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Individual Experience and Home Price Expectations

Shuai Fang
Soochow University, Business School
shuaifang@suda.edu.cn (corresponding author)

Xiaolong Liu
University of Groningen, Department of Economic Geography, Real Estate Centre
xiaolong.liu@rug.nl

Arno J. van der Vlist
University of Groningen, Department of Economic Geography, Real Estate Centre and Amsterdam School of Real Estate
a.j.van.der.vlist@rug.nl

Abstract

We examine whether the heterogeneity of expectations is associated with idiosyncratic variations in experience. Combining household survey data and administrative data from the Netherlands, we find that given market development, households' expectations about house price changes vary with their individual experience. This association is related to the use of information conveyed by experience, which varies in terms of informativeness, recency, and household sophistication. Finally, we find that individual experience also explains how far house price expectations deviate from realized house prices and that it may affect household behavior. Our findings elucidate the role that individual experience plays in expectation formation.

I. Introduction

Expectations about the aggregate economy play a key role in important decisions made by individuals and households throughout their lives, such as decisions regarding durable goods consumption (Bachmann, Berg, and Sims (2015), Ichiue and Nishiguchi (2015)), financial assets investment (Ben-David, Fermand, Kuhnen, and Li (2018)), and home purchases (Agarwal, Hu, and Huang (2016), Armona, Fuster, and Zafar (2019), and Bailey, Davila, Kuchler, and Stroebel (2019)). There is considerable cross-sectional variation in expectations (see, for example, Souleles (2004)), and studies relate these variations to differences in market experience, as such experiences resulted from shared information on market performance. For instance, expectations vary with the inflation rates that individuals observe (Malmendier and Nagel (2016)), the stock market returns that investors witness (Adam, Marcet, and Beutel (2017)),

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or house price changes in the local markets in which households live (Armona et al. (2019), Kuchler and Zafar (2019)). Although the literature elucidates the extent to which expectations are correlated with market experience, large parts of the cross-sectional dispersion in expectations, which vary with individual experience, remain unexplored. In particular, individuals within the same market or cohort can differ in terms of their individual experience, which may lead them to hold different expectations. For instance, the distribution of household expectations of house prices determined by a household survey in the Netherlands conducted by the Dutch Central Bank (De Nederlandsche Bank, DNB) reveals a considerable cross-sectional dispersion in expectations within the same local housing market relative to the median expectation. Nevertheless, this pattern is barely considered in the relevant literature.[1]

In this study, we analyze whether heterogeneity in expectations about future house prices can be explained by idiosyncratic variations in households' experience in housing markets. Households located in the same local housing market may have an individual experience that varies depending on the time when they moved to the current area. For example, a household buying a house in a local market in 2007 would witness completely different market developments to another household buying in the same local market in 2012 (Gerardi, Herkenhoff, Ohanian, and Willen (2018)). Hence, in our study, in addition to the variation in the households' "shared experience of the market," which is measured by the municipal house price change, we seek to answer whether the variation in "individual experience," which we define as the annualized house value changes since the household moved into their house, could explain heterogeneity in expectations about future aggregate house price development.

To achieve this goal, we analyze Dutch national survey data on household expectations about future house price developments and combine this information with administrative records of personal addresses, housing registry data, and data on household characteristics in the Netherlands. The data are characterized by a number of unique properties. First, instead of focusing on narrowly defined geographical regions, the characteristics of the data enable us to adopt a nationwide perspective in our study. Second, by including administrative registry data, it is possible to accurately capture the individual housing careers of Dutch households with minimal concern about measurement errors or under-reporting. Hence, rather than using homeownership as a classification for households or a crude proxy for idiosyncratic housing market experience (Kindermann, Le Blanc, Piazzesi, and Schneider (2021)), we observe individual housing careers. Thus, we can leverage a precise measurement of individual housing market experience to examine the relationship of such experience with expectations about general housing market development. Third, as the data cover the period from 1999 to 2018, we are able to set initial conditions based on a lengthy time interval.

We regress household expectations about future nominal aggregate house price development on both individual experience and market experience. When controlling for market experience and including year-by-move-in-year fixed effects, we find that households experiencing greater home value appreciation

[1]The data are discussed further in Section II.

are more optimistic about the housing market development over the next 2 years than other households. We check for robustness from several perspectives. First, we deal with concerns regarding unobserved heterogeneity by including municipality-by-year fixed effects to eliminate the effects of time-varying factors at the regional level, and by controlling for household fixed effects to remove the effects of household time-invariant features. The results of these robustness tests indicate that our baseline findings are not fully driven by these factors. Second, we alter our definition of expectations to a 10-year-horizon expectation or a categorical variable indicating the expected direction of housing market movement. Our estimations yield robust results and confirm that expectations respond to individual experience.

We seek to interpret the relationship between experience and expectations by referring to the role that information plays in the expectation-formation process. First, the effects of experience on expectations may depend on the level of informativeness of the information embodied in households' experience. Thus, we compare the tendency to use information based on individual experience across varying levels of market experience informativeness. Our results show that when the market experience is more informative, as represented by a low price dispersion in the market or high co-movement with the national house price development, households tend to rely less on their individual experience to form expectations than when market experience is less informative. Next, we classify individual experiences into recent and distant experiences according to when it was gained, that is, in the recent or the more distant past. We find that expectations have a stronger association with more recent experience than with more distant experience. We conjecture that this is because information gained from individual experience in the distant past is perceived as being outdated and less applicable than more recent experience when it comes to future expectations, and that information gained through individual experience can be characterized as having a time decay pattern. Finally, we examine how information utilization depends on household sophistication, denoted by three measures of financial literacy: self-reported financial literacy, an economics-related educational background, and financial literacy scores. We find that compared with highly financially literate households, non-literate households are more inclined to use information from their individual experience and less likely to rely on market experience. These findings suggest that the role of individual experience in expectation formation may result from households' sophistication levels, such that less sophisticated households primarily rely on information that is more accessible rather than being characterized by greater market coverage.

Finally, we examine the consequences of relying on individual experience when forming expectations. First, we measure expectation errors, that is, how far the expected house price change deviates from the realized house price change. We find that the expectation error is positively related to individual experience. When we include household sophistication in the analysis, we find that the relationship between expectation error and individual experience is more pronounced among non-literate than literate households. These findings suggest that using information from individual experience may be a heuristic and could cause expectations to deviate from the realized house price changes. Second, we examine the effect of

expectation errors on households' behavior in house selling and buying. We find that homeowners expecting higher house price growth than realized house price growth are less likely to sell their homes than other households, and that, conditional on selling, they are more likely to set a list price that is higher than the predicted market value of their homes. For renters, we find that expecting a higher house price growth rate increases the likelihood of becoming a homeowner. These findings provide evidence on the consequences of using individual experience to form expectations.

This article contributes to the literature on the role of experience in expectation formation by explicitly including idiosyncratic variations in experience. Studies find that the variation in expectations is dependent on cross-sectional differences between individuals in terms of their market experience (Malmendier and Nagel (2016), Armona et al. (2019), and Kuchler and Zafar (2019)). Building on the work of Armona et al. (2019) and Kuchler and Zafar (2019), we study a setting in which individual experience shapes household expectations alongside market experience. Similar to D'Acunto, Malmendier, Ospina, and Weber (2021) and Hoffmann and Post (2017), we employ a strategy of using idiosyncratic variations in experience, but our study differs from these studies in terms of the market structure being considered. D'Acunto et al. (2021) conclude that price changes in consumption goods that individuals consume on a daily basis could explain their inflation expectations, and Hoffmann and Post (2017) find that individual investors' past returns on stocks could explain their expectations about future returns. In housing markets, individuals differ greatly in terms of their housing careers. We contribute to the literature by documenting the role of experience in expectation formation in a setting characterized by large idiosyncratic variations in experience, lumpy investment, and illiquidity, features that contrast with those of markets for consumer goods or stocks. This article also contributes to the literature on the expectations and expectation errors of households. Studies focus on the expectation errors of professionals, such as financial analysts, investigating the determinants of the performance of their forecasts about the aggregate economy or firms' financial performance (Souleles (2004), Dong, Fisman, Wang, and Xu (2021)). For nonprofessionals, such as households, expectations and expectation errors may be related to financial literacy and may affect households' behavior (Cocco, Gomes, and Lopes (2022)). We find that individual experience pertaining to housing may explain expectation errors and, more importantly, that households' behavior regarding home selling and buying can be shaped by expectation errors. Our paper differs from Cocco et al. (2022) in that, we examine the household expectations on the aggregate outcomes of housing markets.

The remainder of this paper proceeds as follows: Section II describes the data, and Section III seeks correlations between individual experiences and expectations to provide the main results. Section IV analyzes the robustness of the findings. Section V seeks to explain the findings from the perspective of information. Section VI explores the consequences of relying on individual experience to form expectations. Section VII draws conclusions.

II. Data and Descriptive Statistics

Our study combines household-level microdata from various sources: representative survey data from the DNB Household Survey (DHS); administrative data from Statistics Netherlands (CBS); house transaction data and housing registry data from the Cadastre, Land Registry, and Mapping Agency of The Netherlands (Kadaster); and housing characteristics data from the Dutch Association of Realtors (NVM). Every house and individual taxpayer in the Netherlands is assigned a unique identifier, which makes it possible to combine these data sets to form our comprehensive sample.

A. Expectations

Data on household expectations about future nominal house prices are from the DHS, which is a nationally representative survey that examines both psychological and economic aspects of the financial behavior of Dutch households. The DHS data are based on a rotating household panel structure, and the survey is conducted on a yearly basis. The data set consists of several modules, including general information and work, accommodation and mortgage, health and income, assets and liabilities, and economic and psychological aspects. In the accommodation and mortgage module of the DHS, the respondents are asked about their expectations of future nominal house prices. The questions raised are as follows: first, "*What kind of price movement do you expect in the housing market in the next 2 years: will housing prices increase, decrease, or remain about the same?*"; and second, "*How many percentage points will they increase/decrease a year on average?*" Using the responses to these two questions, we measure expectations about the annual rate of change in the nominal house price over the next 2 years. We combine data from the 2010–2018 waves with CBS administrative data on the Netherlands and ultimately obtain 3,686 household-year observations related to 1,321 households.[2]

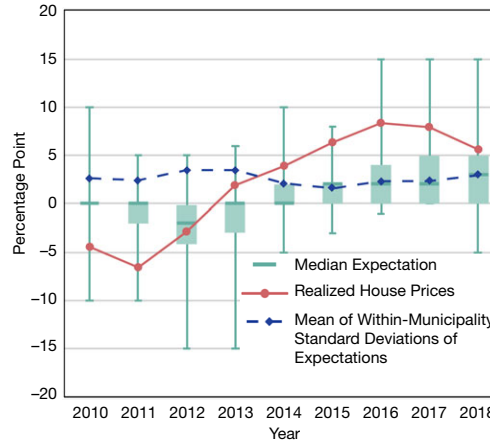
Figure 1 displays the distributions of expectations and realized house price changes in the targeted years. There are substantial variations in house price expectations across households. For example, in 2018, the median expected house price change was zero, with the 99th and 1st percentiles being 15% and −5%, respectively. Comparing the range of expectations over the period of analysis shows that the dispersion in house price expectations was greater during the years of the financial crisis and up to 2013 than in other years. Interestingly, comparing expectations with actual house price changes shows that household expectations lagged behind the actual changes. In addition, we investigate the heterogeneity in expectations from a within-group perspective by calculating the standard deviation of expectations within a municipality. We find that the mean values of these standard deviations across the municipalities were greater than 1.6% every year. This suggests considerable variations in expectations within a local housing market that are not captured by market experience.

[2]The data management procedure is described in Appendix C.

FIGURE 1

Expectations About Average Annual House Price Changes

Figure 1 presents a box-and-whisker plot of expectations by year. The number of household-year observations is 3,683, relating to 1,321 households. The top and bottom sides of the boxes are the 25th and 75th percentiles, respectively. The band in each box is the median. The upper and lower bounds of the whiskers are the 1st and 99th percentiles, respectively. The solid line represents the averaged realized values of national house prices in the Netherlands in the targeted years. The dashed line represents the mean standard deviations across all municipalities of households' expectations about house prices in the next 2 years after the survey.



B. Market Experience

As market experience reflects shared information on market development (Kuchler and Zafar (2019)), we measure market experience as the year-on-year house price change at the municipality level, using house transaction data from the NVM. The NVM records transaction information on housing sales mediated by its members. Given that the Kadaster transaction data includes all house transactions in the Netherlands, one can easily show that the NVM data cover approximately 70% of the market. The great advantage of using the NVM data is that they contain extensive information on housing characteristics, such as the size, the year built, the number of rooms, the type of house or apartment, and interior and exterior maintenance. By applying a log-linear hedonic pricing model to the data, we create a municipal house price index for each of the 361 municipalities in the Netherlands over the period from 2009 to 2017.[3] The procedure is described in Appendix B. Figure 2 depicts the distributions of house price indices in Dutch municipalities over the sampled years.

C. Individual Experience

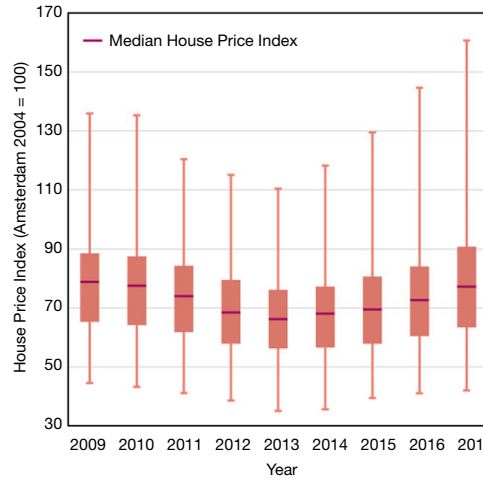
A household's individual housing experience is obtained by combining several data sets. We start with the CBS administrative data to trace the registration address of each household since 1999. The data contain the residential addresses and moving records of all individuals in the Netherlands, who must register their residential addresses with the local municipality during the period from 4 weeks before to 5 days after a move.

[3]The market experience is measured as the year-on-year price change 1 year before the survey.

FIGURE 2

House Price Index Dispersions in Municipalities

Figure 2 presents a box-and-whisker plot of the house price index by year, with the Amsterdam index in 2004 set to 100. The house price index is calculated for each municipality and for each year in the Netherlands based on the log-linear hedonic pricing model shown in equation A1. The number of municipalities is 361. The top and bottom sides of the boxes are the 25th and 75th percentiles, respectively. The band in each box is the median. The upper and lower bounds of the whiskers are the 1st and 99th percentiles, respectively.



Housing registry data from the Kadaster are used to obtain the house values and house transaction history. The housing registry records data on all properties in the Netherlands, including property type, appraisal value, location, and tenure status (owner-occupied or rental) of every house on Jan. 1st of each year since 1999. In the Netherlands, house values are estimated on a yearly basis by municipalities, and the resulting appraisal values are referred to as the *Waardering Onroerende Zaken* (WOZ) values.[4,5] Municipalities use the WOZ value as the basis on which to levy municipal taxes, such as property taxes and water systems charges.[6]

[4]Households can learn their WOZ values in two ways. First, when municipal taxes are determined and due to be paid, homeowners receive a letter from the municipality that states the WOZ value of the house and the amount of taxes due. Second, irrespective of tenure status, every individual can check the WOZ value of all residential properties in the Netherlands without cost on the website of the Kadaster, which is delegated by the Ministry of Interior and Kingdom Relations to collect and register property rights information in the Netherlands.

[5]The literature documents level differences between appraisal values and sales prices of houses (Gatzlaff and Haurin (1998)). Following Pool, Stoffman, Yonker, and Zhang (2019) and Dimmock, Gerken, and Van Alfen (2021), we measure individual experience based on *changes* in appraisal value to prevent any bias.

[6]Although households may appeal against the WOZ assessment to obtain a re-estimate of their tax payment, the number of cases in which objections have been approved is limited. According to the Netherlands Council for Real Estate Assessment, in the period from 2019 to 2021, about 3% of houses appealed each year, and less than 40% of these objections were approved. Moreover, when approved, the WOZ value was changed by less than 10% on average. More detailed information can be found at https://www.waarderingskamer.nl/woz-in-cijfers/feiten-over-de-woz/.

We use unique identifiers to match individuals, households, and houses to obtain the individual experience of a household. We define individual experience as the annualized cumulative percentage change in the appraisal value of the house in which the household has currently living since the household moved into the house. This definition is appropriate for this study for several reasons. First, the house value growth since purchase allows us to identify idiosyncratic variations in households' housing experience, whereas most studies examine market experience, which is often measured by the regional aggregate house price (Bailey, Cao, Kuchler, and Stroebel (2018), Kuchler and Zafar (2019)). The inclusion of municipality-by-year fixed effects in our specification allows us to exploit variations in housing shocks within the same municipality in the same year. Second, the house value upon purchase is salient for homeowners, who often refer to it to evaluate their gains and losses in the housing market (Bracke and Tenreyro (2021), Hong, Loh, and Warachka (2021)).

Third, in the related literature, the timing of purchase is regarded as orthogonal to the household's current decisions, which helps isolate the causal effect of house values on household decisions. For example, Dimmock et al. (2021) exploit financial advisors' cumulative returns since purchase to identify the causal effect of house values on their propensity for misconduct. Chetty, Sándor, and Szeidl (2017) instrument the house value with the regional house price index in the purchasing year to overcome endogeneity bias from the correlation between house value and real estate wealth. The loan-to-value ratio is also found to be causally related to the mortgage repayment decision or mental health, instrumented with the regional cumulative house price appreciation or the timing of purchase (Gerardi et al. (2018), Andersen, Iyer, Johannesen, Jørgensen, and Peydró (2022)). In our study, a benefit of our data is that instead of using the regional cumulative price or the timing of purchase as an instrument, we measure the individual cumulative house value growth since the household moved in and thus isolate the effects of individual experience on expectations.

Because the housing registry data do not contain house values prior to 1999, our measurement of individual experience is valid for households who moved into their current house in or after 1999. Applying this restriction to the sample, we ultimately obtained 3,686 observations based on 1,321 households, covering the 2010–2018 period.[7]

D. Control Variables

Because the socioeconomic status of a household might shape its expectations (Das, Kuhnen, and Nagel (2020)), we include a set of individual- and household-level control variables in our analyses. We use CBS administrative data referring to each person and household to determine annual individual-level control variables covering age, age squared, gender, and the highest education level, and household-level control variables consisting of the annual gross income, the main income source by classifying the household as self-employed or retired, and the tenure

[7]Details of the sample selection procedure are described in Appendix C.

TABLE 1

Summary Statistics

Table 1 reports descriptive statistics for the selected variables. The sample is the households that participated in the DHS during the 2010–2018 period. The total number of observations is 3,686. Individual experience is measured by the annualized percentage change in the house value in year $t-1$ since the household moved into their house. Market experience is measured by the annual percentage change in the municipal house price index in year $t-1$. Variable definitions are provided in Appendix A.

Variables	No. Obs.	Mean	Std. Dev.	p1	p25	Median	p75	p99
Expectation about future nominal house price change (% point)	3,686	1.000	3.832	−10	0	0	3	10
Individual experience (% point)	3,686	0.169	7.593	−10.64	−3.058	−0.644	2.294	18.756
Market experience (% point)	3,686	0.849	6.042	−11.676	−3.81	0.556	4.622	16.197
Age (year)	3,686	49.354	14.64	25	38	46	61	84
Annual gross household income (euro)	3,686	67,065	39,599	12,026	38,272	61,389	86,279	196,170
Self-employed (1 = yes)	3,686	0.036	0.187	0	0	0	0	1
Retired (1 = yes)	3,686	0.188	0.391	0	0	0	0	1
College (1 = yes)	3,686	0.524	0.499	0	0	1	1	1
Female (1 = yes)	3,686	0.365	0.482	0	0	0	1	1
Homeowner (1 = yes)	3,686	0.714	0.452	0	0	1	1	1

status. The descriptive statistics for expectations, house price changes, and the control variables for individuals and households are displayed in Table 1.

III. Main Results

In this section, we examine the association between a household's individual experience level and its expectations about future house prices. Following Kuchler and Zafar (2019), the response of expectations to market experience, which is often measured by the change in the regional house price, can be modeled as

$$(1)\quad \text{Expectation}_{it} = \alpha_0 + \alpha_1 \text{Marketexperience}_{jt-1} + \gamma \text{Controls}_{it} + T_{tm} + \epsilon_{it},$$

where Expectation_{it} is the expectation of household i in year t regarding the rate of the average annual aggregate house price change over the next 2 years; $\text{Marketexperience}_{jt-1}$ is the percent change in the municipal house price index from year $t-2$ to year $t-1$ in the municipality j where household i is living in the year $t-1$; Controls_{it} denotes a vector of control variables for household i in year t; T_{tm} represents year-month fixed effects; and ϵ_{it} is an error term. The estimation results are shown in columns 1 and 2 of Table 2. Column 1 excludes the individual and household control variables. Column 2, which includes control variables, shows that the coefficient of the municipal house price change is 0.061, indicating that a one percentage point increase in the lagged municipal house price is associated with a 0.061 percentage point increase in households' average nominal house price expectations.[8]

[8]Kuchler and Zafar (2019) report a coefficient of 0.089 for the association between house price changes at the postcode level and households' nominal house price expectations in the U.S. In Appendix D, we use the same time window as that in Kuchler and Zafar (2019) (Dec. 2012 to Apr. 2017) and find a coefficient of 0.092, which falls within the confidence interval of the coefficient in Kuchler and Zafar (2019).

TABLE 2

Expectations About House Prices and Experience

Table 2 shows the regression estimates of expectations on experience. Columns 1 and 2 present the estimates of equation (1) without and with control variables, respectively, and column 3 presents the estimates of equation (2). The sample period is 2010–2018. The number of household-year observations is 3,686. The dependent variable is expectations about the average annual house price growth in the next 2 years. Individual experience is measured by the annualized percentage change in the house value in year $t-1$ since the household moved in. Market experience is measured by the annual percentage change in the municipal house price index in year $t-1$. The control variables included are age, age squared, a gender indicator, an indicator of whether the respondent has a college degree, the logarithm of the annual gross income, and indicators of being self-employed, being retired, and the homeownership of the household. Standard errors (in parentheses) are clustered at the household level and robust to heteroskedasticity. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1.

	Expectation		
	1	2	3
Individual experience			0.020***
			(0.007)
Market experience	0.068***	0.061***	0.062***
	(0.018)	(0.018)	(0.018)
Controls		Yes	Yes
Year-month FE	Yes	Yes	Yes
Year × move-in year FE			Yes
Observations	3,686	3,686	3,686
R^2	0.247	0.259	0.282

In the next step, we augment equation (1) by including individual experience with market experience, as shown in equation (2).

$$\text{(2)}\quad \text{Expectation}_{it} = \alpha_0 + \beta \text{Individual experience}_{it-1} + \alpha_1 \text{Market experience}_{jt-1} + \gamma \text{Controls}_{it} + T_{tm} + T_t \times T_{\text{move-in}} + \epsilon_{it},$$

where $\text{Individual experience}_{it-1}$ is the annualized change (in percentage terms) of the value of the house in year $t-1$, in which the household has lived since moving in to the house. The paired fixed effects of the current year and the move-in year, $T_t \times T_{\text{move-in}}$, separate the potential effects of the tenure period from the response of expectations to individual experience. There are three potential ways in which the tenure period may affect home price expectations. First, when the market is rising at an increasing rate, individual experience, measured by the annualized cumulative growth in the house value, is positively correlated with the holding period. Second, the inclusion of $T_t \times T_{\text{move-in}}$ restricts the comparison between households with the same move-in year and the same current year, which excludes time-varying unobserved household and house characteristics that may be correlated with the house transaction timing.[9]

Third, although the timing of moving into a house is usually regarded as orthogonal to other household decisions, such as mortgage repayment (Gerardi et al. (2018)) and financial misconduct (Dimmock et al. (2021)), in our settings, the timing of moving in might be driven by expectations, a possibility suggested by Kurlat and Stroebel (2015). For instance, households may purchase houses in

[9]Similarly, Bracke and Tenreyro (2021) control for year-by-purchase-year fixed effects to isolate the effects of historical gains on the propensity to sell a house. Although the paired fixed effects absorb a substantial amount of variation in individual experience, the estimated results suggest that individual experience has positive and significant effects on expectations, as shown in Table 2 (column 3).

anticipation of a booming market, whereas the decision to sell might be associated with a pessimistic market outlook. As a consequence, the positive association between individual experience and expectations could be attributed to the fact that households with a more optimistic market outlook are more likely to buy a house at the bottom of the cycle. The inclusion of $T_t \times T_{\text{move-in}}$ removes variations in the timing of moving in and thus overcomes this reverse causality issue.

The results are shown in column 3 of Table 2. The coefficient of market experience, measured by the municipal house price change, remains unchanged. The coefficient of individual experience is 0.020. This means that when we control for the regional housing market development, a 1 percentage point (1 standard deviation) increase in the annualized cumulative house price change since moving in is associated with a 0.020 percentage point (0.040 standard deviation) increase in the expectation of the house price change in the next 2 years. This effect is equivalent to a 2.00% change in the mean level of the expectations.

IV. Robustness Checks

In this section, we conduct robustness tests to address concerns about unobservable heterogeneity across regions and households, and we examine whether our main results in Section III change when we use alternative definitions of expectations.

A. Addressing Concerns on Unobservables

In our main results, to isolate the effects of individual experience on expectations from the effects of market experience, we control for market experience by including municipal house price changes. However, there might be time-varying municipality-specific factors other than market experience that are correlated with both expectations and individual experience. For example, the labor market boom and positive demand shocks may drive up house prices and make households more optimistic about the regional economy. These regional–temporal confounders may bias our estimates of the response of expectations to individual experience.

We seek to control for these confounders by including year-by-municipality fixed effects. These fixed effects absorb all the variations across the municipality-year, including the variations in market experience, which we include in equation (2). We effectively estimate the response of expectations to the individual experience by comparing households in the same municipality and in the same year. The results are displayed in column 1 of Table 3. We find that the coefficient of individual experience remains at a similar magnitude to that in our baseline results.

In addition to being correlated with confounders at the regional–temporal level, expectations may be affected by personal and household characteristics. For example, D'Acunto et al. (2021) document that inflation expectations are correlated with factors associated with households' socioeconomic status, such as their income and educational attainments. In our settings of housing market expectations, although we control for many individual and household characteristics, there might be unobservable time-invariant household-specific characteristics that influence the association between individual experience and expectation formation.

TABLE 3

Expectations About House Prices and Experience: Addressing Concerns about Unobservables

Table 3 shows the regression estimates of expectations on experience, based on equation (2) with additional fixed effects. The sample period is 2010–2018. The dependent variable is expectations about average annual house price changes in the next 2 years. Individual experience is measured by the annualized percentage change in the house value in the year $t-1$ since the household moved in. Market experience is measured by the annual percentage change in the municipal house price index in year $t-1$. The control variables included consist of age, age squared, an indicator of the respondent's gender, an indicator of whether they possess a college degree, the logarithm of the annual gross income, and indicators of being self-employed, being retired, and the homeownership of the household. Standard errors (in parentheses) are clustered at the household level and robust to heteroskedasticity. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1.

	Expectation		
	1	2	3
Individual experience	0.017*	0.030***	0.025**
	(0.009)	(0.007)	(0.010)
Market experience		0.025	
		(0.017)	
Controls	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes
Year × move-in year FE	Yes	Yes	Yes
Year × municipality FE	Yes		Yes
Household FE		Yes	Yes
Observations	2,908	3,169	2,336
R^2	0.470	0.568	0.727

For example, within the same geographical area and at the same point in time, some households might be more optimistic than others owing to the household respondent's personality rather than their housing experience. In addition, some households might consider 5 percentage points a huge increase in house prices, whereas others would consider such a rise rather small. In these cases, if such unobserved discrepancies in personalities or perceptions of scale are correlated with individual experience, our estimates of the response of expectations to individual experience could be biased.

To address this issue, we exploit within-household variations by including household fixed effects, which eliminate the effects of household unobserved heterogeneity in time-invariant household-specific factors, such as the religious background and the overall attitude toward the housing market. The results are displayed in columns 2 and 3 of Table 3. In column 2, we add household fixed effects to equation (2) and find that the coefficient of individual experience remains positive. In column 3, we add both year-by-municipality fixed effects and household fixed effects to equation (2) to address unobserved heterogeneity at both regional–temporal and household levels. The results suggest that the positive response of expectations to individual experience holds, a slightly greater magnitude than the main results.

B. Alternative Definitions of Expectations

In our previous analysis, we measure households' expectations of future nominal house price changes using the annual percentage change expected for the next 2 years. One may argue that this measurement is i) relatively short-term and ii) arbitrary. To investigate whether the response of expectations to individual experience is valid for a longer term and more qualitative perspective, we use two

TABLE 4

Expectations About House Prices and Experience: Alternative Definitions of Expectations

Table 4 shows the OLS estimates of expectations on experience based on equation (2), using alternative definitions of expectations. The sample period is 2010–2018. The dependent variable in column 1 is expectations about average annual house price changes in the next 10 years. The dependent variable in column 2 is a categorical variable for expectations in the next 2 years, which equals 1 if the respondent expects an increase, −1 if they expect a decrease, and 0 if the respondent expects house prices to remain constant. Individual experience is measured by the annualized percentage change in the house value in year $t-1$ since the household moved in. Market experience is measured by the annual percentage change in the municipal house price index in year $t-1$. The control variables included consist of age, age squared, an indicator of the respondent's gender, an indicator of whether they possess a college degree, the logarithm of the annual gross income, and indicators of being self-employed, being retired, and the homeownership of the household. Standard errors (in parentheses) are clustered at the household level and robust to heteroskedasticity. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1.

	10-Year Expectation	Expected Direction of House Price Changes
	1	2
Individual experience	0.029*	0.004***
	(0.016)	(0.001)
Market experience	0.012	0.002
	(0.023)	(0.003)
Controls	Yes	Yes
Year-month FE	Yes	Yes
Year × move-in year FE	Yes	Yes
Observations	2,769	3,686
R^2	0.060	0.408

alternative definitions of expectations. First, we use the average annual percentage change expected over the next 10 years. This is generated from the survey responses to the question "*In a period of about 10 years, what do you think is a normal increase or decrease for property prices per year?*" The estimation results are shown in column 1 of Table 4. The coefficient of individual experience is 0.029, which is greater than that in column 3 of Table 2. Second, we use a categorical variable of expectations, which is derived from the responses to the question "*What kind of price movement do you expect in the housing market in the next 2 years: will housing prices increase, decrease, or remain about the same?*" We assign values of 1, −1, and 0 to the responses of expected increase, expected decrease, and expected constancy, respectively. The estimation results are shown in column 2 of Table 4. The coefficient remains positive, indicating that more positive individual experience is associated with higher expectation of future house prices.

V. Role of Information in Expectation Formation

Individual experience and market experience potentially deliver different information. Market experience delivers information on housing market development within a geographical area, that is, house price changes at the municipality level, whereas individual experience provides information on a single transaction conducted or a single house observed by the household. As such, information derived from market experience might be broader than that derived from individual experience. Information from individual experience is generally more accessible than that from market experience because households can more easily recollect their own transaction history. Thus, it is interesting to examine which of the two sources of information households tend to rely on to form their expectations. In this section, we seek to understand the role that information plays in the association between

individual or market experience and expectations in terms of the informativeness and recency of experience and the manner in which households utilize the information that they have.

A. Informativeness and Recency of Experience

The reliance on experience may depend on how informative the experience is (Kuchler and Zafar (2019)). It is likely that households are disinclined to value market experience when forming expectations because they view it as insufficiently informative. To address this possibility, we examine the correlation between expectations and individual experience from the perspective of the informativeness of market experience.

We measure the informativeness of market experience first by price dispersion within the market. In practice, households acquire information on housing market dynamics from sales within a certain geographical area. Hence, the dispersion of observed sales prices could proxy the extent to which the information that households gain from market experience actually reflects market developments. In areas where sales prices are less dispersed, households are more certain about the market, and thus the market experience is more informative. If households choose between various sources of information based only on their informativeness, we expect households in municipalities with a lower price dispersion to rely less on individual experience when forming expectations than households in municipalities with a higher price dispersion.

We measure the regional price dispersion by the standard deviation of the pricing errors. To calculate this, we use a hedonic pricing model to predict the prices of houses and calculate the residuals of each transaction. Next, we calculate the standard deviation of the absolute value of the residuals for each municipality-year. We define a municipality-year as being highly dispersed if its standard deviation is above the median of all municipality-year observations. We interact individual experience with high dispersion and present the results in Table 5 (column 2). We find that households in markets with a higher price dispersion tend to rely on their individual experience to form expectations, whereas households in markets with a lower price dispersion do not. These findings indicate that individual experience plays a more crucial role in forming expectations when the market experience is less informative.

We further investigate the informativeness of market experience from the perspective of local–national house price co-movement. Kuchler and Zafar (2019) document that, in areas where the local house price changes are more positively correlated with the national average house price changes, market experience tends to be more informative than in the converse situation, and households are more likely to infer national housing market developments based on market experience. We seek to extend this argument by investigating the role of individual experience in areas where market experience is highly informative compared with areas where it is not.

Specifically, we label municipalities with high or low co-movement with the national market based on whether the correlation between the municipal house price changes and the national house price development from 2009 to 2017 is above or

TABLE 5

Expectations About House Prices and Experience: By Informativeness and Recency

Table 5 shows the regression estimates of expectations on experience based on the informativeness and recency of experience. The sample period is 2010–2018. The dependent variable is expectations about average annual house price changes in the next 2 years. Individual experience is measured by the annualized percentage change in the house value in year $t-1$ since the household moved in. Market experience is measured by the annual percentage change in the municipal house price index in year $t-1$. *High dispersion* is an indicator of whether, for a municipality-year, the standard deviation of the absolute values of the residuals from a hedonic pricing model is above the median of all the observations. *High local-national co-movement* is an indicator of whether the correlation between municipal house price development and national house price development from 2009 to 2017 is greater than the median of all the municipalities. *Recent individual experience* is the annual average change in house value from year $t-3$ to year $t-1$. *Distant individual experience* is the annual average change in house value from the moving-in year to year $t-3$. The control variables included consist of age, age squared, an indicator of the respondent's gender, an indicator of whether they possess a college degree, the logarithm of the annual gross income, and indicators of being self-employed, being retired, and the homeownership of the household. Standard errors (in parentheses) are clustered at the household level and robust to heteroskedasticity. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Expectation		
	1	2	3
Individual experience × low dispersion	0.049		
	(0.034)		
Individual experience × high dispersion	0.015***		
	(0.006)		
High dispersion	−0.308**		
	(0.156)		
Individual experience × low local-national co-movement		0.024***	
		(0.009)	
Individual experience × high local-national co-movement		−0.020	
		(0.027)	
High local-national co-movement		−0.194	
		(0.161)	
Recent individual experience			0.037*
			(0.021)
Distant individual experience			−0.025
			(0.028)
Market experience	0.053***	0.065***	0.055***
	(0.017)	(0.081)	(0.018)
Controls	Yes	Yes	Yes
Year-month FE	Yes	Yes	Yes
Year × move-in year FE	Yes	Yes	Yes
Observations	3,686	3,686	3,492
R^2	0.284	0.283	0.284

below the median correlation. The results are displayed in column 2 of Table 5. We find that, in municipalities with lower local–national co-movement, households are more inclined to infer future nominal house prices based on their individual experience. Taken together, these findings about the informativeness of market experience help to explain the substitution role of individual experience: when market experience is not informative, households tend to rely on individual experience to form expectations.

The informativeness of experience is related to another dimension of experience, namely recency. Studies find that households give more weight to recent market experience than to more distant experiences when forming expectations (Kuchler and Zafar (2019), Malmendier and Nagel (2016)). In terms of information, the more recent the experience, the more informative it is.

To see whether this holds for individual experience, we investigate how the correlation between expectations and individual experience varies based on the recency of that experience. In particular, we define recent individual experience as the annual average changes in the house value from 3 years before the current year

to 1 year before the current year, and we define distant individual experience as the annual average change in the house value from the moving-in year to 3 years before the current year. In this setting, we restrict the sample to households who moved to the current house at least 3 years ago to allow all households to possess both recent and distant individual experiences. We estimate the response of expectations to recent and distant individual experience and to market experience for these households. The results are shown in column 3 of Table 5. The coefficients of market experience and recent individual experience remain positive and significant, whereas the coefficient of distant individual experience is not significant. These results suggest that households tend to use information from market experience and recent individual experience to shape their expectations.

B. Household Sophistication

Household sophistication relates to the way in which a household utilizes the information available to it. Usually, sophisticated households are assumed to be less prone to cognitive biases than less sophisticated households (Gerardi, Goette, and Meier (2013)). As such, one would expect more sophisticated households to rely more on market experience than on their individual experience when forming expectations. To test this, we refer to financial literacy measures to classify households as sophisticated or unsophisticated. We use a module designed by Van Rooij, Lusardi, and Alessie (2011) and incorporated in the DHS, which is widely used to examine the role of household financial literacy in financial decision-making (Von Gaudecker (2015), Kramer (2016)). Three different measures of household sophistication are applied: the respondent's self-reported financial literacy; the extent to which the respondent's educational background is related to economics; and the household's financial literacy score, which is based on their responses to a series of questions related to numeracy, compound interest, inflation, the time value of money, and money illusion.[10]

The estimation results are displayed in Table 6. In column 1, we measure financial literacy based on self-reported literacy and classify households using the variable *high literacy*.[11] In column 2, we measure financial literacy using the extent to which the respondent's educational background is related to economics.[12] In column 3, we use the financial literacy scores of the respondents. The results show that in column 3, where financial literacy is measured most objectively, the coefficient of individual experience is positive and significant for unsophisticated households, and the coefficient of market experience is positive and significant for sophisticated households. These results imply that compared with sophisticated households, unsophisticated households are more likely to be dependent on their

[10]We use the financial literacy module of the DHS, wave 2005. Because we are only interested in classifying households as sophisticated or unsophisticated, we apply the basic financial literacy index, which is obtained using a similar method to that used by Van Rooij et al. (2011).

[11]In the survey, the respondent reports their financial literacy using a scale from 1 (low) to 7 (high). We define respondents who choose 6 or 7 as being highly literate.

[12]In the survey, the respondents report to what extent their educational background is related to economics using a scale from 1 to 4, where 4 means the least related. We define respondents who choose 1 or 2 as being highly literate.

TABLE 6

Expectations About House Prices and Experience: By Household Sophistication

Table 6 shows the regression estimates of expectations on experience. The sample period is 2010–2018. The dependent variable is the expectations about average annual house price growth in the next 2 years. Individual experience is measured by the annualized percentage change in the house value in year $t-1$ since the household moved in. Market experience is measured by the annual percentage change in the municipal house price index in year $t-1$. *High literacy* is an indicator of whether a household is highly financially literate under three different definitions: self-reported financial literacy in column 1, the extent to which educational background is related to economics in column 2, and the financial literacy score in column 3. The control variables included consist of age, age squared, an indicator of the respondent's gender, an indicator of whether they possess a college degree, the logarithm of the annual gross income, and indicators of being self-employed, being retired, and the homeownership of the household. Standard errors (in parentheses) are clustered at the household level and robust to heteroskedasticity. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1.

	Expectation		
	Self-Reported Financial Literacy	Economic Education Background	Financial Literacy Score
	1	2	3
Individual experience × low literacy	0.015	0.016***	0.020***
	(0.027)	(0.006)	(0.004)
Individual experience × high literacy	0.017***	0.031	−0.004
	(0.005)	(0.054)	(0.026)
Market experience × low literacy	0.064**	0.064**	0.026
	(0.029)	(0.026)	(0.030)
Market experience × high literacy	0.052*	0.066	0.088***
	(0.030)	(0.044)	(0.030)
High literacy	−0.101	−0.093	0.168
	(0.219)	(0.258)	(0.221)
Household controls	Yes	Yes	Yes
Year × move-in year FE	Yes	Yes	Yes
Observations	1,672	1,687	1,714
R^2	0.332	0.327	0.321

individual experience rather than market experience when forming their expectations. In column 2, the results show that unsophisticated households tend to rely on individual experience to form expectations, whereas sophisticated households do not. Interestingly, in column 1, where financial literacy is self-reported, we find that households who believe themselves to be financially literate tend to rely on individual experience to form expectations.

These findings indicate that household sophistication tends to explain the way in which households utilize information obtained from their individual experience and market experience: in particular, information accessibility might be a heuristic that households use when forming their expectations about the future.

VI. Expectation Errors

In previous sections, we have examined the effect of individual experience on expectation formation and explored the underlying channels from the perspective of the role of information. Following these analyses, a natural question may be: what are the implications of these findings? In this section, we seek to answer this question from two perspectives. First, we explore the consequences of using individual experience to form expectations by evaluating the accuracy of expectations. Second, we examine whether the accuracy of expectations consequently affects a household's decision-making.

A. Expectation Errors and Experiences

We first explore how to define the accuracy or correctness of household expectations. Cocco et al. (2022) examine the expectation errors regarding households' own financial situations. Because expectation and realization are both measured by categorical variables in their setting, they define expectation errors by whether expectations are optimistic, the same as, or pessimistic compared with the realizations. We follow the definition of Cocco et al. (2022) but operationalize expectation errors as a continuous variable. Precisely, we define the expectation error as the difference between the expectation and the realization, where the realization is measured by the average yearly percentage point change in house prices in the Netherlands within the 24 months after the survey is taken. The distribution of expectation errors over the years in our sample is shown in Figure 3. We observe that during the housing market downturn from 2010 to 2013, in general, the expectation errors were declining; furthermore, when the market bottomed out in 2014 and 2015, the dispersion of expectation errors decreased. These temporal patterns are consistent with the findings in Souleles (2004).

We regress the households' expectation errors on experiences to examine whether heterogeneity in expectation errors may be explained by variations in individual experience and market experience. The results are shown in Table 7. In column 1, we find that the expectation error is positively related to both individual and market experiences. In column 2, we change the dependent variable to an indicator of whether the expectation error is greater than 1 percentage point, which defines households as being optimistic regarding future nominal house

FIGURE 3

Expectation Errors About the Average Annual House Price Change

Figure 3 presents a box-and-whisker plot for expectation errors by year. The expectation error is the difference between the expectation and the realization, where the realization is defined as the average yearly percentage point change in the house price index in the Netherlands within the 24 months after the survey is taken. The number of household-year observations is 3,683, relating to 1321 households. The top and bottom sides of the boxes are the 25th and 75th percentiles, respectively. The band in each box is the median. The upper and lower bounds of the whiskers are the 1st and 99th percentiles, respectively.

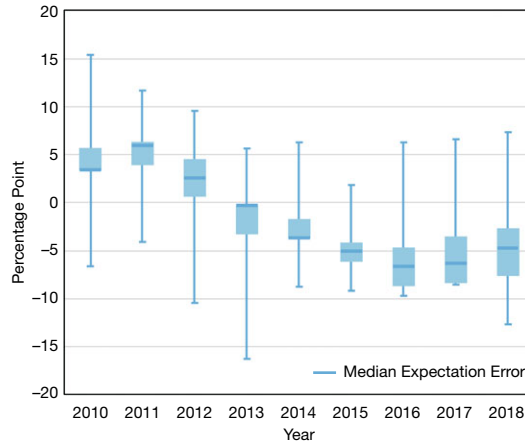


TABLE 7

Expectation Errors and Experience

Table 7 shows the regression estimates of expectation errors on experience. The sample period is 2010–2018. The dependent variable in column 1 is the expectation error, which is defined as the difference between the expectation about the annual house price change in 2 years and the actual annual house price change in 2 years. The dependent variable in column 2 is an indicator of whether the expectation error is greater than 1 percentage point. Individual experience is measured by the annualized percentage change in the house value in year $t-1$ since the household moved in. Market experience is measured by the annual percentage change in the municipal house price index in year $t-1$. The control variables included consist of age, age squared, an indicator of the respondent's gender, an indicator of whether they possess a college degree, the logarithm of the annual gross income, and indicators of being self-employed, being retired, and the homeownership of the household. Standard errors (in parentheses) are clustered at the household level and robust to heteroskedasticity. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1.

	Expectation Error	Optimistic
	Pooled OLS	Logit
	1	2
Individual experience	0.022***	0.016**
	(0.008)	(0.007)
Market experience	0.063***	0.032*
	(0.018)	(0.017)
Controls	Yes	Yes
Year × move-in year FE	Yes	Yes
Observations	3,686	3,105
R^2	0.582	
Pseudo R^2		0.513

price development. The results presented in column 2 indicate that households with more positive experiences are more likely to be optimistic in their expectation formation. These findings suggest that relying on individual experience may affect the performance of households in forming expectations about future house price changes.

Next, we explore how the relationship between the expectation error and experience may be explained from the perspective of information. In Section V, we find that less sophisticated households tend to rely more on individual experience than more sophisticated households when forming expectations. Now, we examine whether this discrepancy exists for expectation errors. In particular, we interact the financial literacy of households with individual experience and display the results in Table 8. In column 1, financial literacy is measured using self-reported literacy; in column 2, it is defined by whether the respondent has an economics-related educational background; and in column 3, it is defined by the financial literacy scores of the respondents. We find that when using the objective measures of financial literacy (in columns 2 and 3), the relationship between expectation errors and individual experience is positive and statistically significant among the financially illiterate households. These findings suggest that using individual experience to form expectations may be a heuristic that is more prevalent among financially illiterate households than other households.

B. Expectation Errors and Household Behavior

Based on our findings of the positive correlation between experience and expectation errors, another relevant question involves whether expectation errors impact the behavior of households. We focus on household behavior that is related

TABLE 8

Expectation Errors and Experience: By Household Sophistication

Table 8 shows the regression estimates of expectation errors on experience by household sophistication. The sample period is 2010–2018. The dependent variable is the expectation error, which is defined as the difference between the expectation about the annual house price change in 2 years and the actual annual house price change in 2 years. Individual experience is measured by the annualized percentage change in the house value in year $t-1$ since the household moved in. Market experience is measured by the annual percentage change in the municipal house price index in year $t-1$. *High literacy* is an indicator of whether the household has high financial literacy based on three different definitions: the self-reported financial literacy in column 1, the extent to which their educational background is related to economics in column 2, and the financial literacy score in column 3. The control variables included consist of age, age squared, an indicator of the respondent's gender, an indicator of whether they possess a college degree, the logarithm of the annual gross income, and indicators of being self-employed, being retired, and the homeownership of the household. Standard errors (in parentheses) are clustered at the household level and robust to heteroskedasticity. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1.

	Expectation Error		
	Self-Reported Financial Literacy	Economic Education Background	Financial Literacy Score
	1	2	3
Individual experience × low literacy	0.023	0.018***	0.022***
	(0.028)	(0.006)	(0.004)
Individual experience × high literacy	0.017***	0.017	−0.007
	(0.006)	(0.062)	(0.029)
Market experience	0.052*	0.055**	0.057**
	(0.027)	(0.027)	(0.027)
Controls	Yes	Yes	Yes
Year × move-in year FE	Yes	Yes	Yes
Observations	1,675	1,690	1,717
R^2	0.657	0.649	0.648

to home selling and buying. Because home selling and buying decisions are largely dependent on market cycles, we include year-fixed effects in the model, along with household fixed effects to exclude the effects of time-invariant factors. We first examine the relationship between expectation errors and the home-selling behavior of homeowners within the 2 years after the survey is taken by applying a linear probability model to the data. The results are shown in Table 9 (column 1). We find that, compared with other homeowners, optimistic homeowners are less likely to sell their house within the 2 years following the survey. Next, we assess the list prices set by homeowners conditional on home selling. In Table 9 (column 2), the dependent variable is an indicator of whether the list price is set higher than the predicted market price, where the latter is obtained using a hedonic pricing model. We apply a logit model, and the results show that compared with sellers who are not optimistic about future house price growth, optimistic sellers are more likely to list their houses with a list price premium.

In addition, we explore how expectation errors affect the home-buying behavior of renters. In Table 9 (column 3), we focus on renters and examine the probability of renters becoming homeowners within the 2 years after the survey is taken. The results of our linear probability model show that an optimistic renter is more likely to become a homeowner than a non-optimistic renter. This is consistent with the literature on house purchase behavior (see, for example, Agarwal et al. (2016), Bailey et al. (2018), and Armona et al. (2019)). Our findings are similar to those of Cocco et al. (2022) in that the expectation error can partly explain the heterogeneity in household behavior.

TABLE 9

Household Behavior and Expectation Errors

Table 9 shows the regression estimates of household behavior on expectation errors. The sample period is 2010–2018. In column 1, the dependent variable is an indicator of whether a household sells their house within 2 years after the survey. In column 2, the dependent variable is an indicator of whether the list price is higher than the predicted sales price, conditional on house sales. In column 3, the dependent variable is an indicator of whether the household buys a house within the 2 years after the survey. *Optimistic* is an indicator of whether the expectation error is greater than 1 percentage point. The control variables included consist of age, age squared, an indicator of the respondent's gender, an indicator of whether they possess a college degree, the logarithm of the annual gross income, and indicators of being self-employed and being retired. Standard errors (in parentheses) are clustered at the household level and robust to heteroskedasticity. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1.

	House Sale Within 2 Years	List Price Premium Conditional on House Sale	Become Homeowners Within 2 Years
	OLS	Logit	OLS
	1	2	3
Optimistic	−0.028*	1.864**	0.036*
	(0.015)	(0.849)	(0.019)
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Household FE	Yes		Yes
Observations	3,173	190	838
R^2	0.541		0.797
Pseudo R^2		0.147	

VII. Conclusion

The role of market experience in determining expectations attracts much attention from researchers. We add to the literature by including idiosyncratic variations in experience to explain variations in households' expectations in the housing market, which is characterized by its illiquid and lumpy nature. The illiquid nature of housing implies that to understand the expectation-formation process, one has to resort to housing experience gained in the past. The issue of the limited time frame of data becomes vital. We are able to utilize a long run-in period to establish the initial conditions. The lumpy nature of house transactions distinguishes our study from studies that investigate consumption goods markets, and we offer insights into other household decisions that relate to lumpy investments.

Using nationally representative survey data combined with administrative registry data from the Netherlands, we find that households with more positive individual housing experience, measured by the annualized change in their house value since they moved in, have higher expectations about future housing market growth than other households. We demonstrate that this association between individual experience and expectations holds when unobservable heterogeneity is addressed at the regional–temporal and household levels and is robust to alternative definitions of expectations. We link our findings to the nature of information by disclosing that heterogeneity in expectations can be further explained by the informativeness and recency of experience and the financial literacy of households. Moreover, we examine the expectation error and how it is related to individual experience. Our findings reveal a positive association between expectation errors and individual experience that is more pronounced among financially illiterate households than literate households. Finally, we explore whether expectation errors are associated with household behavior in

terms of home selling and buying. First, we show that optimistic homeowners are less likely to sell their homes than other homeowners and that, conditional on selling, they list their homes with a list price premium. Second, we find that optimistic renters are more likely to enter into homeownership than less optimistic renters. These findings provide evidence of the consequences of using individual experience to form expectations.

Our findings could be attributed to information availability bias (Tversky and Kahneman (1974), Barberis and Thaler (2003)). Compared with market experience, individual experience is more easily memorized and provides information that is more accessible. This cognitive ease potentially makes the individual experience more retrievable and therefore dominant over market experience when expectations are surveyed. Our findings are consistent with the presence of an information availability bias in expectation formation, in that households rely more on recent individual experience than on individual experience acquired in the distant past. In addition, we differentiate markets on the basis of pricing dispersion, as well as their co-movement with the national housing market, in the belief that the informativeness of market experience may help explain the substitution role of individual experience in expectation formation. These findings are consistent with the availability bias paradigm.

Our findings could also be explained by a representativeness bias, or the law of small numbers (Tversky and Kahneman (1974), Kahneman (2011)). Studies document that individuals tend to overreact to limited news or private signals when making macroeconomic predictions (Bailey et al. (2018), Bordalo, Gennaioli, and Shleifer (2018), and Bordalo, Gennaioli, Porta, and Shleifer (2019)). Our findings show that households indeed rely more on private information retrieved from a small sample, that is, their own housing history, than on broader market information when inferring future market developments.

Appendix A. Variable Definitions

expectation: Expectations about the average annual house price change rate over the next 2 years.

individual experience: Annualized percentage change in the house value since moving in, measured in year $t-1$.

market experience: Annual percentage change in municipal house price, measured in year $t-1$.

age: Age of the respondent of the household.

annual gross income: Annual gross household income in euros, deflated using 2006 euros.

self-employed: An indicator that equals 1 if the household's main source of income is from self-employment, and 0 otherwise.

retired: An indicator that equals 1 if the household's main source of income is the pension, and 0 otherwise.

female: An indicator that equals 1 if the respondent is female, and 0 otherwise.

college: An indicator that equals 1 if the respondent of the household has a college degree, and 0 otherwise. Based on the educational system in the Netherlands, we define degrees from vocational colleges and universities as college degrees.

homeowner: An indicator that equals 1 if the household owns a house, and 0 otherwise.

10-year expectation: Expectations about the average annual house price change in the next 10 years.

expected direction of house price change: A categorical variable for expectations of house prices in the next 2 years that equals 1 if the respondent expects an increase, −1 if they expect a decrease, and 0 if they expect the house price to be constant.

recent individual experience: Annual average change in the house value from 3 years before the current year to 1 year before the current year.

distant individual experience: Annual average change in the house value from the moving-in year to 3 years before the current year.

high dispersion: An indicator of whether the standard deviation of the absolute values of the residuals from a hedonic pricing model is above the median of all the observations for a municipality year.

high local-national co-movement: An indicator of whether the correlation between the municipal house price development and the national house price development from 2009 to 2017 is greater than the median of all the municipalities.

high literacy: An indicator of whether the household is highly financially literate according to one of the three different definitions: self-reported financial literacy, the extent to which their educational background is related to economics, and their financial literacy score.

expectation error: The difference between expectations about the annual house price change in two years and the actual annual house price change in two years.

optimistic: An indicator of whether the expectation error is greater than 1 percentage point.

Appendix B. Municipal House Price Index

We apply the standard log-linear OLS hedonic pricing model to house transaction data from NVM to construct the house price index in each municipality of the Netherlands between 2004 and 2017. The model is shown in equation (A1):

$$\log(P) = X\beta + \sum_t \gamma_t T_t + \sum_k \alpha_k M_k + \sum_{t,k} \lambda_{t,k} T_t \times M_k + \varepsilon, \tag{A1}$$

where P denotes the sales price and X is a matrix of variables for house characteristics with the associated coefficient vector β. T_t is a vector of dummy variables indicating the year of housing sales. M_k is a vector of dummy variables denoting the municipality where the sold house is located. $T_t \times M_k$ is the interaction terms of the elements in T_t and M_k, denoting the interaction of time and municipality fixed effects. γ_t, α_k and $\gamma_{t,k}$ are coefficients corresponding to T_t, M_k, and $T_t \times M_k$, respectively. ϵ is a vector of error terms. We apply the model to house transaction data from the NVM for the period from

TABLE A1

Estimation Results of the Hedonic Pricing Model

Table A1 shows the estimated results of the hedonic pricing model defined in equation (A1). The dependent variable is the logarithm of the sales price. The sample consists of house transactions between 2004 and 2017 in the Netherlands. Year, municipality, and year-municipality fixed effects are included. Standard errors (in parentheses) are clustered at the municipality level and robust to heteroskedasticity. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1.

	Log Sales Price	
	Coefficient	S. E.
Built year (after 1990 is the base)		
Between 1500 and 1930 (1 = yes)	−0.008	(0.024)
Between 1931 and 1970 (1 = yes)	−0.161***	(0.007)
Between 1971 and 1990 (1 = yes)	−0.146***	(0.007)
House type (detached house is the base)		
Terraced house (1 = yes)	−0.491***	(0.009)
Back-to-back house (1 = yes)	−0.297***	(0.008)
Corner house (1 = yes)	−0.443***	(0.007)
Semi-detached house (1 = yes)	−0.298***	(0.005)
Split-level flat (ground floor, 1 = yes)	−0.462***	(0.046)
Split-level flat (upper floor, 1 = yes)	−0.556***	(0.042)
Maisonette flat (1 = yes)	−0.636***	(0.028)
Porch flat (1 = yes)	−0.604***	(0.030)
Gallery flat (1 = yes)	−0.688***	(0.028)
Older adult flat (1 = yes)	−0.670***	(0.053)
Split-level flat (ground and upper floor, 1 = yes)	−0.352***	(0.051)
Facilities		
Stories	0.059***	(0.009)
Lift (1 = yes)	0.093***	(0.014)
Rooms	0.077***	(0.005)
Stairs	−0.017***	(0.003)
With an attic (1 = yes)	−0.027***	(0.004)
Balconies	0.038***	(0.007)
Toilets	0.079***	(0.006)
Bathrooms	0.022***	(0.004)
Parking possibility (1 = yes)	0.150***	(0.004)
With a garden (1 = yes)	−0.025***	(0.007)
Interior maintenance	0.048***	(0.002)
Exterior maintenance	0.019***	(0.001)
Two or more types of insulation (1 = yes)	0.040***	(0.003)
Constant	11.676***	(0.067)
Year fixed effects	Yes	
Municipality fixed effects	Yes	
Year-municipality fixed effects	Yes	
Observations	1,373,219	
N of years	14	
N of municipalities	361	
R^2	0.682	

2004 to 2017. After deleting 1% outlier observations in terms of the sales price, list price, time on the market, and the sales price as a proportion of the list price, we obtain a total of 1,373,219 observations. The estimation results of the log-linear hedonic pricing model are shown in Table A1. For each municipality and year, we calculate the house price index by predicting the fixed effects components based on the estimation results, setting the house price index in Amsterdam in 2004 as 100.

Appendix C. Data Management

The raw data from the DNB Household Survey (DHS) waves form an unbalanced panel with a sample of 4,729 households, comprising 43,204 household-year observations over the period from 2010 to 2018. Each of these households is assigned a unique identification code, and 78% of them agree to disclose their identification codes. We combine the DHS data with the administrative data from the CBS using the disclosed

TABLE A2

Sample Selection Procedure

Selection	No. of Households	No. of Observations
Original	4,729	43,204
Not able to be linked to the CBS data	−1038	−17,305
Missing value of expectations	−1051	−16,702
Moving to the current house prior to 1999, or missing information on house value	−1286	−5312
1% outliers in the distribution of expectations	−43	−199
Selected sample	1,321	3,683

identification codes. As questions on expectations about house prices are only answered by one respondent in each household, our unit of analysis is the household. Furthermore, missing values of expectations are eliminated from the sample. We also exclude the observations with expectations in the upper or lower 1% of the distribution. In addition, we eliminate observations with missing values for individual experience, market experience, or control variables, and ultimately obtain a sample of 1,321 households with 3,683 household-year observations. The sample selection procedure is shown in Table A2.

Appendix D. Alternative Sample

We change the sample period to Dec. 2012 to Apr. 2017 to make it identical to the sample period of Kuchler and Zafar (2019). The estimation results based on equations (1) and (2) are shown in Table A3.

TABLE A3

Expectations About House Prices and Experience: Dec. 2012 to Apr. 2017

Table A3 shows the regression estimates of expectations on the experience based on a sample from Dec. 2012 to Apr. 2017. Columns 1 and 2 present the estimates of equation (1) without and with control variables, respectively, and column 3 presents the estimates of equation (2). The number of household-year observations is 1,775. The dependent variable is expectations about the average annual house price change in the next 2 years. Individual experience is measured as the annualized percentage change in year $t-1$ in the house value since moving in. Market experience is measured as the annual percentage change in the municipal house price index in year $t-1$. The control variables are age, age squared, a gender indicator, an indicator of whether the respondent has a college degree, the logarithm of the annual gross income, and indicators of being self-employed, being retired, and the homeownership of the household. Standard errors (in parentheses) are clustered at the household level and robust to heteroskedasticity. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1.

	Expectation		
	1	2	3
Individual experience			0.019***
			(0.008)
Market experience	0.096***	0.092***	0.089***
	(0.029)	(0.029)	(0.028)
Controls		Yes	Yes
Year-month FE	Yes	Yes	Yes
Year × move-in year FE			Yes
Observations	1,775	1,775	1,770
R^2	0.177	0.212	0.238

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