The Heterogeneous Impact of Inflation on Households' Balance Sheets

Miguel Cardoso (BBVA) Clodomiro Ferreira (BdE) José Miguel Leiva (BBVA) Galo Nuño (BdE) Álvaro Ortiz (BBVA) Tomasa Rodrigo (BBVA) Sirenia Vazquez (BBVA)

- "*The difference between inflation and unemployment is that inflation affects just everybody.[...] Inflation has a social-wide kind of impact.*" Ben Bernanke, May 16, 2022 (NYTimes)

- "*Is there any good reason to believe that inflation hits low-income households especially hard? Inflation redistributes from creditors to debtors — not exactly a burden on the bottom half of the income distribution.*" Paul Krugman, Dec 11, 2021 (Twitter)

Economics 101: which is the costs of inflation to households?

- Which are the costs of unexpected inflation to households? According to Mankiw's "Macroeconomics" textbook (7th edition, 2009):
  1. "Unexpected inflation [...] arbitrarily redistributes wealth among individuals".
  2. "Unanticipated inflation also hurts individuals on fixed pensions".

- The first channel, is the "Fisher channel": inflation redistributes wealth from lenders to borrowers, by changing the value of nominal assets and liabilities (Doepke and Schneider, 2006; Meh et al., 2010; Adam and Zhu, 2016; Auclert, 2019, Cao et al., 2021; or Pallotti, 2022).

- The second channel ("Nominal income channel") is more general, it also includes sticky wages and benefits:

  - Wages, are typically updated at annual frequency (Bihan et al., 2012; and Barattieri et al., 2014).

  - Present in New Keynesian models with sticky wages (Hagedorn et al., 2019; Auclert et al., 2020).

A third channel: inflation inequality

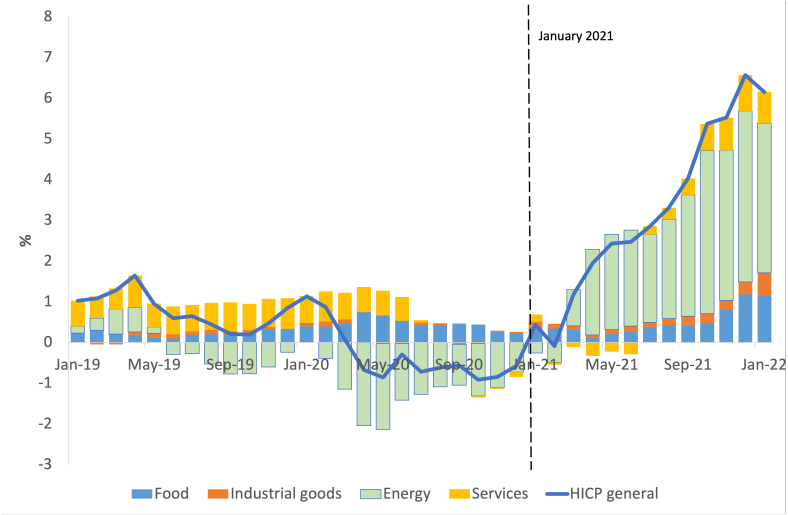
- Inflation differs across agents:
  - The prices of some goods or services rise more than those of others.
  - Individuals consume different baskets of goods and services depending on their age, income... ("relative consumption").
- Emerging literature on "inflation inequality" (Kaplan and Schulhofer-Wohl, 2017; Jaravel, 2021).

What we do: analyzing the impact of inflation on households' wealth

- We characterize how an unanticipated shock to inflation impacts the a person's wealth
- Derive analytical formula capturing the impact of inflation on wealth.
  - Thought experiment: one-off price shock, focus on households, abstract from firms and government.
  - Similar approach to what Auclert (2019) does for monetary policy.
  - Identify the three channels above (Fisher, nominal income and relative consumption).

The surge in inflation in 2021

Figure: Evolution of HICP and components in Spain



Estimation for Spain in 2021

- Estimate these channels using two datasets:
  1. Public surveys: the *Encuesta de Presupuestos Familiares* (EPF), and the *Encuesta Financiera de las Familias* (EFF).
  2. 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).
- The Fisher and the nominal income channel are, on average, one order of magnitude larger than the relative consumption channel.
- Middle-aged people's wealth was roughly unaffected by inflation ($-NNP_j \approx w_j$ due to mortgages), while old people experienced the largest decline in wealth ($NNP_j \gg 0$).

Analytical framework

Price level and inflation

- Aggregate price level P_t:

$$P_t = \sum_{k=1}^{K} p_{kt}\omega_{kt},$$

where

  - p_{kt} is the price of good $k \in K$.
  - ω_{kt} are the weights at time t of the different goods in the basket of the average consumer, $\sum_{k=1}^{K} \omega_k = 1$.

- Aggregate and sectoral inflation:

$$\pi_{t+1} = \frac{P_{t+1}}{P_t} - 1, \; \pi_{kt+1} = \frac{p_{kt+1}}{p_{kt}} - 1, \tag{1}$$

respectively.

Wealth

- The net wealth of an individual j at time t, :

$$P_t a_{j,t} = m_{j,t} + Q_t d_{j,t} + P_t q_t s_{j,t} - Q_t^b b_{j,t}.$$

- We abstract from firms and government.

  - Cash, $m_{j,t}$.
  - Deposits and bonds, $d_{j,t}$.
  - Real assets (such as stocks or housing), $s_{j,t}$,
  - Consumer debt and mortgages, $b_{j,t}$.

  - Q_t: price of nominal assets (deposits and bonds), $\frac{\Delta Q_{t+1}}{Q_t} \equiv \frac{Q_{t+1} - Q_t}{Q_t}$.
  - Q_t^b: the prices of nominal liabilities (debt and mortgages), $\frac{\Delta Q_{t+1}^b}{Q_t^b} \equiv \frac{Q_{t+1}^b - Q_t^b}{Q_t^b}$.
  - q_t, price of real assets (houses and stocks), $\frac{\Delta q_{t+1}}{q_t} \equiv \frac{q_{t+1} - q_t}{q_t}$.

Budget constraint

- The budget constraint is then

$$
\begin{aligned}
P_{t+1} a_{j,t+1} &= m_{j,t} + \left(1 + \frac{\Delta Q_{t+1}}{Q_t} + i_t\right) Q_t d_{j,t} + \left(1 + \frac{\Delta q_{t+1}}{q_t} + r^s_{t+1} + \pi_{t+1}\right) P_t q_t s_{j,t} \\
&\quad - \left(1 + \frac{\Delta Q^b_{t+1}}{Q^b_t} + i^b_t\right) b_{j,t} + w_{j,t+1} - P_{t+1} C_{j,t+1},
\end{aligned}
$$

where $P_{t+1} C_{j,t+1} = \sum_{k=1}^{K} p_{kt+1} c_{j,kt+1}$ is total consumption by the agent.

- Notice how the return on real assets is linked to inflation.

  - Labour income due to wages, unemployment benefits or pension, $w_{j,t}$.
  - Consumption of good/service k, $c_{j,kt}$.
  - i_t, i^b_t: nominal interest payments on nominal assets and liabilities.
  - r^s_{t+1}: real interest payments on real assets.

Inflation shock

- We consider an unexpected one-off price shock, as in Auclert (2019).
- Normalization: we consider time-t prices as the reference, $p_{kt} = P_t = 1, \forall k$. Thus

$$\pi_{t+1} = \sum_{k=1}^{K} \pi_{kt+1} \omega_{kt+1}.$$

- Temporary surprise inflation is defined as

$$\pi_{t+1} > \bar{\pi},\ \mathbb{E}_{t+1}\left[\pi_s\right] = \bar{\pi}, \text{for } s > t+1,$$

where $\bar{\pi}$ is the expected constant inflation rate $\rightarrow$ after the shock no further change expected.

Impact of surprise inflation

The first-order change in nominal wealth, expressed in real terms, at time $t+1$ to a transitory inflation shock, π_{t+1}, is

$$da_{j,t+1} = \left[\underbrace{-NNP_{j,t}}_{\text{Fisher channel}} - \underbrace{w_{j,t+1}}_{\text{Nominal income channel}} \underbrace{- C_{j,t+1} \left(\overbrace{\pi_{j,t+1}}^{\text{Individual inflation}} / \pi_{t+1} - 1 \right)}_{\text{Relative consumption channel}} \right] \pi_{t+1},$$

where

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

is net nominal position (NNP),

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

is nominal consumption expenditure at time $t+1$evaluated at time t prices, and

$$\pi_{j,t+1} = \sum_{k=1}^{K} \pi_{j,kt+1} \omega_{j,kt+1},$$

is the individual inflation rate, with $\omega_{j,kt+1} \equiv \frac{c_{j,kt+1}}{C_{t+1}}$ as the individual consumption weight of good k in agent's j consumption basket.

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 is $(50,000 - 30,000 + 20,000) \times 0.05 = 2,000$ eur, that is, Ana benefits relatively from the inflation through the Fisher and relative consumption channel.

Estimation

Public Spanish databases

- 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.
  - Its goal, similar to the U.S. Consumer Expenditure Survey, is to collect detailed information on household consumption expenditures and its evolution over time.
  - 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 conducted by Banco de España. It started in 2002, it runs every three years and samples around 6,000 households per wave.
  - 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.

Proprietary BBVA data

- Proprietary dataset from Banco Bilbao Vizcaya Argentaria (BBVA).
- This dataset includes detailed granular information for BBVA clients' asset/liabilities positions as well as transactions.
- For this paper, in terms of accounts and net asset positions, we consider:
  - on the asset side, current accounts and deposits.
  - on the liability side, 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.

Inflation was quite heterogeneous across sectors

Table: Annual inflation and weights by ECOICOP group - December 2021

	(a) Inflation		Weights	
	INE	BBVA	(b) INE	(c) BBVA
General	6.6	3.9		
1. Food and non-alcoholic beverages	4.9		22.8	15.6
2. Alcoholic beverages and tobacco	1.6		3.1	5.3
3. Clothing and footwear	0.7		6.3	7.2
4. Housing and energy	22.9		13.2	5.5
5. Furniture and household equipment	2.1		5.9	5.6
6. Health	0.8		3.8	7.7
7. Transport	10.7		12.9	15.6
8. Communications	-0.3		3.6	2.7
9. Recreation and culture	2.3		5.5	9.1
10. Education	1.2		1.6	1.3
11. Hotels, cafes and restaurants	4.0		13.1	10.1
12. Others	1.6		8.1	14.2

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

Was it anticipated? Was it expected to be temporary?

Table: Inflation expectation indicators in 2021 and 2022

	Dec. 2020		Jun. 2021	
	2021	2022	2021	2022
Survey of Professional Forecasters*	0.6	1.2	1.7	1.2
ECB projections	0.6	1.2	1.9	1.2
Inflation-linked swaps (ILS)**	1.0	0.9	1.8	1.3
Consumer Expectations Survey***	2.0	-	2.0	

Source: Survey of Professional Forecasters, ECB, Bloomberg. Note: in pp.

* 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?"

NNPs and nominal income are of similar absolute magnitudes

Table: Components by age-income groups (eur). Computed from representative surveys EFF and EPF

		Income group			
Age group		**<p25**	**p25-p50**	**p50-p75**	**>p75**
<36	Net nominal position	-4,560	-9,365	-16,297	-21,123
	Nominal (labour) income				
	Relative consumption				
36-45	Net nominal position	-8,945	-20,521	-26,452	-33,443
	Nominal (labour) income				
	Relative consumption				
46-55	Net nominal position	-5,173	-10,136	-12,572	-16,206
	Nominal (labour) income				
	Relative consumption				
56-65	Net nominal position	2,241	-1,553	1,430	2,073
	Nominal (labour) income				
	Relative consumption				
>65	Net nominal position	7,039	5,912	10,364	18,910
	Nominal (labour) income				
	Relative consumption				

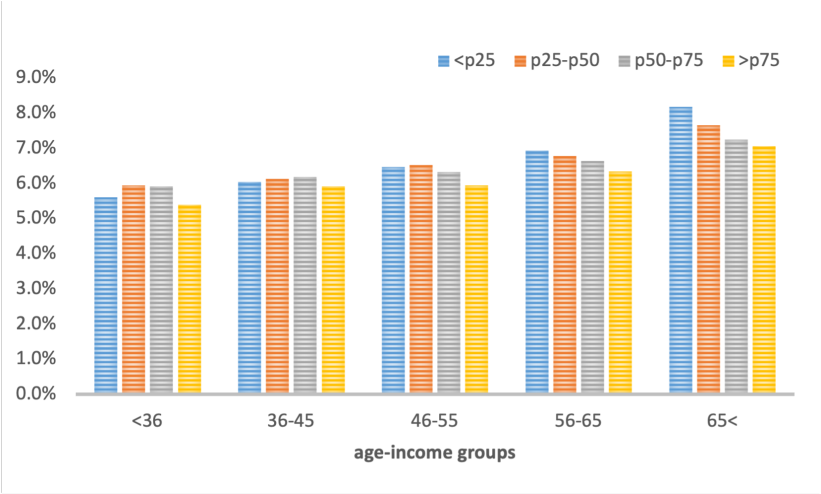
NNPs and nominal income are of similar absolute magnitudes

Table: Components by age-income groups (eur). Computed from representative surveys EFF and EPF

		Income group			
Age group		**<p25**	**p25-p50**	**p50-p75**	**>p75**
<36	Net nominal position	-4,560	-9,365	-16,297	-21,123
	Nominal (labour) income	10,461	18,960	27,827	43,149
	Relative consumption				
36-45	Net nominal position	-8,945	-20,521	-26,452	-33,443
	Nominal (labour) income	11,474	22,260	31,794	50,311
	Relative consumption				
46-55	Net nominal position	-5,173	-10,136	-12,572	-16,206
	Nominal (labour) income	11,403	22,330	32,354	52,807
	Relative consumption				
56-65	Net nominal position	2,241	-1,553	1,430	2,073
	Nominal (labour) income	10,436	20,893	31,625	53,742
	Relative consumption				
>65	Net nominal position	7,039	5,912	10,364	18,910
	Nominal (labour) income	9,603	16,108	23,773	42,590
	Relative consumption				

The dispersion in *individual* inflation rates was relatively contained...

Figure: Individual annual inflation rates, Dec-2021: median for each age-income group in the EPF



... implying a much smaller relative consumption effect

Table: Components by age-income groups (eur). Computed from representative surveys EFF and EPF

		Income group			
Age group		**<p25**	**p25-p50**	**p50-p75**	**>p75**
<36	Net nominal position	-4,560	-9,365	-16,297	-21,123
	Nominal (labour) income	10,461	18,960	27,827	43,149
	Relative consumption	**-1,857**	**-1,237**	**-1,517**	**-2,869**
36-45	Net nominal position	-8,945	-20,521	-26,452	-33,443
	Nominal (labour) income	11,474	22,260	31,794	50,311
	Relative consumption	**-1,047**	**-838**	**-642**	**-1,756**
46-55	Net nominal position	-5,173	-10,136	-12,572	-16,206
	Nominal (labour) income	11,403	22,330	32,354	52,807
	Relative consumption	**-248**	**-200**	**-566**	**-1,346**
56-65	Net nominal position	2,241	-1,553	1,430	2,073
	Nominal (labour) income	10,436	20,893	31,625	53,742
	Relative consumption	**383**	**281**	**3**	**-520**
>65	Net nominal position	7,039	5,912	10,364	18,910
	Nominal (labour) income	9,603	16,108	23,773	42,590
	Relative consumption	**1,774**	**1,503**	**997**	**847**

Total effects

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

		Income group			
Age group		**<p25**	**p25-p50**	**p50-p75**	**>p75**
<36	in levels	-267	-552	-661	-1,264
	as a % of income	-2.6%	-2.9%	-2.4%	-2.9%
36-45	in levels	-98	-59	-310	-997
	as a % of income	-0.9%	-0.3%	-1.0%	-2.0%
46-55	in levels	-395	-792	-1,268	-2,327
	as a % of income	-3.5%	-3.5%	-3.9%	-4.4%
56-65	in levels	-862	-1,295	-2,182	-3,650
	as a \% of income	-8.3%	-6.2%	-6.9%	-6.8%
>65	in levels	-1,215	-1,553	-2,319	-4,115
	as a % of income	-12.7%	-9.6%	-9.8%	-9.7%

Results using BBVA clients are qualitatively similar

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

Results using BBVA clients are qualitatively similar

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

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

Conclusions

- 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.

Thank you!

Additional slides

Dispersion in *individual* inflation rates: BBVA

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