Who Bears the Costs of Inflation?
Euro Area Households and the 2021–2023 Shock

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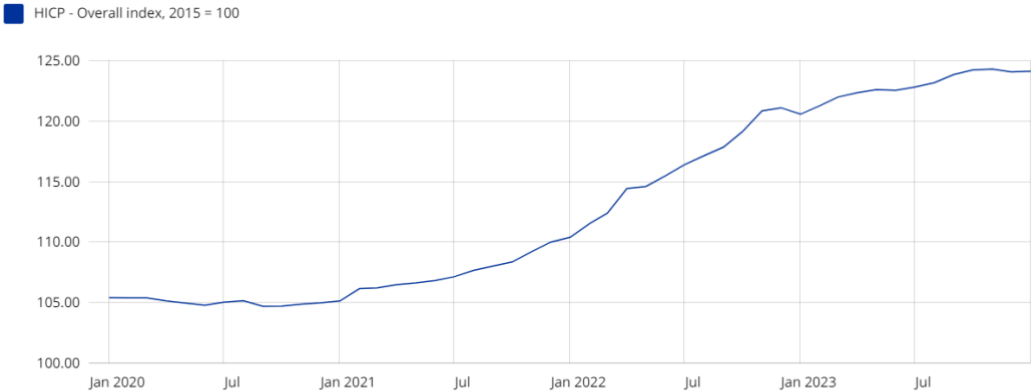
Event study: recent euro area inflation episode, 2021–2023



Source: EUROSTAT

What are the distributional effects of the recent inflation shock?

- Large shock in euro area in 2021–23: 18% cumulative price increase
- Key drivers: energy and food prices Data
- Public debate: contrasting arguments
  - Poorer and younger households spend more on energy and food
  - But wealthier and older households own more nominal wealth
- Our contribution:
  1. Conceptual: Simple framework that illustrates various channels of inflation shocks
  2. Empirical: Quantify size of various channels across households in four EA countries

What the paper does

- Develops a model to illustrate distributional effects of inflation through:
  1. Heterogeneous consumption bundles: different inflation rates across Hhs
  2. Heterogeneous nominal wage rigidity: workers vs pensioners
  3. Devaluation / revaluation of net nominal positions: borrowers vs savers
  4. 'Unconventional' fiscal policy through energy subsidies and direct transfers
  5. Response of real asset prices (housing, stocks) to the inflation shock
- Combines various data sources to measure each channel in four large euro area countries (DE, FR, IT, ES)
- Quantifies welfare cost of each component across the age/consumption distribution

Preview of empirical results

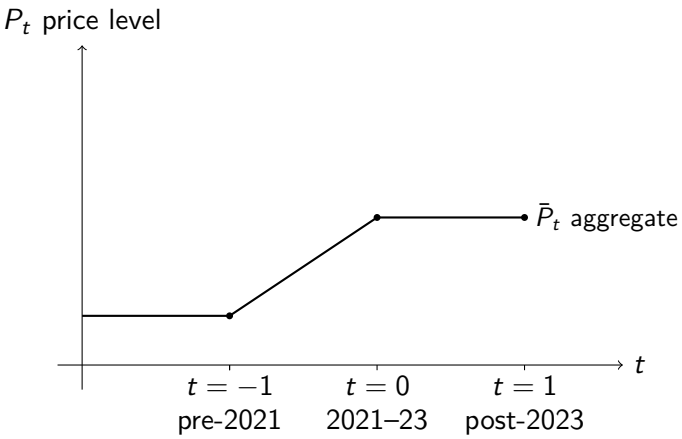
1. Low-consumption Hhs: a bit higher inflation rates, but hedged by low rent inflation
2. Real wages of most households declined (wage stickiness)
3. Net nominal positions: retirees lost, while indebted younger benefited
4. Unconventional fiscal policy: shielded vulnerable Hhs (especially in Spain)
5. Housing and stocks: not good inflation hedges in short run

- Overall:
  - losses are large: 70% of households lost about up to 15% of income;
  - older households lost the most as a fraction of income;
  - within age brackets, lower-consumption households often experienced larger losses;
  - 30% of households experienced gains, especially in France and Spain—indebted

Recent related contributions

- Fagereng, Gomez, Gouin-Bonenfant, Holm, Moll, Natvik (2022)
  - Framework to study impact of capital gain shocks on household welfare
- Del Canto, Grigsby, Qian, Walsh (2023)
  - Builds on Fagereng et al. (2022) to study IRFs to structural inflationary shocks
- Cardoso, Ferreira, Leiva, Nuño, Ortiz, Rodrigo, Vazquez (2022)
  - Distributional impact for Spain using BBVA data
- Many other empirical studies, mostly focusing on heterogeneous consumption baskets
  - Battistini, Di Nino, Dossche, Kolndrekaj (2022)
  - Charalampakis, Fagandini, Henkel, Osbat (2022)
  - Curci, Savegnago, Zevi, Zizza (2023)
  - Menyhert (2022)

Our experiment: one-off increase in infl 2021–23 (MIT shock)



Assumptions

Before $t = 0$ (pre-2021), aggr price level constant (zero infl in steady state)

[A1] At $t = 0$ (short run; years 2021–23), unanticipated inflation shock $dz_0 \Rightarrow$ permanent jump in aggr price level

Relative goods prices left unrestricted

[A2] At $t = 1$ (long run; after 2023), price stability restored

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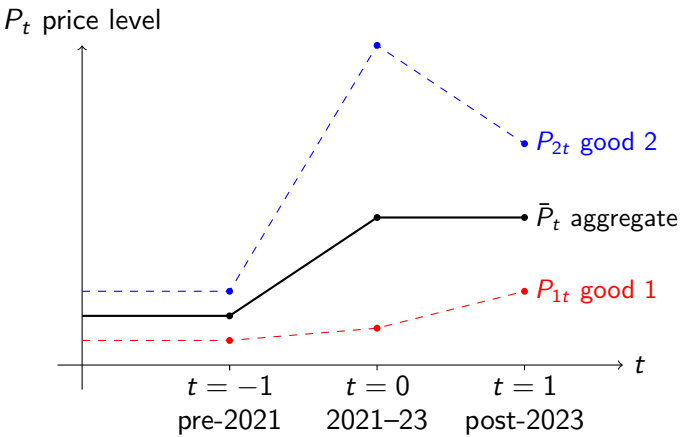

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Relative goods prices left unrestricted

[A2] At $t = 1$ (long run; after 2023), price stability restored

Relative prices back to pre-shock

[A3] The shock is neutral in the long run (real values of wages, asset prices, taxes, dividends do not change)

[A4] Long-run adjustment of the govt budget constraint through price level or future real surpluses

Households

- Overlapping generations living for two periods $t = 0, 1$ (short-run & long-run)
- No uncertainty (aggregate or idiosyncratic), and no binding liquidity constraints
- Problem of individual i belonging to the cohort born at $t = 0$:

$$
\begin{aligned}
V_i &= \max_{c_{it}, a_{i,kt+1}, B_{St+1}, B_{Lt+1}} u_i(c_{i0}) + \beta_i u_i(c_{i1}) \\
&s.t. \\
c_{it} P_{it} &= W_{it} - T_{it} + B_{i,St} + (1 + Q_{Lt}\delta) B_{i,Lt} + \sum_k (Q_{kt} + D_{kt})\, a_{i,kt} \\
&\quad - Q_{St} B_{i,St+1} - Q_{Lt} B_{i,Lt+1} - \sum_k Q_{kt} a_{i,kt+1}.
\end{aligned}
$$

W nominal wages, T nominal gov't taxes net of transfers, B_S short-term bonds, B_L long-term bonds, a_k real assets, $Q.$ asset/bond prices, D_k dividends, δ coupon decay rate

- $P_{it} = P^*_{it}(1 - \mathcal{T}_{it})$, effective prices = raw (counterfactual) prices − government subsidy

Money metric welfare

- Object of interest: impact of inflation shock dz_0 on welfare of each household
- Invoke the **envelope theorem** (dz_0 'small'), and ignore changes in choice variables
- Money metric welfare change:

$$d\mathcal{W}_i = \frac{dV_i / u_i'(c_{i0})}{dz_0} P_{i0}$$

'How much EUR would you be willing to give up to avoid the inflation shock?'

Welfare decomposition: four components

- Differentiate Lagrangean with respect to (inflation) shock z_0
- Decompose welfare change as: $d\mathcal{W}_i = d\mathcal{W}_i^{DIR} + d\mathcal{W}_i^{UFP} + d\mathcal{W}_i^{IND} + d\mathcal{W}_i^{LR}$
  1. Direct: impact of the raw inflation shock, using Hh-level raw inflation shock P_{i0}^*
  2. 'Unconventional' fiscal policy: impact of govt interventions, gap between P_{i0}^* and P_{i0}
  3. Indirect: equilibrium response of labor and capital income, taxes, and asset prices to z_0
  4. Long-run: residual long-run effects (relative price re-alignment)
- These components consist of terms related to parts of budget constrnt (income, NNP, ...)

Measurement

Countries and demographic groups

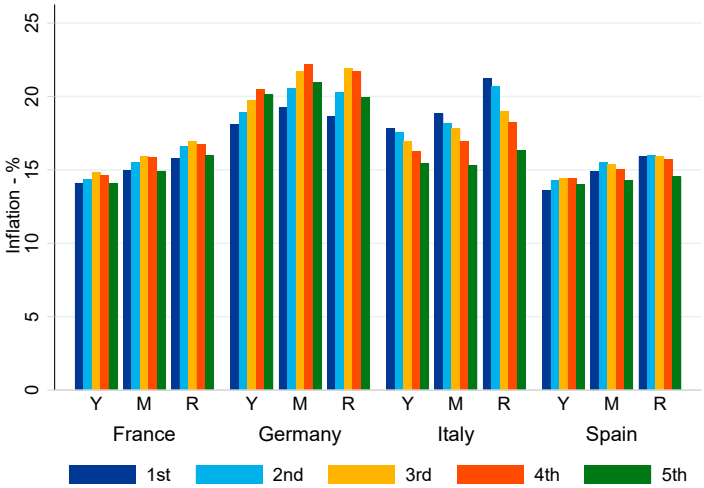
- Big-4 economies in euro area: Germany, France, Italy, Spain
- Breakdown of households by age (25–44, 45–64, 65+) and consumption quintiles

Data sources

- Direct component
  - Prices and consumption baskets: Household Budget Survey (2015), Harmonized Index of Consumer Prices (HICP), expected inflation (Consensus Economics)
  - Income, wealth and portfolios: Household Finance and Consumption Survey (2017)
- Unconventional fiscal pol: Bruegel data, counterfactual energy prices (Dao et al 2023)
- Indirect component
  - Wages from collective agreements and official minimum wage data; pension data
  - House prices, REIT returns, stock market data

Details

2021–23 cumulative household-level inflation: 13–23 percent

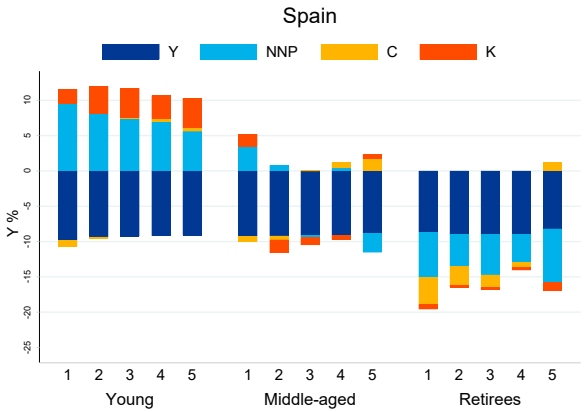


Cumulative inflation shock

- FR: 15%
- DE: 20%
- IT: 17%
- ES: 14%

Inflation decomposition

1. Breakdown of direct component: Spain



- **Net income:** loss of 9%, even across groups
- **Net nominal positions:** positive impact for the young, negative for the retirees
- **π differences:** in general, quite small
- **K gains:** gains for young (net asset buyers) Welfare only affected when trading

Overall:
Old lose 15%, young break even or gain slightly

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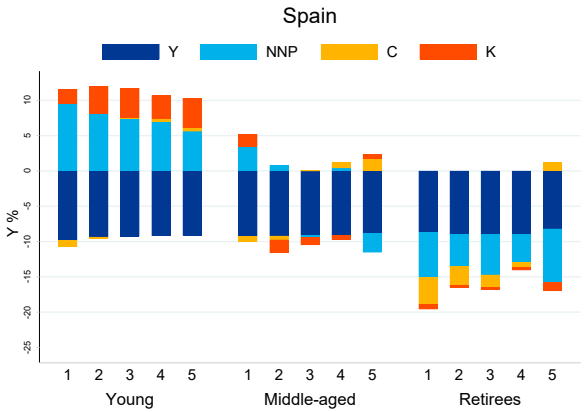

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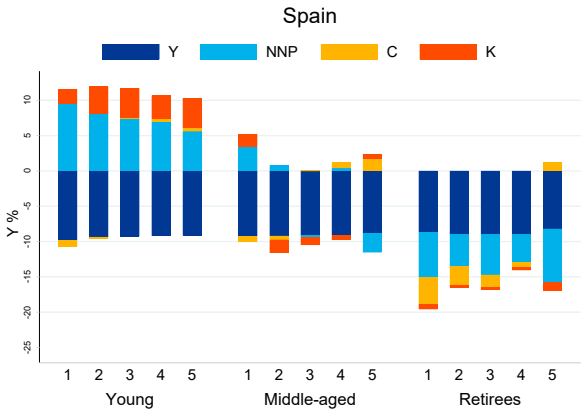

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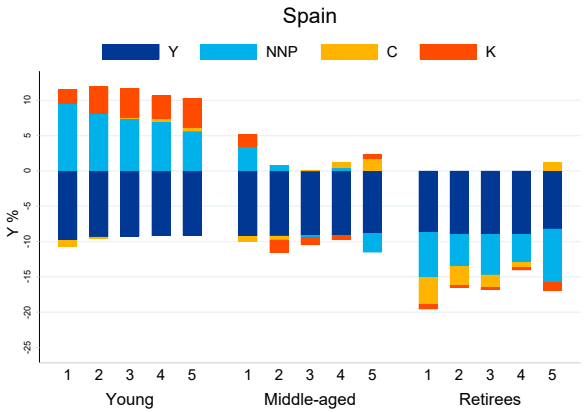

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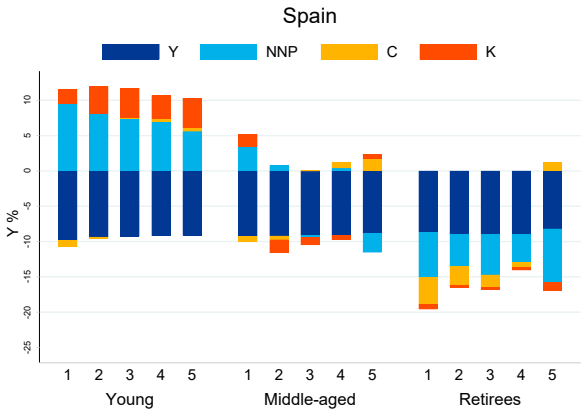

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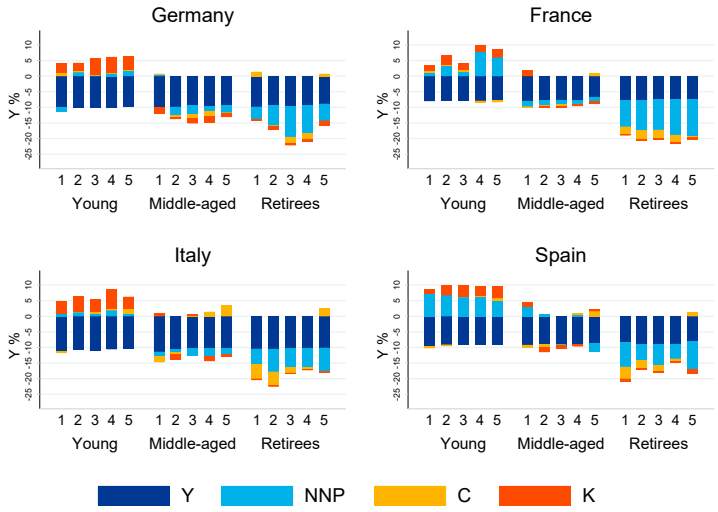
1. Direct component, cross-country comparison: ~ 0 to -15%



Y: Net income

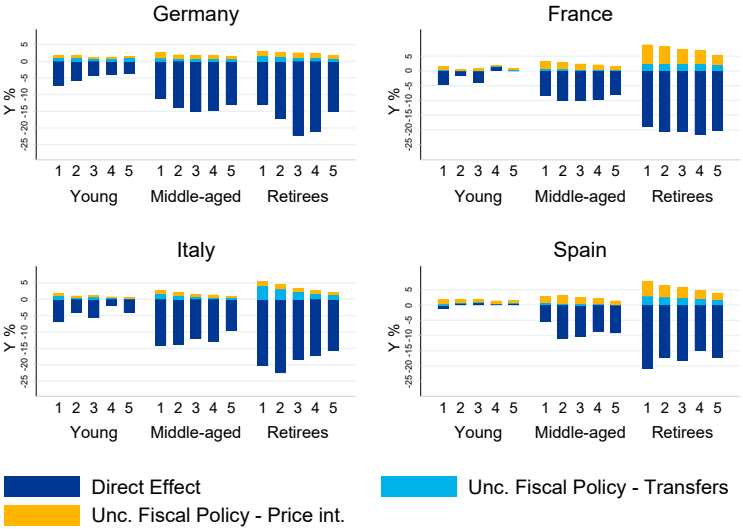
NNP: Net nominal positions

C: π differences

K: Capital gains

More heterogeneity in France and Spain, despite lower inflation, because of larger NNPs

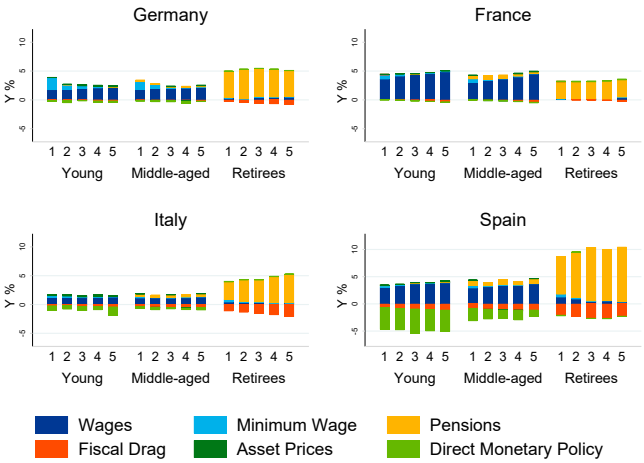
2. Unconventional fiscal policy reduced impact by 1 to 5%



Mitigation of welfare loss, particularly through energy price interventions

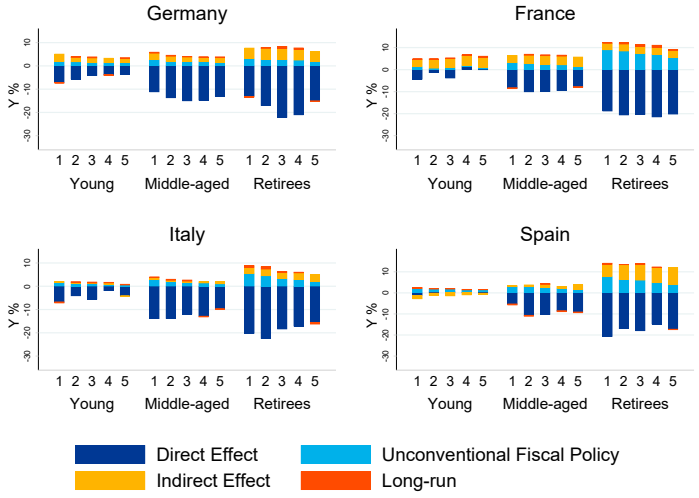
Reduction in inflation

3. Indirect component: $< 5\%$



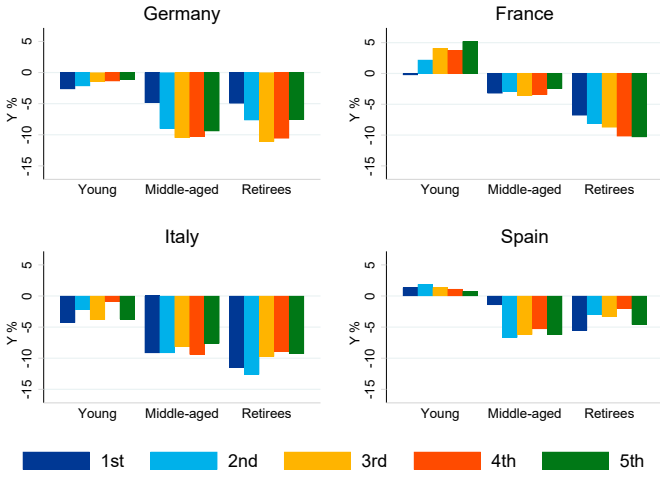
- **Y: Net labor income**: large real purchasing power loss, sizeable recovery only in France
- **Minimum wage**: partially compensates low-income workers in Germany/France
- **Pensions**: mostly indexed, large adjustments, particularly in Spain
- **Monetary policy**: affects negatively ES young (adjustable-rate mortgages)
- **House and stock prices**: small effects

Putting together the four components of the effect on welfare



- **Direct component** dominates
- **Fiscal response** is nontrivial
- **Indirect** relevant for some
- **Long-run** limited effect

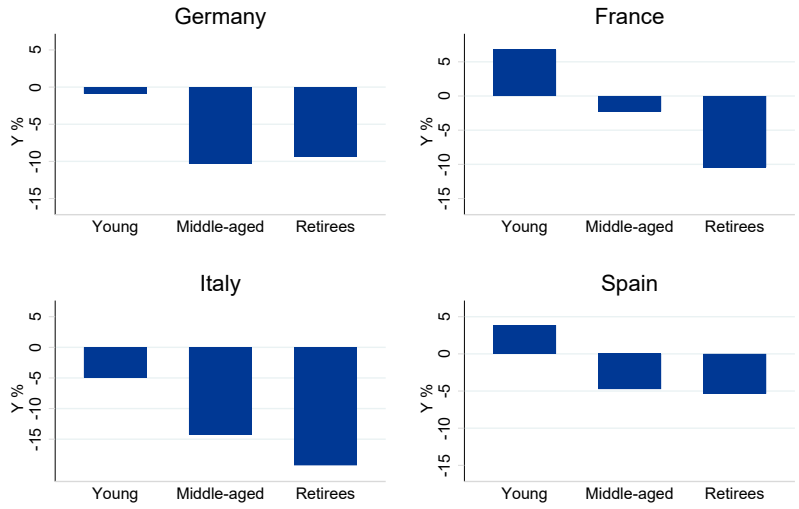
Total welfare change



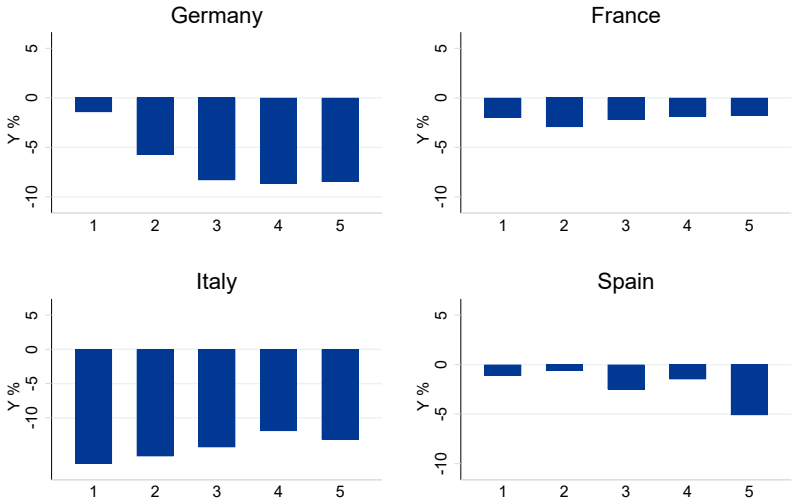
Average total effect (% of income):

- DE: –7.0%
- FR: –2.5%
- IT: –9.0%
- ES: –3.5%

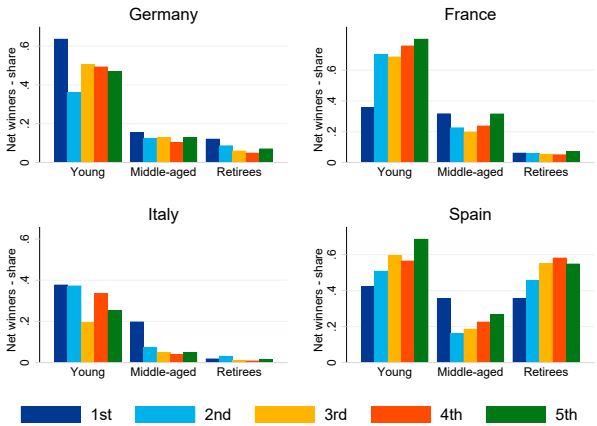
Total welfare change: clear gradient by age



Total welfare change: no clear gradient by consumption



Share of winners



- On average, 30% of net winners
- But there are many young that lose, even in ES/FR
- Most retirees are net losers, except for ES

Summary: who bore the costs of inflation in euro area?

- Inflation shock was an age-dependent tax that hit hard older households
- Uniform incidence within age: higher inflation rate for poor offsets higher NNP for rich
- Nominal wages are quite rigid in the short run
- Unconventional fiscal policy played a significant role, especially in Spain
- Housing and stocks are not good inflation hedges in the short run
- Most households lost, but around 30% (debtors) gained
- (Governments were mostly net winners)

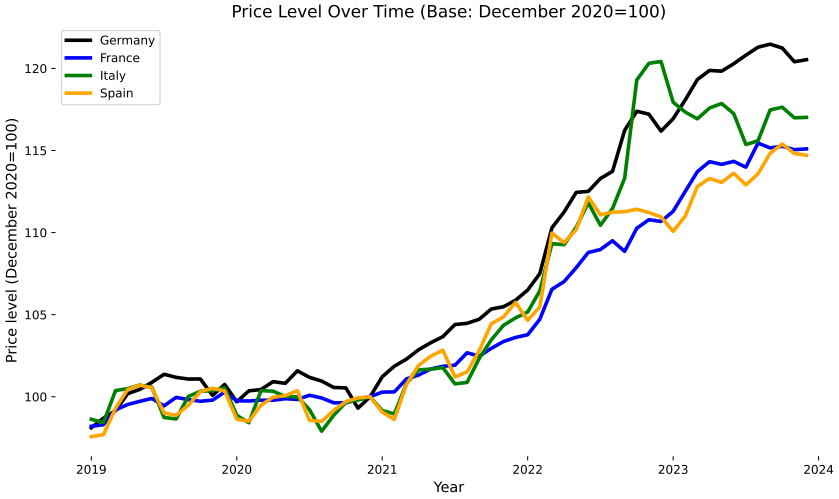
Thanks!

Beyond the household sector: Government

- Household sector is a net loser. But who is on the other side of NNP losses?
- Compute aggregate gains by broad sector (households, government, foreign)
  - Attributing firm holdings to their owners
- Government gains: net borrower + fiscal drag
- But it loses: financing of ad-hoc fiscal measures + higher costs of its purchases.

Country	NNP	Fiscal drag	Fiscal support	Pensions	Government consumption		**Total**
					Lower bound	Upper bound	% of GDP
Germany	3.5	0.2	−1.6	−1.1	−0.5	−1.6	−0.6 to 0.5
France	4.8	0.1	−1.3	−0.6	−0.8	−1.6	1.3 to 2.1
Italy	7.5	0.6	−1.8	−0.9	−0.3	−0.9	4.5 to 5.1
Spain	4.5	1.0	−1.2	−1.7	−0.4	−1.0	1.6 to 2.2

Headline inflation



Key drivers: energy and food prices

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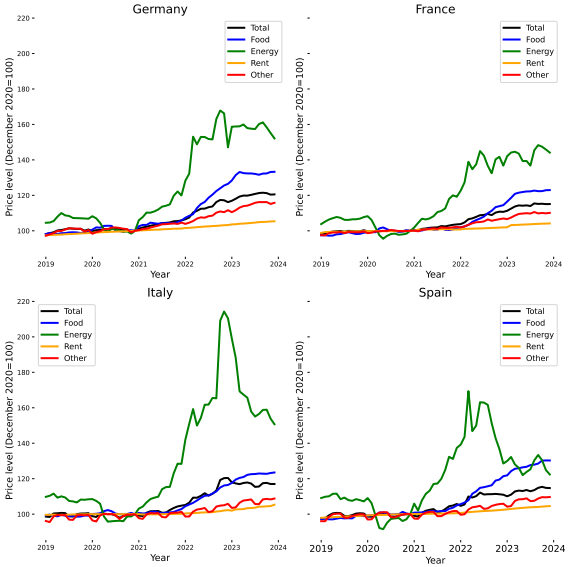

Expenditure Categories

Consumption Categories			
Class	Label	Class	Label
01	Food	07.21	Spare parts
02	Alcohol and tobacco	07.22	Fuels
03	Clothing	07.23	Vehicle maintenance
04.1	Actual rent	07.24	Other services for transport equipment
04.3	Dwelling maintenance	07.3	Transport services
04.4	Water supply	08	Communication
04.5	Electricity and gas	09	Recreation
05	Furnishings	10	Education
06	Health	11	Restaurants and Hotels
07.1	Vehicles	12	Miscellaneous

Source: Household Budget Survey (2015)

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Price indexes: Actual and counterfactual [starred]

- Individual price deflators P_{it} satisfy the relation $c_{it}P_{it} = \sum_{j=1}^{J} c_{i,jt}\mathcal{P}_{jt}$
- Aggregate price deflator $\bar{P}_t$ satisfies same relation for nationwide expenditure shares
- Goods prices $\mathcal{P}_{jt}$ paid by consumers include of good-specific taxes and subsidies (energy)

$$\mathcal{P}_{jt} = \mathcal{P}^*_{jt}\,(1 + \tau_{jt})$$

- Change in household specific price indexes at $t = 0$ induced by the shock:

$$\begin{aligned} d\log P_{i0} &\simeq \sum_{j=1}^{J} xsh_{ij,ss} \cdot d\log \mathcal{P}_{j0} \simeq \sum_{j=1}^{J} xsh_{ij,ss} \cdot \left(d\log \mathcal{P}^*_{j0} + d\tau_{jt}\right) \\ &= \underbrace{\log P^*_{i0}}_{\text{counterfactual price}} + \underbrace{d\log \mathcal{T}_{i0}}_{\text{govt interventions in energy mkt}} \end{aligned}$$

Effect of infl shock consists of: effect on "raw" price and govt interv in energy mkt $\mathcal{T}_{i0}$

Our experiment: One-off increase in infl 2021–23 (MIT shock)

Before $t = 0$ (pre-2021), aggr price level $\bar{P}_{ss}$ constant (zero inflation in steady state)

[A1] At $t = 0$ (short run; years 2021–23),

unanticipated inflation shock $dz_0 \Rightarrow$ permanent jump in aggregate price level

$$\frac{d \log \bar{P}_0}{dz_0} > 0$$

Relative good prices, wages, taxes, dividends, and asset prices left unrestricted at $t = 0$

[A2] At $t = 1$ (long run; after 2023),

price stab restored $d \log \bar{P}_1 = d \log \bar{P}_0$, rel prices back to pre-shock $d \log P_{i1} = d \log \bar{P}_{i0}$

[A3] The shock is neutral in the long run, i.e. at $t = 1$:

$$\frac{d \log W_{i1}}{dz_0} = \frac{d \log T_{i1}}{dz_0} = \frac{d \log D_{i,k1}}{dz_0} = \frac{d \log Q_{k1}}{dz_0} = \frac{dlogP_1}{dz_0}$$

[A4] Long-run adjustment of the govt budget constraint through price level or future real surpluses

Direct component: four sources of heterogeneity

Impact of the raw inflation shock P^*_{i0}

$$d\mathcal{W}_i^{DIR} = \Bigg[\underbrace{-\frac{d\log \bar{P}^*_0}{dz_0}}_{\text{average } \pi} - \underbrace{\left(\frac{d\log P^*_{i0}}{dz_0} - \frac{d\log \bar{P}^*_0}{dz_0}\right)}_{\text{1. } \pi \text{ gap raw}}\Bigg] \times$$

$$\Bigg[\underbrace{W_{i0} - T_{i0}}_{\text{2. net income}} + \underbrace{B_{i,S0} + (1 + Q_{L0}\delta)\, B_{i,L0}}_{\text{3. net nominal position (NNP)}} + \underbrace{\sum_{k=1}^{K} D_{k0} a_{i,k0} + \sum_{k=1}^{K} Q_{0k}\left(a_{i,0k} - a_{i,1k}\right)}_{\text{4. dividends + capital gains (K)}}\Bigg]$$

Note that the change in prices is the raw one, P^*, i.e., before fiscal interventions

‘Unconventional’ fiscal policy: energy market interventions & ad hoc transfers

$$d\mathcal{W}_i^{UFP} = \underbrace{\left(\frac{d\log P_{i0}^*}{dz_0} - \frac{d\log P_{i0}}{dz_0}\right)}_{\text{1. } \pi \text{ gap fiscal: energy market interventions}} \times$$

$$\left[W_{i0} - T_{i0} + B_{i,S0} + (1 + Q_{L0}\delta)\, B_{i,L0} + \sum_{k=1}^{K} D_{k0}\, a_{i,k0} + \sum_{k=1}^{K} Q_{0k}\left(a_{i,0k} - a_{i,1k}\right)\right]$$

$$- \underbrace{\frac{dT_{i0}^{HOC}}{dz_0}}_{\text{2. ad-hoc transfers}}$$

Recall that:

$$\frac{d\log P_{i0}}{dz_0} - \frac{d\log P_{i0}^*}{dz_0} = \frac{d\log \mathcal{T}_{i0}}{dz_0}$$

Indirect component: four sources of heterogeneity

$$d\mathcal{W}_i^{IND} = \underbrace{\frac{d\log W_0}{dz_0} W_0}_{\text{1. } \Delta \text{ wages}} - \underbrace{\frac{d\log T_{i0}^{AUT}}{dz_0} T_{i0}^{AUT}}_{\text{2. } \Delta \text{ net taxes}} - \underbrace{\frac{d\log Q_{S0}}{dz_0} Q_{S0} B_{S0} - \frac{d\log Q_{L0}}{dz_0} Q_{L0} \left(B_{i,L1} - \delta B_{i,L0}\right)}_{\text{3. } \Delta \text{ nominal interest rates}}$$

$$+ \underbrace{\sum_{k=1}^{K} \frac{d\log D_{k0}}{dz_0} D_{k0} a_{i,k0} + \sum_{k=1}^{K} \frac{d\log Q_{k0}}{dz_0} Q_{k0} \left(a_{i,k0} - a_{i,k1}\right)}_{\text{4. } \Delta \text{ dividends + stock and house prices}}$$

The inflationary shock affects all prices entering the household budget constraint

Long-run component

$$d\mathcal{W}_i^{LR} = -R_{S1}^{-1} \cdot \left(\frac{d \log \bar{P}_1}{dz_0} - \frac{d \log P_{i0}}{dz_0} \right) \left[B_{i,S1} + (1 + Q_{L1}\delta)\, B_{i,L1} \right].$$

- Revaluation of NNP at $t = 1$ due to long-run realignment in relative prices
- This component is zero only if the shock does not affect relative prices at $t = 0$. Then:

$$d \log P_{i0} = d \log \bar{P}_0 = d \log \bar{P}_1$$

Inflation decomposition

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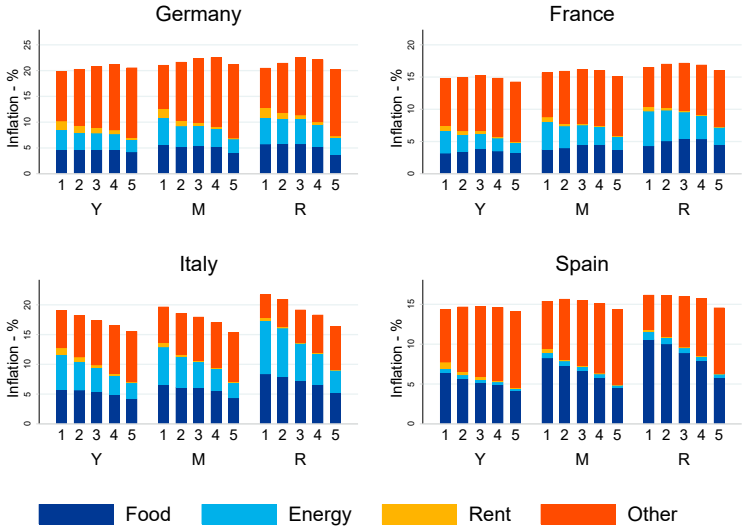

Labor income

- Income distribution: Household Finance and Consumption Survey 2017
- Wages: data on negotiated wage agreements from national statistical agencies
- Minimum wage: national official sources
- Pensions: national data transmitted to the ECB

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Subtract expected inflation from the nominal growth rates

Measurement

Taxes and transfers

- OECD Tax database

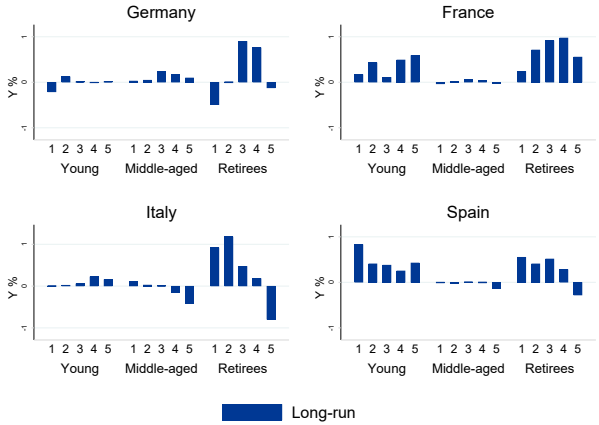
Other sources of income

- Interest, dividends, etc.: Household Finance and Consumption Survey 2017

Asset prices

- Balance sheets: Household Finance and Consumption Survey 2017
- House prices: Reaction of REIT on the day of release of German HICP as instrument for country-level quarterly house price indexes $\rightarrow$ small effect
- Stock prices: Reaction of daily stock price to release of German HICP $\rightarrow$ large effect
- Long-term bond prices: Same strategy $\rightarrow$ small effect

4. Long run component



- Small, except for poor retirees in Italy whose budget share in energy is large