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How income expectations adjust to inflation – a consumers' expectations-revealed pass-through

Abstract

We use inflation and income growth expectations from the ECB Consumer Expectations Survey to measure the subjective expected pass-through of inflation to income in the main euro area countries. By aggregating consumers' responses to probabilistic questions, we obtain significantly higher estimates of the pass-through than those obtained from micro data. Our methodology allows one to examine how the pass-through varies along the probability distribution of expected inflation, which turns out to be particularly large for moderate inflation expectations. We find significant heterogeneity in the inflation pass-through across countries, ages and income groups, consistent with different wage and pension indexation regimes.

Non-technical Summary

In periods of high inflation, keeping inflation expectations anchored to prevent a wage-price spiral is a key concern of central banks. The post-pandemic surge in prices has thus rekindled academic interest in this issue. However, the price and wage moderation of previous decades makes it difficult to assess, on the basis of historical data, how the expectations adjust during periods of high inflation.

This work exploits individuals' expectations about prices and income growth elicited in the probabilistic questions of the ECB Consumer Expectation Survey (CES) to overcome the shortcomings of historical analyses. This source of information helps shedding light on the likelihood of price-wage feedback loops occurring in the future. Although the concepts of income and wage are not equivalent, they are factually very close for the overwhelming majority of CES panellists.

Our analysis contributes to the renewed debate on inflation-income pass-through along two dimensions. First, it provides new estimates of the pass-through ranging in the euro area between 0.25 and 0.6. These estimates are noticeably higher than those obtained from micro data on point-wise expectations. Second, it shows that aggregating micro data smooths outliers, very frequent in survey data, and allows to extract reliable statistical information, consistently with the 'wisdom of the crowd' theory (see Spiegelhalter, 2019; Manski, 2004). Furthermore, based on results by Lichtendahl et al. (2013), our methodology highlights the advantage of using probabilistic information and quantile aggregation (Vincentization) over other common aggregation methods, especially in case of high consumers' disagreement.

The pass-through estimates are in line with the wage increases actually claimed by workers and their representatives and with the indexation schemes for salaries and pensions in euro area's major countries (see ECB 2008 and Checherita-Westphal 2022). Individuals aged above 65 expect their income to adjust by more to inflation in Italy and France, where public pensions are indexed to price inflation through a full or partial automatic mechanism. Not always differences in income levels translate into different inflation-income pass-through. In Spain and in Italy, high earners expect a much higher compensation for inflation, whereas in Germany and France the pass-through is quite the same across income groups.

Overall, consumer surveys turn out to be valuable for assessing the effectiveness of Central Banks' policy stance and communication in anchoring agents' expectations and steering their economic decisions (see Kryvtsov and Petersen 2021 and D'Acunto et al. 2024).

1 Introduction and key findings

In periods of high inflation, a key concern for central banks is preventing higher inflation expectations from becoming entrenched and triggering a wage-price spiral.[1] Unlike during the nineteen seventies, the post-pandemic inflationary episode has so far not brought about equivalent wage growth in the euro area, despite being largely caused by the upsurge of energy commodities prices (see Bodnár et al., 2023).

Reformed labor institutions and bargaining processes dampened wage growth compared to the pace of inflation in the aftermath of the pandemic (see Koester et al., 2021). Nevertheless, a progressive erosion of the purchasing power motivated workers and their representatives to claim more adequate compensation, eventually resulting in wage growth catching up with inflation. There are signals pointing in this direction (see Boissay et al., 2022).

The post-pandemic inflationary episode reignited the literature on inflation pass-through to wages. Alvarez et al. (2022) reconsider the macroeconomic conditions that trigger a wage-price spiral by reviewing several episodes of accelerating wages. The authors argue that rising wage growth does not cause a spiral if it reflects compensation for past inflation, and this seems to be the case in the post-pandemic period. DeLuca and Van Zandweghe (2023) finds that most of the increase in US wage growth reflects higher inflation and not a labor market imbalance. Therefore, wage growth is expected to ease in 2025 should inflation pressures continue to fade. Lorenzoni and Werning (2023) redefines the wage-price spiral as the mechanism amplifying the effect of an inflationary shocks. They reach three interesting conclusions: first, irrespective of the shock originating the excess-demand and the price surge, a wage-price spiral could occur when real wage level aspirations by firms and workers differ. Second, the relative degree of stickiness of goods prices versus wages defines the pattern traced by real wage and the persistence/amplification of the inflationary shock. Third, the co-existence of wage and price rigidity generates a trade-off in the response of monetary policy to supply shocks, which contemplates an optimum with positive output gap and high inflation. Borio et al. (2023) characterises the inflation formation process as a two-regime mechanism with the transition from low- to high-inflation determined by the rising importance of the common component in sectoral price dynamics and rising correlation between price and wages. The work reaches different implications for monetary policy than Lorenzoni and Werning (2023), arguing that monetary policy can tolerate moderate deviations from defined targets in the low-inflation regime, but must act pre-emptively when the risk of a transition to the high-inflation regime increases. And yet they conclude that detecting the transition from one to another regime in real time is admittedly difficult.
Indeed, the protracted period of low-inflation which preceded the current inflationary episode poses a challenge to the estimation of inflation pass-through to wage growth with historical data.

Individuals' expectations about income growth and its adjustment to current and future inflation allow to anticipate the likelihood that a feedback loop between prices and wages occurs

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[1] For a definition of inflation-wage spiral see (Blanchard, 1986).

in the future. Jain et al. (2024) use data from the Canadian Survey of Consumer Expectations to show that the link between wage and inflation expectations is historically weak, but gets stronger during the high-inflation period and varies depending on some characteristics of the respondents, like income distribution. This paper contributes to this debate by estimating the inflation-to-income pass-through elicited from consumers' expectations collected in the Consumer Expectation Survey (CES) conducted by the ECB since April 2020 in the six largest euro area economies (for a first evaluation see Bańkowska et al., 2021).[2] Although the two definitions of income and wage are not equivalent, income growth seems to be a very good proxy of wage growth in the CES survey.[3]

We aggregate the individual responses to the probabilistic questions about price and income expectations over next 12 months and estimate the inflation-income pass-through across different quantiles of the aggregated distribution. A strong and significant relationship is revealed, while the pass-through proves negligible when individual point-wise expectations are used instead. Consistently with the 'wisdom of the crowd' theory (see Spiegelhalter, 2019; Manski, 2004), the aggregation of the microdata smooths outliers, that are very frequent in the survey data, and allows us to extract reliable statistical information (see Lichtendahl et al., 2013).

We find that expected income growth co-moves with inflation expectations, even more tightly since 2022, when the Russian aggression against Ukraine led to the upsurge of energy prices and spurred consumers to reassess their subjective inflation-income pass-through. The rise in the pass-through is similarly identified for U.S. by Amiti et al. (2022). In their new Keynesian model the possibility to substitute more expensive imported inputs with labor (substitution channel) eventually boosts labor demand and ultimately reinforces the pass-through of inflation to wages.

Nonetheless, the estimated pass-through coefficients remain well below one as consumers expect to be less-than-fully compensated for inflation dynamics, ruling out the possibility of an income-price spiral.

In order to corroborate and put into context our aggregate findings, we also investigate if and to what extent the inflation-income pass-through revealed by consumers' expectations varies across countries, age and income groups owing to different indexation regimes of pensions or salaries and to heterogeneous wage-setting mechanisms.

Our results are in line with the wage increases actually claimed and consistent with the indexation schemes for salaries and pensions (see ECB 2008 and Checherita-Westphal 2022). Individuals above 65 years expect their income to adjust by more to inflation in Italy and France, where pensions are indexed to price inflation through a full or partial automatic mechanism. Overall, we find mixed evidence that the higher-income groups may have a stronger bargaining

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[2]In our analysis, we use data from April 2020 to June 2023.

[3]In two consecutive waves, May and and June 2023, the CES survey asked panellists to report their expectations about income growth and wage growth 12 months ahead to identify possible discrepancies between them. We combine the information from these two questions to study the distribution of the differences between expected wage and income growth. We conclude that the two concepts are very close for almost 90% of respondents and exactly the same for half of the sample. About 5% expect wages to grow less than income and the remainder expect her/his wage to grow more than income.

power than the lower-income groups. In Spain and in Italy, high earners expect a much higher compensation for inflation, whereas in Germany and France the pass-through are about the same across income quantiles.

As a robustness check we estimate the pass-through in a pseudo-panel setting, using the quantiles of the aggregated expectations' distributions for all countries, age and income groups. The panel setting allows one to control for unobserved heterogeneity across groups of individuals. Furthermore, increasing the cross-section dimension of the dataset yields more efficient estimates.

The results from the pseudo-panel analysis confirm a sizeable pass-through of expected inflation to expected income growth, which is higher for moderate inflation expectations and largest for Belgium. The pass-through is somewhat higher for income earners aged below fifty and approximately 40% for those with income below or equal to the median.

Knowing how consumers expect their income to evolve with respect to inflation and then foreseeing their claims for defending the purchasing power helps to shape the monetary policy response to rising inflation. In light of our analysis, the outcome of the consumer survey turns out to be a valuable source of information to assess the effectiveness of the Central Bank's policy stance and communication in anchoring agents expectations and steering their economic decisions (see Kryvtsov and Petersen 2021 and D'Acunto et al. 2024).

2 Data

The CES is a multi-country panel survey of euro area consumers launched by ECB in January 2020 and covering a wide array of economic concepts for which consumers expectations are elicited. The survey encompasses household consumption, investment and borrowing decisions, as well as labour market transitions; most importantly to us, the survey regularly queries panellists over their expectations about price inflation and their income growth.[4] For an encompassing overview and first evaluation of the survey coverage and results see Bańkowska et al. (2021), Georgarakos and Kenny (2022).

Being a panel survey with rotation, the CES tracks respondents over-time and makes it possible to measure revisions in consumer expectations in response to actual and perceived economic outcomes and shocks for as long as 24 months while controlling for possible unobserved confounding factors that could otherwise bias the measure of key parameters.

In this paper we employ responses to the probabilistic questions from the core monthly modules concerning consumer expectations about general price and income growth expectations over next 12 months. Respondents are asked to assign points to several inflation- and income-growth bins.

Given inflation dynamics at the time, the number of bins was symmetrically expanded from 8 to 10 in July 2022, allowing consumers to assign a probability also to the specific range of

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[4]In addition the survey has some degree of flexibility to accommodate ad-hoc questions on relevant policy issues.

inflation and income growth between [-8%;-12%] and [8%;12%].[5] In our empirical assessment, a dummy variable controls for potential level shift in the support of the income growth and inflation expectations' distributions that could be induced by the revisions in the number of bins.

3   Mechanisms of income expectations formation

Nominal income expectations tend to adjust to expected inflation non linearly across individuals. There are concurrent elements explaining why this is the case. For instance, expected income growth may result from professional ambitions, expected inflation compensations and fears to lose the occupation, among others. These three factors, and possibly others, weight differently in subjective economic thinking and their relevance varies with personal and macroeconomic conditions (see Pizzinelli, 2022).

For instance, the perceived risk of losing the job is correlated with the expectations about future aggregate activity. As a consequence, a weakening in aggregate activity in connection with higher inflation rates, consistently with the supply-side interpretation of inflation (Candia and Gorodnichenko, 2020), could lead to both an upward revision to the chances of becoming unemployed and a downward assessment of the expected nominal income growth. These revisions will be likely more pronounced for individuals with temporary jobs, or occupied in sectors especially exposed to economic fluctuations. By contrast, for other individuals, whose nominal income is insensitive to fluctuations in aggregate activity, higher inflation will mostly raise their concerns about their real income, purchasing power and their claim for inflation compensation. In these cases the compensation channel is likely to dominate the reassessment of expected nominal income growth.

Overall, when inflation picks up expectations about nominal income growth will rise for some and fall for others, depending on individuals working conditions and characteristics. This dichotomy is clear in the responses to the CES, where nominal income growth expectations are positively correlated with inflation for large positive income growth expectations and negatively correlated for large negative income growths expectations (Figure 1). This stylized fact holds irrespective of the period under analysis.[6]

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[5]The exact wording of the probabilistic question on inflation expectations reads as below. *Now, we would like you to think about how much prices in general in the country you currently live in are likely to change in 12 months from now. We realise that this question may take a little more effort. Below you see ten possible ways in which prices could change. Please distribute 100 points among them, to indicate how likely you think it is that each price change will happen. The sum of the points you allocate should total 100.*
1 Prices will increase by 12% or more; 2 Prices will increase by 8% or more, but less than 12%; 3 Prices will increase by 4% or more, but less than 8%; 4 Prices will increase by 2% or more, but less than 4%; 5 Prices will increase by 0% or more but less than 2%; 6 Prices will decrease by more than 0% but less than 2%; 7 Prices will decrease by 2% or more, but less than 4%; 8 Prices will decrease by 4% or more, but less than 8%; 9 Prices will decrease by 8% or more, but less than 12%; 10 Prices will decrease by 12% or more. The wording of the probabilistic question on income growth is essentially the same, with all the due changes. The bins ranges are also identical.

[6]We order the average income growth by percentile and plot them side by side with the corresponding average

Unless an experimental set-up is applied, like Hajdini et al. 2023, linear panel regressions based on point-wise micro-expectations are not suited to capture the dichotomy and tend to return very poor estimates of the pass-through, even controlling for heterogeneity across individuals, also in terms of expectations about the economic cycle and probability of losing the occupation (see Table 1).

Figure 1: Percentile of income growth expectations and corresponding price growth expectations
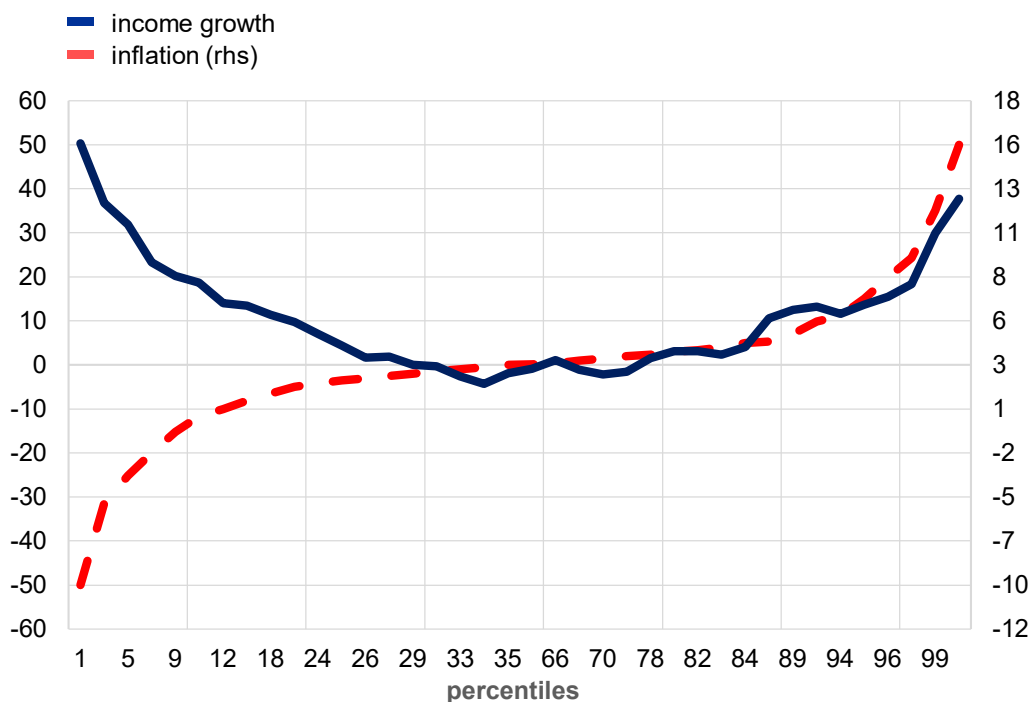
Note: based on ECB CES data. The blue line depicts the average income growth expectations and the red dotted line plots the average expected inflation rate for each income growth percentile.

Faced with this non-linearity and with the noise carried along by the microdata, we resort to aggregating the individual responses from the probabilistic questions and perform regression by quantiles to assess the relationship between income growth and inflation expectations. The aggregation continues to allow one to distinguish the salient characteristics of individuals which could influence the mechanism of expectations formation discussed above.

4 Methodology

We aggregate the individual answers to the probabilistic questions on income and inflation expectations over next 12 months [7] to estimate the aggregated cumulative distribution functions (c.d.f.) for both variables.

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expected inflation rate for each of these percentile.

[7]For brevity, the reference to the horizon '12-month ahead' will be omitted onward.

Table 1: Estimates of the inflation-income pass-through from microdata

	EA- 6	DE	FR	IT	ES	NL	BE
expected inflation t+12	0.025 ***	0.054 **	0.049 ***	0.006	0.019 **	0.030**	0.071 **
	(0.001)	(0.006)	(0.008)	(0.007)	(0.008)	(0.013)	(0.011)
expected GDP growth t+12	0.175 ***	0.174 **	0.049 ***	0.180	0.214 ***	0.010***	0.090 ***
	(0.013)	(0.008)	(0.008)	(0.007)	(0.010)	(0.011)	(0.010)
R2	0.07	0.04	0.04	0.09	0.07	0.03	0.02
Obs	503,305	102,036	106,158	109,840	105,719	38,797	40,755

Note: Source ECB CES, sample period: April 2020- June 2023. Linear panel fixed effects of income growth expectations on inflation expectation 12-month ahead and GDP growth expectations 12-month ahead, controlling for past perceived inflation and with white robust standard errors.

There are several reasons why one should prefer dealing with the probabilistic questions. First, they provide information about the entire subjective probabilistic distribution from which also measures of uncertainty can be estimated. As stated in Engelberg et al. (2009), variation in point-prediction does not imply disagreement or differences among individuals.

Second, the researcher does not know what moment (e.g. mode, mean, median) of the subjective distribution individuals report in their point predictions.

Using the probabilistic questions to make inference on choice behavior allows one to relax restrictive assumptions about agents' expectations (Manski 2004). Finally, we can exploit the quantiles of the aggregated c.d.f. to take into account non-linearities in the relationship between price and income expectations.

We use a piecewise linear approximation to estimate the subjective probability forecasts as in Diebold et al. (1997), and then aggregate them by averaging the quantiles ('horizontal' aggregation or 'Vincentization'; AQF onward) instead of the probabilities ('vertical' aggregation; APF onward). More formally, the combined distribution defined by quantile aggregation is given by:

$$\bar{F}_t^{-1}(\alpha) = \sum_{i=1}^{N} \omega_i F_{it}^{-1}(\alpha) \tag{1}$$

with $\sum_{i=1}^{N} \omega_i = 1$ ($\omega_i = \frac{1}{N}$ $\forall i = 1, \ldots, N$ in our case) and $F_{it}^{-1}(\alpha) = \inf\{y : F_{it}(y) \geq \alpha\}$. We draw from the results in Lichtendahl et al. (2013) and Busetti (2017), showing that AQF scores better than APF, i.e. it provides better probability forecasts in terms of calibration and sharpness.

Other than the aggregated c.d.f. based on all the individual responses, we also construct an aggregated c.d.f. for each country and income/age group, to investigate heterogeneity in the relationship between price and income expectations.

The aggregation of the responses tackles the criticism frequently raised against panel data

analysis over the composition bias stemming from the independent cross-section observations. On the other hand, the aggregation of individual responses is subject to the criticisms of wasting microdata information that can help to identify heterogeneity. We resist this criticism into two ways. First, microdata proves informative to the extent we manage to extract a signal and this may not be the case in surveys where microdata can be affected by outliers and other anomalies. Second, in Section 6 we conduct pseudo-panel analysis as a robustness check. The pseudo-panel model allows one both to control the composition bias, through the aggregation of the individual units into cohorts, and to exploit the cross-section dimension of the data to control for latent heterogeneity and increase the efficiency of the estimates.

Figure 2 shows the median of the overall c.d.f. of price and income expectations.

Figure 2: Income and price growth expectations
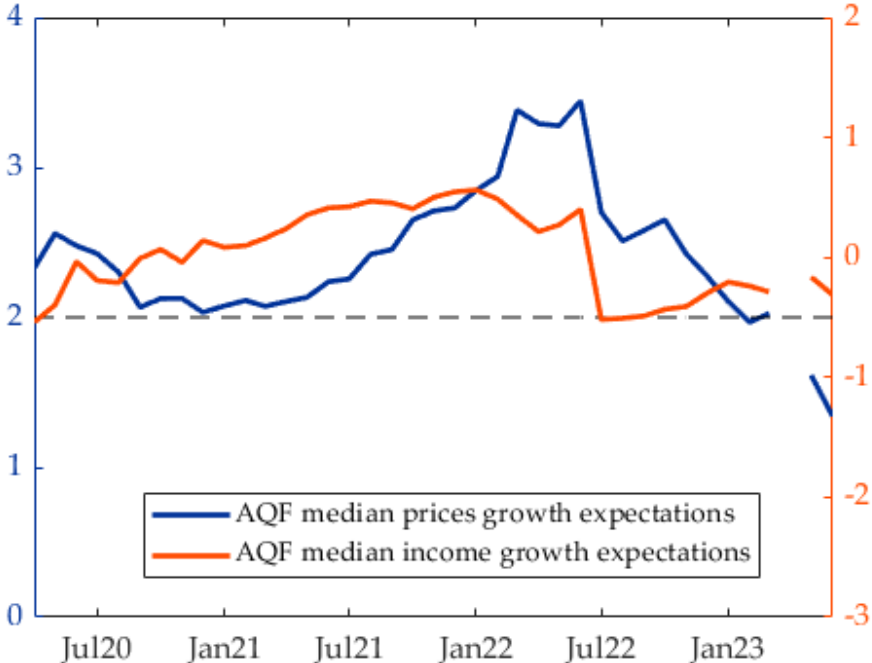
Note: based on ECB CES data. The blue line is the median of the aggregated c.d.f. (AQF) of the inflation expectations; the red line is the median of the aggregated c.d.f. (AQF) of the income growth expectations; the dashed line is the ECB inflation target (in 2021, as part of the monetary policy strategy review, ECB adopted the new symmetric 2% inflation target). In April 2023 the CES survey underwent a temporary change in the way responses were collected which led to a glitch in the micro data. We leave this month out of our analysis.

The income and price growth expectations (blue and red lines, respectively) display a common trend as of the end of 2020. During the first wave of the pandemic, consumers expected a negative evolution of their income on account of the dire expectations about the economic outlook and inflation expectations declined. Income expectations turned positive since the end of 2020, amid a recovery also in inflation expectations, and grew markedly as of the spring 2021, when aggregate activity rebounded with the reopening of the economy and prices (both current

and expected) followed suit. The outbreak of the war in Ukraine at the end of February 2022 marked a break: income growth expectations slipped back, while prices growth expectations picked up, suggesting that consumers on average interpreted the war as a supply shock with inflation and growth dynamics diverging. But soon after, the two series resume similar growth paths. In July 22, the inclusion of new bins for both price and income growth in the probabilistic questions caused the downward shift of the expectation series. Overall, inflation expectations turned out be anchored to 2%, proving the effectiveness of ECB's monetary policy in reining them in.

5   Estimation and results

To pin down whether expected income compensation varies with expected inflation, the relationship at time t between income growth and inflation expectations is estimated across the quantiles of the aggregated distribution from equation (1). More formally:

$$y_t^q = \alpha + \beta x_t^q + \gamma z_t + D_t + \epsilon_t \tag{2}$$

where β is our coefficient of interest, capturing the size of the pass-through from inflation expectations to income growth expectations for all combinations of their quantiles, y_t^q and x_t^q, for $q \in \{10^{th}, 25^{th}, 50^{th}, 75^{th}, 95^{th}\}$; z_t represents the control variable for the economic growth and for past year perceived inflation;[8] D_t is the row vector of the two dummies controlling for both the level shift caused by the introduction of new bins in the probabilistic questions as of July 2022 and the glitch in data collection occurred in April 2023.

Figure 3 and Table 2 show the pass-through of price expectations to income expectations across different quantiles. The estimated pass-through ranges between 20% and almost 40% across the quantiles of inflation expectations, except for the highest one.[9] This means that individuals expect a larger compensation for more moderate inflation than for right-tail inflation. Moreover, the profile of pass-through across price growth expectations is very similar across quantiles of income growth expectations as indicated by distinct lines with different colors, and tends to be higher for above median income growth expectations.

Overall, our findings are consistent with the conclusions of Alvarez et al., 2022, who exclude a wage-price spiral in the recent period and with the actual developments in wage claims and wage inflation. Figure 4 shows how the pass-through of different quantiles of inflation expectations to the median income growth expectations evolved over time. The estimation is carried out using an expanding time-window from April 2022 to May 2023.

The pass-through corresponding to the median inflation expectations averages about 40%

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[8]We use the simple average of the economic growth expectations over 12 months ahead surveyed in the CES at time t. Results do not change significantly if we use the quarterly growth rate of the GDP.

[9]The estimated coefficients are all statistically significant at least to 5% significance level. For the sake of readability, the confidence bands are not plotted.

Figure 3: The relationship between income and inflation expectations across quantiles
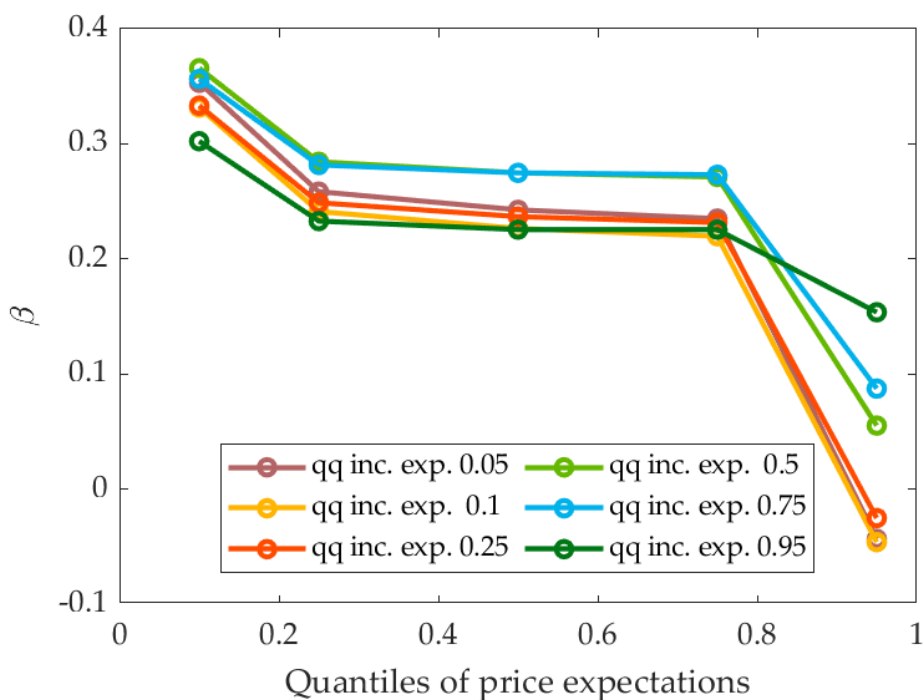
Note: based on ECB CES data.

throughout the sample, while the pass-through corresponding to the highest quantile of inflation expectations decreased steadily from 60% in April 2022 to approximately zero in May 2023, as consumers expected to be less compensated for very high price increases. This result may be partly attributable to the gradual phase-out of the fiscal measures adopted to tackle the huge increase of the inflation in 2022 (running over 8% in the euro area on yearly average).

To investigate the heterogeneity of the pass-through by class of agents and different countries, the analysis has also been conducted by age and income groups and across countries. These exercises highlight whether and to what extent the estimates of the pass-through depend on the working status (working-age respondents versus retirees) or income conditions (better versus worse-off) of the respondents, and how they may vary across countries due to different wage/pension indexation regimes. More formally, we estimate the following equations:

$$y_t^{qG} = \alpha + \beta x_t^{qG} + \gamma z_t^G + D_t + \epsilon_t \tag{3}$$

$$y_t^{qC} = \alpha + \beta x_t^{qC} + \gamma z_t^C + D_t + \epsilon_t \tag{4}$$

$$y_t^{qGC} = \alpha + \beta x_t^{qGC} + \gamma z_t^{GC} + D_t + \epsilon_t \tag{5}$$

for $t = 1, \ldots, T$; we use the quantiles of the aggregated distribution for age and income groups, $G \in \{1^{st} \text{ income quantile}, 5^{th} \text{ income quantile}\}$ and $G \in \{35 - 49 \text{ years}, +65 \text{ years}\}$, countries

Table 2: Estimates of inflation-income pass-through from aggregate analysis

Inflation expectations quantiles *	Pooled sample	DE	FR	IT	ES	NL	BE
10th	0.3657	0.2115	0.2164	0.0964	0.567	0.2907	0.6694
	[0.1395;0.5919]	[0.0795;0.3434]	[0.0574;0.3755]	[-0.2237;0.4169]	[0.2085;0.9269]	[0.1276;0.4543]	[0.5291;0.8098]
25th	0.2843	0.1941	0.1552	0.0148	0.5216	0.286	0.6968
	[0.0559;0.5127]	[0.0684;0.3198]	[-0.0001;0.3105]	[-0.3043;0.3346]	[0.1692;0.8748]	[0.1111;0.4612]	[0.5433;0.8503]
50th	0.2748	0.1953	0.122	0.0398	0.6509	0.2804	0.7212
	[0.0463;0.5032]	[0.0746;0.3161]	[-0.0313;0.2754]	[-0.3195;0.3998]	[0.3028;0.9992]	[0.0956;0.4654]	[0.5518;0.8906]
75th	0.2711	0.1968	0.1057	0.1164	0.6771	0.2793	0.7466
	[0.0476;0.4947]	[0.0777;0.316]	[-0.0436;0.255]	[-0.2321;0.4655]	[0.3609;0.9936]	[0.0778;0.4808]	[0.5546;0.9387]
95th	0.0548	0.1647	0.0913	0.2426	0.2784	0.1524	0.8936
	[-0.4999;0.6094]	[-0.0593;0.3892]	[-0.115;0.2975]	[-0.2017;0.6875]	[-0.0863;0.6435]	[-0.3033;0.6098]	[0.4743;1.3129]
R2 **	0.81	0.87	0.85	0.6	0.62	0.83	0.89

Note: * Results relative to the median income expectations; ** Average across price expectations quantiles. Confidence interval of the estimates is in the squared brackets.

$C \in$ {Germany, France, Italy, Spain, Netherlands, Belgium} and for all combinations of G and C. The superscripts indicate that we estimate single equations for each combinations of groups G and countries C. The βs are our coefficients of interest and represent the price-income pass-through revealed by consumers' expectations. Results in Figure 5 show the pass-through estimated for the median income growth expectation across the quantiles of inflation expectations for different income and age groups. This pass-through is roughly the same between income groups, except for the highest quantile of inflation, for which the poorest consumers expect to be less compensated and experience a greater loss of purchasing power. Also for the age groups, the two estimates of the pass-through decouple at the highest quantile of inflation expectations. The highest pass-through for the oldest group is plausibly ascribable to the favourable inflation compensation regime for pensions throughout the euro area countries considered. Indeed, price indexation of wages is relatively limited in the euro area, while pensions are indexed automatically – fully or partially – to prices and wages (see Checherita-Westphal 2022).

The pass-through is markedly heterogeneous across countries (see Figure 6 and Table 2). Notably, the highest pass-through is estimated for Belgium, where there is a mechanical indexation scheme of wages to inflation.[10] The lowest pass-through is estimated for Italy, which is consistent with the rather sluggish wage adjustment process there. Wages in Italy are negotiated every three years and indexed to the three-year inflation forecast based on the harmonised index of consumer prices net of imported energy products. On top of that, negotiations for the renewal of expired contracts are frequently postponed for years.

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[10]Since 1994, the wage indexation in Belgium is measured using the Health Index, which tracks living costs excluding the price of tobacco, alcohol and fuel. While the indexation mechanism is symmetric, meaning that it follows upward and downward changes in the Health Index, some collective agreements have restrained the negative wage indexation. The application of wage indexation in Belgium differ across two main groups of workers. For the first group, which includes public servants and 40% of employees in the private sector, the indexation takes place in fixed steps of 2% each time the Health Index exceeds the 2% threshold. For the remainder, the wage indexation is calculated at fixed time intervals and annual intervals are commonly used.

Figure 4: The relationship between income and price growth expectations over time and quantiles of expected inflation
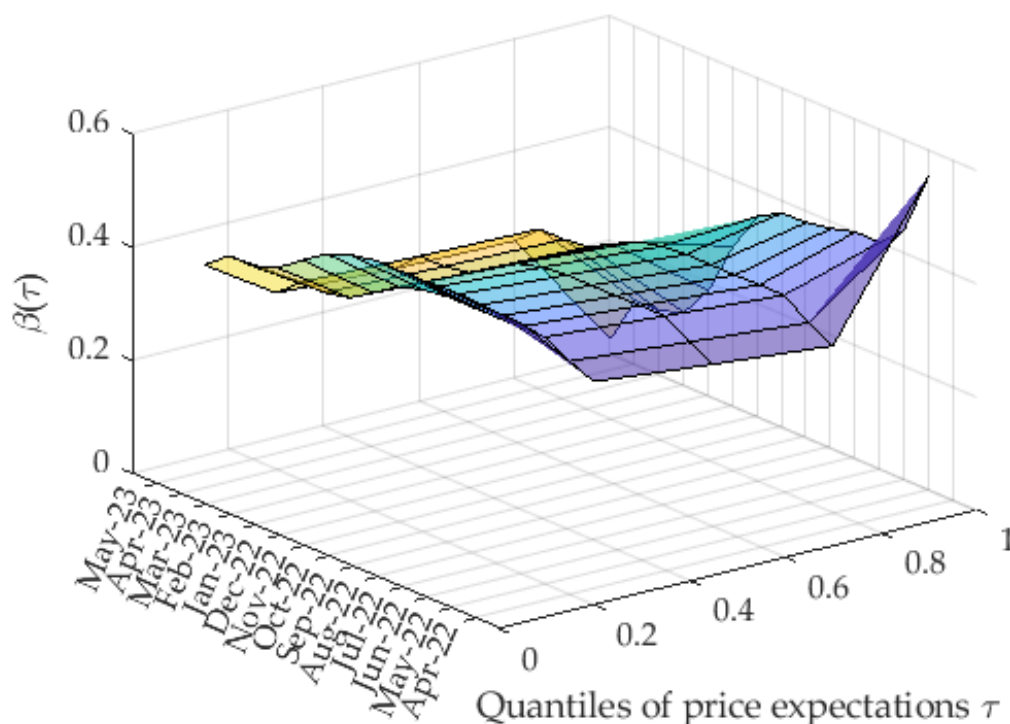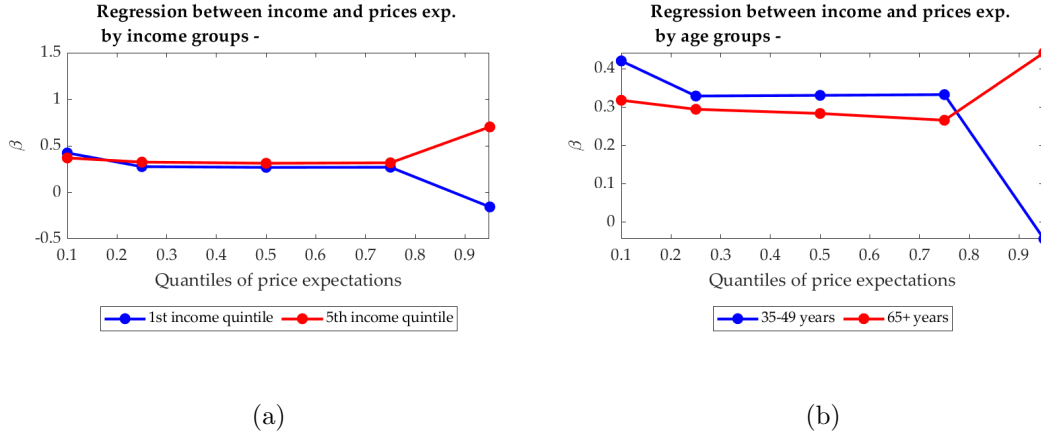

Note: based on ECB CES data. The pass-through plotted in this chart is estimated for the median income growth expectation across the quantiles of inflation expectations.

The pass-through of price growth expectations to income growth expectations is rather similar across income groups in the Netherlands and in Belgium (Figure 7). Otherwise, in Italy and Spain consumers with income in the first quintile of the distribution expect to be less compensated for rising prices than those in the top quintile. In Italy, individuals with income in the lowest quintile do not expect any compensation but anticipate a drop in their income. This result may reflect the downward rigidity of wages (representing 80% of total disposable income of the Italian working population; see Carta and De Philippis 2021) induced by the collective bargaining agreements mostly for the workers whose earnings are close to the wage floor (as stated in Adamopoulou and Villanueva 2022).

If we consider the results by age groups across countries (Figure 8), the working-age population in Spain, the Netherlands and Belgium expect to be more compensated for higher inflation than the older individuals. The opposite result holds for Italy, where oldest individuals expect higher income growth to match their higher inflation expectations. The difference in the pass-through is far less sizeable in Germany and in France, where the estimates decouple at the highest quintile of inflation expectations. Overall, these outcomes map well into different automatic indexation of pensions to inflation across countries.

Figure 5: The relationship between income and price growth expectations by income and age groups
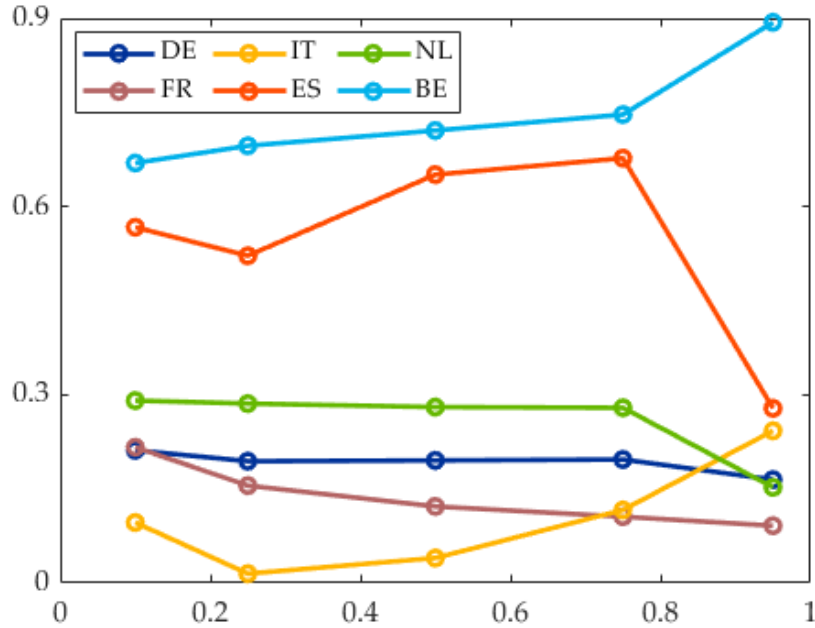

(a)

(b)

Note: based on ECB CES data. The pass-through plotted in this chart is estimated for the median income growth expectation across the quantiles of inflation expectations.

6   Robustness checks in a panel setting

This section presents a pseudo-panel analysis (Deaton 1985) to check the findings from the aggregated model. The panel data framework provides a twofold advantage. The augmented cross-section dimension increases the efficiency of the estimates and we can handle the latent heterogeneity issue. We define two panels: the observations for the first panel are the quantiles of the aggregated distributions constructed for each combination of country-age group ($N = 24$ observations i, with $i \in \{$ 18-34 years DE, 35-49 years DE,...,+65 years BE$\}$), those for the second panel are the quantiles of the aggregated distributions constructed for each combination of country-income group ($N = 30$ observations i, with $i \in \{$ 1st income quantile DE, 2nd income quantile DE,...,5th income quantile BE$\}$). The analysis is conducted across quantiles of the expected inflation distribution paired with the corresponding quantiles of expected income growth distribution Thus, we study how the pass-through changes across pairs of quantiles, namely fifth quantile of expected inflation will be regressed on the fifth quantile of income growth expectations.

$$y_{t,i}^q = \alpha_i + \beta x_{t,i}^q + \gamma z_{t,i} + D_t + \epsilon_{t,i}, \qquad \begin{aligned} i &= 1,\ldots,N \\ t &= 1,\ldots,T \end{aligned} \qquad (6)$$

Figure 6: The pass-through estimated for the six countries involved in the CES.

Note: based on ECB CES data. The pass-through plotted in this chart is estimated for the median income growth expectation across the quantiles of inflation expectations.

Also in this setting, we explore the heterogeneity in the price-income pass-through across different countries, age and income groups. We estimate the equations:

$$y_{t,c,i}^q = \alpha_{c,i} + \beta_c x_{t,c,i}^q \cdot d_c + \gamma_c z_{t,c,i} \cdot d_c + D_t + \epsilon_{t,c,i} \tag{7}$$

$$y_{t,c,i}^q = \alpha_{c,i} + \beta_i x_{t,c,i}^q \cdot d_i + \gamma_i z_{t,c,i} \cdot d_i + D_t + \epsilon_{t,c,i} \tag{8}$$

where $i = 1, \ldots, N^{\text{age}}$ ($i = 1, \ldots, N^{\text{inc}}$) and $c = 1, \ldots, C$; N^{age} and N^{inc} are equal to the number of age and income groups for each country c; d_c and d_i are the dummies for selecting country c and age (income) group i, respectively. Equation (7) estimates the pass-through for each country by pooling observations for both age and income groups; equation (8) shows how the pass-through varies across age or income groups by pooling observations for all the countries.

The results from the pseudo-panel confirm the estimated inflation-income pass-trough from the aggregated model. Comparing Figures 3 and 9, the pass-through decreases for higher quantiles of inflation expectations, with βs a bit higher in the former than in the latter. As shown in Figure 10 panels (a) and (b), there is a marked heterogeneity across countries, with the highest pass-trough recorded for Belgium, as expected. In Figure 10 panels (c) and (d), the difference in βs between working-age population and retirees is larger than found in the aggregated analysis; the pass-through estimated with the two approaches and corresponding to the median income and price growth expectations is nonetheless greater than 30%. In addition the estimates from

pseudo panel regressions exhibit higher pass-through of inflation expectations to income growth for median and below median income brackets and for younger working age population (aged below fifty).

7   Conclusions

The post-Covid surge in inflation has not triggered a wage-price feedback loop but claims from individuals to be compensated for the lost purchasing power can make inflation more persistent.

We exploit the answers in the CES to investigate the inflation-income pass-through revealed by consumers' expectations.

Based on aggregated probabilistic responses, we find that income growth expectations adjust significantly to inflation expectations. In this respect we differ from other studies conducted using survey micro observations, which struggle to take into account the non linearity in the inflation-income pass-through. The latter varies depending on the quantiles of the distribution of both income and price growth expectations. The pass-through turns out to be tighter for lower quantiles of expected price growth, except for countries like Belgium, where wages adjust to inflation through a mechanical indexation, and is higher for above-the-median income growth expectations.

Our analysis also demonstrates substantial heterogeneity in the inflation-income pass-through across countries, income and age groups. This result is consistent with the different wage-setting mechanisms, indexation schemes of pensions and salaries to inflation enforced in each country and with the bargaining power of the individuals changing across income and age groups.

Figure 7: The relationship between income and price growth expectations by countries and income groups
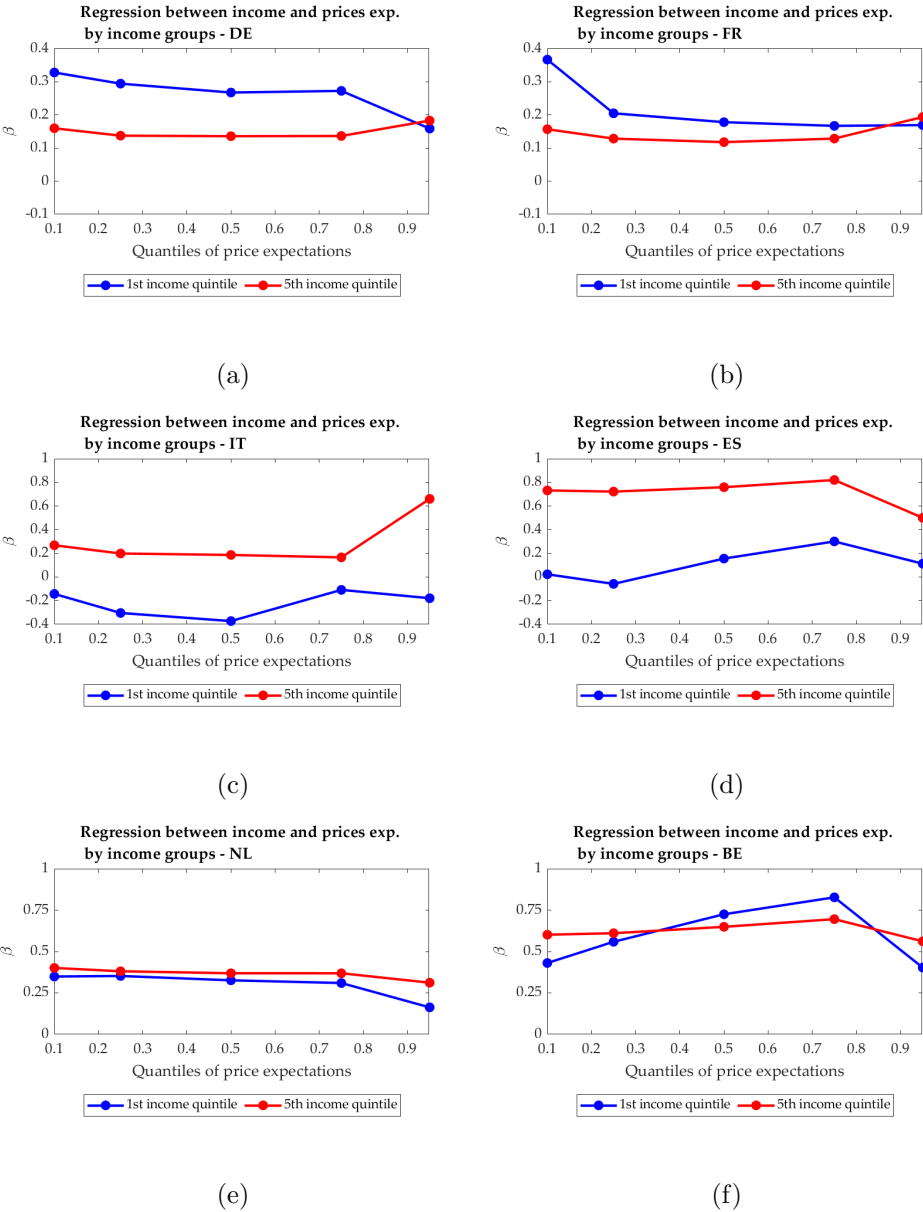

(a)

(b)

(c)

(d)

(e)

(f)

Note: based on ECB CES data. The pass-through plotted in this chart is estimated for the median income growth expectation across the quantiles of inflation expectations.

Figure 8: The relationship between income and price growth expectations by countries and age groups

(a)   (b)
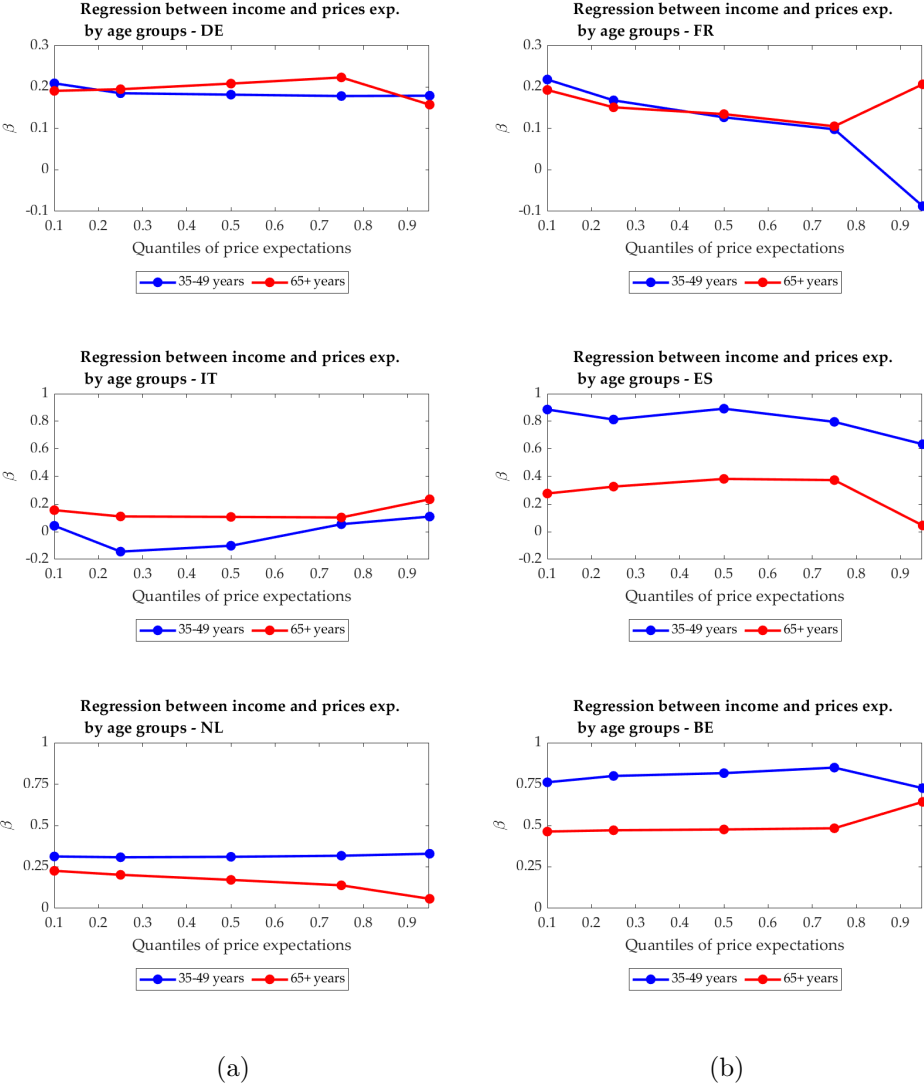
Note: based on ECB CES data. The pass-through plotted in this chart is estimated for the median income growth expectation across the quantiles of inflation expectations.

Figure 9: The pass-through across quantiles of inflation expectations
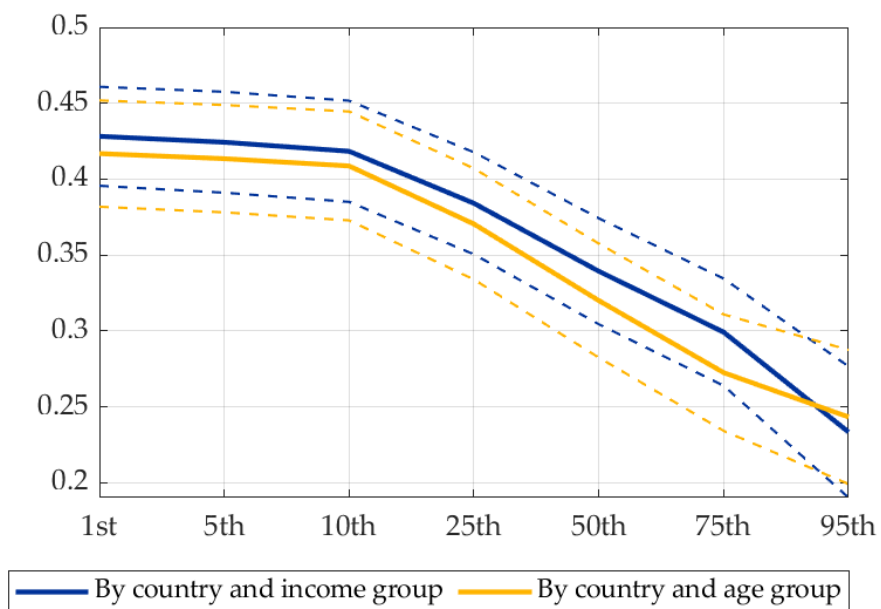
Note: based on ECB CES data. The pass-through is estimated with a linear fixed effect panel across income growth quantiles and corresponding inflation expectations quantiles. The dashed lines contour the 95% confidence interval.

Figure 10: The relationship between income and price growth expectations by countries and age groups with a Pseudo Panel dataset
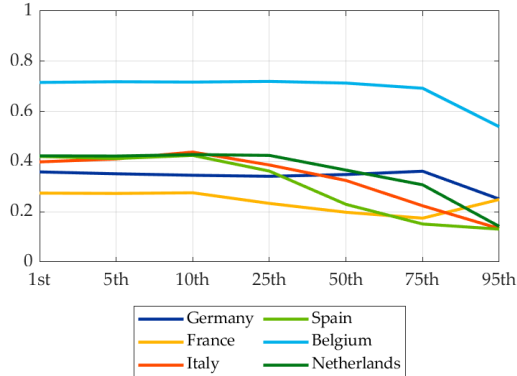
(a) by country pooling age groups
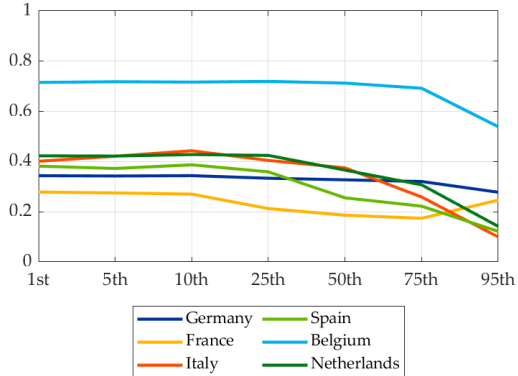
(b) by country pooling income quintiles
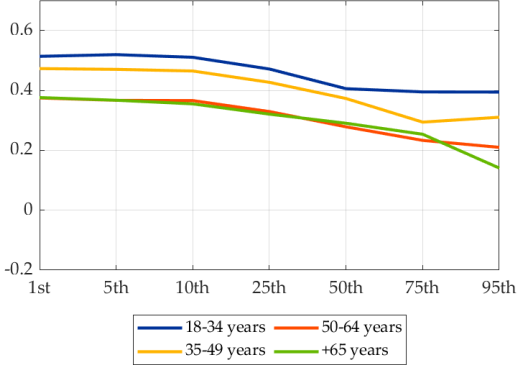
(c) by age groups pooling countries
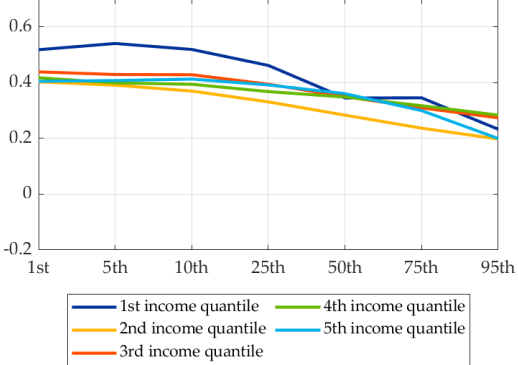
(d) by income quintiles pooling countries

Note: based on ECB CES data.The pass-through is estimated with a linear fixed effect panel across income growth quantiles and corresponding inflation expectations quantiles.

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