THE EFFECT OF MACROECONOMIC UNCERTAINTY ON HOUSEHOLD SPENDING

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First Draft: February 23, 2021
This Draft: September 2, 2021

Abstract: Using a new survey of European households, we study how exogenous variation in the macroeconomic uncertainty perceived by households affects their spending decisions. We use randomized information treatments that provide different types of information about the first and/or second moments of future economic growth to generate exogenous changes in the perceived macroeconomic uncertainty of some households. The effects on their spending decisions relative to an untreated control group are measured in follow-up surveys. Higher macroeconomic uncertainty induces households to reduce their spending on non-durable goods and services in subsequent months as well as to engage in fewer purchases of larger items such as package holidays or luxury goods. Moreover, uncertainty reduces household propensity to invest in mutual funds. These results support the notion that macroeconomic uncertainty can impact household decisions and have large negative effects on economic outcomes.

"Volatility, according to some measures, has been over five times as high over the past six months as it was in the first half of 2007. The resulting uncertainty has almost surely contributed to a decline in spending." CEA Chair Christina Romer (2009)

1   Introduction

"Almost surely." The idea that high uncertainty induces households to spend less and firms to reduce their investment and employment is intuitive and consistent with many theoretical models. It is also omnipresent in policymakers' discussions of the economy, particularly during times of crisis. Yet, as emphasized in Bloom's (2014) survey of the literature on uncertainty, the empirical evidence on these channels is at best "suggestive" and "more empirical work on the effects of uncertainty would be valuable, particularly work which can identify clear causal relationships."[1] In this paper, we use randomized control trials (RCTs) in a new large cross-country survey of European households to induce exogenous variation in the macroeconomic uncertainty perceived by households and study the *causal* effects of the resulting change in uncertainty on their spending relative to that of untreated households. We find that higher uncertainty leads to sharply reduced spending by households on both non-durables and services in subsequent months as well as on some durable and luxury goods and services. In short, we provide direct causal evidence that the "almost surely" can be safely dropped: higher uncertainty makes households spend less on average.

Our results are based on a new, population-representative survey of households in Europe implemented by the European Central Bank (ECB). This survey spans the six largest euro area countries and thousands of households. In September 2020, we made use of the significant dispersion in professional forecasts about GDP growth in the euro area and implemented information treatments to randomly selected subsets of respondents to affect their expectations and uncertainty about future economic growth. Some treatments primarily affected first moments of household expectations (e.g., by telling them about average professional forecasts of future GDP growth), some affected the second moments of their expectations (e.g., by telling them about the uncertainty in professional forecasts of future GDP growth), and some affected both (e.g., by telling them both about the average level and the uncertainty in professional forecasts of future

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[1] Earlier reviews of the literature reported the same key challenge. Browning and Lusardi (1996) observed, "The central problem that faces anyone who wishes to determine the role of pre- cautionary saving in this way is to identify some observable and exogenous source of risk that varies significantly across the population. … The exogeneity issue is the most problematic." Carroll and Kimball (2008) also concluded, "A problem that plagues all these efforts [to estimate the effects of uncertainty on consumption] is identifying exogenous variations in uncertainty across households."

growth). The differential effects of these information treatments on the first and second moments of households' growth expectations allow us to identify *exogenous* variation in the perceived macroeconomic uncertainty of households. With follow-up surveys that measured household spending along different dimensions, we can then characterize the extent to which changes in uncertainty drive household spending decisions.

Our main result is that higher uncertainty, holding constant the first moment of expectations, reduces the spending of households over the next several months. The effect is economically large. In contrast, we find little effect of the first moment of expectations on household spending. As emphasized in Bloom (2014), a central challenge in the uncertainty literature has been separately identifying the effects of expectations about first and second moments, since most large uncertainty events are also associated with significant deteriorations in the expected economic outlook. Our results suggest that, at least when it comes to households, it is uncertainty that is driving declines in spending rather than concerns about the expected path of the economy. These declines in spending stemming from rising uncertainty mainly regard discretionary spending such as health and personal care products and services, entertainment, holidays and luxury goods. Spending is most affected by uncertainty for those individuals working in riskier sectors, as well as households whose investment portfolios are most exposed to risky financial assets. We also find that when individuals face higher uncertainty, they report that they would be less likely to allocate new financial investments to mutual funds or cryptocurrencies. These results indicate that macroeconomic uncertainty affects not just spending decisions but also likely portfolio allocations. On the other hand, we show that (exogenously induced) uncertainty does not influence household attitudes towards investing in real estate.

These results contribute to a growing literature on uncertainty building on the seminal work of Bloom (2009). Work in this literature has focused empirically on how to measure uncertainty and quantify the effect of uncertainty on aggregate conditions (e.g., Bloom et al. 2018; Baker, Bloom and Davis 2016; Jurado, Ludvigson and Ng 2015; Berger, Dew-Becker and Giglio 2019) and theoretically on understanding the different channels through which uncertainty can affect decision-making (e.g., Leduc and Liu 2016, Basu and Bundick 2017). Much of this work has emphasized the effect of uncertainty on firms' decisions (Guiso and Parigi 1999; Bloom, Bond and van Reenen 2007; Baker, Bloom and Davis 2016; Gulen and Ion 2016). There has been more limited research with mixed results on how households respond to uncertainty. Ben-David et al.

(2018), for example, find that U.S. households who are more uncertain about future economic outcomes are more cautious in their consumption and investment decisions, while Khan and Knotek (2011) conclude that uncertainty shocks have only modest effects, at best, on household spending. Christelis et al. (2020b), using Dutch survey data, find that household uncertainty about future consumption induces a strong precautionary savings behavior. Dietrich et al. (2020) consider the possible implications of the rise in uncertainty during the COVID-19 pandemic.

A key challenge in the uncertainty literature is identifying exogenous variation in uncertainty, since large uncertainty episodes are typically associated with events that affect first moments as well as second moments (e.g., 9/11 attacks, Brexit, etc.). Baker, Bloom, and Terry (2020) utilize natural experiments like political shocks or natural disasters to try to identify uncertainty shocks. A more common strategy is to utilize timing restrictions in VARs (e.g., Caldara et al. 2016, Jurado, Ludvigson and Ng 2015, Bachmann, Elstner and Sims 2013). In contrast to this earlier body of work, we apply RCT methods to help identify exogenous changes in uncertainty. To the best of our knowledge, we are the first to apply such methods to create exogenous variation in the uncertainty of households that can then be used to characterize how uncertainty affects spending and portfolio decisions. Moreover, given that we use micro data we can explore the likely heterogeneous effects that uncertainty has across various population segments.

Our paper is part of a broader research agenda that is incorporating RCT methods in large scale surveys of households and firms to address macroeconomic questions. Roth and Wohlfart (2020), for example, use information treatments about the economic outlook to study how households' expectations about future growth affect their consumption plans. Armantier et al. (2016) and Cavallo, Cruces and Perez-Truglia (2017) study how different types of information about inflation or monetary policy affect households' inflation expectations. Coibion, Gorodnichenko and Weber (2019) and Coibion et al. (2019) follow a similar strategy to show that exogenous variation in households' inflation expectations affect their subsequent spending decisions. D'Acunto, Fuster, and Weber (2021) randomize the salience of minority representation on the FOMC to show that diversity salience helps anchor agents' macroeconomic expectations and trust in the central bank. Coibion, Gorodnichenko and Kumar (2018) use RCT methods to study how firms' expectations affect their subsequent pricing, investment and employment decisions. Relative to this earlier body of work, we are the first to use this identification strategy to characterize how economic uncertainty affects the spending decisions of households and their investment attitudes.

Our RCT results exploit a new monthly survey of households that provides harmonized information across the six largest euro area countries (Belgium, Germany, France, Italy, the Netherlands and Spain). The survey offers nationally representative data with interviews of approximately 10,000 households per wave. The survey covers a wide range of questions on household expectations and behavior, similar to the coverage of the Survey of Consumer Expectations run by the New York Federal Reserve, but its scale is significantly larger. In September 2020, we were able to implement a special-purpose survey beyond the regular survey modules. In this special survey, randomly selected households were provided with certain types of information (or no information) about either euro area GDP growth, uncertainty about that future growth, or country-specific measures of growth. Subsequent waves in October 2020 and January 2021 allowed us to assess whether household spending and investment varied with the information treatments.

Our results support one of the main mechanisms via which uncertainty is thought to affect macroeconomic outcomes: changing household spending. The clear evidence we document on household spending speaks directly to policy discussions involving the extent to which high levels of uncertainty may depress economic activity. Our treatments provide information to households about forecasts and disagreement among professional forecasters for euro area growth without any reference to COVID-19. As we show, these information treatments introduce sufficient variation in household expectations and uncertainty to identify the effects of *both* the first and second moments on household behavior. The COVID-19 epidemic has been associated with exceptionally high levels of uncertainty for certain groups of households and has contributed to a reduction in their spending (Binder 2020). Yet, our inference is not driven by pandemic-induced uncertainty *per se* as households impacted by the pandemic are equally represented in the control and treatment groups. Still, our treatments may induce disproportionally more macroeconomic uncertainty for households that are susceptible to the effects of COVID-19. In view of this, we also use our approach to shed light on such heterogeneous treatment effects by considering households with a different exposure to COVID-19 (e.g., split households by sector of employment).

The paper is organized as follows. Section 2 describes the survey. Section 3 presents results on how the information treatments affect expectations. Section 4 then provides evidence on the extent to which exogenous changes in uncertainty change household spending and investment decisions. Section 5 concludes.

2.   Data and Survey Design

We use micro data from the ECB's Consumer Expectations Survey (CES), a new online high-frequency panel survey measuring euro area consumer expectations and behavior. The new survey builds on recent international experiences and advances in survey methodology and design, as reflected, for example, in the New York Fed's Survey of Consumer Expectations (SCE). The CES has a number of novel features that make it easier to explore the transmission of economic shocks in the euro area via the household sector. In what follows we provide a brief summary of the main survey features. Georgarakos and Kenny (2021) provide a more detailed description of the CES and ECB (2021) contains a first evaluation of the survey.

The CES was launched in a pilot phase in January 2020 and quickly achieved its target sample size of approximately 10,000 households by April 2020. Households are interviewed on a monthly basis in the six largest euro area economies: Belgium, France, Germany, Italy, the Netherlands and Spain. The sample is comprised of anonymized household-level responses from approximately 2,000 households in France, Germany, Spain and Italy and 1,000 households in Belgium and the Netherlands. Respondents are invited to answer online questionnaires every month and leave the panel between 12 and 18 months after joining. Three out of four participants in the four largest euro area countries are recruited by phone via random dialing while the remainder are drawn from existing samples. Survey weights are employed to help ensure that the data are nationally representative. As the six countries currently covered by the CES account collectively for more than 85% of the euro area GDP, the survey also provides good coverage for the overall household sector in the euro area.

Each respondent completes a background questionnaire upon survey recruitment. This provides a range of important information that hardly changes on a monthly frequency (e.g., family situation, household annual income, accumulated wealth). More time-sensitive information, e.g., on expectations, is collected in a series of monthly, quarterly and special-purpose questionnaires. Our results are based on four specific waves of the survey (August, September and October 2020 as well as January 2021). The September wave was augmented to incorporate a special-purpose survey in which we implemented our RCT and asked additional questions.

Table 1 provides descriptive statistics about respondents. For example, the average age of the respondent is 49 and the average household after-tax income is 34.4 thousand euro per year for an average household size of 2.6. Around 46% of respondents are working full-time with another

13% working part-time, 24% are out of the labor force, while the remaining 17% are either looking for a job or on leave from work (either temporarily or long-term). Most respondents are quite educated, with 53% reporting that they had completed some tertiary schooling. The sample is balanced across treatment arms (e.g., we can't reject equality of means for any given variable across treatment groups).

The additional questions focus partly on the expectations of households about aggregate economic growth, both in levels and in terms of uncertainty.[2] To measure their initial beliefs about euro area growth, we first ask the following question (Appendix C provides the questionnaire):

> *"Please give your best guess about the <u>lowest</u> growth rate (your prediction for the most pessimistic scenario for the euro area growth rate over the next 12 months) and the <u>highest</u> growth rate (your most optimistic prediction)."*

From the answers about how low and how high economic growth (denoted with y_m and y_M respectively) could potentially be, we compute the moments of the subjective distribution of economic growth by assuming that it follows a simple triangular distribution around $(y_m + y_M)/2$ (see Guiso, Jappelli and Pistaferri 2002). Based on the elicited values for y_m, y_M, we compute the household-specific mean forecast of growth and the uncertainty in their forecast as the standard deviation of the distribution of expected economic growth. The formulas of these statistics are reported in Appendix B.[3]

Summary statistics from this question are reported in Table 2. We present both the raw mean, uncertainty, and cross-sectional standard deviations across all respondents and within each country, as well as Huber-robust versions of these moments to systematically control for outliers. The average forecast of growth of the euro area was around 0.2% with a large standard deviation of 12.3%. Using robust methods yields a mean forecast of 1.5% and a cross-sectional standard deviation of 6.5%, indicating pervasive disagreement across households. Households are also very uncertain, with the Huber-robust average household level of uncertainty being 1.5%. But just as

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[2] Because time allocated to the special-purpose (RCT) module in the September wave of the survey was limited and questions eliciting probability distributions are cognitively demanding, we could measure uncertainty for only one macroeconomic variable.

[3] Following their answers to this question, respondents are also asked a more cognitively demanding question, namely to assign a probability of growth being higher than the average of the two: *"What do you think is the percentage chance that the growth rate of the euro area economy over the next 12 months will be greater than ([low growth rate]+[high growth rate])/2%?"* We use this information to calculate a split triangular distribution and we check the robustness of our baseline results when such distribution is assumed; e.g., compare Table 4 (symmetric triangular distribution) and Appendix Table 3 (flexible triangular distribution).

with the mean forecasts, there is a lot of heterogeneity across households in the amount of uncertainty associated with their forecasts, indicating that some households are quite confident in their beliefs while others are extremely uncertain.

This heterogeneity in beliefs can also be seen in Figure 1. Panel A plots the distribution of mean forecasts across all countries as well as by country, and Panel B does the same for the distribution of uncertainty in forecasts. In terms of mean forecasts, we can observe some significant differences across countries. For example, the mean forecasts of Belgian and Dutch households are significantly more pessimistic than those of Italian and Spanish households although the cross-sectional dispersion in forecasts is broadly similar. Panel B confirms that while many households are relatively confident in their forecasts, there is a large tail of people who report much more uncertainty in their forecasts about future euro area growth. Germans report the highest level of uncertainty on average, after adjusting for outliers, but all countries display significant heterogeneity in the degree of macroeconomic uncertainty across their citizens. Generally, households with more extreme negative/positive views for the growth rate of GDP in the euro area have higher uncertainty in their forecasts (Appendix Figure 1).

Following the initial measurement of household views about the macroeconomic outlook for the euro area, the information treatment was implemented. Households were randomly allocated to one of five groups. The first was a control group that received no information. The second group (Treatment 1) was told about the average professional forecast for euro area growth:

> *"The **average** prediction among professional forecasters is that the euro area economy **will grow at a rate of 5.6%** in 2021. By historical standards, this is a strong growth."*

The treatment includes both a quantitative forecast (5.6% for 2021) as well as a qualitative one ("strong growth"). The combination of quantitative and qualitative information was designed to provide a clear positive signal about the first moment to recipients. Note that this and subsequent treatments provide households with *publicly* available information and hence there should be zero response to the treatments if households have full-information rational expectations (FIRE). Thus, any response of expectations to this treatment indicates a departure from FIRE.

The third group (Treatment 2) received information about the amount of disagreement across professional forecasters. Specifically, the information provided was

> *"Professional forecasters are uncertain about economic growth in the euro area in 2021, with **the difference between the most optimistic and the most pessimistic predictions being 4.8 percentage points**. By historical standards, this is a big difference."*

As with the previous information treatment, the statement includes both quantitative and qualitative information about disagreement. The purpose was to make clear that the provided level of disagreement across professionals was high because households might not be familiar with the extent to which professionals disagree about the outlook. Although disagreement is different from uncertainty, during the sample period high disagreement was accompanied by high uncertainty, and hence this treatment was meant to make clear to households that the economic outlook was particularly uncertain. At the same time, the ranges $(y_M - y_m)$ reported by households (the mean range is 9.5 percentage points and the Huber robust mean for the range is approximately 6.5 percentage points) suggest that households were even more uncertain than professional forecasters. One should also note that the two quoted numbers in the first two treatment arms (5.6 and 4.8) look comparable in terms of magnitude, thus it is unlikely that the effects we estimate are driven by biases due to size effects.

The fourth group (Treatment 3) was provided with a combination of the previous two, providing information about both the average forecast and disagreement among professional forecasts. Specifically, it read

> *"The **average** prediction among professional forecasters is that the euro area economy **will grow at a rate of 5.6%** in 2021. By historical standards, this is a strong growth. At the same time, professional forecasters are uncertain about economic growth in the euro area in 2021, with **the difference between the most optimistic and the most pessimistic predictions being 4.8 percentage points**. By historical standards, this is a big difference."*

As with the two previous treatments, both qualitative and quantitative information about the outlook was provided. The purpose of this treatment was to help identify any interaction effect of providing information about first and second moments of macroeconomic forecasts on households' beliefs and decisions.

The final group (Treatment 4) was told about disagreement among professional forecasters about the economic outlook of the specific country in which a given household resides:

> *"Professional forecasters are uncertain about economic growth in the country you are living in in 2021, with **the difference between the most optimistic and the most pessimistic predictions being <X%> percentage points**. By historical standards, this is a big difference."*

The purpose of this treatment was to protect against the possibility that households would be unaffected by information about the euro area. Providing information about their country was therefore a way to assess whether they placed disproportionate weight on country-specific information when thinking about the broader economic outlook. On the other hand, the design of this treatment arm implies that there is significant variation in the intensity of the underlying treatment information by country (e.g., the professional forecasters' disagreement that is communicated to respondents varies from 5.2 percentage points in France to 8.4 percentage points in Spain).

Following the information treatments (the control group goes straight to the rest of the survey), respondents were asked a few follow-up questions to measure the instantaneous effect of the treatments. In particular, we aim to again measure households' expected output growth and their uncertainty but without re-using the exact same question (to avoid survey fatigue). We do so by first asking the following:

> *"What do you think will be the approximate growth rate in the euro area **over the next 12 months** for each of the scenarios below? We start with your prediction for the most pessimistic scenario for the euro area growth rate over the next 12 months (LOWEST growth rate) and end with your most optimistic prediction (HIGHEST growth rate)."*

Respondents are then asked to provide specific growth rates for three different scenarios: the lowest outcome scenario, a medium scenario, and the highest outcome scenario. Once they have provided forecasts of growth rates for each scenario, we then ask them to assign probabilities to each scenario:

> *"Please assign a **percentage chance** to each growth rate to indicate how likely you think it is that this growth rate will actually happen in the euro area economy over the next 12 months. Your answers can range from 0 to 100, where 0 means there is absolutely no chance that this growth rate will happen, and 100 means that it is absolutely certain that this growth rate will happen. The sum of the points you allocate should total to 100."*

This question follows the structure developed by Altig et al. (2020) to measure the uncertainty of firms about their future sales. Unlike them, we restrict the set of scenarios to three rather than five to simplify the question for households. This question allows us to measure both mean forecasts and the uncertainty of the forecasts for each household without repeating the same triangular question used to extract prior beliefs.

Finally, in every quarter households are asked to report their spending over the previous month for a range of different categories including: 1) food, beverages, groceries, tobacco; 2)

restaurants, cafes, canteens; 3) housing (incl. rent); 4) utilities; 5) furnishing, housing equipment, small appliances and routine maintenance of the house; 6) debt payment; 7) clothing, footwear; 8) health care and personal care products; 9) transport; 10) travel, recreation, entertainment and culture; 11) education; and 12) other. The survey design for this question follows that of the American Life Panel (ALP). That is, after they insert the amounts, respondents see a summary screen displaying spending by category and the implied total monthly spending. Subsequently, respondents can double check and amend the originally provided figures (see Appendix C). We measure total non-durable consumption as the sum of the total amount spent on these categories excluding debt payments.

Making use of the panel structure of the survey, we utilize information on non-durable consumption from the quarterly module in October 2020. It is worth noting that reported amounts refer to consumption in September, i.e., the period following the implementation of our RCT. This way, we are able to track the spending behaviour of households in the immediate aftermath of our RCT by relying on an independent module that was fielded one month later and thus our findings are less likely to suffer from short-term framing effects that information treatments may create. In addition, we use equivalent spending measures reported in the January 2021 wave (i.e., referring to spending three months after the treatment). This allows tracking both the immediate and more persistent effects of changes in uncertainty on household spending and helps rule out survey demand effects that have been shown to be small in settings like ours (De Quidt et al 2018).

While self-reported spending naturally has some associated measurement error due to rounding and the difficulty of recalling spending on specific categories with precision, the quality of the reported information has generally been found to be high (see ECB 2021). Similarly, Coibion, Gorodnichenko and Weber (2019) document consistency between self-reported spending and scanner-tracked spending of U.S. households participating in the Nielsen Homescan Panel. In any case, one should note that the RCT is robust by design to measurement error as respondents who are more prone to misreport their spending are equally represented (due to randomization) in the control and treatment groups.

In addition to this non-durable consumption measure, households were asked in October if they had purchased any of the following large durable or luxury goods over the previous month: 1) house; 2) car; 3) other durable goods (e.g., home appliance, furniture, electronic items incl. gadgets); 4) travel vacation; or 5) luxury goods (e.g., jewellery, watches). Jointly, these questions allow us to assess whether expectations about future aggregate economic conditions, in terms of

both first and second moments, lead to changes in monthly spending on non-durable goods and services and/or on larger durable good purchases.

Finally, in order to assess whether such expectations are likely to impact household investment behavior, we ask respondents to complete a hypothetical portfolio allocation task. In particular, after the information treatments, households are asked to characterize how they would invest hypothetical funds across different financial asset classes. Specifically, they were asked:

> *"Imagine that you receive €10,000 to save or invest in financial assets. Please indicate in which of the following asset categories you will save/invest this amount."*

The categories among which they can choose to invest are: 1) current and savings accounts; 2) stocks and shares; 3) mutual funds and collective investments; 4) retirement or pension products; 5) short term bonds; 6) long term bonds; and 7) Bitcoin or other crypto assets. Moreover, respondents were asked in the October wave of the survey to indicate on a 1 ('very bad') to 5 ('very good') scale their views on investment in real estate:

> *"Is buying real estate in your neighbourhood today a good or a bad investment?"*

We utilize information from this question to examine whether first and second moment expectations about economic growth causally affect household views on investing in real estate.

3.   The Effects of Information Treatments on Expectations

The key to characterizing whether and how uncertainty affects economic decisions is identifying exogenous variation in uncertainty. Our RCT approach was designed precisely for this purpose by using information treatments that provide different types of information about first and second moments of economic activity in the euro area.

To assess the effects of different information treatments on expectations, we run regressions of the form:

$$Post_i = a_0 + b_0 Prior_i + \sum_{j=1}^{4} a_j \times I\{i \in Treat\ j\}$$
$$+ \sum_{j=1}^{4} b_j \times I\{i \in Treat\ j\} \times Prior_i + error_i, \tag{1}$$

where i denotes respondent, $Prior_i$ denotes the respondent's prior belief, $Post_i$ refers to the respondent's posterior belief, and $I\{i \in Treat\ j\}$ is an indicator variable if respondent i is in

treatment group j. The omitted category is the control group, so that coefficients $\{a_j\}_{j=1}^{4}$ and $\{b_j\}_{j=1}^{4}$ can be interpreted as being relative to the control group. We run these regressions for beliefs about the level of future economic growth and the uncertainty about economic growth separately. In each case, we use Huber-robust regressions to systematically control for outliers and we also control for country fixed effects. We also eliminate roughly 14% of households that according to para-data spent virtually no time (less than three seconds) on the screen showing the information treatments.

By regressing posterior beliefs on prior beliefs, this specification is consistent with Bayesian learning in which agents form beliefs as a combination of their priors and the signals they receive. As discussed in Coibion, Gorodnichenko and Kumar (2018), the weight on their prior belief (coefficients b) is an indication of how noisy/informative they perceive the signals to be. The coefficient on the prior belief for treated households ($b_0 + b_1, b_0 + b_2, b_0 + b_3, b_0 + b_4$) should generally be between 0 and 1, with a value of 1 indicating that no weight is being assigned to new information and full weight is being assigned to prior beliefs. A coefficient of zero on priors for treated households indicates that agents are changing their beliefs fully to the provided signal regardless of their prior beliefs. We allow this slope coefficient to vary across treatment groups. This variation informs us about the extent to which agents respond to different signals in updating their beliefs. Coefficients $\{a_j\}_{j=1}^{4}$ inform us where the signal is relative to the average prior belief.

We present results of these regressions in Table 3, for mean expectations in columns 1-3 and uncertainty about growth in columns 4-6, both for the full sample (columns 1 and 4) as well as for households in the Northern countries of Belgium, France, Germany, and the Netherlands (columns 2 and 5) and for households in the Southern countries of Spain and Italy (columns 3 and 6). Looking first at the results for the control group (row 1), we see that the coefficients on prior beliefs are approximately 0.75 for growth expectations and 0.60 for uncertainty. Given that this group is provided no information, one might expect the slope coefficient to be 1. But because the prior and posterior expectations are measured using different questions, the noise introduced by this approach leads to a benchmark coefficient on priors which is less than 1.[4] These results are indistinguishable across regions.

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[4] Coibion, Gorodnichenko and Weber (2019) document that using closer wordings of questions results in estimated slopes of one for the control group. Because our objective is to estimate the causal effect of uncertainty on consumer choices rather than the response of beliefs to information treatments, it suffices for our purposes that treatments generate exogenous variation in beliefs.

Overall, the treatments are largely successful in generating variation in both the first and second moments of household beliefs. Considering first the effects on beliefs about the level of future growth (columns 1-3), we see that treatments 1 and 3 lead to large revisions in beliefs toward the provided signal, since the resulting coefficients on the prior beliefs for these treatments ($b_0 + b_1$ and $b_0 + b_3$) are less than 0.2. Thus, informing households about the forecast of professional forecasters for the future growth rate of the euro area (which is included in both treatments) leads households to significantly revise the first moment of their beliefs. Binscatter plots reported in Panel A of Figure 2 indicate that this result is not driven by outliers or parts of the distribution, and that the relationship is approximately linear across the whole range of priors. Since the coefficients on the two treatments are almost identical, this implies that the marginal effect of providing information about the disagreement among forecasters (which is included in treatment 3 but not treatment 1) once mean forecasts are included is minimal when it comes to the expectations of households for the future growth rate. A similar message comes from looking at the coefficients on the prior beliefs for households in treatments 2 and 4, which only provide information about disagreement among forecasters. In each case, the coefficient on the prior ($b_0 + b_2$ and $b_0 + b_4$) is only marginally smaller than it is for the control group (b_0). This result can also be seen clearly in Panel A of Figure 2, which plots the prior beliefs about future growth rates of respondents against their posterior beliefs in binscatter form separately for each treatment group. Beliefs for households receiving information only about the disagreement among forecasters line up very closely with those of the control group, indicating that this information does not lead households to change their views much about the first moments of growth. Intuitively, informing households about the range of possible outcomes in professional forecasts does not tell households where the central tendency is (e.g., a range of 5 percentage points is consistent with distribution [-5,0], [1,6], [10,15], etc.) and hence households have little basis for revising their point forecasts. In contrast, treatments 1 and 3 that include information about the mean forecasts of professionals clearly lead to much larger revisions in beliefs. Interestingly, households in Spain and Italy seem to respond more strongly to all of the treatments in terms of first moment beliefs than do households in Northern countries (column 2 vs. column 3 in Table 3).

Turning to the effects on uncertainty (columns 4-6), Table 3 documents that treatment 1, which only involved providing information about the mean forecast of professionals leads to large revisions in uncertainty of households, as the associated slope coefficient ($b_0 + b_1$) is less than

0.2. Providing information about the disagreement among professionals in addition to providing information about the mean forecast (treatment 3) further reduces the slope coefficient ($b_0 + b_3$) but not in a statistically significant way. For comparison, providing information *only* about disagreement among forecasters about euro area growth (treatment 2) leads to a large reduction in the slope coefficient relative to the control group, but not as large as that coming from treatment 1. Intuitively, although professional forecasters have a high level of disagreement, households have even more subjective uncertainty so that the disagreement treatment lowers uncertainty for households on average. Providing information only about disagreement among forecasters about growth in the respondent's home country has an even smaller effect on their uncertainty about euro area growth, indicating that households draw different inferences from country-specific information than they do from euro area information for euro area growth uncertainty. Unlike what was the case with households' forecasts of the level of growth, we see no meaningful differences in how people respond to treatments across geographic areas. Panel B of Figure 2 presents a visual depiction of these results with non-parametric (lowess) estimates of the relationship between posteriors and priors for uncertainty. We observe a similar pattern although the results suggest that the effects are particularly strong for households with high initial levels of uncertainty.[5] Treatment 1, despite only including information about the mean forecast of professionals, leads to pronounced revisions in uncertainty, surpassed only by the treatment which includes information about both professionals' forecasts in levels and disagreement. The treatment involving only disagreement about euro area growth (treatment 2) leads to significant revisions in beliefs, but less than the treatment involving only the mean forecast. Finally, the treatment about country-specific disagreement (treatment 4) has only limited effects on uncertainty.

In short, the information treatments lead to revisions in the beliefs of households about both the future level of growth and the uncertainty about growth. These revisions are in line with Bayesian learning where households learn about the mean and the variance of a random variable (DeGroot 1970). Importantly, these treatments do not lead to the same pattern of revisions across

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[5] If we use the log of uncertainty, Panel B of Figure 2 becomes linear like Panel A. Furthermore, because using the log allows us to decompress the distribution for low levels of uncertainty, one can see that households with low pre-treatment uncertainty become more uncertain when they are presented with the disagreement of professional forecasters (see Appendix Figure 2). In addition, the relationship between posteriors and priors becomes approximately linear. Using the log of uncertainty in subsequent results yields the same qualitative results as using the level of uncertainty. Because there is no strong a priori reason to use the log of uncertainty and using logs forces us to drop households that initially report zero uncertainty, we focus on level specifications.

treatments. The treatment involving country-specific forecaster disagreement conveys little information about either the level or uncertainty of future euro area growth. In contrast, the two treatments that include the first moment of growth have large effects on beliefs about both the level of growth and uncertainty about that growth. In turn, the treatment focusing on disagreement among professional forecasters about euro area growth has small effects on beliefs about the level of growth but large effects on uncertainty about growth. These treatment effects are useful both because they speak to the nature of the expectation formation process (e.g., strong responses to publicly available information imply a rejection of FIRE) and because they induce *strong, exogenous, and differential* movements in the first and second moments of households' beliefs about future growth. As a result, these treatments can serve as powerful instruments to help us identify how/whether uncertainty affects household decisions.

4.   The Effects of Uncertainty on Household Decisions

With a source of exogenous variation in beliefs about future economic growth and uncertainty in those beliefs, we are in a position to assess the extent to which those beliefs translate into the economic decisions of households. Specifically, we examine whether exogenous variation in macroeconomic expectations and uncertainty affects consumer spending on durable and non-durable goods as well as potential allocation of funds into various asset classes.

4.1   Spending on Non-durable Goods and Services

For the regular monthly spending of households, we regress their ex-post spending on beliefs:

$$(\log Spend_i) \times 100 = \alpha_1 Post_i^{mean} + \beta_1 Post_i^{uncert} + \alpha_0 Prior_i^{mean} + \beta_0 Prior_i^{uncert}$$
$$+ Controls + error_i, \tag{2}$$

where the dependent variable is the log of reported household spending in the last month, $Post_i^{mean}$ is the posterior (after treatment) belief of household i for the future growth rate of GDP in the euro area and $Post_i^{uncert}$ is the posterior (after treatment) uncertainty of household i about the future growth rate of euro area GDP. We control for prior beliefs ($Prior_i^{mean}$ and $Prior_i^{uncert}$) as well as a vector of household controls (age, household size, log income, education, liquidity status and country fixed effects). Note that equation (2) does not estimate a consumption Euler equation; instead, it is best interpreted as estimating the reduced-form ex-post response of consumption to changes in perceived macroeconomic uncertainty and outlook.

We then instrument for each set of posterior beliefs using the treatments as follows:

$$Post_i^{mean} = a_0 + \sum_{j=1}^3 a_j \times I\{i \in Treat\ j\} \tag{3'}$$

$$+ \sum_{j=1}^3 b_j \times I\{i \in Treat\ j\} \times Prior_i^{mean}$$

$$+ \sum_{j=1}^3 c_j \times I\{i \in Treat\ j\} \times Prior_i^{uncert}$$

$$+ error_i$$

$$Post_i^{uncert} = \tilde{a}_0 + \sum_{j=1}^3 \tilde{a}_j \times I\{i \in Treat\ j\} \tag{3''}$$

$$+ \sum_{j=1}^3 \tilde{b}_j \times I\{i \in Treat\ j\} \times Prior_i^{mean}$$

$$+ \sum_{j=1}^3 \tilde{c}_j \times I\{i \in Treat\ j\} \times Prior_i^{uncert}$$

$$+ error_i$$

Coefficient β_1 in specification (2) provides a measure of the total causal effect of macroeconomic uncertainty across a variety of channels (intertemporal substitution, income effects, potential changes in beliefs about other variables, etc.).[6] One can think of this instrumental variable approach as implementing the following thought experiment. We take two identical households with a given level of initial uncertainty. One household is randomly chosen and treated with information that leads this household to change its uncertainty (i.e., we generate an exogenous change in beliefs). We track this pair of households over time and measure differences in consumer spending between the treated and control households. This pair gives as a "data point" for how differences (if any) in consumption are related to differences in post-treatment beliefs. Then we take another pair of identical households with a different level of initial uncertainty. Again, we randomly choose a household and treat it with information that changes its uncertainty, potentially to a level that is different from the level that we obtained for the first pair. We track this second pair of households and measure consumption differences again. This gives us a second "data point". We repeat this exercise for pairs of households with different levels of initial uncertainty and then run a regression on our "data points". The slope of this regression corresponds to β_1 in specification (2). The estimate of β_1 has a causal interpretation because changes in beliefs are generated exogenously by our RCT. Note that our identification comes from comparing outcomes across treatment and control groups rather than measuring

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[6] We drop households that receive treatment 4 because this treatment has low predictive power for either set of posterior beliefs (as documented in Table 3). Because this treatment group was chosen at random, excluding this group does not matter for our estimates. Following Coibion, Gorodnichenko and Weber (2019) and Coibion et al. (2019), the first stage is estimated by Huber regression and a jackknife approach is used in the second stage to control for outliers in both stages.

before/after-treatment differences, thus minimizing noise that can arise from differencing consumption data (Griliches and Hausman 1986).

This thought experiment implicitly assumes that the treatment moves only uncertainty but this only reflects our desire to distill the intuition rather than a real constraint. As we document in the previous section, our information treatments move the first and second moments of households' beliefs about future aggregate output. To identify the causal effects α_1 and β_1, we do not need to have a given treatment to affect only one moment of beliefs. Instead, we only require to have multiple treatments that generate *differential* effects on the first and second moments. Indeed, the regression analysis does not require uncorrelated regressors to identify a given coefficient in a regression as it suffices to have imperfectly correlated regressors to estimate the effect of a regressor (holding everything else constant) on an outcome variable. The previous section shows that this condition is satisfied (i.e., we have multiple treatments with differential effects on the first and second moments of beliefs) and hence our instrumental variable regressions can identify the causal effect of uncertainty on households' choices.

Results for estimated equation (2) are reported in Table 4. First, the information treatments provide a strong source of variation in the first stage (column 1): the first-stage F-statistic for forecasts of the level of growth is around 130 while the first-stage F-statistic for uncertainty about growth is almost 30. Thus, the RCT approach is successful in generating strong exogenous variation in beliefs to help identify the causal effect of macroeconomic uncertainty on household spending.[7]

The main result of this regression is that higher uncertainty about euro area growth leads to lower household spending both immediately and over the course of subsequent months. The implied order of magnitude is large. Recall from Table 2 that the cross-sectional standard deviation of uncertainty is just above one percentage point. Thus, the estimated coefficient corresponds approximately to the effect of increasing uncertainty by one standard deviation. Table 4 suggests that a one standard deviation increase in uncertainty lowers monthly spending by almost 5 percentage points both on impact and three months later, a large and persistent effect.[8] This provides unique causal evidence that the macroeconomic uncertainty perceived by households negatively affects their spending.

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[7] P-values for over-identifying restrictions tests are comfortably above 10 percent.

[8] We implicitly assume that the effects of uncertainty on consumer spending are symmetric (that is, a unit increase in uncertainty lowers consumer spending by the same amount in absolute terms as a unit decrease in uncertainty raises consumer spending).

Our finding of a large negative effect of macroeconomic uncertainty on household complements and builds upon earlier evidence suggesting a negative link between the two. For example, Christelis et al. (2020b) estimate within an Euler equation framework that a one percentage point increase in the uncertainty perceived by households about their future consumption growth (measured as the variance implied by the reported distribution for consumption growth rate) is associated with approximately a one percentage point decrease in the growth rate of their consumption. These estimates are not directly comparable: the uncertainty measures are different (macroeconomic uncertainty in our case vs. a household's consumption uncertainty in Christelis et al.) as are the econometric specifications (we estimate a reduced form response of ex-post spending whereas Christelis et al. estimate consumption Euler equations), the settings (COVID-19 period in the euro area vs. the Netherlands in 2014-2015) and the identification strategy (we utilize an RCT to generate exogenous variation in uncertainty whereas they use income uncertainty as an instrument for consumption uncertainty).[9] Ben-David et al. (2018) regress an extensive margin for consumer spending ("will your everyday spending increase/decrease/stay the same?") on another measure of household uncertainty (they construct a measure of uncertainty that is a mix of micro- and macro-level uncertainty) in the Survey of Consumer Expectations. They find that a one percentage point increase in their measure of uncertainty is associated with 0.7 to 2.4 percentage point decrease in the share of people reporting that their everyday consumer spending will increase. Our results similarly point to a negative relationship between uncertainty and household spending but along the intensive margin of household spending, over different horizons, controlling for the first moment of expectations and using plausibly exogenous variation in uncertainty.

Although we do not estimate a structural parameter and hence interpretation of β_1 is potentially challenging, we can provide two gauges for $\hat{\beta}_1$. First, using a second-order approximation to the Euler equation, one can find that $\frac{\partial logC_{i,t+1}}{\partial E[std(\Delta logC_{i,t+1})]} \approx -p \times E[std(\Delta logC_{i,t+1})]$ where $E[std(\Delta logC_{i,t+1})]$ is household i's uncertainty about future consumption growth and p is Kimball's coefficient of relative prudence (see e.g. Christelis et al.

2020). In contrast, we estimate $\beta_1 = \frac{\partial log C_{i,t+1}}{\partial E[std(\Delta \log GDP_{t+1})]}$. If one can assume that GDP and consumption are close substitutes, then one can recover relative prudence p. Given that $\hat{\beta}_1 \approx -4.5$ and that the average uncertainty about future growth rate of GDP in the survey data is $E[std(\Delta \log GDP_{t+1})] \approx 1.5$, the implied p is approximately 3. If we assume a CRRA utility, then relative prudence is equal to risk aversion and our implied estimate of risk aversion would be close to earlier estimates in the literature (e.g., Barsky et al. 1997). Using subjective expectations of Dutch households, Christelis et al. (2020) estimate $p \approx 2$. Second, we can use macroeconomic data to measure how changes in uncertainty about future GDP growth affect consumption. Using the Jurado et el. (2015) measure of macroeconomic uncertainty as a sort of variation and uncertainty about future GDP growth from the Survey of Professional Forecasters,[10] we find (see Appendix D for details) for the U.S. that a one percentage point increase in uncertainty about future GDP growth is associated with -6.0 (s.e. 3.9) percentage point decline in aggregate consumer spending on nondurable goods, which is broadly in line with our RCT-based estimates.

In short, our findings imply that higher uncertainty leads households to reduce their spending by both statistically and economically significant amounts. This finding can rationalize why during the COVID-19 crisis when macroeconomic uncertainty was particularly high, households were reluctant to spend income support sent by the government (e.g., Coibion, Gorodnichenko and Weber 2020b). At the same time, we find little evidence that a higher expectation of economic growth in the euro area (the first moment of the macroeconomic forecast, coefficients reported in the first row of the table) by itself leads to significant changes in spending on non-durable goods and services (perhaps, households in the euro area do not see a connection between GDP growth and personal income growth conditional on having a job). This finding is notable because a major stumbling block in the uncertainty literature emphasized by Bloom (2014) and others has been separating first and second moment effects: big changes in macroeconomic uncertainty tend to also be accompanied by large changes in first moment expectations. Our approach allows us to distinguish between first and second moment effects because our instruments generate exogenous but differential variation in the two. Strikingly, only uncertainty seems to play an important role in changing household spending.

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[10] We measure uncertainty as the standard deviation implied by the average probability distribution for real GDP growth rate in the U.S. Survey of Professional Forecasters.

The other estimated coefficients are largely as expected. For example, we find that household spending increases with income, age and education. Larger households also tend to spend more per month. Similarly, households with sufficient liquid resources to meet an unexpected payment of one month of household income have higher spending.[11]

To shed light on a possible channel underlying the persistence of the macroeconomic uncertainty effects, we study how the treatments affect households' uncertainty about their personal income growth in survey waves fielded in subsequent months. Unlike euro area GDP growth rate expectations which were collected only in the September 2020 wave of the survey, personal income growth expectations are a part of the standard module of the CES so that this information is elicited at the monthly frequency. While micro- and macro-level expectations (and specifically uncertainty) are not perfect substitutes, one might expect that elevated macro-level uncertainty should likely translate into elevated micro-level uncertainty. We therefore estimate the following specification:

$$PostIncGrowth_i = \alpha_1 Post_i^{mean} + \beta_1 Post_i^{uncert} + \alpha_0 Prior_i^{mean} + \beta_0 Prior_i^{uncert}$$
$$+ \gamma PriorIncGrowth_i + Controls + error_i \qquad (4)$$

where $PostIncGrowth_i$ is the post-treatment uncertainty of household i about their personal income growth and $PriorIncGrowth_i$ is the corresponding pre-treatment uncertainty. We apply the same instrumenting strategy as before. Consistent with our conjecture, a ten-percentage-point increase in macro-level uncertainty raises micro-level uncertainty by approximately one percentage point for about two months after the treatment (columns 1 and 2 in Table 5) but the effect dissipates after three months (although we cannot reject the null of equality across all months). This persistence of information treatments is broadly in line with the persistence reported in earlier studies examining the persistence of information treatment effects on households' inflation expectations (e.g., Cavallo, Cruces and Perez-Truglia, 2017, Coibion, Gorodnichenko and Weber 2019, Coibion et al. 2019). Hence, one explanation for the persistent effect of uncertainty on household spending is that the change in uncertainty is itself somewhat persistent.

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[11] The liquidity indicator variable is based on the following question: "*Please think about your available financial resources, including access to credit, savings, loans from relatives or friends, etc. Suppose that you had to make an unexpected payment equal to one month of your household income. Would you have sufficient financial resources to pay for the entire amount?*" The indicator variable takes value one if the answer to the question is "yes" and zero otherwise.

Along what dimensions do households reduce their spending when their uncertainty increases? Table 6 presents results in which we regress the share of household spending that goes to a specific category on household beliefs, in the same way as done before with total spending:

$$BudgetShare_i^k = \alpha_1^{(k)} Post_i^{mean} + \beta_1^{(k)} Post_i^{uncert}$$
$$+\alpha_0^{(k)} Prior_i^{mean} + \beta_0^{(k)} Prior_i^{uncert} + Controls + error_i^{(k)}, \tag{5}$$

where $BudgetShare_i^k$ is the share (measured on 0 to 100 scale) of household i budget spent on non-durable category k. The results point toward two primary margins along which households reduce their spending. The first is health care and personal care products. The share of spending going to this category falls by about 0.7% for each extra unit of uncertainty. As described earlier, this category of spending includes a wide range of products of services, covering health insurance, medical exams and prescriptions but also more discretionary goods and services like personal care products (e.g. make-up, cologne) and services (e.g. haircuts). Note that, unlike the U.S., countries covered in the CES provide substantial government-run healthcare schemes with modest out-of-pocket spending for households. As a result, consumer spending in this category is heavily tilted to more discretionary spending. The second category of spending which bears the brunt from higher uncertainty is recreation, which here includes theater/movie tickets, gym memberships, etc. The share of spending going to recreation falls by about 0.8% with each extra unit of uncertainty. This category of spending is one that has experienced a particularly large decline over the course of the COVID-19 crisis (e.g., Dunn, Hood and Driessen 2020, Coibion, Gorodnichenko and Weber 2020a, Christelis et al. 2020a). While some of this decline is likely due to self-imposed isolation as well as lockdown policies, our results suggest that rising macroeconomic uncertainty may have also contributed to the decline in spending on these categories of goods.

4.2 Purchases of Larger Durables and Services

In addition to regular purchases done every month, households occasionally engage in much larger purchases of durable goods (e.g., cars, houses, refrigerators, luxury goods like jewelry) and services (vacations). The follow-up survey in October 2020 asked households whether they had engaged in any such purchases over the previous month. We can therefore assess whether changes in uncertainty made households more or less likely to buy these types of goods and services.

We estimate the effect of uncertainty on purchases of larger goods and services by regressing indicator variables for specific purchases on ex-ante expectations and household controls:

$$PurchDur_i^k \times 100 = \alpha_1^{(k)} Post_i^{mean} + \beta_1^{(k)} Post_i^{uncert} \tag{6}$$

$$+\alpha_0^{(k)} Prior_i^{mean} + \beta_0^{(k)} Prior_i^{uncert}$$

$$+\gamma(PlanDur_i^k \times 100) + Controls + error_i^{(k)},$$

where $PurchDur_i^k$ is an indicator variable equal to one if household i purchased a large durable good/service of type k in the previous month. This specification is therefore directly comparable to specification (2), except that we now focus on an extensive margin for purchasing large durable goods/services. Another difference is that we include an additional indicator variable ($PlanDur_i^k$) which represents households that reported in the previous wave (prior to the information treatments) that they plan to purchase large durable goods/services of type k in the next 12 months. Our approach is therefore effectively focusing on either surprise purchases or surprise postponement of purchases. Given that large purchases are relatively infrequent, conditioning on whether any purchases are planned or not helps yield more precise estimates, although the time horizon for the question about planned purchases is longer than one month. As before, we instrument for posterior beliefs about the level of future euro area growth and the uncertainty around those beliefs using the information treatments and their interactions with household priors.

Our results (Table 7) again point to a negative causal link between uncertainty and household spending, but this time in terms of purchases of larger/durable goods and services. In particular, we find that higher uncertainty of one percentage point reduces the probability of a household having purchased a holiday package by nearly three percentage points and reduces the probability that they purchased a large luxury product (like expensive jewelry) by one percentage point. The coefficients for other categories of durable goods are also negative but are not statistically significant. This likely reflects, in part, the fact that there are fewer purchases of these goods (especially cars and houses) observed in the data which makes the estimation less precise. Note that controlling for a plan to buy a durable/luxury good/service summarizes a lot of information thus making other controls (education, income, etc.) less powerful predictors for purchases of durable/luxury goods/services. The magnitudes of the responses are generally consistent with the estimates reported in Ben-David et al. (2018). When we estimate specification (6) using information on purchases of durable/luxury goods and services three months after the treatment, we cannot reject the null of no effect of macroeconomic uncertainty on these purchases.

In short, we interpret these results as providing further evidence that uncertainty about the macroeconomic outlook reduces household expenditures, not just on typical monthly spending but also on larger and less frequently purchased durable goods and services.

4.3 Investment Decisions

Spending is not the only margin through which households may respond to uncertainty. Another potentially important choice is in terms of their investment decisions. To quantify this margin of adjustment one should take into account that the majority of households exhibit significant inertia in portfolio rebalancing and that multiple survey waves would be necessary in order to trace actual asset transitions. In view of this, we implement a hypothetical portfolio allocation question. Specifically, as described in section 2, respondents were asked how they would assign €10,000 among different types of possible investments after having been exposed to information treatments.

Given their responses to this question, we then run the following regression for each type of investment k:

$$PostShare_i^k = \alpha_1^{(k)} Post_i^{mean} + \beta_1^{(k)} Post_i^{uncert} + \alpha_0^{(k)} Prior_i^{mean} + \beta_0^{(k)} Prior_i^{uncert} \quad (7)$$
$$+ \gamma ActualShare_i^k + Controls + error_i^{(k)},$$

where $PostShare_i^k$ is the post-treatment share of the total investment that household i assigns to investment type k. This specification is again directly comparable to the one used for total spending, except that we now focus on the allocation of hypothetical investments. We also include an additional control variable ($ActualShare_i^k$) which is the actual share of investment type k in household i's investment portfolio. Conditioning on this actual share helps with the interpretation of our findings as we effectively focus on how a household would change its current portfolio given new information. Actual investment portfolios are collected in the August wave (i.e., in the month prior to the RCT implementation). There are missing values for a subset of respondents as only those who provide complete information on their invested amounts for each of the asset categories they own are considered for calculating (pre-treatment) portfolio shares. As a result, the sample size is smaller than the one used for spending behavior. As before, we instrument for posterior beliefs about the level of future euro area growth and the uncertainty around those beliefs using the information treatments and their interactions with household priors.

We present results from these regressions in Table 8. We document a number of findings regarding the effects of uncertainty and outlook for growth on portfolio allocations. In the face of

elevated macroeconomic uncertainty, households appear to reduce their risky holdings. Specifically, a one percentage point increase in uncertainty lowers the share allocated to mutual funds and crypto-currencies by 2.1 and 0.5 percentage points, respectively. This pattern is consistent with the findings in Ben-David et al. (2018) reporting that the share of assets allocated to risky instruments is negatively correlated with uncertainty of households participating in the SCE. On the other hand, the effect of uncertainty on the allocation of hypothetical €10,000 into savings/current accounts is negative, weakly estimated (significant at 10%), and relatively small economically.[12] The implied effects for other relatively safe investments such as retirement assets and bonds are positive but statistically insignificant.

Our results also speak to the effect of first moment expectations on portfolio allocations. In particular, we find that higher expected economic growth leads households to place more weight on directly held stocks. Another finding is that expectations of higher economic growth could lead households to reduce their exposure to cryptocurrencies. This suggests that these digital currencies are perceived as somewhat countercyclical, perhaps because negative economic outcomes are more likely to support growth in alternative currencies. We do not find clear evidence that first moment expectations affect the perceived desirability of other asset classes, but standard errors are quite large in some cases. Nonetheless, as with household spending, we observe that household portfolio allocations seem to be more sensitive to perceived macroeconomic uncertainty than to expectations of future growth rates.

Finally, we examine whether perceived macroeconomic uncertainty affects household views on investing in real estate. To this end we estimate the following equation:

$$PostInvestRealEstate_i^k \qquad\qquad\qquad\qquad\qquad\qquad\qquad (8)$$
$$= \alpha_1^{(k)} Post_i^{mean} + \beta_1^{(k)} Post_i^{uncert} + \alpha_0^{(k)} Prior_i^{mean} + \beta_0^{(k)} Prior_i^{uncert}$$
$$+\gamma PriorInvestRealEstate_i^k + Controls + error_i^{(k)},$$

where post- and pre-treatment attitudes towards investment in real estate are measured in October and September (prior to fielding our RCT) waves, respectively. Results (Appendix Table 4), suggest that, unlike the case for financial assets, elevated macroeconomic uncertainty does not influence household attitudes towards investing in real estate. This also holds true when one considers homeowners and renters separately.

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[12] Our estimate implies a 3.16 percentage point reduction in the share of a widely held asset (the median share of savings/current accounts in the financial portfolios is more than 70%).

4.4   Heterogeneity

Our analysis so far has largely focused on studying the effects of macroeconomic uncertainty on the general population. This focus is motivated by our desire to maximize the precision of the estimated effects. However, exposure to macroeconomic uncertainty is unevenly distributed across households due to differences in probability of losing a job in a recession, exposure to portfolio risk, region of residence, etc. To explore potential differences in sensitivity to macroeconomic uncertainty, we estimate specification (2) for subsets of the population that differ in some key characteristics.

First, we split the sample into three groups based on how susceptible their employment is to COVID-19 concerns either directly (e.g., the hospitality sector may be constrained by orders of public health officials) or indirectly (e.g., demand for cyclically-sensitive sectors such as manufacturing can decline when the economy is pushed into a recession). Specifically, we define a respondent as working in a high-risk sector if their job is in agriculture, manufacturing, construction, trade, transport, hotels, bars, restaurants, arts or entertainment. The low-risk sector includes information/communication services, administrative services, public administration, education and health sectors. We also consider separately the retired because this group has the highest mortality risk due to COVID-19 but likely has the lowest income risk. We find (Table 9) that spending on nondurable goods is much more sensitive to macroeconomic uncertainty for respondents working in the high-risk sector (a one-percentage point increase in uncertainty lowers spending by almost 9 percentage points; column 1 in Table 9) than for respondents in the low-risk sector (we cannot reject the null of zero response; column 2). This behavior is consistent with the greater need of high-risk respondents to engage in precautionary savings in the face of uncertainty. Interestingly, the retired have a similar estimate for the sensitivity to macroeconomic uncertainty but the estimate is not precisely estimated due to the small size of the sample (column 3).

Second, we split the sample based on how households allocate their financial wealth between risky and safe assets. Specifically, we consider a household as having a risky portfolio if it owns stocks or shares in mutual funds. Because stock prices tend to be more volatile than other asset classes and most sensitive to macroeconomic uncertainty, a rise in uncertainty should signal to households owning stocks a greater loss of wealth and potentially income. In agreement with this conjecture, we observe that households owning risky portfolios exhibit strong sensitivity of spending on nondurable goods and services to macroeconomic uncertainty: increasing their uncertainty by one percentage point lowers their subsequent spending by 14 percentage points. In contrast, the respondents with

relatively safe portfolios demonstrate effectively zero sensitivity to macroeconomic uncertainty. This result corroborates the findings in Mankiw and Zeldes (1991) from repeated waves of the Panel Study of Income Dynamics, namely that the consumption of stockholders is more volatile and displays a higher correlation with stock market returns than the consumption of non-stockholders.

Finally, we distinguish between households in Southern vs. Northern countries as country-wide factors (such as quality of institutions or COVID-19 repercussions on local economic activity) may interact with household macroeconomic uncertainty. Table 10 shows results for non-durable spending after one and three months by geographic region. The point estimates suggest that households in Spain and Italy may be more sensitive to uncertainty than those in Northern countries. With reduced sample sizes, the standard errors are much larger in these specifications. After three months, our estimates suggest that uncertainty has a strong negative effect on households in Southern countries but not necessarily in Northern countries even though after one month, one can reject neither the null of equality across regions nor that the effects of uncertainty on spending are zero. This sample split illustrates that, due to the degree of noise in self-reported spending data and expectations, fairly large samples are needed to establish statistical significance and subsample estimates may be plagued by imprecision. The sample split also highlights again the persistence of the estimated effect of uncertainty on spending, with the largest effects being found after three months in Southern countries.

While subsamples tend to have less precise estimates, our results suggest that the effects of macroeconomic uncertainty on household spending are not uniform and imply some potential distributional effects. Households working in cyclically or COVID-19 affected industries, households that are more exposed to fluctuations in asset prices and households living in Southern euro area countries appear to be particularly vulnerable.

5.   Conclusion

When describing his approach to fighting the Great Depression, former U.S. President Franklin D. Roosevelt famously said, "The only thing we have to fear is fear itself." Indeed, macroeconomic uncertainty can instill fear into anybody who has lived through a catastrophe in which many lost livelihoods or even lives. Yet, measuring the effects of macroeconomic uncertainty on households' choices has proven remarkably difficult because this uncertainty is often accompanied by other

calamities (pandemics, revolutions, natural disasters, and economic crises) that potentially confound the estimated effects of macroeconomic uncertainty.

Using a randomized controlled trial, we address this identification challenge and provide unambiguous evidence that elevated macroeconomic uncertainty strongly inhibits consumer spending on nondurable goods and services as well as on larger items such as holiday packages or luxury goods. Our results point to the relevance of both real and financial channels in the propagation of macroeconomic uncertainty. Regarding the former, we find a clear role for job security with the impact of aggregate uncertainty on spending being largely driven by households that are employed in more cyclically sensitive sectors. Regarding financial channels of transmission, macroeconomic uncertainty also directly influences risk taking behavior by reducing exposure to more risky assets such as mutual funds. These estimated causal effects can thus shed new light on the mechanisms behind business cycles and specifically the role of macroeconomic uncertainty in causing and/or amplifying fluctuations in asset prices and consumer spending.

Our work points to a number of directions for future research. For example, our findings point to important heterogeneous effects by sector of employment, portfolio composition and geographic region. One can use larger sample sizes to estimate further heterogeneous effects of macroeconomic uncertainty on particular groups of the population. These estimates will allow developing more targeted policy responses. Furthermore, one can combine our RCT design with other treatments based on actual or hypothetical policy responses (e.g., provide information about potential government transfers to households) to build more effective tools to combat economic downturns. Our results can also contribute directly to developing better countercyclical policies. For example, recessions are characterized by increased macroeconomic uncertainty and so an economic recovery may require management of expectations and assurances by policymakers (e.g., as was done by President Franklin D. Roosevelt; see Pedemonte (2020)). In addition, it may require policies that provide a stronger safety net for the more vulnerable groups (e.g., in affected sectors) and will support aggregate demand. More generally, our estimates suggest that macroeconomic uncertainty can play a key role in the dynamics of aggregate variables and thus theoretical work should incorporate uncertainty as an important mechanism for amplification and propagation of business cycles.

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Table 1. Descriptive statistics by treatment status.

Variable	Control		Treat #1: EA first moment		Treat #2: EA second moment		Treat #3: EA 1st and 2nd moments		Treat #4: Country 2nd moment		Full sample	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Age	49.19	16.73	49.12	16.15	48.98	16.81	48.54	17.03	48.35	16.52	48.82	16.65
Male	0.47	0.50	0.49	0.50	0.48	0.50	0.49	0.50	0.48	0.50	0.48	0.50
Household size	2.58	1.34	2.60	1.27	2.57	1.28	2.65	1.26	2.64	1.27	2.61	1.29
Annual household income ('000€)	34.14	23.15	33.97	22.05	35.22	24.11	34.70	23.62	34.16	23.22	34.43	23.25
Monthly spending on nondur. goods ('000€)	1.63	1.1	1.63	1.07	1.69	1.15	1.64	1.11	1.66	1.2	1.65	1.13
Employment status												
Working full-time	0.45	0.50	0.47	0.50	0.47	0.50	0.45	0.50	0.47	0.50	0.46	0.50
Working part-time	0.12	0.33	0.12	0.33	0.14	0.34	0.14	0.34	0.13	0.34	0.13	0.34
Temporarily laid-off	0.02	0.13	0.01	0.12	0.01	0.12	0.01	0.11	0.01	0.11	0.01	0.12
On extended leave	0.05	0.22	0.05	0.22	0.05	0.23	0.04	0.20	0.04	0.20	0.05	0.21
Have no job but would like to have a job	0.11	0.32	0.11	0.31	0.10	0.30	0.11	0.31	0.12	0.32	0.11	0.31
Have no job and don't want a job	0.24	0.43	0.24	0.42	0.23	0.42	0.25	0.43	0.23	0.42	0.24	0.43
Education												
Primary	0.16	0.37	0.15	0.35	0.15	0.35	0.16	0.37	0.15	0.36	0.15	0.36
Secondary	0.32	0.47	0.32	0.47	0.32	0.47	0.31	0.46	0.33	0.47	0.32	0.47
Tertiary	0.51	0.50	0.53	0.50	0.53	0.50	0.53	0.50	0.52	0.50	0.53	0.50
Housing arrangement												
Owner-occupied property with mortgage	0.26	0.44	0.27	0.45	0.25	0.43	0.26	0.44	0.23	0.42	0.25	0.44
Owner-occupied property w/o mortgage	0.36	0.48	0.35	0.48	0.37	0.48	0.38	0.48	0.39	0.49	0.37	0.48
Rented house/flat	0.33	0.47	0.34	0.48	0.33	0.47	0.33	0.47	0.34	0.47	0.33	0.47
Accommodation provided free of rent	0.05	0.21	0.03	0.17	0.05	0.21	0.03	0.18	0.04	0.19	0.04	0.19
Country												
Belgium	0.05	0.23	0.05	0.22	0.05	0.21	0.05	0.21	0.00	0.00	0.04	0.19
Germany	0.28	0.45	0.31	0.46	0.29	0.45	0.30	0.46	0.32	0.47	0.30	0.46
Spain	0.17	0.37	0.15	0.36	0.14	0.35	0.17	0.37	0.19	0.39	0.17	0.37
France	0.22	0.41	0.21	0.41	0.22	0.41	0.20	0.40	0.25	0.43	0.22	0.41
Italy	0.21	0.41	0.21	0.41	0.22	0.41	0.21	0.41	0.24	0.43	0.22	0.41
Netherlands	0.07	0.26	0.07	0.26	0.09	0.28	0.08	0.26	0.00	0.00	0.06	0.24

Notes: all moments are computed using sampling weights. Household income and spending on nondurable goods are winsorized at bottom and top 1%. The moments are based on the September 2020 wave of the survey.

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Table 2. Expected growth rate of GDP in the euro area.

Country		Implied mean		Implied uncertainty	
		Raw	Robust	Raw	Robust
		(1)	(2)	(3)	(4)
Belgium	mean	-2.02	-0.15	2.20	1.38
	sd	14.68	6.85	2.72	1.27
Germany	mean	-0.01	0.64	2.15	1.82
	sd	10.08	5.88	1.94	1.39
Spain	mean	0.66	2.18	1.83	1.44
	sd	12.70	6.84	2.05	1.17
France	mean	-0.58	1.02	1.89	1.45
	sd	11.57	5.94	2.18	1.19
Italy	mean	2.08	3.54	1.88	1.33
	sd	14.53	6.77	2.36	1.15
Netherlands	mean	-3.31	-1.51	1.69	1.35
	sd	12.64	6.33	1.90	1.19
All	mean	0.16	1.42	1.96	1.52
	sd	12.33	6.45	2.14	1.26

Notes: robust moments are computed using sampling weights and the Huber robust method. The moments are based on the September 2020 wave of the survey.

Table 3. Treatment effects one first and second moments of expected GDP growth in the euro area (EA).

	Mean expectations			Expected uncertainty		
	Full	North	South	Full	North	South
	(1)	(2)	(3)	(4)	(5)	(6)
Prior	0.754***	0.746***	0.767***	0.604***	0.612***	0.592***
	(0.011)	(0.014)	(0.017)	(0.021)	(0.025)	(0.037)
I{Treatment 1} × Prior	-0.564***	-0.515***	-0.620***	-0.415***	-0.399***	-0.449***
	(0.016)	(0.022)	(0.023)	(0.029)	(0.038)	(0.046)
I{Treatment 2} × Prior	-0.104***	-0.078***	-0.150***	-0.291***	-0.299***	-0.274***
	(0.016)	(0.020)	(0.028)	(0.029)	(0.034)	(0.053)
I{Treatment 3} × Prior	-0.620***	-0.598***	-0.647***	-0.467***	-0.482***	-0.444***
	(0.015)	(0.020)	(0.022)	(0.029)	(0.035)	(0.049)
I{Treatment 4} × Prior	-0.105***	-0.075***	-0.134***	-0.196***	-0.195***	-0.190***
	(0.016)	(0.022)	(0.023)	(0.029)	(0.038)	(0.046)
Indicator variables, I{}						
Treatment 1 (EA GDP - 1st m)	2.244***	2.133***	2.503***	0.386***	0.455***	0.276***
	(0.091)	(0.113)	(0.153)	(0.050)	(0.065)	(0.079)
Treatment 2 (EA GDP - 2nd m)	0.450***	0.385***	0.676***	0.269***	0.289***	0.237***
	(0.095)	(0.113)	(0.172)	(0.049)	(0.060)	(0.086)
Treatment 3 (EA GDP - 1st & 2nd m)	2.560***	2.507***	2.712***	0.279***	0.334***	0.190**
	(0.091)	(0.111)	(0.157)	(0.050)	(0.062)	(0.085)
Treatment 4 (C GDP - 2nd m)	0.467***	0.464***	0.526***	0.309***	0.288***	0.318***
	(0.096)	(0.120)	(0.163)	(0.050)	(0.066)	(0.078)
Observations	7,325	4,531	2,794	7,516	4,588	2,928
R-squared	0.712	0.698	0.727	0.260	0.265	0.258

Notes: the table report estimates of specification (1). All estimates are based on Huber-robust estimator. *North* covers Belgium, France, Germany and the Netherlands. *South* covers Italy and Spain. All regressions use sampling weights. The regressions use data only from the September 2020 wave of the survey. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Table 4. Effects of 1st and 2nd moments for expected growth rate of EA GDP on nondurable consumption.

	One month after treatment (October 2020)	Four months after treatment (January 2021)
	(1)	(2)
Posterior: mean	-0.82	-0.26
	(0.52)	(0.49)
Posterior: uncertainty	-4.61**	-4.51**
	(2.23)	(2.25)
Prior: mean	-0.04	0.02
	(0.24)	(0.22)
Prior: uncertainty	3.03***	2.81***
	(0.94)	(0.90)
Education: secondary	-0.08	6.54*
	(3.24)	(3.41)
Education: tertiary	10.71***	18.28***
	(2.97)	(3.07)
Age	0.53***	0.55***
	(0.07)	(0.07)
Household size	10.85***	12.21***
	(0.77)	(0.88)
Log(household income)	11.38***	10.53***
	(1.28)	(1.31)
Liquidity status	14.63***	10.72***
	(2.43)	(2.41)
Observations	4,572	4,113
R-squared	0.19	0.17
1st-stage F stat (mean)	131.00	129.3
1st-stage F stat (uncertainty)	28.68	25.60

Notes: the table reports estimates of specification (2). The dependent variable is log(nondurable consumption)×100. The first stage is given by specification (3). All regressions use sampling weights. Treatment status does not predict whether a household participates in a post-treatment wave. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Table 5. Effects of expected growth rate of EA GDP on uncertainty about personal income growth.

	Uncertainty about personal income growth		
	One month after treatment (October 2020)	Two months after treatment (November 2020)	Three months after treatment (December 2020)
	(1)	(2)	(3)
Posterior: mean	0.00	-0.01	-0.01
	(0.01)	(0.01)	(0.01)
Posterior: uncertainty	0.07**	0.11***	0.04
	(0.04)	(0.04)	(0.04)
Prior: mean	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
Prior: uncertainty	-0.01	-0.03*	0.00
	(0.01)	(0.02)	(0.02)
Prior: uncertainty (personal income growth)	0.67***	0.66***	0.63***
	(0.02)	(0.02)	(0.02)
Education: secondary	0.07	-0.12*	-0.04
	(0.05)	(0.07)	(0.06)
Education: tertiary	0.11**	-0.04	0.03
	(0.05)	(0.06)	(0.06)
Age	-0.00**	-0.00	-0.00***
	(0.00)	(0.00)	(0.00)
Household size	0.04**	0.04**	0.03*
	(0.02)	(0.02)	(0.02)
Log(household income)	0.00	-0.03	0.01
	(0.01)	(0.02)	(0.02)
Liquidity status	-0.09*	-0.03	-0.10*
	(0.05)	(0.05)	(0.05)
Observations	3,924	3,752	3,708
R-squared	0.53	0.50	0.49
1st-stage F stat (mean)	136.8	130.5	124.2
1st-stage F stat (uncertainty)	29.55	24.15	24.78

Notes: the table reports estimates of specification (4). The dependent variable is uncertainty about personal income growth over the next 12 months. Uncertainty is computed as the standard deviation implied by the reported probability distribution for personal income growth. The first stage is given by specification (3). All regressions use sampling weights. Treatment status does not predict whether a household participates in a post-treatment wave. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Table 6. Effects of 1st and 2nd moments for expected growth rate of EA GDP on budget shares for nondurable consumption.

	Food	Housing, utilities, furniture, home equipment	Clothing	Healthcare	Transport	Recreation	Education and other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Posterior: mean	0.02	-0.28*	0.09*	0.08	0.06	0.07	0.08
	(0.14)	(0.17)	(0.05)	(0.07)	(0.06)	(0.07)	(0.09)
Posterior: uncertainty	0.38	-0.42	0.18	-0.71**	0.32	-0.83**	0.07
	(0.60)	(0.80)	(0.23)	(0.31)	(0.30)	(0.32)	(0.35)
Prior: mean	-0.05	0.09	-0.01	-0.02	-0.00	-0.01	-0.04
	(0.07)	(0.08)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
Prior: uncertainty	-0.35	0.33	-0.07	0.20	-0.31***	0.28*	-0.04
	(0.25)	(0.34)	(0.10)	(0.13)	(0.12)	(0.15)	(0.16)
Education: secondary	1.55*	-0.55	-0.48	-0.10	-0.32	-0.49	-0.46
	(0.88)	(1.17)	(0.32)	(0.48)	(0.42)	(0.49)	(0.53)
Education: tertiary	-0.62	-0.21	-0.01	0.33	-0.49	-0.26	0.30
	(0.80)	(1.06)	(0.31)	(0.43)	(0.40)	(0.43)	(0.52)
Age	0.05**	-0.04	-0.01*	0.10***	-0.04***	-0.03***	-0.03***
	(0.02)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Household size	1.12***	-1.89***	0.46***	-0.02	0.24**	-0.58***	0.83***
	(0.22)	(0.28)	(0.08)	(0.12)	(0.10)	(0.11)	(0.15)
Log(household income)	-0.54*	-1.56***	0.27***	0.23	0.08	0.78***	0.70***
	(0.29)	(0.40)	(0.10)	(0.15)	(0.14)	(0.18)	(0.18)
Liquidity status	0.21	-4.17***	0.99***	0.71**	-0.23	2.43***	0.73*
	(0.65)	(0.87)	(0.23)	(0.32)	(0.35)	(0.29)	(0.38)
Observations	4,577	4,577	4,578	4,570	4,573	4,574	4,574
R-squared	0.10	0.05	0.03	0.08	0.05	0.05	0.03
1st-stage F stat (mean)	127	127	128.6	125.7	126.7	126.8	126.7
1st-stage F stat (uncertainty)	26.57	25.69	26.56	26.73	26.97	27.36	26.74

Notes: the table reports estimates of specification (5). The dependent variable is the budget share of spending category k, measured on the 0-100 scale. The first stage is given by specification (3). All regressions use sampling weights. Budget shares (the regressands) are from the October 2020 wave. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Table 7. Effects of 1st and 2nd moments for expected growth rate of EA GDP on actual purchases of durable/luxury goods and services.

	Home	Durable	Car	Holiday	Luxury
	(1)	(2)	(3)	(4)	(5)
Posterior: mean	-0.01	0.07	0.08	-0.02	-0.06
	(0.05)	(0.34)	(0.09)	(0.23)	(0.11)
Posterior: uncertainty	-0.18	-1.81	-0.13	-2.74***	-1.02*
	(0.18)	(1.54)	(0.38)	(1.04)	(0.57)
Prior: mean	0.00	-0.12	-0.01	0.07	0.08
	(0.02)	(0.16)	(0.04)	(0.11)	(0.05)
Prior: uncertainty	0.04	0.28	-0.29	1.01**	0.37
	(0.09)	(0.65)	(0.18)	(0.48)	(0.27)
Plan to buy a given durable	0.03**	0.23***	0.05***	0.15***	0.14***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)
Education: secondary	-0.04	2.16	-0.94	0.04	0.20
	(0.54)	(2.48)	(0.74)	(1.46)	(0.86)
Education: tertiary	0.08	4.31*	-0.39	2.01	0.14
	(0.57)	(2.21)	(0.78)	(1.36)	(0.80)
Age	-0.00	0.07	-0.02	-0.03	-0.03*
	(0.01)	(0.05)	(0.02)	(0.03)	(0.02)
Household size	0.09	2.07***	0.09	-0.50	0.14
	(0.10)	(0.58)	(0.28)	(0.36)	(0.24)
Log(household income)	0.05	0.52	0.18	1.68***	0.11
	(0.11)	(0.69)	(0.16)	(0.52)	(0.29)
Liquidity status	-0.00	3.18**	0.90	2.87***	0.69
	(0.38)	(1.60)	(0.58)	(0.96)	(0.59)
Observations	4,605	4,621	4,606	4,616	4,610
R-squared	0.01	0.08	0.01	0.07	0.03
1st-stage F stat (mean)	130	131.4	132.2	127.7	129.2
1st-stage F stat (uncertainty)	28.10	27.42	28.19	28.14	27.38

Notes: the table reports estimates of specification (6). The dependent variable is an indicator variable ($\times 100$) equal to one if a household purchased a given type of durable/luxury good/service in the previous 12 months. The first stage is given by specification (3). All regressions use sampling weights. The regressands are from the October 2020 wave. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Table 8. Effect of 1st and 2nd moments for expected growth rate of EA GDP for allocation of hypothetical €10,000 across asset classes.

	Saving account	Stocks	Mutual funds	Investment retirement account	Bonds	Crypto-currencies
	(1)	(2)	(3)	(4)	(5)	(6)
Posterior: mean	-0.05	0.37**	-0.01	-0.25	-0.09	-0.10*
	(0.40)	(0.19)	(0.20)	(0.21)	(0.21)	(0.06)
Posterior: uncertainty	-3.16*	0.70	-2.05**	0.40	0.18	-0.48**
	(1.86)	(0.78)	(0.98)	(0.92)	(0.90)	(0.23)
Prior: mean	-0.20	-0.07	-0.02	0.17*	0.13	0.07***
	(0.18)	(0.08)	(0.08)	(0.09)	(0.10)	(0.02)
Prior: uncertainty	1.34*	-1.12***	1.13***	-0.24	-0.63*	0.17*
	(0.78)	(0.34)	(0.42)	(0.37)	(0.35)	(0.10)
Actual share of investment	0.29***	0.39***	0.50***	0.15***	0.33***	0.01*
	(0.03)	(0.05)	(0.05)	(0.02)	(0.10)	(0.01)
Education: secondary	-0.15	-0.90	-0.21	1.80	0.38	0.07
	(3.53)	(1.79)	(1.73)	(1.63)	(1.52)	(0.36)
Education: tertiary	-3.64	-0.31	2.76	0.75	1.32	0.33
	(3.22)	(1.69)	(1.73)	(1.54)	(1.41)	(0.37)
Age	0.06	-0.02	0.04	-0.07**	0.00	-0.04***
	(0.07)	(0.04)	(0.04)	(0.03)	(0.04)	(0.01)
Household size	0.80	0.53	-0.53	0.01	-0.12	0.02
	(0.72)	(0.40)	(0.39)	(0.35)	(0.36)	(0.11)
Log(household income)	-1.09	0.14	0.68	0.15	0.12	-0.30**
	(0.95)	(0.53)	(0.57)	(0.42)	(0.46)	(0.12)
Liquidity status	-5.88***	2.19**	3.89***	-1.39	1.16	-0.61*
	(2.19)	(1.03)	(0.99)	(1.14)	(1.20)	(0.34)
Observations	2,657	2,646	2,653	2,649	2,650	2,646
R-squared	0.17	0.13	0.20	0.06	0.08	0.03
1st-stage F stat (mean)	87.97	81.91	86.51	85.98	86.03	83.64
1st-stage F stat (uncertainty)	19.36	19.58	18.30	19.08	18.75	19.76

Notes: the table reports estimates of specification (7). The dependent variable is the share of hypothetical *€10,000* allocated to a given asset class. Shares are measured on the 0-100 scale. The first stage is given by specification (3). All regressions use sampling weights. Budget shares (the regressands) are from the September 2020 wave. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Table 9. Effect of 1st and 2nd moments for expected growth rate of EA GDP on nondurable consumption, by income risk group and portfolio riskiness.

	'High Risk' Sector	'Low Risk' Sector	Retired	Portfolio incl. risky assets	Portfolio only in safe assets
	(1)	(2)	(3)	(4)	(5)
Posterior: mean	-0.58	-0.95	-0.52	-1.30	-0.53
	(1.02)	(0.73)	(1.47)	(1.07)	(0.68)
Posterior: uncertainty	-8.85**	2.48	-8.15	-14.15***	-1.06
	(3.71)	(3.13)	(7.69)	(5.11)	(2.79)
Prior: mean	0.24	0.16	-0.53	0.30	-0.19
	(0.44)	(0.33)	(0.74)	(0.58)	(0.26)
Prior: uncertainty	5.47***	2.26*	-1.04	5.20***	2.28**
	(1.63)	(1.25)	(2.79)	(1.92)	(1.10)
Education: secondary	-10.36*	4.17	-0.77	14.86*	-7.38*
	(6.13)	(4.97)	(7.07)	(7.88)	(3.85)
Education: tertiary	-2.46	15.13***	16.61**	30.34***	2.86
	(5.82)	(4.69)	(6.54)	(7.11)	(3.64)
Age	0.52***	0.81***	0.14	0.85***	0.36***
	(0.15)	(0.12)	(0.32)	(0.14)	(0.09)
Household size	9.98***	10.74***	16.79***	10.77***	10.89***
	(1.39)	(1.11)	(3.47)	(1.46)	(1.04)
Log(household income)	14.45***	9.07***	9.72***	12.97***	9.35***
	(3.20)	(1.81)	(2.46)	(2.74)	(1.32)
Liquidity status	13.39***	11.15***	18.42**	14.66**	9.28***
	(4.21)	(3.45)	(7.46)	(6.27)	(2.89)
Observations	1,282	1,816	675	1,327	2,432
R-squared	0.17	0.21	0.19	0.11	0.18
1st-stage F stat (mean)	43.72	53.14	22.11	39.94	81.68
1st-stage F stat (uncertainty)	10.11	13.59	5.82	9.04	18.29

Notes: the table reports estimates of specification (2) for various subsamples of respondents. The dependent variable is log(nondurable consumption)×100. The first stage is given by specification (3). The 'High Risk' (affected) sector includes: Agriculture; Industry; Construction; Trade; Transport; Hotels, bars and restaurants; Arts and entertainment. The 'Low Risk' (less affected) sector includes: Information and communication services; Administrative and support services; Public admin incl. military; Education; Health sector; Other. 'Retired' includes respondents who are retired at the time of the survey. 'Portfolio incl. risky assets' includes respondents who owns stocks or shares in mutual funds. 'Portfolio only in safe assets' includes respondents who own neither stocks nor shares in mutual funds. All regressions use sampling weights. The regressands are from the October 2020 wave. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Table 10. Effects of 1st and 2nd moments for expected growth rate of EA GDP on nondurable consumption by geographic region.

|	One month after treatment (October 2020)		Four months after treatment (January 2021)	
	South IT/ES	North FR/DE/BE/NL	South IT/ES	North FR/DE/BE/NL
	(1)	(2)	(3)	(4)
Posterior: mean	-0.12	-1.10*	-0.14	0.15
	(0.87)	(0.67)	(0.90)	(0.62)
Posterior: uncertainty	-6.00	-3.28	-8.51**	-1.60
	(3.72)	(2.82)	(4.09)	(2.79)
Prior: mean	-0.05	-0.13	0.21	-0.24
	(0.34)	(0.31)	(0.32)	(0.30)
Prior: uncertainty	3.18**	2.65**	4.39***	1.75
	(1.62)	(1.14)	(1.43)	(1.15)
Education: secondary	8.71	-5.70	9.53	4.71
	(5.47)	(3.91)	(5.85)	(4.09)
Education: tertiary	19.03***	5.26	21.41***	15.66***
	(4.89)	(3.62)	(4.99)	(3.75)
Age	0.48***	0.54***	0.57***	0.56***
	(0.14)	(0.08)	(0.14)	(0.08)
Household size	9.98***	11.29***	11.69***	12.59***
	(1.44)	(0.91)	(1.63)	(1.04)
Log(household income)	10.46***	11.65***	10.09***	10.89***
	(1.88)	(1.70)	(1.99)	(1.63)
Liquidity status	15.97***	13.69***	11.83***	9.95***
	(3.88)	(3.03)	(4.03)	(2.95)
Observations	1,691	2,881	1,588	2,525
R-squared	0.12	0.21	0.11	0.20
1st-stage F stat (mean)	55.16	72.74	55.11	71.12
1st-stage F stat (uncertainty)	17.86	15.98	15.38	14.44

Notes: the table reports estimates of specification (2). The dependent variable is log(nondurable consumption)×100. The first stage is given by specification (3). All regressions use sampling weights. Treatment status does not predict whether a household participates in a post-treatment wave. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Figure 1. Distribution of forecasts for GDP growth in the euro area.

Panel A. Implied mean

Panel B. Implied uncertainty
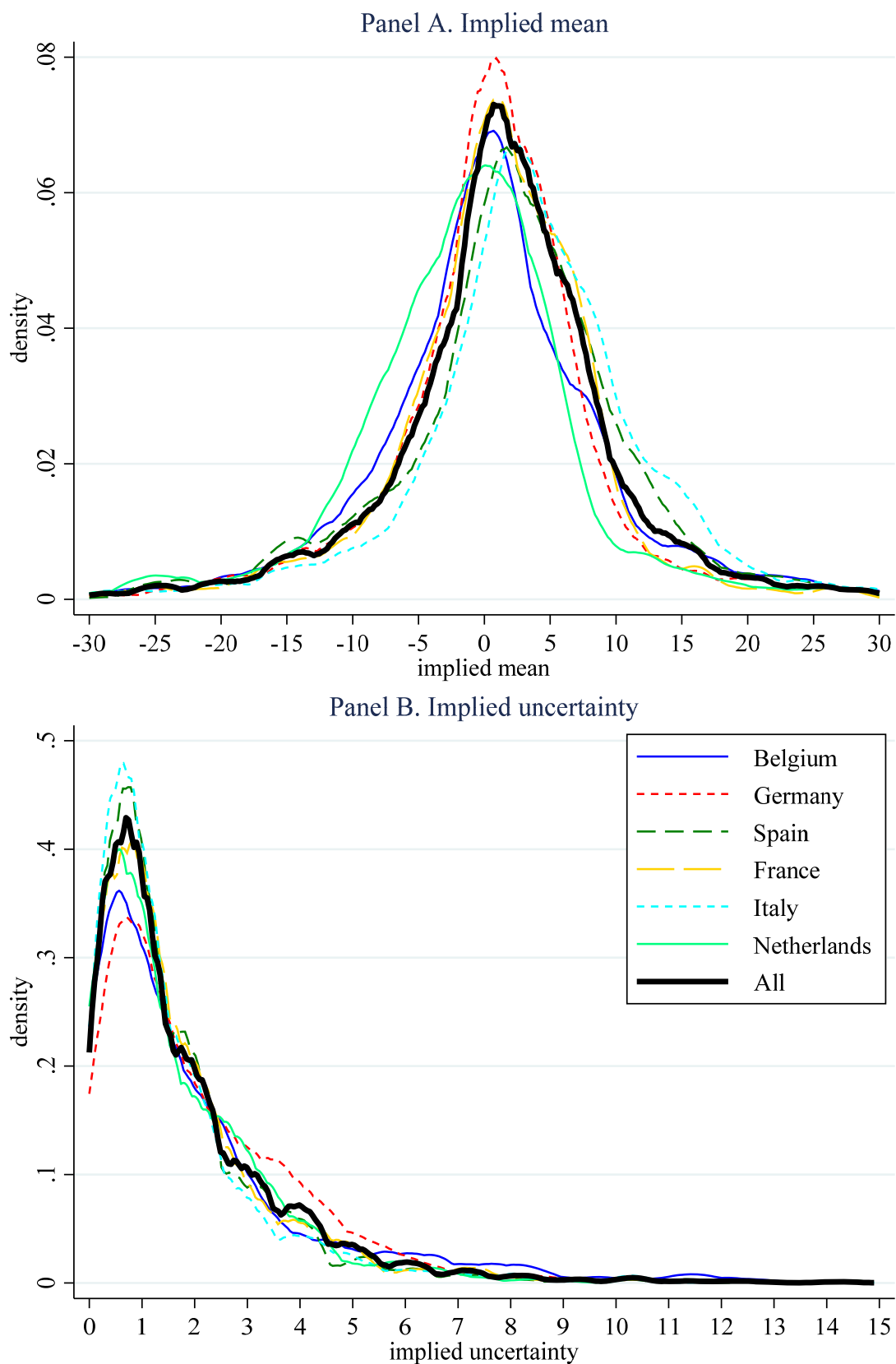
Notes: the figure shows kernel density (with sampling weights) of 1st and 2nd moments for households' predictions for the growth rate of GDP in the euro area implied by the distributions of forecasts reported by households. The moments are based on the September 2020 wave of the survey.

Figure 2. Treatment effects on household beliefs about growth rate of EA GDP.

Panel A: Implied mean

Panel B: Implied uncertainty
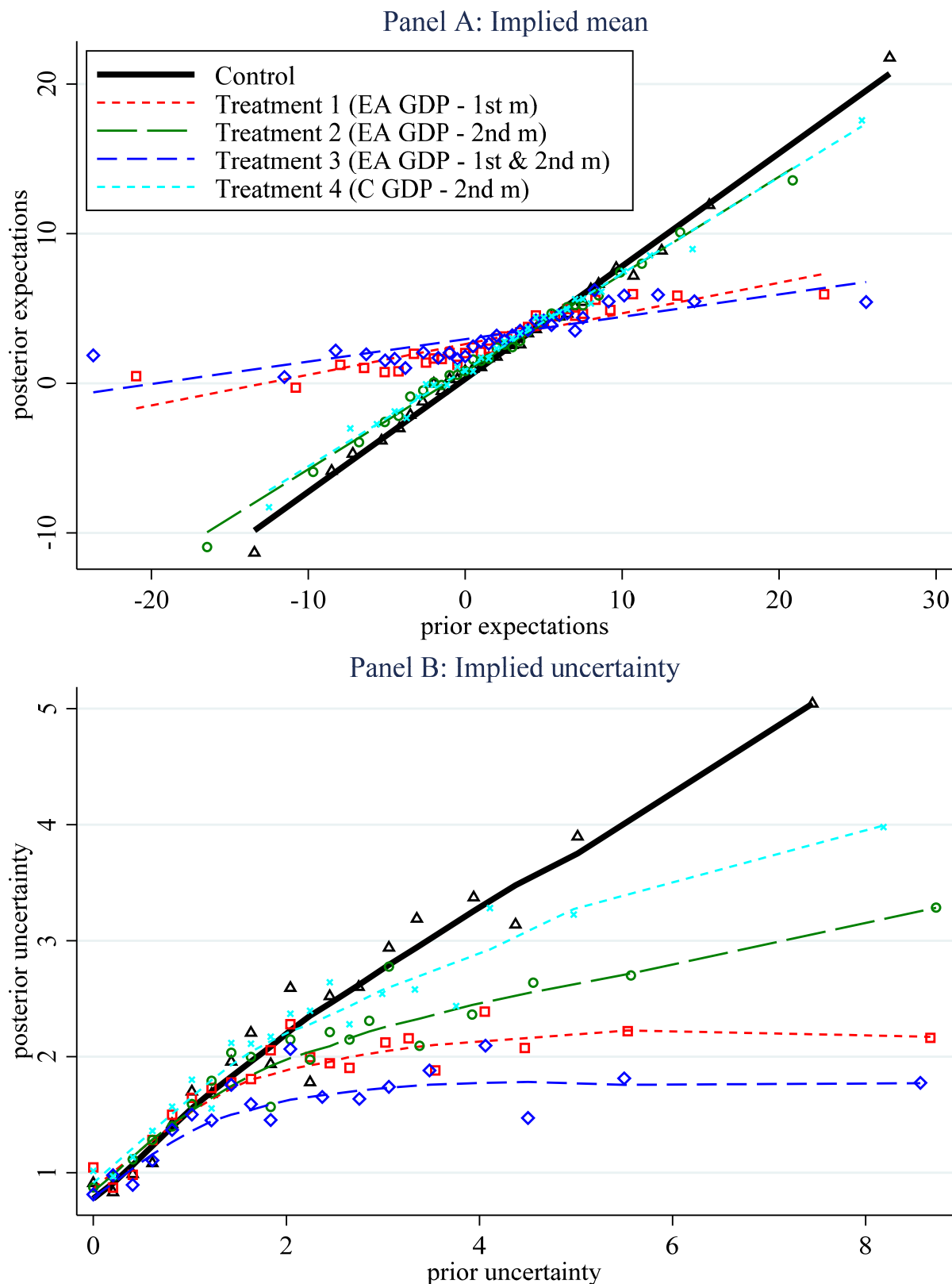
Notes: the figure shows binscatter plots (with sampling weights) for the 1st and 2nd moments for households' predictions for the growth rate of GDP in the euro area implied by the distributions of forecasts reported by households. Data are from the September 2020 waves of the survey.

ONLINE APPENDIX

Appendix A. Additional tables and figures

Appendix Figure 1. Joint distribution of implied mean and uncertainty for EA GDP growth rate.
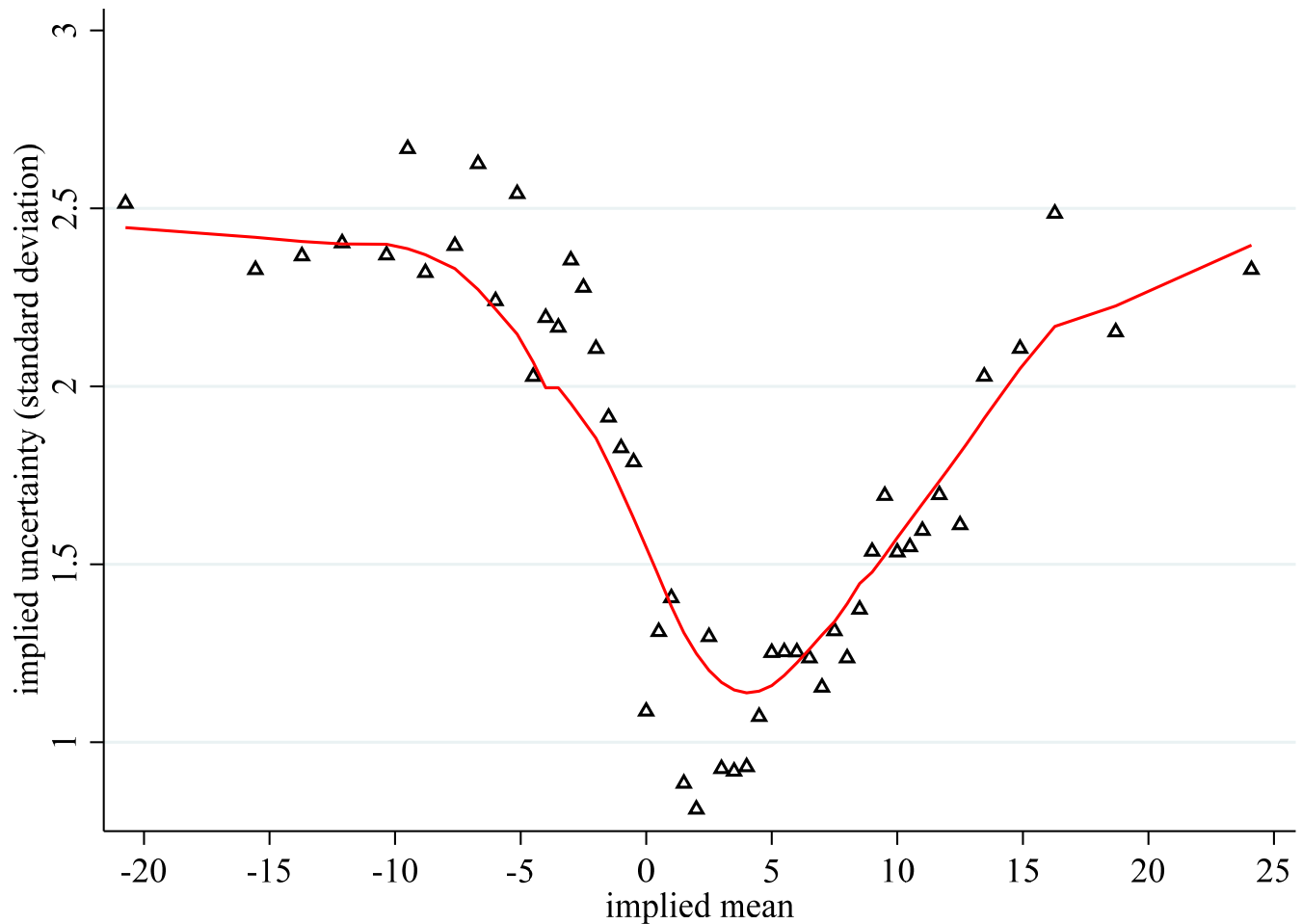
Notes: the figure is a binscatter plot (with sampling weights) where each triangle represents approximately one percent of the sample. The implied mean and uncertainty are computed using pre-treatment beliefs. Data are from the September 2020 waves of the survey.

Appendix Figure 2. Treatment effects on households' log(uncertainty) about growth rate of EA GDP.

Notes: the figure shows binscatter plots for the log of 2nd moment (standard deviation) of households predictions for the growth rate of GDP in the euro area implied by the distributions of forecasts reported by households. Data are from the September 2020 waves of the survey.

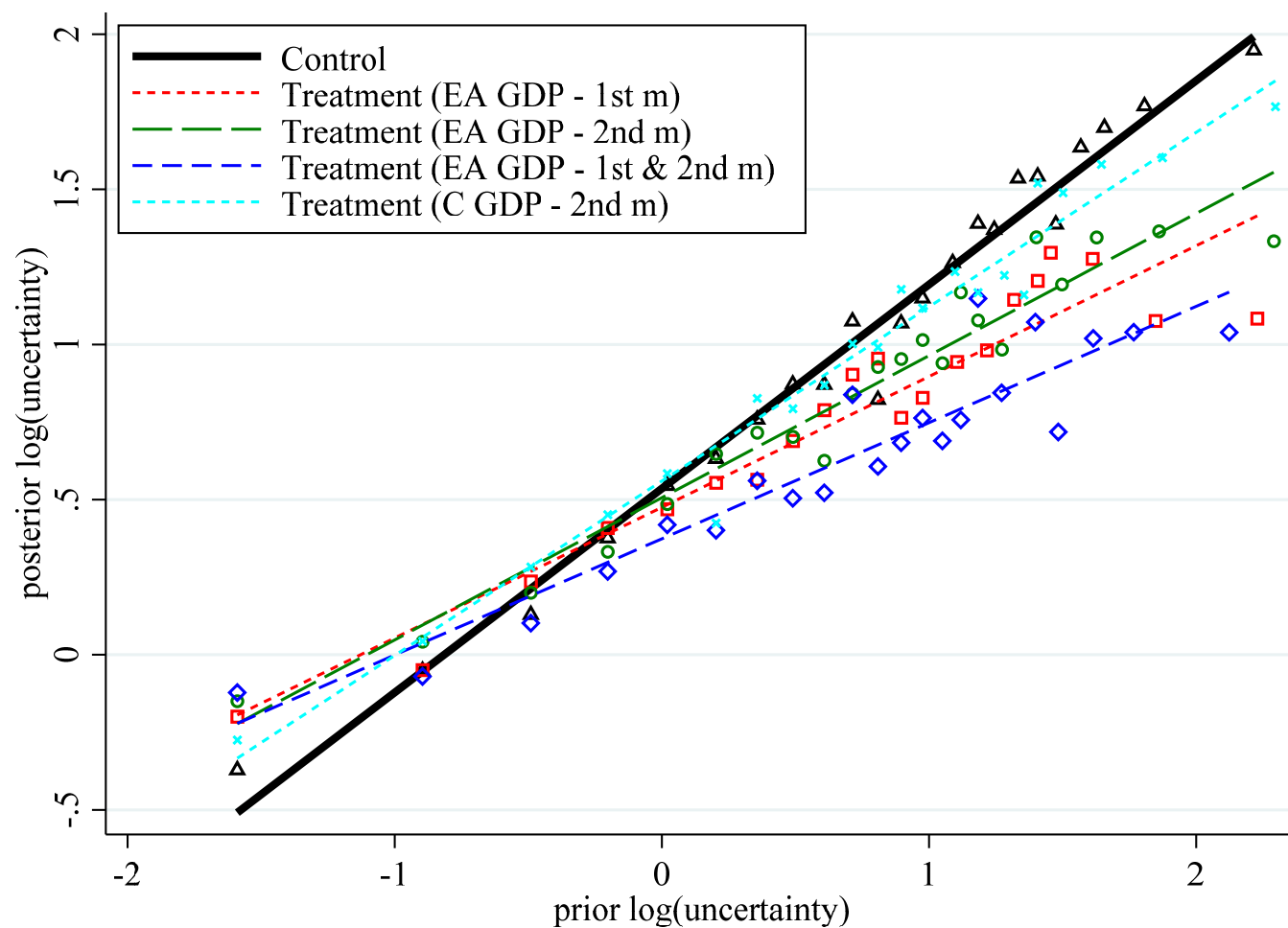Appendix Table 1. Effects of 1st and 2nd moments for expected growth rate of EA GDP on actual purchases of durable/luxury goods and services four months after the treatment.

	Home	Durable	Car	Holiday	Luxury
	(1)	(2)	(3)	(4)	(5)
Posterior: mean	-0.02	-0.78**	0.12**	0.08	-0.06
	(0.06)	(0.35)	(0.05)	(0.07)	(0.11)
Posterior: uncertainty	0.06	-0.73	0.04	0.12	-0.69
	(0.23)	(1.78)	(0.31)	(0.28)	(0.53)
Prior: mean	0.01	0.26	-0.03	-0.01	0.07
	(0.02)	(0.16)	(0.02)	(0.03)	(0.05)
Prior: uncertainty	-0.21**	1.11	-0.26*	-0.41***	0.02
	(0.11)	(0.72)	(0.15)	(0.12)	(0.25)
Plan to buy a given durable	0.04***	0.15***	0.03***	0.02**	0.14***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.03)
Education: secondary	0.26	0.69	0.30	1.01*	-0.69
	(0.51)	(2.80)	(0.61)	(0.59)	(1.07)
Education: tertiary	-0.11	1.76	0.13	1.46***	-0.62
	(0.45)	(2.57)	(0.56)	(0.56)	(1.05)
Age	0.00	0.02	0.00	-0.02	-0.04**
	(0.01)	(0.05)	(0.01)	(0.02)	(0.02)
Household size	0.15	0.85	0.09	0.06	0.65**
	(0.13)	(0.64)	(0.14)	(0.21)	(0.32)
Log(household income)	0.04	0.17	0.36***	0.18	1.10***
	(0.17)	(0.93)	(0.13)	(0.24)	(0.24)
Liquidity status	-0.34	7.16***	0.34	-0.37	1.25*
	(0.45)	(1.73)	(0.35)	(0.74)	(0.65)
Observations	4,146	4,154	4,148	4,139	4,142
R-squared	0.02	0.04	0.01	0.01	0.04
1st-stage F stat (mean)	127	129.6	24.75	128.2	24.58
1st-stage F stat (uncertainty)	24.78	25.28	129.9	25.79	124.8

Notes: the table reports estimates of specification (5). The dependent variable is an indicator variable (×100) equal to one if a household purchased a given type of durable/luxury good/service in the previous 12 months. The first stage is given by specification (3). All regressions use sampling weights. Regressands are from the January 2021 wave of the survey. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Appendix Table 2. Effects of 1st and 2nd moments for expected growth rate of EA GDP on categories of nondurable consumption.

	Food	Housing, utilities, furniture, home equipment	Clothing	Healthcare	Transport	Recreation	Education and other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Posterior: mean	-0.82	-1.39*	-1.84**	-0.01	0.31	0.22	-1.42
	(0.55)	(0.72)	(0.88)	(1.05)	(0.78)	(1.44)	(1.38)
Posterior: uncertainty	-2.51	-3.08	-4.23	-5.56	4.13	-12.09*	-9.37
	(2.42)	(3.15)	(3.74)	(4.83)	(3.54)	(6.73)	(5.81)
Prior: mean	-0.11	0.15	1.09***	-0.46	-0.18	0.73	0.09
	(0.25)	(0.33)	(0.42)	(0.49)	(0.35)	(0.70)	(0.74)
Prior: uncertainty	1.32	3.05**	0.94	3.35	-1.77	5.34*	4.19*
	(1.02)	(1.31)	(1.78)	(2.09)	(1.41)	(2.82)	(2.50)
Education: secondary	2.56	-2.55	1.22	8.54	-3.54	-14.63	-7.93
	(3.49)	(4.98)	(6.03)	(6.71)	(5.11)	(9.53)	(8.21)
Education: tertiary	8.98***	8.04*	11.03**	23.25***	-0.56	-15.58*	7.47
	(3.09)	(4.57)	(5.47)	(5.99)	(4.69)	(8.12)	(7.53)
Age	0.65***	0.30***	0.33***	1.51***	-0.06	-0.35**	0.10
	(0.08)	(0.11)	(0.12)	(0.15)	(0.10)	(0.18)	(0.18)
Household size	15.32***	4.89***	12.35***	9.63***	12.19***	0.54	9.83***
	(0.90)	(1.17)	(1.40)	(1.68)	(1.14)	(2.09)	(2.06)
Log(household income)	9.81***	6.15***	12.53***	9.36***	10.48***	18.64***	23.12***
	(1.33)	(1.61)	(2.40)	(2.37)	(1.77)	(4.09)	(4.27)
Liquidity status	14.81***	-0.58	17.05***	16.38***	9.53***	34.31***	9.40
	(2.74)	(3.72)	(4.32)	(4.77)	(3.69)	(6.74)	(6.02)
Observations	4,564	4,522	2,772	3,449	4,153	2,419	2,038
R-squared	0.16	0.08	0.10	0.15	0.15	0.08	0.09
1st-stage F stat (mean)	122.9	125.6	72.53	97.28	118.1	69.21	47.11
1st-stage F stat (uncertainty)	27.29	27.63	19.00	22.91	24.66	10.92	11.23

Notes: the table reports estimates of specification (5) with the dependent variable being 100×log(spending category k). The first stage is given by specification (3). All regressions use sampling weights. Data are from the October 2020 waves of the survey. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Appendix Table 3. Effects of 1st and 2nd moments for expected growth rate of EA GDP on nondurable consumption, flexible triangular distribution.

	One month after treatment (October 2020)			Four months after treatment (January 2021)		
	All countries	South IT/ES	North FR/DE/BE/NL	All countries	South IT/ES	North FR/DE/BE/NL
	(1)	(2)	(3)	(4)	(5)	(6)
Posterior: mean	-0.75	0.05	-1.10	-0.23	-0.48	0.54
	(0.55)	(0.91)	(0.74)	(0.54)	(0.96)	(0.68)
Posterior: uncertainty	-4.88**	-6.60*	-3.56	-4.55**	-7.23*	-1.82
	(2.18)	(3.80)	(2.66)	(2.07)	(3.73)	(2.58)
Prior: mean	-0.08	-0.11	-0.17	-0.09	0.27	-0.59
	(0.27)	(0.37)	(0.37)	(0.27)	(0.39)	(0.37)
Prior: uncertainty	2.78***	3.05*	2.34**	2.16**	4.13***	0.59
	(0.95)	(1.69)	(1.14)	(0.90)	(1.42)	(1.16)
Education: secondary	-0.89	8.51	-7.33*	7.64**	8.87	7.10
	(3.43)	(5.61)	(4.23)	(3.59)	(5.97)	(4.38)
Education: tertiary	10.54***	18.49***	4.80	19.11***	21.56***	17.39***
	(3.10)	(5.04)	(3.78)	(3.21)	(5.10)	(3.99)
Age	0.52***	0.43***	0.55***	0.55***	0.52***	0.58***
	(0.07)	(0.14)	(0.08)	(0.07)	(0.14)	(0.08)
Household size	10.63***	9.43***	11.24***	11.62***	11.00***	12.09***
	(0.81)	(1.48)	(0.96)	(0.91)	(1.66)	(1.07)
Log(household income)	11.57***	10.48***	11.95***	11.17***	10.01***	12.29***
	(1.33)	(1.95)	(1.76)	(1.39)	(2.06)	(1.72)
Liquidity status	14.58***	15.45***	13.98***	10.26***	10.96***	9.10***
	(2.59)	(4.04)	(3.31)	(2.50)	(4.16)	(3.02)
Observations	4,265	1,600	2,665	3,836	1,501	2,335
R-squared	0.19	0.11	0.21	0.18	0.11	0.21
1st-stage F stat (mean)	123.7	57.22	65.73	117.9	54.96	62.67
1st-stage F stat (uncertainty)	29.81	19.33	16.57	27.82	17.03	15.38

Notes: the table reports estimates of specification (2). The dependent variable is log(nondurable consumption)×100. The first stage is given by specification (3). Pre-treatment expectations are compute using the generalized triangular distribution (i.e., the assumption of symmetric triangular distribution is relaxed); see Appendix B for more details. All regressions use sampling weights. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Appendix Table 4. Effects of 1st and 2nd moments for expected growth rate of EA GDP on investment attitudes towards real estate.

	Worth investing in real estate		
	Total sample	Home owners	Non-home owners
	(1)	(2)	(3)
Posterior: mean	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)
Posterior: uncertainty	-0.01	-0.03	0.01
	(0.03)	(0.04)	(0.05)
Prior: mean	0.00	0.00	-0.00
	(0.00)	(0.00)	(0.01)
Prior: uncertainty	0.00	0.01	0.01
	(0.01)	(0.01)	(0.02)
Prior beliefs on investing in real estate	0.47***	0.49***	0.42***
	(0.02)	(0.02)	(0.03)
Education: secondary	0.07	0.08	0.05
	(0.05)	(0.06)	(0.08)
Education: tertiary	0.12***	0.10*	0.15**
	(0.05)	(0.06)	(0.07)
Age	0.00	0.00	-0.00
	(0.00)	(0.00)	(0.00)
Household size	0.00	0.00	-0.00
	(0.01)	(0.01)	(0.02)
Log(household income)	0.01	-0.02	0.03
	(0.01)	(0.02)	(0.02)
Liquidity status	0.04	0.00	0.04
	(0.03)	(0.05)	(0.05)
Observations	4,619	2,990	1,629
R-squared	0.24	0.26	0.21
1st-stage F stat (mean)	129.5	97.51	37.71
1st-stage F stat (uncertainty)	28.19	18.30	11.98

Notes: the table reports estimates of specification (8). The dependent variable is the response to the following question: "Is buying real estate in your neighbourhood today a good or a bad investment?", 1-very bad … 5- very good. The first stage is given by specification (3). Regressands are from the September 2020 waves of the survey. All regressions use sampling weights. Heteroskedasticity robust standard errors are reported in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Appendix B.

1. Mean prediction and uncertainty implied by distributions reported in the pre-treatment stage.

Let $f_i(y)$ denote the distribution of variable y for person i. The survey provides information on the support of the distribution $[y_{m,i}, y_{M,i}]$ and on the probability mass to the right of the mid-point of the support $\pi_i = Prob_i(y > (y_{m,i} + y_{M,i})/2)$. We assume that the distribution $f_i(y)$ is triangular over each of the two intervals $[y_{m,i}, (y_{m,i} + y_{M,i})/2]$ and $[(y_{m,i} + y_{M,i})/2, y_{M,i}]$ as shown in the figure below. If $\pi_i = 0.5$, the distribution collapses to a simple triangular distribution over the interval $[y_{m,i}, y_{M,i}]$.
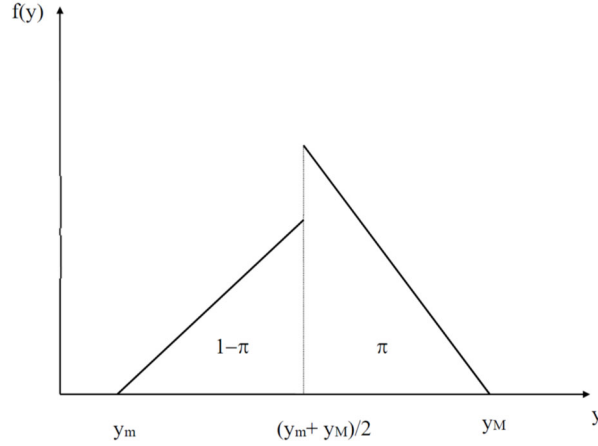
Knowing the support of the distribution, the expected value and variance of y can be expressed as

$$E_i(y) = \int_{y_{m,i}}^{y_{M,i}} y f_i(y) dy,$$

$$Var_i(y) = \int_{y_{m,i}}^{y_{M,i}} [y - E_i(y)]^2 f_i(y) dy.$$

Note that $E_i(y)$ and $Var_i(y)$ depend only on three known parameters $\{y_{m,i}, y_{M,i}, \pi_i\}$. We measure uncertainty as the standard deviation ($\sqrt{Var_i(y)}$) of the reported distribution. For $\pi_i = 0.5$ (our baseline), $E_i(y) = (y_{m,i} + y_{M,i})/2$ and $Var_i(y) = (y_{m,i} - y_{M,i})^2/24$.

2. Mean prediction and uncertainty implied by distributions reported in the post-treatment stage.

At the post-treatment stage, respondents are asked to assign realizations for variable y in three scenarios: lowest $(y_i^{(l)})$, medium $(y_i^{(m)})$, and highest $(y_i^{(h)})$. Then they are asked to assign probabilities for each scenario: $\pi_i^{(l)}, \pi_i^{(m)}, \pi_i^{(h)}$. We compute the mean d variance of the implied distribution as follows:

$$E_i(y) = \sum_{s\in\{l,m,h\}} \pi_i^{(s)} y_i^{(s)},$$

$$Var_i(y) = \sum_{s\in\{l,m,h\}} \pi_i^{(s)} \left[y_i^{(s)} - E_i(y)\right]^2.$$

Appendix C. Survey Questionnaire

Q1. What is the highest level of school you have completed, or the highest degree you have received? [asked in

background survey]

Primary or no education
Lower secondary education
Upper secondary education
Post-secondary non-tertiary education
Short-cycle tertiary education
Bachelor or equivalent
Master or equivalent
Doctoral or equivalent

Q2. How many people – including children and yourself – normally live with you as members of this household? By household we mean everyone who usually lives at your main place of residence (including yourself) and, that shares a common budget (that is, excluding flatmates and lodgers). [asked in background survey]

Q3. What was your household's total **net** income (that is, after tax and compulsory deductions) **over the past 12 months** from all sources?
If you don't know the exact figure, please give an estimate.
Please consider the income of all household members, and from all sources: wages or salaries; income from self-employment or farming; pensions; unemployment/redundancy benefit; any other social benefits or grants; income from investment, savings, insurance or property; income from other sources. [asked in background survey]

_____ [RANGE: 0-999999]
Prefer not to answer
Don't know
Skipped

Q4. Perhaps you can provide the approximate range instead. What category best matches your household's total **net** income (that is, after tax and compulsory deductions) **over the past 12 months**?
We greatly appreciate your response and assure you that everything you say will be treated in the strictest confidence.
[asked in background survey]

Less than €10,000
€10,000-€14,999
€15,000-€19,999
€20,000-€24,999
€25,000-€29,999
€30,000-€39,999
€40,000-€49,999
€50,000-€59,999
€60,000-€74,999
€75,000 or more
Prefer not to answer
Don't know
Skipped

Q5. Please think about your available financial resources, including access to credit, savings, loans from relatives or friends, etc. Suppose that you had to make an unexpected payment equal to one month of your household income. Would you have sufficient financial resources to pay for the entire amount? [asked in August, September (pre-RCT), October, November and December waves]

Yes
No

Q6.What best describes your current employment situation?
[asked in August, September (pre-RCT), October, November and December waves]

Working full-time (self-employed or working for someone else)
Working part-time (self-employed or working for someone else)
Temporarily laid-off (you expect to return to your previous workplace)
On extended leave (disability, sick, maternity or other leave)
Unemployed and actively looking for a job
Unemployed, interested in having a job but not actively looking for a job
Unable to work because of disability or other medical reasons
In retirement or early retirement
Studying, at school, or in training
Looking after children or other persons, doing housework
Other

if Q6="Full time", "Part time", "Temporarily laid off" or "On extended leave":
Q7a. In which sector/industry do you currently work? If you have more than one job, please consider the job in which you work the most hours per week.
[asked in August wave]

if Q6 "Unemployed", "Unable to work", "Retired", "Studying", "Housework" or "Other":
Q7b. In which sector/industry did you work in your last paid job?
[asked in August wave]

Agriculture
Industry
Construction
Trade
Transport
Hotels, bars and restaurants
Information and communication services
Administrative and support services
Public administration, including military
Education
Health sector
Arts and entertainment
Other

Q8. Do you or anyone in your household own financial assets in each of the following categories? [asked in August wave]
[Multiple responses possible]

Savings and current accounts
Stocks and shares
Mutual funds and collective investments
Retirement and pension products (other than a state pension), and whole life insurances

| Bonds (including short-term and long-term bonds) |
| Other financial assets not included above |

Additional info on financial instruments displayed:

Stocks and shares	an ownership share in a public or private company
Mutual funds and collective investments	a portfolio of stocks, bonds or other securities
Retirement and pension products (other than a state pension), and whole life insurances	a voluntary plan for setting aside money to be spent after retirement; an insurance policy which is guaranteed to remain in force for the insured's entire lifetime or to the maturity date.
Bonds (including short-term and long-term bonds)	a fixed income investment that pays back the principal amount at a future date

if in Q8 at least one category of financial products was selected:
Q9. Please provide an estimate of the total value of the financial assets that you and your household own in the following categories. [asked in August wave]
[Brackets] For each item [see below list of brackets]

Savings and current accounts	<drop-down menu>
Stocks and shares	<drop-down menu>
Mutual funds and collective investments	<drop-down menu>
Retirement and pension products (other than a state pension), and whole life insurances (the amount of money that has been accumulated so far, excluding the current face value of the policy)	<drop-down menu>
Bonds (including short-term and long-term bonds)	<drop-down menu>
Other financial assets not included above	<drop-down menu>

<drop-down menu>
€1-€999
€1,000-€4,999
€5,000-€9,999
€10,000-€14,999
€15,000-€19,999
€20,000-€29,999
€30,000-€39,999
€40,000-€49,999
€50,000-€69,999
€70,000-€99,999
€100,000-€149,999
€150,000-€199,999
More than €200,000
Prefer not to answer
Don't know
Skipped

Q10. Below you see 8 possible ways in which your household's total net income could change **over the next 12 months**. Please distribute 100 points among them, to indicate how likely you think it is that each income change will happen. The sum of the points you allocate should total to 100. [asked in August, September (pre-RCT), October, November and December waves]
Instruction: *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 chance points
Increase by 8% or more	

Increase by 4% or more, but less than 8%	
Increase by 2% or more, but less than 4%	
Increase by less than 2%	
Decrease by less than 2%	
Decrease by 2% or more, but less than 4%	
Decrease 4% or more, but less than 8%	
Decrease by 8% or more	
Total (the points should sum to 100)	**100**
Skipped	

Q11. Which of the following have you purchased **in the past 30 days**? Please select all that apply. [asked in August, September (pre-RCT), October, November and December waves]
[Multiple responses possible]

A house/apartment
A car or other vehicle
A home appliance, furniture or electronic items (incl. gadgets)
A holiday
Luxury items, including jewellery and watches
Other major item, not listed above
None of the above

Q12. Which of the following do you plan to purchase **in the next 12 months**? Please select all that apply. [asked in August, September (pre-RCT), October, November and December waves]
[Multiple responses possible]

A house/apartment
A car or other vehicle
A home appliance, furniture or electronic items (incl. gadgets)
A holiday
Luxury items, including jewellery and watches
Other major item, not listed above
None of the above

Introduction (separate screen):

(intro). In the next questions, we ask you to give your best guess about the rate at which the euro area economy will grow or shrink. The growth rate of an economy is the percentage by which the total value of all goods and services produced in a specific period changes. A positive growth rate indicates that the economy will grow, while a negative growth rate (with a '-' sign in front of it) indicates that the economy will shrink.

Q13. Please give your best guess about the **lowest** growth rate (your prediction for the most pessimistic scenario for the euro area growth rate over the next 12 months) and the **highest** growth rate (your most optimistic prediction). [asked in September (pre-RCT) wave]
Instruction: *Please use the sliders below to indicate the growth rates. If you think that the economy will shrink rather than grow you can provide a negative percentage.*

Q13a. What do you think the **lowest** growth rate of the euro area economy will be **over the next 12 months**?
Q13b. What do you think the **highest** growth rate of the euro area economy will be **over the next 12 months**?
Slider with range from -50% to 50%

Q14. What do you think is the percentage chance that the growth rate of the euro area economy **over the next 12 months** will be greater than (Q1a + Q1b)/2 %? [asked in September (pre-RCT) wave]
Instruction: *Please use the slider below to select the percentage chance.*

Slider with range from 0% to 100%

Randomization/Treatment

Group A
Group B
Group C
Group D
Group E

Info screens for each experimental group. Subsequently, all questions identical among groups.
[asked in September wave]

Group	Statement for screen:
A	No additional screen
B	Growth rate forecast for 2021 month in the euro area – first moment Screen 1: On the next screen, we describe some predictions that have been made about economic growth in the euro area. We would like to ask you to **review this information carefully**. Please note that this information will be shown only once and you will not be able to go back to it. Screen 2: The **average** prediction among professional forecasters is that the euro area economy **will grow at a rate of 5.6%** in 2021. By historical standards, this is a strong growth.
C	Growth rate forecast for 2021 in the euro area - second moment Screen 1: On the next screen, we describe some predictions that have been made about economic growth in the euro area. We would like to ask you to **review this information carefully**. Please note that this information will be shown only once and you will not be able to go back to it. Screen 2: Professional forecasters are uncertain about economic growth in the euro area in 2021, with **the difference between the most optimistic and the most pessimistic predictions being 4.8 percentage points**. By historical standards, this is a big difference.
D	Growth rate forecast for 2021 in the euro area - first & second moment Screen 1: On the next screen, we describe some predictions that have been made about economic growth in the euro area. We would like to ask you to **review this information carefully**. Please note that this information will be shown only once and you will not be able to go back to it. Screen 2: The **average** prediction among professional forecasters is that the euro area economy **will grow at a rate of 5.6%** in 2021. By historical standards, this is a strong growth. At the same time, professional forecasters are uncertain about economic growth in the euro area in 2021, with **the difference between the most optimistic and the most pessimistic predictions being 4.8 percentage points**. By historical standards, this is a big difference.
E	Growth rate forecast for 2021 in own country - second moment Screen 1: On the next screen, we describe some predictions that have been made about economic growth in the country you currently live in. We would like to ask you to **review this information carefully**. Please note that this information will be shown only once and you will not be able to go back to it.

	Screen 2: Professional forecasters are uncertain about economic growth in the country you are living in in 2021, with **the difference between the most optimistic and the most pessimistic predictions being <X%> percentage points**. By historical standards, this is a big difference.

Replaced "in the country you are living in" by the actual country name (France for FR, Germany for DE, Italy for IT, Spain for ES) and **<X%>** by the corresponding value for the respective country.

Q15. We would now like to ask you again about possible growth rates in the euro area. What do you think will be the approximate growth rate in the euro area **over the next 12 months** for each of the scenarios below?
We start with your prediction for the most pessimistic scenario for the euro area growth rate over the next 12 months (LOWEST growth rate) and end with your most optimistic prediction (HIGHEST growth rate). [asked in September (post-RCT) wave]

Instruction: *If you think that the euro area economy will shrink rather than grow in one or more scenarios, please provide a negative number.*
Info button after growth rates (first sentence): The growth rate of an economy is the percentage by which the total value of all goods and services produced in a specific period changes.

Sentence	Value field
The LOWEST growth rate in the euro area economy would be about:	__% [RANGE: -50 to 50]
A MEDIUM growth rate in the euro area economy would be about:	__% [RANGE: -50 to 50]
The HIGHEST growth rate in the euro area economy would be about:	__% [RANGE: -50 to 50]

Q16. Now we ask you to think about the **chance of the growth rates you entered in the previous screen actually happening** in the euro area economy over the next 12 months.
Please assign a **percentage chance** to each growth rate to indicate how likely you think it is that this growth rate will actually happen in the euro area economy over the next 12 months. Your answers can range from 0 to 100, where 0 means there is absolutely no chance that this growth rate will happen, and 100 means that it is absolutely certain that this growth rate will happen. The sum of the points you allocate should total to 100. [asked in September (post-RCT) wave]
Instruction: You can allocate the points by typing a number in each box. (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).

Sentence	Value field
LOWEST: The chance of a <a>% growth rate in the euro area economy would be:	__% [RANGE: 0-100]
MEDIUM: The chance of a <b>% growth rate in the euro area economy would be:	__% [RANGE: 0-100]
HIGHEST: The chance of a <c>% growth rate in the euro area economy would be:	__% [RANGE: 0-100]
Total	[sum of values above]

Q17. Imagine that you receive €10,000 to save or invest in financial assets. Please indicate in which of the following asset categories you will save/invest this amount. [asked in September (post-RCT) wave]
Instruction: *You can allocate €10,000 by typing an amount in each box. (Note that your answers should sum to €10,000 – if your sum exceeds €10,000, you should first decrease the amount in one option before you increase the amount in another).*

Euro	
Savings or current accounts	
Stocks and shares	
Mutual funds and collective investments	
Retirement or pension products	
Short-term bonds	
Long-term bonds	

Bitcoin and/or other crypto assets	
Total (the values should sum to €10,000)	**€10,000**
Skipped	

Show info buttons of definitions for financial instruments:

Stocks and shares	an ownership share in a public or private company
Mutual fund and collective investments	a portfolio of stocks, bonds, or other securities (incl. ETFs)
Retirement or pension products	a plan for setting aside money to be spent after retirement
Short-term bonds	a fixed income investment that pays back the principal amount in three years or less
Long-term bonds	a fixed income investment that pays back the principal amount in ten years or more
Bitcoin and other crypto assets	virtual or digital means of payment that takes the form of tokens and secured by cryptography

Q18. Is buying real estate in your neighbourhood today a good or a bad investment?
[asked in September (pre-RCT) and October waves]

Very bad
Bad
Neither good nor bad
Good
Very good

Q19a. During **September 2020**, how much did your household spend on the goods and services listed below? [asked in October and January waves]
Instruction: *If your household has not spent any money on a specific item or service in the last month, then tick the "No money spent last month" box.*

Screen I

		Amount spent last month	No money spent last month
1	**Food, beverages, groceries, tobacco**	€__ [RANGE: 0 to 99999]	[tick box]
2	**Restaurants** (including take-out food, delivery), **cafes/ canteens**	€__ [RANGE: 0 to 99999]	[tick box]

Screen II

		Amount spent last month	No money spent last month
3	**Housing** (including rent, maintenance/repair costs, home owner/renter insurance, but excluding mortgage payments)	€__ [RANGE: 0 to 99999]	[tick box]
4	**Utilities** (including water, sewer, electricity, gas, heating oil, phone, cable, internet)	€__ [RANGE: 0 to 99999]	[tick box]
5	**Furnishings** (furniture, carpets), **household equipment** (textiles, appliances, garden tools), **small appliances and routine maintenance of the house** (cleaning, gardening)	€__ [RANGE: 0 to 99999]	[tick box]
6	**Debt repayments** (instalments in mortgage, consumer loans, auto loans, credit cards, student loans, other loans)	€__ [RANGE: 0 to 99999]	[tick box]

Screen III

		Amount spent last month	No money spent last month
7	**Clothing, footwear**	€__ [RANGE: 0 to 99999]	[tick box]

8	**Health** (health insurance, medical products and appliances, dental and paramedical services, hospital services, prescription and non-prescription medication, personal care products and services)	€__ [RANGE: 0 to 99999]	[tick box]
9	**Transport** (fuel, car maintenance, public transportation fares)	€__ [RANGE: 0 to 99999]	[tick box]
10	**Travel, recreation, entertainment and culture** (holidays, theatre/ movie tickets, club/ gym membership, newspapers, books, hobbies equipment)	€__ [RANGE: 0 to 99999]	[tick box]

Screen IV

11	**Childcare and education** (including tuition fees for child and adult education, costs of after school activities, care of children/ babysitting, but excluding instalments on student loans)	€__ [RANGE: 0 to 99999]	[tick box]
12	**Other expenditures not mentioned above**	€__ [RANGE: 0 to 99999]	[tick box]

<u>Checking Screen (dynamic):</u>

Q19b. According to your entries, your household's spending on the described items and services over the last month was: € ___ [sum from all values in Q19a]. Below is a summary of your entries. If you would like to make any changes to your entries, you can change the amounts in the table below. Once you are satisfied with your entries, please click 'Continue'. [asked in October wave]

		Amount spent last month
21	**Food, beverages, groceries, tobacco**	€__ [RANGE: 0 to 99999]
22	**Restaurants** (including take-out food, delivery), **cafes/ canteens**	€__ [RANGE: 0 to 99999]
23	**Housing** (including rent, maintenance/repair costs, home owner/renter insurance, housekeeping and cleaning service, but excluding mortgage payments)	€__ [RANGE: 0 to 99999]
24	**Utilities** (including water, sewer, electricity, gas, heating oil, phone, cable, internet)	€__ [RANGE: 0 to 99999]
25	**Furnishings** (furniture, carpets), **household equipment** (textiles, appliances, garden tools), **small appliances and routine maintenance of the house** (cleaning, gardening)	€__ [RANGE: 0 to 99999]
26	**Debt repayments** (instalments in mortgage, consumer loans, auto loans, credit cards, student loans, other loans)	€__ [RANGE: 0 to 99999]
27	**Clothing, footwear**	€__ [RANGE: 0 to 99999]
28	**Health** (health insurance, medical products and appliances, dental and paramedical services, hospital services, prescription and non-prescription medication, personal care products and services)	€__ [RANGE: 0 to 99999]
29	**Transport** (fuel, car maintenance, public transportation fares)	€__ [RANGE: 0 to 99999]
30	**Travel, recreation, entertainment and culture** (holidays, theatre/ movie tickets, club/ gym membership, newspapers, books, hobbies equipment)	€__ [RANGE: 0 to 99999]
31	**Childcare and education** (including tuition fees for child and adult education, costs of after school activities, care of children/ babysitting, but excluding instalments on student loans)	€__ [RANGE: 0 to 99999]
32	**Other expenditures not mentioned above**	€__ [RANGE: 0 to 99999]
	Total:	€__ [sum of values above]

Appendix D.

We can gauge the magnitudes of our estimates using aggregate data. Since 1981 the U.S Survey of Professional Forecasters has been collecting also probability distributions for real GDP growth rate forecasts. The reported probability distribution as are for fixed events (the current calendar year and the next year). To construct a proxy for one-year-ahead forecast, we use weighted averages of current- and next-year forecasts where weights depend on how far into a year a given quarter is (e.g., for second quarter, we use a weight of ¾ for the current year and ¼ of the next year). We use quarterly dummy variables to remove the remaining seasonality in the data.

Once the measure of uncertainty for future GDP growth rate is constructed, we can use local projections to estimate responses of consumption to change in uncertainty about GDP as follows. We estimate the following two regressions on quarterly U.S. data:

$$\log C_{t+1} = \sum_{k=0}^{4} a_{c,k} U_{t-k} + \sum_{k=1}^{4} b_{c,k} \log C_{t-k} + \sum_{k=1}^{4} m_{c,k} std(SPF\ GDP)_{t-k} + error$$

$$std(SPF\ GDP)_{t+1} = \sum_{k=0}^{4} a_{SPF,k} U_{t-k} + \sum_{k=1}^{4} b_{SPF,k} \log C_{t-k} + \sum_{k=1}^{4} m_{SPF,k} std(SPF\ GDP)_{t-k} + error$$

where C is a measure of aggregate consumption, U is a measure of macroeconomic uncertainty from Jurado, Ludvigson and Ng (2015), and $std(SPF\ GDP)$ is the standard deviation implied by the average probability distribution for real GDP growth rate in the U.S. Survey of Professional Forecasters (SPF). We are interested in estimating $\partial log C_{t+1}/\partial std(SPF\ GDP)_{t+1}$. Because $std(SPF\ GDP)$ can more for a variety of reasons (e.g., changes in the composition of survey participants), we use innovations to macroeconomic uncertainty U to create the requisite variation in $std(SPF\ GDP)$. Note that we can reformulate our object of interest as

$$\frac{\partial log C_{t+1}}{\partial std(SPF\ GDP)_{t+1}} = \frac{\partial log C_{t+1}}{\partial U_t} \div \frac{\partial std(SPF\ GDP)_{t+1}}{\partial U_t} = \frac{a_{c,k}}{a_{SPF,k}}$$

which also has an instrumental variable interpretation (i.e., one can regress consumption on $std(SPF\ GDP)$ and use U as an instrument). We estimate that $\frac{a_{c,k}}{a_{SPF,k}}$ is -5.2 (s.e. 2.7) for total consumer spending and -6.0 (s.e. 3.9) for nondurable consumption. We find similar results when we use disagreement in the SPF as a proxy for uncertainty: $\frac{a_{c,k}}{a_{SPF,k}}$ is -2.9 (s.e. 1.0) for total consumer spending and -2.3 (s.e. 1.1) for nondurable consumption. These estimates for aggregate US data are broadly in line with our estimates based on survey data for the euro area.