

Who Bears the Costs of Inflation?

Euro Area Households and the 2021–2022 Shock

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The views expressed in this paper solely reflect those of the authors and do not necessarily represent those of the European Central Bank

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- **Develops a model** to analyze the **unequal impact of inflation shock** through:
 1. Shift in relative prices + heterogeneous consumption bundles (DIR)
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 4. Indexation of contractual and minimum wages, and pensions to the inflation shock (IND)
 5. Response of asset (bonds, housing, stocks) prices to the inflation shock (IND)
- **Combines various data sources** to measure each channel in DE, FR, IT, ES
- **Quantifies welfare cost** of each component across the **age × consumption distribution**

Household Problem

- Overlapping generations living for two periods
- No aggregate or idiosyncratic uncertainty, and no binding liquidity constraints
- Problem of the cohort born at $t = 0$

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

- Raw price index P_{it}^* before government subsidy

Nature of the inflation surprise

Before $t = 0$, the aggregate price level is constant

- [A1] At $t = 0$ (short-run), the shock induces a permanent jump in the aggregate price level
 Δ in relative good prices, wages, taxes, dividends, and asset prices are left unrestricted
- [A2] At $t = 1$ (long-run), price stability is restored, and relative prices converge to pre-shock values
- [A3] The shock is neutral in the long-run, i.e. at $t = 1$, nominal income and asset prices adjust fully to new price level
- [A4] The adjustment of the government budget constraint occurs either through the price level, or through higher real surpluses beyond $t = 1$

Welfare analysis

- **Object of interest:** impact of inflation shock on each household welfare
- **Methodology:** envelope theorem (first-order approximation)
- **Welfare criterion:** money metric welfare change, i.e. share of income individual i would be willing to pay in 2021-2022 in order to avoid the inflation shock
- Decompose welfare change as:
$$dW_i = dW_i^{DIR} + dW_i^{UFP} + dW_i^{IND} + dW_i^{LR}$$
 1. **Direct:** impact of the raw inflation shock
 2. **Unconventional fiscal policy:** impact of targeted government intervention
 3. **Indirect:** equilibrium response of labor and capital income, taxes, and asset prices
 4. **Long-run:** residual long-run effects (i.e., relative price re-alignment)

Direct component: four sources of heterogeneity

$$dW_i^{DIR} = \left[\underbrace{\frac{d \log \bar{P}_0^*}{dz_0}}_{\text{average } \pi} - \underbrace{\left(\frac{d \log P_{i0}^*}{dz_0} - \frac{d \log \bar{P}_0^*}{dz_0} \right)}_{\text{1. } \pi \text{ gap raw}} \right] \times$$
$$\left[\underbrace{W_{i0} - T_{i0}}_{\text{2. net income}} + \underbrace{\hat{B}_{i,S0} + \hat{B}_{i,L0}}_{\text{3. net nominal position}} + \underbrace{\sum_{k=1}^K D_{k0} a_{i,k0} + \sum_{k=1}^K Q_{0k} (a_{i,0k} - a_{i,1k})}_{\text{4. dividends + capital gains ('K gains')}} \right]$$

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

Unconventional fiscal policy

$$d\mathcal{W}_i^{UFP} = \underbrace{\left(\frac{d \log P_{i0}^*}{dz_0} - \frac{d \log P_{i0}}{dz_0} \right)}_{1. \pi \text{ gap fiscal}} \times$$
$$\left[W_{i0} - T_{i0} + \hat{B}_{i,S0} + \hat{B}_{i,L0} + \sum_{k=1}^K D_{k0} a_{i,k0} + \sum_{k=1}^K Q_{0k} (a_{i,0k} - a_{i,1k}) \right]$$
$$- \underbrace{\frac{dT_{i0}^{HOC}}{dz_0}}_{2. \text{ ad-hoc transfers}}$$

Indirect component: four sources of heterogeneity

$$d\mathcal{W}_i^{IND} = \underbrace{\frac{d \log W_0}{dz_0} W_0}_{1. \Delta \text{ wages}} - \underbrace{\frac{d \log T_{i0}^{AUT}}{dz_0} T_{i0}^{AUT}}_{2. \Delta \text{ net taxes}} + \underbrace{\frac{dr_{S0}}{dz_0} B_{iS0} + \frac{dr_{L0}}{dz_0} B_{i,L0}}_{3. \Delta \text{ nominal interest rates}}$$
$$+ \underbrace{\sum_{k=1}^K \frac{d \log D_{k0}}{dz_0} D_{k0} a_{i,k0} + \sum_{k=1}^K \frac{d \log Q_{k0}}{dz_0} Q_{k0} (a_{i,k0} - a_{i,k1})}_{4. \Delta \text{ dividends + stock and house prices}}$$

The inflationary shock affects all prices entering the household budget constraint

Long-run component

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

- Revaluation of NNP at $t = 1$ due to long-run **realignment in relative prices**

Long-run component

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- Revaluation of NNP at $t = 1$ due to long-run **realignment in relative prices**

We express welfare change as a **share of household total disposable income**

Measurement

Countries and demographic groups

- Big 4 economies in Euro Area: [Germany](#), [France](#), [Italy](#), [Spain](#)

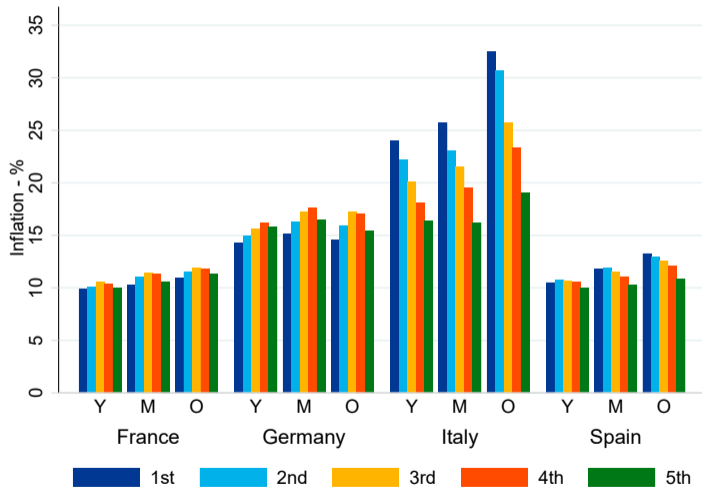
Demographic groups

- 3 age groups: 25-44, 45-64, 65+
- 5 consumption quintiles (proxy for permanent income)

Individual price indexes

- Initial expenditure shares: 20 categories, Household Budget Survey (2015) Categories
- Good-level prices: Harmonized Index of Consumer Prices (HICP)
- We measure [surprise inflation](#): deviation from expected inflation (Consensus Economics)

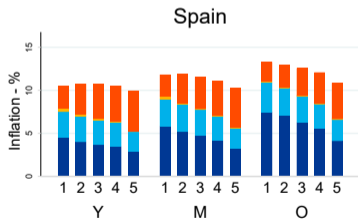
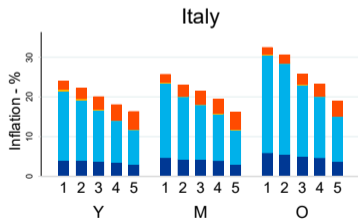
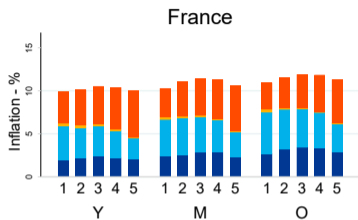
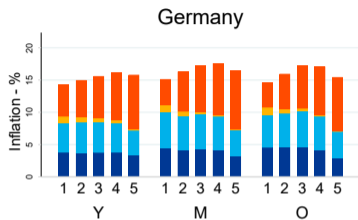
2021–22 cumulative household-level inflation



Cumulative change in the price level

- FR: 11%
- DE: 16%
- IT: 20%
- ES: 11%

Inflation decomposition



Food Energy Rent Other

Measurement

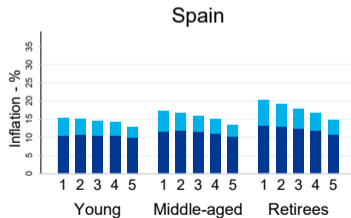
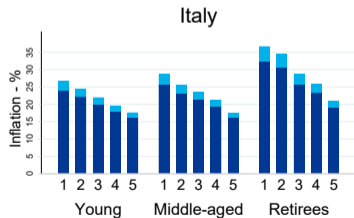
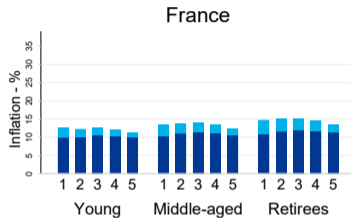
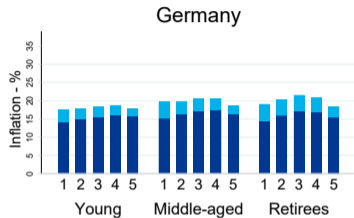
Unconventional fiscal policy

Bruegel dataset on national fiscal policy responses to the energy crisis

Split interventions in two groups:

1. **Energy market interventions**: include both subsidies and outright regulation
 - Calculate counterfactual price indices separately for gas used for heating, electricity and liquid fuels (petrol and diesel), and then aggregate
2. **Direct transfers**: ad-hoc income support to low-income households, etc...

Role of unconventional fiscal policy in containing inflation



Actual Inflation Difference to Counterfactual Inflation

Inflation reduction

- DE: -2.3%
- FR: -1.9%
- IT: -2.0%
- ES: -4.9%

Measurement

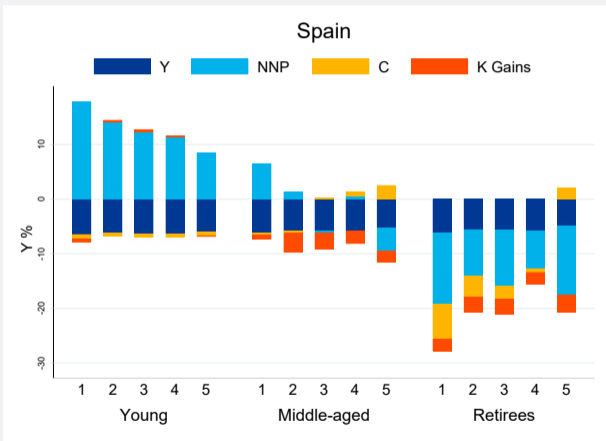
Distribution of household income and balance sheet

- 2017 Household Finance and Consumption Survey

Prices

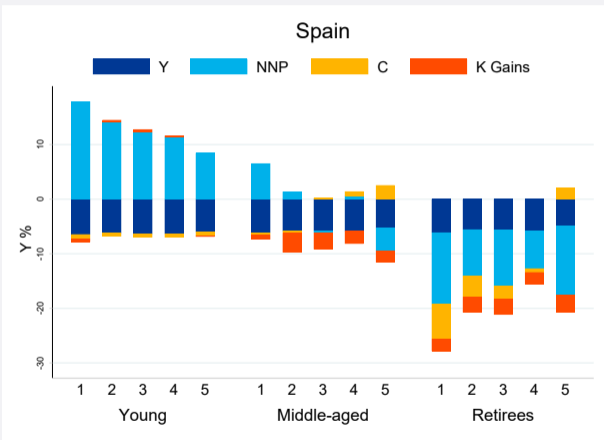
- **Wages**: official data on negotiated wage agreements and minimum wages
- **House prices**: Reaction of REIT on the day of release of German HICP as instrument for country-level quarterly house price indexes → small effect
- **Stock prices**: Reaction of daily stock price to release of German HICP → large effect
- **Long-term bond prices**: Same strategy → small effect

1. Breakdown of direct component: Spain



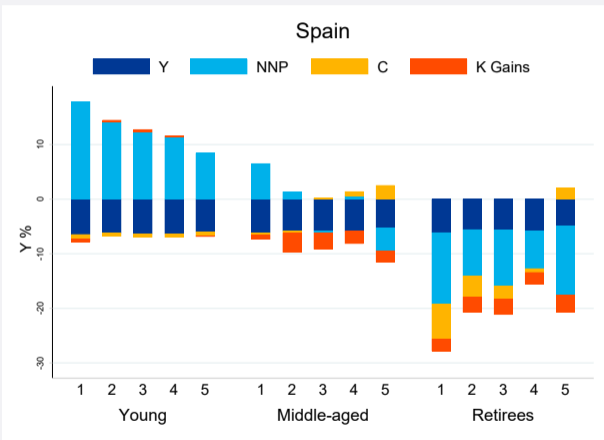
- **Net income:** loss of 7%, even by definition

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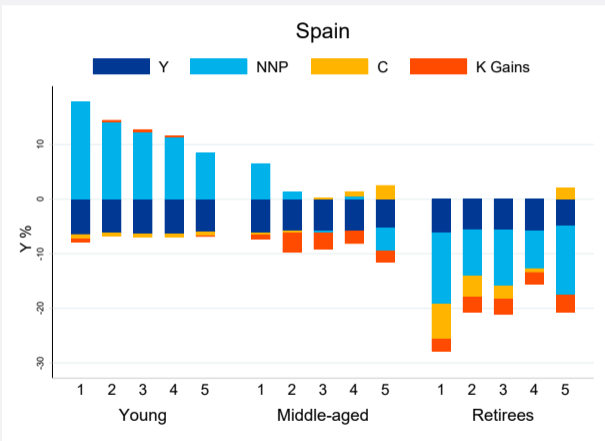
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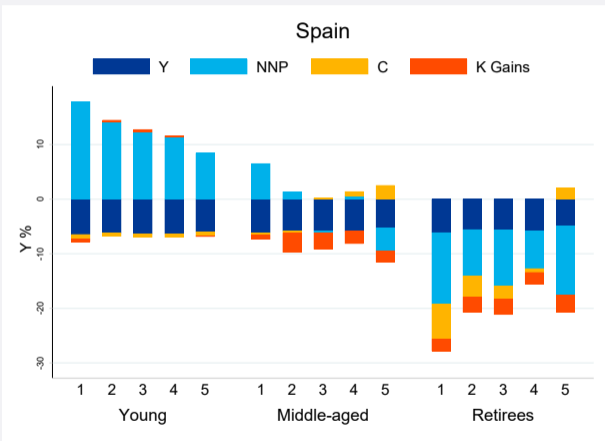
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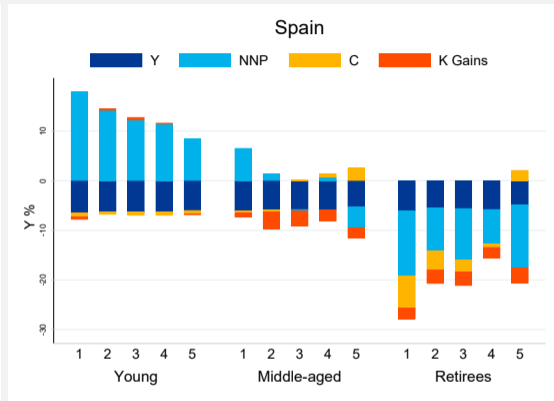
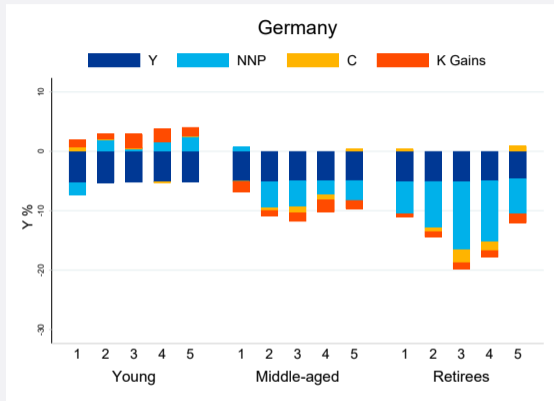


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Overall:

Old lose 20%, young gain 5% of income

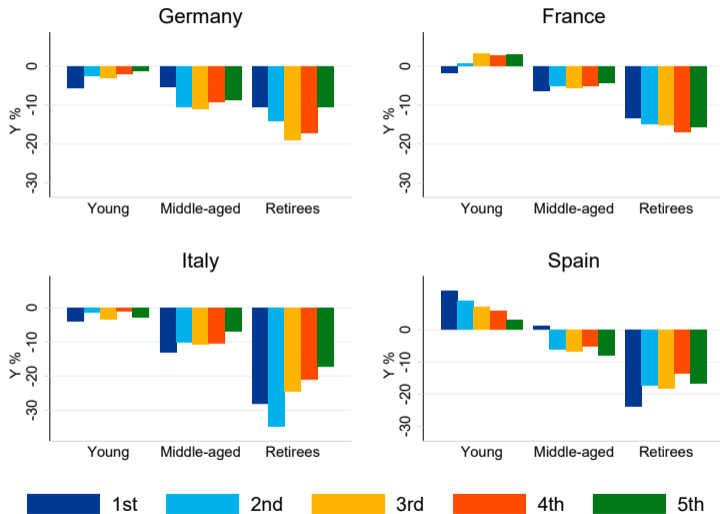
1. Direct component: Germany vs Spain



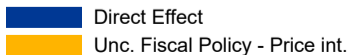
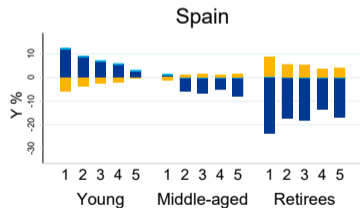
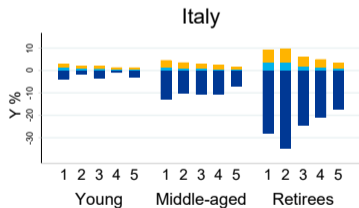
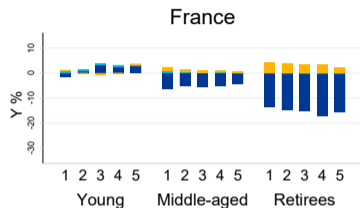
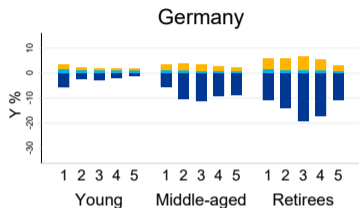
Y: Net income; NNP: Net nominal positions; C: inflation differences; K gains

More heterogeneity in Spain, in spite of lower inflation because of larger NNP and wider inflation differentials

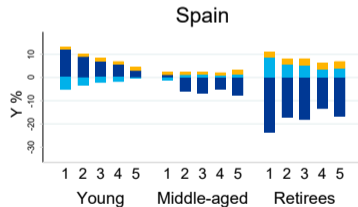
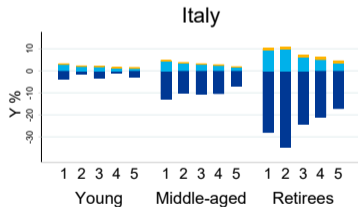
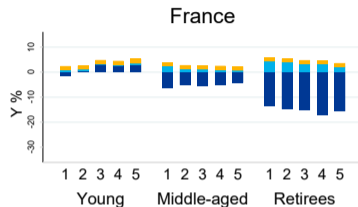
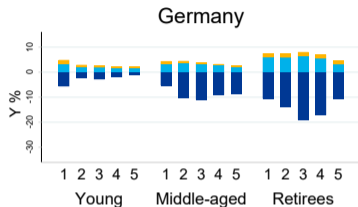
1. Direct component: cross country comparison



2. Unconventional fiscal policy component



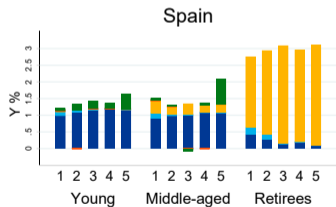
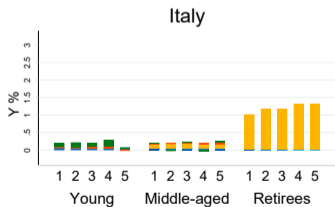
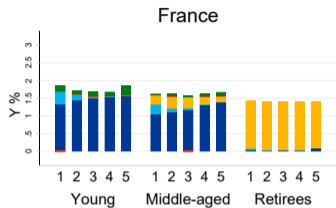
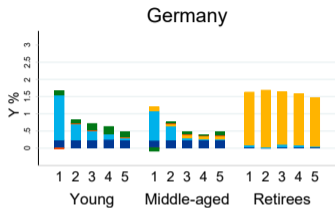
3. Indirect component



Direct Effect
Indirect Effect

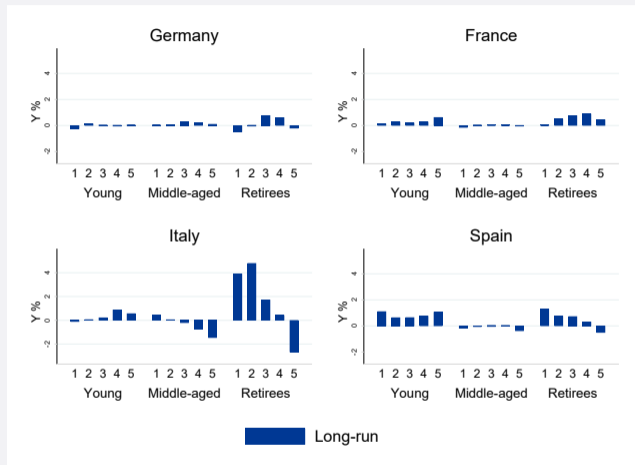
Unconventional Fiscal Policy

3. Breakdown of indirect component



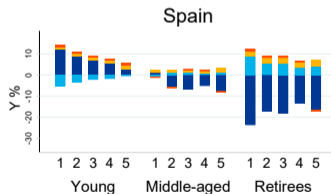
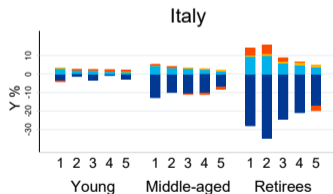
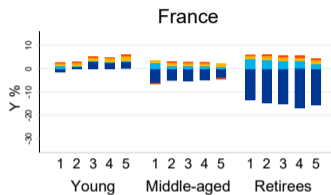
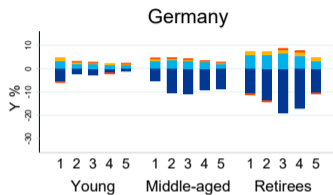
Legend: Wages (dark blue), Min. Wage (light blue), Pensions (yellow), NNP (orange), K (green)

4. Long run component



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

Total welfare change: decomposition



- Direct component dominates
- Fiscal response is nontrivial

Average effect:

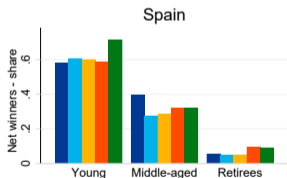
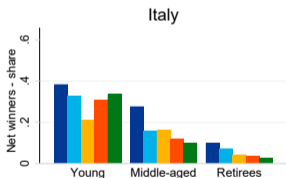
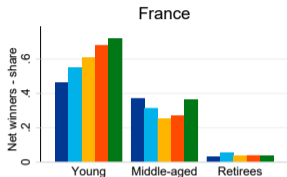
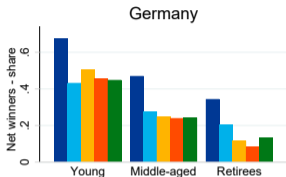
- DE: -4.3%
- FR: -2.8%
- IT: -8.4%
- ES: -3.0%

Total welfare change: heterogeneity



- Inflation is an **age-dependent tax**, but there is no clear pattern across quantiles with age
- **Heterogeneity**: 5% gains among young in ES, and 15% losses among retirees in Italy

Share of winners



1st 2nd 3rd 4th 5th

- On average, 30% of net winners
- In DE, FR, ES half of 25-44 win
- Young win because of NNP gains
- More winners in FR and ES because of negative NNPs
- Almost every retiree is a net loser

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 the poor offsets higher NNP for the rich
- Italy has recorded the largest welfare losses among the big four
- Spain has the largest share of winners
- **Unconventional fiscal policy** played a significant role, especially in Spain
- Housing and stocks are **not good inflation hedges** in the short run
- Nominal wages are quite **rigid** in the short-run

Thanks!

Headline inflation

HICP inflation and the HICP price level

(left: annual percentage changes, right: index: Dec-1998 = 100)



Sources: Eurostat.

Notes: The right panel is based on seasonally adjusted data.

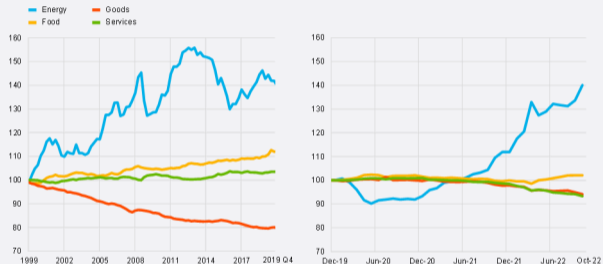
The latest observations are for October 2022.

Source: Lane (2022)

Key drivers: energy and food prices

Price developments relative to HICP for different subcomponents

(left: index: 1998 Q4 =100, right: index: December 2019 = 100)



Sources: Eurostat.

Note: Seasonally adjusted data for HICP, food, goods and services. Seasonally adjusted series for energy are not available. The goods category here only includes non-energy industrial goods (NEIG).

The latest observations are for October 2022.

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Expenditure Categories

Expenditure Categories			
Class	Label	Class	Label
01	Food	07.22	Fuels
02	Alcohol and tobacco	07.23	Vehicle maintenance
03	Clothing	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	11.1	Restaurants
07.1	Vehicles	11.2	Hotels
07.21	Spare parts	12	Miscellaneous

Source: Household Budget Survey (2015)

Cumulative inflation without rents

