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What Have They Been Thinking? Homebuyer Behavior in Hot and Cold Markets

ABSTRACT Questionnaire surveys undertaken in 1988 and annually from 2003 through 2012 of recent homebuyers in each of four U.S. metropolitan areas shed light on their expectations and reasons for buying during the recent housing boom and subsequent collapse. They also provide insight into the reasons for the housing crisis that initiated the current financial malaise. We find that homebuyers were generally well informed, and that their short-run expectations if anything underreacted to the year-to-year change in actual home prices. More of the root causes of the housing bubble can be seen in their long-term (10-year) home price expectations, which reached abnormally high levels relative to mortgage rates at the peak of the boom and have declined sharply since. The downward turning point, around 2005, of the long boom that preceded the crisis was associated with changing public understanding of speculative bubbles.

Between the end of World War II and the early 2000s, the U.S. housing market contributed much to the strength of the macroeconomy. It was a major source of jobs, produced consistently rising home equity, and served as perhaps the most significant channel from monetary policy to the real economy. But starting with a drop in the S&P/Case-Shiller Home Price Index for Boston in September 2005, home prices began to fall in city after city. By the time the slump was over, prices were down almost 32 percent on a national basis, with many cities down by more than 50 percent,

wiping nearly $7 trillion in equity off household balance sheets. The production of new homes and apartments, as measured by housing starts, peaked in January 2006 at 2.27 million on an annual basis. Starts then fell 79 percent, to fewer than 500,000, in just 2 years. From October 2008 until September 2012—a stretch of 48 months—starts remained below a seasonally adjusted annualized rate of 800,000 units, a 50-year-low.

As prices fell, the mortgage industry collapsed and the entire financial system was shaken to its core. Even mortgages and mortgage-backed securities that had been well underwritten went into default. Very high rates of default and foreclosure sent Fannie Mae and Freddie Mac, the two main government-sponsored enterprises in the housing finance industry, into receivership and led to the failure of the investment banks Lehman Brothers and Bear Stearns in 2008. The economy went into a severe recession in the fourth quarter of 2007. A similar pattern infected housing markets around the world, including parts of the euro zone and China.

What do we know and what do we need to know about the forces that led to this huge failure of such a large market? The literature on the housing boom and bust of the 2000s is extensive and has identified several potential culprits: a growing complacency of lenders in the face of declining loan quality (Mian and Sufi 2009, Demyanyk and van Hemert 2011); money illusion on the part of homebuyers that led to flawed comparisons of home purchase prices with rents (Brunnermeier and Julliard 2008, along lines exposited by Modigliani and Cohn 1979 for the stock market); an agency problem afflicting the credit rating agencies (Mathis, McAndrews, and Rochet 2009); and government failure to regulate an emerging shadow banking system (Gorton 2010). Most if not all of these certainly contributed, even if their relative importance remains unknown. But one thing that is known is that what happens in the housing market depends on the behavior and attitudes of millions of individual participants, and foremost among them are homebuyers.

We believe that one aspect of this episode has not received the attention that it deserves: the role of homebuyers' expectations. What were people thinking when they bought a home? At the time of purchase, a buyer of a capital asset is buying a flow of services and benefits that will all come in the future, and the future is always uncertain. Buying a home means making a series of very difficult decisions that will in all likelihood affect the buyers' lives forever. Anyone who has ever signed an offer sheet, read a building inspector's report, or written a down payment check, and wondered what would happen if she lost her job or fell seriously ill, knows that these decisions are emotional, personal, and difficult. The title of this paper focuses on this process of thinking about the future that homebuyers go

through—calculating subjective costs, weighing risks and one's own tolerance for risk, formulating and trading off among preferences—all difficult topics for economists. Understanding the housing market is really about understanding what goes on in the minds of buyers, and we chose to go directly to the source.

This paper reports and analyzes results of a series of surveys that we have conducted since 1988 of homebuyers in four metropolitan areas nationwide. We begin with a description of the survey, of the questionnaire itself, and of the sample sizes. The bulk of the paper then asks and attempts to answer, using the survey data, a number of questions that, we think, will add to our understanding of how the housing market works:

—Do homebuyers know what the trends in housing prices are in their metro area at the time of the survey?

—What do homebuyers expect to happen to the value of their home in the next year and over 10 years?

—Are homebuyers' expectations rational, and how are they formed?

—What brought the early-2000s housing bubble to an end?

—What caused the rebound in the market in 2009–10, and why did it fizzle?

The choice of questions is constrained by the nature of the data, and the methodologies we use to answer them are simple and somewhat ad hoc, given that we lack a theoretical framework for our analysis. The roughly 5,000 respondents had one thing in common: they had purchased a home recently. Rather than look only at their actual behavior, we chose to ask about their perceptions, interpretations, and opinions. We singled out recent homebuyers in order to focus on the opinions of people who were actively involved in the process that determines home prices. We wanted to see how these opinions change through time. We cannot, however, assume that their responses describe the opinions of the great mass of people who were not actively participating in the housing market during this period.

I. Our Survey of Homebuyers

More than two decades ago, to gain a better understanding of the role of psychology and expectations in the housing market, we decided to survey a sample of homebuyers and ask them specifically about their reasons for buying. That survey, mailed in the late spring of 1988, consisted of a questionnaire of approximately 10 pages, which we sent to a random sample of 500 homebuyers in each of four locations within metropolitan areas around the country: Alameda County, California (Oakland and much of the East

Bay, in the San Francisco-Oakland-Fremont, CA Metropolitan Statistical Area); Milwaukee County, Wisconsin (the core of the Milwaukee-Waukesha-West Allis, WI Metropolitan Statistical Area); Middlesex County, Massachusetts (Cambridge and the areas north and west, in the Boston-Cambridge-Quincy, MA–NH Metropolitan Statistical Area), and Orange County, California (which includes Anaheim and Irvine in the southern part of the Los Angeles-Long Beach-Santa Ana, CA Metropolitan Statistical Area). These four were chosen to represent what were viewed at the time as two "hot" markets (Los Angeles and San Francisco), a "cold" (postboom) market (Boston), and a relatively stable market (Milwaukee).

The questionnaires were identical across the four survey locations. Participation was limited to people who had actually closed on a home that spring. In a typical year, only about 5 percent of the nationwide housing stock changes hands. Thus, our respondents do not necessarily represent the universe of homeowners, home seekers, or home sellers. Yet these are the people on whom we based our implicit valuation of the entire stock.

The response rate to that first survey was extraordinary: of 2,030 surveys mailed, 886, or 43.6 percent, were ultimately completed and tabulated. Case and Shiller (1988) presented the results of that survey and concluded, "While the evidence is circumstantial, and we can only offer conjectures, we see a market largely driven by expectations. People seem to form their expectations from past price movements rather than having any knowledge of fundamentals. This means that housing price booms will persist as home buyers become destabilizing speculators." In addition, we found significant evidence that housing prices were inflexible downward, at least in the absence of severe and prolonged economic decline.

In 2003 we decided to replicate the survey in the same four counties, to see whether changes in market conditions and other recent history had changed people's views. We have repeated the survey in the spring of each year since then. Except for the addition of some new questions at the end, the questionnaire has remained exactly the same in all surveys. We now have completed the process a total of 11 times, and this paper presents a first look at the aggregate results.

The response rate in the 2003 survey was 35.3 percent of 2,000 originally mailed (table 1 shows the response rates for the whole series). The high response rate was in part the result of sending the questionnaire with a letter hand signed by both Case and Shiller, sending a postcard follow-up to nonrespondents, and finally sending a second mailing. When response rates dropped off after 2005, we included a letter signed by a colleague in each state. The response rate remained low in 2007, at 15 percent overall.

Table 1. Response Rates in the Homebuyers Survey, 1988–2012

Year	*Surveys returned*	*Response rate (percent)*
1988	886	43.6
2003	705	35.3
2004	456	22.8
2005	441	22.1
2006	271	13.6
2007	300	15.0
2008	545	27.3
2009	370	18.5
2010	375	18.8
2011	319	16.0
2012	328	16.4
All years	4,996	22.7

Source: Authors' calculations from homebuyers survey data.

It rebounded somewhat in 2008, to 27.3 percent, and then fell back below 20 percent from 2009 through 2012.

II. Were Homebuyers Aware of Local Price Trends?

Table 2 compares the actual behavior of home prices in the four metro areas with what our respondents perceived to be happening in their area at the time. For each metro area across all 11 survey years, we calculated the correlation of the actual year-to-year change in the second-quarter average of the local S&P/Case-Shiller Home Price Index with the percentage of respondents in the corresponding survey area in that year's survey who said prices were "rising rapidly," and with the percentage who said "falling rapidly."[1] If buyers were well informed, one would expect to see a high positive correlation of the year-over-year price increase with the percentage saying "rising rapidly," and a high but negative correlation with the percentage who said "falling rapidly."

The simple correlation coefficients are indeed high in all four locations, and all have the right sign, indicating that respondents' perceptions were

1. From question 14 of the questionnaire. The full questionnaire is available on the *Brookings Papers* website at www.brookings.edu/about/projects/bpea/, under "Past Editions."

Table 2. Correlations between Actual and Perceived Home Price Trends, by Survey Location, 2003–12[a]
Correlation coefficients

	Actual price trend				
Perceived price trend	*Alameda County*	*Middlesex County*	*Milwaukee County*	*Orange County*	*All*
Rising rapidly	0.67	0.86	0.89	0.81	0.76
Falling rapidly	–0.88	–0.65	–0.80	–0.71	–0.76

Source: Authors' calculations from homebuyers survey data.

a. Results are simple correlations between the percentage of respondents in the indicated location who gave the indicated response and the actual annual percentage change in the S&P/Case-Shiller Home Price Index for that metropolitan area (measured from the second quarter in the year before the survey to the second quarter of the survey year; see figure 1 for the wording of the survey question). Data for each location are pooled across all 10 survey years.

largely on target. The correlations weaken, although slowly at first, when one compares current perceptions with price changes in the more distant past (results not reported).

Figure 1 provides more detail. It plots the nominal S&P/Case-Shiller Home Price Indexes for all four metro areas since 1987; the tables within each panel report for each corresponding survey location the full breakdown of responses to the question about price trends (question 14 in the questionnaire) in six of the annual surveys (whose dates are indicated in the figure by vertical bars). In all four locations the responses reflected a reasonable knowledge of what was happening at the time of the survey. There was not always consensus, but there was an extraordinary consistency in the results across time and between metro areas. These are believable stories.

Consider, for example, the results for Orange County. At the time of the 1988 survey, the *Wall Street Journal* was publishing articles about the "buyers' panic" in the California market.[2] (It was indeed one such article that led us to undertake the survey in the first place.) Consistent with that reporting, 91 percent of Orange County respondents in that first survey, when asked to describe the current home price trend in their area, said prices were "rising rapidly," and all the rest said "rising slowly." No respondent said "falling" or "falling rapidly." Similarly, in 2004, prices were again rising rapidly in Orange County—by the end of the year they had doubled from year-2000

2. See, for example, Asra Q. Nomani, "Buyers' Panic Sweeps California's Big Market in One-Family Homes," *Wall Street Journal,* June 1, 1988, p. 1.

levels—and respondents knew it: 100 percent said that home prices were rising rapidly. Homebuyers in Alameda County also correctly perceived the price trend in their metro area, that of San Francisco (top left panel of figure 1). In both California metro areas in both 1988 and 2004, fully 100 percent of respondents thought prices were rising, and the vast majority of those thought they were rising rapidly.

Our Boston-area homebuyers, in contrast, saw a great deal of uncertainty in 1988. As the top right panel of figure 1 shows, the local market was at or approaching a peak in that year. It appears that people could not clearly see a trend amid the short-run noise: 37 percent of our Middlesex County respondents said prices were "not changing," while most of the rest were split, with 34 percent saying prices were rising slowly and another 22 percent saying that they were falling slowly (top right panel of figure 1). Home prices in the Boston area were sticky and indeed essentially flat, but there was a great deal of debate at the time about the likelihood of a recession and an actual price decline. Home prices in Milwaukee, by contrast, rose more slowly and steadily in the late 1980s (bottom left panel of figure 1), and our respondents' perceptions reflect that. Like their Boston-area counterparts, few Milwaukee County respondents saw prices moving rapidly in either direction: 53 percent perceived prices to be rising slowly, and another 24 percent said prices were not changing.

What we observed in the late 1980s was a set of housing markets behaving very differently across regions. By the middle of the 1990s, however, home prices in the United States had begun to move up in many markets at the same time. By 2000 the beginnings of a national boom were becoming evident. Between 2000 and 2005 the S&P/Case-Shiller 10-City composite 10 index increased by more than 125 percent. Survey respondents in 2004 clearly saw the boom as it was occurring, In both California counties the vast majority said prices were rising rapidly, while in the Boston and Milwaukee areas most said prices were rising slowly.

The 2006 survey was sent out during a major turn in the marketplace. The boom ended sometime between late 2005 and early 2007, depending on the city, with home prices in Orange County up about 170 percent from their level in 2000. In San Francisco the increase from 2000 to the peak was 118 percent, and over the same period Boston was up 82 percent and Milwaukee 67 percent.

Finally the boom turned into a bust. The decline began in Boston, where prices peaked in September 2005. By the time the spring 2006 survey in the Boston area was tabulated, 70 percent of respondents were reporting that home prices were either not changing or falling. In San Francisco home

Figure 1. S&P/Case-Shiller Home Price Indexes for the Four Survey Locations, 1987–2012[a]

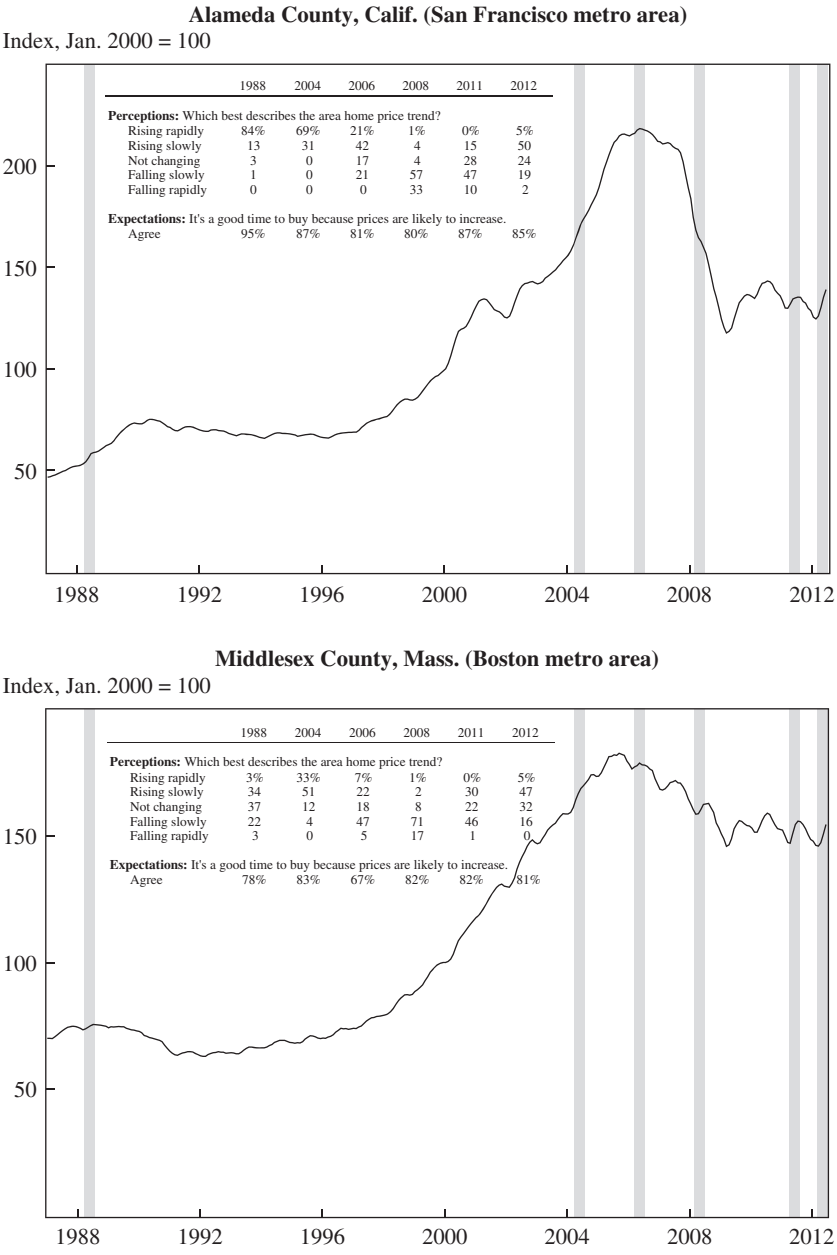
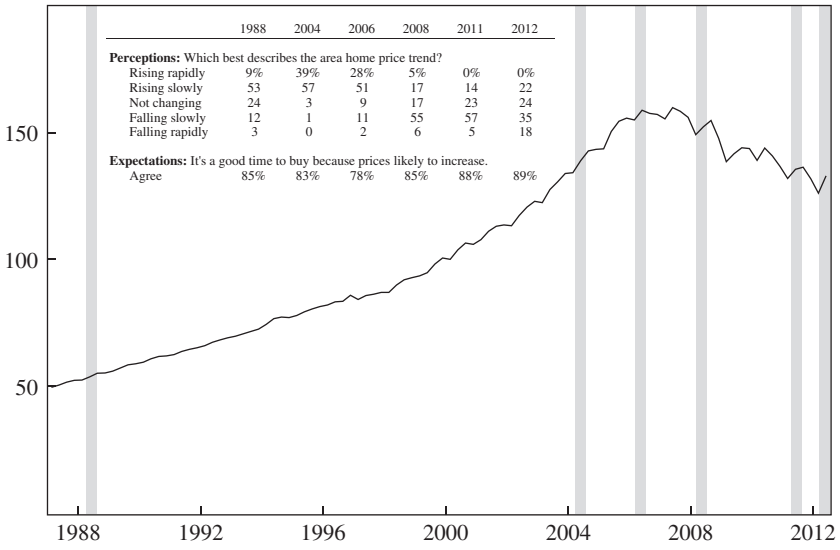


Figure 1. S&P/Case-Shiller Home Price Indexes for the Four Survey Locations, 1987–2012[a] (*Continued*)

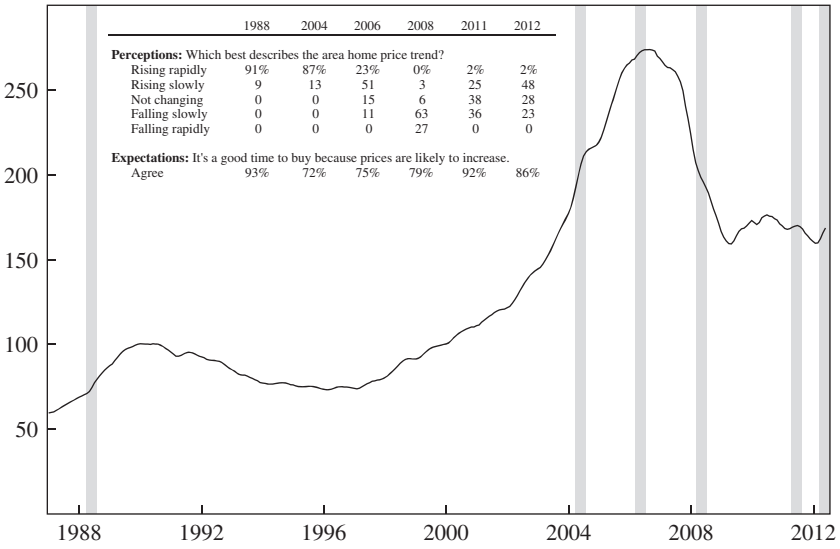
Milwaukee County, Wisc.

Index, Jan. 2000 = 100



Orange County, Calif. (Los Angeles metro area)

Index, Jan. 2000 = 100



Sources: S&P/Case-Shiller and Fiserv, Inc.

a. Vertical lines indicate quarters in which the homebuyers survey was conducted. The questions in each table are from survey questions 14 and 25; the full survey questionnaire is available on the *Brookings Papers* website at www.brookings.edu/about/projects/bpea/, under "Past Editions."

prices peaked in May 2006, and 38 percent of Alameda County respondents that year reported that they thought prices were either flat or falling. Prices in the Milwaukee area and Orange County continued to increase until September 2006. Once again homebuyers correctly perceived the trend: in Orange County only 26 percent thought prices were flat or falling, and in Milwaukee County the figure was 22 percent.

In 2008 Bear Stearns and Lehman Brothers failed, and it was learned that the economy had been in recession since the fourth quarter of 2007. Home prices had fallen in every one of the S&P/Case-Shiller cities by September 2008. By the time that year's survey was completed, 90 percent of respondents in both Orange County and Alameda County thought prices were falling, and 95 percent thought prices were either flat or falling. In the Boston area 88 percent reported that they thought prices were falling, and 96 percent thought they were flat or falling. Respondents in Milwaukee County were slightly more optimistic, with 78 percent seeing either flat or falling prices.

Prices continued to fall during 2008 and into 2009: the S&P/Case-Shiller indexes in all of the composite 20 cities fell through the rest of 2008 and beyond. By the end of 2009, however, all of the cities had recorded some price increase. By 2010 there was much debate in the press about whether the national housing market had made a bottom or was caught in a "dead cat bounce," a pure result of the $8,000 tax credit for first-time homebuyers in effect from the spring of 2009 to the summer of 2010 (additional homebuyer tax credits were made available in California). Despite the rally, homebuyers still perceived a down market. The results of the survey in 2011 showed that the respondents who thought home prices were falling in that year outnumbered those who thought they were rising—by 36 to 27 percent in Orange County, 57 to 15 percent in Alameda County, 47 to 30 percent in Middlesex County, and 62 to 14 percent in Milwaukee County.

Things improved in 2012. A majority of respondents in that year's survey in Alameda, Middlesex, and Orange Counties thought that prices were rising. However, our Milwaukee County respondents were not as optimistic: only 22 percent thought prices were rising. The respondents in the first three areas were correct: year over year and month over month as of July 2012, prices were up in all four cities.

Notice also the answers to the other question reported in figure 1. When asked whether they agreed with the statement, "It is a good time to buy a home because prices are likely to rise in the future," the vast majority of respondents said yes. In every single survey in every county, the share agreeing with the statement was never less than 67 percent, and in most it was over 80 percent. Buyers are optimists.

III. What Were Homebuyers' Price Expectations for the Short and the Long Term?

Many stories of the housing boom in the early 2000s describe it as a bubble driven by irrational expectations. People are alleged to have been excessively optimistic. Our data allow us to examine such notions, as we began to do in our 2003 Brookings Paper, but now can do even better with the expectations data that our survey provides over the full course of the boom, bubble, and collapse.

Two questions in our survey help us to assess the rationality of buyers' expectations. Question 6 asks respondents how much they think their home is likely to increase or decrease in value over the next 12 months. Question 7 asks what they think will happen to the value of their home *each year* over the next 10 years. Table 3 tabulates the answers for every year from 2003 through 2012. One way to think of these results is as the expected value of the average increase in home prices over the *next year* (the short-run expected annual gain; top panel) and the expected value of the average increase in price *each year for the next 10 years* (the long-run expected annual gain; bottom panel).

The data in table 3 are trimmed means, calculated after dropping the top 5 percent and the bottom 5 percent of observations. We did the trimming because a fair number of responses suggested that the respondent did not understand the question or was simply giving a frivolous answer. We considered a number of different methods of trimming and determined that the results do not change markedly over a wide range of percentages. (For a full discussion see the appendix.)

What can be said about the patterns observed here? First of all, to some economists the expectation of price increases in excess of 10 percent per year for 10 years, as occurs at least once in each of the four locations, will seem absurd. But when one computes the actual rates of appreciation in the S&P/Case-Shiller 10-City Price Index (a nationwide measure) from 1996 to 2006, just before the peak, it turns out to be a little above 10 percent per year on average for that 10-year period. Indeed, more than half of our city-specific indexes show 10 years of returns averaging in excess of 10 percent per year. This was taking place precisely as the expectations that we are describing in our survey were being formed.

Figure 2 presents these patterns graphically. The bars in each of the left-hand panels show, for each year from 2003 to 2012, the trimmed mean of our respondents' *1-year* expectation for home prices in one of our four survey locations. Also shown are the S&P/Case-Shiller Home Price Index for

Table 3. Short- and Long-Term Home Price Expectations, by Survey Location and Year, 2003–12
Mean response (percent)[a]

Survey year	Survey location: Alameda County	Middlesex County	Milwaukee County	Orange County
	"How much of a change do you expect there to be in the value of your home over the next 12 months?"[b]			
2003	7.6	4.4	5.5	9.4
2004	9.3	7.6	6.4	13.1
2005	9.6	6.3	6.6	8.7
2006	7.4	1.9	5.9	6.0
2007	4.9	2.9	6.1	–0.1
2008	–1.6	–0.7	2.4	–2.6
2009	2.4	2.0	1.5	0.7
2010	4.4	2.2	3.7	3.8
2011	2.3	2.3	1.7	0.3
2012	4.4	2.3	2.3	3.6
	"On average over the next ten years how much do you expect the value of your property to change each year?"[c]			
2003	12.3	8.9	7.1	11.5
2004	14.1	10.6	10.4	17.4
2005	11.5	8.3	11.9	15.2
2006	9.4	7.5	9.9	9.5
2007	10.7	5.3	8.1	12.2
2008	7.9	6.4	7.2	9.4
2009	8.5	6.2	8.2	6.9
2010	9.8	5.0	7.3	5.7
2011	7.6	4.1	4.7	7.1
2012	5.4	3.1	3.1	5.0

Source: Authors' surveys.

a. Means are 10 percent trimmed means; that is, we dropped the highest and lowest 5 percent of responses before calculating the mean.

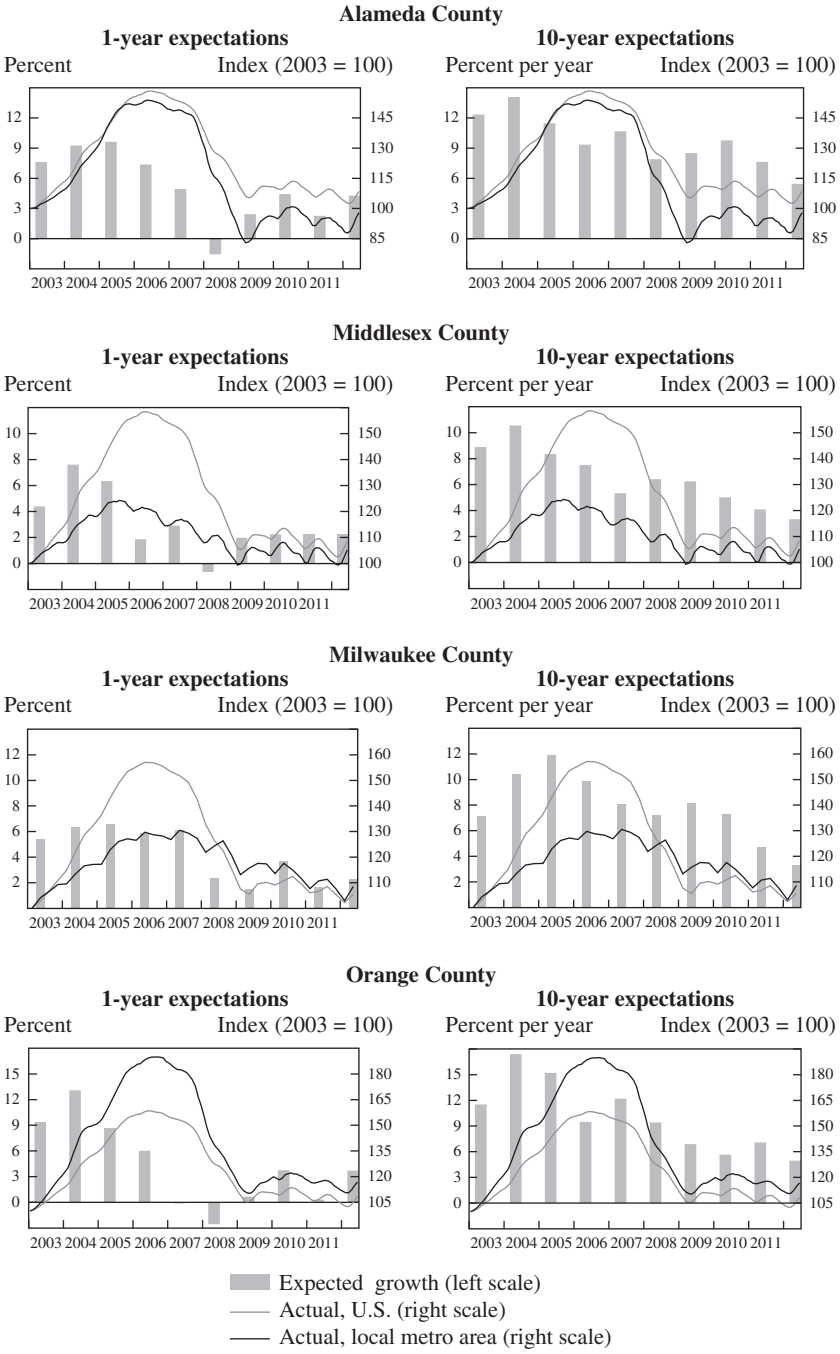
b. Survey question 6.

c. Survey question 7; in the 2012 survey only, the words "On average" and "each year" were underlined.

the corresponding metro area and the S&P/Case-Shiller 10-City index. The right-hand panels show the trimmed means of our respondents' annualized *10-year* expectations, again by location.

A large difference is observed between the 1-year and the 10-year expectations. The 1-year expectations are much more volatile and at times negative, whereas the 10-year expectations follow a simpler pattern, peaking around 2004 and then only gradually declining. The 10-year expectation

Figure 2. Expected Home Price Growth and Actual Home Prices in the Four Counties Surveyed, 2003–12



Sources: S&P/Case-Shiller, Fiserv, Inc., and authors' calculations from homebuyers survey data.

exceeds the corresponding 1-year expectation in every year in every location, indicating that buyers are more optimistic about price increases over the long haul than in the short term.

Both kinds of expectations are important. If 1-year expectations are high, home sellers will have an incentive to wait another year to sell, while buyers will have an incentive to buy now rather than next year. But when it comes to the decision of whether to buy at all, and comparing the expected rate of return on the investment with the mortgage rate, the longer-term expectations are likely to be more important.

Table 4 presents yet another way of looking at the expectations data. Here we look at expectations since 2003, both short- and long-term, and at actual rates of change in nominal home prices annually from 1996 through 2012 for Orange (top panel) and Middlesex (bottom panel) Counties. This is important because later on we will consider how expectations reacted to changes taking place in the market.

The first column in the top panel of table 4 shows that in 2003, buyers in Orange County on average expected the value of their property to increase by 9.4 percent in the following year—well below the 18.2 percent increase in the previous year. When prices then jumped 31.1 percent between 2003 and 2004, it must have been a surprise. Similarly, in 2004 buyers expected prices to increase 13.1 percent in the year following their purchase, but in fact prices rose 18.5 percent. A similar pattern can be observed in the Boston area (bottom panel), but the expected and actual rates of change are lower.

When asked to project how much their home's value would increase or decrease in each of the following 10 years, homebuyers in both locations were more optimistic. But even these expectations were not unreasonable given the performance of the market before 2006. Price increases in Orange County were actually accelerating after 2000, and long-term expectations remained solid as long as prices continued to rise. Even when prices started falling sharply in 2007 and 2008, buyers continued to expect healthy price appreciation over the next 10 years, and even their 1-year expectations resisted the idea that the severe drops that were already occurring would continue.

IV. Were Homebuyers' Expectations Rational and How Were They Formed?

We can test whether the expectations of our homebuyers were rational by regressing actual home price changes on the expected changes. Of course, with our present data set we can do this only for the 1-year expectations,

Table 4. Expected versus Actual Short- and Long-Term Home Price Expectations in Orange and Middlesex Counties

Survey location and year	Expected annual price increase (percent)		Actual 1-year price increase (percent)	Implied value of a home worth $100,000 in 1996
	Next year	Next 10 years		
		Orange County		
1996	n.a.[a]	n.a.		$100,000
1997	n.a.	n.a.	2.4	102,440
1998	n.a.	n.a.	12.8	115,594
1999	n.a.	n.a.	11.5	128,902
2000	n.a.	n.a.	10.2	142,074
2001	n.a.	n.a.	9.8	155,986
2002	n.a.	n.a.	11.8	174,318
2003	9.4	11.5	18.2	206,043
2004	13.1	17.4	31.1	270,205
2005	8.7	15.2	18.5	320,167
2006	6.0	9.5	14.9	367,883
2007	–0.1	12.2	–3.3	355,662
2008	–2.6	9.4	–24.3	269,082
2009	0.7	6.9	–19.6	216,212
2010	3.8	5.7	8.9	235,450
2011	0.3	7.1	–2.9	228,595
2012	3.6	5.0	–2.1	223,901
		Middlesex County		
1996	n.a.	n.a.		$100,000
1997	n.a.	n.a.	6.0	105,962
1998	n.a.	n.a.	8.8	115,298
1999	n.a.	n.a.	12.3	129,497
2000	n.a.	n.a.	14.1	147,810
2001	n.a.	n.a.	16.4	172,090
2002	n.a.	n.a.	10.8	190,655
2003	4.4	8.9	11.3	212,161
2004	7.6	10.6	9.6	232,443
2005	6.3	8.3	8.4	252,031
2006	1.9	7.5	–1.4	248,583
2007	2.9	5.3	–4.2	238,218
2008	–0.7	6.4	–6.0	224,001
2009	2.0	6.2	–6.9	208,446
2010	2.2	5.0	4.3	217,499
2011	2.3	4.1	–3.2	210,551
2012	2.3	3.1	0.0	210,476

Sources: S&P/Case-Shiller, Fiserv, Inc., and authors' calculations from homebuyers survey data.
a. n.a. = not available.

Table 5. Regressions Testing for Rational Expectations of the One-Year Change in Home Prices[a]

	Survey location				
	Alameda County	*Middlesex County*	*Milwaukee County*	*Orange County*	*All*
Using S&P/Case-Shiller Home Price Indexes, 2003–12					
Constant	–12.79	–4.75	–5.67	–9.48	–9.13
	(8.84)	(2.85)	(4.52)	(5.16)	(2.52)
Own-city expected	2.57	1.50	1.43	2.71	2.34
12-month price change[b]	(1.42)	(0.71)	(0.94)	(0.78)	(0.46)
No. of observations	9	9	9	9	36
R^2	0.32	0.39	0.25	0.63	0.43
Using FHFA home price data					
Constant	–8.60	–4.82	–6.96	–8.75	–8.11
	(4.12)	(2.50)	(3.45)	(2.88)	(1.48)
Own-city expected	2.03	1.73	1.86	2.81	2.32
12-month price change[b]	(0.66)	(0.62)	(0.72)	(0.44)	(0.27)
No. of observations	9	9	9	9	36
R^2	0.57	0.52	0.49	0.86	0.69

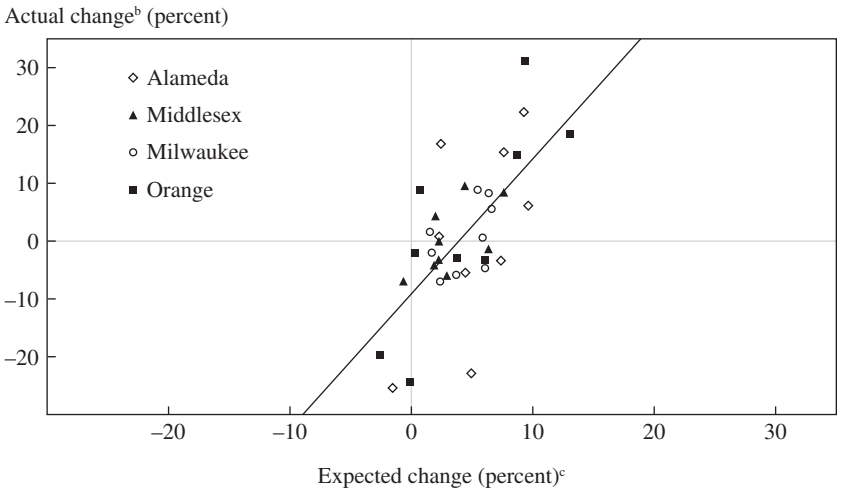
Sources: Authors' regressions using data from S&P/Case-Shiller, Fiserv, Inc., the Federal Housing Finance Agency, and the homebuyers survey.

a. Each column in each panel reports results of a single regression. The dependent variable is the actual percentage home price change in the indicated city from the second quarter of the year to the second quarter of the following year. Standard errors are in parentheses.

b. Trimmed mean of responses to question 6 of the homebuyers survey.

since we do not have 10 years of subsequent price data. The majority of the surveys in each year were returned in the second quarter, so we calculated the actual price change in each metro area as the percentage change in the S&P/Case-Shiller Home Price Index for that area from one second quarter to the next. Under traditional rational expectations theory, the constant term in these regressions should be zero, and the slope coefficient should equal +1. The top panel of table 5 reports the results. In all four survey locations the slope coefficients are statistically significant and have the right sign, but they are always much greater than 1. (The constant term is always negative, reflecting a necessary correction for the mean when the slope coefficient is greater than 1.) This may be interpreted as implying that homeowners had information that was relevant to the forecast but were not aggressive enough in their forecasts. A scatter diagram of actual against expected 1-year price changes for the four metro areas (figure 3) conveys how far individuals underestimated the absolute magnitude of home price movements.

Figure 3. Expected versus Actual One-Year Changes in Home Prices, 2003–11[a]



Source: S&P/Case-Shiller, Fiserv, Inc., and authors' calculations from survey data.

a. Each observation represents one of the four survey locations in a single year.

b. Actual change in metro-area home prices from the second quarter of the survey year to the second quarter of the next year.

c. Trimmed mean of respondents' expected change in home prices for the next year.

Contrary to what one might expect from popular stories about bubble mentality, then, the 1-year expectations of homebuyers were not *overreacting* to information, but rather *underreacting* to it. However, this is not necessarily inconsistent with the presence of a bubble. Certainly, the longer-term expectations, whose rationality is harder to judge, seem likely to have been more in line with information in the early years of our sample when they were predicting appreciation of over 10 percent a year for the next 10 years.

The above results do not depend on using the S&P/Case-Shiller Home Price Indexes to measure actual price changes. Substituting the home price indexes of the Federal Housing Finance Agency (FHFA, formerly the Office of Federal Housing Enterprise Oversight, OFHEO) yields rather similar results (bottom panel of table 5). Unlike the S&P/Case-Shiller indexes, the FHFA indexes include appraised values as well as actual sales in their construction.

Much of this apparent underreaction of expectations to information about future home prices is confined to certain metro areas and episodes. Note that in the metro areas where prices were tamer, Milwaukee and Boston, the coefficients in table 6 using the S&P/Case-Shiller data are 1.50

Table 6. Regression Testing for Rational Expectations of the One-Year Change in Home Prices with Additional Information Variables[a]

	Regression coefficient
Constant	−12.91
	(3.82)
Own-city expected 12-month price change (percent)[b]	3.28
	(0.93)
Lagged own-city actual 12-month price change (percent)	−0.25
	(0.29)
Lagged national (10-city) actual 12-month price change (percent)	−0.03
	(0.26)
No. of observations	36
R^2	0.48

Sources: Authors' regression using data from S&P/Case-Shiller, Fiserv, Inc., and the homebuyers survey.

a. The dependent variable is the percentage change in actual home prices in the respondent's metro area from the second quarter of the survey year to the second quarter of the next year. Data are pooled across all locations and survey years. Standard errors are in parentheses.

b. Trimmed mean of responses to question 6 of the homebuyers survey.

or less and not statistically significantly different from 1; although the coefficients are slightly higher in the regressions using the FHFA data, they still are not significantly different from 1.

We can test the rational expectations hypothesis further by adding to the regression other variables reflecting information available to homebuyers when their expectations were recorded; these other variables should have a coefficient of zero if their expectations were rational. We tried two such variables: the actual lagged 12-month price change in the same metro area and the actual lagged 12-month price change for the United States as a whole, as measured by the S&P/Case-Shiller 10-City Home Price Index. As table 6 reports, both of these variables' coefficients have the opposite of the expected positive sign but are insignificant. This is consistent with the rational expectations hypothesis for the 1-year forecasts: respondents do appear to incorporate this other information in making those forecasts.

Table 7 reports results of regressions in which the actual and expected price changes switch sides in the equation and the time lag is reversed: we regress the 1-year expectation on the lagged actual 1-year price change. This allows us to see whether there is a simple structure to expectations. The R^2s in these regressions are substantial, ranging between 0.64 and 0.87. Of course, the slope coefficient is far less than 1, because as we have noted, expectations are much less volatile than actual price changes.

Thus, the 1-year expectations are fairly well described as attenuated versions of lagged actual 1-year price changes, and yet we know from

Table 7. Regressions of the Expected One-Year Change in Home Prices on Lagged Actual Price Changes[a]

	Survey location				
	Alameda County	*Middlesex County*	*Milwaukee County*	*Orange County*	*All*[b]
Constant	4.87	2.79	3.76	3.25	3.72
	(0.64)	(0.49)	(0.30)	(0.61)	(0.28)
Lagged own-city actual 12-month price change (percent)	0.18	0.29	0.30	0.26	0.23
	(0.04)	(0.07)	(0.05)	(0.04)	(0.02)
No. of observations	10	10	10	10	40
R^2	0.70	0.64	0.82	0.87	0.73

Sources: Authors' regressions using data from S&P/Case-Shiller, Fiserv, Inc., and the homebuyers survey.

a. Each column reports results of a single regression. The dependent variable is the trimmed mean of the expected 1-year change in home prices in the indicated location. Standard errors are in parentheses.

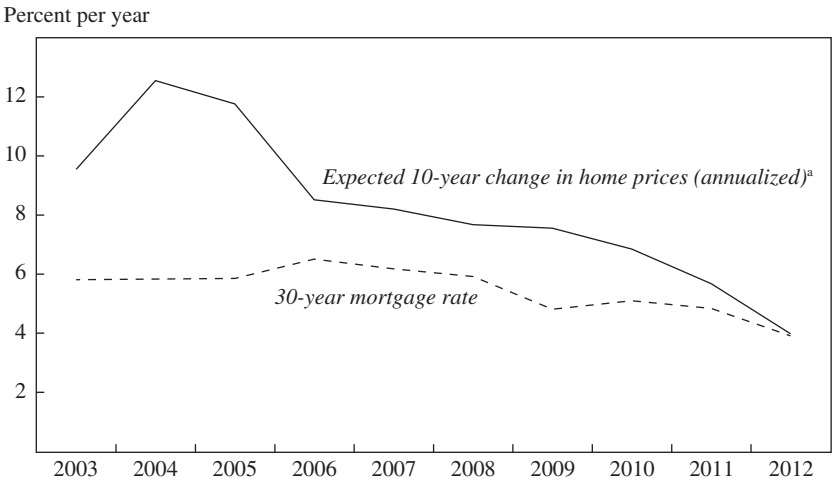
b. Data are pooled across all locations and survey years.

table 6 that they also contain significant information about future price changes beyond what is contained in the lagged actual price change. This conclusion does not mean, however, that any story of feedback in determining price should be modeled in rational terms. Long-term expectations also matter importantly for demand for housing, because as previously noted, they are important to people's decisions about whether to buy a home at all.

As John Maynard Keynes suggested in his 1936 *General Theory of Employment, Interest and Money,* it is long-term expectations that may be the real driver of speculative booms, even though these expectations are not normally the focus of economic forecasters. It may be a general expectation about the vague and distant future that helps explain why people behaved in the 2000s as if they thought that home prices could never fall: perhaps they thought so only about the long run, as our 10-year expectations data seem to confirm.

Figure 4 shows annualized 10-year expectations of home price appreciation from our survey, averaged across our four locations, along with the national-average 30-year mortgage rate, from 2003 to 2012. These two series are roughly matched in term, since the average actual duration of a mortgage in the United States, before a move or a refinancing or the like, is about 7½ years, not the contractual 30 years. As the figure shows, these expectations, if they could have been trusted, implied enormous profit opportunities in buying a home around 2004: the spread between the two series was roughly 6 percentage points. Leveraging their investment 10 to 1

Figure 4. Ten-Year Expectations for Home Price Growth and Thirty-Year Mortgage Rates, 2003–12



Sources: Freddie Mac's Primary Mortgage Market Survey and authors' calculations from survey data.
a. Average of trimmed means for all survey respondents.

(as one does when taking out a standard conventional mortgage), our homebuyers in 2004 would have expected to multiply that 6-percentage-point spread by 10 (after taking the other expenses of homeownership into account). This helps explain the bubble enthusiasm of that time.

After 2004, however, long-term expectations fell faster than mortgage rates, so that this expected profit opportunity narrowed, sharply at first and then more gradually. Neither monetary stimulus nor the other policy measures applied in the wake of the financial crisis—neither lower interest rates, the federal conservatorship of Fannie Mae and Freddie Mac, the Public-Private Investment Program, quantitative easing, nor Operation Twist—succeeded in lowering mortgage interest rates by anything like the decline in expectations.

By 2012, as figure 4 shows, long-term expectations had fallen to a level practically equal to the mortgage rate, suggesting that homebuyers no longer perceived a long-term profit opportunity in investing in a home. Since a sample consisting only of homebuyers is likely to be upwardly biased in terms of expectations relative to the population as a whole, the perceived investment opportunity among the general population may be even lower. A survey of professional forecasters conducted by Pulsenomics LLC suggests that these professionals are less optimistic than our respondents.

Their average expectation for annual home price appreciation for 2012–16, reported in the June 2012 Pulsenomics survey, was 1.94 percent, about half the 10-year expectation of the homebuyers in our 2012 survey.

Why were home price expectations so high relative to interest rates around 2004? Some simple stories come to mind but cannot be proved or disproved with any data that we know of. One is that these long-term expectations were formed over many decades during which home prices more or less consistently rose. Another is that money illusion plays a role: people may fail to consider that with lower overall inflation today than in past decades, home price increases are likely to be smaller than in the past.

Notably, the peak in expectations during the 2000s boom occurred 2 years before prices began to fall, 3 years before the beginnings of the subprime crisis, and 4 years before the most intense phase of the crisis in late 2008. This, together with the fact that the decline in expectations is fairly steadily downward over the 8 years after 2004, shows that the crisis cannot be the cause. Perhaps that should not be altogether surprising, for the crisis was presented to the public as just that—something short-term. It was associated with an economic recession, and all recessions in recent decades have been short. So perhaps it was not so much the crisis itself as its surprising duration that gradually contributed to bringing expectations further down.

V. How Did the Bubble End?

Our sample period includes only one major turning point in the housing market, the sudden, historic end of the housing bubble. Although we have only one observation of this turning point, understanding it is central to our objectives. Of particular interest here are respondents' answers to a pair of open-ended questions in the survey (questions 16 and 17):

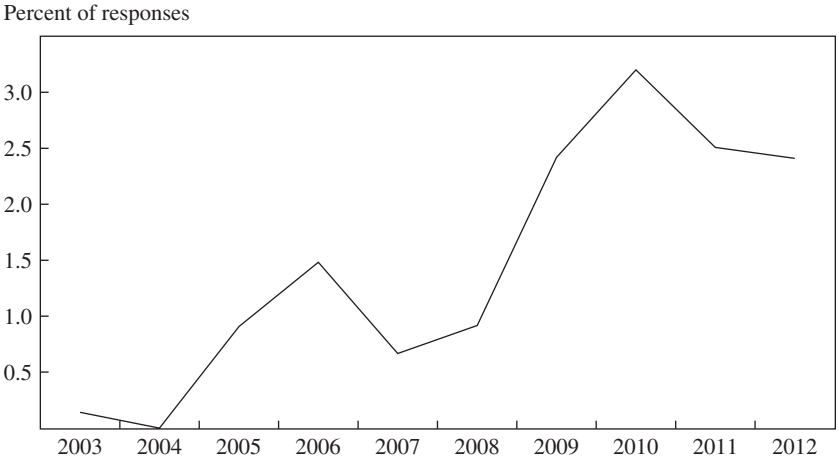
—Was there any event or events in the last two years that you think changed the trend in home prices?

—What do you think explains recent changes in housing prices in [location]? What, ultimately is behind what is going on?

Most respondents wrote in answers to these questions; only a few left them blank. The questionnaires left space for writing 20 words or so, and many filled the available space. Only a few wrote one-word answers.

Comparing the responses to these two questions between the 2004 and 2006 surveys seems likely to be fruitful for understanding the turning point, because long-term expectations dropped a full 4 percentage points over that relatively short interval, roughly half of the total drop from the

Figure 5. Appearances of "Housing Bubble" in Homebuyers Survey Responses, 2003–12[a]



Source: Authors' calculations from homebuyers survey data.

a. Share of respondents who used the words "housing bubble" anywhere in their answers to the homebuyers survey.

peak. Moreover, the answers will not be clouded by any references to the financial crisis, which was still entirely in the future.

Between these two years, a striking change in the tenor of the answers can be observed. The common themes in 2004 included a "shortage of houses," a large number of "immigrants," "scarcity of land," "lack of building space," "too many people," and "the desire to have it all." These answers are mostly consistent with perceptions of a shortage of supply. Only occasionally did respondents mention in 2004 that affordability might be an issue. By 2006 the optimistic themes of 2004 were still in evidence but were less prevalent. The most common theme in 2006 was "rising interest rates." Some themes were mentioned repeatedly, in different forms, as suggested by answers such as the following: "high prices," "no equivalent rise in wages," "overvalued homes," "numerous newspaper & media articles speculating on/or reporting on slowing sales," and "astronomical price spikes of previous 2 years simply cannot be sustained."

In 2004, 14 percent of respondents volunteered the word "supply" in answering these two questions, almost always with a suggestion of short supply, limited supply, no supply, or demand exceeding supply. In 2006 only 5 percent of respondents used this word.

As figure 5 shows, the phrase "housing bubble" did not appear in a single handwritten response in 2004, although one respondent used the

term in 2003. By 2006, however, the word was being volunteered by a few respondents. As time went on after the crisis, the percentage mentioning "housing bubble" rose, until by 2010 over 3 percent of the respondents were using the term.

As of 2004, a few professional economists were already responding to the claim of some that the housing market was in a bubble. Our own 2003 Brookings Paper (Case and Shiller 2003) strongly suggested that housing was in a bubble, but others took a different view.

Our questionnaire itself did not use the word "bubble" except in the 2010 survey, when we added the following yes-or-no question:[3]

> Do you think the home price boom and bust in first decade of the 2000s was basically a speculative bubble and burst (prices driven up by greed and excessive speculation and then inevitably collapsing down)?

Eighty-five percent of respondents answered yes to this question. It is too bad that we did not think to ask this question until 2010. We probably did not in 2003 or 2004 because we could not have then imagined that many people would even recognize the term "speculative bubble" in this context.

There was a clear change in public perceptions in the 2 years between 2004 and 2006. Ideas (speculative bubbles, overpriced homes) that were "in the air" in 2004 actually were not much talked about then, but their frequency of mention had increased dramatically by 2006.

Why was there such a dramatic increase in these notions? Between 2004 and 2006, the idea seems to have emerged in media accounts that there are such things as bubbles and that they might be expected to burst. Over this 2-year period, a number of analyses of bubble arguments appeared, most of them in publications that few homeowners are likely to have read. They must have viewed the news accounts of these debates more as a sporting event, whose outcome was very uncertain.

In December 2004 Joseph McCarthy and Richard Peach published an article in the Federal Reserve Bank of New York's *Economic Policy Review,* "Are Home Prices the Next Bubble?" in which they answered their title question in the negative. They argued that home prices might not even have increased at all, if one adjusted for quality changes: a repeat-sales index like the OFHEO index (or the Case-Shiller index) may not effectively control for quality if homeowners improve their homes between sales. However, the only evidence they offered for a widespread change in

3. In this year as in some others, we added one or more questions at the end of the questionnaire, without, however, changing the wording of any of the other questions.

average home quality was that the overall increase in the OFHEO index in recent years was approximately the same as that of the ordinary median price, which does not attempt to hold quality constant.

In February 2005 David Lereah published his book *Are You Missing the Real Estate Boom?* Lereah strongly rejected the mounting suspicion that a real estate bubble was forming. He argued instead that lower interest rates meant that housing was much more affordable than it had been in the previous couple of decades, and that demand from the baby-boom generation would keep the market going strong for years to come. Although he was right about these points, it was still a leap of judgment to conclude, as he did, that the housing market at the time offered a "once-in-every-other generation opportunity" for investors.

In March 2005 one of us (Shiller) published the second edition of his book *Irrational Exuberance,* which included a new data set on real home prices since 1890. No such long data set of U.S. home prices had ever been published before, and a chart depicting the aggregate series revealed that by historical standards the current real estate boom was highly abnormal, "like a rocket taking off" (Shiller 2005, p. 4). The chart was reprinted in a number of places, including the *New York Times.*

On June 16, 2005, the *Economist* published a cover story titled "After the Fall," with a cover illustration of a falling brick inscribed with the words "house prices." The story said:

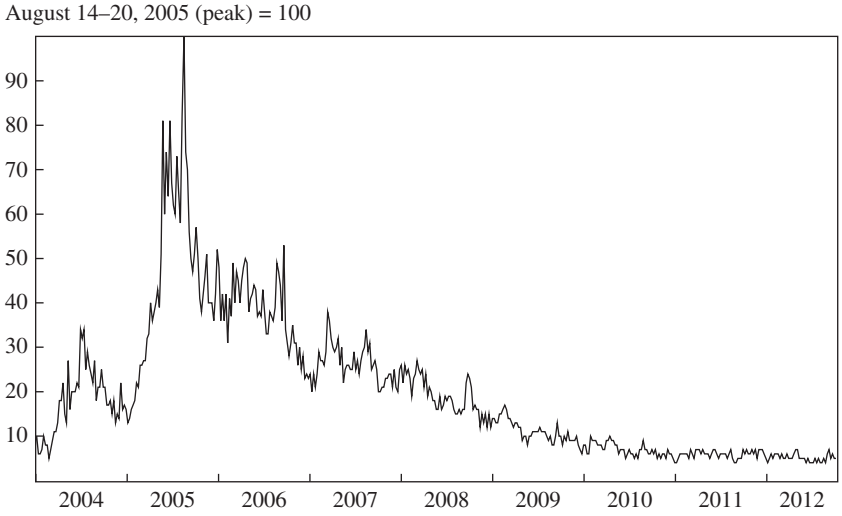
> Perhaps the best evidence that America's house prices have reached dangerous levels is the fact that house-buying mania has been plastered on the front of virtually every American newspaper and magazine over the past month. Such bubble-talk hardly comes as a surprise to our readers. We have been warning for some time that the price of housing was rising at an alarming rate all around the globe, including in America. Now that others have noticed as well, the day of reckoning is closer at hand. It is not going to be pretty. How the current housing boom ends could decide the course of the entire world economy over the next few years.[4]

Indeed, it does appear that the news media had by this time flocked to the notion that the housing boom was really a bubble. On June 13, 2005, *Time* published a cover story titled "Why We're Going Gaga over Real Estate," with an illustration of a man lovingly hugging a house. A week later *Barron's* ran a cover story by Jonathan Laing titled "The Bubble's New Home."

Why did all this media attention happen so suddenly? It is hardly controversial to suggest that the major news media are always looking

4. *The Economist,* "After the Fall," June 16, 2005. www.economist.com/node/4079458.

Figure 6. Google Web Searches for "Housing Bubble," January 4, 2004, to September 9, 2012



Source: Google Trends (www.google.com/trends/?q=housing+bubble). Accessed January 1, 2013.

for stories that will resonate with their readers, and that when one of them comes across such a story, the others follow. Somehow the housing bubble story seems to have become such a story around that time, marking a turning point in public thinking. That people were changing their thinking about housing bubbles in mid-2005 can also be measured by a Google Trends count of web searches for the term "housing bubble." As figure 6 shows, 2005 saw a sudden burst in web searches for this term, peaking in August.

Fernando Ferreira and Joseph Gyourko (2011) find a wide dispersion in the timing of the beginning of the real estate bubble, ranging from 1994 in some metro areas to 2005 in others. But their analysis also shows that all this came to an abrupt end in all areas at about the same time, just before 2006. Even many months after public opinion had begun to turn decisively toward the view that the recent boom in home prices was a bubble, some economists continued to argue that all price increases were justified by fundamentals and that there was no bubble.

In March 2006 Margaret Hwang Smith and Gary Smith presented a paper before the Brookings Panel that argued, among other things, that the downtrend in nominal interest rates since 2000 fully justified the increase in home prices. One of us argued, in a comment on their paper (Shiller 2006),

that whether speculative price changes are "justified" can be answered in many ways and that the issues in financial theory are sufficiently complex that it is hard to be definitive, yet that there were reasons to suspect that the observed price changes were related to swings in public opinion rather than changes in fundamentals.

Smith and Smith (2006) is, to our knowledge, the last major paper to argue that there never was a housing bubble in the 2000s. By 2006 a substantial segment of the population had concluded that it was a bubble, and professional economists as apologists largely disappeared.

VI. What Caused the Rebound in 2009–10 and Why Did It Fizzle?

The rebound in home prices from 2009 to 2010 is quite striking. In some metro areas it was strong: San Francisco–area home prices rose 22 percent in the 16 months between March 2006 and July 2010 (see top left panel of figure 1). But this rebound did not last, and home prices resumed their fall. Interestingly, long-term expectations for home prices did not increase between 2009 and 2010. What, then, might explain the temporary uptick?

It is at first striking that very few respondents' answers to our open-ended questions about the forces behind home price trends even mention the "usual suspects" that economists would consider. In none of the more than 4,000 questionnaires from 2008 to the present is there a single mention of the Home Affordable Modification Program (HAMP, created by the Emergency Economic Stabilization Act of 2008 and amended by the American Recovery and Reinvestment Act of 2009), the Home Affordable Refinancing Program (HARP), or the Homeowners Affordability and Stability Plan (HASP, announced by President Barack Obama in February 2009, using funds from the Housing and Economic Recovery Act of 2008). Nor did anyone mention either of Fannie Mae's refinancing programs Refi Plus and DU Refi Plus. This whole alphabet soup of relatively ineffective homeowner assistance programs appears to have been totally missed by our respondents, although some of their answers may have included vague, hard-to-interpret references to them or their effects.

The homebuyer tax credit, created by the American Recovery and Reinvestment Act in February 2009, the second month of President Obama's tenure, was much more salient, perhaps because it took the form of a substantial outright gift to eligible parties: initially these were first-time homebuyers, who received a credit of up to $8,000, but later other homebuyers were granted a credit of as much as $6,500. The credit's

expiration date, originally November 30, 2009, was later extended to April 30, 2010 (with closing required by June 30), when non-first-time buyers were also allowed.[5] The total cost of the program was estimated at $22 billion.[6]

The fact that these tax credits came at the beginning of a new presidency, at a time when other stimulus programs were being announced, may have amplified the sense of hope that they offered. A search through our questionnaires for the words "tax credit" produced 3 hits in 2009, 37 in 2010, 10 in 2011, and 2 in 2012. In 2010 all but one of the 37 mentions came from first-time homebuyers. The questionnaire for 2010 differed from those in all other years in that it asked (question 22b, well after questions 16 and 17), "Are you getting the home buyer tax credit for this home purchase?" This may have reminded some respondents (who did not necessarily answer all questions in order) of this fact and prompted them to mention the credit in the earlier questions.

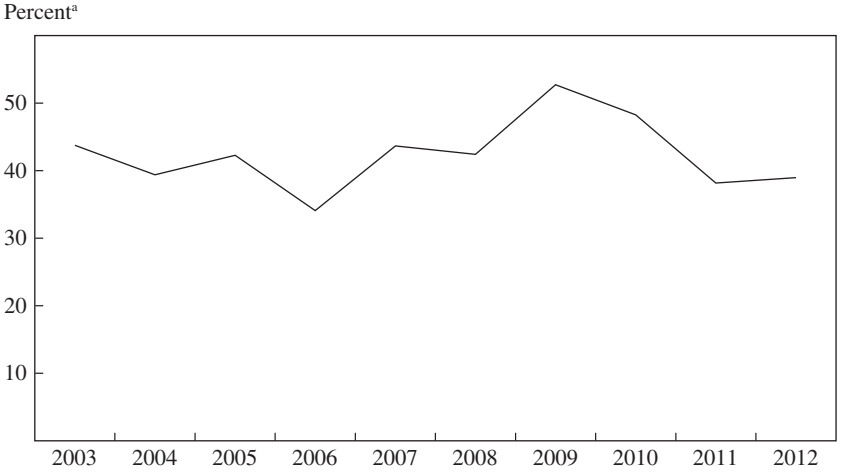
A remarkably large fraction of respondents in 2010—80 percent in Orange County, 65 percent in Middlesex and Milwaukee Counties, and 64 percent in Alameda County—said that they would receive the credit. The credit appears to have motivated some households to become homeowners: figure 7 shows that the fraction of our respondents who were first-time homebuyers rose to 53 percent in 2009, compared with 42 percent in 2008 and 34 percent in 2006.

These results suggest that the homebuyer tax credit was an important factor in the temporary turnaround in the housing market: homebuyers were aware of it, leading sales and prices to increase and inventory (as measured by months of supply, from the National Association of Realtors) to fall. This set the stage for a decline in home prices in 2011, possibly unrelated to expectations of future price increases.

5. A $7,500 tax credit was also legislated as part of the Housing and Economic Recovery Act of 2008, but that credit had to be repaid and so was really a loan rather than a subsidy.

6. U.S. Government Accountability Office, in a letter to Rep. John Lewis (D-Ga.), chairman of the House Subcommittee on Oversight, September 2, 2010 (www.gao.gov/new.items/d101025r.pdf). Since two of our four survey locations are in California, it is worth noting that California had its own homebuyer tax credits, each worth $10,000. The first was in effect from March 1, 2009, to February 28, 2010. It was not limited to first-time buyers but was limited to newly built homes. The second, in effect between May 1, 2010, and December 31, 2010, allocated $100 million to first-time homebuyers and an additional $100 million to other purchasers of new homes. Both credits were distributed on a first-come, first-served basis. Measured on a per capita basis, the California program was less than a tenth the size of the federal program.

Figure 7. First-Time Buyers in the Homebuyers Survey, 2003–12



Source: Authors' calculations from homebuyers survey data.

a. Percent of respondents answering "yes" to question 4 of the survey: "Are you a first time home buyer?"

A couple of theories come to mind to explain why homebuyers suddenly came into the market just then. One theory is that the decisive government action in legislating the tax credit persuaded them that home prices would quickly go up. But this theory is belied by our expectations data in figure 2. Short-term expectations generally improved between 2008 and 2009 or 2010, but not by much, and so remained low by historical standards. Nor did long-term expectations change much between 2008 and 2009 or 2010.

Another possible explanation relies on the psychological theory of regret. The homebuyer tax credit was a reason for homebuyers to act quickly. Missing the credit, and perhaps buying soon after it expired, would generate a pang of regret. Regret theory, as advanced by Graham Loomis and Robert Sugden (1982), argues that people are especially motivated to avoid the feeling of regret for having missed an opportunity or made a mistake, and that the regret itself looms large in their mind, sometimes out of proportion to the actual loss.

To the extent that regret theory explains the market impact of the homebuyers tax credit on home prices, it might also help explain why the 2009–10 rally fizzled. These dates do not mark a substantial upward turn-

ing point as did 2004–06 because there was no fundamental change in expectations.

VII. Conclusion

The rise and fall of the housing market during the past decade is one of the most important events in modern economic history. This paper has focused on a factor in that episode that has received little formal analysis: the role of expectations. We have tried to draw some conclusions from a data set of nearly 5,000 completed mail questionnaires collected over the past 25 years from actual homebuyers in four metropolitan areas.

The descriptions of the data and the questions that we ask may seem somewhat ad hoc and arbitrary, but as we noted at the outset, no theoretical framework exists to guide us. However, we can say a few things in conclusion. First, the data suggest that homebuyers were very much aware of trends in home prices at the time they made their purchase. There is a strong correlation between the respondents' stated perceptions of price trends and actual movements in prices. The data also show that the opinions of homebuyers have varied over time. When price trends are strong, there is little disagreement among respondents. When there is ambiguity, respondents seem, not surprisingly, to have a much less clear picture.

The data also show that homebuyers were, if anything, out in front of the short-term changes that were occurring and that their short-run expectations underreacted to the year-to-year changes in actual home prices. Their long-term expectations have been consistently more optimistic across both time and locations, but the absolute difference between long-term and short-term expectations fell from a high of 8.3 percentage points in 2008 to just 0.8 percentage point in 2012. We cannot test the rationality of long-term expectations as we can the short-term expectations, and yet, since most homebuyers own their home for many years, these are arguably the more important determinants of housing demand. It is from these nebulous and relatively slow-moving expectations that the bubble took much of its impetus, and that future home price movements will as well.

Perceptions of where prices are headed in the short term turned more positive in 2012, but long-term expectations continued to weaken. Thus, although a recovery may be plausible, and home prices were rising fairly strongly as this paper went to press, we do not see any unambiguous indication in our expectations data of the sharp upward turnabout in demand for housing that some observers and media accounts have suggested.

APPENDIX

Controlling for Outliers

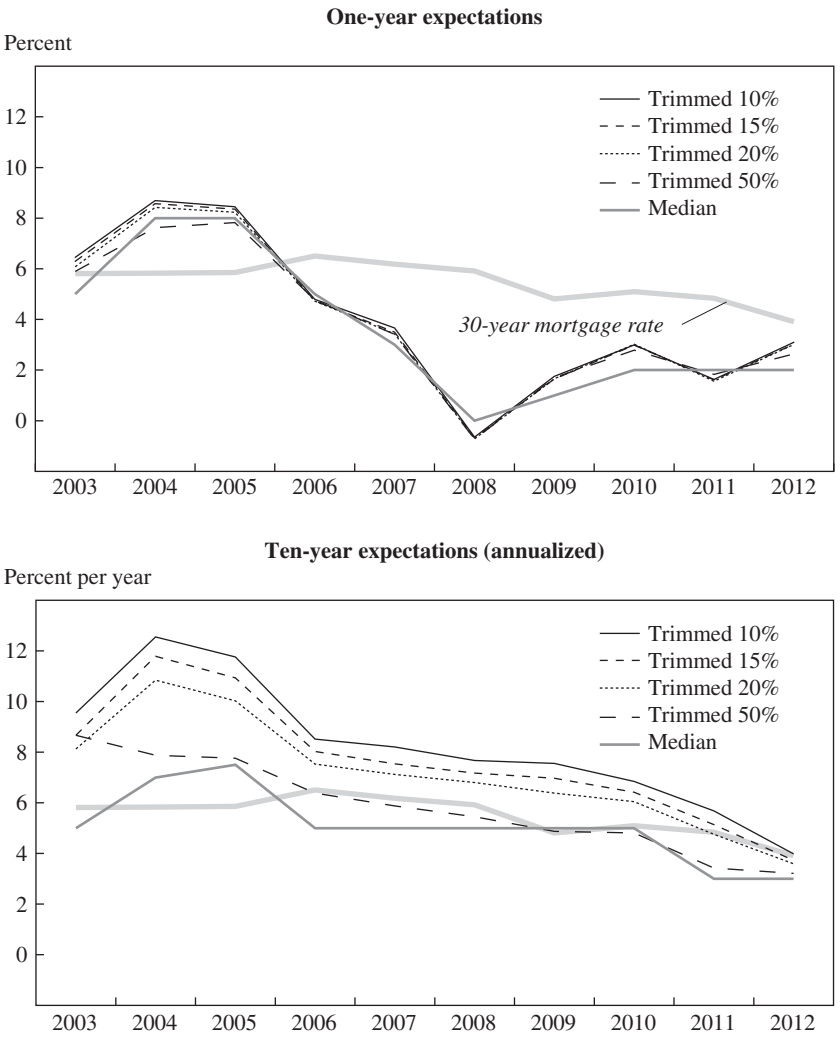
The trimmed mean removes the extreme observations at the upper and lower ends of a distribution, making analysis of the data more resistant to outliers. The degree of trimming can, however, produce significantly different mean values in widely dispersed data with long tails. Our 1-year expectations data fell within a relatively tight range, and thus, as the top panel of figure A.1 shows, differences in the amount of trimming had a minor impact. The difference between the 10 percent and the 50 percent trimmed means (removing 5 percent and 25 percent of observations from each tail, respectively) exceeded 1 percentage point only in 2004, the peak of homebuyer optimism. In most other years the trimmed values were closely aligned. The top panel of figure A.2 shows that fewer than 5 percent of those surveyed in any year expected home prices to increase by 20 percent or more over the following 12 months. Not surprisingly, in the bust years the outliers were on the low end of the spectrum. In 2008, 59 percent of homebuyers surveyed expected prices to remain level or fall over the following year, compared with just 3 percent of 2004 respondents.

Annual 10-year expectations among surveyed homebuyers were more optimistic and more skewed in the upper tail, as shown in the bottom panel of figure A.1. This was especially true in the boom years of 2004 and 2005, when year-over-year gains in monthly home prices exceeded 20 percent and many respondents believed prices would continue to rise. In 2004 the 10 percent trimmed mean expectation was 12.6 percent. Although high, this was far below the actual annual rate of appreciation. Using a 50 percent trimmed mean reduces the expected annual rate of appreciation by 4.7 percentage points, to 7.9 percent, far below reality. The bottom panel of figure A.2 shows that 19 percent of all 2004 survey respondents expected home prices to appreciate by more than 20 percent in each of the following 10 years.

From the beginning of the housing bust in 2006 onward, the spread between the 10 percent and the 50 percent trimmed means averaged just 2 percentage points. Having seen price appreciation begin to slow, people came to realize that perhaps the sky was not the limit and that prices could not rise at double-digit rates in perpetuity. By 2012 the trimmed means were closely aligned, with a difference of less than 1 percentage point.

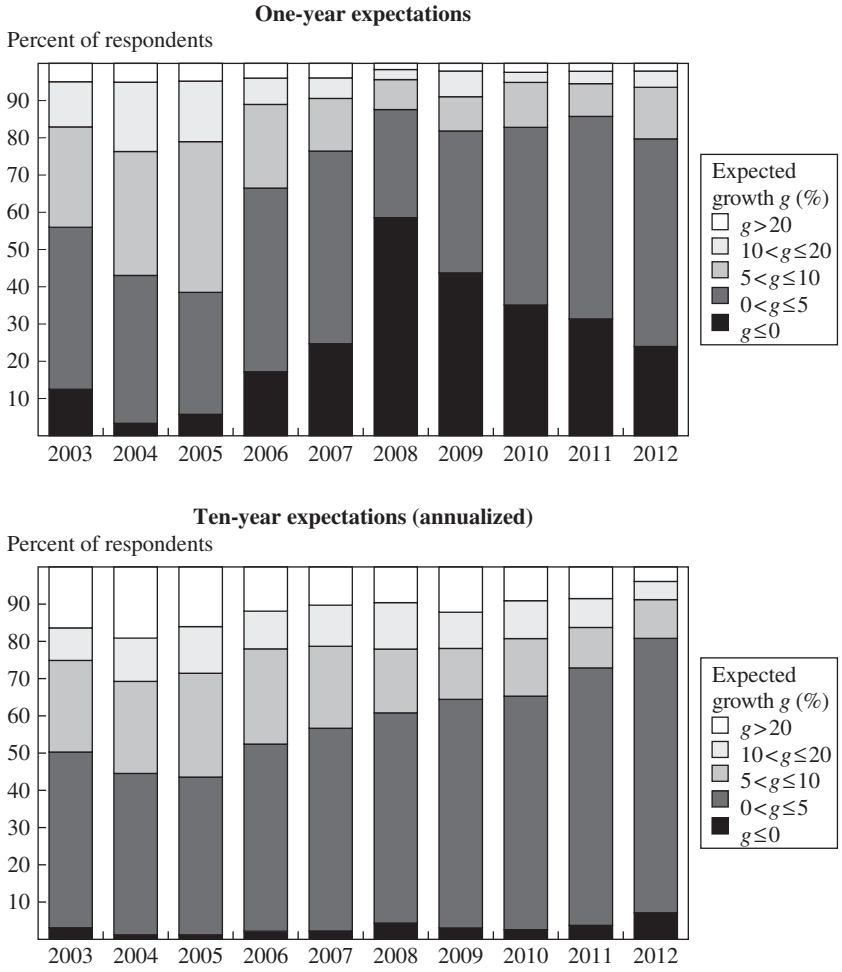
Market exuberance was not the only reason for high expectations for appreciation. Two other factors that likely influenced expectations were failure to understand the impact of compounding and misinterpretation

Figure A.1. Expected Home Price Growth Using Alternative Trimmings of Outliers, 2003–12



Sources: Freddie Mac's Primary Mortgage Market Survey and authors' calculations from homebuyers survey data.

Figure A.2. Distributions of Expected One-Year and Ten-Year Home Price Growth



Source: Authors' calculations from homebuyers survey data.

of the question on long-term expectations. For example, a survey respondent who expects prices to double over the next decade might mistakenly report an expected annual increase of 10 percent. In fact, a compound 10 percent annual increase would bring the price of a $100,000 home to $285,000 over 10 years, not $200,000. Some of those surveyed also appeared to misinterpret the question as the total appreciation over the next 10 years, not the annual rate of appreciation. This is likely the case among

those respondents who reported their 10-year annual expected appreciation as 10 times their 1-year expectation.

Questions have been added to the end of the survey questionnaire in the past, and more will likely be added in the future as we continue to assess what important additional information we might garner from respondents. A second long-term expectations question, "How much higher do you expect home prices to be, in percentage terms, in 10 years?" might yield interesting results. However, we would expect to find some apparent inconsistencies between the answers to this question and the answers to the question about expected annual appreciation for 10 years, and we still would not know which question elicited their true 10-year expectation. Most people are not used to making 10-year forecasts and have trouble knowing whether prices might double or triple or anything else. We could ask even more questions about what scenarios and probabilities they consider plausible, but in asking such detailed questions we would run the risk that our questioning was educating them and making them think more clearly about future home prices than they ever had before. As survey pioneer George Katona (1975) stressed, most people have only the vaguest long-term expectations and have to struggle to express them in any quantitative terms. Yet the fundamental problem for economists is that these vague expectations are likely to be extremely important in determining the demand for housing.

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Comments and Discussion

COMMENT BY

DAVID LAIBSON It's very impressive to have called the housing bubble a few years before it popped. It's even more impressive to have conducted a perfectly timed series of housing surveys that anticipated the bubble. These authors are prophetic.

This paper by Karl Case, Robert Shiller, and Anne Thompson offers key insights into the thinking of participants in the housing market. The survey findings are required reading for anyone trying to explain the extraordinary up-and-down price movements that have whipsawed homeowners, homebuilders, banks, and by extension, most of the world economy.

There is much to praise in the remarkable survey studied in this paper, but I will focus on a survey design problem that leads me to reinterpret a few of its findings. Stated briefly, the 10-year forecasting data need far more trimming than the 10 percent trim (discarding the top and bottom 5 percent of the data) that the authors adopt.

In most survey data a 10 percent trim would be adequate—often more than adequate—to remove outliers. The survey data used here, however, suffer from an unusual bias that is not corrected with a 10 percent trim. Some fraction of the respondents—let's say a quarter for now—appear to be confusing the concepts of annualized returns and total returns. For the 1-year forecast data, these two concepts are the same, so that the bias that I am highlighting does not apply. But for the 10-year forecast data there is an enormous difference between an annualized return (what the survey question asks for) and a total return (what perhaps a quarter or more of the subjects are thinking).[1]

1. The actual language in the question is, "On average over the next ten years how much do you expect the value of your property to change each year?" The underlining appears in the actual survey instrument only in 2012.

To see how this bias works, consider the following simplified example. Suppose that all respondents believe that housing will appreciate 3 percent per year for the next 10 years. Assume as well that three quarters of the subjects respond correctly to the question about 10-year returns, giving an answer of 3 percent, and one quarter give an answer of 30 percent (the total 10-year return, ignoring compounding to keep things simple). Then the mean response is an "annualized return" of 9.75 percent per year, more than triple the subjects' true belief. In this simple example, the researchers would need to trim 50 percent of the data to unbias the mean (since the bias is not symmetric).

Four related empirical facts about the survey results point to the existence of this bias:

—Some subjects give an answer for the 10-year *annualized* return forecast that is exactly 10 times the answer they give for the 1-year forecast (see the authors' appendix).

—A substantial fraction of the answers to the 10-year forecast question are so high that they are far more likely to be total returns than annualized returns. For example, my table 1 shows that at least 10 percent of the 2004 survey respondents say (if you take their answers literally) that housing prices will appreciate 50 percent *per year* for the next 10 years, implying a total price appreciation of 5,670 percent. Note that the authors' 10 percent trim removes only half of these respondents from the calculation of the mean.

—The 10-year annualized forecasts are far *more* right skewed than the 1-year annualized forecasts (see table 1 and the authors' appendix figures A.1 and A.2).

—The mean 10-year forecast exceeds the mean 1-year forecast (both using the 10 percent trim) in all study years. In most years this gap is considerable (appendix tables A.1a and A.1b).

It is hard to know what to do about this bias. For some of the reasons discussed above, I believe that the authors' 10 percent trim is not adequate. Indeed, I think that a quarter or more of the data may be corrupted by respondent confusion about annualized versus total returns.

Consider the following suggestive evidence. The 1-year forecast mean is unaffected by trimming. Whatever the trimming parameter used (10, 15, 20, 50, or 100 percent), the 1-year forecast "mean" barely budges (see appendix table A.1a). But for the 10-year forecast mean, each additional bit of trimming lowers the mean a little more. Only at a 50 percent trimming does the pattern of falling means abate, and in some years the trimming has to go to 100 percent before the mean stops falling (see appendix table A.1b).

Table 1. Distribution of Home Price Forecasts from the 2004 Case, Shiller, and Thompson Homebuyer Survey

		Reported 10-year growth forecast	
Percentile of respondents	*Reported 1-year growth forecast (percent)*	*Percent per year*	*Implied total growth (percent)*
99	50	125	332,425
95	22	50	5,667
90	20	50	5,667
75	10	20	519
50	8	7	97
25	5	5	63
10	2	2	22
5	1	2	22
1	–4	–5	–40

Source: Author's calculations using data from the Case, Shiller, and Thompson homebuyers survey.

It is still possible that 10 percent trimming is the right methodological answer. Nothing I have said explicitly rules that out. But the preponderance of evidence suggests that one should be wary of the 10-year forecasts. Researchers who wish to use then should explicitly take up the issue of confusion between annualized and total returns and offer a set of assumptions for modeling and measuring this bias.

It is tempting to think that the median is the conservative path to take. But even the median is not immune from these problems. Suppose that beliefs about annualized returns are uniformly distributed from zero to 6 percent, and again assume that one quarter of the respondents instead report the total return (again simplified to 10 times the annual return). If x is the median, then

$$0.75 \times x/6 + 0.25 \times x/60 = 0.5.$$

$$x \approx 3.9.$$

Hence, the median is biased upward from the true value of 3 percent to a value of 3.9 percent.

In summary, I am awed by this survey that the authors fielded far in advance of the collapse of the housing market. But I urge my fellow economists who are thinking of using the 10-year forecasts in their own research to do so with caution. They cannot be interpreted literally, whether with a 10 percent or even a 100 percent trim.

COMMENT BY

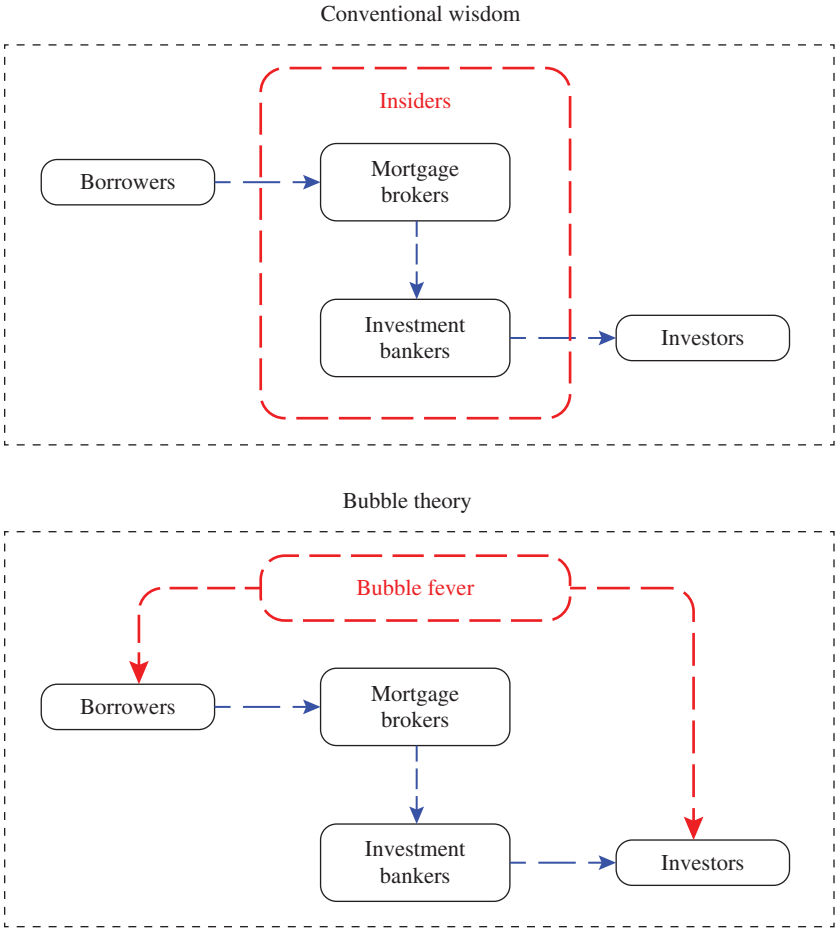
PAUL WILLEN My discussion of this paper by Karl Case, Robert Shiller, and Anne Thompson will attempt to place the paper in the context of our evolving understanding of the causes of the housing and financial crises that started in 2007. To me, the central research question about the crisis is why so many people made so many decisions that turned out so badly ex post. Why did borrowers take out loans they could not afford? Why did lenders lend them the money? Why did so many investors buy securities backed by loans that borrowers could not afford to repay? As Christopher Foote, Kristopher Gerardi, and Willen (2012) argue, two alternative narratives seek to answer this question.

The first, which Foote and coauthors refer to as the "insider/outsider" story, and which has dominated popular accounts and much academic research, is depicted in the top panel of my figure 1. According to this theory, the key to the crisis is the institutional fact that the securitization process placed intermediaries in between subprime borrowers and the ultimate investors. These intermediaries, the theory says, understood that the borrowers were going to lose their homes and that the investors were going to lose their money, but they deceived the borrowers and the investors into thinking that these transactions were going to end well for everyone. Foote and coauthors argue that the evidence, some of which I discuss in more detail below, is not kind to the insider/outsider theory. Among other things, intermediaries not only facilitated transactions but were major investors in them, and indeed, as my table 1 shows, the biggest losses were concentrated among the firms most closely associated with the securitization of subprime mortgages. In other words, the insiders appear to have been among the most deceived parties.

The alternative theory, depicted in the bottom panel of figure 1, is what Foote and coauthors call the "bubble theory." This theory holds that optimistic expectations of home price appreciation explain the bad decisions made by borrowers and investors **[see follow-up e-mail of 2/6]** that led to the crisis. According to this theory, both borrowers and investors were trying to cash in on the greatest real estate boom in U.S. history. If one believes that home prices are going to keep rising at a rate of 10 percent per year, one can easily rationalize ex ante decisions that appear absurd ex post. For example, taking out a mortgage at a monthly payment that exceeds one's monthly income does not normally make sense, but it does make sense if one expects to be able to sell the house in a year at a 10 percent profit.

The results in this paper fill an important gap in the debate over the bubble story. Before now, direct evidence already existed that optimistic

Figure 1. Alternative Theories of the Foreclosure Crisis[a]



a. According to the conventional wisdom (top panel), mortgage industry insiders (mortgage brokers and investment bankers) took advantage of outsiders (borrowers and investors). Brokers cheated borrowers by extending them "exploding" adjustable-rate mortgages, which became unaffordable when their interest rates reset. Investment bankers took advantage of investors by packaging these mortgages in complex securities, whose toxic nature the investors were unable to discern. In the bubble theory of the crisis (bottom panel), borrowers, lenders, and insiders all believed that home prices would continue rising. Borrowers were eager to purchase homes, and the others wanted more exposure to the housing market. The securitization process merely facilitated these transactions.

Table 1. Mortgage-Related Losses to Financial Institutions in the Subprime Crisis, as of June 18, 2008[a]

Billions of dollars

Rank	*Institution*	*Loss*	*Rank*	*Institution*	*Loss*
1	Citigroup	42.9	11	Washington Mutual	9.1
2	UBS	38.2	12	Credit Agricole	8.3
3	Merrill Lynch	37.1	13	Lehman Brothers	8.2
4	HSBC	19.5	14	Deutsche Bank	7.6
5	IKB Deutsche	15.9	15	Wachovia	7.0
6	Royal Bank of Scotland	15.2	16	HBOS	7.0
7	Bank of America	15.1	17	Bayerische Landesbank	6.7
8	Morgan Stanley	14.1	18	Fortis	6.6
9	JPMorgan Chase	9.8	19	Canadian Imperial (CIBC)	6.5
10	Credit Suisse	9.6	20	Barclays	6.3

Source: Bloomberg, "Subprime Losses Top $396 Billion on Brokers' Writedowns," June 18, 2008. www.bloomberg.com/apps/news?pid=newsarchive&sid=a5GaivCMZu_M.

a. The date chosen precedes the Lehman bankrupcty to avoid contamination from the wider financial crisis.

beliefs were central to investors' decisions, but evidence on the role of beliefs on the borrower side was only circumstantial and anecdotal. The paper provides some of the first direct evidence on borrower beliefs.

On the investor side, the direct evidence is ample. Gerardi and others, in a 2008 Brookings Paper, provide extensive evidence along these lines. They point to a table (reproduced here as table 2) from a report titled "HEL Bond Profile across HPA Scenarios," prepared by analysts at Lehman Brothers and widely circulated in the fall of 2005, which illustrates the logic behind investing in subprime mortgage-backed securities. The purpose of the report was to measure the potential losses on subprime bonds across different home price scenarios. The table shows massive losses in the event of a fall in home prices. In the report's "meltdown" scenario, the Lehman analysts estimated that the deals would suffer losses of 17 percent, which implies, assuming that the average default results in a 50 percent loss to the lender, that about a third of the loans would end in foreclosure. Ex post, the Lehman forecast was remarkably accurate. Home prices fell twice as fast as in the meltdown scenario, at a rate of −10 percent rather than −5 percent, and actual investor losses were about 23 percent.

Table 2 provides strong evidence against the insider/outsider theory and in favor of the bubble theory. Contrary to the insider/outsider story, the table illustrates that investors were not deceived about the quality of the loans in which they were investing. Lenders typically foreclose on a fraction of a percent of mortgages rated prime; thus, the 5 percent losses in

Table 2. Lehman Brothers Conditional Forecasts of Losses on Subprime Investments, August 2005

Scenario name	*Description*[a]	*Assigned probability*	*Cumulative loss*
"Aggressive"	11 percent annual HPA over the life of the pool	15%	1.4%
	8 percent annual HPA over the life of the pool	15%	3.2%
"Base"	HPA slows to 5 percent annual by end of 2005	50%	5.6%
"Pessimistic"	Zero HPA for next 3 years, 5 percent annual thereafter	15%	11.1%
"Meltdown"	–5 percent annual for next 3 years, 5 percent annual thereafter	5%	17.1%

Source: "HEL Bond Profile across HPA Scenarios," from Lehman Brothers, "U.S. ABS Weekly Outlook," August 15, 2005.

a. HPA = home price appreciation.

the "baseline" scenario imply that these loans were orders of magnitude riskier than the typical prime mortgage. Evidence in support of the bubble theory is the fact that, as table 2 also shows, the Lehman analysts were remarkably optimistic about home prices. Their "base" scenario (to which they assigned a probability of 50 percent) involves home price appreciation of more than twice expected inflation, and their "aggressive" scenario (with a probability of 15 percent) implies that despite having risen by almost 75 percent over the previous 5 years, home prices would rise another 35 percent over the next 3. Put another way, the Lehman analysts assigned three times as high a probability to the aggressive scenario as they did to the meltdown scenario (5 percent)—which was, in fact, a better outcome than what actually happened. Further, credit protection on subprime deals had to exceed at least 15 percent before any of the triple-A-rated securities lost money, so the implied probability of loss was less than 5 percent. In short, the Lehman analysis and similar research at other firms, as documented by Gerardi and others (2008), illustrates how the belief in continued rapidly rising prices led to the ex post bad decisions at the heart of the crisis.

On the borrower side, until now the evidence was not as complete. On the one hand, there was little evidence to support the idea that borrowers had been deceived. Proponents of the insider/outsider theory (for example, Eakes 2007) point to the use of adjustable-rate mortgages (ARMs) as evidence of deception. According to the theory, lenders used mortgages with deceptively low initial payments to lure borrowers into mortgages

Table 3. Payment Changes and Default, 2007–10

	2007	*2008*	*2009*	*2010*	*All*
FRM share (percent)	38	48	62	74	59
Payment changes (percent of loans eventually foreclosed upon)[a]					
Interest rate reset	18	20	18	11	17
Payment increase	12	17	11	9	12
Payment reduction	0	0	4	8	4
No change since origination	88	82	85	83	84
Private label (percent of loans)	68	54	37	23	41
No. of observations (thousands)	374	641	874	756	2,646

Source: Foote and others (2012).
a. Only those changes that occurred before delinquency spell that led to foreclosure are counted.

they ultimately could not afford. But my table 3 shows that ARMs could have played only a small role in causing the crisis, because the vast majority of borrowers defaulted while making payments that were the same or lower than the initial payment on the loan. Table 3 shows that whereas the performance of subprime ARMs was appalling, that of subprime fixed-rate mortgages was almost as bad.

But evidence against a theory is not necessarily evidence in favor of the alternative. If borrowers did not take out the loans because of unrealistically low initial mortgage payments, why did they take out loans they ultimately could not afford? The present paper provides an answer: like investors, they were incredibly optimistic about home prices. Figure 4 of the paper shows that in the key years of the boom—2004 and 2005—homebuyers expected home prices to rise by about 12 percent on an annualized basis.

Putting such beliefs into standard portfolio choice models yields exactly the sort of behavior that was observed. Equation 29 of Merton (1969), for example, shows that the share of wealth invested in the risky asset equals

$$\omega^* = \frac{1}{RRA} \times \frac{\mathrm{E}\left(\tilde{R}\right) - R_f}{\sigma\left(\tilde{R}\right)} \tag{1}$$

where R is the return on the risky asset, R_f is the risk-free rate, and RRA is the coefficient of relative risk aversion. Case and coauthors document that for housing, $\mathrm{E}(\tilde{R})$ rose dramatically, and in particular, came to be highly elevated relative to the relevant R_f, the mortgage rate.

Table 4. Relative Performance of Subprime Adjustable-Rate and Fixed-Rate Mortgages, 2005–07

	All subprime mortgages		*Subprime fixed-rate mortgages*			*Subprime adjustable-rate (2/28) mortgages*[a]		
Year	*Originations (thousands)*	*Percent defaulting*	*Originations (thousands)*	*Percent of all subprime mortgages*	*Percent defaulting*	*Originations (thousands)*	*Percent of all subprime mortgages*	*Percent defaulting*
2005	529	41.9	198	37.3	37.1	332	62.7	44.8
2006	504	55.9	258	51.2	50.7	246	48.8	61.4
2007	246	55.9	208	84.5	53.8	38	15.5	66.8
Total	1,278	50.1	663	51.9	47.6	615	48.1	52.8

Source: Foote and others (2012), using data from Lender Processing Services, Inc.

a. In a 2/28 mortgage, the interest rate remains constant for the first 2 years and then adjusts periodically over the remaining 28 years of the mortgage.

To see how this would lead to an explosion in leverage, remember that ω* is the share of *total wealth* defined as the sum of financial and human wealth. In other words,

$$\omega^* = \frac{\text{investment in risky assets}}{\text{total wealth}} = \frac{\text{investment in risky assets}}{\text{financial wealth + human wealth.}}$$

As $E(\tilde{R}) - R_f$ goes up, investment in the risky asset grows relative to financial wealth, and at some point the only way for the household to hit its target investment level is to start borrowing against its human wealth. In other words, changing beliefs about home price appreciation are all that is need to explain the rise in mortgage debt.

The bubble explanation, of course, leaves many questions unanswered. Why did such optimistic beliefs emerge? How do households form such beliefs? To understand the crisis, researchers must focus to some extent on the measurement and modeling of beliefs and on the typical work of economists, the measurement and modeling of behavior. To some degree the shift to research on beliefs has already happened: arguably, it has been going on ever since the rational expectations revolution in macroeconomics in the 1970s. One strand of the literature that has emerged in the wake of the crisis describes the phenomenon in the housing market in the boom years as "distorted beliefs."[1]

Let me conclude by suggesting some directions for future research. Case, Shiller, and Thompson's survey asks households about the first moment of their expectations, but the second moment is also important to most home purchase and default decisions. One can think of a mortgaged home as a call option: the borrower "sells" the house to the lender and gets an option to buy it back by repaying the outstanding balance of the loan. As any finance student can explain, the volatility of the underlying asset is the key to the valuation of this option. If one believed that home prices were equally like to rise by 20 percent or fall by 20 percent in 2005, then a mortgage allowed one to enjoy the upside and to default on the downside—which, indeed, millions of Americans did.

1. See, for example, Gennaioli and Shleifer (2010), Simsek (2012), Fuster, Laibson, and Mendel (2010), Geanakoplos (2009), and Cheng, Raina, and Xiong (2012).

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GENERAL DISCUSSION Karen Pence observed that in the typical residential real estate transaction, many people—the realtor, the mortgage lender, the title insurer, and others—have a financial incentive in seeing the transaction go through, but no one profits directly if it does not. As a result, potential buyers may hear more about the benefits of homeownership than the risks. It therefore seemed to Pence unsurprising that unrealistic beliefs about future home price appreciation could persist.

To Frederic Mishkin the authors' own charts suggested that the problem of respondents anchoring on the expected 1-year price appreciation rate when answering the question about the 10-year rate was even greater than David Laibson feared. He himself had seen signs of such anchoring in responses about long-term inflation expectations in the University of Michigan survey and therefore tended to ignore those data. Mishkin acknowledged that the authors' expectations data, especially the short-term data, could still be of some value to the extent that people acted on the basis

of their irrational expectations, but he felt the measurement problem needed further study. Justin Wolfers pointed out that in the latest Michigan survey, many of the answers even about short-term inflation made no sense either: 10 percent of respondents thought that inflation would exceed 10 percent in the next year, and some believed it would be 40 percent or more. That indicated either that many respondents are profoundly economically illiterate, or that they were not giving serious answers.

Bradford DeLong wished that the authors' survey had focused on the expectations of the marginal homebuyer—the household right on the edge between buying and not buying—rather than on those of the average buyer. One thing he took away from the study, however, was that even today, in the wake of a major housing bust, many people remain overoptimistic about home prices, which suggested to him that there will always be homebuyers who are overoptimistic about home prices. That, together with Pence's point about the bias of third parties' incentives toward completing the transaction, argued in DeLong's view for greater attention to credit standards as an essential governing mechanism.

Ricardo Reis proposed that the authors address the problem of irrational price expectations either by trimming the outliers further or by focusing on the median rather than on the trimmed mean responses. Whatever measure of central tendency the authors chose, he thought they should discuss the reasons for that choice in the paper. He himself had looked at a number of surveys of expectations of various kinds—of stock prices, for example, as well as inflation—and found that in most cases the median response of the general public is in line with the median response of professional analysts. The difference is in the dispersion: whereas the analysts' answers are usually tightly distributed, typically at least 25 to 30 percent of the lay respondents give answers that are off the chart. Therefore, simply trimming 10 percent from the tails of the distribution and calculating the trimmed mean will still give biased results.

Replying to Paul Willen on the role of incorrect beliefs in forming bubbles, Reis observed that an important lesson from attempts to model bubble formation is that buyers with optimistic beliefs need to be matched with sellers with more pessimistic beliefs; the model needs to capture not so much those beliefs that are extreme as the full dispersion of beliefs. He therefore urged the authors to include in the paper an analysis of some measure of disagreement among respondents.

William Brainard thought it important to distinguish between new and existing homes when discussing home prices and price expectations, both because the factors that affect the prices of the two types of homes differ,

and because the two types differ in the way changes in their prices affect output. New home prices primarily reflect construction costs and the price of undeveloped land; changes in new home prices, in turn, affect housing construction, a direct contributor to GDP and source of jobs, but have minor effects on household wealth. Changes in existing home prices, in contrast, have major effects on household wealth, and therefore on consumption, but in cities like Boston and San Francisco these price changes primarily reflect changes in the shadow price of land rather than construction costs. They have only indirect effects on incentives to build new homes on undeveloped land at the periphery. Since the factors that would be expected to affect home prices differ, Brainard thought it would be interesting to report separately the results for the expectational behavior of buyers of the two types of homes. He also thought it would be interesting to compare the expectations of buyers and sellers in the resale market with those of buyers and speculative builders in the new home market.

Robert Hall was impressed with the case Paul Willen had made that the finance industry during the housing boom was not recklessly throwing money away, as is often alleged. It seemed that the underwriting of mortgage-backed securities during that period had been careful and rational after all, using probability distributions just as prescribed by state-of-the-art decision theory. The problem was that when the analysts wrote down the distribution, they assigned only a tiny probability to a price decline, and then the model's undoing was simply an unbelievably unlucky draw from the that distribution: the sudden collapse in home prices across the United States. Under no principle of economics, Hall concluded, were the underwriters following the wrong decisionmaking procedure. From a longer historical perspective, it seemed likely that they understated the probability of a large price decline.

On the question of trimmed means versus medians, Hall suggested instead using quantile regressions so as to capture the characteristics of the whole distribution, as he had done in a forthcoming paper in the *American Economic Review*. He thought the most interesting approach here would be to analyze the joint distribution of the 1-year and 10-year price expectations.

Steven Davis saw the paper as an important effort at the frontier of developing a more extensive collection of data about the beliefs of economic agents. The evolution of beliefs during the housing boom and subsequent crisis was central to the theory of the crisis that Willen had sketched out, and Reis had noted that a number of interesting theories stress the dispersion of beliefs in explaining what happened. Yet, Davis observed, the federal statistical agencies devote almost no resources to

eliciting information about beliefs. Data from nongovernmental sources on business and consumer sentiment are available but often difficult to interpret. The profession, in Davis's view, was a long way from having data sets equal to the task of evaluating the theories that Reis had described, or of understanding the beliefs of DeLong's marginal buyer. A particular need was for data matching the beliefs of individuals with their demographic and other objective characteristics. The federal government or the Federal Reserve, Davis thought, was surely in by far the best position to take on these tasks.

Nellie Liang saw the paper as supporting the idea that the formation of expectations matters for understanding economic behavior, and she suggested that this was true not just of households buying homes but also of sophisticated participants in equity markets. During the dot-com bubble, for example, many equity analysts held views about the future long-term growth of technology firms that seemed to mirror the expectations reported in the authors' survey. That indicated to her that it might be worth investigating whether there was some sort of commonality in how these expectations are formed. Unfortunately, information about these expectations is difficult to obtain in real time. Liang also was interested in knowing to what extent expectations correlated with lending standards, because the most costly bubbles tend to be those whose aftermath involves the widespread unwinding of leverage.

Christopher Carroll agreed that there is a scarcity of data of the kind that would yield insight into how beliefs are formed, and he surmised that macroeconomists have tended to shy away from developing models of belief formation in part because of this lack of data. He pointed out, however, that some data useful for that purpose were available, in the Michigan survey and elsewhere, yet were not being fully exploited. He thought it would be worth investigating what these data could say about expectations and their formation, so that economists doing empirical research are not limited to the unsatisfying choice of simply accepting or rejecting the standard rational expectations model. Indeed, Carroll saw the study of belief formation as a potential growth area for macroeconomics.

Laibson's point about long-term reversion to the mean in asset price series reminded Carroll of a 1996 paper by Shiller and John Campbell about mean reversion in stock price-earnings ratios—that was the paper that seemed to have inspired Alan Greenspan's speech invoking "irrational exuberance" a few weeks later. Carroll had recently returned to Shiller and Campbell's model to see what level of stock prices it would have predicted for October 2008, shortly after the Lehman Brothers meltdown: he found

that the 1996 model predicted prices on that date almost perfectly, after being wrong for the whole intervening period. That, to Carroll, suggested that this was the kind of model that one ought to be investigating for this set of issues.

Robert Pozen offered further evidence that a large part of the general public lacks an understanding of basic financial concepts: surveys by the investment community have found, he said, that half of all individual investors think that bond prices rise when interest rates rise. Given the importance of mortgage interest rates in home buyers' decisions, Pozen suggested that the authors add some questions to their survey aimed at determining the respondents' understanding of the relationship between prices and interest rates.

David Laibson seconded Hall's call for studying whole distributions rather than some single measure of central tendency, but with a caveat in this case. The authors' data on long-term expectations consisted not of a single outcome—the answer to a particular question—with some noise. Rather, two-thirds of the data were answers to one question, and one-third the answer to a different question, and any model used to analyze such a data set needed to take that into account.

Benjamin Kay suggested that the noise in the data might be reduced by adding questions about the opinions of the respondents' friends and family members, as Wolfers had done in some recent work. In the face of a declining response rate, such a strategy might boost the information that could be elicited for a given sample size.

Gerald Cohen wondered whether part of the problem in analyzing people's beliefs about the housing market was that a home is both an investment and a consumption good. Changes over time in the degree to which individual respondents purchase homes primarily for investment or primarily for consumption, he surmised, could result in substantial shifts in observed expectations about price appreciation. Cohen noted that the various official inflation measures themselves differed on this score, with the PCE deflator treating housing more as consumption whereas the CPI, with its concept of owner's equivalent rent, treated it more as investment.

Responding to the discussion, Karl Case began by noting that although the responses to the question on expected 10-year home price appreciation seemed problematic, they were consistent across the four cities surveyed. Moreover, the expectations of the California respondents of a 10-year average appreciation exceeding 10 percent a year were not completely unreasonable given that state's history of home prices: prices there had risen at an annual average rate of 10.6 percent from 1996 to 2006, and

at a similar rate in the earlier boom from 1975 to 1985. Prices had risen by more than 10 percent a year in several other cities around the nation as well. Of course, real returns in the earlier period were much smaller because of the high inflation of the time, but Case stressed that whereas economists focus on real prices, participants in the real estate market tend to focus on nominal values. This, too, was not unreasonable, because mortgages are denominated in nominal terms.

Case went on to note that people often forget just how hot the housing market was between 2002 and 2006. In Orange County in 2003, for example, homebuyers expected prices to rise by a (trimmed) average of 11.5 percent annually. And in 2000 and 2001 prices had actually rose by 11 percent and 10 percent, respectively. But then things changed: actual price increases for Orange County were 17 percent in 2002, 20 percent in 2003, 28 percent in 2004, and 21 percent in 2005. Long-term expectations as measured in the survey peaked in 2004 at 17 percent, which seemed unreasonable to Case and his colleagues, but the market at the time was witnessing even faster growth.

Finally, Case remarked that little research has been done into the interaction of the home ownership and home rental markets on the supply side. It seemed to him that prices are determined in very different ways in the two markets: whereas rental housing is priced on the basis of capitalization rates and revenue flows, home purchase prices are largely driven by buyers trying to figure out how large a mortgage they can obtain or afford.

Robert Shiller pointed out that whatever problems lay in the 10-year price expectations data, the changes observed in those expectations over time should still be instructive, because the questions remained the same every year. In fact, the pattern for the 10-year expectations differed over time from that for the 1-year expectations, the former being significantly more sluggish. Shiller cited his book *Animal Spirits,* co-written with George Akerlof, as providing evidence that although people's expectations about the distant future matter enormously, those expectations are fuzzy and are not captured well by any existing forecasting model. He acknowledged that the survey questions might have been better worded in retrospect, and additional questions such as about the opinions of friends and family, as suggested by Kay, might be worth adding, but in principle the attempt to elicit 10-year price expectations was worth undertaking. He and his coauthors had considered changing the wording of some questions before the most recent survey but felt that doing so would cloud the interpretation of the results.

Replying to DeLong's suggestion to focus on the marginal home buyer, Shiller thought that by surveying only households who had recently purchased a home, he and his coauthors were coming as close to the marginal buyer as one reasonably could.

Finally, Shiller was intrigued by Hall's proposal that the authors use quantile regressions in analyzing their data set, but the balance of the discussion led him to think that their first approach in revising the paper should be to further trim the tails of the distributions. He pointed out that Reis's suggestion to use the median instead of the mean was equivalent to trimming 50 percent of the distribution from each tail. The problem with using the median in this survey, however, was that because many people give answers in round numbers, the median tends to stick at one such number from year to year and any movement in the central tendency gets lost.

Anne Thompson provided some detail on how she had trimmed the data. In one version she simply trimmed the top and bottom 10 percent of responses, which resulted in the mean response for the 1-year expectation declining 0.2 percentage point and the annualized 10-year expectation falling by about 1.0 percentage point, but the overall pattern was otherwise the same. Alternatively, she looked at the responses one by one to identify extreme outliers and obvious misreadings of the question. Specifically, she discarded any response that exceeded 40 percent, and where the 10-year expectation was a 10-fold multiple of the 1-year, she changed the former to equal the latter. This procedure lowered the mean response by about 0.9 percentage point but again did not alter the pattern.