Who Bears the Costs of Inflation?

Euro Area Households and the 2021–2023 Shock

Appendix*

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Abstract

We measure the heterogeneous first-order welfare effects of the recent inflation surge across households in the euro area. A simple framework illustrating the numerous transmission channels of surprise inflation to household welfare guides our empirical exercise. By combining micro data and aggregate time series, we conclude that: (i) country-level average welfare costs –expressed as a share of triennial income– were sizable and heterogeneous: around 3% in France and Spain, 7% in Germany, and 9% in Italy; (ii) this inflation episode resembles an age-dependent tax, with the retirees losing up to 14%, and roughly half of the 25–44 year-old winning; (iii) losses were quite uniform across consumption quantiles because rigid rents served as a hedge for the poor; (iv) nominal net positions were the key driver of heterogeneity across-households; (v) the rise in energy prices generated vast variation in individual-level inflation rates, but unconventional fiscal policies helped shield households. The counterpart of this household-sector loss is a significant gain for the government.

Keywords: Inflation, Redistribution, Household Heterogeneity, Net Nominal Positions, Income, Fiscal Support, Welfare.

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Introduction

The Appendix is organized as follows. Section A contains more details on the theoretical model and its derivations. Section B contains additional figures and Section C additional tables. Section D.1 outlines in more detail the measurement of price indexes, expenditure shares, household balance sheets, wages, and asset prices. Section F summarizes the calculations of counterfactual energy price indexes, in absence of government interventions. Section G summarizes the main transfer payment programs implemented in the four countries in 2021–2022. Section H explains how we compute losses for the government budget constraints due to rising energy prices. Section I discusses discrepancies between measures of nominal assets and liabilities in survey data and aggregate data on financial accounts.

Appendix A Theoretical framework

A.1 Short- and long-term debt

We model nominal short-term bonds as a contract whereby individual i buys $B_{i,St+1}$ units of bonds at the prevailing market price Q_{St} at date t and next period, they receive $B_{i,St+1}$ units of currency. Thus Q_{St}^{-1} is the nominal gross interest rate between t and $t+1$.

We model long-term bonds as a perpetuity contract with nominal coupon payments that decay geometrically at rate $\delta > 0$. A perpetuity contract specifies a price Q_{Lt} and a purchase ℓ_{it} such that household i spends $Q_{Lt}\ell_{it}$ at date t in exchange for a promise to receive $\delta^{n-1}\ell_{it}$ units of currency in every future period $t+n$, with $n > 0$. Let $B_{i,Lt}$ denote the nominal *face value* of the long-term bond portfolio held by household i at time t as the total payments due in period t on all purchases of past issuances.

$$B_{i,Lt} = \sum_{n=1}^{t} \delta^{n-1}\ell_{i,t-n} = \ell_{i,t-1} + \delta\ell_{i,t-2} + \delta^2\ell_{i,t-3} + \cdots + \delta^{t-1}\ell_{i,0}. \tag{A1}$$

Rearranging (*A*1), it is easy to obtain the recursive relation

$$B_{i,L,t+1} = \delta B_{i,Lt} + \ell_{it},$$

where $\delta B_{i,Lt}$ is outstanding nominal debt and ℓ_{it} are new bond purchases at time t.

We want to obtain the market value of outstanding nominal debt, which is defined as the discounted present value of all future payments from $t+1$ onward:

$$\begin{aligned} \text{MktValue\_LTBond}_{it} &= Q_{St}\left[\delta\ell_{i,t-1} + \delta^2\ell_{i,t-2} + \delta^3\ell_{i,t-3} + \dots\right] \\ &+ Q_{St}Q_{S,t+1}\left[\delta^2\ell_{i,t-1} + \delta^3\ell_{i,t-2} + \delta^4\ell_{i,t-3} + \dots\right] \\ &+ \dots \\ &= Q_{St}\left[1 + Q_{S,t+1}\delta + Q_{S,t+1}Q_{S,t+2}\delta^2 + \dots\right]\delta B_{i,Lt}. \end{aligned} \tag{A2}$$

Now consider the no-arbitrage condition between short and long term bond (see the derivation below for details)

$$Q_{Lt} = Q_{St} \left(1 + \delta Q_{L,t+1}\right)$$

and substitute out $Q_{L,t+n}$, $n > 0$, recursively to obtain

$$Q_{Lt} = Q_{St} \left[1 + \delta Q_{S,t+1} \left(1 + \delta \left(Q_{S,t+2} \left(1 + \delta Q_{L,t+3}\right)\right)\right)\right],$$

which, compared to the second line in (*A*2), illustrates that the market value of outstanding long-term bonds at t is $Q_{Lt}\delta B_{i,Lt}$. The case $\delta = 0$ corresponds to short-term one-period bonds which we denoted by $B_{i,St}$.

A.2 Price indexes

Let P_{it} be the individual-level price index faced by household i and defined as the deflator for basket c_{it} which satisfies the relation (1) in the main text

$$c_{it} P_{it} = \sum_{j=1}^{J} c_{ij,t} \mathcal{P}_{jt}, \tag{A3}$$

where $j = 1, \ldots, J$ denotes a specific consumption category and $\mathcal{P}_{jt}$ its price. Taking logs of (*A*3) and evaluating the effect of small changes in the entire vector $\{\mathcal{P}_{jt}\}$, at $t = 0$ where the economy rests in steady state, on the individual price index P_{it} we obtain

$$\begin{aligned} \log P_{it} &\simeq \log P_{i0} + \sum\nolimits_{j=1}^{J} \frac{\left(\frac{c_{ij,0}}{c_{i,0}}\right)}{\sum\nolimits_{j=1}^{J} \left(\frac{c_{ij,0}}{c_{i0}}\right) \mathcal{P}_{j0}} \left(\mathcal{P}_{jt} - \mathcal{P}_{j0}\right) \\ &= \log P_{i0} + \sum\nolimits_{j=1}^{J} \frac{c_{ij,0}\mathcal{P}_{j0}}{\sum\nolimits_{j=1}^{J} c_{ij,0}\mathcal{P}_{j0}} \left(\frac{\mathcal{P}_{jt} - \mathcal{P}_{j0}}{\mathcal{P}_{j0}}\right), \end{aligned}$$

which yields

$$d\log P_{it} \simeq \sum\nolimits_{j=1}^{J} xsh_{ij,0} \cdot d\log \mathcal{P}_{jt},$$

where $xsh_{ij,0}$ is the expenditure share of household i on good j at the initial time, the point of the expansion, i.e., before the price change. The notation $d\log X_{it}$ represents the log change of variable X_i between its steady-state value and its value at $t + 1$.

Recall that $\mathcal{P}_{jt} = \mathcal{P}^*_{jt} \left(1 + \tau_{jt}\right)$, where $\mathcal{P}^*_{jt}$ is the raw price and τ_{jt} denote good-specific wedges (interpreted as taxes is positive and subsidies if negative). For our decomposition in the main text, it is useful to separate the effect of deviations in raw prices $\mathcal{P}_{jt}$ from the effect of deviations in taxes τ_{jt}.

We generalize the previous derivation as

$$\begin{aligned}\log P_{it} &\simeq \log P_{i0} + \sum\nolimits_{j=1}^{J} \frac{\left(\frac{c_{ij,0}}{c_{i0}}\right)(1+\tau_{j0})}{\sum\nolimits_{j=1}^{J}\left(\frac{c_{ij,0}}{c_{i0}}\right)\mathcal{P}_{j0}}\left(\mathcal{P}^*_{jt}-\mathcal{P}^*_{j0}\right) + \sum\nolimits_{j=1}^{J} \frac{\left(\frac{c_{ij,0}}{c_{i0}}\right)\mathcal{P}^*_{j0}}{\sum\nolimits_{j=1}^{J}\left(\frac{c_{ij,0}}{c_{i0}}\right)\mathcal{P}_{j0}}\left(\tau_{jt}-\tau_{j0}\right) \\ &= \log P_{i0} + \sum\nolimits_{j=1}^{J} \frac{c_{ij,0}\mathcal{P}_{j0}}{\sum\nolimits_{j=1}^{J} c_{ij,0}\mathcal{P}_{j0}}\left(\frac{\mathcal{P}^*_{jt}-\mathcal{P}^*_{j0}}{\mathcal{P}^*_{j0}}\right) + \sum\nolimits_{j=1}^{J} \frac{c_{ij,0}\mathcal{P}_{j0}}{\sum\nolimits_{j=1}^{J} c_{ij,0}\mathcal{P}_{j0}}\left(\frac{\tau_{jt}-\tau_{j0}}{1+\tau_{j0}}\right),\end{aligned}$$

which yields

$$d\log P_{it} \simeq \sum\nolimits_{j=1}^{J} xsh_{ij,0}\cdot d\log \mathcal{P}^*_{jt} + \sum\nolimits_{j=1}^{J} xsh_{ij,0}\cdot d\tau_{jt}.$$

In the main text, we use the notation

$$\begin{aligned}d\log P^*_{it} &= \sum\nolimits_{j=1}^{J} xsh_{ij,0}\cdot d\log \mathcal{P}^*_{jt}, \\ d\log \mathcal{T}_{it} &= \sum\nolimits_{j=1}^{J} xsh_{ij,0}\cdot d\tau_{jt}.\end{aligned}$$

A.3 Household problem and optimality

We restate periods $t = 0, 1$ budget constraints for a cohort born at $t = 0$:

$$\begin{aligned}c_{i0}P_{i0} &= W_{i0} - T_{i0} + B_{i,S0} + B_{i,L0} + \sum_{k=1}^{K}\left(Q_{k0}+D_{k0}\right)a_{i,k0} - Q_{S0}B_{i,S1} - Q_{L0}\left(B_{i,L1} - \delta B_{i,L0}\right) - \sum_{k=1}^{K} Q_{k0}a_{i,k1} \\ c_{i1}P_{i1} &= W_{i1} - T_{i1} + B_{i,S1} + \left(1+Q_{L1}\delta\right)B_{i,L1} + \sum_{k=1}^{K}\left(Q_{k1}+D_{k1}\right)a_{i,k1}, \qquad \text{(A4)}\end{aligned}$$

where the $t = 1$ constraint encodes the fact that it is the last period of this cohort's lifetime, and thus optimality implies that $B_{i,S2} = B_{i,L2} = a_{i,k2} = 0$ for all k.

The Lagrangean of this problem is

$$\begin{aligned}\mathcal{L}_i = \sum_{t=0}^{1}\beta_i^t u_i\left(c_{it}\right) + \sum_{t=0}^{1}\beta_i^t\lambda_{it} & \Bigg[W_{it} - T_{it} + B_{i,St} + \left(1+\delta Q_{Lt}\right)B_{i,Lt} + \sum_{k=1}^{K}\left(Q_{kt}+D_{kt}\right)a_{i,kt} \\ & -c_{it}P_{it} - Q_{St}B_{i,St+1} - Q_{Lt}B_{i,Lt+1} - \sum_{k=1}^{K} Q_{kt}a_{i,kt+1}\Bigg] \qquad \text{(A5)}\end{aligned}$$

where λ_{it} is the shadow value of one unit of account (e.g., one euro) for individual i at date t.

The first order conditions (FOCs) with respect to $(c_{it}, B_{i,S1}, B_{i,L1}, a_{i,k1})$ are:

$$\begin{aligned}
u_i'(c_{it}) &= \lambda_{it} P_{it} \text{ for } t = 0, 1 \\
\lambda_{i0} Q_{S0} &= \beta_i \lambda_{i1} \\
\lambda_{i0} Q_{L0} &= \beta_i \lambda_{i1} (1 + Q_{L1}\delta) \\
\lambda_{i0} Q_{k0} &= \beta_i \lambda_{i1} (Q_{k1} + D_{k1}) \text{ for all } k.
\end{aligned} \tag{A6}$$

Combining the first two equations yields

$$\beta_i \lambda_{i1} = Q_{S0} \cdot \frac{u'(c_{i0})}{P_{i0}}. \tag{A7}$$

Note that the FOCs can be rewritten as

$$\begin{aligned}
Q_{S0} &= \beta_i \frac{u_i'(c_{i1})}{u_i'(c_{i0})} \left(\frac{P_{i0}}{P_{i1}} \right) \\
Q_{L0} &= Q_{S0} (1 + Q_{L1}\delta) \\
Q_{k0} &= Q_{S0} (Q_{k1} + D_{k1}) \text{ for all } k.
\end{aligned} \tag{A8}$$

A.4 Welfare impact of the shock

By invoking the envelope theorem, the impact of the shock on a household's welfare can be computed from the Lagrangean abstracting from any change in choice variables (i.e., the composition of the consumption basket and the asset portfolio) because, to a first-order, whether the agent adjusts optimally or not at all does not matter:

$$\frac{dV_i}{dz_0} = \frac{d\mathcal{L}_i}{dz_0}. \tag{A9}$$

We focus on the notion of 'money-metric welfare' $\mathcal{W}_i$ defined as:

$$d\mathcal{W}_i = \frac{dV_i/dz_0}{\lambda_{i0}} = \frac{dV_i/dz_0}{u'(c_{i0})} P_{i0}, \tag{A10}$$

where for the second equality we have used (A6). Note that dV_i/dz_0 is expressed in utils. Thus, as clear from the second equality, dividing it by λ_{i0} is equivalent to first transforming it in real terms by dividing by the marginal utility of the individual consumption bundle, and then in nominal terms by multiplying it by the initial individual-level price index at $t = 0$ before the shock hits.

We now split welfare into the first period and second-period welfare changes as:

$$d\mathcal{W}_i = d\mathcal{W}_{i0} + d\mathcal{W}_{i1}.$$

Differentiating the Lagrangean with respect to z_0 yields:

$$
\begin{aligned}
\frac{d\mathcal{L}_i}{dz_0} = \lambda_{i0} \quad & \left[-\frac{d\log P_{i0}}{dz_0} c_{i0} P_{i0} + \frac{d\log W_{i0}}{dz_0} W_{i0} - \frac{d\log T_{i0}}{dz_0} T_{i0} + \sum_{k=1}^{K} \frac{d\log Q_{k0}}{dz_{i0}} Q_{k0} \left(a_{i,k0} - a_{i,k1}\right) \right. \\
& \left. + \sum_{k=1}^{K} \frac{d\log D_{k0}}{dz_0} D_{k0} a_{i,k0} \right] \qquad \text{(A11)} \\
& + \lambda_{i0} \left[-\frac{d\log Q_{S0}}{dz_0} Q_{S0} B_{i,S1} - \frac{d\log Q_{L0}}{dz_0} Q_{L0} \left(B_{i,L1} - \delta B_{i,L0}\right) \right] \\
+\beta_i \lambda_{i1} \quad & \left[-\frac{d\log P_{i1}}{dz_0} c_{i1} P_{i1} + \frac{d\log W_{i1}}{dz_0} W_{i1} - \frac{d\log T_{i1}}{dz_0} T_{i1} + \sum_{k=1}^{K} \frac{d\log Q_{k1}}{dz_0} Q_{k1} a_{i,k1} \right. \\
& \left. + \sum_{k=1}^{K} \frac{d\log D_{k1}}{dz_0} D_{k1} a_{i,k1} \right] \\
+\beta_i \lambda_{i1} \quad & \frac{d\log Q_{L1}}{dz_0} \delta Q_{L1} B_{i,L1}.
\end{aligned}
$$

Note that the last term is zero because of *Assumption 3*.

Using (*A6*) and (*A7*) to substitute out the multipliers, exploiting the envelope theorem result in (*A9*), and applying our definition of welfare in (*A10*) we arrive at:

$$
\begin{aligned}
d\mathcal{W}_{i0} \quad = \quad & -\frac{d\log P_{i0}}{dz_0} c_{i0} P_{i0} + \frac{d\log W_{i0}}{dz_0} W_{i0} - \frac{d\log T_{i0}}{dz_0} T_{i0} + \sum_{k=1}^{K} \frac{d\log Q_{k0}}{dz_{i0}} Q_{k0} \left(a_{i,k0} - a_{i,k1}\right) \qquad \text{(A12)} \\
& + \sum_{k=1}^{K} \frac{d\log D_{k0}}{dz_0} D_{k0} a_{i,k0} - \frac{d\log Q_{S0}}{dZ_0} Q_{S0} B_{i,S1} - \frac{d\log Q_{L0}}{dZ_0} Q_{L0} \left(B_{i,L1} - \delta B_{i,L0}\right)
\end{aligned}
$$

for the first period and

$$
d\mathcal{W}_{i1} = Q_{S0} \left[-\frac{d\log P_{i1}}{dz_0} c_{i1} P_{i1} + \frac{d\log W_{i1}}{dz_0} W_{i1} - \frac{d\log T_{i1}}{dz_0} T_{i1} + \sum_{k=1}^{K} \frac{d\log Q_{k1}}{dz_0} Q_{k1} a_{i,k1} + \sum_{k=1}^{K} \frac{d\log D_{k1}}{dz_0} D_{k1} a_{i,k1} \right] \qquad \text{(A13)}
$$

for the second period.

Assumptions 2-3 on duration and long run neutrality of the shocks state that

$$
\frac{d\log W_{i1}}{dz_0} = \frac{d\log T_{i1}}{dz_0} = \frac{d\log D_{k1}}{dz_0} = \frac{d\log Q_{k1}}{dz_0} = \frac{d\log \bar{P}_{i1}}{dz_0} = \frac{d\log \bar{P}_1}{dz_0}.
$$

Thus, collecting terms, we can rewrite the second-period welfare change $d\mathcal{W}_{i1}$ as

$$
d\mathcal{W}_{i1} = \frac{d\log \bar{P}_1}{dz_0} Q_{S0} \left[-c_{i1} P_{i1} + W_{i1} - T_{i1} + \sum_{k=1}^{K} \left(Q_{k1} + D_{k1}\right) a_{i,k1} \right].
$$

Using period $t = 1$ budget constraint from ($A4$), we arrive at

$$d\mathcal{W}_{i1} = -\frac{d\log \bar{P}_1}{dz_0} Q_{S0} \left[B_{i,S1} + (1 + Q_{L1}\delta) B_{i,L1}\right]. \tag{A14}$$

A.5 Decomposition

We now derive the breakdown of this welfare change into four components: (i) a short-run pre-government direct component, (ii) an unconventional fiscal policy component, (iii) a short-run indirect component, and (iv) a long-run component:

$$d\mathcal{W}_i = d\mathcal{W}_i^{DIR} + d\mathcal{W}_i^{UFP} + d\mathcal{W}_i^{IND} + d\mathcal{W}_i^{LR}.$$

The direct component $d\mathcal{W}_i^{DIR}$ takes into account only the increase in the raw cost of living for an individual, and abstracts from ad-hoc government interventions in response to the shock $\left(\tau_{jt}, T_{it}^{HOC}\right)$, from all equilibrium changes in wages and net transfers $\left(W_{it}, T_{it}^{AUT}\right)$, as well as from changes in prices $(Q_{St}, Q_{Lt}, Q_{kt}, D_{kt})$.

Consider the first term of $d\mathcal{W}_{i0}$ in equation ($A12$) and use the period $t = 0$ budget constraint ($A4$):

$$\begin{aligned} -\frac{d\log P_{i0}}{dz_0} c_{i0} P_{i0} &= -\frac{d\log P_{i0}}{dz_0} \Bigg[W_{i0} - T_{i0} + B_{i,S0} + (1 + Q_{L0}\delta) B_{i,L0} + \sum_{k=1}^{K} Q_{0k} \left(a_{i,0k} - a_{i,1k}\right) \\ &\quad + \sum_{k=1}^{K} D_{0k} a_{i,0k} - Q_{S0} B_{i,S1} - Q_{L0} B_{i,L1}\Bigg] \\ &= -\frac{d\log P_{i0}}{dz_0} \left[W_{i0} - T_{i0} + B_{i,S0} + (1 + Q_{L0}\delta) B_{i,L0} + \sum_{k=1}^{K} Q_{0k} \left(a_{i,0k} - a_{i,1k}\right) + \sum_{k=1}^{K} D_{0k} a_{i,0k}\right] \\ &\quad + \frac{d\log P_{i0}}{dz_0} \left[Q_{S0} B_{i,S1} + Q_{L0} B_{i,L1}\right]. \end{aligned} \tag{A15}$$

Recall that from our derivation of Section 2:

$$\frac{d\log P_{i0}}{dz_0} = \frac{d\log P_{i0}^*}{dz_0} + \frac{d\log \mathcal{T}_{i0}}{dz_0}. \tag{A16}$$

We define the short-run direct component of the welfare change as the term in the second line of equation ($A15$) which is driven by the change in raw individual-level price indexes P_{i0}^*:

$$d\mathcal{W}_i^{DIR} = -\frac{d\log P_{i0}^*}{dz_0} \left[W_{i0} - T_{i0} + B_{i,S0} + (1 + Q_{L0}\delta) B_{i,L0} + \sum_{k=1}^{K} Q_{0k} \left(a_{i,0k} - a_{i,1k}\right) + \sum_{k=1}^{K} D_{0k} a_{i,0k}\right]. \tag{A17}$$

The main text provides an interpretation, term by term.

To determine the unconventional fiscal policy component, it is useful to distinguish between two components of net transfers to households

$$T_{i0}^{AUT} + T_{i0}^{HOC},$$

and define $d\log T_{i0}^{AUT}$ as the automatic adjustment to the shock, for a given tax and transfer system already in place at the time of the shock, and $d\log T_{i0}^{HOC}$ as all ad-hoc direct fiscal transfers to households adopted to fight the inflationary shock. This welfare component collects this latter term as well as the ad-hoc government interventions that directly mitigate the rise in certain prices, i.e. $d\log \mathcal{T}_{i0}$ in equation ($A16$). Combining terms

$$\begin{aligned} d\mathcal{W}_i^{UFP} &= -\frac{d\log \mathcal{T}_{i0}}{dz_0}\left[W_{i0} - T_{i0} + B_{i,S0} + (1+Q_{L0}\delta)\, B_{i,L0} + \sum_{k=1}^{K} Q_{0k}\left(a_{i,0k} - a_{i,1k}\right) + \sum_{k=1}^{K} D_{0k}a_{i,0k}\right] \\ &\quad -\frac{dT_{i0}^{HOC}}{dz_0}. \end{aligned} \tag{A18}$$

It is easy to see that by summing ($A17$) and ($A18$) one obtains ($A15$), net of the term in the fourth line of ($A15$).

Consider now precisely this term in the third line of ($A15$) and add it to $t = 1$ welfare change $d\mathcal{W}_{i1}$ computed in ($A14$). We define the long-run component of the welfare change as

$$d\mathcal{W}_i^{LR} = d\mathcal{W}_{i1} + \frac{d\log P_{i0}}{dz_0}\left[Q_{S0}B_{i,S1} + Q_{L0}B_{i,L1}\right].$$

Using the expression for $d\mathcal{W}_{i1}$ in ($A14$) together with the no-arbitrage condition $Q_{L0} = Q_{S0}\,(1 + Q_{L1}\delta)$ between short-term and long-term bonds in ($A8$) yields

$$d\mathcal{W}_i^{LR} = Q_{S0}\left(\frac{d\log P_{i0}}{dz_0} - \frac{d\log \bar{P}_1}{dz_0}\right)\left[B_{i,S1} + (1+Q_{L1}\delta)\, B_{i,L1}\right]. \tag{A19}$$

The main text contains the interpretation of each term of this component.

The remaining term is the short-run general equilibrium welfare change which collects all the remaining terms in $d\mathcal{W}_{i0}$

$$\begin{aligned} d\mathcal{W}_i^{IND} &= \frac{d\log W_{i0}}{dz_0}W_{i0} - \frac{d\log T_{i0}^{AUT}}{dz_0}T_{i0}^{AUT} + \sum_{k=1}^{K}\frac{d\log Q_{k0}}{dz_0}Q_{k0}\left(a_{i,k0} - a_{i,k1}\right) + \sum_{k=1}^{K}\frac{d\log D_{k0}}{dz_0}D_{k0}a_{i,k0} \\ &\quad -\frac{d\log Q_{S0}}{dz_0}Q_{S0}B_{i,S1} - \frac{d\log Q_{L0}}{dz_0}Q_{L0}\left(B_{i,L1} - \delta B_{i,L0}\right). \end{aligned} \tag{A20}$$

The main text contains an interpretation of this last component.

A.6 Old cohort

These derivations apply to the young cohort who lives through the short-run and the long-run. We now obtain similar derivations for the old cohort, which we denote with the hat symbol. Their Lagrangean satisfies:

$$\widehat{\mathcal{L}}_i = u\left(c_{i0}\right) + \lambda_{i0}\left[W_{i0} - T_{i0} + B_{i,S0} + B_{i,L0} + \sum_{k=1}^{K}\left(Q_{k0} + D_{k0}\right) a_{i,k0} - c_{i0}P_{i0} + Q_{L0}\delta B_{i,L0}\right].$$

Differentiating with respect to the shock dz_0, and following the same steps as before, we obtain:

$$\begin{aligned} d\widehat{\mathbb{W}}_i &= -\frac{d\log P_{i0}}{dz_0}c_{i0}P_{i0} + \frac{d\log W_{i0}}{dz_0}W_{i0} - \frac{d\log T_{i0}}{dz_0}T_{i0} + \sum_{k=1}^{K}\frac{d\log Q_{k0}}{dz_{i0}}Q_{k0}a_{i,k0} \\ &\quad + \sum_{k=1}^{K}\frac{d\log D_{k0}}{dz_0}D_{k0}a_{i,k0} + \frac{d\log Q_{L0}}{dz_0}\delta B_{i,L0}. \end{aligned} \tag{A21}$$

The decomposition becomes:

$$\begin{aligned} d\widehat{\mathbb{W}}_i^{DIR} &= -\frac{d\log P_{i0}^*}{dz_0}\left[W_{i0} - T_{i0} + Q_{L0}\delta B_{i,L0} + B_{i,S0} + B_{i,L0} + \sum_{k=1}^{K}Q_{k0}a_{i,k0} + \sum_{k=1}^{K}D_{k0}a_{i,k0}\right] \\ d\widehat{\mathbb{W}}_i^{UFP} &= \left(\frac{d\log P_{i0}^*}{dz_0} - \frac{d\log P_{i0}}{dz_0}\right)\left[W_{i0} - T_{i0} + Q_{L0}\delta B_{i,L0} + B_{i,S0} + B_{i,L0} + \sum_{k=1}^{K}Q_{k0}a_{i,k0} + \sum_{k=1}^{K}D_{k0}a_{i,k0}\right] \\ &\quad -\frac{dT_{i0}^{HOC}}{dz_0} \\ d\widehat{\mathbb{W}}_i^{IND} &= \frac{d\log W_{i0}}{dz_0}W_{i0} - \frac{d\log T_{i0}^{AUT}}{dz_0}T_{i0}^{AUT} + \sum_{k=1}^{K}\frac{d\log Q_{k0}}{dz_{i0}}Q_{k0}a_{i,k0} + \sum_{k=1}^{K}\frac{d\log D_{k0}}{dz_0}D_{k0}a_{i,k0} \\ &\quad + \frac{d\log Q_{L0}}{dz_0}\delta B_{i,L0}. \end{aligned}$$

A.7 Sectoral aggregation

In this section, we describe the budget constraints of the household, government and foreign sectors, as well as the value of the firm sector, and show that, by aggregating them, one obtains the fundamental national income account identity.

Household sector. Summing across all households i (young and old) budget constraints at $t = 0$ in equation (6), we obtain the consolidated budget constraint of the household sector

$$\bar{P}_0C_0 + Q_{A0}A_1^h + \sum_{j=h,f,g,x} Q_{j0}\left(B_{j1}^h - \delta_j B_{j0}^h\right) = W_0 - T_0 + \left(Q_{A0} + D_0\right)A_0^h + \sum_{j=h,f,g,x} B_{j0}^h, \tag{A22}$$

where $\bar{P}_0 = \bar{P}_0^*\left(1 + \mathcal{T}_0\right)$ is the price index gross of taxes/subsidies. In addition, $\bar{P}_0C_0 = \sum_{i=1}^{I} P_{i0}c_{i0}$,

$W_0 = \sum_{i=1}^{I} W_{i0}, A_0^h = \sum_{i=1}^{I} a_{i0}^h$, and so on. Note that, compared to equation (6), the only differences are that 1) we combine all K real assets into one, and 2) we combine short-term and long-term nominal positions of households, denoted by B_{St} and B_{Lt} in equation (6), and re-express them in terms of debt issued by the four sectors.

Firm sector. The consolidated value of all firms in the economy at $t = 0$ can be written recursively as:

$$(Q_{A0} + D_0) A_0 = \bar{P}_0^Y Y_0 - P_0^I I_0 - W_0 - \sum_{j=h,f,g,x} Q_{j0} \left(B_{j1}^f - \delta_j B_{j0}^f \right) + \sum_{j=h,f,g,x} B_{j0}^f + Q_{S0} (Q_{A1} + D_1) A_1, \tag{A23}$$

where Y_0 is total real output, I_0 is real gross investment, and $\bar{P}_0^Y$ and $\bar{P}_0^I$ are the output and investment deflator, respectively. This equation clarifies the origin of the capital gain component due to the change in the price of real assets which appears in equation (13). For instance, if nominal wages are stickier than prices, the inflation shock raises firm profits, which contributes to the rise in Q_{A0}. Or, if the firm sector is, on net, a borrower, inflation will dilute debt and the value of the firm sector will rise. And so on. All these effects, jointly, are captured in our estimates of Sections 3.3.3 and 3.3.4. Thus, for example, the reduction of real wages induces a loss for households showing up as one of the components of equation (13). The same force, however, contributes to a capital gain for those households who hold shares of the business sector showing up in that same equation in a different term.

Government sector. The intertemporal government budget constraint at $t = 0$ reads

$$(Q_{A0} + D_0) A_0^g + \sum_{j=h,f,g,x} B_{j0}^g = \bar{P}_0^G G_0 - T_0 - \bar{P}_0^* \mathcal{T}_0 C_0 + Q_{A0} A_1^g + \sum_{j=h,f,g,x} Q_{j0} \left(B_{j1}^g - \delta_j B_{j0}^g \right), \tag{A24}$$

where G_0 are real government expenditures and $\bar{P}_0^G$ denotes their deflator.

Foreign sector. The domestic net asset position of the foreign sector toward the domestic economy evolves according to

$$Q_{A0} A_1^x + \sum_{j=h,f,g,x} Q_{j0} \left(B_{j1}^x - \delta_j B_{j0}^x \right) + \bar{P}_0^E E_0 = (Q_{A0} + D_0) A_0^x + \sum_{j=h,f,g,x} B_{j0}^x + \bar{P}_0^M M_0 \tag{A25}$$

where E_0 and M_0 denote, respectively, exports from and imports into the domestic economy, with corresponding aggregate price indexes $\bar{P}_0^E$ and $\bar{P}_0^M$. This equation also states that the current account surplus plus the capital account surplus of the domestic economy must sum to zero.

Finally, note that, by market clearing:

$$\begin{aligned} \sum_{s=h,f,g,x} B_{jt}^s &= 0, \qquad \text{for } j = h, f, g, x, \\ \sum_{s=h,g,x} A_t^s &= 1. \end{aligned} \tag{A26}$$

We now show that equations ($A22$) to ($A25$) aggregate properly and yield the national income identity in nominal terms. From the household budget constraint ($A22$) and the market clearing conditions ($A26$) :

$$\begin{aligned}
& \bar{P}_0^* \left(1+\mathfrak{T}_0\right) C_0 + Q_{A0}\left(A_1 - A_1^g - A_1^x\right) + Q_{f0}\left(B_{f1} - \delta_f B_{f0}\right) + Q_{g0}\left(B_{g1} - \delta_g B_{g0}\right) + Q_{x0}\left(B_{x1} - \delta_x B_{x0}\right) \\
& - \sum_{j=h,g,x} Q_{j0}\left(B_{j1}^f - \delta_j B_{j0}^f\right) - \sum_{j=h,f,x} Q_{j0}\left(B_{j1}^g - \delta_j B_{j0}^g\right) - \sum_{j=h,f,g} Q_{j0}\left(B_{j1}^x - \delta_j B_{j0}^x\right) + \sum_{j=f,g,x} B_{h0}^j \\
= \; & W_0 - T_0 + \left(Q_{A0}+D_0\right) A_0 - \left(Q_{A0}+D_0\right) A_0^g - \left(Q_{A0}+D_0\right) A_0^x + B_{f0} + B_{g0} + B_{x0} \\
& - \sum_{j=h,g,x} B_{j0}^f - \sum_{j=h,f,x} B_{j0}^g - \sum_{j=h,f,g} B_{j0}^x + \sum_{j=f,g,x} Q_{h0}\left(B_{h1}^j - \delta_h B_{h0}^j\right).
\end{aligned}$$

Using the government budget constraint ($A24$) to substitute out $Q_{g0}\left(B_{g1} - \delta_g B_{G0}\right)$, the expression above simplifies to:

$$\begin{aligned}
& \bar{P}_0^* C_0 + \bar{P}_0^G G_0 + Q_{A0}\left(A_1 - A_1^x\right) + Q_{f0}\left(B_{f1} - \delta_f B_{f0}\right) + Q_{x0}\left(B_{x1} - \delta_x B_{x0}\right) \\
& - \sum_{j=h,g,x} Q_{j0}\left(B_{j1}^f - \delta_j B_{j0}^f\right) - \sum_{j=h,f,g} Q_{j0}\left(B_{j1}^x - \delta_j B_{j0}^x\right) + \sum_{j=f,x} B_{h0}^j \\
= \; & W_0 + \left(Q_{A0}+D_0\right) A_0 - \left(Q_{A0}+D_0\right) A_0^x + B_{f0} + B_{x0} \\
& - \sum_{j=h,g,x} B_{j0}^f - \sum_{j=h,f,g} B_{j0}^x + \sum_{j=f,x} Q_{h0}\left(B_{h1}^j - \delta_h B_{h0}^j\right).
\end{aligned}$$

Using the firm sector budget constraint ($A23$) to substitute out $\left(Q_{A0}+D_0\right) A_0$, the expression above simplifies to:

$$\begin{aligned}
& \bar{P}_0^* C_0 + P_0^I I_t + \bar{P}_0^G G_0 - Q_{A0} A_1^x + Q_{x0}\left(B_{x1} - \delta_x B_{x0}\right) - \sum_{j=h,f,g,x} Q_{j0}\left(B_{j1}^x - \delta_j B_{j0}^x\right) + B_{h0}^x = \\
& \bar{P}_0^Y Y_0 - \left(Q_{A0}+D_0\right) A_0^x + B_{x0} - \sum_{j=f,g,S} B_{j0}^x + Q_{h0}\left(B_{h1}^x - \delta_h B_{h0}^x\right),
\end{aligned}$$

where we have used the no-arbitrage condition $Q_{A0} = Q_{S0}\left(Q_{A1}+D_1\right)$. Finally, using the foreign sector equation ($A25$) to substitute out $Q_{A0}A_1^x$, we obtain the national income identity:

$$\bar{P}_0^* C_0 + P_0^I I_t + \bar{P}_0^G G_0 + \bar{P}_0^E E_0 - \bar{P}_0^M M_0 = \bar{P}_0^Y Y_0. \tag{A27}$$

Appendix B Additional figures

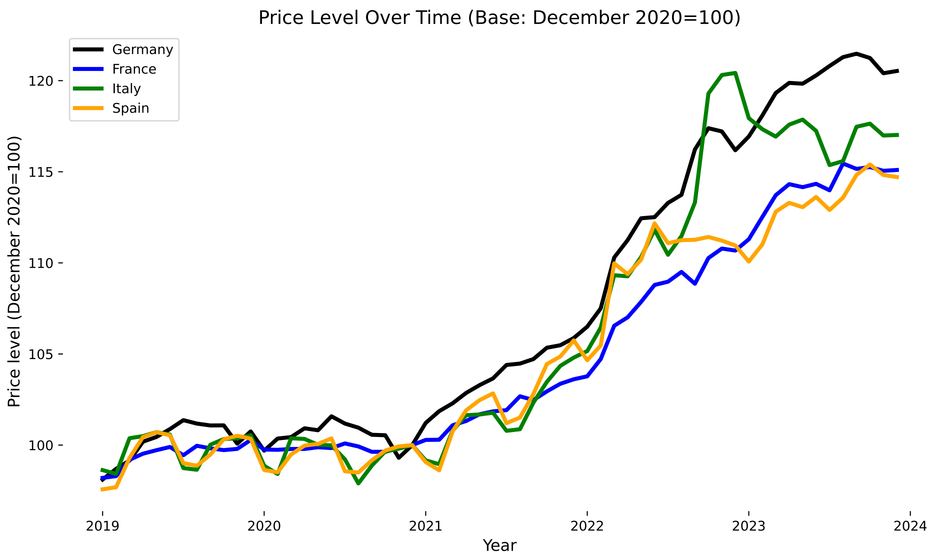

Figure B.1: Price level index (December 2020 = 100) for Germany, France, Italy and Spain.

Note: Not seasonally adjusted, January 2019–December 2023
Source: Eurostat, Harmonized Index of Consumer Prices, Household Budget Survey.

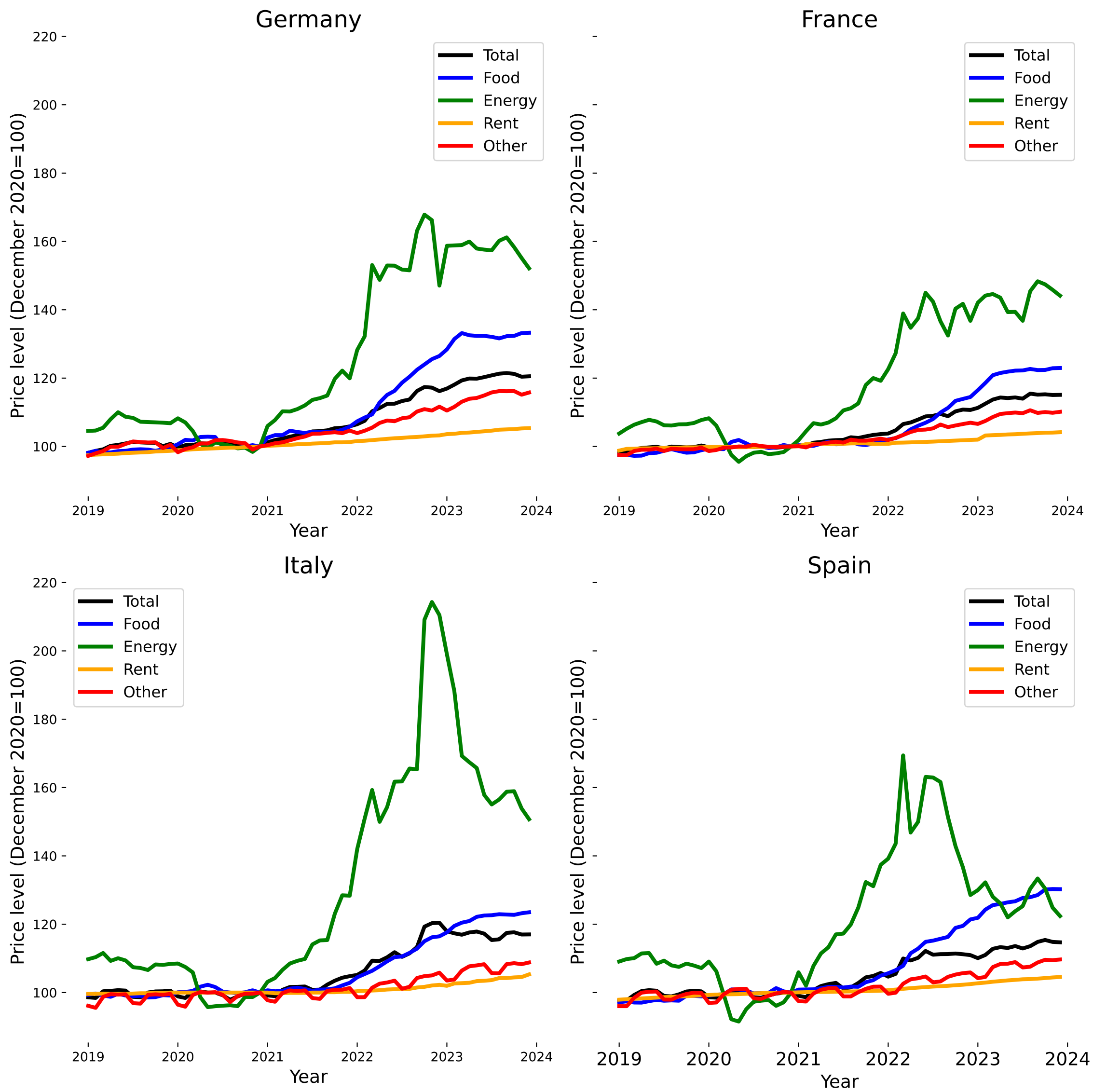

Figure B.2: Price level index (December 2020 = 100) for Germany, France, Italy and Spain. Total and subcomponents (Food, Energy, Rent, Other).

Note: Not seasonally adjusted, January 2019–December 2023. Food corresponds to "food at home" (COICOP 1), energy includes electricity and gas (4.5) and fuels (7.22), rent is actual rent (4.1), while Other comprises all the rest of consumption categories. The weights for each category to construct the sub-indexes come from HBS 2015, as in the rest of the paper.
Source: Eurostat, Harmonized Index of Consumer Prices, Household Budget Survey 2015.

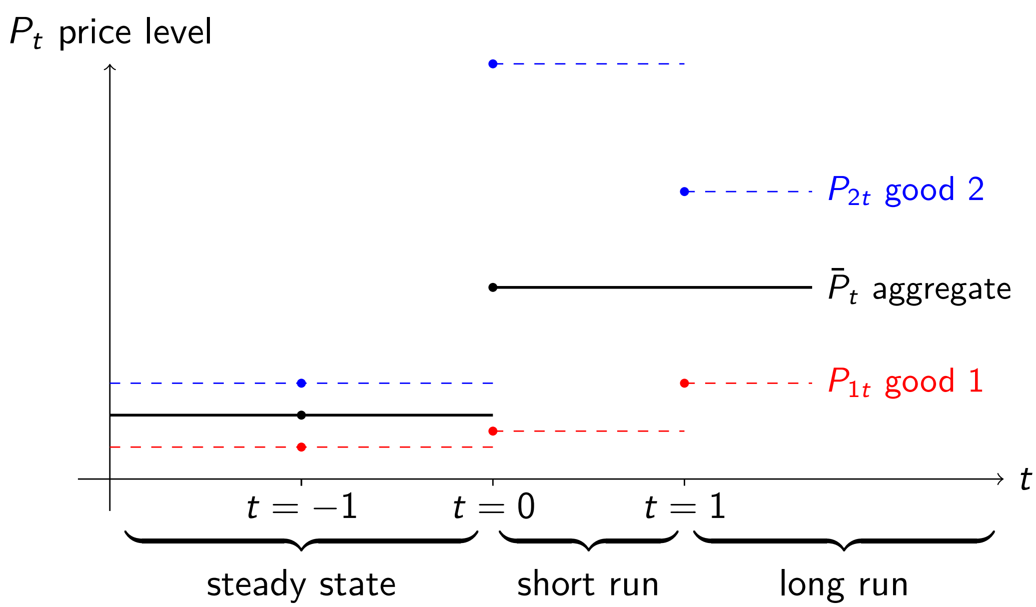

Figure B.3: Schematic depiction of the inflation shock

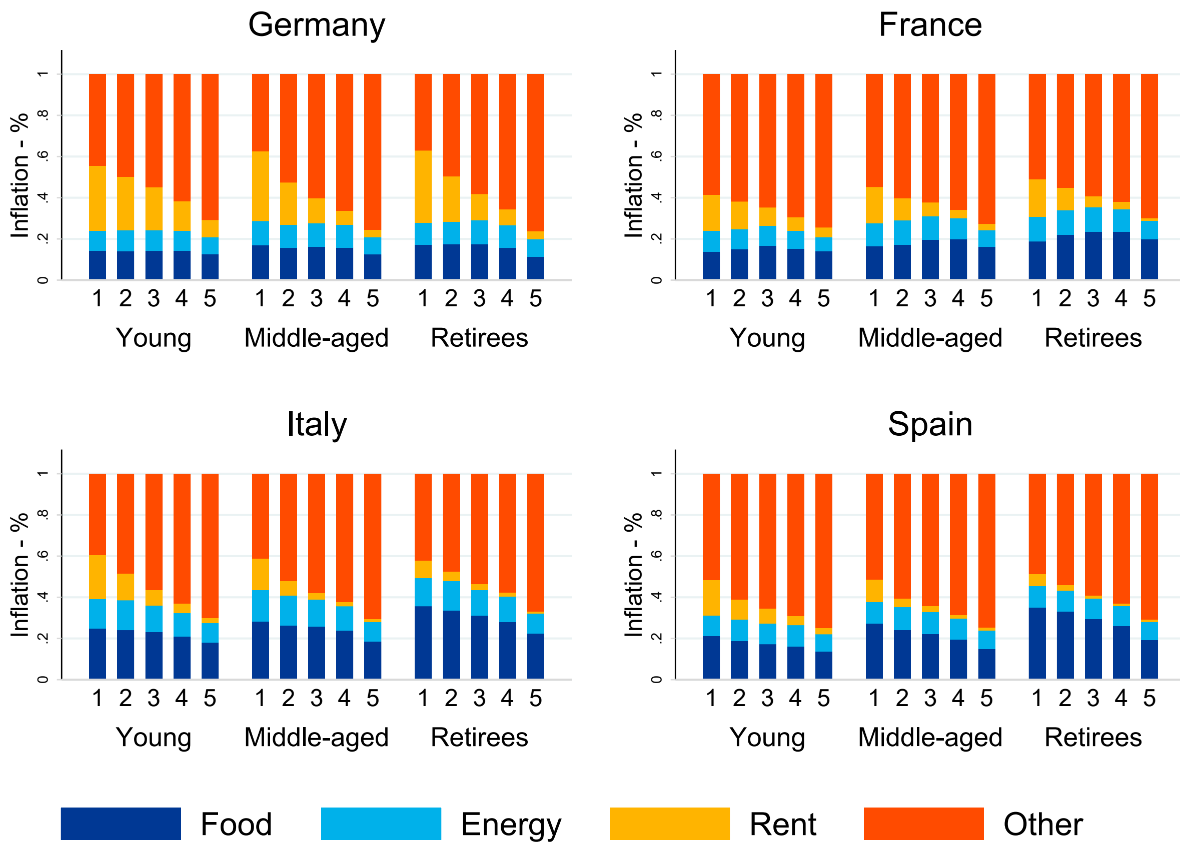

Figure B.4: Structure of consumption expenditures by age classes and nondurable consumption quintiles within each age class

Note: The chart show the shares of main consumption components on total consumption in percent; the complement to 1 are the remaining consumption components. Young, Middle-aged and Retirees denote ages of less than 45 years, 45–64 years and older than 64 years.
Source: Household Budget Survey, 2015

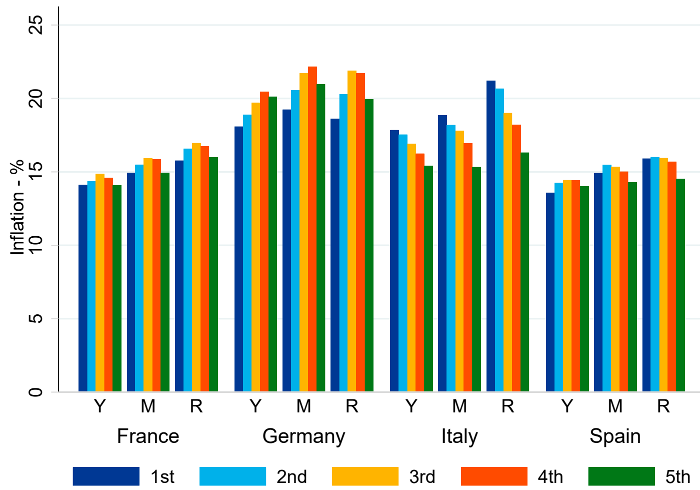

Figure B.5: Household-level inflation rates by age classes and nondurable consumption quintiles, 2021–2023, cumulative two-year rates in percent, consumption baskets *excluding rents*

Note: The figure shows realized cumulative inflation rates in 2021–23 by age class and consumption quintiles within each age class. The groups Y, M and R denote ages of less than 45 years, 45–64 years and older than 64 years.
Source: Household Budget Survey 2015.

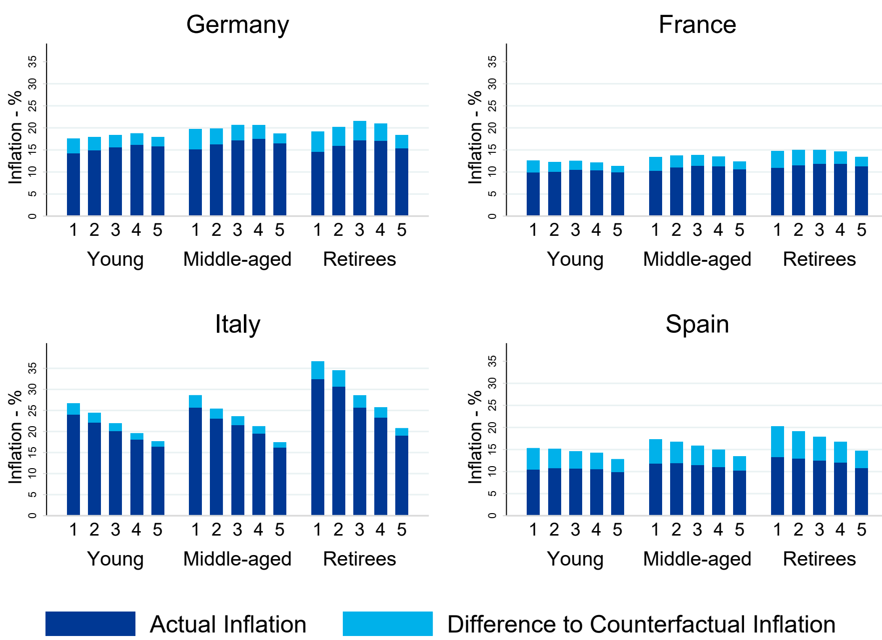

Figure B.6: Actual and counterfactual household-level inflation rates by age classes and nondurable consumption quintiles within each age class, 2021–2022, cumulative 2-year rates in percent

Source: Household Budget Survey 2015.

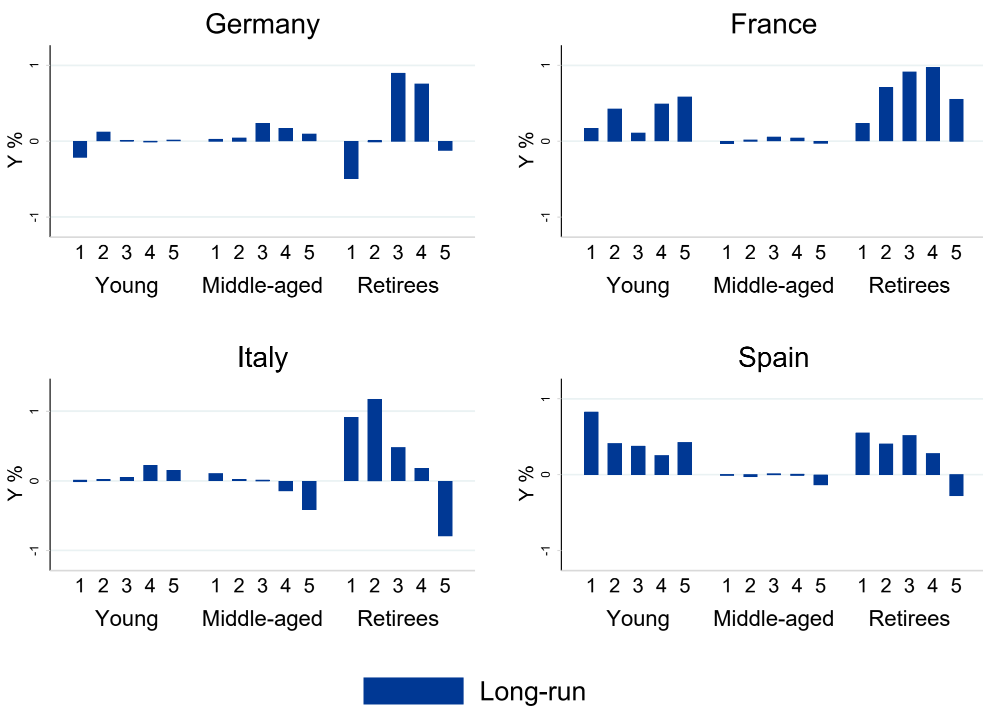

Figure B.7: Average long-run effect, in percent of triennial disposable income, by age class and nondurable consumption quintile.

Note: The figure reports the average long-run effect. Young, Middle-aged and Retirees denote ages of less than 45 years, 45–64 years and older than 64 years.
Source: Household Finance and Consumption Survey 2017.

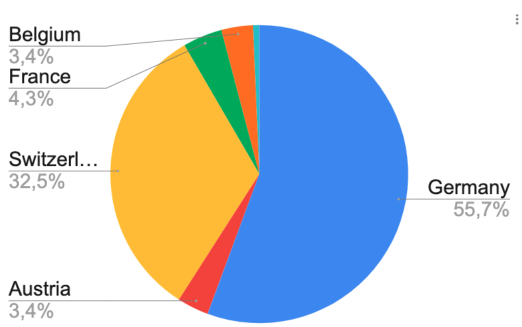

Figure B.8: Distribution of the REITs by country.

Source: REITs websites.

Appendix C Additional tables

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

Table C.1: Classification of consumption by purpose (COICOP) categories

Note: The remaining COICOP categories covering imputed rents are excluded from our measure of consumption.

Germany CPI Release Dates			
10 Dec 2021	12 Mar 2021	13 Jul 2022	13 Apr 2023
29 Nov 2021	1 Mar 2021	28 Jul 2022	28 Apr 2023
10 Nov 2021	10 Feb 2021	30 Aug 2022	10 May 2023
28 Oct 2021	28 Jan 2021	12 Sep 2022	31 May 2023
13 Oct 2021	19 Jan 2021	13 Sep 2022	13 Jun 2023
30 Sep 2021	6 Jan 2021	29 Sep 2022	29 Jun 2023
10 Sep 2021	19 Jan 2022	13 Oct 2022	11 Jul 2023
30 Aug 2021	31 Jan 2022	28 Oct 2022	28 Jul 2023
11 Aug 2021	11 Feb 2022	11 Nov 2022	8 Aug 2023
29 Jul 2021	1 Mar 2022	29 Nov 2022	30 Aug 2023
13 Jul 2021	11 Mar 2022	13 Dec 2022	8 Sep 2023
29 Jun 2021	30 Mar 2022	3 Jan 2023	28 Sep 2023
15 Jun 2021	12 Apr 2022	17 Jan 2023	11 Oct 2023
31 May 2021	28 Apr 2022	9 Feb 2023	30 Oct 2023
12 May 2021	11 May 2022	22 Feb 2023	8 Nov 2023
29 Apr 2021	30 May 2022	1 Mar 2023	29 Nov 2023
15 Apr 2021	14 Jun 2022	10 Mar 2023	8 Dec 2023
30 Mar 2021	29 Jun 2022	30 Mar 2023	

Table C.2: Press Release Dates for CPI in Germany (2021–23)

Source: German Federal Statistical Office

Step 1:	$R(Q_t) = \beta\,\Delta ILS_{1Y,t} + \gamma R(S_t) + \varepsilon_t$		
	REITs	**Bonds**	**Stocks**
Inflation surprise $\Delta ILS_{1Y,t}$	−3.955	−0.726	−0.410
	(3.108)	(2.160)	(0.514)
$R(S_t)$	1.011	−0.066	0.134
	(4.804)	(1.089)	(1.088)
const	−0.107	0.059	0.159
	(0.524)	(1.103)	(1.246)
Obs	71	71	69
Adj. R^2	0.314	−0.007	−0.043
F-stat	17.06	2.92	0.75

Step 2: $R(H_t) - R_f = \alpha + \delta\big[R(Q_{t-1}) - R_f\big] + \tilde{\gamma}\big[R(S_t) - R_f\big] + \text{controls} + \varepsilon_t$	
	House returns
$R(Q_{t-1}) - R_f$	0.035*
	(0.017)
$R(S_t) - R_f$	−0.007
	(0.020)
Exchange Rate	−0.240**
	(0.029)
Industrial Production	−0.002
	(0.043)
Inflation	-0.299^{+}
	(0.173)
Term Structure	−0.644**
	(0.233)
const	25.184**
	(2.883)
Obs	65
Adj. R^2	0.616
F-stat	26.324

Table C.3: Sensitivities of asset prices to inflation surprises

For stocks, the table reports the results for Germany. The market returns $R(S_t)$ are proxied with the EU returns for REITs and bonds, and with global returns for stocks. See Appendix D.7.1 for further details.

Appendix D Data

This section contains a detailed description of our data sources and some of some key steps of our measurement exercise.

D.1 Measurement of direct and indirect components

We are interested in the effects of an inflation shock dz_0. In our empirical implementation, we therefore abstract from expected trends that would have unfolded independently of the shock.

D.1.1 Direct components

Regarding direct components, we need to compute terms of the sort $-\frac{d\log P_0}{dz_0} \times X_{i,0}$, where P_0 is a (average, or household-specific) price level and $X_{i,0}$ is an element of the household budget constraint. We proceed differently for stock and flow variables. For illustrative purposes, we refer to bond holdings $B_{i,S0}$ and net income $Y_{i,0} = W_{i,0} - T_{i,0}$ as representative of these two variable types.

In the first case, we measure pre-shock holdings $B_{i,S0}$ as $B_{i,S0} = B_{i,S,Dec2017}$; in the second, $Y_{i,0} = Y_{i,2017}$. We then compute the price shock $\frac{d\log P_0}{dz_0}$ in deviation from the expected trend growth in prices expected in the absence of the shock. More specifically, for stock variables we compute

$$-\frac{d\log P_0}{dz_0} \times X_{i,0} = -\left[\log \frac{P_{Dec2023}}{P_{Dec2020}} - \log\left(\frac{P_{Dec2023}}{P_{Dec2020}}\right)^*\right] \times B_{i,S,Dec2017}$$

where $\left(\frac{P_{Dec2023}}{P_{Dec2020}}\right)^*$ is measured through inflation expectations prior to the dz_0 shock.

For flow variables such as income, assuming that it is received monthly and mostly consumed the same month, we use monthly inflation rates to devalue monthly income. For 2021, for example, this would imply

$$\begin{aligned}
-\frac{d\log P_0}{dz_0} Y_{i,0} = &-\left[\log \frac{P_{Jan2021}}{P_{Dec2020}} - \log\left(\frac{P_{Jan2021}}{P_{Dec2020}}\right)^*\right] \times Y_{i,Jan2017} \\
&-\left[\log \frac{P_{Feb2021}}{P_{Dec2020}} - \log\left(\frac{P_{Feb2021}}{P_{Dec2020}}\right)^*\right] \times Y_{i,Feb2017} \\
&- ... \\
&-\left[\log \frac{P_{Dec2021}}{P_{Dec2020}} - \log\left(\frac{P_{Dec2021}}{P_{Dec2020}}\right)^*\right] \times Y_{i,Dec2017}
\end{aligned}$$

Since we have no information on monthly income, we assume that each month is equal to 1/12 of the yearly income. The above expression can therefore be rewritten as

$$\begin{aligned}
-\frac{d\log P_0}{dz_0} Y_{i,0} = &-\left[\log \frac{P_{Jan2021}}{P_{Dec2020}} + \log \frac{P_{Feb2021}}{P_{Dec2020}} + ... + \log \frac{P_{Dec2021}}{P_{Dec2020}}\right] \times \frac{Y_{i,2017}}{12} \\
&-\left[-\log\left(\frac{P_{Jan2021}}{P_{Dec2020}}\right)^* - \log\left(\frac{P_{Feb2021}}{P_{Dec2020}}\right)^* - ... - \log\left(\frac{P_{Dec2021}}{P_{Dec2020}}\right)^*\right] \times \frac{Y_{i,2017}}{12}
\end{aligned}$$

or

$$-\frac{d\log P_0}{dz_0}Y_{i,0} = -\left[\frac{\log\frac{P_{Jan2021}}{P_{Dec2020}} + \log\frac{P_{Feb2021}}{P_{Dec2020}} + ... + \log\frac{P_{Dec2021}}{P_{Dec2020}}}{12}\right] \times Y_{i,2017}$$
$$-\left[-\frac{\log\left(\frac{P_{Jan2021}}{P_{Dec2020}}\right)^* + \log\left(\frac{P_{Feb2021}}{P_{Dec2020}}\right)^* + ... + \log\left(\frac{P_{Dec2021}}{P_{Dec2020}}\right)^*}{12}\right] \times Y_{i,2017}$$

For an appropriately defined average inflation rate – i.e. the inflation rate in each month of 2021 compared to December 20202 – or

$$\log\frac{P_{2021}}{P_{Dec2020}} \equiv \frac{1}{12}\left[\log\frac{P_{Jan2021}}{P_{Dec2020}} + \log\frac{P_{Feb2021}}{P_{Dec2020}} + ... + \log\frac{P_{Dec2021}}{P_{Dec2020}}\right]$$

we can finally write

$$-\frac{d\log P_0}{dz_0}Y_{i,0} = -\left[\log\frac{P_{2021}}{P_{Dec2020}} - \log\left(\frac{P_{2021}}{P_{Dec2020}}\right)^*\right] \times Y_{i,2017}$$

Over the entire 2021-23 period we obtain

$$\begin{aligned}
-\frac{d\log P_0}{dz_0}Y_{i,0} = &-\left[\log\frac{P_{2021}}{P_{Dec2020}} - \log\left(\frac{P_{2021}}{P_{Dec2020}}\right)^*\right] \times Y_{i,2017}\\
&-\left[\log\frac{P_{2022}}{P_{Dec2020}} - \log\left(\frac{P_{2022}}{P_{Dec2020}}\right)^*\right] \times Y_{i,2017}\\
&-\left[\log\frac{P_{2023}}{P_{Dec2020}} - \log\left(\frac{P_{2023}}{P_{Dec2020}}\right)^*\right] \times Y_{i,2017}
\end{aligned}$$

where

$$\log\frac{P_{2022}}{P_{Dec2020}} \equiv \frac{1}{12}\left[\log\frac{P_{Jan2022}}{P_{Dec2020}} + \log\frac{P_{Feb2022}}{P_{Dec2020}} + ... + \log\frac{P_{Dec2022}}{P_{Dec2020}}\right]$$
$$\log\frac{P_{2023}}{P_{Dec2020}} \equiv \frac{1}{12}\left[\log\frac{P_{Jan2023}}{P_{Dec2020}} + \log\frac{P_{Feb2023}}{P_{Dec2020}} + ... + \log\frac{P_{Dec2023}}{P_{Dec2020}}\right]$$

D.1.2 Indirect components

For the indirect component we follow a more differentiated approach.

Regarding short-term nominal assets, we assume that the change in interest rates is the monetary policy response to the inflation shock. We also assume no change in net nominal asset holdings, so that $B_{S1} = B_{S0}$. We therefore compute

$$\frac{d\log Q_{S0}}{dz_0} \times Q_{S0} \times B_{S1} = \left[\log\frac{Q_{S,Dec2023}}{Q_{S,Dec2020}} - \log\left(\frac{Q_{S,Dec2023}}{Q_{S,Dec2020}}\right)^*\right] \times Q_{S,Dec2020} \times B_{i,S,Dec2017}$$

where we assume that interest rates were expected to remain unchanged over the 2021-2023 period and therefore $\left(\frac{Q_{S,Dec2021}}{Q_{S,Dec2020}}\right)^* = 1$. We compute the change $\log Q_{S,Dec2023} - \log Q_{S,Dec2020}$ using the actual change interest rates over this period. We treat positive holdings (mostly bank deposits) and negative holdings (debt) differently. For the former we use the evolution of bank deposit rates, for the latter the evolution of bank lending rates.

Regarding real asset k, we proceed in a comparable manner and compute

$$\frac{d\log D_{k0}}{dz_0} \times D_{k0} \times a_{i,k0} = \left[\log \frac{D_{k,Dec2023}}{D_{k,Dec2020}} - \log\left(\frac{D_{k,Dec2023}}{D_{k,Dec2020}}\right)^*\right] \times D_{k,Dec2020} \times a_{i,k,Dec2017}$$

but in this case the surprise movement in asset income, $\log \frac{D_{k,Dec2023}}{D_{k,Dec2020}} - \log\left(\frac{D_{k,Dec2023}}{D_{k,Dec2020}}\right)^*$, is computed from the surprise movement in asset prices as described in sections 3.3.2 and 3.3.3.

Finally, regarding wage income we compute

$$\begin{aligned}\frac{d\log W_0}{dz_0} \times W_0 = & \left[\log \frac{W_{2021}}{W_{2020}} - \log\left(\frac{W_{2021}}{W_{2020}}\right)^*\right] \times W_{2020} \\ & + \left[\log \frac{W_{2022}}{W_{2020}} - \log\left(\frac{W_{2022}}{W_{2020}}\right)^*\right] \times W_{2020} \\ & + \left[\log \frac{W_{2023}}{W_{2020}} - \log\left(\frac{W_{2023}}{W_{2020}}\right)^*\right] \times W_{2020}\end{aligned}$$

where we assume that the evolution of nominal wages in the absence of shocks is consistent with the 2% inflation target.

D.2 Inflation rates

We take the inflation rate of each of our consumption categories reported in Table C.1 from the Harmonised Index of Consumer Prices (HICP). As described in the main text, we then weigh each inflation rate by the share of the related expenditures reported in the Household Budget Survey (HBS). We construct these weights for each of our household cohort by aggregating over fifteen groups defined in terms of age (25–44, 45–64, 65+) and consumption quintiles.

The latest available HBS is from 2015. To take into account the evolution of prices from 2015 to 2020, we update the expenditure shares by assuming households keep the quantities purchased q_j of each category j fixed. Namely, defining xsh_j as the budget share of category j in 2015 HBS, we estimate the share in 2020 xsh'_j as:

$$xsh'_j = \frac{xsh_j(1+\pi_j)}{\sum_{i=1}^{I} xsh_i(1+\pi_i)}.$$

This approximation produces aggregate, cumulated inflation rates that are close to the official numbers, see Table D.1. For Germany, France and Italy, our benchmark estimates are within 0.5 pp of the official measures. Our benchmark rates are somewhat lower in Spain (by 1.5 pp) and lower in Spain (by 1.5 pp). The third row reports the results of using the original weights from the 2015 Household Budget Survey (i.e., without adjusting for the evolution of prices to year 2020, as described above).

The discrepancies reported in Table D.1 refer to HICP inflation rates *cumulated* over 2021-23. Discrepancies are smaller for average annual inflation rates, which we use to devalue flows (notably income).

	Italy	Germany	France	Spain
Official	17.5	20.2	14.9	16.1
Our benchmark	17.0	20.5	15.1	14.7
No weight adjustment	17.3	20.7	14.9	14.7

Table D.1: Comparison between cumulated inflation rates for 2021-2023: official sources (HICP) versus our benchmark results using the 2015 Household Budget Survey, adjusted for the evolution of prices between 2015 and 2020. "No weight adjustment" reports the results by using the 2015 Household Budget Survey without adjusting for prices.

D.3 Expenditure shares

The figures containing the evolution of expenditure shares by income quintile from 2005 to 2015 using the Household Budget Survey can be found in our public folder at this link. The folder contains also the shares of these categories in terms of aggregate consumption using National Accounts from 2015 to 2019. Almost all consumption categories exhibit a flat trend from 2015 to 2019, and relatively stable rankings across income quintiles from 2005 to 2015.

D.4 The Household Finance and Consumption Survey

Net income. We take gross income from the HFCS, and we apply the methodology by Slacalek et al. (2020) to estimate disposable income. Specifically, for France, Germany and Spain we approximate after-tax income by applying marginal tax rates available from the OECD on taxable income (variable `di1100`) + $\frac{2}{3}\times$ self-employment income (`di1200`) and adding non-taxable income. For Italy, after-tax income is available directly in the HFCS. We refer the reader to their paper for further details on the procedure, as we follow closely in each step.

Net nominal position. Following Doepke and Schneider (2006), the net nominal position is defined as the sum of nominal assets `da2101` (deposits), `da2103` (bonds), `da2107` ("money owed to households") less liabilities `dl1000` ("Total outstanding balance of household's liabilities"), which consist of mortgages and non-mortgage debt (credit lines, credit cards and other non-collateralized loans). It thus excludes exposure arising from ownership of shares in financial intermediaries (e.g., mutual funds) or equity.

Other items. We measure housing wealth in the HFCS using variables `da1110` ("Value of household's main residence") and `da1120` ("Value of other real estate properties"). For stocks, we use directly held stocks reported in variable `da2105` ("Shares, publicly traded"). For rental income, we use `di1300` ("Rental income from real estate property").

D.5 Wages

The evolution of nominal wages in 2021 and 2023 is obtained from data on negotiated wages from National Statistical Agencies. Figures D.1 plots growth rates over this period, whereas D.2 reports their evolution over time starting from 2006, to put this last two years in a historical perspective. Table D.2 summarizes the growth rate of negotiated wages and the minimum wage over the period in the four countries.

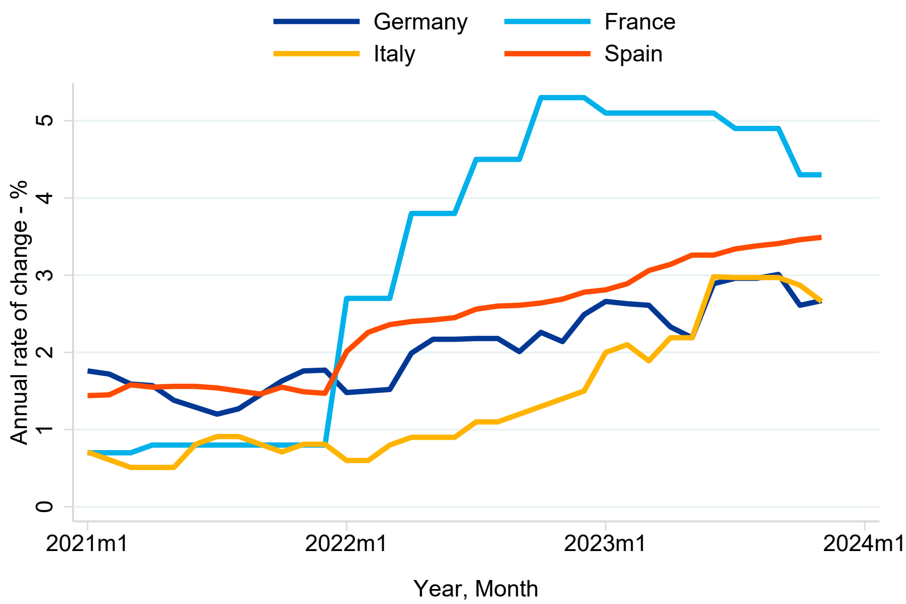

Figure D.1: Average annual rate of change for negotiated wages, monthly data, 2021–2022
Source: National Statistical Agencies.

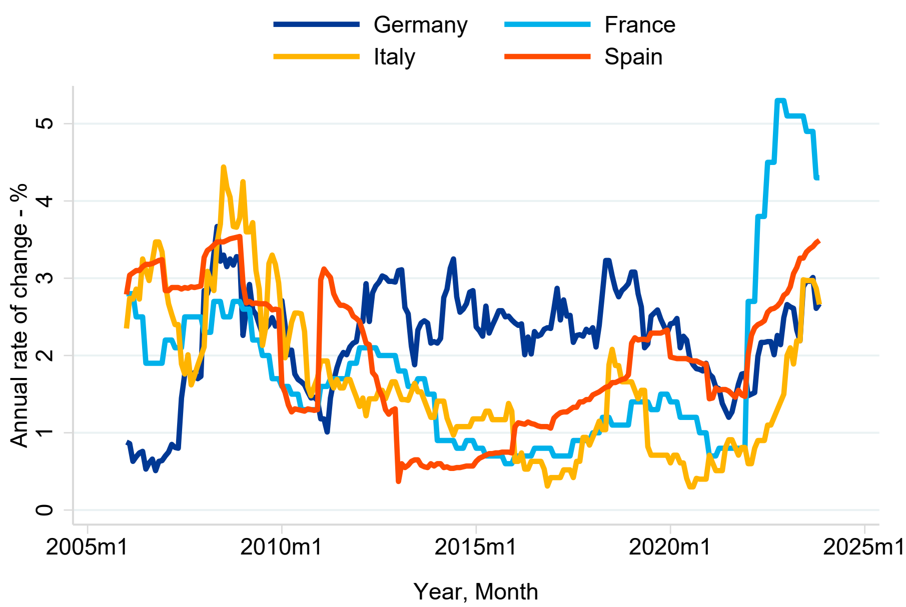

Figure D.2: Average annual rate of change for negotiated wages, monthly data, 2006–2022
Source: National Statistical Agencies.

D.6 Financial data

D.6.1 REITs and house prices

To measure REITs returns in the euro area, we use the FTSE EPRA Nareit Developed Europe REITS Index, produced by Russell. Figure D.3 reports its evolution from 2006. We compiled a list of the

Country	Indicator	Year 2021	2022	2023
Germany	Negotiated Wages	1.51	2.60	4.00
	Minimum Wage	1.60	10.76	0
	Pensions	2.50	4.00	5.30
France	Negotiated Wages	0.78	4.03	4.80
	Minimum Wage	0.98	3.12	0
	Pensions	1.00	3.40	4.20
Italy	Negotiated Wages	0.67	1.04	2.90
	Minimum Wage	NA	NA	NA
	Pensions	1.70	3.00	7.20
Spain	Negotiated Wages	1.51	2.80	3.50
	Minimum Wage	0.53	4.71	0
	Pensions	4.20	4.60	9.60

Table D.2: Growth rates of negotiated nominal wages and legislated minimum wages. Negotiated wages come from National Statistical Agencies and minimum wages from official sources. Italy does not have a legislated minimum wage. Pensions figures come from the Eurosystem staff macroeconomic projections for the euro area.

largest residential REITs in Europe and checked the countries in which most of their investment are concentrated using information on their domicile and on their investments where publicly available. More than half of the residential properties are concentrated in Germany, as reported in Figure B.8.[1]

We obtain house prices from the OECD, weighting each EU country according to the geographical distribution of REIT index described above.[2] Figure D.4 traces the evolution over time of our index.

D.7 Inflation surprises

The dates for the releases of the German HICP are reported in table C.2. We use daily data from one-year-ahead Inflation Linked Swaps, obtained from Refinitiv.

[1]The list includes Vonovia, Swiss Prime Site, Gecina Societe anonyme, LEG Immobilien SE, PSP Swiss Property AG, Aedifica SA, Covivio, Kojamo Oyj, Cofinimmo, Allreal Holding AG, Swiss Life Holding AG and Nextensa.

[2]For REITs domiciled in Switzerland, we assume they have a portfolio of properties across the euro area.

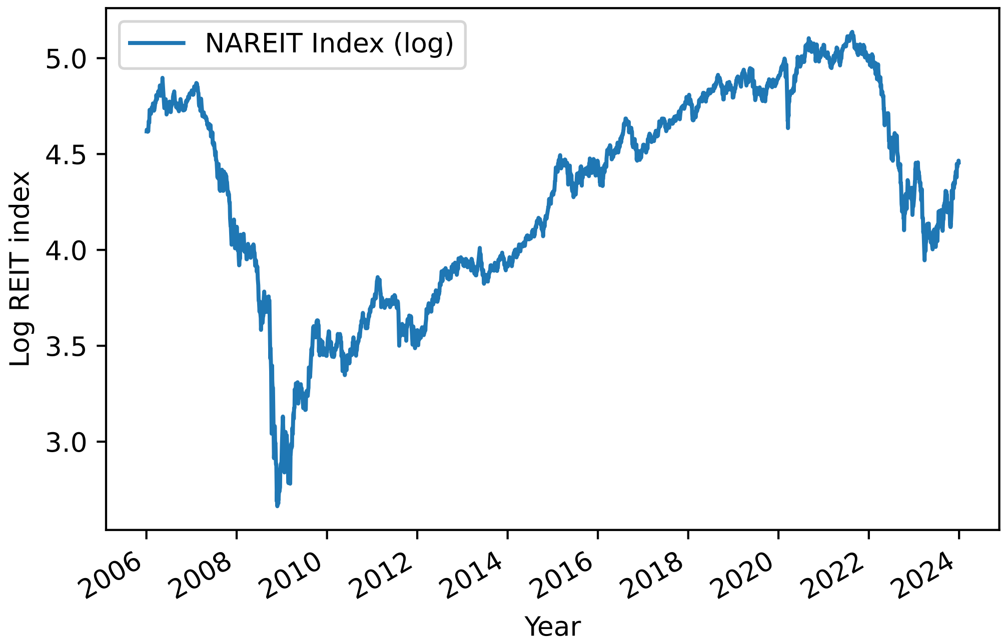

Figure D.3: NAREIT Euro zone Residential Index; in logs.

Source: Bloomberg.

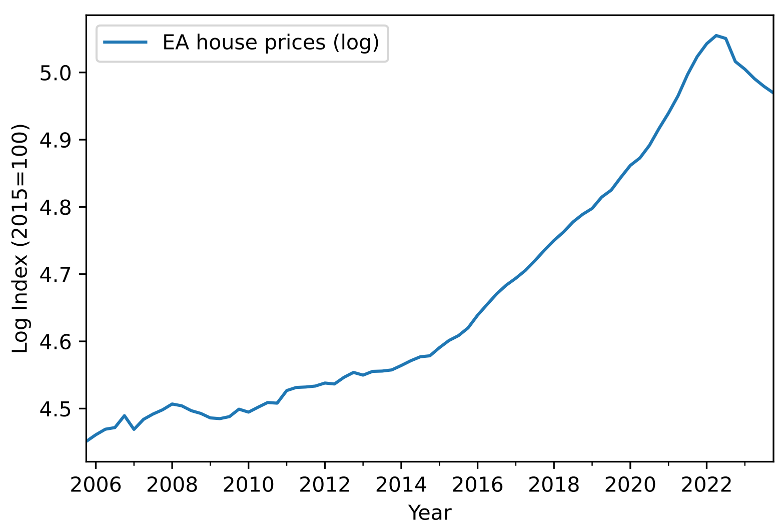

Figure D.4: Euro area house prices, weighted by the share residential REIT index.

Source: OECD

D.7.1 Stocks and bond indices

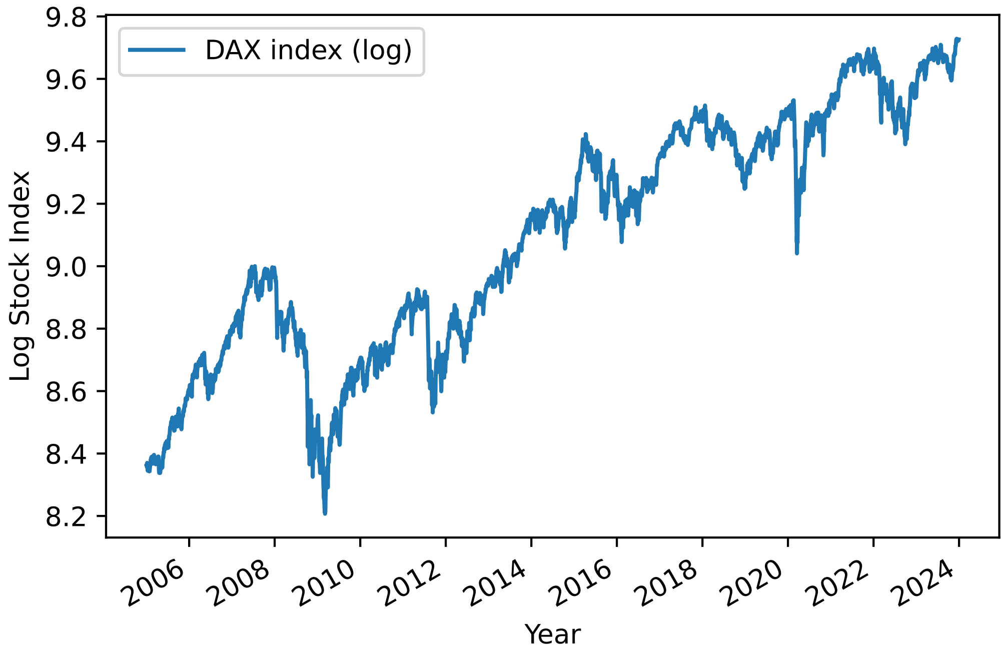

Figure D.5: Value of the DAX Index; in logs.

Source: Bloomberg.

For stock prices, we use the main index in each country (i.e., DAX for Germany, CAC 40 for France, IBEX 35 for Spain, FTSE MIB for Italy). Figure D.5 reports its change since 2006. We control for global stock returns using iShares Core MSCI World All Cap ETF. For bond prices in the euro area, we construct a weighted average of a government bond index and a corporate bond index in proportion to the total value outstanding (with the weights corresponding to two thirds and one third, respectively). For the government bond index, we use iShares Core Euro Govt Bond UCITS ETF, while for the corporate we use iShares Core Euro Corp Bond UCITS ETF.

Appendix E Calculation of net income and measurement of fiscal drag

This appendix summarizes how we estimate net income and compute the fiscal drag during the inflation episode. The (nominal) fiscal drag reflects the extra taxes that the households pay and governments receive when the tax system is not indexed to inflation. We quantify the amount of additional taxes by estimating how tax revenues change with inflation, relative to a counterfactual with no inflation surge.

E.1 Estimation of net income

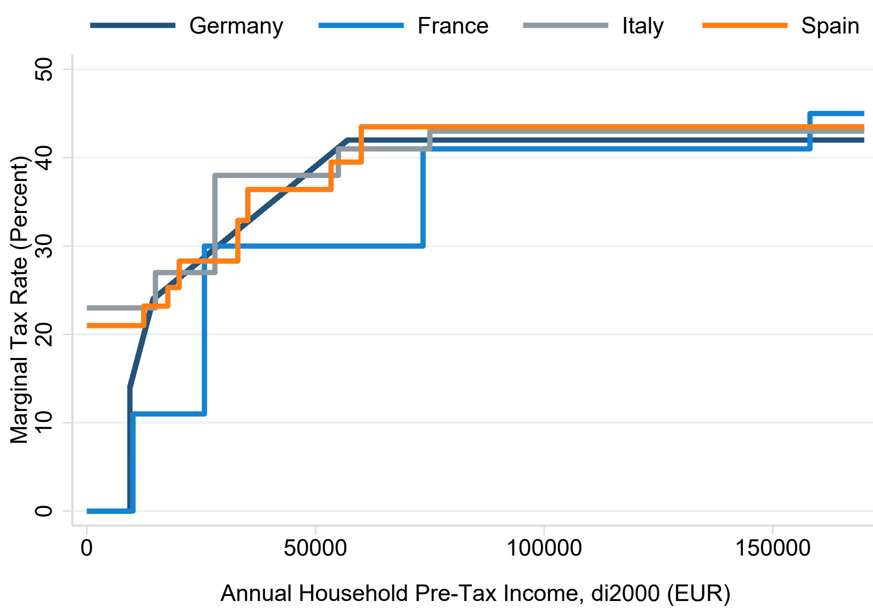

Figure E.1: Marginal tax rates, 2020

Note: The figure shows how (statutory) marginal tax rates depend on taxable household income. In Italy, there is the basic employee tax credit of EUR 1880 (not included in taxable income). For Spain, the tax rates shown include both national and regional taxes.
Source: OECD Tax Database, https://www.oecd.org/tax/tax-policy/tax-database/

Most of our results in section 4 are reported in percent of household net income prior to the shock. We approximate household net (after-tax) incomes by applying tax schemes of 2020 to taxable incomes and adding nontaxable income, following Slacalek et al. (2020). We calculate taxable income in the HFCS data as: employee income (variable `di1100`) + 2/3×self-employment income (`di1200`) + income from pensions (`di1500`).

After-tax income is the sum of taxable income net of taxes and nontaxable income. Nontaxable income consists of transfers, income from pensions, rental income from real estate property, income from financial assets, income from private business other than self-employment, regular social transfers (except pensions), regular private transfers and income from other sources.

To estimate taxes, we use tax brackets and marginal tax rates from the OECD Tax Statistics, https://www.oecd-ilibrary.org/taxation/data/oecd-tax-statistics_tax-data-en; tables 'Central government personal income tax rates and thresholds' and 'Sub-central personal income tax rates-progressive systems'.

E.2 Estimation of fiscal drag

The fiscal drag is the variation in income tax revenues caused by the inflation shock because of the lack of, or imperfect, indexation of tax brackets.[3]

Denote the actual tax paid by household h in year $t \in \{2021, 2022, 2023\}$ and as $T_{h,t}$ and the counterfactual tax that would have been paid absent the inflation shock as $T^*_{h,t}$. The fiscal drag, measured in euros, is the difference

$$drag_{h,t} = T_{h,t} - T^*_{h,t}.$$

For each household, we apply the actual tax brackets and marginal tax rates from the OECD Tax Statistics to compute the actual tax burden $T_{h,t}$. While tax brackets in Italy and Spain did not change in 2020–23, in France they are automatically adjusted to inflation annually and in Germany every two years. Consequently, in France and Germany, we take into account this upward adjustment in tax brackets due to inflation indexation.

To compute counterfactual taxes, we start from actual gross nominal labour income in 2020, $W_{h,2020}$. We assume that, absent the inflation shock, gross taxable income in each year would have grown with (gross) expected inflation over the corresponding horizon, $\mathbb{E}\pi_{2020,2021}, \ldots, \mathbb{E}\pi_{2020,2023}$. The expected inflation in Consensus Economics data for our four countries ranges between 0.4% and 1.7% per year.

We therefore estimate counterfactual gross nominal income growth in years 2021–2023 as $W^*_{h,2021} = \mathbb{E}\pi_{2020,2021} \cdot W_{h,2020}$, $W^*_{h,2022} = \mathbb{E}\pi_{2020,2022} \cdot W_{h,2020}$ and $W^*_{h,2023} = \mathbb{E}\pi_{2020,2023} \cdot W_{h,2020}$, respectively. We apply counterfactual tax brackets and marginal tax rates to compute $T^*_{h,y}$. For Italy and Spain, these are the tax brackets observed in 2020. For Germany and France, we assume that tax brackets in 2021–23 would have grown at the inflation rate expected at the start of 2021. For Italy and Spain tax brackets remain unchanged.

Figure E.2 (included in the top panel of Figure 5) shows the average fiscal drag over 2021–23 in percent of initial triennial net (disposable) income:

$$\frac{d \log T^{AUT}_{i,0}}{dz_0} T^{AUT}_{i,0} = -100 \times \frac{1}{3} \times \left(\frac{drag_{i,2021}}{Y^n_{i,2020}} + \frac{drag_{i,2022}}{Y^n_{i,2020}} + \frac{drag_{i,2023}}{Y^n_{i,2020}} \right),$$

where i denotes an age/quintile group in each country.

Note that the fiscal drag is produced by inflation-induced changes in the tax schedule and/or in the household's income level. The estimates of the direct effect of the shock shown in Figure 3 are based on an unchanged (pre-shock) tax schedule and therefore abstract from the fiscal drag. Also note that the fiscal drag can be positive, for example, if tax brackets grow with the inflation rate while nominal incomes grow less than inflation.

[3] There is a literature investigating the inflation-induced bracket creep. For a discussion of indexation of the tax system to inflation and empirical evidence, see Aaron (1976) and Immervoll (2005), respectively. Deutsche Bundesbank (2022) discusses the set-up in Germany and provides estimates of the size of inflation-induced bracket creep.

The fiscal drag produces corresponding effects also on governments' revenues. The change in government revenues in country c is the sum of the fiscal drag experienced by all households, or:

$$drag_{c,yt} = -\sum_{h \in c} drag_{h,t}.$$

Table 4 shows our estimates of the total change in fiscal revenues due to the fiscal drag in percent of triennial GDP, i.e.:

$$drag_c = \frac{drag_{c,2021} + drag_{c,2022} + drag_{c,2023}}{3 \times GDP}.$$

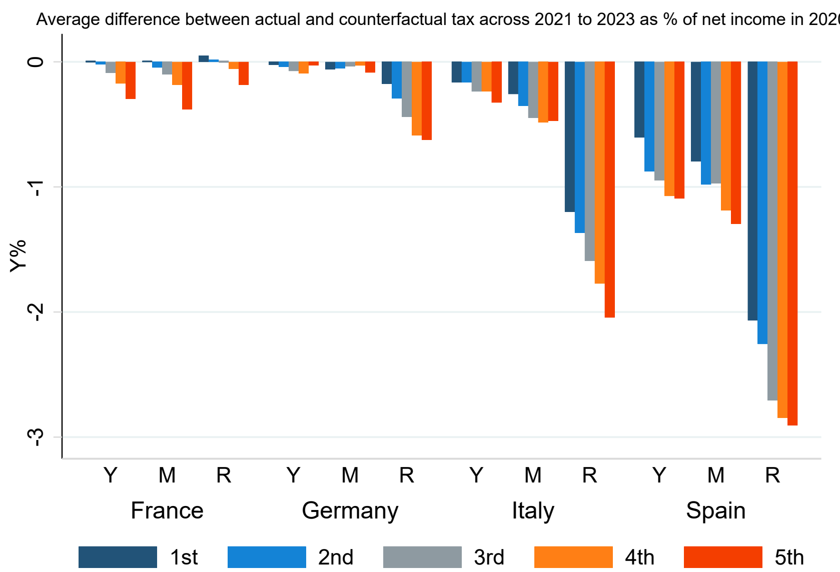

Figure E.2: Fiscal drag in percent of triennial disposable income, by age class and nondurable consumption quintile.
Note: The figure shows how the fiscal drag is distributed across households by age class and consumption quintiles within each age class. The groups Y, M and R denote ages of less than 45 years, 45–64 years and older than 64 years.
Source: OECD Tax Database, https://www.oecd.org/tax/tax-policy/tax-database/; Household Finance and Consumption Survey 2017

Appendix F Government interventions in energy markets: Estimation of counterfactual prices

This appendix summarizes our calculations of actual price indices for household group i, P_{it}, and counterfactual price indices P_{it}^* – that is, indices absent government interventions in energy prices and energy markets. We focus on three energy-related consumption categories in which governments intervened substantially with taxes and subsidies to dampen the adverse effects of the shock: petrol (and other transportation fuels), natural gas used for household heating and electricity.

We obtained actual (post-tax, post-government intervention) prices P_{it} for the three energy-related components of the Harmonised Index of Consumer Prices from the Eurostat.

F.1 Petrol

The governments implemented price reductions in petrol and other transportation fuels that mostly took the form of a fixed amount of euro cent per liter (see Table F.1).

To compute counterfactual prices we proceed in two steps. First, we combine actual petrol prices (EUR/L) at the beginning of 2021 (January 11, 2021) from the European Commission's Weekly Oil Bulletin with indices on petrol from the Eurostat's Harmonised Index of Consumer Prices to create a time series of actual petrol prices (in EUR/L). Second, we subtract the impact of the price reductions measures listed in Table F.1, assuming full pass through to households.

The resulting evolution of actual and counterfactual petrol prices (EUR/L) is plotted in Figure F.1. Although relatively short lived, the fiscal measures were significant, particularly taking into account that transportation fuels are an important part of household budget shares. We estimate that the measures reduced prices by about 20 percent in 2021–22 (with some heterogeneity across countries), and mostly ceased being active early in 2023.

F.2 Natural gas

To quantify the effects of direct government interventions in the gas market, we use data provided by Dao et al. (2023), who use a model-based approach to estimate counterfactual natural gas prices in France during this time period, and extend it to 2023 using data from the French Energy Regulatory Commission (CRE). Because gas is traded internationally, we assume that counterfactual gas prices would have been the same in other countries. This assumption is somewhat restrictive to the extent

Country	Measure	Time period
Germany	30 cents per liter	June–August 2022
Spain	20 cents per liter	April–December 2022
France	18 cents per liter	April–September 2022
France	30 cents per liter	October 2022
France	10 cents per liter	November–December 2022
Italy	30 cents per liter	March–September 2022

Table F.1: Subsidies to petrol and other transportation fuels. Source: Sgaravatti et al. (2021)

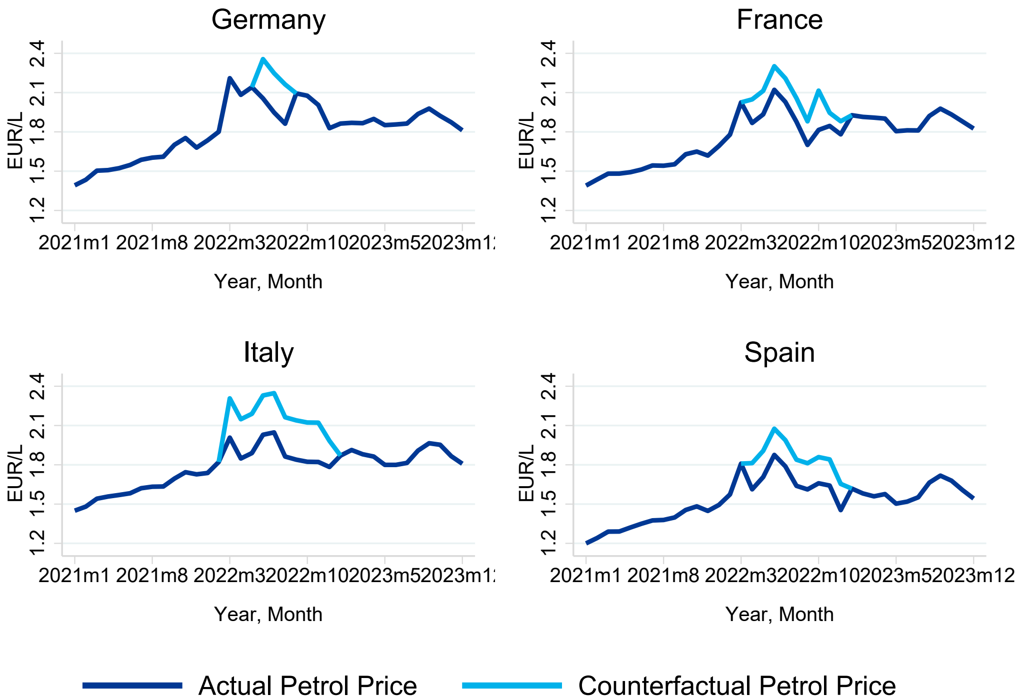

Figure F.1: Actual and Counterfactual prices for petrol in Germany, France, Italy, and Spain; EUR
Source: Eurostat, Insee, Statista, myLPG.eu, mise.gov.it and Sgaravatti et al. (2021).

that bottlenecks in supply systems and other trading frictions can generate differences in prices across countries.

Figure F.2 shows actual gas prices and our counterfactual series. The counterfactual prices peak around 0.3 EUR/kWh, compared to the peak of actual prices at around 0.13 EUR/kWh in Germany and France, 0.08 EUR/kWh in Spain and around EUR 0.18 EUR/kWh in Italy. These differences imply that the fiscal interventions in natural gas markets were more substantial in Germany and Spain (reducing prices by about 70 to 80%) than in France and Italy (reducing prices by about 25 to 35%).

F.3 Electricity

France and Spain introduced substantial direct interventions in their electricity markets. In order to calculate counterfactual electricity price index for France, we again employ data from Dao et al. (2023), which presents monthly time series of counterfactual electricity prices, and extend it to 2023. We show the series in the left panel of Figure F.3.

In Spain, the government also intervened to decouple local electricity prices from international gas prices. Usually, most of the energy in Spain is produced at a lower cost than the price of gas, but gas-fired power plants tend to be the marginal producers of electricity and as such they set the price of every unit of electricity. Effectively, the government set a cap on the price of gas used for the production of electricity and compensated gas-fired power plants accordingly. As a result, counterfactual electricity prices in the absence of the intervention can be computed by looking at the corresponding outstanding prices of gas in international markets. Thus, we obtain daily data of actual

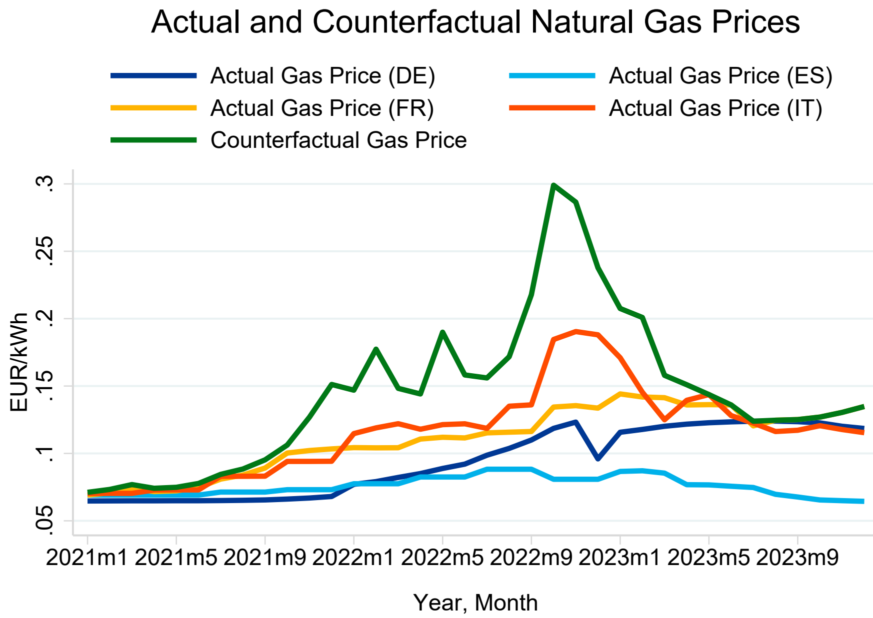

Figure F.2: Actual and Counterfactual prices for natural gas in Germany, Spain, France, and Italy; EUR Source: Eurostat and Dao et al. (2023).

and counterfactual wholesale electricity prices for 2021 and 2023 from the electricity operator OMIE (EPData, 2023).

In order to accommodate possible incomplete pass-through of wholesale prices to retail prices, we begin by running a regression of daily observed retail electricity prices on daily observed wholesale electricity prices:

$$P_t^{\text{retail,actual}} = a + b \cdot P_t^{\text{wholesale,actual}}. \tag{F1}$$

Next, we assume that the pass-through coefficient b would remain unchanged under the counterfactual wholesale prices $P_t^{\text{wholesale,count}}$ and predict counterfactual retail prices $P_t^{\text{retail,count}}$ by computing:

$$\hat{P}_t^{\text{retail,count}} = a + b \cdot P_t^{\text{wholesale,count}}. \tag{F2}$$

The right panel of Figure F.3 shows the implied counterfactual electricity prices for Spain together with actual prices. The differences induced by government intervention are comparable to, but slightly larger than, those in France, staying in general below 10 cents per kWh (a reduction of 20–35% in the effective price of electricity). However, in Spain these interventions stopped being active around February 2023, given the large drop in international gas prices. In France, instead, the data on counterfactual electricity prices provided by the French Energy Regulatory Commission (CRE) suggests that, absent interventions, electricity prices would have remained elevated for much of 2023.

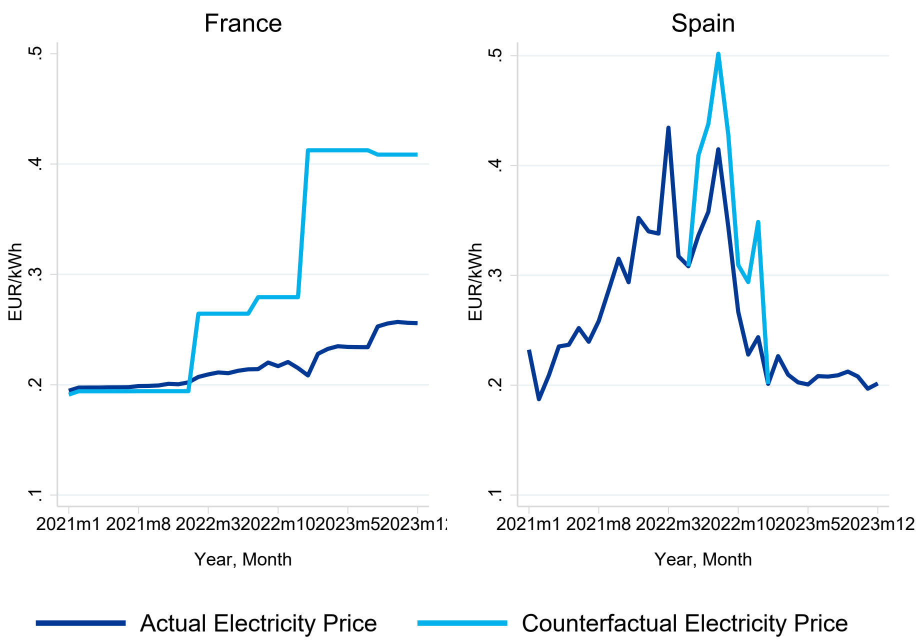

Figure F.3: Actual and Counterfactual prices for electricity in France and Spain; EUR
Source: Eurostat, OMIE and Dao et al. (2023).

Appendix G Summary of 2021–23 transfer payments

This appendix summarizes the main transfer payment programs implemented in the four countries in 2021–2022. These include lump-sum payments and other forms of income support. We obtain the information from a dataset put together by Bruegel and take these measures into account in our analysis. Appendix F describes how we account for direct interventions in energy markets (e.g., temporary reductions of VAT rates, excise duties, price caps).

G.1 Germany

- EUR 135 lump-sum payment for students and vulnerable citizens
- One-time payment of EUR 300 for every taxpayer, a EUR 100 cheque to boost child support and a monthly reduction to EUR 9/month for public transport
- One-time lump sum of EUR 300 to pensioners and EUR 200 to university students
- Increase in welfare payments by EUR 600 (in 2023)
- EUR 100 subsidy to unemployed people (in 2022 and 2023)
- EUR 200 subsidy for recipients of social security (in 2023)

G.2 France

- EUR 100 one-off bonus to workers earning less than EUR 2,000 net
- 4% increase in benefits to those in the national safety net, including low-income families, and those on disability benefits
- One-time back-to-school payment for low-income families on social assistance of EUR 100 per parent and EUR 50 per dependent child (in 2022); the measure was updated for 2023 folllowing the latest indication of the government: https://www.service-public.fr/particuliers/actualites/A15056?lang=en
- One time energy bonus of EUR 200 for for households whose annual reference tax income per consumption unit is strictly less than EUR 10,800 euros and EUR 100 for those where it is above EUR 10,800 and below EUR 20,000

G.3 Italy

- EUR 200 one-off bonus for workers and pensioners with an income level lower than EUR 35,000
- EUR 150 payment to workers and pensioners with income level lower than EUR 20,000
- Households with ISEE lower than 12k pay electricity and gas at 2021 summer's prices (proxied with net income)
- Tax discount of 1.2 pp for workers with an income below EUR 35,000 (in 2022 and 2023)
- 2% increment for pensioners with income lower than EUR 35,000 (in 2022 and 2023)

G.4 Spain

- EUR 200 subsidy for low incomes (in 2022)

Appendix H Computing losses from energy prices for the government

Estimating the increase in nominal government expenditure due to the inflationary shock is challenging, given that many of the goods directly provided by the government (such as public education and healthcare) are not traded in the market, and therefore no suitable price index is available. We circumvent this issue by assuming that the increase in nominal government expenditure was only caused by the increase in energy prices, taking into account both direct government expenditures in energy (e.g., the electricity bill paid by public hospitals) and the energy content of all of the goods included in government consumption, based on input-output tables. Thus, we proceed in two steps: first, we estimate the share of energy in government spending; second, we use this share to compute the increase in the cost of government expenditure due to the higher energy prices.

We use two estimates of the share of energy in government expenditure, both of which include direct and indirect spending. The first estimate provides a lower bound. It takes into account only the increase in prices of fossil fuel and how it propagated through the production network downstream to government purchases. The second estimate, an upper bound, assumes that the increase in fossil fuel prices also applied to other primary sources of energy, such as electricity (e.g., directly imported electricity or electricity produced with other goods other than fossil fuels). To derive the increase in the cost of government expenditure, we apply the increase in the price of energy to the energy shares computed above.

More specifically, let A denote the input–output matrix in which rows represent sectors of origin of a given flow and columns represent sectors of destination. For example A_{ij} represents how much sector i sells to sector j in a given year.

We also have information on the shares of government consumption for each sector i, sh_i^G, and on the rise in imported fossil fuel prices π_{it}^{Me}. For our lower bound estimates, we assume that the only price increase that affected the government was the rise in imported fossil fuel prices and how it spread through the value chain. For our upper bound estimates, we apply this same price increase to other energy-related goods (namely, refined petroleum and electricity) and how they spread through the value chain. We adjust the latter calculation using import shares to make sure that there is no double-counting.

Thus,

$$L^{lower} = \pi_{it}^{Me} e^e (\mathbb{I} - A)^{-1} sh_i^G,$$

$$L^{higher} = \sum_{j=1}^{J} \pi_{it}^{Me} sh_j^M e^j (\mathbb{I} - A)^{-1} sh_i^G,$$

where e^e is a row vector of zeros with a 1 in the fossil fuel sector, e^j is a row vector of zeros with a 1 in the j sector, sh_j^M denotes the import share of sector j and sh_i^G is a column vector of shares of government consumption, and the J sectors are fossil fuels, refined fuels and electricity. For consistency with the rest of our empirical approach, we scale these values by triennial GDP.

Appendix I Reconciling micro and macro data on direct nominal positions of households

Table I.1 compares the aggregated direct net nominal positions for households from the HFCS with those recorded in aggregate financial account data. From this latter source, we compute direct nominal net positions (DNNP) as defined in Section 5.1.1 because this is the closest counterpart to our measure from the HFCS microdata.

	Micro data (HFCS)			Aggregate data (Financial Accounts)		
Country	DNNP	Nominal assets	Liabilities	DNNP	Nominal assets	Liabilities
Germany	7,449	22,106	14,657	35,360	55,995	20,636
France	4,975	20,439	15,465	33,158	56,772	23,614
Italy	5,588	10,039	4,451	31,074	46,100	15,026
Spain	760	14,231	13,471	11,072	27,251	16,179

Table I.1: Direct nominal positions in micro and aggregate data, EUR per capita, 2017

Aggregated positions in surveys are substantially lower than those in financial account data. Differences are more pronounced for assets than for liabilities: per capita nominal assets in aggregate data are roughly 2.5–3 times larger than in surveys, while the corresponding factor for liabilities is around 1.5–2. These discrepancies are magnified when computing net positions.

There are multiple reasons for discrepancies between survey and aggregate data (see also European Central Bank, 2024). On the survey side, the first one is under-coverage: households often under-report their assets and liabilities. The second problem with surveys is related to the difficulty to interview extremely wealthy households, which account for a disproportionate share of total wealth and its components, assets especially (item- and unit non-response). This limitation is not completely eliminated even when surveys employ effective strategies to over-sample wealthy households. The limitation is more severe for net nominal positions, a variable which is extremely unevenly distributed (even more so than net wealth). On the side of financial accounts, measurement issues can arise because they sometimes treat households as a residual when allocating assets and liabilities across economic sectors.

All in all, Table I.1 suggests that our results in Section 4 might underestimate the loss suffered by certain households through the devaluation of their net nominal positions. A plausible conjecture is that significant downward bias is only present for individuals at the top of the wealth distribution.

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