The Heterogeneous Impact of Inflation on Households’ Balance Sheets

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Disclaimer: *the views expressed in this presentation are those of the authors and do not necessarily represent the views of Banco de España, the ECB, the Eurosystem or BBVA*
What are the costs of inflation born by households?

- A question with a history of at least 60 years, since works by Friedman and Tobin in the 1950's and 1960's

- Answer crucially depends on:
  - Features of the inflation surge
    - Whether expected or unexpected...
    - ... as well as its persistence and volatility
  - Households' balance sheet and consumption basket
Context: the surge in inflation in 2021...

Figura: Evolution of HICP and components in Spain

![Graph showing the evolution of HICP and components in Spain from January 2019 to January 2022.](image-url)
... was unexpected and perceived as temporary

## Cuadro: Inflation expectation indicators for 2021 and 2022

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>2021</td>
<td>2022</td>
</tr>
<tr>
<td>Survey of Professional Forecasters*</td>
<td>0.6</td>
<td>1.2</td>
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<tr>
<td>ECB projections</td>
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<td>Inflation-linked swaps (ILS)**</td>
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<td>0.9</td>
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<tr>
<td>Consumer Expectations Survey***</td>
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<td>-</td>
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<tr>
<td>Realized annual inflation</td>
<td>6.6</td>
<td>n.a.</td>
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</table>

* For 2022 we employ the January 2021 survey.
** ILS instantaneous forward rates for Euro area inflation in Dec. 21 / 22
*** Median response about “which 12-month ahead Euro area do you expect?”
In the next 30 minutes...

- Characterize how a shock to inflation impacts the a person’s wealth
  - Thought experiment: unanticipated and temporary shock
  - Focus on households
  - Provide a simple decomposition into three channels:
    - Fisher channel
    - nominal income channel, and
    - consumption inequality channel.

- Estimate these channels for Spain in 2021 using two datasets:
  - Representative surveys: the *Encuesta de Presupuestos Familiares* (EPF), and the *Encuesta Financiera de las Familias* (EFF).
  - Proprietary data: BBVA client data (bank accounts, bill payments and credit/card expenses), already exploited by Carvalho et al. (2021) and Buda et al., (2022).
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Analytical framework
Nominal wealth dynamics for an individual is given by

$$P_{t+1}a_{j,t+1} = m_{j,t} + \left(1 + \frac{\Delta Q_{t+1}}{Q_t} + i_t\right) Q_t d_{j,t} + \left(1 + \frac{\Delta q_{t+1}}{q_t} + r_{t+1}^s + \pi_{t+1}\right) P_t q_t s_{j,t}$$

$$- \left(1 + \frac{\Delta Q_{t+1}^b}{Q_t^b} + i_t^b\right) Q_t^b b_{j,t} + w_{j,t+1} - P_{t+1} C_{j,t+1}$$

where

- Cash, $m_{j,t}$
- Deposits and bonds, $d_{j,t}$ with price $Q_t$
- Real assets (such as stocks or housing), $s_{j,t}$ with prices $q_t$
- Consumer debt and mortgages, $b_{j,t}$ with prices $Q_t^b$
- Labour income due to wages, unemployment benefits or pension, $w_{j,t}$
- $P_{t+1} C_{j,t+1} = \sum_{k=1}^{K} p_{kt+1} c_{j,kt+1}$ is total consumption by the individual
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- \left(1 + \frac{\Delta Q_{t+1}^b}{Q_t^b} + j_t^b\right) Q_t^b b_{j,t} + w_{j,t+1} - P_{t+1} C_{j,t+1}
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A particular inflation shock

- We consider the following experiment:

1. An unexpected, one-off price shock.
2. The shock is temporary
   \[ \pi_{t+1} > \bar{\pi}, \ E_{t+1}[\pi_s] = \bar{\pi}, \text{for } s > t + 1, \]
   where \( \bar{\pi} \) is the expected constant inflation rate \( \rightarrow \) after the shock no further change expected.
3. Nominal income is "sticky"
   income at \( t + 1 \) does not depend on inflation.

- This set up implies:

  - Nominal returns \( i_t, i^b_t \), determined at \( t \), dont incorporate surge in inflation
  - Capital gains are independent of inflation surge, since \( Q_{t+1}, Q^b_{t+1} \) and \( q_{t+1} \) are forward looking
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On the assumption of sticky wages

Figura: Proportion of nominal wages in Spain that change in each month
Proposition 1: Impact of surprise inflation

The first-order change in real wealth, at time $t + 1$ after a transitory inflation shock, $\pi_{t+1}$, is

$$
\begin{align*}
\Delta a_{j,t+1} &= \\
&= \left[ -NNP_{j,t} - w_{j,t+1} - C_{j,t+1} \left( \frac{\pi_{j,t+1}}{\pi_{t+1}} - 1 \right) \right] \pi_{t+1},
\end{align*}
$$

where

$$
NNP_{j,t} \equiv m_{j,t} + Q_t d_{j,t} - Q_t b_{j,t},
$$

is net nominal position (NNP), and

$$
C_{j,t+1} \equiv \sum_{k=1}^{K} c_{j,k,t+1}, \quad \pi_{j,t+1} \equiv \sum_{k=1}^{K} \pi_{k,t+1} \omega_{j,k,t+1}
$$

are nominal consumption expenditures and individual inflation
**Example**

- The economy is composed by only two goods, namely books and fuel,
  - They are consumed in equal terms by the average consumer.
  - Fuel experiences a 10% inflation rate for a year, while the price of books remain constant.
  - Aggregate inflation is thus 5%.

- Ana earns 30,000 eur per year. She has a 60,000 eur mortgage and 10,000 eur in deposits. She spends every year 20,000 euros on books and zero on fuel,
  - Its NNP is $10,000 - 60,000 = -50,000$ eur.
  - Its nominal income is 30,000 eur.
  - Its individual inflation is 0%. Its relative consumption is thus $-20,000$ eur.

- **Total impact:**

  $$da = (50,000 - 30,000 + 20,000) \times 0.05 = 2,000$$

that is, Ana benefits relatively from the inflation through the Fisher and relative consumption channel.
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  \[
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  \]

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Estimation
Estimation with: two representative Spanish surveys

- The Encuesta de Presupuestos Familiares (EPF) is a comprehensive expenditure survey carried out with an annual frequency by the national statistical institute (INE) since 1958, with a sample size of around 20,000 households.
  - It is the main input into the calculations of weights used to construct official inflation figures.

- The Encuesta Financiera de las Familias (EFF) instead is a representative survey collecting detailed information on household’s balance sheets.
  - It is the Spanish counterpart to the Survey of Consumer Finance in the U.S., with the advantage of having a significant (rotating) panel component.

- Can’t observe same individual in both samples. But Income (household and individual), as well as age are reported in both.
This dataset includes detailed granular information for BBVA clients’ asset/liabilities positions as well as transactions.

In terms of accounts and net asset positions, we are currently considering:

- assets: current accounts and deposits.
- liabilities: consumer loans, mortgages and credit card balances.

In terms of identified transactions, we consider three types of payments:

- credit and debit card payments.
- direct debit payments.
- ’irregular’ transfers.
Importantly, we also observe labour-related income (wages, pension payments and unemployment benefits).

Our initial sample includes more than 4 million bank accounts. We then keep

- (i) those non-commercial clients for which we observe non-zero labour-related income in 2021;
- (ii) who have been BBVA clients for at least one year;
- (iii) for whom we observe at least 10 transactions per quarter.

This leaves us with a final sample of around 1.6 million clients observed since 2016.
Proposition 1: **Impact of surprise inflation**

The first-order change in real wealth, at time $t + 1$ after a transitory inflation shock, $\pi_{t+1}$, is

$$
\Delta a_{j,t+1} = \begin{bmatrix}
-NNP_{j,t} & -w_{j,t+1} & -C_{j,t+1} \left( \frac{\pi_{j,t+1}}{\pi_{t+1}} \right) - 1
\end{bmatrix} \pi_{t+1},
$$

where

$$
NNP_{j,t} \equiv m_{j,t} + Q_t d_{j,t} - Q_t b_{j,t},
$$

is net nominal position (NNP), and

$$
C_{j,t+1} \equiv \sum_{k=1}^{K} c_{j,k,t+1}, \quad \pi_{j,t+1} \equiv \sum_{k=1}^{K} \pi_{k,t+1} \omega_{j,k,t+1}
$$

are nominal consumption expenditures and individual inflation.
NNPs and nominal income are of similar absolute magnitudes

<table>
<thead>
<tr>
<th>Age group</th>
<th>Income group</th>
<th>j25</th>
<th>p25-p50</th>
<th>p50-p75</th>
<th>j75</th>
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<td>-4,560</td>
<td>-9,365</td>
<td>-16,297</td>
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<td></td>
<td>Nominal (labour) income</td>
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<td>Relative consumption</td>
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<tr>
<td>36-45</td>
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<td>56-65</td>
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<tr>
<td>¡65</td>
<td>Net nominal position</td>
<td>7,039</td>
<td>5,912</td>
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Cuadro: Components by age-income groups (eur). Computed from representative surveys EFF and EPF.
NNPs and nominal income are of similar absolute magnitudes

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<th>3p25</th>
<th>p25-p50</th>
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<td>18,960</td>
<td>27,827</td>
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<td>31,794</td>
<td>50,311</td>
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<td>22,330</td>
<td>32,354</td>
<td>52,807</td>
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</table>
Dispersion in individual inflation rates was relatively small…

Figura: Individual annual inflation rates, Dec-2021: median for each age-income group in the EPF
… implying a much smaller relative consumption effect

<table>
<thead>
<tr>
<th>Age group</th>
<th>Income group</th>
<th>j25</th>
<th>p25-p50</th>
<th>p50-75</th>
<th>¿75</th>
</tr>
</thead>
<tbody>
<tr>
<td>j36</td>
<td>Net nominal position</td>
<td>-4,560</td>
<td>-9,365</td>
<td>-16,297</td>
<td>-21,123</td>
</tr>
<tr>
<td></td>
<td>Nominal (labour) income</td>
<td>10,461</td>
<td>18,960</td>
<td>27,827</td>
<td>43,149</td>
</tr>
<tr>
<td></td>
<td>Relative consumption</td>
<td>-1,857</td>
<td>-1,237</td>
<td>-1,517</td>
<td>-2,869</td>
</tr>
<tr>
<td>36-45</td>
<td>Net nominal position</td>
<td>-8,945</td>
<td>-20,521</td>
<td>-26,452</td>
<td>-33,443</td>
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<tr>
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<td>Nominal (labour) income</td>
<td>11,474</td>
<td>22,260</td>
<td>31,794</td>
<td>50,311</td>
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<tr>
<td></td>
<td>Relative consumption</td>
<td>-1,047</td>
<td>-838</td>
<td>-642</td>
<td>-1,756</td>
</tr>
<tr>
<td>46-55</td>
<td>Net nominal position</td>
<td>-5,173</td>
<td>-10,136</td>
<td>-12,572</td>
<td>-16,206</td>
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<tr>
<td></td>
<td>Nominal (labour) income</td>
<td>11,403</td>
<td>22,330</td>
<td>32,354</td>
<td>52,807</td>
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<tr>
<td></td>
<td>Relative consumption</td>
<td>-248</td>
<td>-200</td>
<td>-566</td>
<td>-1,346</td>
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<tr>
<td>56-65</td>
<td>Net nominal position</td>
<td>2,241</td>
<td>-1,553</td>
<td>1,430</td>
<td>2,073</td>
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<td></td>
<td>Nominal (labour) income</td>
<td>10,436</td>
<td>20,893</td>
<td>31,625</td>
<td>53,742</td>
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<tr>
<td></td>
<td>Relative consumption</td>
<td>383</td>
<td>281</td>
<td>3</td>
<td>-520</td>
</tr>
<tr>
<td>¿65</td>
<td>Net nominal position</td>
<td>7,039</td>
<td>5,912</td>
<td>10,364</td>
<td>18,910</td>
</tr>
<tr>
<td></td>
<td>Nominal (labour) income</td>
<td>9,603</td>
<td>16,108</td>
<td>23,773</td>
<td>42,590</td>
</tr>
<tr>
<td></td>
<td>Relative consumption</td>
<td>1,774</td>
<td>1,503</td>
<td>997</td>
<td>847</td>
</tr>
</tbody>
</table>

**Cuadro**: Components by age-income groups (eur). Computed from representative surveys EFF and EPF.
### Total effects

**Cuadro:** Total effect by age-income groups (eur). Computed from representative surveys EFF and EPF

<table>
<thead>
<tr>
<th>Age group</th>
<th>Income group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ip25</td>
</tr>
<tr>
<td>18-25</td>
<td>-267</td>
</tr>
<tr>
<td>as a % of income</td>
<td>-2.6 %</td>
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<tr>
<td>25-35</td>
<td>-98</td>
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<tr>
<td>as a % of income</td>
<td>-0.9 %</td>
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<tr>
<td>35-45</td>
<td>-395</td>
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<tr>
<td>as a % of income</td>
<td>-3.5 %</td>
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<tr>
<td>45-55</td>
<td>-862</td>
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<tr>
<td>as a % of income</td>
<td>-8.3 %</td>
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<tr>
<td>55-65</td>
<td>-1,215</td>
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<tr>
<td>as a % of income</td>
<td>-12.7 %</td>
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</tbody>
</table>
Results using BBVA clients are qualitatively similar

<table>
<thead>
<tr>
<th>Age group</th>
<th>Income group</th>
<th></th>
<th>p25</th>
<th>p25-p50</th>
<th>p50-p75</th>
<th>&gt;p75</th>
</tr>
</thead>
<tbody>
<tr>
<td>36-45</td>
<td>Net nominal position</td>
<td>-5,133</td>
<td>-9,056</td>
<td>-10,863</td>
<td>-18,913</td>
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<tr>
<td></td>
<td>Nominal (labour) income</td>
<td>7,530</td>
<td>15,744</td>
<td>22,183</td>
<td>37,929</td>
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<tr>
<td></td>
<td>Relative consumption</td>
<td>-439</td>
<td>-135</td>
<td>-35</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>36-45</td>
<td>Net nominal position</td>
<td>-21,874</td>
<td>-29,618</td>
<td>-39,010</td>
<td>-48,051</td>
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<tr>
<td></td>
<td>Nominal (labour) income</td>
<td>10,902</td>
<td>20,507</td>
<td>29,182</td>
<td>49,487</td>
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<tr>
<td></td>
<td>Relative consumption</td>
<td>-335</td>
<td>30</td>
<td>-220</td>
<td>27</td>
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<tr>
<td>46-55</td>
<td>Net nominal position</td>
<td>-8,583</td>
<td>-10,702</td>
<td>-10,468</td>
<td>-6,280</td>
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<tr>
<td></td>
<td>Nominal (labour) income</td>
<td>11,421</td>
<td>22,149</td>
<td>31,788</td>
<td>56,558</td>
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<tr>
<td></td>
<td>Relative consumption</td>
<td>-149</td>
<td>161</td>
<td>345</td>
<td>252</td>
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<tr>
<td>56-65</td>
<td>Net nominal position</td>
<td>8,357</td>
<td>12,891</td>
<td>22,028</td>
<td>44,839</td>
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<td>Nominal (labour) income</td>
<td>11,593</td>
<td>22,616</td>
<td>32,325</td>
<td>59,370</td>
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<tr>
<td></td>
<td>Relative consumption</td>
<td>-78</td>
<td>189</td>
<td>297</td>
<td>449</td>
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</tr>
<tr>
<td>&gt;65</td>
<td>Net nominal position</td>
<td>23,179</td>
<td>32,283</td>
<td>41,381</td>
<td>61,539</td>
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<tr>
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<td>Nominal (labour) income</td>
<td>11,160</td>
<td>18,874</td>
<td>26,402</td>
<td>42,490</td>
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<tr>
<td></td>
<td>Relative consumption</td>
<td>-446</td>
<td>-336</td>
<td>-171</td>
<td>-107</td>
<td></td>
</tr>
</tbody>
</table>
Results using BBVA clients are qualitatively similar

Cuadro: Total effect by age-income groups (eur). Computed from BBVA clients’ data

<table>
<thead>
<tr>
<th>Age group</th>
<th>Income group</th>
<th>p25</th>
<th>p25-p50</th>
<th>p50-p75</th>
<th>p75</th>
</tr>
</thead>
<tbody>
<tr>
<td>¡36 in levels</td>
<td>¡p25</td>
<td>-76</td>
<td>-253</td>
<td>-439</td>
<td>-735</td>
</tr>
<tr>
<td>as a % of income</td>
<td>-24.0 %</td>
<td>-1.6 %</td>
<td>-2.0 %</td>
<td>-1.8 %</td>
<td></td>
</tr>
<tr>
<td>36-45 in levels</td>
<td>p25</td>
<td>437</td>
<td>351</td>
<td>371</td>
<td>-56</td>
</tr>
<tr>
<td>as a % of income</td>
<td>7.8 %</td>
<td>1.7 %</td>
<td>1.3 %</td>
<td>0.1 %</td>
<td></td>
</tr>
<tr>
<td>46-55 in levels</td>
<td>¡p25</td>
<td>-104</td>
<td>-448</td>
<td>-837</td>
<td>-1,952</td>
</tr>
<tr>
<td>as a % of income</td>
<td>9.2 %</td>
<td>-2.0 %</td>
<td>-2.6 %</td>
<td>-3.3 %</td>
<td></td>
</tr>
<tr>
<td>56-65 in levels</td>
<td>¡p25</td>
<td>-768</td>
<td>-1,379</td>
<td>-2,111</td>
<td>-4,043</td>
</tr>
<tr>
<td>as a % of income</td>
<td>-12.0 %</td>
<td>-6.1 %</td>
<td>-6.5 %</td>
<td>-6.7 %</td>
<td></td>
</tr>
<tr>
<td>ª65 in levels</td>
<td>¡p25</td>
<td>-1,309</td>
<td>-1,963</td>
<td>-2,612</td>
<td>-4,014</td>
</tr>
<tr>
<td>as a % of income</td>
<td>-3.8 %</td>
<td>-10.4 %</td>
<td>-9.9 %</td>
<td>-9.6 %</td>
<td></td>
</tr>
</tbody>
</table>
Conclusions and ongoing work

- New analytical framework to analyze the impact of unanticipated temporary inflation on households’ wealth.

- Three channels: (i) Fisher; (ii) Nominal income; (iii) Relative consumption.

- Estimation for Spain in 2021:
  - Fisher and income much larger (in absolute values) than relative consumption
  - Middle-aged people largely unaffected (large debtors), old people (specially poor old people), mostly affected.
  - Results robust across datasets.

- Ongoing work:
  - Shock more persistent than expected: portfolio and consumption adjustment
  - Dynamics in 2022
Thank you!
Inflation was quite heterogeneous across sectors

**Cuadro: Annual inflation and weights by ECOICOP group - December 2021**

<table>
<thead>
<tr>
<th></th>
<th>(a) Inflation</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INE</td>
<td>BBVA</td>
</tr>
<tr>
<td>General</td>
<td>6.6</td>
<td>3.9</td>
</tr>
<tr>
<td>1. Food and non-alcoholic beverages</td>
<td>4.9</td>
<td>22.8</td>
</tr>
<tr>
<td>2. Alcoholic beverages and tobacco</td>
<td>1.6</td>
<td>3.1</td>
</tr>
<tr>
<td>3. Clothing and footwear</td>
<td>0.7</td>
<td>6.3</td>
</tr>
<tr>
<td>4. Housing and energy</td>
<td>22.9</td>
<td>13.2</td>
</tr>
<tr>
<td>5. Furniture and household equipment</td>
<td>2.1</td>
<td>5.9</td>
</tr>
<tr>
<td>6. Health</td>
<td>0.8</td>
<td>3.8</td>
</tr>
<tr>
<td>7. Transport</td>
<td>10.7</td>
<td>12.9</td>
</tr>
<tr>
<td>8. Communications</td>
<td>-0.3</td>
<td>3.6</td>
</tr>
<tr>
<td>9. Recreation and culture</td>
<td>2.3</td>
<td>5.5</td>
</tr>
<tr>
<td>10. Education</td>
<td>1.2</td>
<td>1.6</td>
</tr>
<tr>
<td>11. Hotels, cafes and restaurants</td>
<td>4.0</td>
<td>13.1</td>
</tr>
<tr>
<td>12. Others</td>
<td>1.6</td>
<td>8.1</td>
</tr>
</tbody>
</table>

Values are in pp. Source: Spanish National Statistics Institute (INE, www.ine.es) and BBVA proprietary data. General inflation (a) is computed using the inflation rates for each COICOP group (common to INE and BBVA) and the spending weights (columns (b) and (c)).
Dispersion in individual inflation rates: BBVA

**Figura:** Individual annual inflation rates, Dec-2021: median for each age-income group in the BBVA clients’ database