The Heterogeneous Impact of Inflation on Households' Balance Sheets*

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Abstract

We identify and study three key channels that shape how inflation affects wealth inequality: (i) the traditional Fisher channel through which inflation redistributes from lenders to borrowers; (ii) a nominal labour income channel through which inflation reduces the real value of sticky wages and benefits; and (iii) a relative consumption channel through which heterogeneous increases in the price of different goods affect people differently depending on their consumption baskets. We then quantify these channels for Spain in 2021 using both public surveys and a novel proprietary bank dataset that includes detailed information on clients' assets and liabilities, credit and debit card payments, bills and labour related income. Results show that the Fisher and labour income channels are one order of magnitude larger than relative consumption. Middle-aged individuals were roughly unaffected by inflation while older ones suffered the most its consequences.

Keywords: inflation inequality, net nominal positions, nominal wage rigidities.

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1 Introduction

Ben Bernanke, former Chairman of Federal Reserve, stated that "The difference between inflation and unemployment is that inflation affects just everybody.[...] Inflation has a social-wide kind of impact." (Ross Sorkin 2022). While inflation may affect everyone, it does not affect everyone in the same way. Differences in wealth composition, salary or consumption patterns may lead to quite different outcomes for different individuals. The aim of this paper is to cast some light in the different channels through which inflation affects households' balance sheets.

The paper first characterizes how an unanticipated shock to inflation impacts the balance sheet of an individual. We follow the approach by Auclert (2019), and derive an analytical expression decomposing the impact of inflation on wealth in three different channels.[1]

First, the "Fisher channel" captures how inflation redistributes real wealth from lenders to borrowers, by changing the value of nominal assets and liabilities. This channel has already been studied by Doepke and Schneider (2006), Adam and Zhu (2016) or Auclert (2019). The impact of inflation on wealth is fully captured by the net nominal position (NNP), defined as the difference between nominal assets and nominal liabilities.

Second, income sources such as wages, pensions, or unemployment benefits are sticky in most advanced economies. Inflation thus reduces the real value of nominal income, in what we call the "nominal income channel". Wages, for instance, are typically updated at annual frequency or even lower than that. Bihan et al. (2012) and Barattieri et al. (2014), find that the pattern of nominal wage changes appears to be in line with the staggered contracting model of Taylor (1980), with the hazard for wage contracts peaking at 12 months both in France and the US. While inflation reduces the real income of all agents, the impact will naturally be higher the higher the nominal income is.

Third, inflation does not typically affect all prices homogeneously. The prices of some goods or services rise more than those of others. Given that individuals consume different baskets of goods and services, an increase in prices that is heterogeneously distributed across these goods will impact agents differently. We demonstrate how this "relative consumption channel" is proportional to a person's consumption expenditure

[1] While Auclert (2019) analyzes the impact of monetary policy shocks on consumption, we are just concerned with impact of inflation shocks on wealth.

multiplied by the ratio between the *individual inflation rate*, computed using the basket of each particular individual, and the *economy-wide inflation rate*, computed using the basket of the average consumer. This connects this channel to the emerging literature on "inflation inequality" (Kaplan and Schulhofer-Wohl, 2017; Jaravel, 2021), which analyzes how different individuals experience different inflation rates. For those agents who consume more of the goods and services that experience the largest price increases, that is those agents with higher individual inflation rates, this channel will lead to reduction in their wealth, as they need to devote a larger share of resources to pay for their consumption basket. Conversely, those agents experiencing lower individual inflation rates will enjoy an increase in their wealth, as they need to devote less resources to pay for their consumption.

Next, we turn to the empirical quantification of these three channels. To this end, we work on two different Spanish datasets. First, we use data from two public surveys that have been extensively employed both in the policy and research domains: the *Encuesta de Presupuestos Familiares* (EPF), and the *Encuesta Financiera de las Familias* (EFF). The EPF is a comprehensive household expenditure survey carried out with an annual frequency by the Spanish national statistical institute (INE). The EFF instead is a representative household survey collecting detailed information on household's balance sheets. Second, we employ a novel proprietary dataset from Banco Bilbao Vizcaya Argentaria SA (BBVA). BBVA is a large global bank with a strong presence in Spain. The raw dataset is composed of the universe of card transactions collected from BBVA cardholders and BBVA-operated point-of-sale in Spain, originally collected in Carvalho et al. (2021) (and further expanded in Buda et al. (2022)), together with other means of payments such as cash, direct debit and transfers, which allows us to account for monthly payment to utilities (i.e electricity, water, gas and telecommunication..). Finally, the raw dataset also includes the universe of bank accounts, with information about deposits and current accounts, as well as mortgages, consumer loans, credit and pre- paid cards.[2]

Armed with the theoretical framework and the data, we analyze the different channels through which the surge in inflation in the year 2021 affected individuals. Three

[2]The advantages of using actual transaction and accounts data instead of surveys in our setting are twofold: first, and as discussed in Kaplan and Schulhofer-Wohl, 2017, actual transactions do not suffer from a problem of mis-reporting, or lack of memory. Second, unlike both representative surveys available for the purpose of comparison, our client data contains *both* transaction (i.e. consumption spending) as well as income and detailed balance sheet information.

main results emerge. First, both the Fisher and the nominal income channel are, on average, one order of magnitude larger than the relative consumption channel. This implies that heterogeneity in consumption baskets plays a smaller role than these two 'traditional' channels. The reason is that the dispersion in *individual* inflation rates across the population is not large enough in order to generate significant losses or gains.

Second, the magnitudes of the income and Fisher channels are equivalent in absolute value, though the former leads to inflation reducing real wealth of all households, whereas the latter increases the real wealth of debtors while reducing that of creditors. The result is that middle-aged individuals, who have large negative NNPs due to mortgages, were roughly unaffected by inflation, while old people experienced the largest decline in real wealth, as the have large positive NNPs.

Third, these results are consistent independent of the dataset considered. The BBVA data magnifies the impact of the Fisher channel, as NNPs are larger in absolute value, and minimizes even more the relative consumption channel, as it exhibits little dispersion in individual inflation rates.

This paper contributes to the emerging literature analyzing the heterogeneous consequences of inflation across the population. In addition to the empirical references already cited, a number of recent papers have analyzed the redistributive effects of monetary policy in general-equilibrium models with heterogeneous agents through the Fisher channel (see Nuño and Thomas, 2016 or Ferrante and Paustian, 2019, among others), wage stickiness (Hagedorn et al., 2019, Auclert et al., 2020) or the relative consumption channel (Cravino et al., 2020). We contribute to this literature by presenting a clear theoretical framework that allows us to quantify the relative importance of the different channels.

The structure of the paper is as follows. Section 2 introduces the theoretical framework. Section 3 presents the two datasets employed. The main results are discussed in Section 4. Finally, Section 5 concludes.

2 A theoretical framework to quantify the impact of surprise inflation on individual wealth

In this section, we introduce a theoretical framework to analyze the impact of surprise inflation on agents' wealth. Time t is discrete. Agents can consume goods or services from K different sectors. The *aggregate* price level P_t is constructed as

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

where p_{kt} is the price of good $k \in K$, and ω_{kt} are the weights at time t of the different goods in the basket of the average consumer, $\sum_{k=1}^{K} \omega_k = 1$. We define aggregate and sectoral inflation as

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

respectively.

The net wealth of an individual j at time t, $P_t a_t$, is the sum of cash, $m_{j,t}$, deposits and bonds, $d_{j,t}$, real assets (such as stocks or housing), $s_{j,t}$, and (minus) consumer debt and mortgages, $b_{j,t}$:

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

where a_t is the wealth expressed in real terms, Q_t and Q_t^b are the prices of nominal assets and liabilities, respectively, and q_t is the price of real assets. Each period, the individual receives (i) a nominal labour income $w_{j,t}$ due to wages, unemployment benefits or pension payments; (ii) nominal interest payments i_t, i_t^b on nominal assets (bonds and deposits) and liabilities (loans and mortgages)[3]; and (iii) real interest payments r_{t+1}^s on real assets (rents, capital gains, dividends). Each period the agent also spends a nominal amount $P_{t+1}C_{t+1} = \sum_{k=1}^{K} p_{kt+1}c_{j,kt+1}$ on consumption, where $c_{j,kt}$ is the consumption of good/service k.

[3]In the case of liabilities, the agent does not receive any payment, but should pay to her creditors instead.

The budget constraint of the individual is then

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

where $\frac{\Delta Q_{t+1}}{Q_t} \equiv \frac{Q_{t+1}-Q_t}{Q_t}$, $\frac{\Delta q_{t+1}}{q_t} \equiv \frac{q_{t+1}-q_t}{q_t}$ and $\frac{\Delta Q^b_{t+1}}{Q^b_t} \equiv \frac{Q^b_{t+1}-Q^b_t}{Q^b_t}$ are the capital gains/losses on deposits, real assets and debts, respectively. The budget constraint reflects how the nominal wealth in the next period is the result of the gains/losses on current assets, including interest payments, plus nominal income and minus consumption expenditures.

We follow Auclert (2019) and analyze the impact of surprise temporary inflation on wealth between periods t and $t+1$. We consider time-t prices as the reference, $p_{kt} = P_t = 1, \forall k$ and $\pi_{t+1} = \sum_{k=1}^{K} \pi_{kt+1}\omega_{kt+1}$.Temporary surprise inflation is defined as an unexpected inflation rise at time $t+1$ that is expected to disappear at time $t+2$, that is,

$$\pi_{t+1} > \bar{\pi},\ \mathbb{E}_{t+1}\left[\pi_{t'}\right] = \bar{\pi}, \text{for } t' > t+1,$$

where $\bar{\pi}$ is the expected constant inflation rate.[4]

We assume that nominal income is "sticky", defined as the fact that income at time $t+1$ does *not* depend on inflation in that period. This implies that wages or benefits are set in period t and then kept constant for a period. They can include the expected inflation at time t, $\bar{\pi}$, but not the realized inflation π_{t+1}.

Auclert's focus is at the same time wider and narrower than ours. Wider as it goes beyond inflation shocks to also incorporate changes in real rates and in real income. Narrower as it considers a single homogeneous good and abstracts from nominal income rigidities.

Given these assumptions, we can characterize the impact of temporary surprise inflation on wealth,

Proposition 1 (Impact of surprise inflation) *The first-order change in nominal*

[4]The fact that inflation is *unexpected* implies that nominal returns at time $t+1$ i_t, i^b_t, which are determined at end of period t, do not incorporate the surge in inflation. The fact that inflation is *expected to be temporary* implies that the capital gains/losses at time $t+1$ are independent of inflation at time $t+1$. This is because asset prices at time $t+1$ only depends in future payments, which are unaffected as inflation is expected to revert back to its trend.

wealth, expressed in real terms, at time $t+1$ *to a transitory inflation shock ,* $\frac{dP_{t+1}}{P_{t+1}} = 1-\pi_{t+1} = \frac{1}{1-\pi_{t+1}}$*, is*

$$da_{j,t+1} = \left[\underbrace{-NNP_{j,t}}_{\text{Fisher channel}} - \underbrace{w_{j,t+1}}_{\text{Nominal income channel}} - \underbrace{C_{j,t+1}\left(\overbrace{\pi_{j,t+1}}^{\text{Individual inflation}} / \pi_{t+1} - 1 \right)}_{\text{Relative consumption channel}} \right] \pi_{t+1} \quad (2)$$

where

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

is the net nominal position (NNP) at the end of period t*,* $C_{t+1} \equiv \sum_{k=1}^{K} c_{j,kt+1}$ *is nominal consumption expenditure in period* $t+1$ *evaluated at time* t *prices,*

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

is the individual inflation rate, and 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.*

The proof can be found in AppendixA. Equation (2) captures the three main channels through which surprise inflation affects the wealth of an individual. First, there is the standard *Fisher channel*, analyzed by Doepke and Schneider (2006) and Adam and Zhu (2016), by which inflation redistributes wealth from creditors of nominal assets to debtors. In our case, as in Auclert (2019), given the temporary expected nature of inflation, this channel only operates through product of the NNP at the end of period t times inflation at $t+1$: $NNP_{j,t}\pi_{t+1}$. This contrast with the analysis carried out by Doepke and Schneider (2006), for instance, who consider how changes in the future paths of inflation affect the NNP through asset prices. To provide a simple example, assume a person who has a NNP of 10,000 euros in one year deposits. Assuming that the period of surprise temporary inflation is one year, and that inflation is 5%, this person's real wealth is decreasing by $10,000 \times 0.05 = 500$ euros compared to a counterfactual with no inflation.

Second, there is a *nominal labour income channel* as inflation reduces the real value of nominal income flows. Wages in most countries are not updated in real time. Instead they are maintained for a period of time, typically a year, after which they are updated

again for another period. Something similar happens with unemployment benefits and pensions. This implies that inflation will dent on workers' and pensioners' purchasing power. While the Fisher channel favors debtors and harms creditors, the income channel negatively affects all households, as long as they enjoy labour incomes, though its impact will be larger the larger the incomes are. Following with the example, a person earning 30,000 euros per year with a 5% inflation rate will experience a $30,000 \times 0.05 = 1,500$ euro loss in real terms.

Third, there is a *relative consumption channel*. The basket of goods consumed by individuals can differ from the average one, which is the one employed to compute aggregate inflation. If the prices of all goods grew at the same rate, this fact would be inconsequential. However, if inflation is asymmetric, that is, if inflation is higher for some goods than for others, those individuals who consume more of the goods experiencing higher price increases will have to devote proportionally more resources to maintain the same consumption basket. The result is that those individuals experiencing higher individual inflation rates compared to the average, $\pi_{t+1} < \pi_{j,t+1}$, will have to devote more resources to maintain their consumption patterns, whereas those with individual inflation below average, $\pi_{t+1} > \pi_{j,t+1}$, will devote less resources. This mechanism will be proportional to the total consumption expenditure $C_{j,t+1}$ of the individual. For instance, imagine that the economy is composed by only two goods, namely books and fuel, consumed in equal terms by the average consumer. Fuel experiences a 10% inflation rate while the price of books remain constant. Aggregate inflation is thus 5%. If the person in our example spends every year 20,000 euros on fuel and zero on books, its individual inflation is 10% and she is losing $20,000 \times (0.1/0.05 - 1) \times 0.05 = 1,000$ euros *relative* to an individual who spends those 20,000 euros on the *average* basket.

The combination of these three channels, namely Fisher, income and consumption, will determine whether a person has more or less real available resources after a bout of surprise inflation. Continuing our example, the total loss of the person would be $500 + 1,500 + 1,000 = 3,000$ euros in a year, a 10% of her labour income, after a temporary 5% surprise inflation. Another person with the same income, but with 20,000 euros in a mortgage and consuming 10,000 euros in books would gain 1,000 euros through the Fisher channel and 500 euros through the consumption channel, so that despite the loss of 1,500 euros due to the income loss, she would remain with the same real wealth as if inflation would have been zero.

Compared to the Fisher channel, which operates through the stock of nominal

wealth, both the income and consumption channel operate through flows.

3 Description of the data

In order to implement equation (2), we need individual level data on assets, liabilities, labour income and detailed consumption expenditures, potentially at a high frequency. To this end, we consider two different types of data sources for Spain: representative surveys and client-level data from a big private bank. We also need data on inflation by expenditure (consumption) component. We focus on the year 2021. We map one period in equation (2) to one year. This is quite convenient, as wages are typically sticky at annual frequency, as discussed in the introduction. Furthermore, as discussed in Appendix B, the surge in inflation in 2021 was largely a surprise and widely expected to be temporary (which ex-post has proven to be incorrect), which fits well within the theoretical framework.

Household finance and expenditure surveys. First, we employ data from two publicly available surveys, representative of the Spanish population, that have been extensively used both in the policy and research domains: the *Encuesta de Presupuestos Familiares* (EPF), and the *Encuesta Financiera de las Familias* (EFF). The 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 main goal, similar to the U.S. Consumer Expenditure Survey (CES), is to collect detailed information on household consumption expenditures and its evolution over time. This is the main input into the calculations of weights used to construct price indices and official inflation figures.

The EFF instead is a representative survey collecting detailed information on household's balance sheets. It is conducted by Banco de España, the national central bank. It started in 2002, it runs every three years and it samples around 6,000 households per wave.[5] It is the Spanish counterpart to the Survey of Consumer Finance (SCF) in the U.S., with the advantage of having a significant (rotating) panel component

[5]Starting in 2020, it will run every two years.

Bank client data. Second, we also consider a proprietary dataset from Banco Bilbao Vizcaya Argentaria (BBVA). BBVA is the second largest Spanish bank by total assets, and third by number of clients. 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: (i) on the asset side, current accounts and deposits; (ii) on the liability side, consumer loans, mortgages and credit card balances. In terms of identified transactions, we consider three types of payments: (i) credit and debit card payments, (ii) direct debit payments, and (iii) 'irregular' transfers. We then follow follow Carvalho et al. (2021) and Buda et al. (2022) and map transactions to particular consumption goods and services, and group them according to the European Classification of Individual Consumption by Purpose (E-COICOP).[6]Importantly, we also observe labour-related income (wages, pension payments and unemployment benefits) received by each client in those cases in which the said client has her BBVA account defined as a "salary/pension account".

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; and (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. Restrictions (i) and (iii) are the most relevant, and standard, in this context. They are imposed in order to minimize the probability that a particular client, while having an open account with BBVA, has her main account, labour payments and financial products in a different financial intermediary which we cannot observe. This could introduce biases in our calculations.

Price indices. We collect price indices and inflation figures directly from the national statistical institute in Spain (INE). Column (a) in Table 1 shows the annual growth rate of the Harmonized Index of Consumer Prices (HICP) in Spain in December 2021, which was 6.6%. Inflation surged in 2021, with energy and food items experiencing a larger increase than services or manufactured goods This inflation rate is much larger than that in December 2020 (-0.6%) or even in June 2021 (2.5%), reflecting the surge in inflation

[6]Each of these transactions has associated to it either a Mechant Client Code (MCC), a BBVA label (ca. 100) or an IBAN / beneficiary name, together with an ID for the counterparty firm. Although we also observe cash withdrawals, we cannot map these 1-to-1 into particular transactions. For further details on the construction and grouping of consumption-related transactions, we refer the reader to the methodology described in Carvalho et al. (2021).

experienced over the year 2021. The increase in prices was strongly asymmetric. On the one hand, housing, water, electricity gas and other fuels (item 4) increase more than 20% and transportation (item 7) more than 10%, reflecting the large rise in the price of oil and gas after the Covid crisis. On the other hand, communications (item 8) declined by -0.3% and clothing and footwear (item 3) increased only 0.7%.

Column (b) displays the weights in 2021 employed to compute aggregate inflation, which INE computes using EPF responses. Food and non-alcoholic beverages (item 1), housing (item 4) and transport (item 7) represent almost half of the consumption expenditures of the average individual. Column (c) presents the weights computed using BBVA client data.[7] The main differences that emerge with respect to INE is the smaller weight in housing and energy prices (item 4) and the larger increase in health (item 6) and recreation and culture (item 9). This reflects the client characteristics outlined in the previous paragraphs: there is a higher proportion of richer and older individuals compared to the Spanish population. This leads to a lower inflation in the BBVA sample, that is, if we compute the average increase in prices in the consumption basket of BBVA clients it yields 3.9% instead of 6.6%, as shown in Table 1.

4 Results

We analyze the heterogeneous impact of inflation on households' balance sheets through the different channels uncovered in equation (2) using the two Spanish datasets. We start with the official surveys EPF-EFF. Table 2 displays the mean value of the key objects characterizing the three channels (Fisher, nominal income and relative consumption) computed for different age and income groups.

Several interesting results emerge. First, NNP are negative for individuals below 56 years, irrespective of their income. This reflects the life-cycle dynamics by which young people borrow to finance the purchase of a house, repaying it before retirement. Old people instead enjoy positive NNP in the form of cash and deposits. The most negative NNP, -33,443 eur, is that of individuals aged 36-45 years in the upper quartile of income, whereas the most positive, 18,910 eur, is that of individuals older than 65 also in the upper income quartile. Patterns are similar to what has been found by

[7] We do not included cash expenditures, as it is hard to impute the final use of this cash.

Table 1: 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)).

Doepke and Schneider (2006) for the U.S. using aggregate data. Surprise inflation thus redistributes wealth from older to younger people through the Fisher channel, the more so the for individuals in higher income quartiles, as their NNPs are larger in absolute values.[8]

Second, the nominal income channel is larger than the Fisher channel. For all age and income groups, average annual income is higher than the NNP in absolute value. If wages and benefits are sticky at frequencies higher than annual, as suggested by the empirical literature cited in the introduction, the erosion in real income due to surprise inflation for all agents is then larger than the redistributive gains/losses of the Fisher channel. This channel is naturally higher the higher income is, peaking for households before retirement age, namely those aged 56-65 years in the upper quartile.

Third, the effect through relative consumption is small in magnitude compared to

[8]Balance sheet and demographic characteristics of winners through this channel can be mapped to the wealthy hand-to-mouth" identified in Kaplan and Violante (2014), while characteristics of losers resemble those of *Ricardian* individuals at the latter part of the life-cycle. As documented by Slacalek et al. (2020), the share of wealthy hand-to-mouth households in Spain is above that of other large European countries.

Table 2: Total effect of inflation on saving capacity, and components, by age-income groups. Computed from representative surveys EFF and EPF

		Income group			
Age group		**<p25**	**p25-p50**	**p50-p75**	**>p75**
	Total effect				
	in levels	**-267**	**-552**	**-661**	**-1,264**
	as a % of income	**-2.6%**	**-2.9%**	**-2.4%**	**-2.9%**
<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
	Individual inflation	5.6%	5.9%	5.9%	5.4%
	Total effect				
	in levels	**-98**	**-59**	**-310**	**-997**
	as a % of income	**-0.9%**	**-0.3%**	**-1.0%**	**-2.0%**
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
	Individual inflation	6.0%	6.1%	6.2%	5.9%
	Total effect				
	in levels	**-395**	**-792**	**-1,268**	**-2,327**
	as a % of income	**-3.5%**	**-3.5%**	**-3.9%**	**-4.4%**
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
	Individual inflation	6.5%	6.5%	6.3%	6.0%
	Total effect				
	in levels	**-862**	**-1,295**	**-2,182**	**-3,650**
	as a % of income	**-8.3%**	**-6.2%**	**-6.9%**	**-6.8%**
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
	Individual inflation	6.9%	6.8%	6.6%	6.3%
	Total effect				
	in levels	**-1,215**	**-1,553**	**-2,319**	**-4,115**
	as a % of income	**-12.7%**	**-9.6%**	**-9.8%**	**-9.7%**
>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
	Individual inflation	8.2%	7.7%	7.2%	7.1%

The table presents, for each age-income group, (i) the mean total effect (in levels and as a % of individual income) together with (ii) the three components in eq. (2), and (iii) *individual* inflation rates. Values are at the individual level, transformed from household-level using equivalent OECD scales. Total effects are computed as of December 2021, using the year-on-year IAPC inflation rate for Spain of 6.6%. Net nominal positions are computed from the EFF; nominal income and consumption are computed from the EPF, and are measured at an annual frequency. *Individual* inflation is the inflation rate effectively experienced by each age-income group in December 2021, computed using average inflation indices for each ECOICOP category in that month and the *predetermined* consumption basquet as reported in the 2020 wave of the EPF. All quantities are in euros, except indicated otherwise.

the other two channels. Relative consumption, defined as the mean of $C_{j,t+1}\left(\frac{\pi_{j,t+1}}{\pi_{t+1}}-1\right)$ is one order of magnitude lower than the other two channels. This is not due to lower consumption (in fact, consumption is of the same order of magnitude as income), but to the size of the dispersion of *individual* inflation across age and income groups, presented in the last row of each panel.

Notice that the relative consumption channel is negative for all individuals younger than 55 years and positive for most older people. This reflects the fact that old people, especially low-income ones, devote a larger share of their consumption to food and energy, which in 2021 experienced the larger increases. The asymmetric increase in prices across sectors thus redistributes wealth from poor old people to rich young ones. The most negative relative consumption is -2,869 eur for people below 36 years in the upper income quartile whereas the most positive is 1,774 eur for individuals older than 65 in the lower income quartile.

Table 2 also reports the total effect of inflation as of December 2021, computed as the sum of the three channels multiplied by the annual inflation rate, according to equation (2). Three important results emerge. First, the impact of inflation is negative for all households. Second, this impact is almost negligible for people aged 36-45 with income below the 75th percentile, as the Fisher channels almost perfectly cancels out with the income one, and it reaches its maximum for the oldest individuals, as the three channels penalize them. Third, when presented as a percentage of annual income, it can be seen that the main losers are the *poorest* individuals above 55 years of age.[9]

We turn next to BBVA client data. Results, reported in Table 3, roughly coincide with those described above for NNP and labour income. In particular, the conditional income distributions map surprisingly well to the ones emerging from the representative surveys. There are two main differences, however. First, BBVA clients aged 36-45 have more negative NNPs and clients older than 65 have more positive NNPs than the representative Spanish household in the corresponding age group reported in the EFF. Second, there is a difference in terms of consumption baskets. The sign of the relative consumption channel reverses for several age groups, as older households now benefit

[9]The total effect as a % of annual income is computed as the ratio of the average total effect in levels (row 1 in each panel) and the average nominal income (row 4 in each panel). Ideally, and what we actually do in table 3 below with BBVA client data, one would first construct the ratio for each individual, and then compute the mean within the corresponding age-income group. However, the fact that we cannot observe the *same* individual in both surveys prevents us from taking this route.

Table 3: Total effect of inflation on saving capacity, and components, by age-income groups. Computed from the BBVA client sample

		Income group			
Age group		**<p25**	**p25-p50**	**p50-p75**	**>p75**
	Total effect				
	in levels	**-76**	**-253**	**-439**	**-735**
	as a % of income	**-24.0%**	**-1.6%**	**-2.0%**	**-1.8%**
<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
	Individual inflation	3.7%	3.8%	3.9%	3.8%
	Total effect				
	in levels	**437**	**351**	**371**	**-56**
	as a % of income	**7.8%**	**1.7%**	**1.3%**	**0.1%**
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
	Individual inflation	3.7%	3.9%	3.9%	3.8%
	Total effect				
	in levels	**-104**	**-448**	**-837**	**-1,952**
	as a % of income	**9.2%**	**-2.0%**	**-2.6%**	**-3.3%**
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
	Individual inflation	3.8%	4.0%	4.0%	3.9%
	Total effect				
	in levels	**-768**	**-1,379**	**-2,111**	**-4,043**
	as a % of income	**-12.0%**	**-6.1%**	**-6.5%**	**-6.7%**
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
	Individual inflation	3.8%	4.0%	4.0%	3.9%
	Total effect				
	in levels	**-1,309**	**-1,963**	**-2,612**	**-4,014**
	as a % of income	**-3.8%**	**-10.4%**	**-9.9%**	**-9.6%**
>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
	Individual inflation	3.5%	3.7%	3.9%	3.9%

The table presents, for each age-income group, (i) mean total effect (in levels and as a % of individual income) together with (ii) means of the three components in eq. (2), and (iii) individual inflation rates. Total effects are computed as of December 2021, using the year-on-year inflation rate experienced by BBVA clients in Spain, which was 3.9%. Nominal income and consumption are meassured at an annual frequency. *Individual* inflation is the average inflation rate effectively experienced by each age-income group in December 2021, computed using average inflation indices for each ECOICOP category in that month and *predetermined* consumption basquets as constructed from clients' transactions in 2021. All quantities are in euros, except indicated otherwise.

from inflation. This result, however, is inconsequential for the overall result, as the relative consumption channel is even more negligible in the BBVA data, given the even smaller dispersion in individual inflation rates across age and income groups.

5 Conclusions

In this paper we explore the redistributive consequences of inflation. We put forward a novel decomposition of the impact of surprise inflation on agents' real wealth and then quantify them using a new granular dataset that contains detailed information about consumption patterns, income sources and nominal assets and liabilities.

We find that the Fisher and income channels are the largest, while the relative consumption one is much less significant. Inflation hurts all households through the income channel, but middle-age households benefited through the Fisher one as they are typically large nominal debtors in mortgages.

We hope that our work will encourage new research in this direction.

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Appendix

A Proof of Proposition 1

Nominal wealth expressed in real terms is

$$a_{j,t+1} = \frac{1}{1+\pi_{t+1}} m_{j,t} + \frac{1+\frac{\Delta Q_{t+1}}{Q_t}+i_t}{1+\pi_{t+1}} d_{j,t} + \frac{Q_{t+1}/Q_t + r^s_{t+1} + \pi_{t+1}}{1+\pi_{t+1}} Q_t s_{j,t} - \left(\frac{1+i^b_t+\frac{\Delta Q^b_{t+1}}{Q^b_t}}{1+\pi_{t+1}}\right) b_t + \frac{w_{j,t+1}}{1+\pi_{t+1}} - \sum_{k=1}^{K} \frac{1+\pi_{kt+1}}{1+\pi_{t+1}} c_{j,kt+1}, \quad (3)$$

where we have applied the definition of inflation (1). For low inflation levels, $\frac{1}{1+\pi_{t+1}} \approx 1-\pi_{t+1}$ and $\frac{1+\frac{\Delta Q_{t+1}}{Q_t}+i_t}{1+\pi_{t+1}} \approx 1+\frac{\Delta Q_{t+1}}{Q_t}+i_t-\pi_{t+1}$. Equation (3) then simplifies to

$$a_{j,t+1} \approx -NNP_{j,t}\pi_{t+1} - w_{j,t+1}\pi_{t+1} + C_{t+1}\left(\pi_{t+1}-\pi_{j,t+1}\right) + \Omega_t, \quad (4)$$

where

$$\Omega_t = m_{j,t} + \left(1+\frac{\Delta Q_{t+1}}{Q_t}+i_t\right) d_{j,t} + \left(Q_{t+1}/Q_t + r^s_{t+1}\right) s_{j,t} - \left(1+i^b_t\right) b_t + w_{j,t+1} - \sum_{k=1}^{K} c_{j,kt+1},$$

collects all the terms that are independent of time $t+1$ inflation.

B Some reflections on the 2021 inflation surge

This section discusses why the case of Spain in the year 2021 constitutes a good candidate to apply the framework above in order to study the heterogeneous effects of inflation. First, we show how economic agents did not expect this increase in inflation back in 2020 or even in the first half of 2021. Second, we provide evidence on how agents expected the increase in inflation in 2021 to be temporary.

Was inflation anticipated? Table B.1 displays different indicators of inflation expectations for Spain. These include the Survey of Professional Forecasters (SPF), the ECB Macroeconomic Projections, the ECB Consumer Expectations Survey (CES) and the instantaneous forward rates derived from inflation-linked swaps (ILS). The first

two indicators, the SPF and ECB projections, forecast Spanish inflation. The SPF is a survey of banks and economic institutions. The ECB projections are based on different econometric models. The CES is a survey of European households, which includes questions about their 12-month ahead inflation forecast. The ILS are market indicators. They reflect the compensation for inflation risks demanded by market participants. They do not reflect genuine inflation expectations, as they may include a certain term-premium if market participants are risk averse.

Table B.1. 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?"

All these measures suggest that the increase in inflation in 2021 was largely unanticipated. The expectations in December 2020 (first column in Table 2) were relatively low, all below the ECB target of 2%. The comparison between these numbers and the 6.6% inflation rate discussed above is not straightforward, as some of them reflect point estimates of inter-annual inflation (ILS and CES), which can be compared to 6.6%, whereas other reflect the average yearly inflation rate (SPF and ECB projections). The average inflation rate in 2021 was 3%, much higher than inflation expectations. Notwithstanding, all these numbers support the idea that economic agents were not expecting in 2020 a surge in inflation such as the one observed in 2021.

Was inflation expected to be temporary? Finally, we argue that inflation was, at least in the first half of the year, expected to be a temporary phenomenon. Inflation expectations for 2022 hardly changed from December 2020 to June 2021 (second and fourth columns in Table B.1), despite the fact that expected inflation in 2021 was much larger by the June of that year than previously expected (third column). Though inflation expectations for 2022 adjusted progressively towards the end of 2021, this evidence

suggests that markets and people alike interpreted the rise in inflation as temporary. For instance, in the Monetary Policy Statement following the ECB Governing Council meeting on 9 September 2021, President Lagarde stated that "*The current increase in inflation is expected to be largely temporary and underlying price pressures are building up only slowly.*"[10]

[10]See https://www.ecb.europa.eu/press/pressconf/2021/html/ecb.is210909~b2d882f724.en.html