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Elasticity of Intertemporal Substitution in the Euro Area

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JEL Classification

D12, D15, D84, E21

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Elasticity of intertemporal substitution in the euro area*

Michal Marenčák† Giang Nghiem‡

August 28, 2024

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This paper estimates the elasticity of intertemporal substitution for the euro area. It leverages the unique design of the Consumer Expectations Survey in Europe to directly infer it from the Euler equation. Our final estimates range between 0.7 and 0.8 for the euro area as a whole, which are higher than those for the US. We also observe economically sizeable heterogeneity across the member states, and over time. Belgium, Germany, and the Netherlands have lower elasticity compared to France, Spain, and Italy. The implications are discussed.

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1 Introduction

The elasticity of intertemporal substitution (EIS) measures how consumers adjust their expected consumption growth in response to anticipated changes in the real interest rate. It determines the extent of shifts between consumption and savings over time, which is essential in dynamic economic and financial modelling.

Despite its omnipresence in economics and finance, quantifying the EIS has proven challenging due to the simultaneous lack of data on both *expected* consumption growth and *expected* rates of return for sufficiently large and representative samples.[1] Furthermore, most EIS estimations focus on the US data.[2]

The aim of this paper is to estimate the EIS for the euro area and document any possible heterogeneity across demographic groups, member countries, and over time. To this end, we leverage the unique design of the Consumer Expectations Survey (CES) conducted by the European Central Bank (ECB),[3] which provides data on both expected inflation and consumption growth by individual households. This approach eliminates the need for arbitrary assumptions about how households form expectations or how planned consumption growth relates to actual consumption levels, which were previously necessary when estimating the EIS. To the best of our knowledge, this is the first paper estimating the EIS for the euro area as a whole.

We estimate the Euler equation using direct measures of households' subjective

[1] Quantification of the EIS mechanisms has been subject of a large literature starting by Hall (1978, 1988); Hansen and Singleton (1982). Thimme (2017) provides a literature review. Havránek et al. (2015) and Havránek (2015) provide a meta study and examine the cross-country heterogeneity in the estimates of the EIS and the the role of applied methods, respectively.

[2] In the meta study of 2,735 EIS estimates in the literature spanning 104 countries, Havránek et al. (2015) note that about half of all estimates (1429) are computed for the US, while there are 44 estimates for France, 39 for Germany, but none for the euro area as a whole.

[3] The CES is a monthly online survey of consumers from 11 euro area countries, covering 97% of the euro area nominal GDP in 2024Q1. It includes, since April 2020: Belgium, Germany, Spain, France, Italy, the Netherlands; since April 2022, additionally: Ireland, Greece, Austria, Portugal and Finland. See Section 2 for more details.

expectations of both consumption growth and inflation, the latter implying variation in the real rate of return. This approach follows the research setup of Crump et al. (2022) for the US, who use the Federal Reserve Bank of New York's Survey of Consumer Expectations (SCE) to obtain direct observations of individual expectations of inflation and consumption growth.

Our final estimates range between 0.7 and 0.8 for the euro area as a whole. These values are higher than those for the US by Crump et al. (2022), who find an EIS of 0.7-0.8 in their baseline calibration, which, however, decreases to about 0.5 after controlling for income expectations.[4] We do not observe for the euro area an excess sensitivity of consumption growth to anticipated income changes. When controlling for expected income changes, relative to our baseline results, the EIS decreases from about 0.8 to approximately 0.75.

In addition, we find significant heterogeneity in the EIS estimates across socio-demographic groups, member states, and over time. However, the differences related to socio-demographic factors such as age, gender, education, or wealth distribution are statistically significant but not economically sizeable. In contrast, the heterogeneity over time and especially among the euro area member states is economically relevant.

The variation over time reveals that the EIS at the euro area level has significantly declined since the pandemic years of 2020 and 2021, from values around 0.9. Since 2022, it has remained relatively stable at around 0.77. These results confirm that pandemic-induced shifts in consumption patterns and enforced savings led people to experience and anticipate significant changes in their consumption profiles. To ensure the robustness of the results, we also consider a sample excluding the COVID years 2020-2021 and all eleven countries covered by the CES (see Section 2). We confirm that our preferred range of EIS estimates, between 0.7 and

[4] Our sample period is 2020-2024, while that of Crump et al. (2022) is 2013-2019.

0.8, is not sensitive to the COVID period.

Across member countries, we find that Belgium, Germany, and the Netherlands have an average EIS of 0.72, which is lower than the average EIS of 0.83 for France, Spain, and Italy. We also provide estimates for new countries covered by the CES since April 2022. While for Austria and Greece we find lower values of EIS at 0.69 and 0.71, respectively, we observe higher values for Ireland (0.79), Portugal (0.79), and Finland (0.84). Country-specific estimations over time show that the decline in the EIS since the pandemic years is universal except for Germany, where the EIS increased to 0.8 in 2024, similar to levels observed during the pandemic years. To showcase the relevance of cross-country differences within the euro area, we demonstrate the implications of using these values in the well-known model for the euro area by Smets and Wouters (2003). Using the lower estimates of the EIS implies a larger coefficient of risk aversion and, hence, a more muted response of consumption to a monetary policy shock, as consumers in such a setting are less willing to accept changes in their consumption profile. Explaining the observed differences in the EIS estimates across countries would go beyond the scope of this paper, yet our analysis clearly highlights the importance of considering such heterogeneity when formulating and evaluating monetary policy across the euro area.

We also compare our country-specific estimates with those documented in the literature. To this end, we rely on the meta-study by Havránek et al. (2015) as a benchmark. With the exception of Belgium, we do find EIS estimates that are in stark contrast to previous estimates.

Our results benefit from the unique survey design of the CES by the ECB and are not prone to arbitrary choices about the expectations formation process or how observed past consumption relates to expected spending growth paths. Therefore, using the microdata at the household level, we can identify EIS values that might

be informative for calibrating or estimating macroeconomic and financial models. Last but not least, we provide estimates for the euro area as a whole.

The remainder of the paper is organized as follows. Section 2 describes the data and our empirical strategy. Section 3 is the key section in which we present the empirical evidence on the EIS from the CES. These results are then discussed in Section 4, where we focus on implications and comparisons with the literature estimates. Section 5 concludes.

2 Data and econometric approach

The ECB Consumer Expectations Survey has been conducted online monthly by the ECB since April 2020. It provides high-frequency data on euro area consumers' perceptions and expectations regarding the economy, as well as their economic choices. The survey is an unbalanced panel and initially included the six largest economies in the euro area: Belgium, Germany, Spain, France, Italy, and the Netherlands. In April of 2022, the sample was extended to include five additional countries: Ireland, Greece, Austria, Portugal, and Finland.[5] This paper uses in the first place data from the six original countries, spanning from April 2020 to June 2024, with more than 600,000 respondents. Yet we also provide EIS estimates for the countries which joined in 2022.

2.1 Descriptive statistics

The main survey questions of interest are eliciting households' expectations of inflation and nominal spending growth for the next 12 months. Their formulations are as follows:[6]

[5] For further details see Bańkowska et al. (2021) and Georgarakos and Kenny (2022).

[6] Additional survey questions are included in Appendix A.

- Qualitative (*directional*) inflation expectations, $E_t\pi_{t+1}^{qual}$: Looking ahead to 12 months from now, what do you think will happen to prices in general? We are interested in even very small changes.

  [Prices will increase a lot; Prices will decrease a lot; Prices will increase a little; Prices will decrease a little; Prices will be exactly the same (that is 0% change)]

- Quantitative (*level*) inflation expectations, $E_t\pi_{t+1}$: How much higher (lower) do you think prices in general will be 12 months from now in the country you currently live in? Please give your best guess of the change in percentage terms. You can provide a number up to one decimal place. ...%

- Nominal household's spending growth, $E_t\Delta c_{t+1}^{nominal}$: By what percent do you expect your household spending on all goods and services to change during the next 12 months compared with your spending in the past 12 months? Even very small changes in the amount your household will spend are of interest.

  Please give your best guess of the change in percentage terms. ...%

Finally, the real spending growth at the household level, $E_t\Delta c_{t+1}$, is defined as nominal spending growth less expected inflation:

$$E_t\Delta c_{t+1} = E_t\Delta c_{t+1}^{nominal} - E_t\pi_{t+1}. \tag{1}$$

We clean the data in the following way. First, we interpolate missing spending growth expectations. Specifically, respondents who do not provide an explicit estimate of household spending growth on all goods and services can answer using intervals, which we use to replace missing observations with no point estimates (see Appendix A for details). Second, we exclude the upper and lower 2.5% of

	Mean	Median	Std.Dev.	Min.	Max.	Obs.
Exp. Inflation, Point Estimate (pp)	4.63	3.00	5.79	-10.00	50.50	627,797
Nom. Exp. Spending Growth (pp)	3.01	2.00	5.62	-30.00	38.00	627,797
Real Exp. Spending Growth (pp)	-1.61	0.00	6.65	-70.00	40.00	627,797
Obs. per Country	137,101 (IT)	133,524 (FR)	132,604 (ES)	128,645 (DE)	48,833 (BE)	47,090 (NL)

Table 1: Summary statistics

Notes: This table presents summary statistics for selected variables from the Consumption Expectations Survey (CES) of the European Central Bank (ECB) for the six countries included since 2020. All variables are obtained monthly."pp" denotes variables measured in percentage points. "Obs" denotes the number of observations. The sample period is 2020:04 – 2024:06.

observations per country and per survey round for all variables on expectations to mitigate the issues of outliers. We end up with 627,797 observations from 62,107 respondents, of which 46,537 (75%) participated more than once.

Table 1 provides distributional statistics for our key variables of interest across the entire sample, including expected inflation, expected nominal spending growth, and expected real spending growth over the next 12 months. Figure 1 depicts the evolution of these variables over time in relation to actual inflation at the euro area level. Additional time series evidence for individual countries is provided in Appendix B. Figure 1 reveals a positive relationship between expected inflation and expected nominal spending growth, with both variables also moving in tandem with actual inflation in the euro area. Across all survey waves, we find that average nominal spending growth expectations are lower than inflation expectations, resulting in negative real spending growth expectations, with a mean of -1.6%.

2.2 Empirical strategy

The theoretical foundation is a standard intertemporal Euler equation derived from the first-order conditions of a household's maximization of a lifetime constant

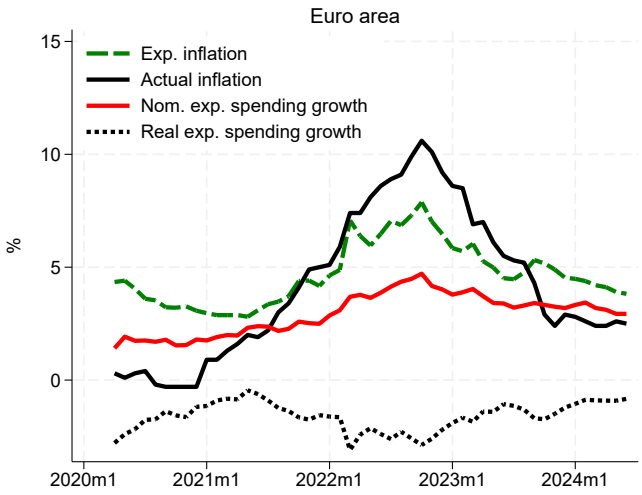


Figure 1: Time series evidence

Notes: This figure shows for the euro area (six original countries in the CES) the monthly HICP, y-o-y, inflation rate in % (solid black) against the average expected inflation in the cross-section of the given month (dashed green), as well as the average nominal expected spending growth over the next 12 months (solid red) and the average real expected spending growth (dotted black).

relative risk aversion utility function:

$$1 = E_t^i \left[\beta^i \left(\frac{C_{t+1}^i}{C_t^i} \right)^{-\frac{1}{\sigma}} \left(\frac{R_t}{\Pi_{t+1}} \right) \right], \tag{2}$$

where β^i and C_t^i denote household specific discount factor and a bundle of goods consumed in period t, respectively. R_t denotes the gross nominal return and Π_{t+1} the gross rate of inflation between periods t and $t+1$. The parameter σ is the EIS. It is worthwhile to point out that we assume households forming expectations about individual spending growth and but countrywide inflation. Hence, there is a representative price index which is consistent with the CES survey design eliciting inflation perceptions and expectations of households in general.

Taking a log-linear approximation of equation (2) yields

$$E_t^i \left[\Delta c_{t+1}^i \right] = \sigma \log \beta^i + \sigma \left(i_t - E_t^i \pi_{t+1} \right), \tag{3}$$

where i_t and π_{t+1} denote the net nominal rate in period t and the net inflation rate in $t+1$, respectively.

Equation (3) builds the cornerstone of our regression equation (4) which we extend for further variables capturing possible deviations from the basic Euler equation:

$$E_t^i \Delta c_{i,t+1} = \alpha + \beta E_t^i \pi_{t+1} + \eta_t + \mu_i + \upsilon_i + \gamma X_{it} + \epsilon_{it}, \tag{4}$$

where β is the coefficient of interest (EIS $= -\beta$), $E_t^i \pi_{t+1}$ denotes households' subjective point inflation expectations,[7] η_t captures time fixed effects, μ_i covers country fixed effects, X_{it} is a vector of control variables (income, age, gender, education, household size, number of children, partnership), and, finally, υ_i stays for individual fixed effects. We cluster standard errors at the individual level.

Instrumental variable approach While our main measure of inflation expectations is based on the explicit point estimates by households, for robustness purposes and in line with literature, we also instrument *quantitative* inflation expectations by the subjective *qualitative* inflation expectations to mitigate potential measurement error issues. Following Dräger and Nghiem (2021), we therefore also use in our main results qualitative inflation expectations as an instrumental variable for quantitative inflation expectations in the next 12 months.

[7] Note that while Crump et al. (2022) use the density-implied mean of the distribution of subjective expected inflation over the following twelve months as their preferred measure of inflation expectations, we rely on point estimates for the CES. This is due to a survey design change in July 2022, where additional intervals were introduced to capture the increasing inflation expectations of households (see Appendix A). However, in the robustness section, we verify our baseline strategy by replacing point forecasts with weighted means of individual distributions and controlling for their variance. Our results remain robust.

3 Results

3.1 Baseline results for the euro area

We estimate equation (4) using panel regression techniques and monthly waves of the CES from April 2020 through June 2024 focusing on the original six largest countries in the euro area. Table 2 presents our baseline results. Column (1) reports the regression coefficient on expected inflation, $-\sigma$, in a simple specification with country and wave fixed effects, and random effects. Column (2) adds a rich set of controls discussed above and Column (3) reports the results of a fixed effect model. Columns (4) to (6) repeat the same regressions using the qualitative expectations of inflation as an instrument for the point forecasts of inflation.

	Dependent variable: Real Spending growth expectations					
	Panel regression			IV-Panel regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
Infl. Exp.	-0.80***	-0.80***	-0.83***	-0.76***	-0.76***	-0.81***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
R^2	0.370	0.371	0.364	0.370	0.372	0.364
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Ind. FE	No	No	Yes	No	No	Yes
N	627797	627797	627797	627797	627797	627797

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Baseline results

Notes: This table presents estimation results from our baseline specification in equation (4) for the six original countries in the CES. The dependent variable is the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's point forecast of inflation over the next 12 months as the measure of subjective expected inflation. The right panel reports results based on an IV estimator using the respondent's qualitative expectations of future inflation as the instrument. Columns (1) and (4) report results with country, time fixed effects, and random effects. Columns (2) and (5) report results when additionally controlling for income, age, gender, education, household size, number of children, and partnership. Columns (3) and (6) employ individual fixed effects. Standard errors, clustered at the household level, are reported in parentheses. The sample period is 2020:04 – 2024:06.

Across specifications, we observe a remarkably consistent finding of the elasticity of intertemporal substitution of about 0.8 with sufficient precision. Using the qualitative expectations of inflation as an instrument slightly decrease the EIS estimates. In both cases including individual fixed effects tends to increase the estimated values of EIS.

Robustness Crump et al. (2022) document for the US case that EIS estimates are sensitive to including measures of expected income growth in regressions of consumption growth to returns. We do not observe an economically sizeable impact of excess sensitivity in the euro area (see Section C.1 in the appendix). The EIS estimates significantly decrease from about 0.8 to about 0.75, yet this decline is much less pronounced than in the US where the EIS decreases from 0.7-0.8 to about 0.5 (Crump et al., 2022).

Furthermore, we also examine whether redefining the real interest rate as the difference between interest rate expectations on mortgages and the inflation point forecasts might change the results. Note that in this setup, the estimated coefficients are expected to be positive as they directly represent the EIS. The results align with this interpretation, with robust EIS estimates remaining at the lower end of the 0.7-0.8 range (see Table 7 in the appendix).

Next, we use pooled OLS to estimate our baseline specification, allowing us to check the sensitivity of our results when employing sample weights in our regressions. The results are presented in Section C.3 in the appendix, showing the estimated EIS of 0.7, which slightly increases to 0.71 when applying the sample weights. These results suggest that the sample weights do not significantly influence our findings.

Finally, we consider whether using density forecasts as the main dependent variable, as in Crump et al. (2022), instead of point estimates, might change the

results (see Section C.4 in the appendix). In this case, we also do not observe any significant change in the estimates. This observation also holds when including measures of second-order moments of the subjective distributions (variance) in the regression (see Table 10 in the appendix).

We therefore conclude that the baseline results hold across a variety of sensitivity checks and are robust to deviations from the standard Euler equation. Our preferred range of EIS estimates for the euro area is between 0.7-0.8.

3.2 Heterogeneity across socio-demographic factors

In the following, we document the differences in EIS estimates across six socio-demographic characteristics: (1) education, (2) age groups, (3) partnership status, (4) gender, (5) income quintiles, and (6) credit access. Each panel in Figure 2 illustrates the differences within each category. We find that while the estimated EIS across groups in some categories is statistically significant, the differences are not economically substantial.

To explore the heterogeneity arising from households' expectations regarding their access to credit, we use the following question: "Looking ahead, do you think that 12 months from now it will generally be harder or easier for your household to obtain credit or loans (including credit and retail cards, car loans, student loans, and mortgages) than it is these days?" Households are classified as facing credit constraints if they respond 'Much harder' or 'Somewhat harder.' Other possible responses include 'Equally easy/hard,' 'Somewhat easier,' and 'Much easier.' Interestingly, we find that households expecting credit constraints exhibit a significantly, though only slightly, lower EIS compared to unconstrained households. This may suggest a preference for credit to smooth consumption and avoid larger fluctuations.

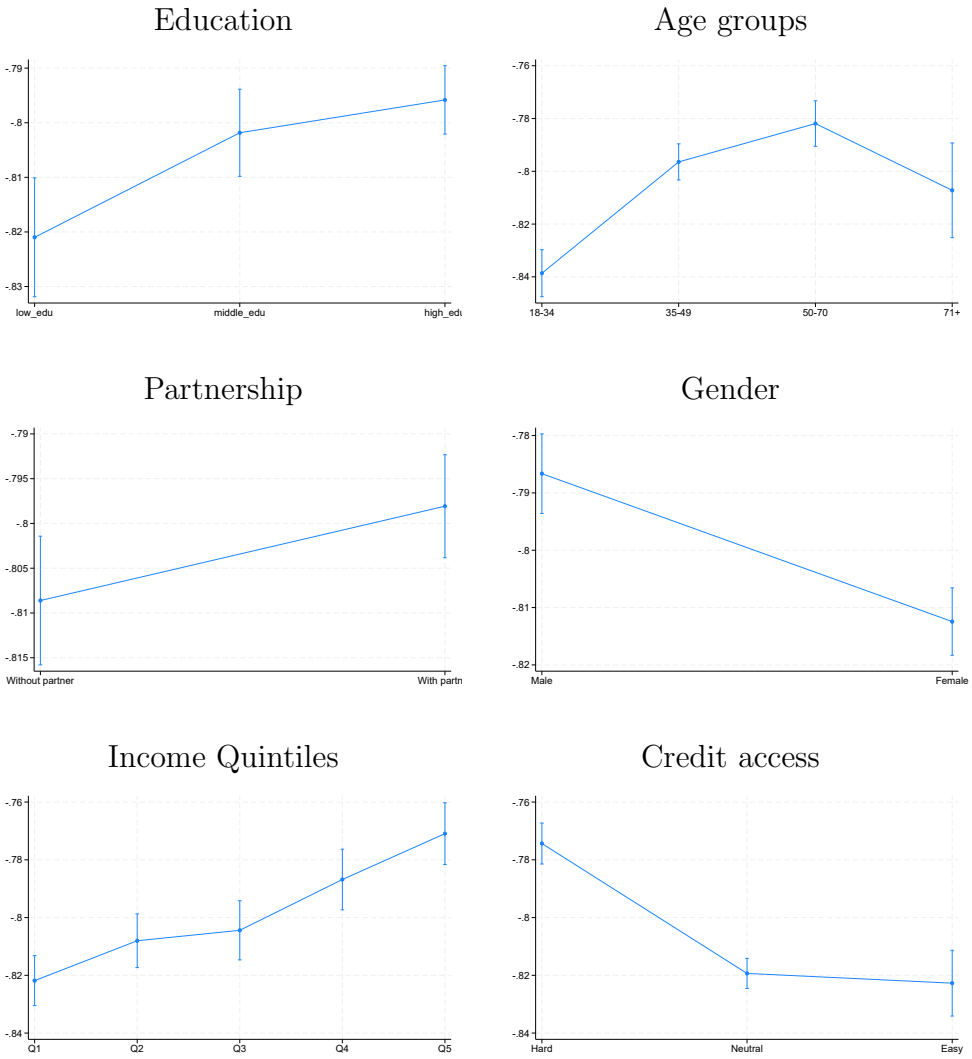


Figure 2: Heterogeneity in the EIS esimates according to different socio-demographic characteristics

Notes: This exhibit presents estimation results with 90% confidence intervals for groups in different socio-demographic categories. The dependent variable is the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's point forecast of inflation over the next 12 months as the measure of subjective expected inflation. Country and time fixed effects are included. Groups in the education category are as follows: low_edu - Primary or lower secondary education; middle_edu - Upper secondary, non-tertiary education; high_edu - Tertiary education. Income quantiles are determined in each survey round. Credit access groups are as follows: Hard - Much harder or Somewhat harder; Neutral - Equally easy/hard; Easy - Somewhat easier or Much easier Standard errors, clustered at the household level, are reported in parentheses. The sample period is 2020:04 – 2024:06.

3.3 Heterogeneity over time

In this subsection, we check the variation of the EIS over time. Figure 3 reveals that the EIS at the euro area level has declined since the pandemic years 2020 and 2021. Since 2022, it has remained relatively stable at a level of around 0.77.

These results suggest that during the pandemic, people were accepting larger changes in their consumption profiles. Admittedly, the observed high values of EIS in the years 2020 and 2021 could be a counterpart to the observed excess savings in the Eurozone. Households were not able to consume as intended due to pandemic lockdowns, leading to a larger variation in expected consumption given the same level of expected inflation. Including time-fixed effects in the baseline regression setup is therefore of first order.[8]

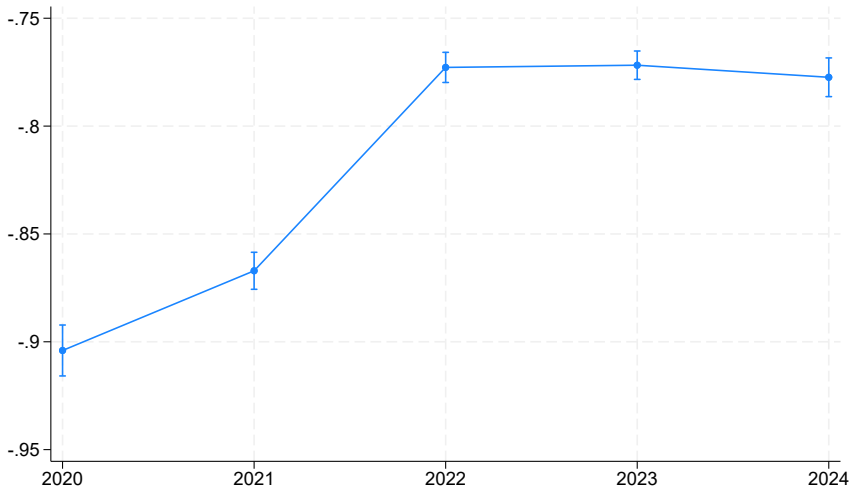


Figure 3: Heterogeneity over time

Notes: This exhibit presents estimation results with 90% confidence intervals over time with country fixed effect. The dependent variable is the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's point forecast of inflation over the next 12 months as the measure of subjective expected inflation. Standard errors, clustered at the household level, are reported in parentheses. The sample period is 2020:04 – 2024:06.

[8] In Appendix D, we show the EIS estimates for each survey round, i.e., monthly frequency, at the euro area level as well as per country.

3.4 Heterogeneity across countries

Finally, we uncover the heterogeneity of the EIS across country members of the euro area by estimating the EIS for each country separately. Figure 4 shows the results.

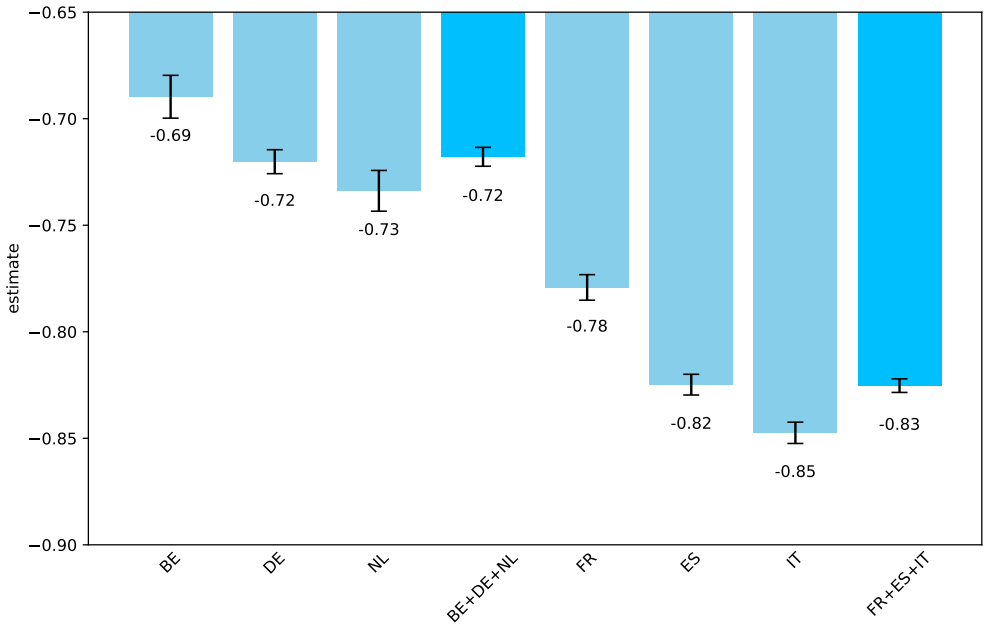


Figure 4: Cross-country heterogeneity

Notes: This exhibit presents estimation results with 90% confidence intervals for each country. It also shows results for groups of countries with lower EIS values (BE, DE, and NL) and higher EIS values (FR, ES, and IT), including country fixed effects. The dependent variable is the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's point forecast of inflation over the next 12 months as the measure of subjective expected inflation. Survey round fixed effects are employed. Standard errors, clustered at the household level. The sample period is 2020:04 – 2024:06.

We find that the estimated EIS is substantially lower for Belgium, Germany, and the Netherlands, with an average EIS of 0.72, compared to France, Spain, and Italy, where the average is 0.83. These estimates account for survey round fixed effects and include country fixed effects when estimating groups of countries with lower and higher EIS values. Respondents in the second group tend to accommodate larger up-and-downs in consumption paths compared to the first group. This

preference might matter for other economic choices such as housing or portfolio structure.[9]

While explaining the observed differences is beyond the scope of this paper, our analysis underscores the importance of accounting for this heterogeneity in policy considerations across the euro area and over different time periods. We provide a discussion in Section 4.

3.5 Results for all 11 countries since April 2022

Given the extended scope of the CES since April 2022, when five additional countries were included, we reassess the robustness of our previously reported results for the euro area as a whole. This sample period excludes the COVID years 2020-2021, making it a suitable test of the robustness of our period selection as well. Our results, shown in Table 3, remain remarkably consistent, with the Eurozone estimates staying almost unchanged compared to the estimates based on the original six countries.

Regarding cross-country heterogeneity, the previously documented differences persist (Figure 5). We observe that Austria and Greece are similar to Germany, Belgium, and the Netherlands in terms of the size of the EIS, while Finland, Portugal, and Ireland show higher values of EIS similar to France, Spain and Italy.

[9]The time series evidence on expectations of inflation and nominal spending growth in Appendix B illustrates that the co-movement of these variables is strong and more pronounced in the group of Germany, Belgium and the Netherlands than in the second group.

	Dependent variable: Real Spending growth expectations					
	Panel regressions			IV-Panel regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
Infl. Exp.	-0.79***	-0.79***	-0.83***	-0.73***	-0.73***	-0.81***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
R^2	0.358	0.360	0.336	0.358	0.361	0.336
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Ind. FE	No	No	Yes	No	No	Yes
N	502689	502689	502689	502689	502689	502689

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Baseline results for all 11 countries since April 2022

Notes: This table presents estimation results from our baseline specification in equation (4). The dependent variable is the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's point forecast of inflation over the next 12 months as the measure of subjective expected inflation. The right panel reports results based on an IV estimator using the respondent's qualitative expectations of future inflation as the instrument. Columns (2) and (5) report results when additionally controlling for income, age, gender, education, household size, number of children, and partnership. Columns (3) and (6) employ individual fixed effects. Standard errors, clustered at the household level, are reported in parentheses. The sample period is 2022:04 – 2024:06.

4 Discussion

We start by discussing our results in the context of previous estimates of the EIS in the literature. To this end we refer to the meta study by Havránek et al. (2015) which focuses specifically on the cross-country differences. Table 4 sums up the evidence. With the exception of Belgium, we find EIS estimates that are in stark contrast to previous estimates. This observation holds also for countries which started to be covered by CES since 2022.[10]

To showcase the economic relevance of this heterogeneity within the Eurozone, we use the well-known model of Smets and Wouters (2003) for the euro area and study the implications of various EIS estimates on consumption dynamics while

[10]The standard errors reported for the estimates from Havránek et al. (2015) in Table 4 refer to the variation in available estimates for a given country across different studies and are thus not directly comparable to standard errors of our estimates.

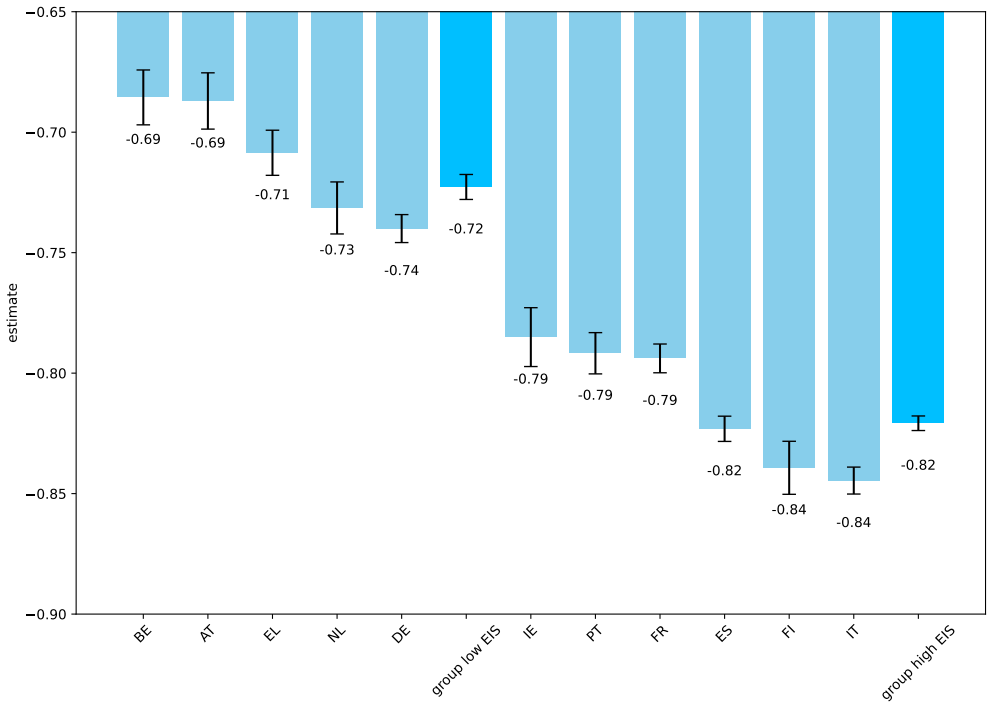


Figure 5: Cross-country heterogeneity since April 2022

Notes: This exhibit presents estimation results with 90% confidence intervals for each country. It also shows results for groups of countries with lower EIS values (BE, AT, EL, NL, and DE) and higher EIS values (IE, PT, FR, ES, FI, and IT), including country fixed effects. The dependent variable is the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's point forecast of inflation over the next 12 months as the measure of subjective expected inflation. Survey round fixed effects are employed. Standard errors, clustered at the household level. The sample period is 2022:04 – 2024:06.

keeping all other parameters at their original values.[11]

Figure 6 shows the response of consumption to a contractionary demand shock due to an interest rate increase, conditional on various values of the EIS. The case of EIS equal to one corresponds to the common case of log-utility. The scenario with EIS equal to 0.74 illustrates the response of consumption in the original model. The two cases of EIS equal to 0.72 versus 0.82 are meant to highlight the

[11]Note that the estimated model of Smets and Wouters (2003) includes a significant role for external habit formation. This implies that consumption depends on a weighted average of past and expected future consumption. Consequently, the response of consumption to a monetary policy shock depends not only on the EIS but also on the habit persistence parameter. To highlight solely the implications of varying EIS values in the original model, we keep the habit persistence at the estimated level.

Country	Havránek et al. (2015)			This paper	
	Mean EIS	Std. err. of the mean	No. of estimates	Our estimate	Std. error
US	0.594	0.036	1429	0.54†	0.02†
EA	-	-	-	0.80	0.00
Belgium	0.677	0.390	10	0.69	0.01
France	-0.034	0.153	44	0.78	0.00
Germany	0.080	0.163	39	0.72	0.00
Italy	0.290	0.162	33	0.85	0.00
Netherlands	0.027	0.221	31	0.73	0.01
Spain	0.504	0.107	44	0.82	0.00
Austria	3.149	1.876	6	0.69	0.01
Greece	0.561	0.291	18	0.71	0.01
Finland	0.185	0.320	46	0.84	0.01
Ireland	1.739	0.778	7	0.79	0.01
Portugal	0.152	0.258	7	0.79	0.01

† Values taken from Crump et al. (2022).

Table 4: Evidence on cross-country differences

Notes: This table compares our results for the countries included in the CES in 2022 with the estimates documented by the meta study Havránek et al. (2015). The estimate from Crump et al. (2022) is after controlling for excess sensitivity towards expected income changes. Values reported for our paper are without this control yet as we have shown our estimates are robust to the impact of anticipated income changes. Each country estimate is based on the longest possible sample. Eurozone estimate is based on the six largest countries since April 2020.

implications of the group heterogeneity within the euro area.

In the model, the coefficient of relative risk aversion of households is equal to the inverse of the EIS. Therefore, higher EIS values imply lower relative risk aversion and thus a stronger preference for adapting the consumption path in response to shocks. This leads to a stronger reaction of consumption to monetary shocks. Using the lower estimates of the EIS implies a larger coefficient of risk aversion and, hence, a more muted response of consumption, as consumers in such a setting are less willing to accept changes in their consumption profile. Therefore, the documented significant and economically sizeable cross-country heterogeneity should be considered when evaluating the impacts of monetary policy in individual countries.

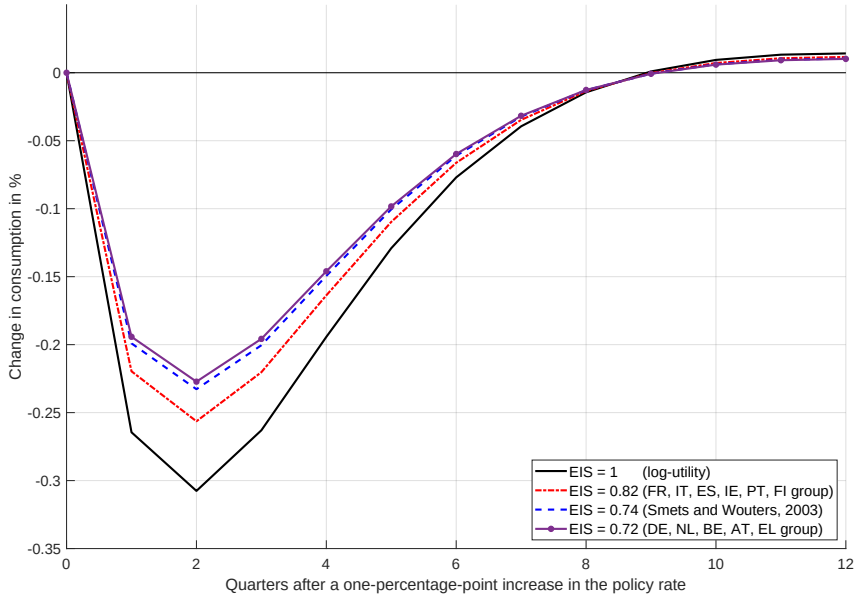


Figure 6: Implication of various values of EIS

Notes: This figures shows simulated impulse responses of consumption to a one-percentage-point increase in the monetary policy rate in the estimated DSGE model for the euro area by Smets and Wouters (2003). We vary the value of the EIS ceteris paribus. For the simulations we use Matlab code from the Macroeconomic Model Data Base (Wieland et al., 2012).

The variation over time documented in Section 3.3 can be analyzed similarly. The EIS estimates at the euro area level during the pandemic years of 2020 and 2021 are approximately 0.9, thus close to the responses akin to the log-utility case. In contrast, for the post-pandemic years of 2022-2024, we observe remarkably stable estimates at around 0.77, which are close to the original scenario of Smets and Wouters (2003). Hence, the heterogeneity over time should also be considered when assessing the real effects of monetary policy in different periods.

5 Conclusion

In this paper, we estimate the elasticity of intertemporal substitution (EIS) for the euro area, utilizing the unique design of the Consumer Expectations Survey (CES)

conducted by the European Central Bank (ECB). By leveraging direct measures of households' subjective expectations of both consumption growth and inflation, we overcome the limitations associated with previous studies that required arbitrary assumptions about expectation formation and consumption planning. Our work is motivated by Crump et al. (2022), who applied this approach to the US. Therefore, our results complement theirs by expanding the evidence on the role of subjective inflation expectations for consumption in the euro area.

Our findings indicate that the EIS for the euro area as a whole ranges between 0.7 and 0.8, which is higher than the estimates found for the US (Crump et al., 2022). This suggests that euro area consumers are relatively more willing to adjust their consumption growth in response to anticipated changes in the real interest rate. A possible consequence could be larger real effects of monetary policy in the Euro area compared to the US, as higher values of EIS suggest a stronger response to monetary policy shocks.

Importantly, our results also reveal significant heterogeneity across different euro area member states, demographic groups, and over time. Particularly, the heterogeneity across member countries and over time is not only statistically significant but also economically sizeable.

Specifically, Belgium, Germany, and the Netherlands exhibit lower EIS values compared to France, Spain, and Italy. When expanding the sample to include new countries since April 2022, Austria and Greece exhibit lower values of EIS, similar to the first group, while Finland, Portugal, and Ireland show higher values of EIS, akin to France, Spain, and Italy. This cross-country heterogeneity has crucial implications for monetary policy, as countries with lower EIS are likely to exhibit more muted consumption responses to policy shocks. Our analysis highlights the relevance of considering such heterogeneity when formulating and evaluating monetary policy across the euro area.

Our study contributes to the existing literature by providing the first comprehensive estimates of EIS for the euro area as a whole. We document the implications of varying EIS values within the well-known Smets and Wouters (2003) macroeconomic model for the euro area, demonstrating that higher EIS values lead to stronger consumption responses to monetary policy shocks.

Our research underscores the importance of understanding the diverse economic behaviors across the euro area and provides valuable insights for policymakers and economists. Future research could further explore the dynamics of EIS across different economic environments, its implications for other macroeconomic variables, and the reasons for observed heterogeneity across countries and over time.

References

Bańkowska, K., A. M. Borlescu, E. Charalambakis, A. D. D. Silva, D. D. Laurea, M. Dossche, D. Georgarakos, J. Honkkila, N. Kennedy, G. Kenny, A. Kolndrekaj, J. Meyer, D. Rusinova, F. Teppa, and V.-M. Törmälehto (2021, December). Ecb consumer expectations survey: an overview and first evaluation. ECB Occasional Paper Series No 287.

Coibion, O., Y. Gorodnichenko, and M. Weber (2022). Monetary policy communications and their effects on household inflation expectations. *Journal of Political Economy 130*(6), 1537–1584.

Crump, R. K., S. Eusepi, A. Tambalotti, and G. Topa (2022). Subjective intertemporal substitution. *Journal of Monetary Economics 126*, 118–133.

Dräger, L. and G. Nghiem (2021, 07). Are Consumers' Spending Decisions in Line with A Euler Equation? *The Review of Economics and Statistics 103*(3), 580–596.

Georgarakos, D. and G. Kenny (2022). Household spending and fiscal support during the covid-19 pandemic: Insights from a new consumer survey. *Journal of Monetary Economics 129*, S1–S14.

Hall, R. E. (1978). Stochastic implications of the life cycle-permanent income

hypothesis: Theory and evidence. *Journal of Political Economy 86*(6), 971–987.

Hall, R. E. (1988). Intertemporal substitution in consumption. *Journal of Political Economy 96*(2), 339–357.

Hansen, L. P. and K. J. Singleton (1982). Generalized instrumental variables estimation of nonlinear rational expectations models. *Econometrica 50*(5), 1269–1286.

Havránek, T. (2015, 12). Measuring Intertemporal Substitution: The Importance of Method Choices and Selective Reporting. *Journal of the European Economic Association 13*(6), 1180–1204.

Havránek, T., R. Horváth, Z. Iršová, and M. Rusnák (2015). Cross-country heterogeneity in intertemporal substitution. *Journal of International Economics 96*(1), 100–118.

Smets, F. and R. Wouters (2003). An estimated dynamic stochastic general equilibrium model of the euro area. *Journal of the European Economic Association 1*(5), 1123–1175.

Thimme, J. (2017). Intertemporal substitution in consumption: A literature review. *Journal of Economic Surveys 31*(1), 226–257.

Wieland, V., T. Cwik, G. J. Müller, S. Schmidt, and M. Wolters (2012). A new comparative approach to macroeconomic modeling and policy analysis. *Journal of Economic Behavior & Organization 83*(3), 523–541. The Great Recession: motivation for re-thinking paradigms in macroeconomic modeling.

A Additional survey questions

- **Inflation expectations using density forecasts:** 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 eight (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 to 100.

  You can allocate points by typing a percentage in each box. (Note that your answers should sum to 100 – if your sum exceeds 100, you should first decrease the points again in one option before you can add points in another).

Percent change points: Used from April 2020 to June 2022		
1	Prices will increase by 8% or more	
2	Prices will increase by 4% or more, but less than 8%	
3	Prices will increase by 2% or more, but less than 4%	
4	Prices will increase by 0% or more, but less than 2%	
5	Prices will decrease by more than 0% but less than 2%	
6	Prices will decrease by 2% or more, but less than 4%	
7	Prices will decrease by 4% or more, but less than 8%	
8	Prices will decrease by 8% or more	
	Total (the points should sum to 100)	**100**

Percent change points: Used since July 2022		
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	
	Total (the points should sum to 100)	**100**

Table 5: Distribution of Price Change Expectations

Notes: The design of this question has changed over time, particularly from April 2020 to June 2022, when it featured 8 bins, and from July 2022 onwards, when it expanded to 10 bins. Following Coibion et al. (2022), we construct the weighted average and standard deviation of inflation expectations for each respondent by using the midpoints of each bin. For respondents allocating weights to the bins [Price will decrease by 12 (8)% or more] and [Price will increase by 12(8)% or more], we use the values of -14 (-10)% and 14(10)%, respectively.

- **Interest rate expectations:** In 12 months from now, what do you think will be the interest rate on mortgages in the country you are currently living in?

  Please give your best guess. You can provide a number up to one decimal place.

  ...%

- **Expected income changes:** By about what percent do you expect the total net income of your household to increase (decrease)? Please give your best guess of the expected change in percentage terms. You can provide a number up to one decimal place.

  During the next 12 months, I expect the total net income of my household to increase (decrease) by ...%

- **Spending growth:** If a respondent does not provide a quantitative point estimate of the expected spending growth during the next 12 months, they are asked to specify the subjective spending growth rate by choosing from several options as follows:

  Please estimate how much higher (lower) (in percent) you expect your monthly household spending on all goods and services to be 12 months from now using the categories listed below.

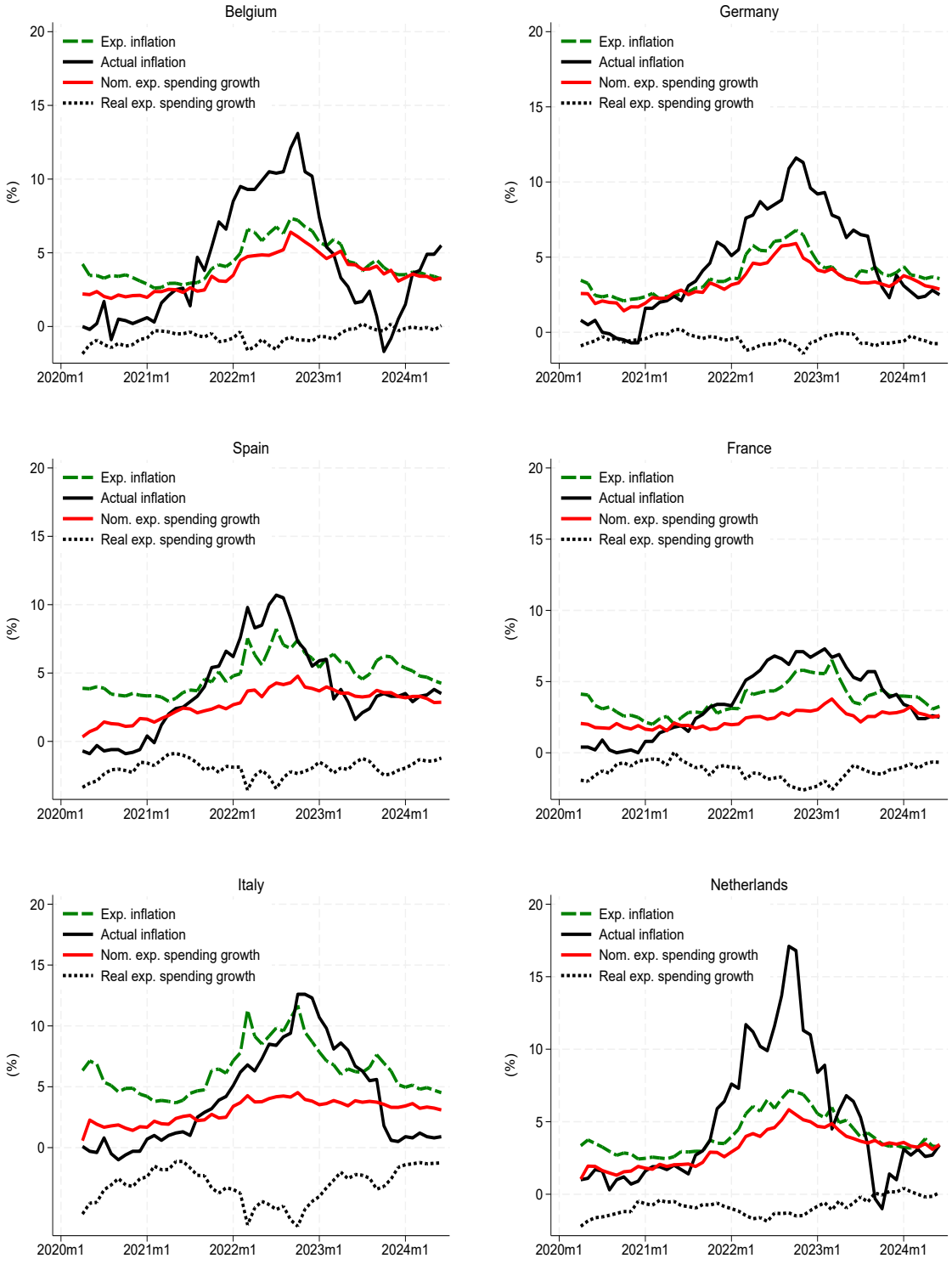
  [Less than 2%; 2-3%; 4-6%; 7-10%; 11-15%; 16-20%; More than 20%]

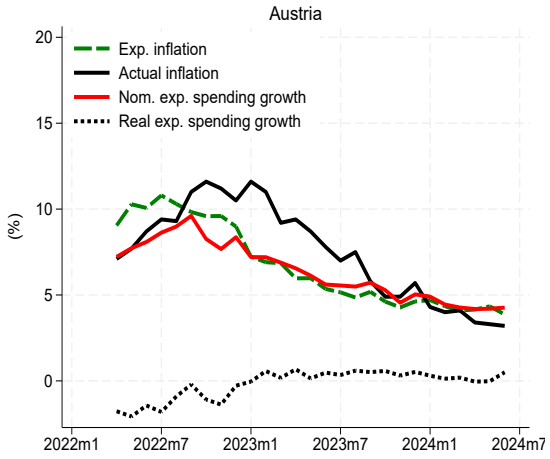
  As our regressions require point estimates for spending growth, we replace the brackets chosen by respondents using the following mapping: [1%; 2.5%; 5%; 8.5%; 13%; 18%; 22%;]

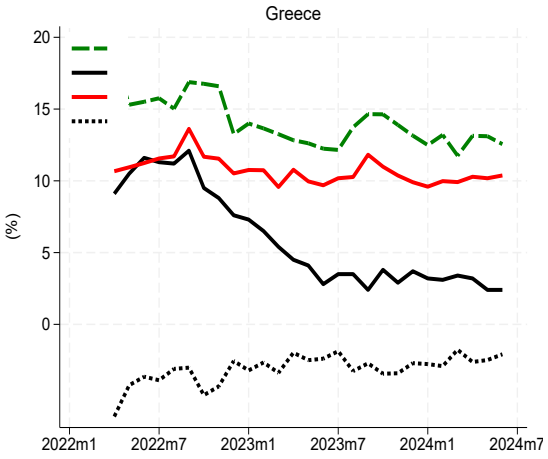
For a complete list of questions and further explanations see the website of the CES: `https://www.ecb.europa.eu/stats/ecb_surveys/consumer_exp_survey/html/index.en.html`, and the main references: Bańkowska et al. (2021) and Georgarakos and Kenny (2022).

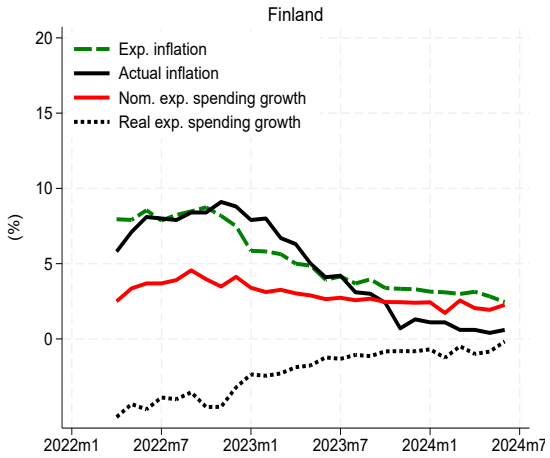
B Time series evidence for individual countries

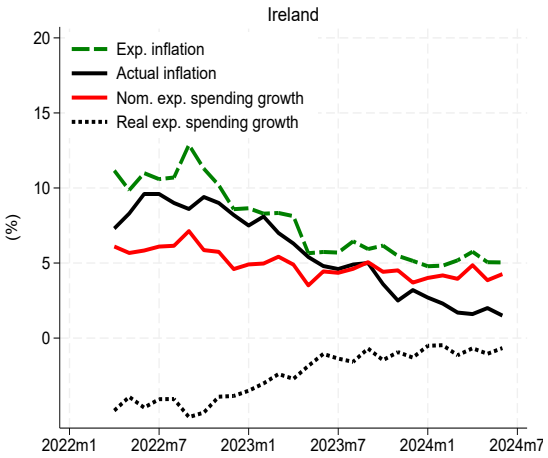
In this section we show the monthly HICP, y-o-y, inflation rate in % (solid black) against the average expected inflation in the cross-section of the given month (dashed green), as well as the average expected spending growth over the next 12 months (solid red) and real expected spending growth over the next 12 months (dotted black) for each of the initial six countries covered by the CES since April 2020 as well as the five additional countries since April 2022.

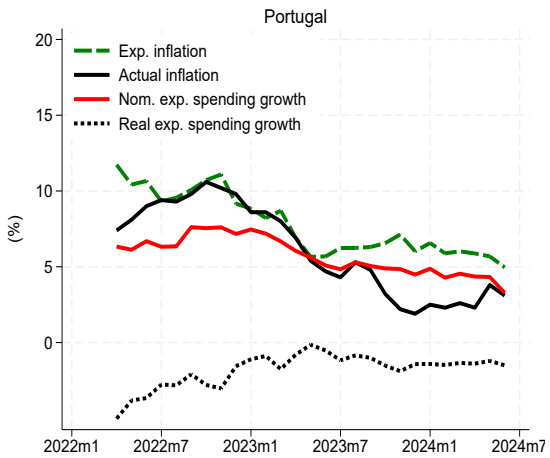

Belgium
Germany
Spain
France
Italy
Netherlands
Exp. inflation
Actual inflation
Nom. exp. spending growth
Real exp. spending growth
(%)
20
15
10
5
0
2020m1
2021m1
2022m1
2023m1
2024m1


Austria
Exp. inflation
Actual inflation
Nom. exp. spending growth
Real exp. spending growth
(%)
20
15
10
5
0
2022m1
2022m7
2023m1
2023m7
2024m1
2024m7


Greece
(%)
20
15
10
5
0
2022m1
2022m7
2023m1
2023m7
2024m1
2024m7


Finland
Exp. inflation
Actual inflation
Nom. exp. spending growth
Real exp. spending growth
(%)
20
15
10
5
0
2022m1
2022m7
2023m1
2023m7
2024m1
2024m7


Ireland
Exp. inflation
Actual inflation
Nom. exp. spending growth
Real exp. spending growth
(%)
20
15
10
5
0
2022m1
2022m7
2023m1
2023m7
2024m1
2024m7


Portugal
Exp. inflation
Actual inflation
Nom. exp. spending growth
Real exp. spending growth
(%)
20
15
10
5
0
2022m1
2022m7
2023m1
2023m7
2024m1
2024m7

C Robustness checks

C.1 Excess sensitivity of consumption growth to anticipated income changes

	Dependent variable: Real Spending growth expectations					
	Panel regressions			IV-Panel regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
Infl. Exp.	-0.74***	-0.74***	-0.77***	-0.67***	-0.67***	-0.73***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)
Real Inc. Exp.	0.059***	0.060***	0.062***	0.089***	0.089***	0.081***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)
R^2	0.375	0.377	0.369	0.375	0.377	0.369
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Ind. FE	No	No	Yes	No	No	Yes
N	608869	608869	608869	608869	608869	608869

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Results for excess sensitivity

Notes: Like baseline results but additionally included a covariate in the form of real income growth expectations. This table presents estimation results from our baseline specification in equation (4). The dependent variable is the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's point forecast of inflation over the next 12 months as the measure of subjective expected inflation. The right panel reports results based on an IV estimator using the respondent's qualitative expectations of future inflation as the instrument. Columns (1) and (4) report results with country, time fixed effects, and random effects. Columns (2) and (5) report results when additionally controlling for income, age, gender, education, household size, number of children, and partnership. Columns (3) and (6) employ individual fixed effects. Standard errors, clustered at the household level, are reported in parentheses. The sample period is 2020:04 – 2024:06.

C.2 Interest rate expectations

Dependent variable: Real Spending growth exp.	Panel regressions		
	(1)	(2)	(3)
Real Rate Exp.	0.71***	0.71***	0.72***
	(0.003)	(0.003)	(0.003)
R^2	0.317	0.321	0.308
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Controls	No	Yes	Yes
Ind. FE	No	No	Yes
N	563761	563761	563761

Std. Err. in parentheses, *** $p < 0.01$.

Table 7: Baseline results

Notes: This table presents a robustness check for the baseline estimation results. The dependent variable is still the respondent's forecast of expected household spending growth over the next 12 months. The explanatory variable of interest is, however, not the respondent's point forecast of inflation over the next 12 months but the difference between the expected rate on mortgages less of the respondent's point forecast of inflation over the next 12 months. Column (1) reports results with country, time fixed effects, and random effects. Column (2) reports results when additionally controlling for income, age, gender, education, household size, number of children, and partnership. Column (3) employs individual fixed effects. Standard errors, clustered at the household level, are reported in parentheses. The sample period is 2020:04 – 2024:06.

C.3 Pooled OLS regressions and sample weights

	Dependent variable: Real Spending growth expectations			
	Pooled OLS		Pooled OLS with sample weights	
	(1)	(2)	(3)	(4)
Infl. Exp.	-0.70***	-0.70***	-0.71***	-0.71***
	(0.004)	(0.004)	(0.005)	(0.005)
R^2	0.371	0.373	0.372	0.374
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Controls	No	Yes	No	No
N	627797	627797	627797	627797

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Baseline results

Notes: This table presents estimation results from our baseline specification in equation (4) using Pooled OLS regressions. The dependent variable is the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's point forecast of inflation over the next 12 months as the measure of subjective expected inflation. The right panel reports results based on pooled OLS regression with sample weights. Columns (1) and (3) report results with country and time fixed effects. Columns (2) and (4) report results when additionally controlling for income, age, gender, education, household size, number of children, and partnership. Standard errors, clustered at the household level, are reported in parentheses. The sample period is 2020:04 – 2024:06.

C.4 Using probability density inflation expectations as the main independent variable

	Dependent variable: Real Spending growth expectations					
	Panel regressions			IV-Panel regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
Infl. Exp.	-0.79***	-0.79***	-0.82***	-0.61***	-0.62***	-0.68***
	(0.003)	(0.003)	(0.003)	(0.006)	(0.006)	(0.006)
R^2	0.180	0.181	0.173	0.180	0.181	0.172
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Ind. FE	No	No	Yes	No	No	Yes
N	608249	608249	608249	608249	608249	608249

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Results using density means as dependent variable

Notes: This table presents estimation results as in our baseline results but when using a different explanatory variable. The dependent variable is still the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's average density forecast of inflation over the next 12 months as the measure of subjective expected inflation. The right panel reports results based on an IV estimator using the respondent's qualitative expectations of future inflation as the instrument. Columns (2) and (5) report results when additionally controlling for income, age, gender, education, household size, number of children, and partnership. Columns (3) and (6) employ individual fixed effects. Standard errors, clustered at the household level, are reported in parentheses. The sample period is 2020:04 – 2024:06.

	Dependent variable: Real Spending growth expectations					
	Panel regressions			IV-Panel regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
Infl. Exp.	-0.77***	-0.77***	-0.82***	-0.61***	-0.61***	-0.68***
	(0.003)	(0.003)	(0.003)	(0.006)	(0.006)	(0.006)
Infl. Exp. Variance	0.14***	0.15***	0.066***	0.22***	0.22***	0.11***
	(0.006)	(0.006)	(0.008)	(0.007)	(0.007)	(0.009)
R^2	0.186	0.187	0.176	0.188	0.190	0.178
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Ind. FE	No	No	Yes	No	No	Yes
N	608249	608249	608249	608249	608249	608249

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Results using density means and measures of second order moments

Notes: This table presents estimation results as in our baseline results but when using a different explanatory variable. The dependent variable is still the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's average density forecast of inflation over the next 12 months as the measure of subjective expected inflation while including measures of second order moments of the subjective distributions expressed by respondents. The right panel reports results based on an IV estimator using the respondent's qualitative expectations of future inflation as the instrument. Columns (2) and (5) report results when additionally controlling for income, age, gender, education, household size, number of children, and partnership. Columns (3) and (6) employ individual fixed effects. Standard errors, clustered at the household level, are reported in parentheses. The sample period is 2020:04 – 2024:06.

D Heterogeneity across survey rounds

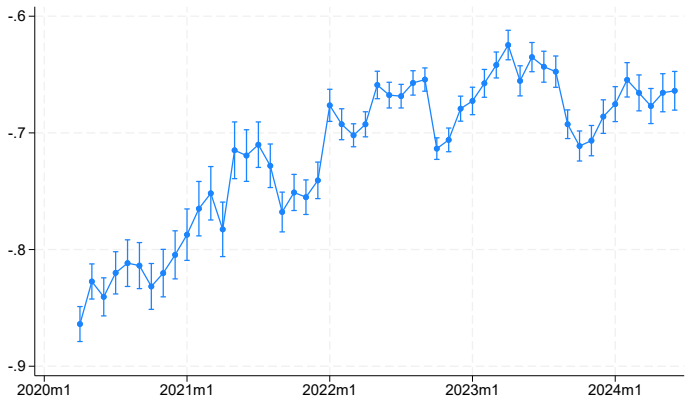


Figure 7: Heterogeneity in all countries covered by the CES

Notes: This figure shows the estimated values with 90% confidence intervals of the EIS at the euro area level per survey round over time. The dependent variable is the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's point forecast of inflation over the next 12 months as the measure of subjective expected inflation. Country fixed effects are included. The sample period is 2020:04 – 2024:06.

D.1 Heterogeneity across survey rounds per country

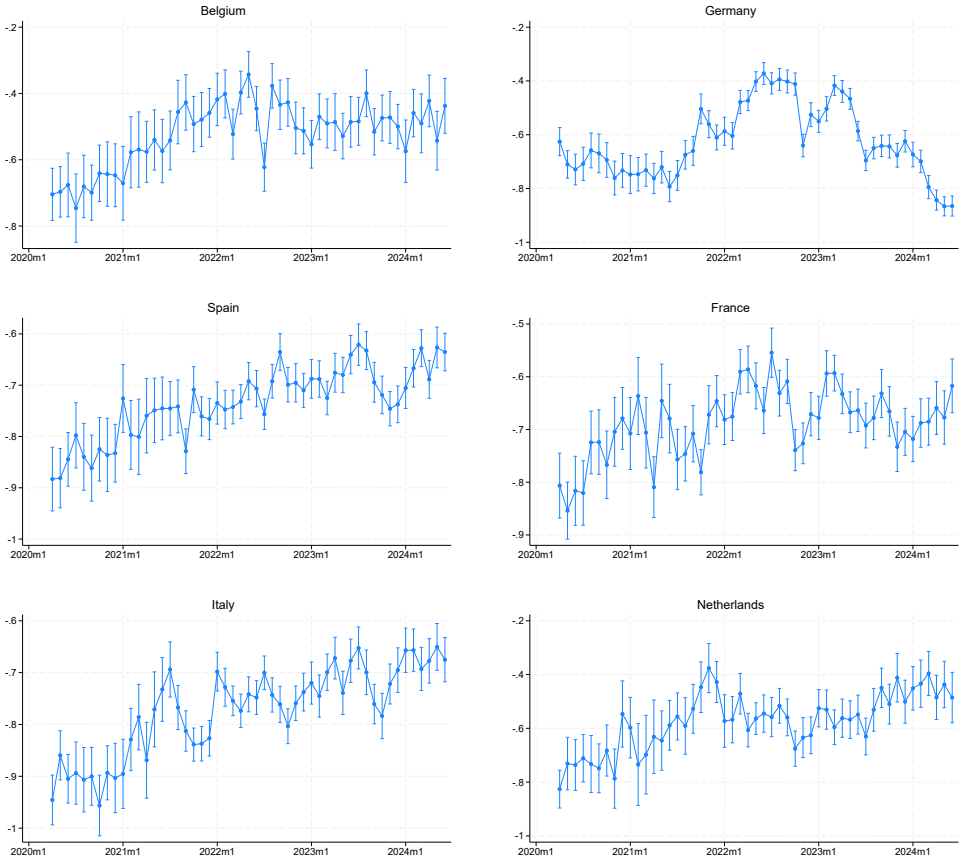


Figure 8: Varying estimates across countries per survey round

Notes: This figure shows the estimated values with 90% confidence intervals of the EIS for each of the initial six countries in the CES per survey round by applying an OLS in the cross section of the given country and given month. The dependent variable is the respondent's forecast of expected household spending growth over the next 12 months. We use the respondent's point forecast of inflation over the next 12 months as the measure of subjective expected inflation. No fixed effects are included. The sample period is 2020:04 – 2024:06.