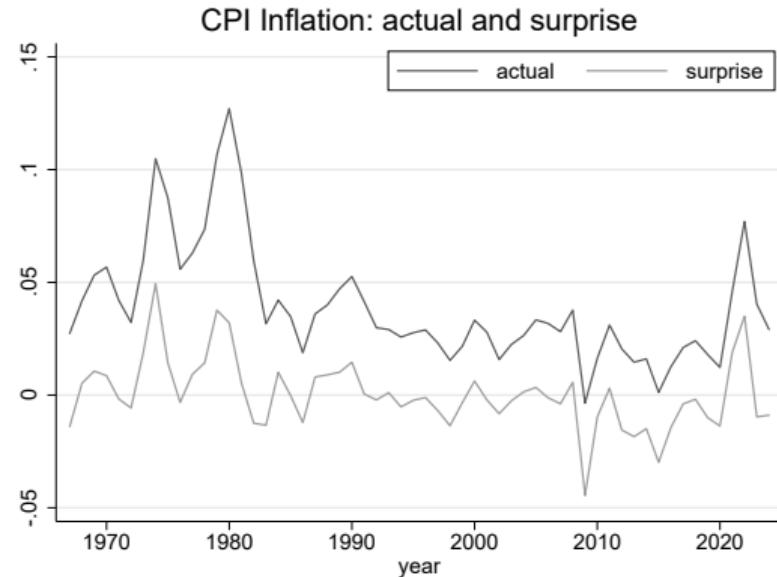
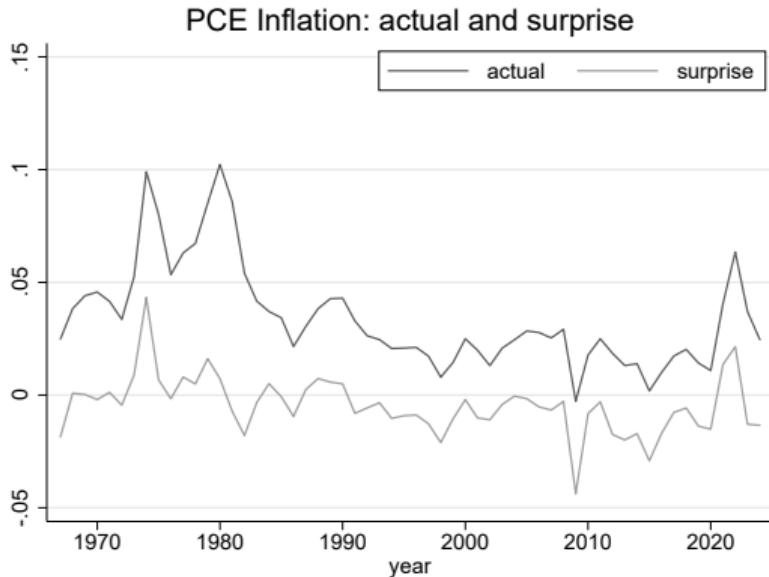
- ▶ BEA Table 2.1, Personal income and its disposition 2023

- ▶ Wages and salaries
- ▶ Income from interest and dividends
- ▶ Transfers from the government (includes SS, Medicare, Medicaid, UI)

	Per capita	Fraction of Personal Income
Wages and Salaries	35k	50%
Income from Interest and Dividends	11.4k	16.3%
Gov Transfers	12.4k	17.7%

Exclude proprietors income and supplements to wages and salary

Inflation and inflation shocks



- Inflation shocks = inflation - expected inflation (Michigan after 1978, VAR before)

Regression specification

$$\Delta y_{it} = \beta_i \pi_t + \gamma_i \Delta a_t + \varepsilon_{it}$$

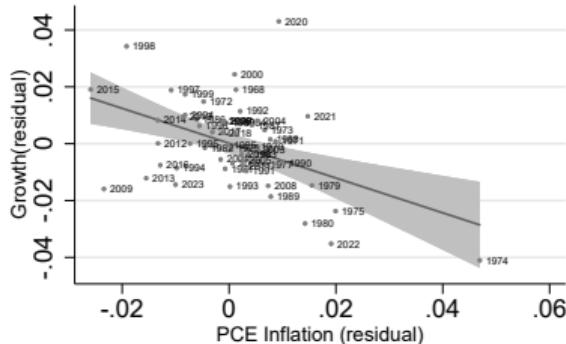
Where

- ▷ Δy_{it} real growth in income category i in year t
- ▷ π_t inflation (or inflation shock) in year t
- ▷ Δa_t control for aggregate real growth in year t

- ▷ Real aggregate growth controls for the fact that both inflation and real income categories are systematically associated with real growth
- ▷ Coefficient of interest is β_i , if inflation neutral, $\beta_i = 0$ for all i

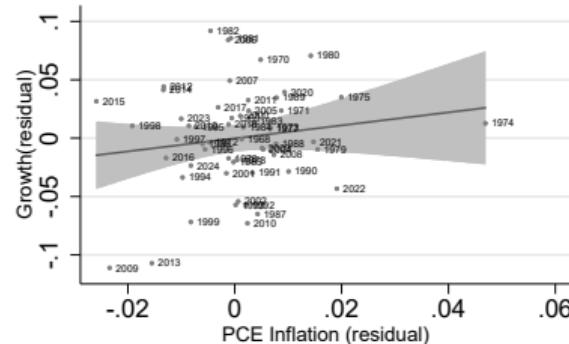
Regression results, PCE Inflation shocks

Wage Bill and PCE Inflation



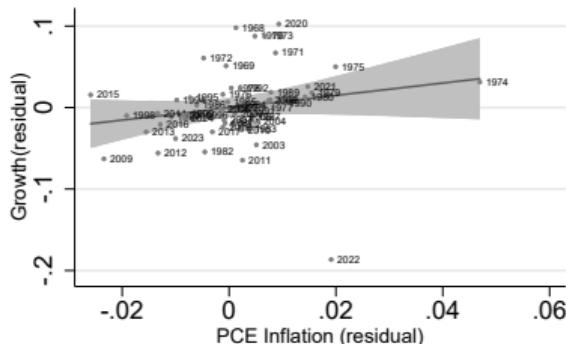
Coefficient: -0.61(0.19), control is Emp. growth

Asset income and PCE Inflation



Coefficient: 0.56(0.52), control is Emp. growth

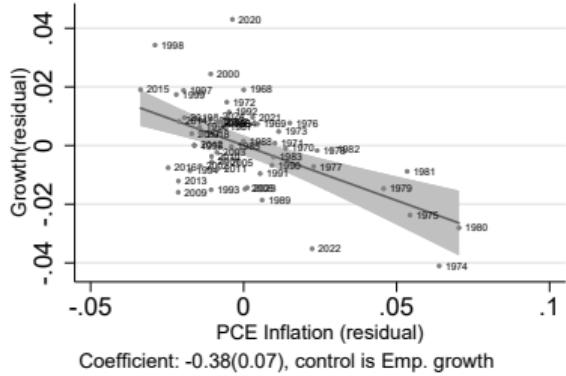
Transfers and PCE Inflation



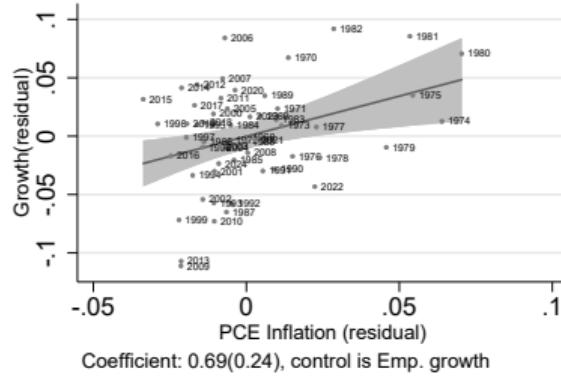
Coefficient: 0.76(0.61), control is Emp. growth

Regression results, PCE Inflation

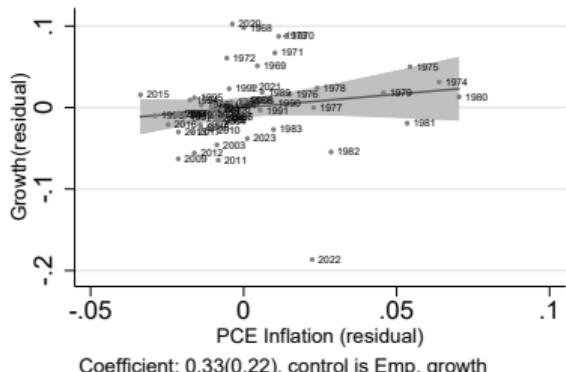
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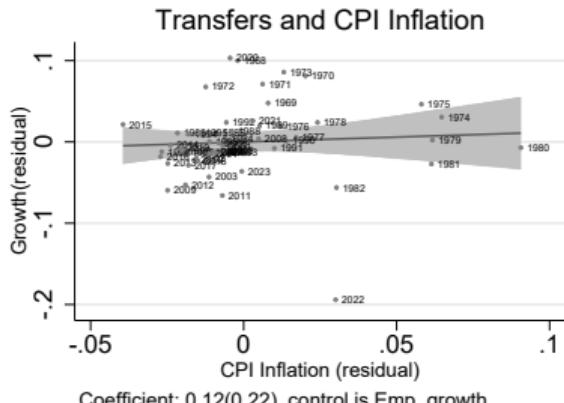
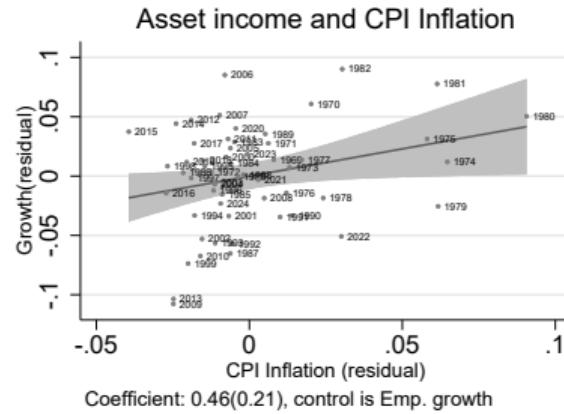
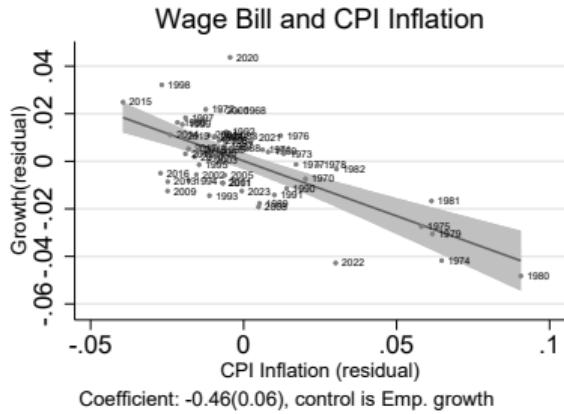
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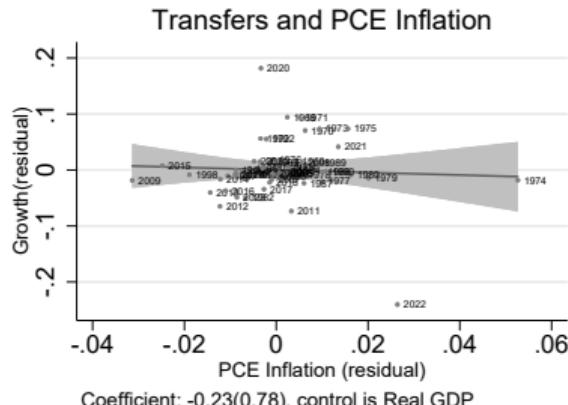
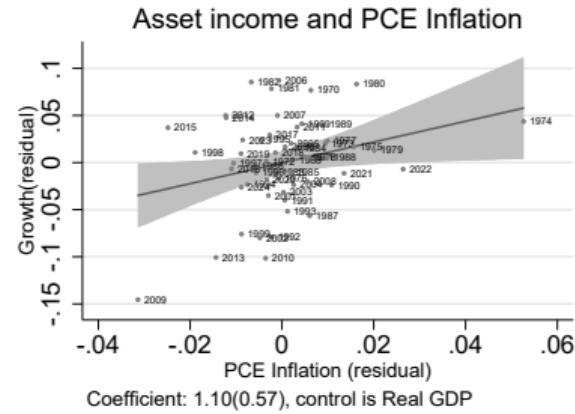
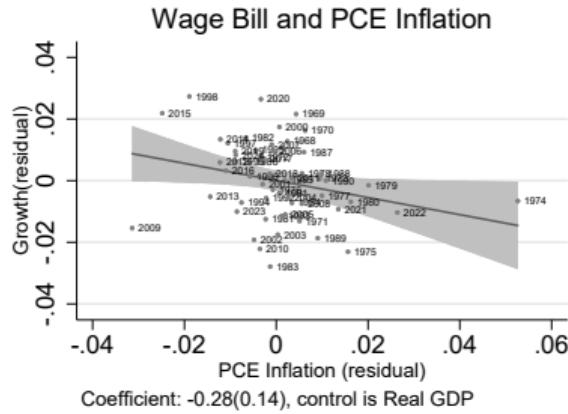
Transfers and PCE Inflation



Regression results, CPI Inflation



Regression results, PCE Inflation shocks, use Real GDP



Summary

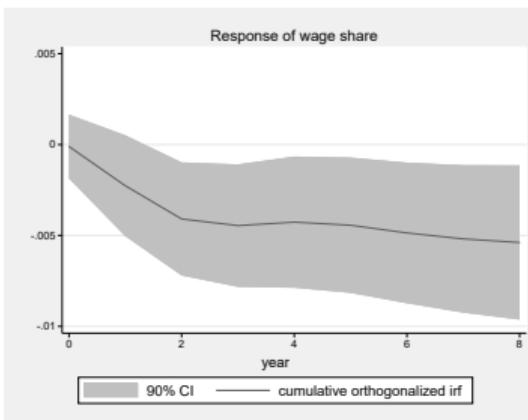
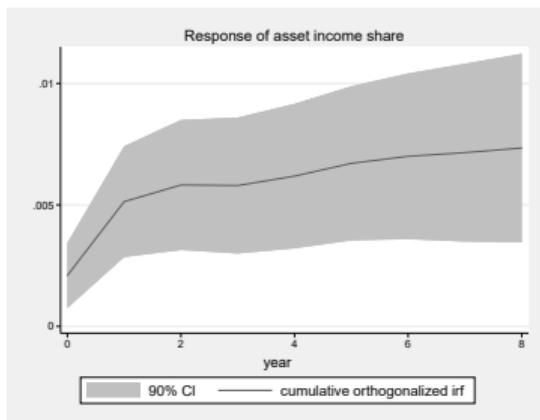
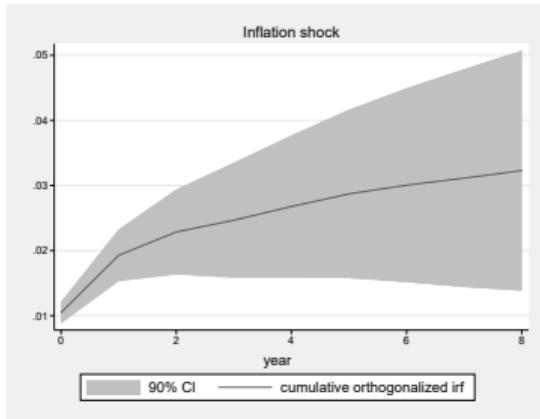
- ▷ In the U.S. over the period 1967-2024
- ▷ A 10% inflation (shock) increase associated with:
 - ▷ Decline in real wage bill of around 5%
 - ▷ Increase in real asset income of around 5%
 - ▷ No significant change in real transfers

VAR specification

$$\begin{bmatrix} \Delta ws_t \\ \Delta as_t \\ \pi_t \\ \Delta a_t \end{bmatrix} = B_1 \begin{bmatrix} \Delta ws_{t-1} \\ \Delta as_{t-1} \\ \pi_{t-1} \\ \Delta a_{t-1} \end{bmatrix} + B_2 \begin{bmatrix} \Delta ws_{t-2} \\ \Delta as_{t-2} \\ \pi_{t-2} \\ \Delta a_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_{wst} \\ \varepsilon_{ast} \\ \varepsilon_{\pi t} \\ \varepsilon_{at} \end{bmatrix}$$

- ▷ Δws_t , Δas_t : changes in the share of wage and asset income over total income (i.e. wages + asset income + transfers)
- ▷ π_t , Δa_t : inflation and control for real growth (Aggregate employment or Real GDP)
- ▷ Measure dynamic association between inflation shocks and share of income categories
- ▷ Control for dynamic association between inflation and economic activity

VAR results in shares (cumulative IRF)



- ▷ A 6% increase in inflation associated with a decline of approx 1 pct points in the share of wages and similar increase in share of asset income
- ▷ No change in share of transfers

Micro impact

- ▷ Use micro data(CPS) to assess how the three income categories are distributed across households
- ▷ Problem: wage income well measured in surveys, capital income and transfer income are not!
- ▷ Solution: Distributional National Accounts (DNA, Piketty et al, 2017, Heathcote et al. 2023)
- ▷ Idea: adjust micro data to make them consistent with aggregates

Income distribution in NIPA and CPS, 2023

	Wages and salaries		Asset income		Transfers	
	NIPA	CPS	NIPA	CPS	NIPA	CPS
Level	35k	34.5k	11.4k	2.9k	12.4k	4.4k
Share	59.5%	82.5%	19.5%	7%	20.5%	10.5%

- ▷ Wages and salaries in CPS and NIPA very close (going back to 1967)
- ▷ Both asset income and transfer income much lower in CPS than NIPA
- ▷ Some of the discrepancy due to under-reporting, some due to survey nature (Households not asked about medicare, nor asset income in retirement accounts)

A crude correction

- ▷ We simply multiply each income category in CPS to make it consistent with NIPA
- ▷ Underlying assumption: missing income accrues only to those households which report at least some income of that category

Impact of correction

	CPS, raw			CPS, rescaled		
	Labor	Asset	Transfers			
Top 1%	90%	9%	1%	51%	44%	4%
Top 5%	89%	9%	2%	52%	42%	6%
Mid 10%	75%	5%	19%	62%	6%	32%
Bottom 20%	26%	5%	68%	59%	5%	36%

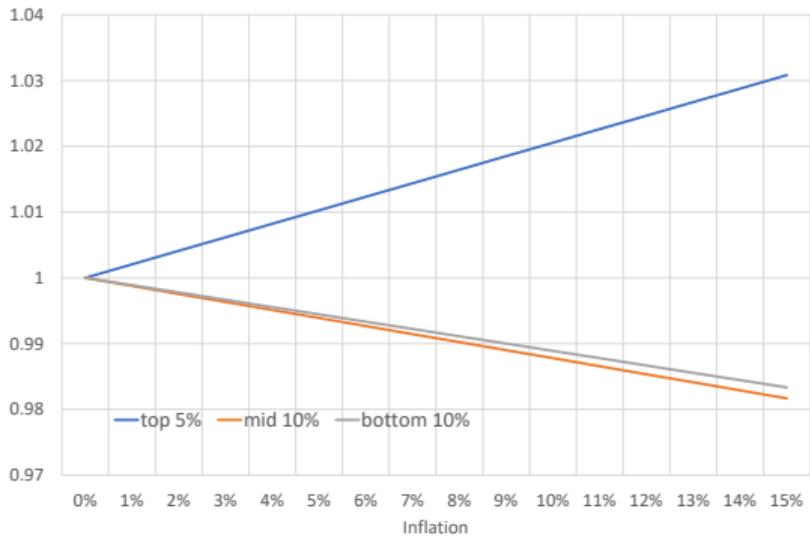
- ▷ Asset income much more important at the top (similar numbers as in Piketty et al. 2017)
- ▷ Transfer income more important at the bottom and mid of the distribution

Inflation and (corrected) income inequality

- ▷ VAR estimates: 6% inflation reduces wage share by 1% and increases asset share by 1%
- ▷ Growth of asset income $\frac{\alpha_K + \pi/6}{\alpha_K}$ faster than total
- ▷ Growth of labor income $\frac{\alpha_L - \pi/6}{\alpha_L}$ slower than total where α_L and α_K are initial share of asset and wage income

Inflation and (corrected) income inequality

- Applying growth rates of the income portfolios of different section of the distribution:



- A 6% inflation shock increases gap between top and bottom by approx 2%, no difference between bottom and mid
- Effects not large but comparable to those documented in group CPIs (Argente and Lee, 2021, Jaravel 2024)

Inflation and labor income

- ▷ So far focused on different income types
- ▷ Now zoom in on labor income (wage and employment)
- ▷ Does labor income in different group of population respond differently to inflation? and why?

CPS and PSID samples

- ▷ PSID
 - ▷ All heads of household and spouses appearing at least 2 consecutive years, 1967(1)1996, 1998(2)2022
- ▷ CPS
 - ▷ All persons appearing 2 consecutive years in ASEC, 1977-2023
 - ▷ 3 Educational groups: HSD,HS+SC,C+
 - ▷ Age between 25 and 65
 - ▷ Work at least 400 hours in each year: Log Changes in real wages and salaries, real hourly wage, annual hours
 - ▷ Work positive hours at least one year: Arc-growth in hours $\frac{h_t - h_{t-1}}{h_t + h_{t+1}}$
 - ▷ Control for aggregate employment growth and relevant interactions

CPS regression results

	g(labor income)	g(wages)	g(hours)	Δ(hours)
Constant	-2.91%*** (0.3%)	0.00% (0.3%)	-3.02%*** (0.2%)	-12.1%*** (0.6%)
HS+SC	2.68%*** (0.4%)	1.15%*** (0.3%)	1.52%*** (0.2%)	6.2%*** (0.6%)
C+	4.80%*** (0.4%)	2.26%*** (0.4%)	2.53%*** (0.2%)	9.0%*** (0.6%)
Surprise π	-1.26*** (0.27)	-0.88*** 0.26	-0.38** 0.46***	-1.16** 1.48***
Sur. π^*HS+SC	0.72** (0.29)			
Sur. π^*C+	0.71** (0.3)	0.18	0.53***	1.31***
g_emp	1.30*** (0.27)	0.41***	0.89***	1.94*** (0.37)
g_emp*HS+SC	-0.48*** (0.16)	-0.19.	-0.28***	-0.65*** (0.22)
g_emp*C+	-0.74*** (0.17)	-0.09	-0.64***	-1.31*** (0.22)
	N=631728	N=631728	N=631728	N=727426

- ▷ Surprise π associated with low real wages for all groups
- ▷ Surprise π associated with lower hours only for low education groups
- ▷ High aggregate employment associated with higher real wage for all groups
- ▷ High aggregate employment associated with higher hours mostly for low education groups

PSID Results

	g(labor income)	g(wages)	g(hours)	Δ (hours)
Constant	-1.7%*** (0.3%)	0.8% (0.3%)	-2.47%*** (0.2%)	-3.9%*** (0.6%)
HS+SC	1.98%*** (0.4%)	.06%* (0.3%)	1.4%*** (0.3%)	2.2%*** (0.3%)
C+	3.3%*** (0.4%)	1.7%*** (0.4%)	1.67%*** (0.3%)	2.46%*** (0.3%)
Surprise π	-1.34*** (0.20)	-0.37** -0.10	-0.96** 0.55***	-0.56*** 0.59***
Sur. π^*HS+SC	0.45* (0.25)			
Sur. π^*C+	0.80*** (0.23)	0.05	0.74***	0.48***
g_emp	1.47*** (0.13)	0.61***	0.86***	0.98***
g_emp*HS+SC	-0.46*** (0.17)	-0.11	-0.34***	-0.33***
g_emp*C+	-0.65*** (0.16)	-0.33*	-0.31***	-0.29***
N=220443		N=220443	N=220443	N=275512

▷ Surprisingly very similar!

A basic model of inflation and labor markets

- ▷ Small open economy which takes price of final output p_t (relative to labor) as given
- ▷ (not a theory of inflation, working on it)
- ▷ Labor supply
 - ▷ Two types of workers, high and low efficiency E_i , both hand to mouth
 - ▷ Take as given wages per efficiency unit w_t , profits π_t and p_t and solve:

$$\max_{l_{it}^s, c_{it}} \frac{c_{it}^{1-\sigma}}{1-\sigma} - \frac{1}{1+\phi_i} (l_{it}^s)^{1+\phi_i}$$

s.t.

$$p_t c_{it} = (w_t l_{it}^s E_i + \lambda_i \pi_t) (1 - \tau_i) + p_t T_{it}$$

- ▷ Let $l_{it}^s(w_t, \pi_t, p_t)$ the labor supply functions of both types
- ▷ Labor demand

- ▷ Competitive firms, take as given w and p and solve:

$$\max_{l_t^d} \pi_t = A_t p_t \left(l_t^d \right)^\alpha - w_t l_t^d$$

where A_t is a standard productivity shock.

- ▷ Let $l_t^d(w_t, p_t)$ the labor demand function.

Sticky wages and rationing

- ▷ Equilibrium wages w_t^* solve:

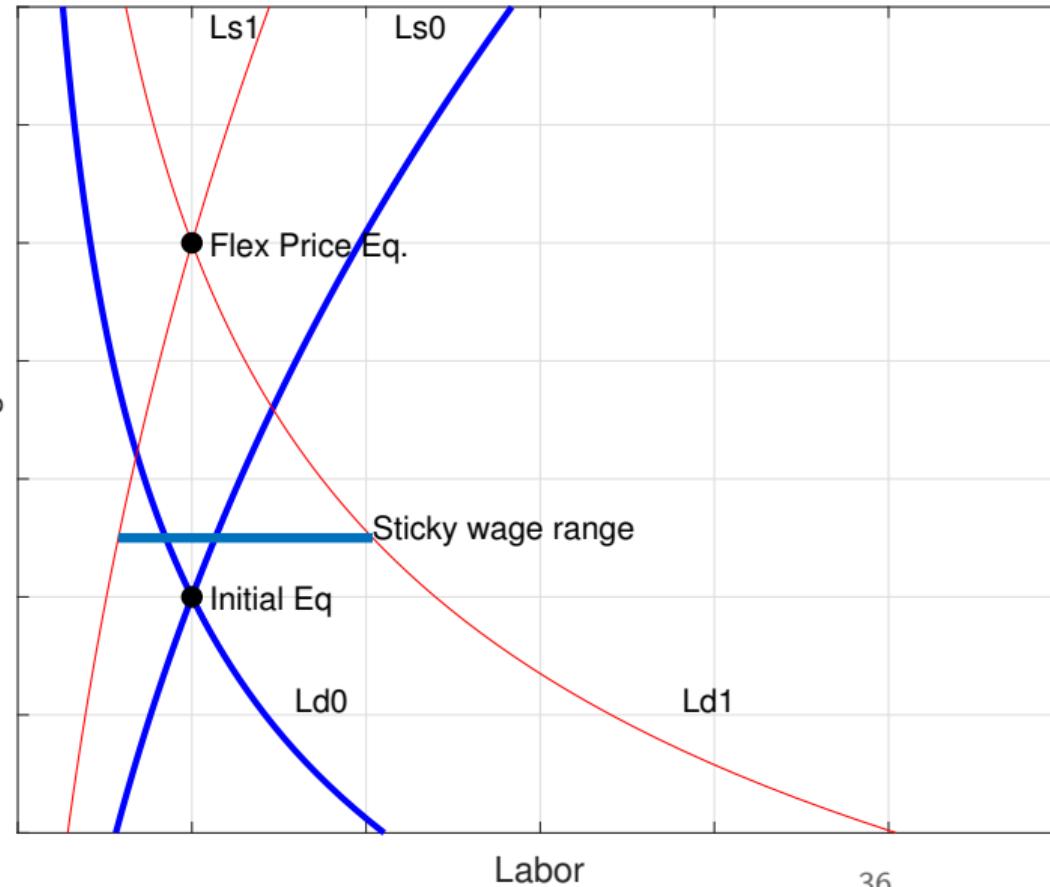
$$I_t^d(w_t^*, p_t) - E_H S_H I_{H,t}^s(w_t^*, \pi_t, p_t) - E_L S_L I_{L,t}^s(w_t^*, \pi_t, p_t) = \eta(w_t^* - \bar{w}_t)$$

- ▷ If $\eta = 0$, wages fully flex, $\Delta w_t = \Delta p_t$ and price shocks are neutral
- ▷ If $\eta > 0$ wages sticky, labor demand \neq labor supply, price shocks have real effects
- ▷ Given w_t^* equilibrium employment is determined by

$$L_{H,t}^* = \beta I_t^d(w_t^*, p_t) \frac{E_H S_H I_{H,t}^s(w_t^*, \pi_t, p_t)}{E_H S_H I_{H,t}^s(w_t^*, \pi_t, p_t) + E_L S_L I_{L,t}^s(w_t^*, \pi_t, p_t)} + (1 - \beta) E_H S_H I_{H,t}^s(w_t^*, \pi_t, p_t)$$
$$L_{L,t}^* = \beta I_t^d(w_t^*, p_t) \frac{E_L S_L I_{L,t}^s(w_t^*, \pi_t, p_t)}{E_H S_H I_{H,t}^s(w_t^*, \pi_t, p_t) + E_L S_L I_{L,t}^s(w_t^*, \pi_t, p_t)} + (1 - \beta) E_L S_L I_{L,t}^s(w_t^*, \pi_t, p_t)$$

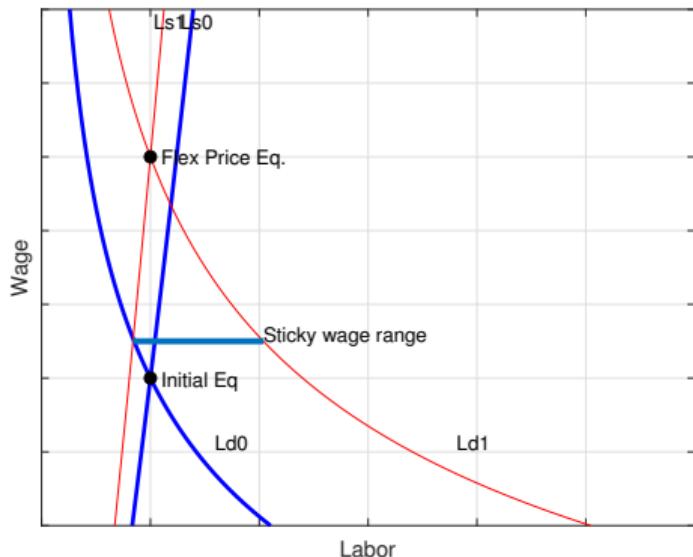
- ▷ If $\beta = 1$ employment is demand determined (Standard NK model)
- ▷ If $\beta = 0$ employment is determined by labor supply
- ▷ If $0 < \beta < 1$ firms off labor demand, wrkrs off labor supply

Labor impact of a price increase

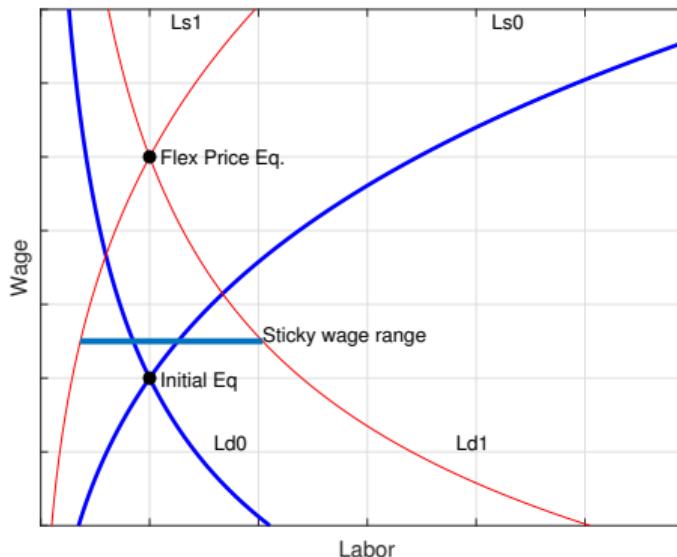


Price increase with different labor supply elasticities ($\frac{1}{\phi}$)

Low elasticity



High elasticity



- With high elasticity the same price shock induces larger reduction in of labor supply, more likely to drive a reduction in equilibrium hours

Equilibrium

- ▷ An equilibrium is a sequence for

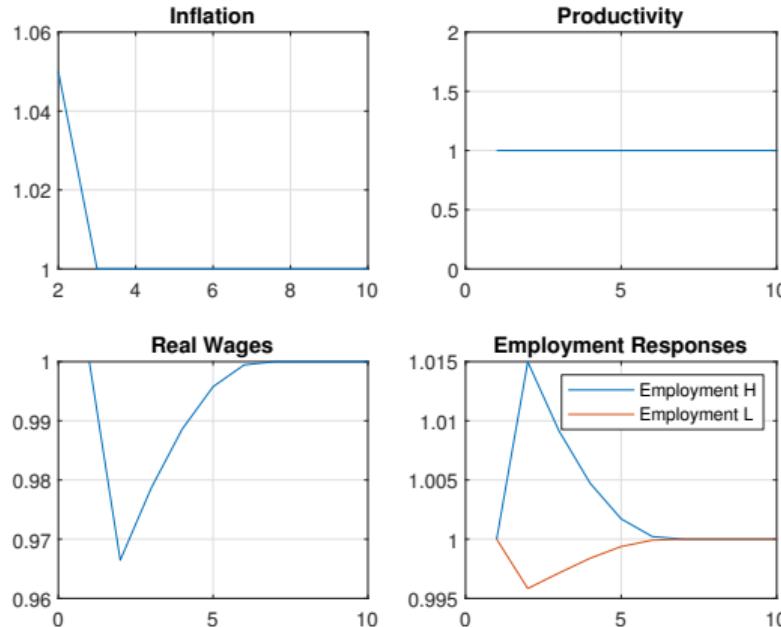
$$I_{Ht}^s, I_{Lt}^s, I_t^d, L_{Ht}^*, L_{Lt}^*, w_t^*, \bar{w}_t, \pi_t^*, B_t, c_{Ht}^*, c_{Lt}^*$$

- ▷ Given w_t^*, π_t^* desired labor supply and demand $I_{Ht}^s, I_{Lt}^s, I_t^d$ solve firm and household problem
- ▷ w_t^* and \bar{w}_t solve wage equation
- ▷ $\bar{w}_t = w_{t-1}^*$ (only dynamic equation)
- ▷ Equilibrium employment $L_{H,t}^*$ and $L_{L,t}^*$ set by the β equation
- ▷ Equilibrium profits and consumption are determined by equilibrium employment
- ▷ Government debt absorbs imbalances

Key parameters

- ▷ Taxes, transfers, profit shares, efficiency, shares and curvature of consumption are all set to match data on wages, labor supply and other income shares for 2 groups in the CPS ASEC population: high school drop-outs, and some college and more. Easily identified.
- ▷ Productivity and prices follow independent random walk with standard deviations set to match observed dispersion of aggregate employment growth and surprise inflation
- ▷ The wage stickiness parameter set to match the regression coefficient of individual wage changes on inflation and on aggregate employment
- ▷ In order for the model to match the differential comovement of hours of high and low skill with inflation and the aggregate employment need both:
 - ▷ Low $\beta << 1$ (Role of labor supply in determining employment)
 - ▷ Low skill have higher elasticity (1/2 and 2)

Result 1a. Impulse response to an inflation shock



- ▷ Inflation lower real wages, increase labor demand, lower labor supply
- ▷ Different elasticities of labor supply across groups induce different labor responses
- ▷ Wage stickyness induces propagation of shock

Result 1b. Impulse response to a productivity shock

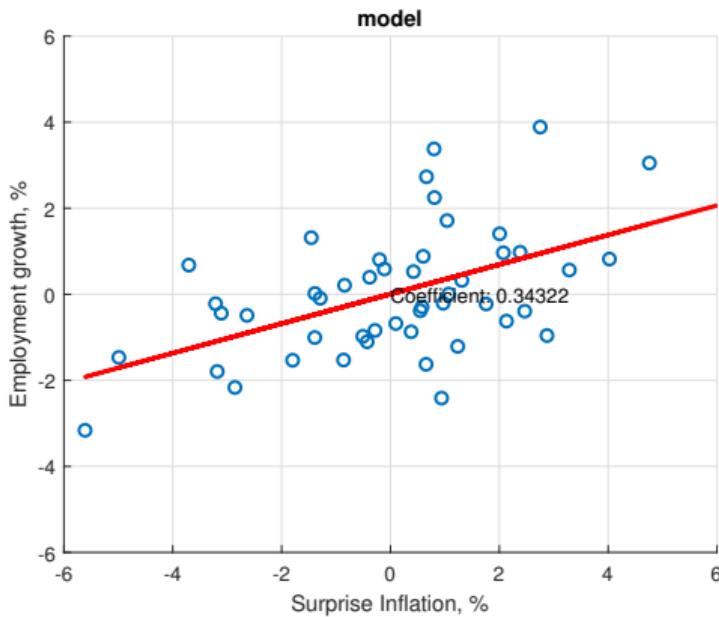
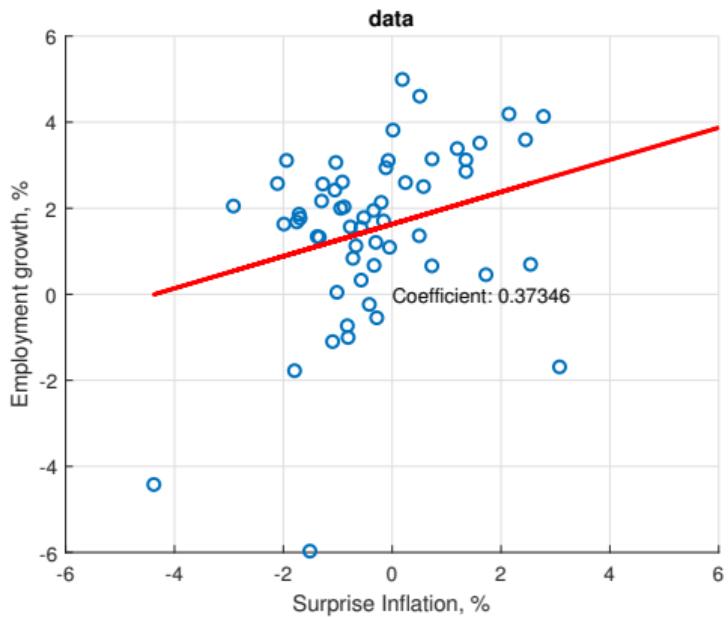


- ▷ Productivity increases labor demand, and induces persistent real wage growth
- ▷ Higher labor supply elasticity induces stronger employment response by the L group

Result 2. Regression coefficients

	Inflation coefficient		Employment Coefficient	
	[CPS,PSID]	Model	[CPS,PSID]	Model
Wages	[-0.88,-0.37]	-0.61	[0.41,0.61]	0.40
Hours L	[-0.38, -0.96]	-0.34	[0.89,0.86]	1.31
Hours H	[0.15, 0.22]	0.03	[0.25,0.56]	0.96

Result 3. Aggregate co-movement



- ▷ Wage stickyness induces correlation between equilibrium employment and surprise inflation

Conclusions

- ▷ Overall theme of the lecture is that inflation (a macro phenomenon) can have a significant impact on the distribution of real resources, including income, consumption and wealth, and can induce differential response across different households
- ▷ Highlighted two channels through which inflation can affect distribution of income
 - ▷ Income composition (asset v/s labor income)
 - ▷ Uniform impact on hourly wages and differential effect on hours across groups
- ▷ Model suggests three features can explain the observed patterns:
 - ▷ sticky wages
 - ▷ high labor supply elasticity of low skill workers
 - ▷ labor supply impact on equilibrium employment
- ▷ Next: make inflation endogenous (firm pricing decision)