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The formation of subjective house price expectations: the role of perceptions and local economic conditions

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The Formation of Subjective House Price Expectations: The Role of Perceptions and Local Economic Conditions*

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Abstract

We provide new empirical facts on the formation of subjective expectation regarding rarely studied local house price changes. Using new survey data from Britain, a country with high homeownership rates and heterogeneous local price dynamics, we find no evidence that individuals extrapolate from realized local house prices. Rather, individuals rely on their – often incorrect – perceptions of local house prices, and on observable measures of local economic conditions. The extent to which they rely on these signals depends on local house price uncertainty and individuals' financial sophistication. Local price uncertainty is also reflected in the second moment of subjective expectations.

JEL classification: D12; D84

Keywords: Subjective Expectations; Local Housing Markets; Local Economic Conditions

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1 Introduction

Subjective expectations about economic and financial outcomes play a crucial role in individual decision-making (Weber et al., 2022). In housing markets, they affect investment and mortgage behavior (Armona et al., 2019; Bailey et al., 2018, 2019; Bottan and Perez-Truglia, 2025; Chopra et al., 2025) and drive aggregate dynamics, including housing booms and busts (Burnside et al., 2016; Case et al., 2012; Duca et al., 2021; Kaplan et al., 2020; Kindermann et al., 2021). However, the classical full-information rational expectations model fails to explain individual subjective expectations and observed macrodynamics, leading to alternative models, surveyed in Coibion et al. (2018), that allow for bounded rationality, information rigidity, and rational inattention. In this paper, we document new empirical regularities to inform the development of models of belief formation.

We study subjective expectations of local (rather than national) house price changes in British housing markets. Local prices matter directly for individual decision-making – for example, for homeowners wishing to track the value of their asset or move locally. Moreover, house price dynamics vary substantially across geographies within countries (Agrawal and Phillips, 2020; Drayton et al., 2025). Britain's high homeownership and transaction rates, as well as its rich geographic variation in price dynamics provide a compelling setting.

Our key finding is that individuals rely on signals from multiple sources. First, (often incorrect) individual perceptions of past house price changes predict subjective expectations about local house price changes while realized past prices do not. Further, individuals rely on local economic conditions, measured through local claimant counts of unemployment. Local economic conditions shift expectations by roughly 20–25 % as much as an equivalent change in perceived local house prices. Consistent with models of limited attention (Sims, 2003), our third observation is that the reliance on these signals varies with past price uncertainty in local housing markets, individuals' financial sophistication, and incentives to be informed. For instance, individuals rely more heavily on local conditions when local house prices are more volatile. Market uncertainty enters the second moment of their subjective expectations, increasing the uncertainty of beliefs. These results are consistent with behavioral theories positing that individuals extrapolate from multiple noisy signals (Woodford, 2014, 2020).

We use a large sample of almost 2,800 individuals across 364 local housing markets. The data come from a newly designed survey module on subjective expectations, which we developed and administered in collaboration with the Financial Conduct Authority as part of the Financial Lives survey between August 2019 and February 2020, i.e., shortly before the onset of the COVID-19 pandemic. We elicit perceptions of house price changes over the past year in respondents' local area of residence, as well as subjective expectations of one-year-ahead local house price changes. More specifically, we use probabilistic elicitation techniques to obtain both the mean and the standard deviation of respondents' subjective belief distribution (Manski, 2004). We link these data to realized local house price changes – based on spatial disaggregates of the UK House Price Index – and to easily observable, locally experienced economic conditions, i.e., local unemployment rates at the time of the interview.

We make several empirical contributions to the understanding of belief formation in housing markets. The first is to elicit beliefs about local housing market dynamics. Local prices and beliefs about their evolution are directly relevant to individual decision-making, and information on them may be more easily observable. Most empirical studies have focused on expectations about national house prices as an important economic indicator (see Kuchler et al. (2023) for a recent overview). Yet, national house price dynamics have been shown to mask significant within-country geographic variation in many developed economies - including both the UK and US. Analogously, Kuchler et al. (2023) document systematic geographic differences in subjective expectations on national house price changes. We thus provide rare evidence on the key predictors of *local* house price expectations.

Second, we enrich the space of possible mental models by allowing for a broader set of predictors individuals may use when forming subjective house price beliefs. We find that in addition to past house price changes, subjective expectations are predicted by local macroeconomic conditions. This is consistent with the hypothesis raised in Armona et al. (2019) that individuals may take into account "information other than past home price growth, [incorporating] variables capturing local macroeconomic conditions." We focus on the local unemployment rate as a proxy for local economic conditions because it is reported regularly and easily observable.[1] In our analysis, local economic conditions emerge as a key predictor of expected

[1] Amior and Manning (2018) and Langella and Manning (2022) argue that local unemployment rates are a sufficient statistic for local economic well-being because "if there is any elasticity in the supply of labor to an area, the utility offered by living in an area can be written as a function of the utility obtained when

house prices, suggesting that individuals extract signals from a broader information set than previously considered. When local conditions deteriorate by one standard deviation, individuals expect around -0.18 percentage points lower house prices – economically meaningful, but smaller than the effect due to (perceived) house price changes. This finding is consistent with behavioral models in which individuals form and update beliefs about underlying fundamentals by extrapolating from multiple, potentially noisy signals (Woodford, 2014, 2020).

Third, our data reveal that, at the local level, perceptions rather than realizations influence beliefs about future house prices. Prior work, motivated by Case and Shiller's (1989) seminal finding of short-run momentum in house prices, has often relied on adaptive expectations models, using past house price changes as the primary predictor. These studies have established that individuals tend to underestimate short-run momentum and fail to anticipate long-run mean reversion (Kuchler et al., 2023). Recent behavioral approaches highlight the role of perceptions in shaping subjective expectations, including house prices. Armona et al. (2019) find in an information experiment that both realizations and perceptions of past (national) house price changes matter in the expectation formation process. In contrast, we find that the changes in the local house price realized in the past year do *not* predict subjective expectations of the changes in the local house price for the next 12 months. Rather, individuals rely on their perceptions: a one percentage point increase in the perceived past one-year local house price change is associated with a 0.13 percentage point increase in individuals' house price expectations (0.97 of a standard deviation). Perceptions often overestimate the magnitude of price changes (on average by around 2.68 percentage points), creating a sizable perception gap. A growing literature emphasizes personal experiences or local information as sources of biased beliefs about aggregate outcomes, including house prices and general inflation (Bailey et al., 2018, 2019; Kuchler and Zafar, 2019; Malmendier, 2021).[2]

non-employed in an area and the unemployment rate of residents in the area, which acts as a sufficient statistic for all the [economic] opportunities" (Langella and Manning 2022, p. 3). We also consider alternative measures for robustness.

[2]These range from the use of local economic signals (D'Acunto et al., 2021a; Kuchler and Zafar, 2019), to individuals' social networks (Bailey et al., 2018, 2019), to individualized time horizons and weighting of past exposures to macroeconomic fluctuations (D'Acunto et al., 2021b; Malmendier, 2021). For instance, Kuchler and Zafar (2019) use past house price changes in an individual's place of residence as a measure of personal housing experiences and find a positive relationship with individuals' expectations about nationwide house price changes. Bailey et al. (2018, 2019) emphasize the role of (geographically distant) friends' housing market experiences in shaping individuals' subjective expectations about local house price growth. Malmendier (2021) and D'Acunto et al. (2021b) highlight that past experiences of hyperinflation may have a lasting effect on

This provides our fourth contribution, a rationale for the frequently stated stylized fact of short-run overshooting in house price beliefs (Glaeser and Nathanson, 2017). We find that individuals extrapolate in a manner and magnitude that echoes the short-run momentum in house price fundamentals (e.g., Case and Shiller, 1989; Guren, 2018), but based on their often biased perceptions. Using monthly-level data from the UK HPI, we estimate dependencies in local housing markets in Britain. For the period between 2010 and 2019, the average short-run momentum is around 15.6%[3]. This closely resembles the extrapolation weight that individuals attribute to their perceptions of these fundamentals. But perceptions overestimate the magnitude of price changes by around 2.68 percentage points (or 5 percentage points in absolute terms) on average, creating a sizable perception gap – and short-run overshooting in house price beliefs.

Fifth, we show that individuals heterogeneously vary their reliance on the two signals when forming beliefs. Theories of rational inattention would suggest that individuals may particularly rely on easily observable signals if they have incomplete observations of other signals – such as housing market dynamics – or face cognitive limitations and lack incentives to acquire accurate information. In fact, this is what we find. Individuals with low financial sophistication – who have less accurate price perceptions, i.e. know less about past price changes – additionally use easily observable local economic conditions as a heuristic in their formation of house price expectations. Financial sophistication has been linked to biased beliefs and perceptions across several domains of expectations (D'Acunto et al., 2019; Kuchler and Zafar, 2019). Also in accordance with standard models of choices under uncertainty, we show that risk-averse individuals diversify their information sources by relying strongly on both signals.

Finally, we provide novel evidence that individuals faced with higher local house price uncertainty adjust their beliefs in two ways: first, they adjust the weighting they give to different signals in their 'mental model' towards stronger reliance on easily observable local unemployment rates (Andre et al., 2022). Second, the variance of their local house price expectations is

inflation expectations, and that individual grocery shopping experiences may lead to biased inflation beliefs due to a personalized, unrepresentative consumer basket or price schedule.

[3]A closer look shows that local house price dynamics are heterogeneous: For 44.2% of the local authorities, there is a positive and significant relation between past one-year and future one-year house price growth, while the remainder of localities display negative or no momentum. Since the consequences of the COVID-19 pandemic – which only unfolded afterward – could not have been anticipated by respondents at the time of the survey, we cannot compare the degree of extrapolation in the expectations data with the degree of autocorrelation in the realized house price data for the period following the survey.

higher, reflecting the larger price uncertainty. These findings are based on nonparametric estimates of the first and second moments of expectations, possible since we elicited expectations probabilistically based on a sequence of support points. Kuchler and Zafar (2019) showed that more volatile local house price changes are associated with a wider distribution of expected national house price changes. We use measures of local market uncertainty to document that this also holds for local house price expectations. Individuals faced with uncertainty in fundamentals broaden their set of underlying signals, and directly incorporate such uncertainty into the first and second moments of their subjective expectations.

2 Data

In a survey module developed in collaboration with the Financial Conduct Authority (FCA), we measure individuals' perceptions of recent local house price changes, and subjective expectations of future house price dynamics. Respondents were also asked about subjective expected and perceived past stock market returns.[4] It was cognitively pretested by the FCA and implemented in the 2020 wave of the *Financial Lives Survey* – a comprehensive, large, and nationally representative survey of 16,000 adults aged 18 and older living in the UK.[5] The module was presented to a randomized subset of just under 4,000 participants who were interviewed between August 2019 and February 2020, i.e., fieldwork completed shortly before the onset of the COVID-19 pandemic. COVID-related online searches increased only after the end of the survey in March 2020 (see Online Appendix C for a detailed analysis), so it is unlikely that the beliefs and expectations of survey respondents about future house price changes were distorted by the upcoming COVID-19 pandemic. Social distancing measures were not introduced until mid March 2020.

The Financial Lives survey includes rich information on socio-economic characteristics and attitudes, individuals' use of financial products, and their experiences in dealing with financial products and services. It also elicits financial sophistication which we measure based on the canonical four-item financial literacy instrument covering knowledge of interest rates, interest

[4] It also elicited savings account returns as well as the relative riskiness of broad asset classes.

[5] The wording of the survey questions on perceptions and expectations of house price changes was pre-tested and piloted by the Financial Conduct Authority (FCA) in cooperation with an independent survey institute. Pre-testing included cognitive testing in different local authorities at different points in time.

compounding, inflation, and risk diversification (for measurement details, see Lusardi and Mitchell, 2008). In our sample, 48% of the respondents answer all four questions correctly. We define these as having *high* financial literacy; the remaining 52% of the sample are defined as having *low* financial literacy.[6] As an alternative, we construct a second measure of financial sophistication based on knowledge about interest rates for savings accounts.[7]

We restrict our sample to respondents residing in Great Britain, for whom information on the place of residence is available, and who provide answers to the survey questions about perceived past and expected future house price changes, resulting in a final sample of 2,799 respondents living in 364 local authorities (LAs).[8] Respondents' Local Authority of residence[9] is used to link the survey data with administrative data to obtain relevant local measures of realized house prices and economic conditions.

The survey data reflect the high homeownership rates in Great Britain and the prime role housing plays in households' portfolios: Almost three quarters of respondents in our sample report owning a home (either outright or with a mortgage); 42% hold other assets (e.g., stocks, bonds, or investment funds). Table A2 in the Online Appendix reports summary statistics.

2.1 Subjective house price expectations

We measure subjective expectations about local house price changes using probabilistic elicitation techniques (see Dominitz and Manski, 1997; Giglio et al., 2021; Hurd and McGarry, 2002; Manski, 2004). More specifically, we ask respondents to assign probabilities to a range of

[6] In line with previous research (Lusardi and Mitchell, 2008), we find that women, individuals with low education, and those with low household income are less likely to have high financial literacy. Also, individuals living in regions with higher rates of unemployment are less likely to have high financial literacy (see Table A5 in the Online Appendix).

[7] A person's interest rate knowledge is considered *high* if three concepts related to the riskiness of savings accounts, and ranges of past and expected future interest rates are understood, and *low* otherwise. More precisely, if they (i) know that the interest rate on a savings account was not higher than 2% in the year before interview, (ii) think there is no chance of earning an interest rate of 4.1% or more on money kept in a savings account in the year after interview, and (iii) believe that keeping their money in a savings account over the next 12 months will be less risky than investing in the stock or local housing market. Financial sophistication using this measure is slightly lower with 37% of respondents with high interest rate knowledge.

[8] The randomized sample comprises 3,662 individuals of which we drop 3 observations with a missing Local Authority and 860 observations who did not understand the probabilistic question format of the risk-and-return questions, and thus refused to answer. These were more likely to be female, younger, less educated and less financially literate. Our sample does not include respondents from seven local authorities (Barrow-in-Furness, City of London, Derbyshire Dales, Hertsmere, Isles of Scilly, Blaenau Gwent, and Merthyr Tydfil).

[9] We use the terms 'Local Authority' and 'local area' synonymously.

possible future house price changes in their local area, requiring them to add up to 100%.[10] Respondents were prompted to imagine that they received an unexpected inheritance of £100,000 which they put towards buying a house in their local area, and to subjectively assess the percentage chances that – in 12 months' time – the house will have *decreased in value* by (i) 10% or more, (ii) 9.9% to 5%, or (iii) 4.9% to 0%; or *increased in value* by (iv) 0.1% to 5%, (v) 5.1% to 10%, (vi) 10.1% to 15%, or (vii) 15.1% or more. Brackets were chosen to reflect the distribution of past house price changes.[11]

Figure 1 shows the distribution of subjective expectations about future changes in local house prices. Each bar represents the average of the probabilities the respondents reported for the corresponding bracket of returns.[12] The realization of gains in local housing markets is believed to be considerably more likely than the realization of losses. Modest positive changes (between 0.1% and 5%) are most likely. The average probability of large gains (of 15.1% or more) is around 6% and twice as large as that of large losses (of at least −10%).

Using these responses, we construct a measure of subjective expected one-year house price changes, adopting the estimation approach suggested by Hurd et al. (2011). They construct non-parametric estimates of the mean of the expected rate of return distribution for stock market investments. The model is given by

$$E(\pi) = \sum_j P(\pi \in B_j) E(\pi | \pi \in B_j) \tag{1}$$

where, $P(\pi \in B_j)$, is an individual's subjective probability assigned to bracket j, and, $E(\pi|\pi \in B_j)$, is the historical average of one-year rates of return conditional on the return being in bracket j.

We adopt the same methodology to construct a measure of the subjective expected house price change from the probabilities corresponding to the seven brackets B_j described above. We compute historical UK-wide year-on-year house price changes r_t for each month using the quality-adjusted UK House Price Index for the time between January 2002 and July 2019.[13]

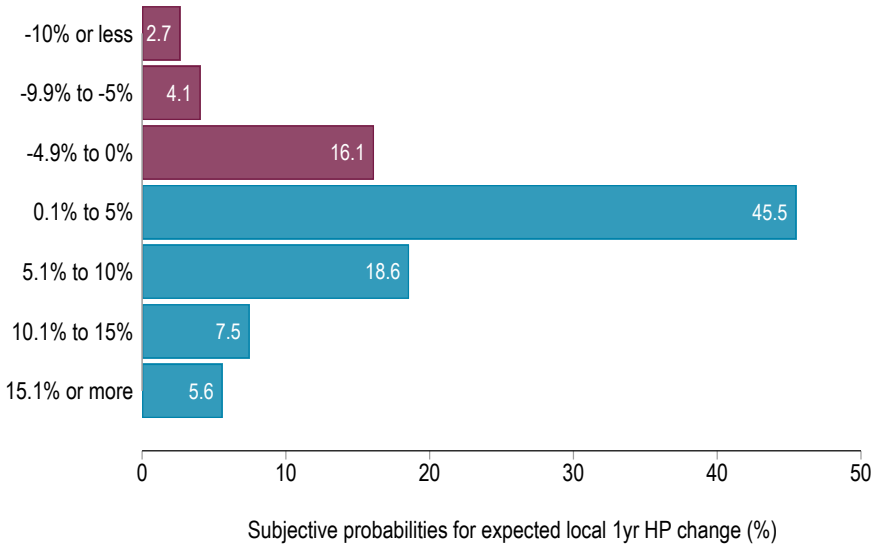
[10] If reported probabilities did not add up to a 100%, respondents were shown a message reminding them of this requirement to ensure consistency (see also Giglio et al. 2021).

[11] The survey questions are listed in Online Appendix A.

[12] Since each respondent was forced to report probabilities that sum to 100, these means also sum to 100, up to rounding error.

[13] Figure B2 in the Online Appendix shows that estimates of subjective expected house price changes are qualitatively unchanged when we instead use house price changes that are vary by geographic localities (the

Figure 1: Subjective expected one-year local house price changes



Notes: The figure shows the distribution of one-year-ahead expected local house price (HP) changes, N=2,799. Each bar represents the average of the probabilities the respondents reported for the corresponding bracket of returns. For detailed summary statistics, see Table A3 in the Online Appendix. *Source*: Financial Lives 2020 survey.

We then assign these historical returns to the return brackets B_j to get bracket-specific average returns $E(r|r \in B_j)$. Table 1 shows the summary statistics of the non-parametric estimates of the mean and standard deviation of each respondent's subjective distribution of one-year house price changes. The sample mean of the first moment of these subjective distributions (which we refer to as the "expected one-year house price change") is 3.71%, with a standard deviation of 4.45 percentage points. The second moment ("the subjective standard deviation of one-year house price changes") has a sample mean of 4.49 percentage points, with a standard deviation of 2.82. The table also reports the first and ninth decile and the sample median of these estimates. For more detail on the non-parametric estimation, see Online Appendix B.

individual's government office region or Local Authority instead of the whole UK) or use alternative time horizons (1969–2019 instead of 2002–2019) in the computation of $E(r|r \in B_j)$.

Table 1: Summary statistics: expectations, perceptions, and realizations

	Mean	Std Dev	P10	P50	P90
Panel A: Expectations					
Expected 1yr HP change (%)	3.71	4.45	0.13	2.69	8.52
Subjective Std Dev of 1yr HP change (%-points)	4.49	2.82	1.54	3.54	8.67
Panel B: Perceptions					
Perceived 1yr HP change (%)	3.79	7.52	0.00	3.00	10.00
Panel C: Realizations					
Realized 1yr HP change (%)	1.11	2.68	−2.16	1.20	4.20
Panel D: Perception gap					
Absolute perception gap (%-points)	5.04	6.73	0.63	3.51	10.24
	[2.68]	[7.97]	[−3.61]	[2.20]	[9.50]
N	2,799				

Notes: The table shows summary statistics. The absolute perception gap denotes the difference between realized and perceived past one-year (1yr) local house price (HP) changes in percentage points in absolute terms. The gap, expressed as a simple difference, is shown in square brackets. Computation of expectations is based on the non-parametric estimation approach by Hurd et al. (2011); for details, see Online Appendix B. *Source*: Financial Lives 2020 survey, and historical values from the UK HPI.

2.2 Perceptions of past local house price changes

We also elicited respondents' perceptions of house price changes in their local area in the past year. Following the *Survey of Consumer Expectations Housing Survey*, fielded by the Federal Reserve Bank of New York, we use a two-step format in the survey where respondents first report their beliefs regarding the direction of house price changes in the last 12 months and are then requested to give a point estimate (see Online Appendix A1). On average, respondents' perceptions were that house prices increased by 3.79% over the previous 12 months (Table 1). Only 5.8% of respondents believed house price had fallen. The standard deviation of 7.52 percentage points to large variation in respondents' perceptions of past local house price growth. This may be due to differentials in local house prices or reflect perception gaps - we will get back to this point in Section 4.

2.3 Past local house prices

Next, we construct measures of the realized past house price change individuals experienced in their local area of residence. We use the *UK House Price Index* (*UK HPI*), published by *HM Land Registry*, to compute past house price changes. The Local Authority-specific

index is updated monthly, and is mix-adjusted to account for changes in housing quality and composition (HM Land Registry, 2021). It produces highly accurate price trends, as residential property sales occur frequently in most local authorities. In 2019 (2018), more than 1,000 residential properties were sold annually in 95% (96%) of the 339 local authorities in England and Wales, and above 2,000 properties in 50% (58%) of them (Office for National Statistics, 2023).

We follow the approach in Kuchler and Zafar (2019) to compute past experienced local house price changes.[14] We link local house prices into the Financial Lives survey data by respondents' area of residence and interview month, and use the annual percentage change in local house prices, measured over the 12 months preceding the month a respondents' interview was conducted.

British house price dynamics vary considerably across time and place, as Figure 2 exemplifies for six local authorities (see also Online Appendix D). Table 1 shows that local house prices rose on average by a modest 1.11% with a standard deviation of 2.68.

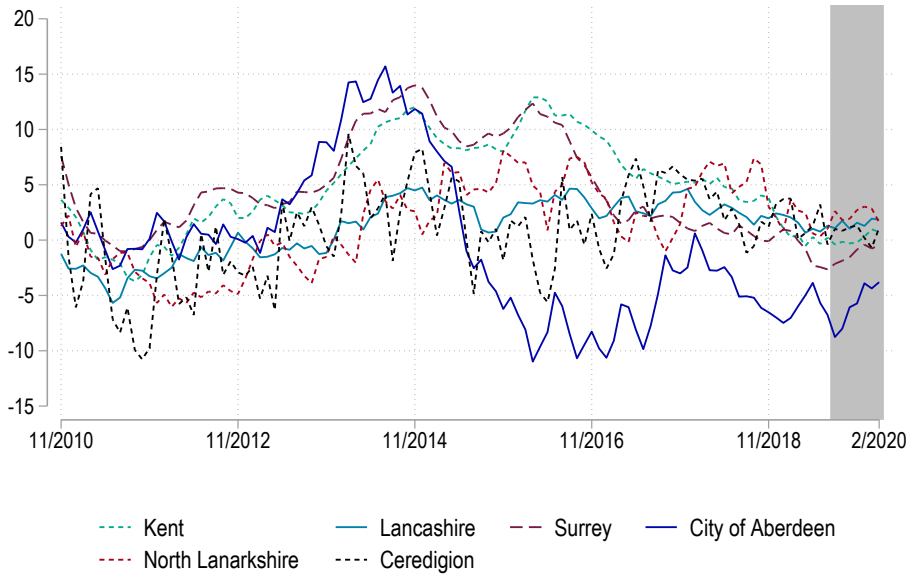
2.4 Local economic conditions

We consider a salient, widely used measure of local macroeconomic conditions, the local unemployment rate. It is frequently reported in the news specifically for local areas. We measure it using administrative claimant counts, i.e the total number of individuals (i) claiming Jobseeker's Allowance, plus those (ii) claiming Universal Credit and being out of work, divided by the resident local population aged 16–64. Claimant counts (referred to as 'local unemployment rate' throughout the paper) are lower than officially reported unemployment rates, but available for granular geographic areas.[15] They refer to the respondent's Local Authority of

[14] In the literature on the role of past experiences in shaping subjective expectations, more sophisticated aggregation functions for historic experiences have been proposed. As a robustness check, we followed the approach by Malmendier and Nagel (2011) and constructed a weighted average of annual local house price changes, selecting a combination of lookback period and weights that yielded the best goodness-of-fit. We achieve the best fit for the 5-year lookback period with slowly decreasing weights. Our main results are robust to using this alternative measure of historic return experiences. See Online Appendix F for details.

[15] Officially reported unemployment rates are based on self-reports in the Labor Force survey and Annual population survey, whose sample sizes are not sufficient for granular spatial analysis at monthly level. Claimant counts yield systematically lower unemployment rates as they exclude, for example, those searching for a job who have not claimed unemployment or other benefits. E.g., the unemployment rate based on claimant counts across local authorities was on average 2.4% in 2019; in contrast, the model-based estimate of the officially reported unemployment rate across local authorities was 3.6% in 2019 (Office for National Statistics, 2022).

Figure 2: Realized local house price dynamics



Notes: The figure shows (monthly computed) annual house price changes for the period 11/2010 to 02/2020 for an arbitrary selection of six different local authorities across Great Britain. The shaded area indicates the survey period. *Source*: Historical values from UK HPI.

residence in the month of interview. Table 2 reports average local unemployment rates for the survey period. Even in a period of low unemployment, we see large variation across the areas in our sample, visualized in Figure 3. The mean (median) unemployment rate is 2.6% (2.4%), with a standard deviation of 1.13 percentage points. Older industrial areas, some seaside towns, and some London boroughs are among the places with the highest unemployment rates.

In sensitivity analysis, we show that our results are robust to an alternative measure of local economic conditions – the social and economic deprivation score (see Online Appendix Section F, Figure F2). It aggregates indicators of local conditions across a broad spectrum of social and economic dimensions, and is frequently considered in the design of local and national policies, such as the UK government's 'Levelling Up' agenda.[16]

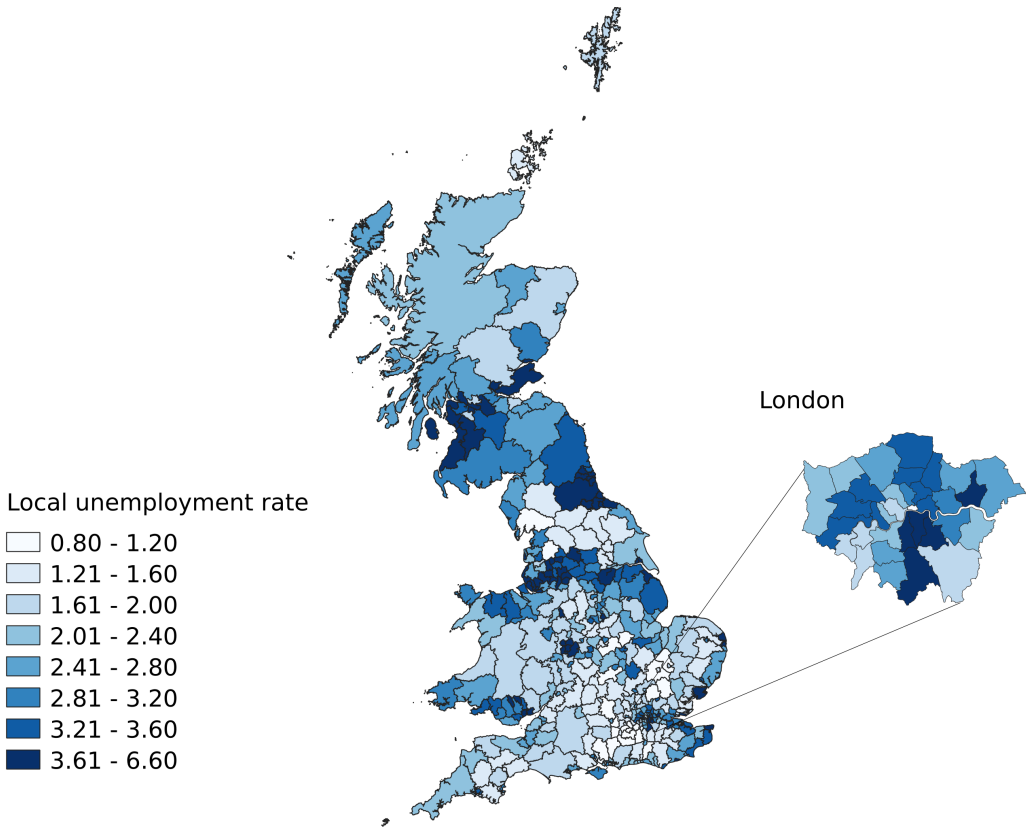
[16]It is taken from the 2019 Index of Multiple Deprivation, provided by the *Ministry of Housing, Communities & Local Government*. The score aggregates indicators from seven domains, including (i) income, (ii) employment, (iii) education, skills, and training, (iv) health and disability, (v) crime, (vi) barriers to housing and services, and (vii) living environment. Due to methodological differences in their measurement and underlying indicators across the constituent countries of Great Britain, estimates based on this measure of local eco-

Table 2: Summary statistics: local economic conditions

	N	Mean	Std Dev	P10	P50	P90
Local unemployment rate	364	2.59	1.13	1.33	2.41	4.23
Local deprivation score	312	19.66	7.99	10.24	18.58	30.72

Notes: The table shows summary statistics for the local authorities covered in our sample. Monthly local unemployment rates averaged for the survey period between August 2019 and February 2020. Local deprivation score as of 2019 (only available for English local authorities). *Source*: Office for National Statistics (data from Nomis) and Ministry of Housing, Communities & Local Government.

Figure 3: Local unemployment rates



Notes: The map shows the average monthly local unemployment rates for the survey period between August 2019 and February 2020, measured as claimants per resident population aged 16–64. *Claimants* denote those claiming Jobseeker's Allowance and out-of-work claimants of Universal Credit. *Source*: Office for National Statistics (data from Nomis).

nomic conditions are produced for England only. Online Appendix E shows that both measures are positively correlated with each other and with other measures of local conditions.

2.5 Local house price uncertainty

We construct two measures that capture the uncertainty associated with local house prices – volatility and short-run momentum. First, we consider the temporal volatility of house prices within a locality over the last five years, i.e. the standard deviation of monthly computed local one-year house price changes.

Second, we use historic panel data on local house price dynamics between 2011 and 2019 to estimate the short-run momentum in the housing market, i.e., to provide evidence on the extent to which information on local house prices at time t predicts house prices a year ahead. We follow Armona et al. (2019) to estimate local AR(1) models[17]:

$$\Delta HPI_{l,t+12} = \alpha_l + \sigma_l \Delta HPI_{l,t} + \epsilon_{l,t}\,, \tag{2}$$

where $\Delta HPI_{l,t}$ is the rate of one-year change in the UK House Price Index in Local Authority l and month t. The rate of change in house prices is calculated over the horizon of 12 months. σ_l measures the extent to which the local house price change in the last period predicts the current local house price change.

We estimate autoregressive coefficients σ_l for each of the 364 local authorities by an OLS model with Newey–West standard errors for the time horizon from 7/2011 to 7/2019 (i.e., after the financial crisis occurred, and before the Financial Lives survey was conducted).

Table 3: Dependence in realized local house price changes, 7/2011–7/2019

	Mean (Std) (1)	Percent of areas with positive momentum (2)	Percent of areas with negative momentum (3)
σ_l	0.156 (0.226)	44.2	6.9

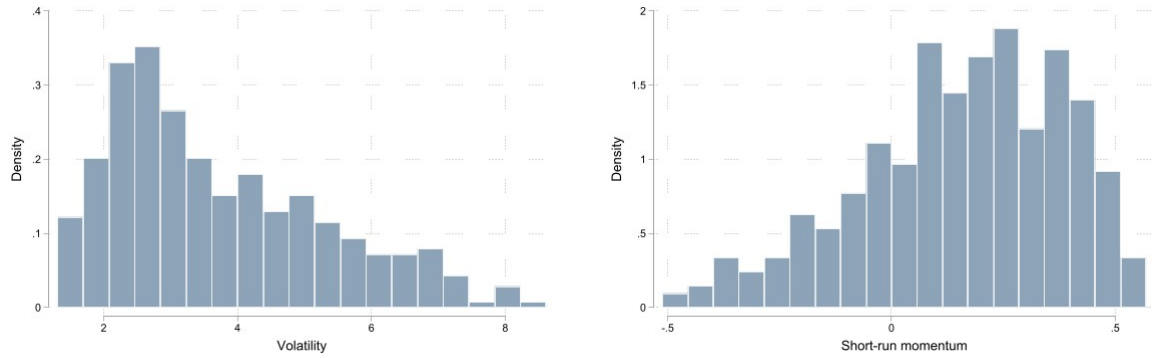
Notes: The table shows regression estimates of (one-year) local house price (HP) growth dependence on lagged one-year local HP growth for the local authorities covered in our survey sample ($N = 364$), with 97 observations for monthly-computed annual house price growth per Local Authority. Mean coefficient and standard deviation across local authorities shown in column (1). Column (2) [respectively (3)] shows the percent of estimates that are statistically significantly positive [negative] at the 5% level, based on Newey–West standard errors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: UK HPI.

The average estimated autoregressive coefficient across the local authorities in our sample, shown in column 1 of Table 3, indicates that across local areas in our sample, a one percentage

[17] We base this on monthly-computed one-year local changes in house prices and their lagged values.

point higher house price growth in month t is followed, on average, by 0.156 percentage point higher rates of house price growth in the consecutive 12 months. This confirms the well-established short-run momentum in housing markets (Case and Shiller, 1989). Yet, within local housing markets, the autoregressive coefficient is positive and statistically significant (at 5%) only in 44% of localities in our sample, and negative in 7% of localities (see columns 2 and 3 of Table 3).[18] Local markets with short-run momentum can be found across all regions of Great Britain; they do include most local authorities in London (91%) and more than half of local authorities in the East of England and the West Midlands but also more than a third of local authorities in the South East, the North West, and Yorkshire and Humberside. Summary statistics of the two measures of local housing market uncertainty are presented in Table 4.

Figure 4: Local housing market uncertainty: volatility and momentum



Notes: The left figure shows the distribution of house price volatility over the past 5 years across localities, the right figure shows the distribution of the estimated momentum parameters σ_l across localities. *Source*: Financial Lives 2020 survey, and historical values from the UK HPI.

Table 4: Summary statistics: local housing market uncertainty

	N	Mean	Std Dev	P10	P50	P90
Volatility	362	3.73	1.60	2.01	3.28	6.20
Short-run momentum	364	0.16	0.23	−0.17	0.18	0.42

Notes: The table shows summary statistics computed at the level of local areas in our sample. 5 yr house price volatility is measured as the standard deviation of monthly computed local one-year house price changes over the past 5 years. Short-run momentum is the local autoregressive coefficient σ_l from equation 2. *Source*: Financial Lives 2020 survey, and historical values from the UK HPI.

[18] We also consider a five-year lag in prices (using *annualized* house price changes) to investigate long run mean reversion, and find predictive power for about 40% of local authorities – but only weak evidence of mean reversion for about half of them. Results available from the authors upon request.

3 Empirical method

The primary goal of this paper is to characterize the role of local economic conditions and past (perceived and realized) local house price changes in shaping the formation of individuals' subjective expectations about future changes in local house prices. Our main empirical specification is as follows:

$$E(\Delta HPI^{t+12})_{ilt} = \lambda LEC_{lt} + \delta \Delta HPI_{ilt}^{t-12} + \gamma X_{ilt} + \eta_t + \epsilon_{ilt} \tag{3}$$

The dependent variable $E(\Delta HPI^{t+12})_{ilt}$ is non-parametrically estimated mean of the subjective distribution of future house price changes of individual i residing in local area l in interview month t.[19] For convenience, we refer to this as the expected change in house prices.

Local economic conditions in locality l are denoted as LEC_{lt}, e.g., in our baseline specification the monthly unemployment rate in the individual's residential Local Authority. ΔHPI_{ilt}^{t-12} refers to the perceived past one-year rate of change in the local house price index in Local Authority l relative to the interview month t. In some regression specifications, we also consider *realized* past local house price changes; in these cases, ΔHPI_{ilt}^{t-12} simplifies to ΔHPI_{lt}^{t-12}, as it varies only by Local Authority and interview month. X_{ilt} is a vector of individual-specific controls - age and education categories, household-income categories, whether respondents are female, married, or working, and whether they finished the interview during one day - and η_t are interview-month fixed effects.[20] Standard errors are clustered at the level of local authorities. The number of observations in the full regression sample drops from 2,799 to 2,725 due to item non-response on covariates.[21]

In the following sections, we consider additional dependent variables and adjust the set of right-hand side variables. In Section 4.5, we replace the dependent variable with the standard deviation of the respondent's subjective distribution of one-year house price changes. These regressions do not include perceived or realized house price changes.

[19] The subscript refers to the point in time at which expectations are formed and the superscript refers to the period of time over which they are formed.

[20] We do not include local-authority fixed effects because there is little within-LA variation in local unemployment rates over the short interview period of the survey.

[21] Slight additional reductions in the sample size arise in some regression specifications due to missing values for certain covariates.

4 Results

4.1 Predictors of subjective house price expectations

We estimate equation (3) to study the role of past house price changes and of locally experienced economic conditions in shaping the formation of subjective expectations about one-year-ahead changes in local house prices. In column (1) of Table 5, we include local unemployment rates and *realized* local one-year house price growth as explanatory variables; in column (2), we replace realized local one-year house price growth with *perceived* local one-year house price growth; in column (3), we include all three variables.

Table 5: Predictors of subjective expected house price changes

	Expected 1yr HP change (%)		
	(1)	(2)	(3)
Local unemployment rate	-0.192^{**}	-0.186^{***}	-0.183^{***}
	(0.077)	(0.069)	(0.070)
Realized 1yr HP change	−0.003		−0.005
	(0.031)		(0.030)
Perceived 1yr HP change		0.130^{***}	0.130^{***}
		(0.028)	(0.028)
Effect of 1 std in Local unemployment rate	−0.21	−0.21	−0.20
(in %)	(−5.77)	(−5.59)	(−5.52)
Effect of 1 std in Realized 1yr HP change	−0.01		−0.01
(in %)	(−0.19)		(−0.33)
Effect of 1 std in Perceived 1yr HP change		0.97	0.97
(in %)		(26.30)	(26.30)
Mean DepVar	3.71	3.71	3.71
R-squared	0.04	0.09	0.09
N	2,725	2,725	2,725

Notes: The table shows regression estimates with *expected 1yr house price (HP) change* as the dependent variable. Realized, perceived, and expected one-year changes in prices refer to the *local* housing market. Local unemployment rates vary by interview month and local area. All specifications include the following controls: indicators for age, education and household income, whether respondents are female, married, or working, whether they finished the interview during one day, whether they are risk-averse, financially literate, moved recently, their homeowner status and month-year of interview fixed effects. Detailed definitions and summary statistics are provided in Online Appendix Tables A1 and A2. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

The estimation results show that individuals do *not* extrapolate from past realized one-year local house price changes when forming subjective expectations about one-year-ahead local house price changes. Instead, they heavily extrapolate from perceived past local house price changes, consistent with models of rational inattention. The estimate of the coefficient of perceived local one-year house price growth is positive and significant at the 1% level, and economically meaningful: individuals whose local house price perceptions increased by one

standard deviation are also more likely to expect higher local house price growth, in fact an increase by 26.3% or 0.97 percentage points, in the future. A strong positive association between past perceived and future expected house price changes was also documented in Armona et al. (2019).

Our estimates of the short-term momentum for each local housing market in Great Britain, presented in Table 4, indicated that across local areas, a one percentage point higher house price growth in month t is followed by 0.156 percentage point higher rates of house price growth in the consecutive 12 months on average. This estimate is very similar to the estimated percentage point change in subjective house price expectations upon a one percentage point change in *perceived* local house prices of 0.130. While individuals do not perfectly recall the realized past local house price change, they appear to extrapolate consistently with the average short-run momentum in realized house prices.

The estimates also show that in addition to perceived past house price changes, economic conditions in the local area are an important predictor of subjective house price expectations. Individuals who live in local areas with higher unemployment rates expect, on average, lower rates of house price growth: A one standard-deviation increase in local unemployment rates is associated with a decrease in individuals' expected local house price changes by 0.20 percentage points (which corresponds to 6% of one-year-ahead expected local house price changes).

Comparing the magnitude of the effects of local economic conditions and past perceived local house price changes on subjective expectations, we find that a one standard deviation change in local economic conditions decreases subjective price-change beliefs by less – the magnitude of the effect is about 20–25% of that from an equivalent change in perceived local house prices.

4.2 House price perception gaps

The empirical analysis so far revealed that individuals base their subjective house price expectations on perceived rather than realized past house price changes, suggesting a deviation between them, in short: a "perception gap." Table 1 displays indeed a large absolute perception gap of 5.04 percentage points, measured as the absolute difference between realized and perceived one-year local house price changes. For half of the sample, it is above 3.5 percentage points; for around 10% of the sample, the perception gap exceeds 10 percentage points. For

comparison, this is very similar to the 5.44 percentage point gap in absolute terms found in (Armona et al., 2019).

We investigate the correlates of individuals' perception gaps in Table 6 (columns 3 and 4). First, we find that realized house price changes do not strongly correlate with individual perceptions. Second, neither perceptions nor the perception gap vary with local economic conditions. Yet, they do vary with local market uncertainty: the gap is larger for those living in local authorities that experienced high house price volatility over the past five years, i.e. where keeping track of house price changes is complex. It is also larger for women, and smaller among homeowners.

The key predictor of the perception gap, however, is individuals' financial sophistication. Table 6 shows that high financial sophistication is associated with lower perception gaps (by about one-fifth compared to the overall average), and is strongly statistically significant. That is, financially sophisticated individuals assess past one-year changes in local house prices more accurately than individuals with low financial literacy.[22] At the same time, results in columns 1 and 2 show that none of these characteristics predicts the *level* of perceived house price changes. For example, women's perceptions and those of individuals with low financial literacy tend to be less accurate, but they do not systematically over- or underestimate past house price changes.

In summary, individuals' perceptions of past house prices are far from accurate. Perception gaps vary with the level of uncertainty in the local housing market, with individuals' financial sophistication and characteristics such as homeownership, which the literature associates with the use of information about housing markets. Rational inattention models predict that all three factors - prior uncertainty, financial sophistication and incentives to be informed influence individual perceptions and, in consequence, choices Sims (2003).

[22]When we replacing the main financial sophistication measure with our alternative measure, *interest rate knowledge*, the regression coefficient remains negative and significant at the 0.01 level.

Table 6: Correlates of perceived past house price changes and the perception gap

Dependent variable	Perceived 1yr HP change		Absolute perception gap (%-points)	
	(1)	(2)	(3)	(4)
Local area characteristics				
Realized 1yr HP change	−0.065	−0.068		
	(0.056)	(0.057)		
Realized 1yr HP change (absolute value)			0.148	0.096
			(0.117)	(0.128)
Local unemployment rate	−0.089	−0.088	0.083	−0.027
	(0.177)	(0.181)	(0.183)	(0.194)
Volatility	−0.181	−0.225	0.362**	0.385***
	(0.171)	(0.172)	(0.149)	(0.143)
Log property sales	0.524	0.161	0.730	0.539
	(1.065)	(1.082)	(1.081)	(1.071)
Household (or head) characteristics				
Female		0.399		0.580**
		(0.310)		(0.274)
Age (ref: 18–44)				
45–64		−0.121		−0.047
		(0.461)		(0.386)
65 or older		−0.238		−0.610
		(0.558)		(0.485)
Partner in household		−0.213		0.299
		(0.348)		(0.318)
Working		0.484		−0.120
		(0.503)		(0.430)
Education (ref: Higher)				
Lower or medium		0.621*		0.270
		(0.322)		(0.300)
None		−0.874		0.006
		(0.633)		(0.500)
Info missing		−6.350*		6.418**
		(3.472)		(2.893)
Annual HH income (ref: £70k or more)				
Less than £20k		−0.184		0.227
		(0.504)		(0.422)
£20k - <£40k		−0.226		0.390
		(0.350)		(0.314)
£40k - <£70k		0.861**		0.673**
		(0.333)		(0.296)
Info missing		0.119		1.030**
		(0.520)		(0.479)
Risk averse		0.281		0.361
		(0.325)		(0.287)
High financial literacy		−0.447		−1.056***
		(0.308)		(0.283)
Recent mover		−0.504		−0.604
		(0.430)		(0.426)
Homeowner		−0.038		−0.955**
		(0.456)		(0.402)
Survey finished on same day		0.282		0.375
		(0.335)		(0.269)
Constant	1.874	2.810	2.823	3.751
	(4.029)	(4.100)	(3.933)	(3.845)
Mean DepVar	3.82	3.84	5.05	5.04
Adj. R-squared	0.01	0.02	0.01	0.05
N	2,516	2,456	2,516	2,456

Notes: The table shows regression estimates for the dependent variables *perceived one-year HP change* (columns 1 and 2) and *absolute perception gaps* (columns 3 and 4). 'ref.' indicates the omitted category. "Log property sales" denotes the logarithm of local residential property sales per 1,000 inhabitants (note that results remain qualitatively unchanged when using the log of local residential property sales per 1,000 dwellings instead). Local unemployment rates vary by interview month and local area. All specifications include month-year of interview fixed effects. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. Detailed definitions and summary statistics for all covariates are provided in Online Appendix Tables A1 and A2. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

4.3 Subjective expectations, financial sophistication, and information acquisition

General measures of sophistication, for instance numeracy, educational attainment, cognitive ability and intelligence, have been shown to affect belief formation (see D'Acunto et al., 2019 for inflation expectations, and Kuchler and Zafar, 2019 and Kuchler et al., 2023 for house price expectations, and Fuster et al., 2022 for home price expectations, among others). D'Acunto et al. (2023) find a positive relationship between cognitive abilities and the accuracy of expectations. Fuster et al. (2022) show in an experiment involving costly, endogenous information acquisition from multiple sources that there is substantial heterogeneity in the type of signal individuals acquire. They posit "that at least part of the variation [in subjective expectations] is due to heterogeneity in cognitive abilities that are helpful in identifying informative signals" (p. 1060).

In this section, we provide empirical evidence that individuals extrapolate from multiple signals heterogeneously – depending on their financial knowledge and economic incentives to be informed. We first test whether beliefs about local house price changes vary with individuals' (financial) sophistication. We already established that individuals with low financial literacy have less accurate perceptions (Table 6). Those with low financial sophistication exhibit an average absolute perception gap of 5.77 percentage points, while at 4.23 percentage points, the gap is significantly lower – though still sizeable – among those with high financial literacy. Individuals with low financial literacy also systematically expect larger increases in house prices over the next 12 months (4.35% vs. 3%); and their expectations exhibit a high standard deviation.[23] So, do they extrapolate differently from the two predictors?

In Table 7, we stratify the sample and estimate the baseline model separately for three binary variables: financial literacy, homeownership, and risk aversion. Panel A shows that past house price changes matter for the formation of expectations in both groups; irrespective of their level of financial literacy, individuals extrapolate from *perceived* rather than *realized* house price changes. Yet, individuals with low financial literacy rely much less on their (less accurate) perceptions as a predictor. Instead, they base their expectations more heavily on

[23]Related, Kuchler and Zafar (2019) show that sophistication lowers the extent to which individuals naively extrapolate from local house price changes when asked about their beliefs regarding future national house price changes.

local economic conditions (see columns 3 and 4) in comparison to those with high financial literacy (columns 1 and 2).[24]

These results are consistent with the notion that information costs matter: for less financially sophisticated individuals, it may be cognitively less costly to learn about past local economic conditions than about past local house price changes, as local economic conditions are more persistent, less volatile over time, and arguably also more salient. Another interpretation is that those with low financial literacy are less confident in the accuracy of their perceptions. We leave to future work a further analysis of the channels through which financial literacy affects the information used when individuals form subjective house price expectations.

Second, the literature often posits that homeownership can induce individuals to track the value of what is often their largest asset by monitoring house price dynamics, making them better informed about the local housing market. However, whether homeowners have a stronger incentive to monitor house prices (and other price dynamics) than renters is still subject to debate – with mixed evidence.[25] We find, indeed, that homeowners are better informed on average than renters, as evidenced by a 1 percentage point lower perception gap (Table 6). They also rely strongly on their perceptions and local economic conditions when forming beliefs about future local house prices, while renters rely only on their perceptions (Panel B of Table 7).

Similarly to homeowners, recent movers might be better informed about house price trends, which, in turn, might be reflected in how they form their beliefs. We find that recent movers rely more strongly on their perceptions than non-movers, while the latter rely on both predictors when forming beliefs about future house price changes (Panel B of Table F4). A plausible interpretation of this finding is that, while recent movers' perception gaps are not different from those of non-movers (Table 6 above), they overestimate how well they are informed about local prices. In Online Appendix Section F, we additionally develop a measure of the salience

[24]Estimates are virtually unchanged if we include realized one-year house price changes (in columns 1 and 3) as a control variable. Results are also qualitatively similar when we use our alternative sophistication measure, interest rate knowledge (see Online Appendix F).

[25]For example, Adelino et al. (2018) show that renters view housing as riskier than owners. In a study of regional house prices in Germany, Kindermann et al. (2021) find that on average, households underpredict local price growth. Yet, renters make on average higher and hence more accurate forecasts than owners, although their forecasts are more dispersed and their mean squared forecast errors are higher. Ahn et al. (2024) find that homeowners are attentive to news on interest rates – driven by changes in mortgage-rates, and adjust their inflation expectations accordingly, but do not investigate subjective house price expectations. Gohl et al. (2024) find no evidence of house price expectation biases related to individual housing tenure decisions.

Table 7: Heterogeneity of subjective expectations

	Expected 1yr HP change (%)			
	A. Financial Literacy			
	Yes		No	
Local unemployment rate	−0.015	0.009	−0.353***	−0.351***
	(0.077)	(0.060)	(0.121)	(0.115)
Realized 1yr HP change	0.022	0.003	−0.011	−0.007
	(0.033)	(0.024)	(0.051)	(0.050)
Perceived 1yr HP change		0.342***		0.086***
		(0.043)		(0.028)
Mean DepVar				
R-squared	0.04	0.27	0.03	0.05
N	1,308	1,308	1,417	1,417
	B. Homeowner			
	Yes		No	
Local unemployment rate	−0.223***	−0.234***	−0.186	−0.170
	(0.079)	(0.071)	(0.168)	(0.161)
Realized 1yr HP change	0.032	0.021	−0.060	−0.056
	(0.034)	(0.032)	(0.076)	(0.076)
Perceived 1yr HP change		0.169***		0.085***
		(0.047)		(0.031)
Mean DepVar	3.55	3.55	4.12	4.12
R-squared	0.04	0.12	0.08	0.10
N	1,963	1,963	762	762
	C. Risk averse			
	Yes		No	
Local unemployment rate	−0.334**	−0.311***	−0.108	−0.100
	(0.130)	(0.117)	(0.091)	(0.087)
Realized 1yr HP change	−0.031	−0.010	0.020	0.006
	(0.047)	(0.043)	(0.041)	(0.041)
Perceived 1yr HP change		0.112**		0.138***
		(0.048)		(0.035)
Mean DepVar	3.72	3.73	3.70	3.70
R-squared	0.05	0.08	0.06	0.11
N	1,142	1,164	1,583	1,583

Notes: The table shows regression estimates with *expected one-year house price (HP) change* as the dependent variable. Realized, perceived, and expected one-year changes in prices refer to the *local* housing market. Local unemployment rates vary by interview month and local area. All specifications include the following controls: indicators for age, education and household income, whether respondents are female, married, or working, whether they finished the interview during one day, whether they are risk-averse, financially literate, moved recently, their homeowner status and month-year of interview fixed effects. Financial literacy, homeowner status and risk aversion are omitted, respectively, in panels A,B C. Detailed definitions and summary statistics are provided in Online Appendix Tables A1 and A2. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

of local media information on house prices, but find little variation in belief formation by the salience of local house price information, possibly due to measurement error in our media indicator.

We also consider whether risk averse individuals are more likely to diversify their information sources and rely on local economic conditions *and* own perceptions in their belief formation. We split our sample into those with higher self-reported risk aversion, measured through a widely used and validated survey question on risk attitudes.[26] We find that risk averse individuals indeed extrapolate from both predictors, while individuals who are more tolerant of risk rely only on their perceptions (Panel C of Table 7).

Finally, studies of subjective expectations often find systematic gender differences and more distorted beliefs among women (D'Acunto et al., 2021b). In our data, men have lower perception gaps (Table 6) and rely more strongly on their perceptions of past changes, but we do not find consistent differences in the reliance on local economic conditions between men and women (Panel A of Appendix Table F4).

4.4 Subjective expectations and local market uncertainty

Next, we turn to investigating the role of local market uncertainty in belief formation. Some local authorities have experienced highly volatile house prices over the past five years. Do individuals' subjective expectations reflect this local market uncertainty – that is, do individuals rely on different predictors when facing greater uncertainty in their local housing market?

We already showed that perception gaps are higher in local housing markets with more volatile prices, implying that noisier signals of past house prices make it more difficult to form accurate beliefs about past house price changes (see columns 3 and 4 in Table 6). An increase in volatility (in the last 5 years) by one standard-deviation increases the perception gap by 0.385 percentage points or about 8%. In contrast, perceptions are not systematically higher or lower in markets with higher uncertainty (columns 1 and 2).

We follow the same approach as in the previous section: We estimate equation 3 and stratify the sample by median splits of the two measures of local house-price uncertainty – price

[26] This question has been shown to be a good predictor of risk taking behavior across different domains (e.g., Bonin et al., 2007; Jaeger et al., 2010; Dohmen et al., 2011).

volatility over the past 5 years and short-run momentum – as well as a measure of the salience of local price information. We then explore whether individuals extrapolate differently from the two key predictors (perceived past price changes and local unemployment) in the subsamples of high and low house price uncertainty.

Our findings imply that market uncertainty matters for belief formation. Panel A of Table 8 shows that in housing markets with high volatility, our first measure, individual perceptions of past price changes remain an important predictor of subjective house price expectations even though they are less precise. However, individuals additionally rely strongly on local economic fundamentals. A one percentage point increase in the local unemployment rate reduces expected future house price growth by 0.287 percentage points. This is in contrast to individuals who live in areas with less volatility where we find only weak evidence that individuals rely on local economic conditions in their belief formation.

Second, we stratify observations by the area-specific estimates of the short-run momentum reported in Table 3, our second measure of uncertainty (Figure 4 (b) shows the distribution). We estimate that those living in areas with short-run momentum extrapolate strongly from perceived past house price changes – and in a manner that is quantitatively similar to our main findings in Table 5 (Panel B of Table 8). However, those who reside in areas where past prices are not predictive for future prices extrapolate very differently: they rely strongly on local unemployment rates in their belief formation; in fact, similarly to those living in areas with high price volatility. A one percentage point increase in the local unemployment rate is associated with an 0.285 percentage point decrease in expected local house price growth. This suggests that individuals may adapt the model which they use to form beliefs to the uncertainty in the local housing markets they find themselves in.

In summary, the extent to which individuals rely on their perceptions of past house prices and particularly the weight they attribute to easily observable local economic conditions and perceptions in their belief formation varies with the uncertainty in the local housing market.

4.5 Predictors of the subjective standard deviation

The probabilistic method for subjective expectations was developed to elicit the full subjective distribution of future outcomes (Bellemare et al., 2012; Dominitz and Manski, 1997). Several

Table 8: Heterogeneity of subjective expected house price changes by local market uncertainty

	Dependent variable: Expected 1yr HP change (%)			
	(1)	(2)	(3)	(4)
	A. Volatility of local house prices (past 5 years)			
	Low		High	
Local unemployment rate	−0.193*	−0.178*	−0.294**	−0.287**
	(0.102)	(0.094)	(0.132)	(0.123)
Realized 1yr HP change	−0.046	−0.038	0.012	−0.001
	(0.049)	(0.047)	(0.043)	(0.040)
Perceived 1yr HP change		0.095***		0.173***
		(0.030)		(0.049)
Mean DepVar	3.80	3.80	3.62	3.62
R-squared	0.04	0.07	0.06	0.14
N	1,360	1,360	1,362	1,362
	B. Housing market with short-run momentum			
	Yes		No	
Local unemployment rate	−0.114	−0.118	−0.330***	−0.285**
	(0.096)	(0.089)	(0.126)	(0.117)
Realized 1yr HP change	−0.041	−0.038	0.055	0.040
	(0.044)	(0.042)	(0.042)	(0.040)
Perceived 1yr HP change		0.127***		0.143***
		(0.039)		(0.039)
Mean DepVar	3.82	3.82	3.58	3.58
R-squared	0.05	0.10	0.06	0.11
N	1,429	1,429	1,296	1,296

Notes: The table shows regression estimates with *expected one-year house price (HP) change* as the dependent variable. Panel A separately shows estimates for individuals living in areas with below and above median house price volatility over the past 5 years. Panel B separately shows estimates separately for individuals in areas with and without short-run momentum in house prices. Areas with 'No' momentum comprise those exhibiting no autocorrelation or reversal. Results are qualitatively unchanged when we exclude areas exhibiting reversal.
Realized, perceived, and expected one-year changes in prices refer to the *local* housing market. Local unemployment rates vary by interview month and local area. All specifications include the following controls: indicators for age, education and household income, whether respondents are female, married, or working, whether they finished the interview during one day, whether they are risk-averse, financially literate, moved recently, their homeowner status and month-year of interview fixed effects. Detailed definitions and summary statistics are provided in Online Appendix Tables A1 and A2. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

studies estimate moments beyond the mean or other features of individuals' subjective return distributions, particularly for stock market returns (e.g., Dominitz and Manski, 2007; Hurd et al., 2011; von Gaudecker and Wogrolly, 2022). However, recent survey-based research on belief formation has largely focused on the determinants of expected changes – that is, the mean of the subjective return distribution.

Building on our finding that uncertainty in local housing markets influences the first moment of subjective beliefs, we now examine whether it also affects the second moment – that is, whether greater market uncertainty leads to more uncertainty in individuals' beliefs about

future house price changes. Specifically, we ask whether subjective return distributions reflect local housing market uncertainty, as captured by our measures of historical price variability: volatility and short-run momentum.

We estimate linear regression models that are similar to those used in previous sections, but now the dependent variable is the standard deviation of the individual's subjective distribution of future house price changes, as described in Section 2.1. The explanatory variables are alternative measures of house price uncertainty as well as measures of local economic conditions, past house price changes, and other control variables.

Table 9 reports regression estimates for the determinants of subjective uncertainty. The standard deviation of individuals subjective distributions of future house price changes is larger in more volatile local markets (column 1). The estimates in column 2 show that in local markets where the momentum parameter is larger, the subjective standard deviation is also larger. The same holds when we use a dummy variable for markets characterized by positive momentum, i.e., those where the autoregressive coefficient is larger than zero (column 3). The results for volatility are clear-cut: Individuals' subjective uncertainty increases with volatility. The observation that subjective uncertainty also increases with momentum may indicate that in local markets with histories of increasing prices, individuals are less certain whether such trends continue.

4.6 Stock market return expectations

The analysis so far shows that individuals incorporate local economic conditions into their mental models of subjective house price expectations. This suggests that, especially for those with limited knowledge of past local prices or lower financial sophistication, indicators like the local unemployment rate may be more accessible than historical house price data. Our findingsare consistent with recent research emphasizing the role of salient experiences in shaping expectations.

In this section, we investigate whether individuals also draw on local conditions when forming beliefs about national outcomes. Kuchler and Zafar (2019) show that individuals extrapolate from local (zip code-level) experiences when they form beliefs about future *national* house prices. We collected subjective beliefs and perceptions about price changes over the past 12

Table 9: Predictors of the subjective standard deviation

Dependent variable	Subjective Std Dev of 1yr HP change (%-points)		
	(1)	(2)	(3)
Volatility	0.081**		
	(0.032)		
Short-run momentum		0.524*	
		(0.272)	
Local market with short-run momentum			0.232**
			(0.105)
Local unemployment rate	0.058	0.007	0.002
	(0.046)	(0.044)	(0.043)
Mean DepVar	4.47	4.47	4.47
Adj. R-squared	0.13	0.13	0.13
N	2,722	2,725	2,725

Notes: The table shows regression estimates, with *subjective standard deviation of local house price changes* as the dependent variable. Local unemployment rates vary by interview month and local area. All specifications include the following controls: indicators for age, education and household income, whether respondents are female, married, or working, whether they finished the interview during one day, whether they are risk-averse, financially literate, moved recently, their homeowner status and month-year of interview fixed effects. Detailed definitions and summary statistics are provided in Online Appendix Tables A1 and A2. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

months for an *aggregate* asset, the FTSE-100 UK stock market index. As before, we use the non-parametric method from Hurd et al. (2011) to construct expected stock market returns. Summary statistics are shown in Online Appendix G.

In Table 10, we present estimation results from models that are specified analogously to those we used to study the mean of respondents' subjective house price expectations. The dependent variable is the mean of the respondent's subjective distribution of one-year stock market returns, and the explanatory variables are the realized and perceived stock market returns.

The coefficient of perceived past returns is statistically significant and positive, while realized past returns are not a statistically significant predictor of stock market expectations. As in our analysis of house price expectations, we find that perceptions of the past matter rather than realizations.[27] The positive coefficient of perceived past returns indicates that individuals, on average, believe that stock market return expectations are characterized by momentum.

[27]However, in our sample there is little variation in realized returns – a quantity that varies only by interview date but not between respondents – due to the short field period of the survey.

It would be interesting to distinguish between different types of stock market expectation formation, as in the discrete mixture model of Heiss et al. (2022), who allow for three types (momentum, mean reversion, and random walk), but the cross-sectional data of the present study are not suited for such an extension.

In contrast to our analysis of house price expectations, we do not find that local economic conditions predict subjective expectations about expected returns of the FTSE-100 UK stock market index – an outcome at the aggregate level. Individuals use local economic conditions as salient characteristic when forming expectations about a *local* outcome but not an aggregate outcome which is, of course, what one would expect.

Table 10: Predictors of stock market return expectations

	Expected 1yr stock market return (%)	
	(1)	(2)
Local unemployment rate	−0.064	−0.063
	(0.074)	(0.074)
Realized 1yr stock market return		−0.007
		(0.076)
Perceived 1yr stock market return	0.126***	0.126***
	(0.021)	(0.021)
Effect of 1 std in Local unemployment rate	−0.07	−0.07
(in %)	(−3.34)	(−3.33)
Effect of 1 std in Realized 1yr stock market return (d)		−0.03
(in %)		(−1.26)
Effect of 1 std in Perceived 1yr stock market return	1.06	1.06
(in %)	(49.66)	(49.64)
Mean DepVar	2.13	2.13
R-squared	0.07	0.07
N	2,725	2,725

Notes: The table shows regression estimates, with *expected one-year stock market return* as the dependent variable. Realized, perceived, and expected one-year returns refer to the *national* stock market. Local unemployment rates vary by interview month and local area. All specifications include the following controls: indicators for age, education and household income, whether respondents are female, married, or working, whether they finished the interview during one day, whether they are risk-averse, financially literate, moved recently, their homeowner status and month-year of interview fixed effects. Detailed definitions and summary statistics are provided in Online Appendix Tables A1 and A2. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

5 Conclusion

In this paper, we study the formation of subjective expectations about local house prices, which are more directly relevant for individual decision-making than beliefs about future national house prices. We analyze probabilistic house price beliefs elicited in the UK Financial Lives

survey, and exploit considerable variation in house price changes and economic conditions across local authorities in Great Britain.

We show that individuals form expectations based not only on past house price changes but also on local economic conditions, such as unemployment. Further, perceptions of past local price changes, rather than actual realized changes, drive expectations of future prices. There is substantial heterogeneity in how individuals weigh these signals in their belief formation by financial sophistication, risk aversion, and indicators of information acquisition costs. For instance, individuals with low financial sophistication complement perceptions of past house price growth with local economic indicators in their formation of subjective expectations about future house prices.

We further present new evidence that the weight individuals assign to their perceptions and to local economic conditions in their belief formation depends on price dynamics of the local housing market in which they reside. In local markets with high price uncertainty – reflected in high past price volatility or weak short-run momentum in realized prices – individuals rely more on local economic conditions than on their house price perceptions. As the data allow us to infer both the mean and the variance of the subjective distribution of expected house prices, we can also show that higher local market uncertainty is reflected in greater subjective uncertainty in beliefs.

We conclude that individuals' belief formation process is not fully captured by models that rely solely on perceived past house price changes as predictors. This finding has implications for empirically-founded models of belief formation that go beyond rational expectations (e.g., Barberis et al., 2015; Coibion et al., 2018; Fuster et al., 2010; Gelain and Lansing, 2014). Our findings are also in line with recent models such as Andre et al. (2022), who provide evidence that even when individuals have access to similar information about macroeconomic fundamentals, there is substantial heterogeneity in their subjective models, resulting in different expectations. We pinpoint some important individual and local characteristics behind this heterogeneity and show how they change the weighting of signals in belief formation consistent with models of rational attention. Identifying these characteristics as causal would require separating heterogeneity and state dependence in the presence of varying external conditions – an important task for future research on belief formation.

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Appendix

A Survey questions and survey data

In this section, we report the wording of the survey questions on subjective expectations and perceptions about local house price changes and aggregate stock market returns (Figure A1). Table A1 describes the variables we use in our analysis, and Tables A2 and A3 show sample summary statistics, demonstrating that perceived past one-year house price changes differ from realized values (Figure A2). Table A4 shows the wording of the financial literacy questions. We define an individual as financially literate (i.e., *high*) if all four standard financial literacy questions are answered correctly, and *low* otherwise. The probability of having high financial literacy is lower among women, those with low education and low household income, among renters, and in areas with higher unemployment rates (Table A5).

Table A1: Description of variables

Label	Description
(*a*) *Socio-demographic characteristics*	
	Dummy equal to 1 if ...
Female	Female, and 0 if male.
Age 44 or younger	Aged between 18 and 44.
Age 45 to 64	Aged between 45 and 64.
Age 65 or older	Aged 65 or older.
Higher education	One of the following qualifications: (1) Higher degree, or (2) Degree or degree equivalent, or (3) Other Higher Education below degree level.
Lower or medium education	One of the following qualifications: (1) A level, vocational level 3 and equivalents, or (2) Trade Apprenticeships, or (3) O level/ GCSE Grades 4-9/A*-C, vocational level 2 and equivalents, or (4) Qualifications at level 1 and below, or (5) Other qualifications including overseas.
No education	No qualifications, or question about qualifications answered with "don't know."
Education info missing	No information on respondent's education.
Partner in household	Married, in a registered civil partnership, or living with someone in the household as a couple.
Working	Employed or self-employed.
	Total annual household income from all sources (including benefits) before taxes and other deductions ...
Annual HH income: less than £20k	... less than £20,000 a year.
Annual HH income: £20k–<£40k	... £20,000 or more but less than £40,000 a year.
Annual HH income: £40k–<£70k	... £40,000 or more but less than £70,000 a year.
Annual HH income: £70k or more	... £70,000 or more a year.
Annual HH income: info missing	No information on respondents' total annual household income.

Continued on next page

Table A1 (*Continued*)

Label	Description
Holding risky asset	Currently having one of the following investments (either in own name or in joint names): (1) Investment fund, e.g. unit trust, OEIC, ETF, or endowment, or (2) Shares/equities, or (3) Corporate bond or gilt / government bond, or (4) Investment-based crowdfunding, or (5) Peer-to-peer lending, or (6) Structured deposit (sometimes referred to as a savings bond) or structured investment, or (7) Stocks and shares ISA, or (8) Lifetime ISA that is invested, or (9) Insurance bonds (investment bonds), or (10) Innovative Finance ISA (IFISA).
Homeowner	Owning the property currently living in (1) outright, or (2) with a mortgage (or a different kind of loan).
Recent mover	Event of moving house experienced in the last 12 months.
Risk averse	Answer to the question "Are you a person who is generally willing to take risks?" (on a scale from 0 to 10, where 0 is "Not at all willing to take risks" and 10 is "Very willing to take risks") ≤ 5.
High financial literacy	All four standard financial-literacy questions are answered correctly.
High interest rate knowledge	Understanding three out of three concepts related to past financial developments and future financial expectations.
Interview finished on same day	Survey questionnaire finished on the same day.
(*b*) *Expectations, perceptions, realizations, and perception gaps*	
Expected 1yr HP change	Non-parametric estimates of the subjective expected rate of one-year change in the house price (HP) index in the individual's local authority, relative to the interview month.
Perceived 1yr HP change	Perceived past one-year house price (HP) change in the individual's local authority, relative to the interview month.
Realized 1yr HP change	Realized past one-year house price (HP) change in the individual's local authority, relative to the interview month.
Absolute perception gap	Difference in absolute terms between realized and perceived past one-year local house price (HP) changes.
Expected 1yr stock market return	Non-parametric estimates of the subjective expectations about one-year ahead returns in the FTSE-100 UK stock market index, relative to the interview month.
Perceived 1yr stock market return	Perceived past one-year return in the FTSE-100 UK stock market index, relative to the interview month.
Realized 1yr stock market return	Realized past one-year return in the FTSE-100 UK stock market index, relative to the interview month.
(*c*) *Local conditions*	
Local unemployment rate	Unemployment rate in the individual's local authority in the interview month; proxied by the number of claimants as a proportion of the resident population of a local area aged 16–64. *Claimants* are defined as the number of people claiming Jobseeker's Allowance, plus those claiming Universal Credit and being out of work. Data from Nomis.
Local deprivation score	Deprivation score in the individual's local authority, taken from the 2019 Index of Multiple Deprivation (comparable data available for England only).
Log property sales	Logarithm of residential property sales per 1,000 inhabitants in the individual's local authority (comparable data available for England and Wales only). Data from: ONS.
5yr local house price volatility	Standard deviation of monthly-computed one-year local changes in house prices in the individual's local authority over the five years before the interview month; definition of "low" and "high" based on sample median split. Data from: UK HPI / HM Land Registry.
High local media coverage of house prices	Dummy equal to 1 if self-constructed measure of the media coverage of the topic of "house prices" in the individual's local authority above median (computed at local-authority level).

Notes: The table shows a detailed description of the variables used in the analyses.

Table A2: Summary statistics

	N	Mean	Std Dev
(*a*) *Socio-demographic characteristics*			
Female	2,774	0.47	0.50
Age 44 or younger	2,799	0.43	0.49
Age 45 to 64	2,799	0.34	0.48
Age 65 or older	2,799	0.23	0.42
Higher education	2,799	0.63	0.48
Lower or medium education	2,799	0.30	0.46
No education	2,799	0.05	0.22
Education info missing	2,799	0.03	0.16
Partner in household	2,744	0.71	0.45
Working	2,799	0.62	0.49
Annual HH income: less than £20k	2,799	0.15	0.36
Annual HH income: £20k - <£40k	2,799	0.23	0.42
Annual HH income: £40k - <£70k	2,799	0.23	0.42
Annual HH income: £70k+	2,799	0.20	0.40
Annual HH income: info missing	2,799	0.18	0.39
Holding risky asset	2,799	0.42	0.49
Homeowner	2,799	0.72	0.45
Recent mover	2,799	0.09	0.29
Risk averse	2,789	0.42	0.49
High financial literacy	2,799	0.48	0.50
High interest rate knowledge	2,799	0.40	0.49
Survey finished on same day	2,799	0.91	0.28
(*b*) *Expectations, perceptions, realizations, and perception gaps*			
Expected 1yr HP change (%)	2,799	3.71	4.45
Perceived 1yr HP change (%)	2,799	3.79	7.52
Realized 1yr HP change (%)	2,799	1.11	2.68
Realized 1yr HP change (absolute value)	2,799	2.28	1.80
Absolute perception gap (%-points)	2,799	5.04	6.73
Expected 1yr stock market return (%)	2,799	2.13	4.94
Perceived 1yr stock market return	2,799	2.58	8.34
Realized 1yr stock market return	2,799	3.30	3.52
(*c*) *Local conditions*			
Local unemployment rate	2,799	2.73	1.11
Local deprivation score	2,375	20.55	8.12
Log property sales	2,516	2.63	0.23
5yr local house price volatility	2,799	3.53	1.65
High local media coverage of house prices	2,799	0.59	0.49

Notes: The table shows summary statistics. *Source*: Financial Lives 2020 survey, Office for National Statistics, Ministry of Housing, Communities & Local Government, and historical values from the UK HPI and the FTSE-100 Index.

Table A3: Summary statistics of subjective expected one-year local house price changes

	N	Mean	Std Dev	P10	P25	P50	P75	P90
B1: -10% or less	2,799	2.65	8.87	0	0	0	1	10
B2: -9.9% to -5%	2,799	4.07	8.29	0	0	0	5	10
B3: -4.9% to 0%	2,799	16.13	19.67	0	0	10	25	50
B4: 0.1% to 5%	2,799	45.51	31.69	0	20	49	70	95
B5: 5.1% to 10%	2,799	18.57	22.54	0	0	10	25	50
B6: 10.1% to 15%	2,799	7.48	14.42	0	0	0	10	20
B7: 15.1% or more	2,799	5.59	15.64	0	0	0	5	12

Notes: The table shows summary statistics of the raw subjective probabilities for one-year-ahead expected local house price changes. *Source*: Financial Lives 2020 survey.

Table A4: Elicitation of financial literacy in the *Financial Lives* Survey

Concept	Survey question
Interest rate	Suppose you put £100 into a savings account with a guaranteed interest rate of 2% per year. There are no fees or tax to pay. You don't make any further payments into this account and you don't withdraw any money. How much would be in the account at the end of the first year, once the interest payment is made? Please type in your answer to the nearest pound.
Interest compound	And how much would be in the account at the end of five years (remembering that there are no fees or tax deductions)? 1. More than £110 2. Exactly £110 3. Less than £110 4. It is impossible to tell from the information given 5. Do not know
Inflation	If the inflation rate is 5% and the interest rate you get on your savings is 3%, will your savings have more, less or the same amount of buying power in a year's time? 1. More 2. The same 3. Less 4. Do not know
Risk diversification	Is the following statement true or false? Buying shares in a single company usually provides a safer return than buying shares in a range of companies. 1. True 2. False 3. Do not know

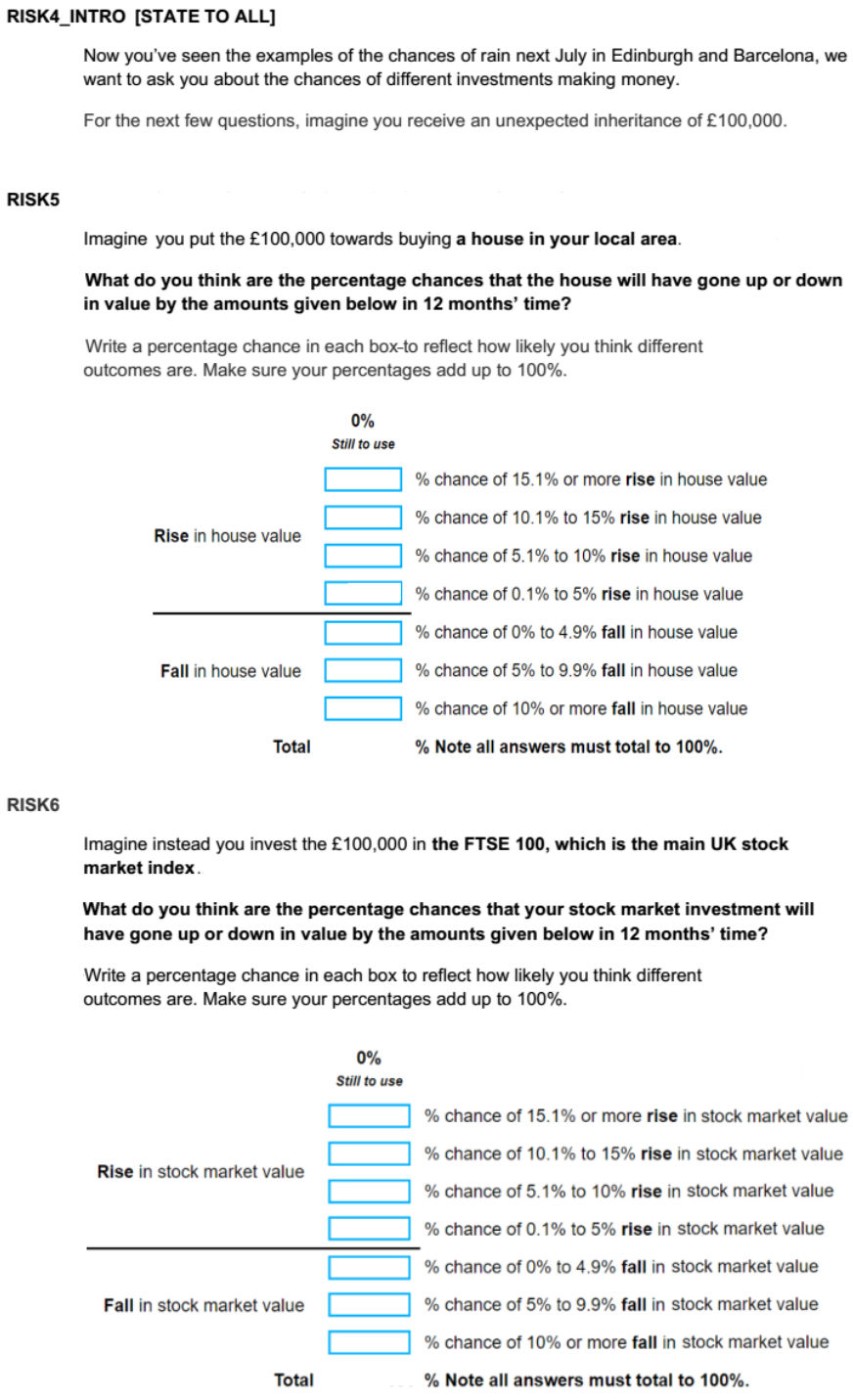
Notes: The table shows the financial-literacy questions on interest rates, interest compound, inflation, and risk diversification included in the Financial Lives 2020 survey.

Table A5: Correlates of financial literacy

Dependent variable	High financial literacy
Female	−0.186***
	(0.019)
Age (ref: 18–44)	
45–64	0.173***
	(0.021)
65 or older	0.153***
	(0.031)
Partner in household	0.003
	(0.021)
Working	−0.011
	(0.024)
Education (ref: Higher)	
Lower or medium	−0.148***
	(0.018)
None	−0.188***
	(0.042)
Info missing	−0.283***
	(0.057)
Annual HH income (ref: £70k or more)	
Less than £20k	−0.221***
	(0.032)
£20k - <£40k	−0.128***
	(0.028)
£40k - <£70k	−0.082***
	(0.025)
Info missing	−0.179***
	(0.032)
Risk averse	−0.035*
	(0.020)
Recent mover	−0.016
	(0.030)
Homeowner	0.110***
	(0.023)
Survey finished on same day	−0.086***
	(0.032)
Local unemployment rate	−0.028***
	(0.008)
Constant	0.656***
	(0.078)
Mean DepVar	0.48
R-squared	0.19
N	2,725

Notes: The table shows estimates from a linear probability model. The dependent variable equals 1 for individuals with high financial literacy (i.e., answers all four standard financial literacy questions, as shown in Table A4, correctly), and 0 otherwise. 'ref.' indicates the omitted category. Local unemployment rates vary by interview month and local area. All specifications include month-year of interview fixed effects. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. Detailed definitions and summary statistics for all covariates are provided in Online Appendix Tables A1 and A2.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

Figure A1: Elicitation of subjective expectations and perceptions about local house price changes and aggregate stock market returns in the *Financial Lives* survey



RISK4_INTRO [STATE TO ALL]

Now you've seen the examples of the chances of rain next July in Edinburgh and Barcelona, we want to ask you about the chances of different investments making money.

For the next few questions, imagine you receive an unexpected inheritance of £100,000.

RISK5

Imagine you put the £100,000 towards buying **a house in your local area**.

What do you think are the percentage chances that the house will have gone up or down in value by the amounts given below in 12 months' time?

Write a percentage chance in each box to reflect how likely you think different outcomes are. Make sure your percentages add up to 100%.

	0% *Still to use*	
Rise in house value		% chance of 15.1% or more **rise** in house value
		% chance of 10.1% to 15% **rise** in house value
		% chance of 5.1% to 10% **rise** in house value
		% chance of 0.1% to 5% **rise** in house value
Fall in house value		% chance of 0% to 4.9% **fall** in house value
		% chance of 5% to 9.9% **fall** in house value
		% chance of 10% or more **fall** in house value
Total		**% Note all answers must total to 100%.**

RISK6

Imagine instead you invest the £100,000 in **the FTSE 100, which is the main UK stock market index**.

What do you think are the percentage chances that your stock market investment will have gone up or down in value by the amounts given below in 12 months' time?

Write a percentage chance in each box to reflect how likely you think different outcomes are. Make sure your percentages add up to 100%.

	0% *Still to use*	
Rise in stock market value		% chance of 15.1% or more **rise** in stock market value
		% chance of 10.1% to 15% **rise** in stock market value
		% chance of 5.1% to 10% **rise** in stock market value
		% chance of 0.1% to 5% **rise** in stock market value
Fall in stock market value		% chance of 0% to 4.9% **fall** in stock market value
		% chance of 5% to 9.9% **fall** in stock market value
		% chance of 10% or more **fall** in stock market value
Total		**% Note all answers must total to 100%.**

Figure A1: Elicitation of subjective expectations and perceptions about local house price changes and aggregate stock market returns in the *Financial Lives* survey (cont.)

RISK9b Now let's imagine you actually received the unexpected £100,000 inheritance **12 months ago**.

If you put your £100,000 towards a house **in your local area**, do you think the value of your £100,000 investment would have increased, decreased or stayed the same over the last 12 months?

1. Increased
2. Stayed the same
3. Decreased

IF CODE 1 SELECTED SHOW THE FOLLOWING

By how much do you think it would have increased? [ ] %

IF CODE 3 SELECTED SHOW THE FOLLOWING

By how much do you think it would have decreased? [ ] %

RISK9c If instead you invested your £100,000 in the main UK stock market index, called the FTSE 100 index, do you think the value of your £100,000 investment would have increased, decreased or stayed the same over the last 12 months?

1. Increased
2. Stayed the same
3. Decreased

IF CODE 1 SELECTED SHOW THE FOLLOWING

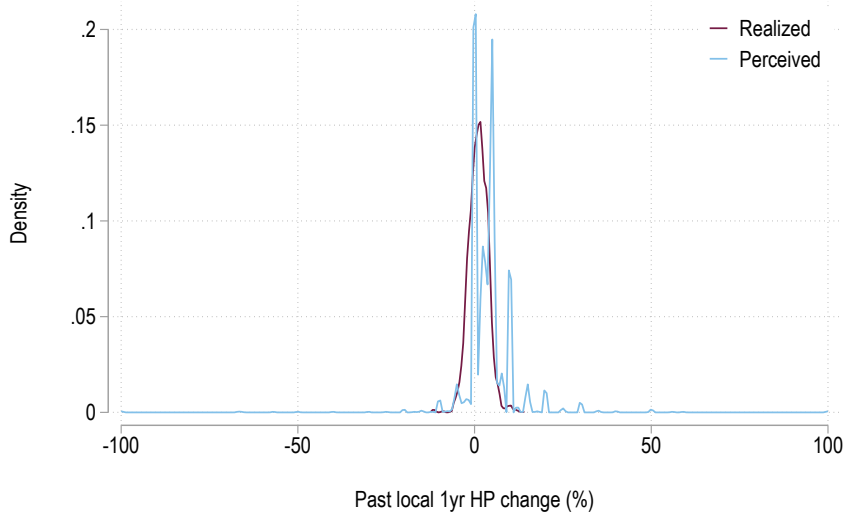
By how much do you think it would have increased? [ ] %

IF CODE 3 SELECTED SHOW THE FOLLOWING

By how much do you think it would have decreased? [ ] %

Source: Financial Lives 2020 survey.

Figure A2: Realized and perceived past local one-year house price changes



Notes: The figure shows kernel densities of realized and perceived past local one-year house price (HP) changes in our survey sample. *Source*: Financial Lives 2020 survey and UK HPI. N=2,799.

B Non-parametric estimation of subjective expected one-year house price changes

In this section, we provide a detailed description of how we construct our measure of subjective expected one-year house price changes. We adopt the non-parametric estimation approach suggested by Hurd et al. (2011). They construct non-parametric estimates of the mean of the expected rate of return distribution for stock market investments. The model is given by

$$E(\pi) = \sum_j P(\pi \in B_j) E(\pi | \pi \in B_j) \tag{4}$$

where, $P(\pi \in B_j)$, is an individual's subjective probability assigned to bracket j, and, $E(\pi|\pi \in B_j)$, is the historical average of one-year rates of return conditional on the return being in bracket j. The number and thresholds of the brackets are pre-determined by the respective survey questions.

Table B1: Averages of historical year-on-year house price changes in bracket j, $E(r|r \in B_j)$

	Average of historical UK-wide house price changes 1/2002–7/2019)
Brackets:	
B1: -10% or less	−14.21
B2: -9.9% to -5%	−8.36
B3: -4.9% to 0%	−1.54
B4: 0.1% to 5%	2.64
B5: 5.1% to 10%	7.33
B6: 10.1% to 15%	11.95
B7: 15% or more	21.77

Notes: The table shows bracket-specific averages of monthly computed historical year-on-year house price changes, computed at the UK level. *Source*: UK HPI.

We use the same methodology to construct a measure of the subjective expected house price change from the probabilities corresponding to the seven brackets B_j in our survey question on expected house price changes, where $B_1 = (-\infty, -10\%]$, $B_2 = (-10\%, -5\%]$, $B_3 = (-5\%, 0\%]$, $B_4 = (0\%, 5\%]$, $B_5 = (5\%, 10\%]$, $B_6 = (10\%, 15\%]$, and $B_7 = (15\%, \infty)$.

We compute $E(r|r \in B_j)$ based on historical UK-wide year-on-year house price changes r for each month from the UK House Price Index for the time between January 2002 and July 2019 (this corresponds to the period before the survey was conducted, and for which

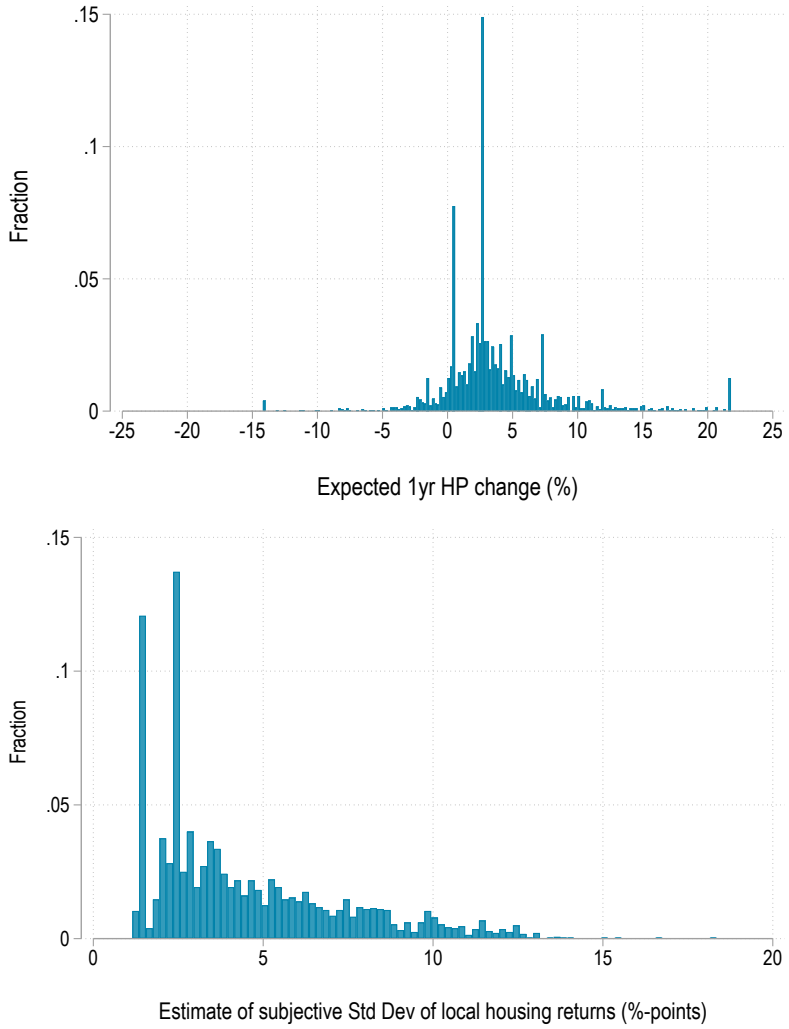
annual historical house price changes are available on a monthly basis). We then assign these historical house price changes to the brackets B_j to get bracket-specific average house price changes $E(r|r \in B_j)$. Table B1 shows the resulting bracket-specific averages of the historical year-on-year house price changes.

Following equation (4), we use the bracket-specific averages of the historical year-on-year house price changes, $E(r|r \in B_j)$, and weight them with the respondents' probabilities assigned to the seven different brackets, $P(r \in B_j)$, to estimate the subjective expected house price change. In Figure B1, we show the corresponding sample distribution.[28]

Figure B2 shows that relying on different specifications of geographic localities (the individual's government office region or Local Authority instead of the whole UK) and time horizons (1969–2019 instead of 2002–2019) in the computation of $E(r|r \in B_j)$, resulting estimates of subjective expected house price changes are qualitatively unchanged.

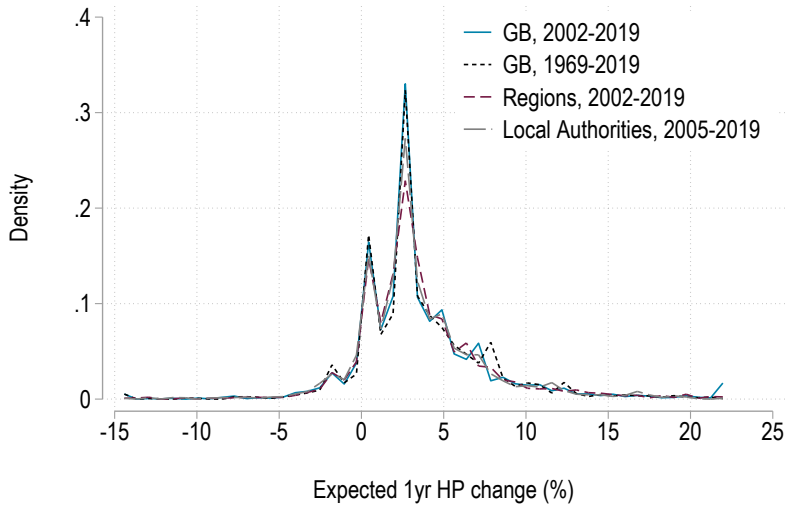
[28]There are two outliers; the first outlier is caused by respondents assigning a probability of 50% to the bracket "between −4.9% and 0%," and another 50% to the bracket "between 0.1% and 5%;" the second outlier is driven by respondents assigning a probability of 100% to the bracket "between 0.1% and 5%."

Figure B1: Distribution of the expected one-year HP change and its standard deviation, $E(r)$



Notes: Computation of expectations is based on the non-parametric estimation approach by Hurd et al. (2011).
Source: UK HPI and Financial Lives 2020 survey, N=2,799.

Figure B2: Kernel-density plot of the expected one-year house price change, $E(r)$



Notes: The figure shows kernel densities for the expected one-year house price (HP) change resulting from different specifications of geographic localities and time horizons in the non-parametric estimation approach by Hurd et al. (2011). *Source*: UK HPI and Financial Lives 2020 survey, N=2,799.

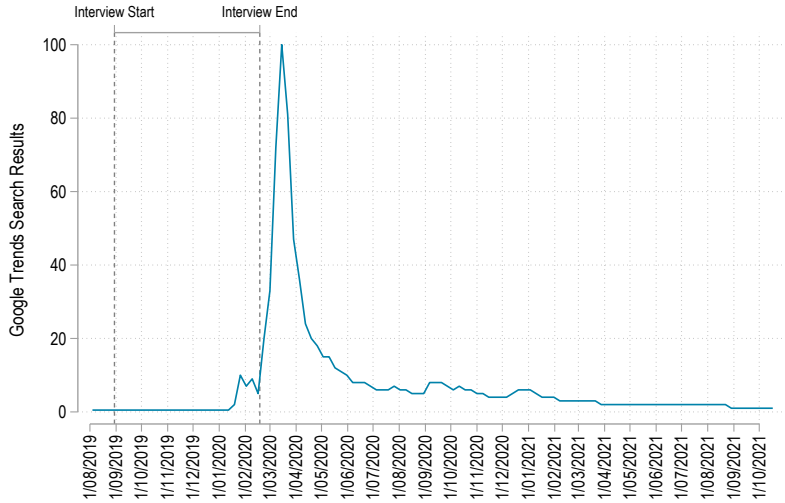
C Survey fielding and pandemic onset

As of February 2020, which constitutes the end of our survey period, there were no more than 47 registered cases in the UK; while the first case in the UK was registered in January 2020, the first COVID-19 related death was registered only on March 2, 2020. The first lockdown in the UK started on March 23, 2020 (https://coronavirus.data.gov.uk/details).

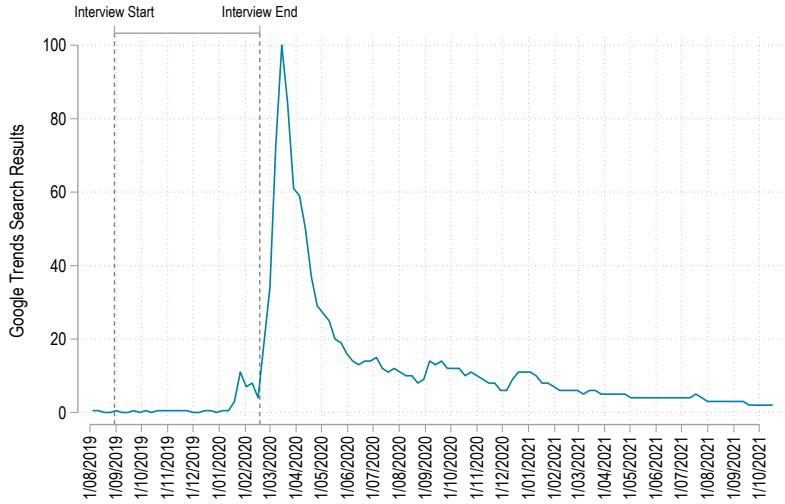
In Figure C1, we report *Google Trends* search results for various COVID-related search terms during and after the period in which the FCA Financial Lives 2020 survey was conducted. Searches of related terms such as "Corona," "Coronavirus," "COVID," or "COVID-19" increased rapidly only in March 2020, i.e., after the survey was conducted. In contrast, search intensity was close to zero during the survey period. Hence, it is unlikely that individuals' beliefs and expectations about future house price changes in our sample were distorted by the upcoming pandemic.

Figure C1: Google Trends search results for COVID-related search terms

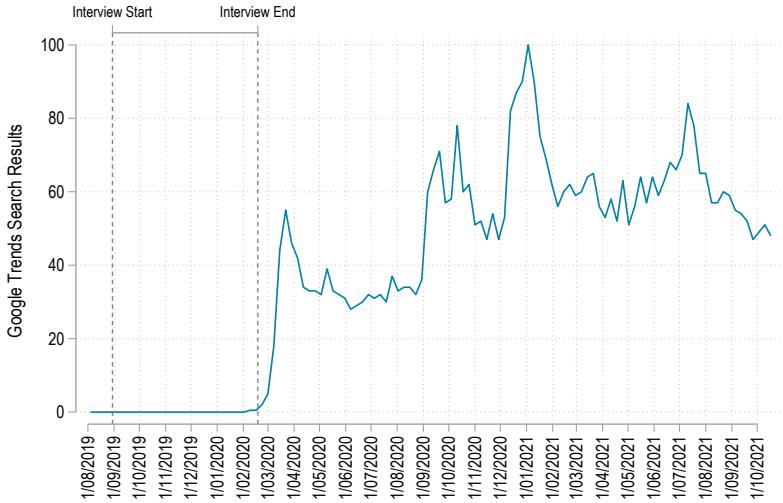
(a) Search term: *Corona*



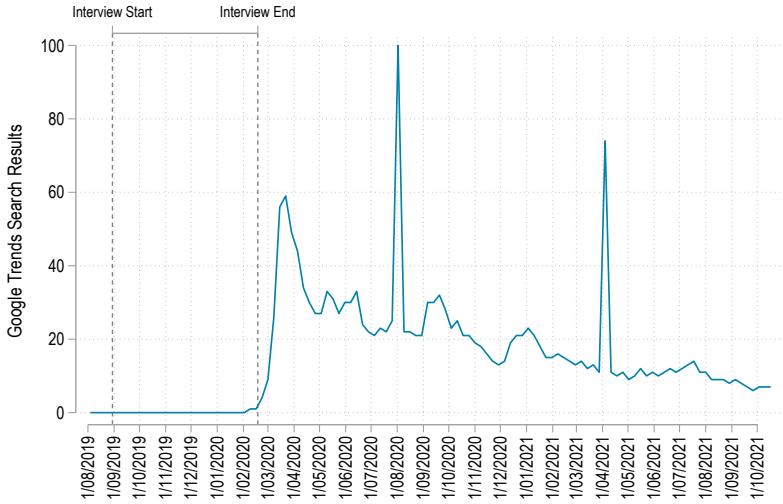
(b) Search term: *Coronavirus*



(c) Search term: *COVID*



(d) Search term: *COVID-19*



Notes: The graphs show the daily search intensity for information on the COVID-related terms in Great Britain.
Source: https://trends.google.com/trends/?geo=GB, data retrieved October 20, 2021.

D House price dynamics in Great Britain, 1995 to 2019

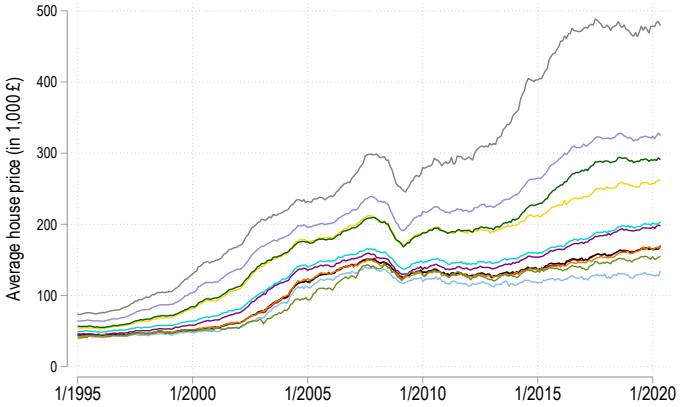
Here, we report house price dynamics in Great Britain. Figure D1 shows average house prices and their annual changes in the HPI since 1995 for Government Office Regions. Figure D2a displays the spatial variation in the annual change in house prices across local areas as of January 2020, the survey month in which a large number of interviews were conducted; annual house price changes vary between -13.6% in the *City of London* and +12.3% in *Burnley*. Since respondents of the Financial Lives survey were interviewed at different points in time over a period of seven months, our measure of past local house price changes varies not only across different local authorities but also over time. During the survey period, the average local annual house price changes range between 0.6% in August 2019 and 1.4% in February 2020 (Figure D2b).

E Local economic conditions

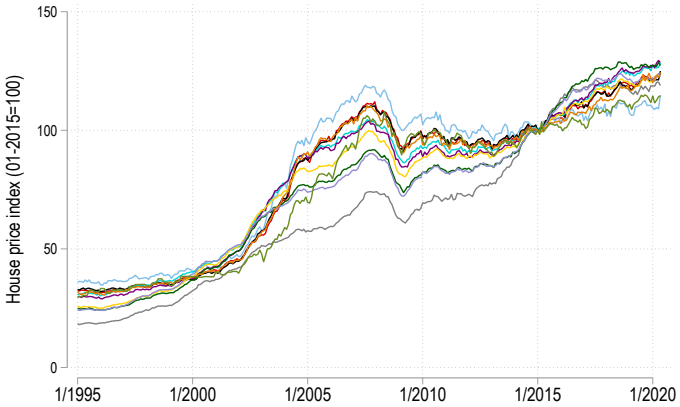
Different measures of local economic conditions are strongly positively correlated. Figure E1a shows that the local unemployment rate, our main measure of local economic conditions, is highly positively correlated with the local deprivation score measure. In addition, we investigate the relationship with a different measure: local monetary losses from welfare reforms. After the General Election 2010, the Conservative-Liberal-Democrat coalition government implemented far-reaching welfare cuts via the Welfare Reform Act 2012 and follow-up reforms. We draw on estimates from Beatty and Fothergill (2016) who provide local-authority-level estimates of the total annual financial benefit loss per working-age adult, separately for pre-2015 and post-2015 welfare reforms. The authors base their estimates on official statistics from the HM Treasury, the Department for Work and Pensions, and the HM Revenue and Customs department, including data on benefit claimants, statistics on welfare-related financial savings, and government's Impact Assessment. Figure E1b shows that these losses from welfare reforms are strongly associated with the unemployment rates in a given Local Authority.

Figure D1: Regional house price dynamics in Great Britain

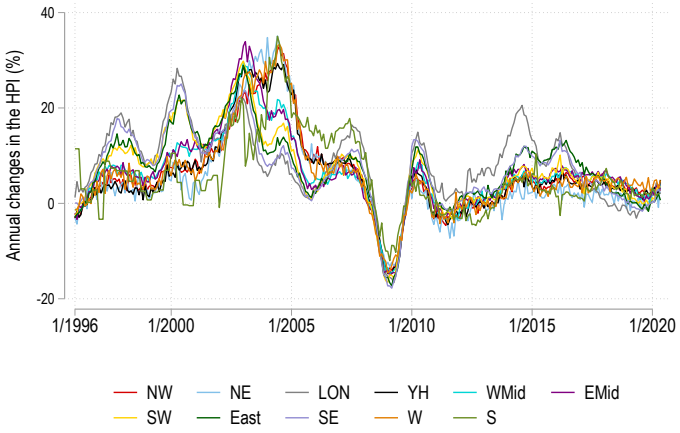
(a) Average house prices



(b) House price index (HPI)



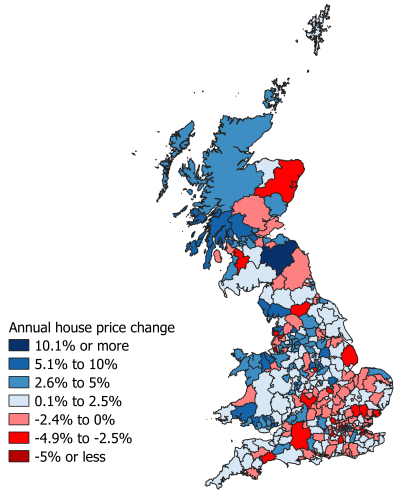
(c) Percentage change in HPI



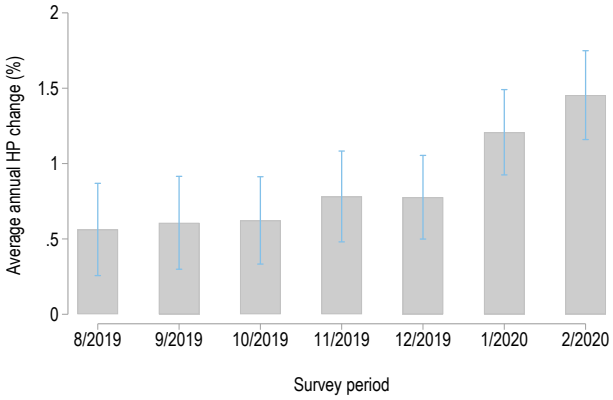
Notes: Panel (a) shows average house prices (including all residential property types) from 1995 to 2020 in Wales, Scotland, and England's regions (NorthWest, NorthEast, London, Yorkshire & Humberside, West Midlands, East Midlands, SouthWest, SouthEast). Panel (b) shows the (quality and composition adjusted) *UK House Price Index* (*HPI*) (January 2015=100), and (c) the percentage change in the HPI compared to twelve months earlier. *Source*: UK HPI.

Figure D2: Variation in annual house price changes across local authorities and across the survey period

(a) Spatial variation (in January 2020)



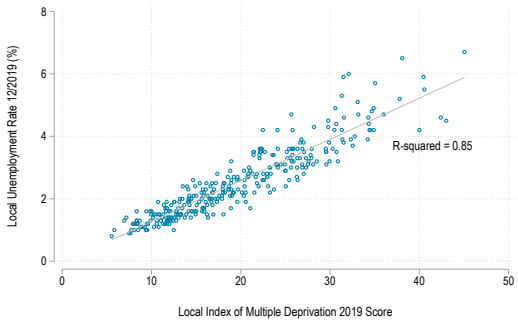
(b) Time variation (across local authorities)



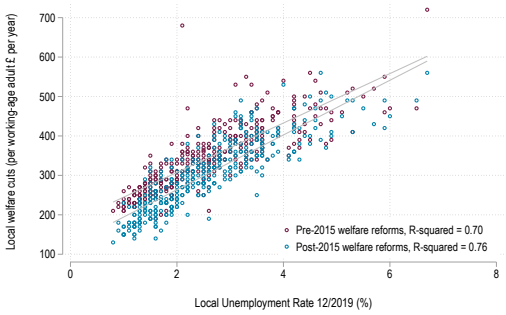
Notes: Panel (a) shows the spatial variation in annual house price changes across the local authorities in Great Britain in January 2020. Panel (b) shows the mean and 95% confidence interval of annual house price changes across local authorities for the survey period (between August 2019 and February 2020); we treat all local authorities identically (i.e., we compute *unweighted* averages) and exclusively consider local authorities covered in our survey sample ($N = 364$). *Source*: UK HPI.

Figure E1: Correlation between local claimant counts and other measures of local economic conditions

(a) Local index of multiple deprivation in England



(b) Local welfare cuts in Great Britain (in £ p.p.)



Notes: The figures show the relationship between different measures of local economic conditions. *Source*: Office for National Statistics (data from Nomis), Ministry of Housing, Communities & Local Government, and Beatty and Fothergill (2016). Panel (a), N=312 local authorities (information on the index-of-multiple-deprivation score is restricted to LAs in England); panel (b), N=364 local authorities.

F Sensitivity analysis

In the following, we document a series of sensitivity analyses, using alternative measures of (i) past house price changes, (ii) local economic conditions, and (iii) financial sophistication. Additionally, we present additional estimates of heterogeneous belief formation by gender and two proxies for informedness about local house prices - a recent move and local newspaper information on local house prices.

Alternative measures of past house price changes

As outlined in Section 2.3, we follow the approach in Malmendier and Nagel (2011) in robustness checks, considering different time horizons in the past and allowing different returns in the past to carry different weights.

Malmendier and Nagel (2011) define the concept of *weighted average annual returns* of individual i in year t, A_{it}, as a weighted sum of individually experienced annual returns, $R_{i,t-s}$, at time, $t-s$, over an individual's lifetime, S_i:

$$A_{it} = \sum_{s=0}^{S_i-1} w_{i,s}(\lambda) R_{i,t-s}, \tag{5}$$

where

$$w_{i,s}(\lambda) = \frac{(S_i - s)^\lambda}{\sum_{s=0}^{S_i-1}(S_i - s)^\lambda}. \tag{6}$$

The weights, $w_{i,s}$, depend on (i) the time horizon of the individual's experience, S_i (short: *lookback period*), (ii) how much time ago, s, the return was realized, and (iii) the weighting parameter, λ. The weighting parameter, λ, allows past experiences to carry different weights. If $\lambda < 0$, more distant returns get higher weights than more recent returns. Conversely, if $\lambda > 0$, more recent returns get higher weights than more distant returns (the weighting function is linear if $\lambda = 1$, concave if $\lambda < 1$, and convex if $\lambda > 1$). If $\lambda = 0$, weights are constant, and, A_{it}, refers to the simple (unweighted) average annual return.

Kuchler and Zafar (2019) apply this concept to house price changes but instead assume a constant lookback period, S, leading to common weights, w_s, across individuals. They determine, S, and, λ, via simulation to maximize their goodness-of-fit in predicting subjective

house price expectations. They use zipcode-level annual house price changes to construct a measure of personally experienced returns. We aim to capture local experience and thus construct weighted average annual local house price changes based on past returns at the local-authority level.

We compute the weighted average annual local housing return (where annual returns are computed monthly) as outlined in equation (5) for different time horizons S (12, 24, 36, 48, 60, 72, 84, 96, 108, 120, 132, 144, 156, and 168 months);[29] we perform return calculations for a series of different weights λ, ranging from -2 to 30, considering steps of 0.1 (i.e., $-2, -1.9, \ldots, 29.9, 30$). We then select the weighted average annual local housing return (and the underlying combination of S and λ) that yields the highest fit of our model (equation (3)), as measured by the R-squared.

Figure F1a illustrates the R-squared for each combination of time horizon S and weighting parameter λ when predicting subjective house price expectations. The longer the time horizon, the higher the weighting parameter λ at which R-squared is maximized, indicating that respondents' recent experiences matter more for their future local house price expectations than experiences that lie further in the past. A similar pattern has been identified in Kuchler and Zafar (2019) for the US local housing market. We achieve the best goodness-of-fit for $S = 60$ (months, i.e., a 5-year lookback period) and $\lambda = 0.5$, implying slowly decreasing return weights across the lookback period (Figure F1b).

For this specification, the weighted average annual local housing return in the sample is equal to 3.7% (with a standard deviation of 1.5 percentage points).[30] In a different regression specification, we consider realized (annualized) local house price changes over the past five years, similar to Armona et al. (2019).[31]

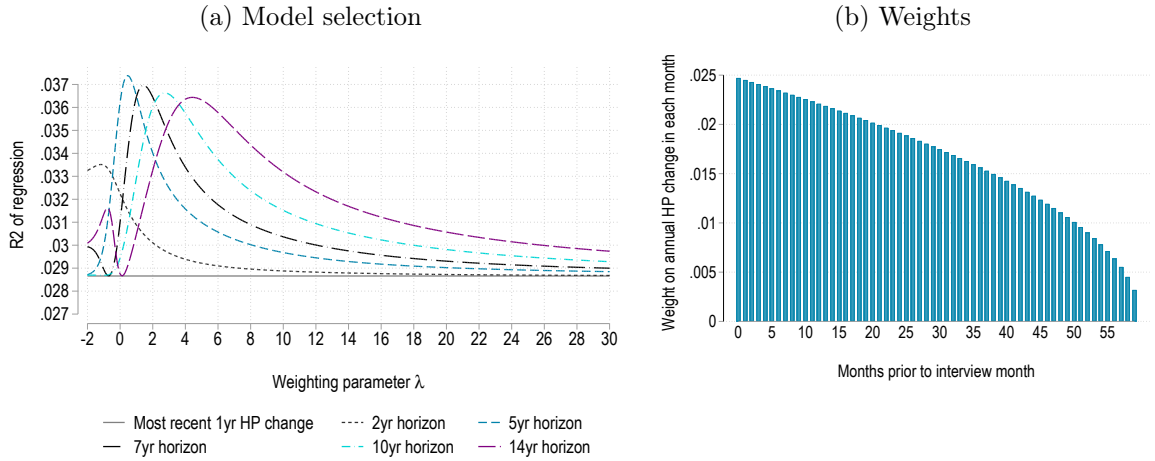
Table F1 shows that both the coefficients on the weighted average of local house price changes over the past 60 months (column 1) and on the annualized house price change over the past five

[29] Housing return data from the UK HPI are available since 2005 for all local authorities, i.e., for 14 years (168 months) prior interview. We therefore cannot consider longer time horizons, e.g., the time horizon since a respondent's birth. $S = 12$ refers to the *most recent available* annual local housing return.

[30] We also construct weighted average annual local house price changes taking into account only those past annual returns that refer to the month of a year in which a respondent was interviewed. Here, the best fit is achieved for $S = 5$ years and $\lambda = 0.1$. Using this measure of past local house price experiences, results are qualitatively similar.

[31] Note that in the survey, we elicit respondents' *perception* of local house price changes over the past one-year horizon, but not over the past five-year horizon.

Figure F1: Model selection and weights on house price changes



Notes: Panel (a) shows the R-squared of the regression estimates for local house price changes for each combination of time horizon S and weighting parameter λ . Panel (b) shows weights on the monthly-calculated annual local house price changes for the combination of S and λ that achieves the best goodness-of-fit in predicting subjective house price expectations, that is $S = 60$ (5yr horizon) and $\lambda = 0.5$. *Source*: Financial Lives 2020 survey.

years (column 2) are positive and statistically significant at the 1% level. It is not implausible that respondents' one-year local house price expectations are positively correlated with realized house price changes over the past five years, but not with realized house price changes over the past one year. Information on how house prices have changed over the past 12 months might not be publicly available that easily and therefore less salient than information on how house prices have evolved on average over the past five years.[32]

Table F1 also shows that for the different specifications of past local house price changes, the effect of the locally experienced unemployment rates on expected local house price changes remains negative and statistically significant. Repeating the regression analyses with the alternative measures of past local house price experiences for the subgroups of individuals with high and low financial literacy, regression results remain qualitatively unchanged (not shown). While individuals with high financial literacy rely more heavily on past returns (here, over the past 5 years) in the expectation formation process, less financially literate respondents place a smaller weight on their (less accurate) perceptions.

[32]Also, since the UK HPI is based on completed sales, it is publicly available only with a delay of three months. For instance, if a respondent is interviewed in January 2020, the last housing return available to the public is from October 2019.

Table F1: Alternative measures of past house price changes

	Expected 1yr HP change (%)	
	(1)	(2)
Local unemployment rate	−0.207***	−0.204***
	(0.067)	(0.068)
Weighted average of local HP change[a]	0.201***	
	(0.054)	
Realized 5yr HP change		0.173***
		(0.049)
Perceived 1yr HP change	0.126***	0.127***
	(0.028)	(0.028)
Mean DepVar	4	4
R-squared	(0.09)	(0.09)
N	2725	2725

Notes: The table shows regression estimates, with expected one-year house price (HP) change as the dependent variable. Realized, perceived, and expected one-year changes in prices refer to the *local* housing market. Realized 5yr HP change is annualized. [a]Calculation of weighted average of past local house price changes with best fit (see Malmendier and Nagel, 2011) for $S = 60$ and $\lambda = 0.5$. Local unemployment rates vary by interview month and local area. All specifications include the following controls: indicators for age, education and household income, whether respondents are female, married, or working, whether they finished the interview during one day, whether they are risk-averse, financially literate, moved recently, their homeowner status and month-year of interview fixed effects. Detailed definitions and summary statistics are provided in Online Appendix Tables A1 and A2. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

Alternative measures of local economic conditions

Our results are robust to using local deprivation scores as an alternative measure of local economic conditions (Table F2). Individuals use local economic conditions as salient characteristics when forming expectations about local house price changes, in particular those with low financial literacy. Since deprivation can only be consistently measured for the subsample residing in England, estimates are less precisely estimated. Similar to our baseline results, individuals extrapolate from perceived, not realized one-year house price changes over the past year.

Alternative measures of financial sophistication

In robustness checks, we split the sample along a different dimension of financial sophistication – interest rate knowledge. A person's interest rate knowledge is considered *high* if three concepts related to past financial developments and future financial expectations are understood, and *low* otherwise. Using a different measure for financial sophistication, we find that results are qualitatively similar to our main results from Table F3. While individuals with high interest rate knowledge draw more heavily on past house price changes when forming

Table F2: Deprivation score as alternative measure of local economic conditions

	Expected 1yr HP change (%)					
			Financial literacy			
	Pooled		High		Low	
	(1)	(2)	(3)	(4)	(5)	(6)
Local deprivation score	−0.019	−0.020*	0.010	0.010	−0.046**	−0.048**
	(0.012)	(0.011)	(0.011)	(0.009)	(0.019)	(0.019)
Realized 1yr HP change	−0.016	−0.013	−0.022	−0.013	0.002	0.005
	(0.038)	(0.037)	(0.036)	(0.031)	(0.067)	(0.066)
Perceived 1yr HP change		0.137***		0.346***		0.092***
		(0.031)		(0.048)		(0.030)
Mean DepVar	3.76	3.76	3.06	3.06	4.41	4.41
R-squared	0.05	0.10	0.05	0.29	0.03	0.06
N	2,319	2,319	1,121	1,121	1,198	1,198

Notes: The table shows regression estimates, with expected one-year house price (HP) change as the dependent variable. Realized, perceived, and expected one-year changes in prices refer to the *local* housing market. The local deprivation score refers to the 2019 IMD measure of deprivation. Estimates are for England only. All specifications include the following controls: indicators for age, education and household income, whether respondents are female, married, or working, whether they finished the interview during one day, whether they are risk-averse, financially literate, moved recently, their homeowner status and month-year of interview fixed effects. Detailed definitions and summary statistics are provided in Online Appendix Tables A1 and A2. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

subjective expectations about year-ahead local house prices, individuals with low interest rate knowledge draw less heavily on past house price changes, but instead also take into account local economic conditions.

Additional estimates of heterogeneity in subjective expectations

We also test for systematic gender differences in beliefs. We find that men have lower perception gaps (Panel A of Table F4) and rely more strongly on their perceptions of past changes. However, we do not find evidence that men and women differ in their reliance on local economic conditions.

In Panel B of Table F4, we split the sample into recent movers versus stayers. Like homeowners, recent movers may be better informed about house prices, or overestimate their knowledge of local housing markets, leading them to rely too heavily on their own perceptions when predicting future price changes. Our estimates show that recent movers base their expectations about future house prices primarily on their own perceptions, while non-movers incorporate both, their perceptions and other available information, when forming these beliefs. Notably, Table 6 shows that recent movers do not have more accurate perceptions than non-movers;

Table F3: Interest rate knowledge as alternative measure of financial sophistication

	Expected 1yr HP change (%)					
			IR Knowledge			
	Pooled		High		Low	
	(1)	(2)	(3)	(4)	(5)	(6)
Local unemployment rate	−0.176**	−0.167**	−0.167*	−0.159*	−0.222**	−0.215**
	(0.075)	(0.069)	(0.098)	(0.086)	(0.109)	(0.103)
Realized 1yr HP change	−0.003	−0.005	0.013	0.014	−0.008	−0.009
	(0.031)	(0.030)	(0.046)	(0.038)	(0.047)	(0.045)
Perceived 1yr HP change		0.129***		0.378***		0.092***
		(0.028)		(0.029)		(0.027)
Mean DepVar	3.71	3.71	3.10	3.10	4.12	4.12
R-squared	0.04	0.08	0.04	0.24	0.04	0.07
N	2,725	2,725	1,097	1,097	1,628	1,628

Notes: The table shows regression estimates, with *expected one-year house price (HP) change* as the dependent variable. Realized, perceived, and expected one-year changes in prices refer to the *local* housing market. Local unemployment rates vary by interview month and local area. Interest rate (IR) knowledge is *high* if all three concepts related to past financial developments and future financial expectations are answered correctly, and *low* otherwise. All specifications include the following controls: indicators for age, education and household income, whether respondents are female, married, or working, whether they finished the interview during one day, whether they are risk-averse, moved recently, their homeowner status and month-year of interview fixed effects. Detailed definitions and summary statistics are provided in Online Appendix Tables A1 and A2. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

both groups display a similar perception gap. In consequence, recent movers may be overconfident about their insight into price trends, causing them to discount other valuable information sources that non-movers continue to use.

Finally, in Panel C of Table F4, we consider whether belief formation varies with local house price reporting in the media. Frequent reporting may lower the cost of information acquisition, reduce individuals' perceptions gaps, and change the weight of perceptions in individuals' belief formation.

We develop a measure of how frequently the topics 'house prices' or 'property prices' are reported in the media in the different local authorities using the following approach: we compile a list of local newspapers; for the time period from August 2018 to February 2020, which covers the 12-month period before the first survey interview was conducted and the survey period, we count, for each local newspaper, the number of articles that contain these search terms, using Google search results extraction. We use this measure as a proxy for the local media coverage of the topic of house prices but note that it likely underestimates the

Table F4: Heterogeneity of subjective expectations

	Expected 1yr HP change (%)			
	A. Gender			
	Female		Male	
Local unemployment rate	−0.202*	−0.213*	−0.208**	−0.170**
	(0.113)	(0.111)	(0.094)	(0.085)
Realized 1yr HP change	−0.065	−0.063	0.056	0.046
	(0.049)	(0.045)	(0.046)	(0.044)
Perceived 1yr HP change		0.104***		0.185***
		(0.033)		(0.050)
Mean DepVar				
R-squared	0.03	0.07	0.08	0.15
N	1,271	1,271	1,454	1,454
	B. Recent mover			
	Yes		No	
Local unemployment rate	−0.330	−0.381	−0.175**	−0.164**
	(0.234)	(0.231)	(0.078)	(0.072)
Realized 1yr HP change	0.011	−0.035	−0.001	−0.001
	(0.081)	(0.085)	(0.032)	(0.030)
Perceived 1yr HP change		0.207***		0.122***
		(0.054)		(0.029)
Mean DepVar	3.61	3.61	3.72	3.72
R-squared	0.21	0.29	0.04	0.08
N	252	252	2,473	2,473
	C. Local media coverage of house prices			
	High		Low	
Local unemployment rate	−0.189**	−0.179**	−0.216	−0.202
	(0.095)	(0.084)	(0.132)	(0.128)
Realized 1yr HP change	0.010	−0.003	−0.013	−0.001
	(0.048)	(0.046)	(0.038)	(0.037)
Perceived 1yr HP change		0.126***		0.134**
		(0.029)		(0.056)
Mean DepVar	3.71	3.71	3.70	3.70
R-squared	0.05	0.09	0.06	0.11
N	1,619	1,619	1,106	1,106

Notes: The table shows regression estimates with *expected one-year house price (HP) change* as the dependent variable. Realized, perceived, and expected one-year changes in prices refer to the *local* housing market. Local unemployment rates vary by interview month and local area. All specifications include the following controls: indicators for age, education and household income, whether respondents are female, married, or working, whether they finished the interview during one day, whether they are risk-averse, financially literate, moved recently, their homeowner status and month-year of interview fixed effects. Gender respectively recent mover status are omitted, respectively, in panels A and B. Detailed definitions and summary statistics are provided in Online Appendix Tables A1 and A2. Standard errors in parentheses are adjusted for clustering at the *local-authority* level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: Financial Lives 2020 survey.

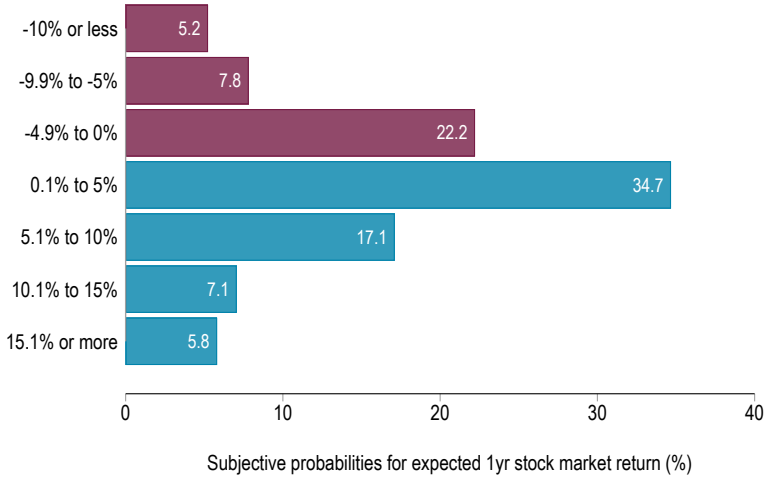
variation in salient information on house prices across local areas, as it does not include widely used commercial property search engines.[33]

We find no evidence that individuals exposed to more salient information about local house prices extrapolate differently from their perceived house price changes (Panel C of Table F4). Yet, while local unemployment rates are a weakly stronger predictor of local house price expectations in areas with little coverage of house prices in the media, the coefficient is not statistically significant. However, our measure is likely subject to measurement error due to the lack of information from widely used online house search platforms.

G Stock market return expectations, perceptions, realizations, and perception gaps

Figure G1 shows the subjective probabilities for one-year-ahead expected stock market returns. Table G1 reports summary statistics for stock market return expectations, perceptions, realizations, and perception gaps. We find a perception gap similar in magnitude to that of house price changes.

Figure G1: Subjective expected one-year stock market return



Notes: The figure shows the distribution of one-year-ahead expected stock market returns, N=2,799. For detailed summary statistics, see Table G1. *Source*: Financial Lives 2020 survey.

[33]Unfortunately, more granular localized information on the search intensity for house price information was not available from these providers due to their business sensitive nature.

Table G1: Summary statistics: stock market return expectations, perceptions, and realizations

	Mean	Std Dev	P10	P50	P90
Panel A: Expectations					
Expected 1yr stock market return (%)	2.13	4.94	−1.99	1.76	7.50
Panel B: Perceptions					
Perceived 1yr stock market return	2.58	8.34	−3.00	2.50	10.00
Panel C: Realizations					
Realized 1yr stock market return	3.30	3.52	−1.36	4.55	5.25
Panel D: Perception gap					
Absolute perception gap (%-points)	5.39	7.12	0.45	4.55	10.98
N	2,799				

Notes: The table shows summary statistics. The absolute perception gap denotes the difference between realized and perceived past one-year stock market returns in absolute terms. Computation of expectations is based on the non-parametric estimation approach by Hurd et al. (2011); for details, see Online Appendix B. *Source*: Financial Lives 2020 survey and historical values from the FTSE-100 Index.