Physical Health Effects of the Housing Boom: Quasi-Experimental Evidence From the Health and Retirement Study

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Objectives. We examined the impact of the dramatic increases in housing prices in the United States in the 1990s and early 2000s on physical health outcomes among a representative sample of middle-aged and older Americans.

Methods. Using a quasi-experimental design, we exploited geographic and time variation in housing prices using third-party valuation estimates of median single-family detached houses from 1988 to 2007 in each of 2400 zip codes combined with Health and Retirement Study data from 1992 to 2006 to test the impact of housing appreciation on physical health outcomes.

Results. Respondents living in communities in which home values appreciated more rapidly had fewer functional limitations, performed better on interviewer-administered physical tasks, and had smaller waist circumference.

Conclusions. Our results indicate that increases in housing wealth were associated with better health outcomes for homeowners in late middle age and older. The recent sharp decline in housing values for this group may likewise be expected to have important implications for health and should be examined as data become available. (*Am J Public Health.* 2013;103:1039–1045. doi:10.2105/AJPH.2012.301205)

The boom and bust in US housing markets over the past decade has been unusual in size and scope.[1] These price fluctuations may have important health impacts, especially for homeowners around retirement age. By the early 1990s, more than 80% of Americans who came of age in the aggressively pro–homeownership policy environment of the midcentury lived in owner-occupied homes.[2] These Americans will be relying on their wealth to support them in retirement; for many of them, housing equity represents the largest and most important component of their wealth portfolio.[3]

We explored the health impacts of housing price increases during the 1990s and early 2000s on middle-aged and older US adults using a quasi-experimental empirical strategy that takes advantage of geographic differences in housing market price trends. The real value of houses increased during this period for the vast majority of our sample, translating directly into wealth accumulation for these homeowners just as they were approaching retirement age. Housing bubbles nationwide began imploding about a year after the end of our follow-up period.[4]

Predicting a priori whether changes in housing wealth would have any significant impact on health or well-being is difficult. On one hand, rising housing wealth might be inconsequential to consumption and welfare if homeowners cannot easily access that wealth.[5] On the other hand, housing wealth accumulated by late middle age may occupy a special place in homeowners' wealth portfolios, serving as an important buffer against negative economic shocks later in life [3,6,7] Even for homeowners who are not intending to sell their houses soon, rates of appreciation can still influence economic prospects[8,9]—and, in turn, health and well-being. Important unanswered empirical questions remain about the health impacts of changes in housing wealth.

METHODS

Our approach addresses a key challenge generic to identifying health effects of wealth—namely, that the propensity to gain or lose wealth may be correlated with individual characteristics also related to health, leading to unobserved confounding and misestimation of causal effects in observational studies. Quasi-experimental designs aim to leverage arguably exogenous variation in the exposure of interest. Specifically, we used variation in prices across time and space as our exposure, based on the identifying assumption that baseline house prices reflect both current home and neighborhood quality as well as expectations, because markets create incentives for many independent actors to build expectations about the future price of an asset into its current price, allowing long-run price changes to be driven mostly by new information as it arrives. For housing, this means that a group of houses in the same metropolitan area priced similarly at baseline should have similar expected appreciation over a long period of time. In such a group, buyers and sellers would believe *ex ante* that any positive realization is equally likely for any house; *ex post,* those houses that appreciate more were "lucky" in the sense that they were the ones in the group to benefit from unforeseen external factors (such as rezoning, a significant new employer, or other local improvements) that took effect during follow-up and contributed to higher than expected appreciation or they were the ones that were spared from unforeseen factors (such as firm closings, a crime wave, or mismanagement of local schools) that prevented the others from fulfilling their promise. The key implication of this assumption is that differences in wealth accumulation within such a group are as if randomly assigned, and thus houses in the same area that were priced similarly at baseline but appreciated less are a good control group for those that appreciated more. Research in the housing economics literature has suggested that the housing market is not necessarily efficient in this sense over short periods of time,[10] so we used a set of placebo regressions to verify its validity over

our long follow-up period, in which we tested whether housing price appreciation can predict baseline characteristics of homeowners whose houses are priced similarly at baseline. If it cannot, we gain confidence that using the housing market in this way provides a valid quasi-experiment.

Data

All individual-level information came from the Health and Retirement Study (HRS). Estimates of housing values come from DataQuick, a California-based real estate consultancy firm.

The HRS began in 1992 as a biennial longitudinal study of US adults born from 1930 to 1941 and their spouses; in 1998, it expanded to cover those born from 1924 to 1947 and their spouses. The primary objective of the HRS is to examine economic and health causes and consequences of retirement; it includes detailed modules on debt, income, wealth, and housing. Respondents reported whether they owned their housing and some basic information about the dwelling unit itself. Data were also collected on demographic characteristics (age, gender, race/ethnicity, educational attainment) and self-reported physical health and functioning. In 2006, the questionnaire was expanded with a special biomeasures supplement, which included physical measurements for a randomly selected half of the sample. We use geocoded information on respondents' residential location at the zip code level, available under restriction.

DataQuick is a private-sector real estate consulting firm that applies a proprietary analytical approach to public data on house sales to estimate the market value of residential properties; they sell their estimates to private-sector, for-profit clients including lenders and real estate investors. We purchased a dataset of estimates of the value of median single-family detached houses over the period 1988–2007 in each of 2400 zip codes in which HRS respondents were residing at the time of their baseline interview. We cross-checked DataQuick's estimates against the S&P/Case-Shiller Home Price Index, which is a highly respected source of similar information.[11] Where they overlap, the 2 sources are very highly correlated (results available on request).

Sample

Our main analytical sample consisted of 4207 homeowners born between 1924 and 1960. Baseline interviews were completed in 1992 for 2964 of these respondents, who were in the original core HRS sample at the inception of the study. For the remaining 1243 respondents, baseline interviews were completed in 1998, when the study expanded its sample. Our follow-up period for all respondents ended in 2006. Self-reported outcomes were available for all 4207 respondents.

We also analyzed several measured outcomes from the 2006 biomeasures supplement, which were available for a total of 1985 homeowners. In follow-up analyses, we also expanded the sample to include the 713 HRS-respondent renters in the same birth cohorts who lived in the same type of housing and in the same zip codes as our main sample. The biomeasures supplement was administered to 350 of these renters.

Health Outcome Measures

Limited capacity for activities of daily living was scored as 1 if the respondent indicated that he or she was not able or was able with difficulty to carry out any of the following tasks: walking a few blocks; jogging a mile; sitting for 2 hours; rising after sitting for a long period; climbing stairs without resting; extending his or her arms above shoulder level; stooping, kneeling, or crouching; pulling or pushing large objects such as a living room chair; lifting or carrying loads weighing more than 10 pounds such as a heavy bag of groceries; or picking up a dime from a table. Incident cardiovascular disease was scored as 1 if a respondent answered "yes" to the following question: "Has a doctor ever told you that you had a heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems?" (restricted to those who had answered "no" to the same question at baseline). Peak expiratory flow (L/min) was the average of 3 measurements taken 30 seconds apart, using the Mini-Wright Peak Flow Meter (Clement Clarke International, Harlow, United Kingdom). Success in full-tandem balance test was scored as 1 if the respondent successfully completed the full-tandem stand (30 seconds for respondents aged 65 years or older, 60 seconds for respondents younger than 65 years). Timed walk was measured continuously as the average of 2 times required to walk a 98.5-inch course. Only respondents aged 65 years and older were eligible to participate in the timed walk task. About 5% of those eligible did not participate in the task at all because they were unable to walk that distance safely; therefore, we treated participation in the timed walk as a health outcome in itself. Waist circumference was measured in inches at the level of the navel. Diastolic and systolic pressure (mm Hg) were the average of 3 readings taken 45 seconds apart.

Analysis

We ran separate regressions for each 2006 health outcome. Our exposure variable was the (natural logarithm of) home values in 2006, as estimated by DataQuick. All of our analyses restricted comparisons to individuals in the same metropolitan area. Housing markets are highly segmented; thus, we took this conservative approach to ensure that our results would not be driven by comparisons between homeowners in different cities. Because the decision to move over the follow-up period would likely be associated with the unobserved characteristics we were trying to control with our design, we used an intent-to-treat approach, which deliberately did not distinguish those who stayed in the same home from those who moved.

All models included controls for the following characteristics:

- home value at baseline, as estimated by DataQuick (logged and splined, with notches at the 10th, 25th, 50th, 75th, and 90th percentiles),
- dollar value of total nonhousing wealth at baseline (logged and splined, with notches at the quartiles),
- share of housing equity at baseline, which is a measure of housing debt (indicators for equity stake amounting to less than two thirds of the purchase value of the house and less than the full purchase value of the house),
- nonhousing debt at baseline (indicators for none, more than a fifth, or more than three quarters of total nonhousing wealth), and
- indicators for self-rated health at baseline, metropolitan area of residence at baseline, birth year, race, gender, and study cohort.

Given the inclusion of our controls for house valuation at baseline, the coefficient on house valuation in 2006 indicates the effect of the appreciation in home values over the follow-up period. Algebraically, our regression specification was a more flexible version of one that has average annual growth as the exposure.

To begin to untangle the effects of wealth accumulation from local changes that may have driven housing appreciation, we stratified our main analyses on the basis of the fraction of respondents' wealth (> 95% or < 95%) that was represented by their houses at their baseline interview and by owners versus renters. We hypothesized that wealth effects would be stronger for those whose portfolios were weighted more heavily toward housing wealth, whereas health effects driven by local improvements would be felt more uniformly.

Finally, we tested the validity of our identifying assumption by estimating a series of placebo regressions in which the outcome was a respondent characteristic from the baseline year. Our identifying assumption would imply that in these regressions, the parameter estimate for 2006 housing valuation should be zero.

RESULTS

Table 1 shows descriptive statistics for our sample. Similarity between the main and external measures samples suggests that the HRS was successful in including a randomly selected subsample in the 2006 biomeasures supplement, with some evidence that the supplement might underrepresent the very wealthiest and most asset-poor respondents. The median owner-occupied house doubled in nominal value over the follow-up period. According to the Consumer Price Index, prices of consumer goods increased by only 43% over the same period (http://www.bls.gov/cpi). The importance of housing wealth is also illustrated; the median homeowner in the sample had about $250 000 in net assets at the time of their baseline interview, of which about 77% was embodied in their house. Almost all of the remaining 23% was accounted for by financial instruments such as stocks, bonds, retirement accounts, and cash savings.

Table 2 shows results of our regression models for all physical health outcomes. In this sample, 10% of homeowners experienced average housing price growth rates of 3% per year or slower, and 90% experienced growth rates of 13% per year or faster. For 2 houses priced similarly at baseline, if one experienced the growth rate of the 10th percentile and the other that of the 90th percentile, then by the end of a decade the difference between their log values would be 1. Therefore, throughout this discussion, the parameter estimates in the tables are reported as representing a comparison of the predicted effect of a decade of housing wealth growth at the 10th percentile versus a decade at the 90th percentile.

More than three fifths of respondents reported a functional limitation of some kind in 2006. An increase from the 10th to the 90th percentile in terms of housing price appreciation significantly reduced that likelihood by about 6.3 percentage points. The association appears strongest for owners with less than 95% of their wealth portfolio in their house; for renters, faster increases in housing prices were associated with greater likelihood of functional disability. However, the differences in these estimated effects across the strata were not statistically distinguishable from zero.

Externally measured functional capacity showed a pattern consistent with the self-reports. Those respondents experiencing greater housing appreciation were better able to complete the balancing task successfully. Overall, about 53% of the sample was able to maintain their balance for the full allotted time; moving from the 10th to the 90th percentile in terms of housing price appreciation increased that probability by 10.4 percentage points.

Nonparticipants in the timed walk assessment (about 5% of those eligible) most frequently cited being unable to walk the requisite distance safely as the reason that they did not participate. The probability of a homeowner suffering this major functional limitation was cut in half at the 90th percentile in terms of housing price growth, compared with the 10th percentile. Walking speed among those who did participate—a positively self-selected sample—was not associated with the rate of growth in housing wealth. Price appreciation was also significantly associated with lung capacity among those whose wealth portfolios were most reliant on their houses but was not significant for the overall sample.

Turning to cardiovascular risk factors, faster growth in housing wealth was associated with decreased abdominal obesity. The average man in the sample had a waist circumference of 41.3 inches; the average woman, 37.6 inches. Moving from the 10th to the 90th percentile in terms of housing appreciation decreased waist circumference by 1.2 inches for homeowners. In terms of the point estimate, price appreciation had the opposite effect on renters; however, the effect on renters was not statistically significant at traditional confidence levels. Analyses of body mass index (defined as weight in kilograms divided by the square of height in meters) indicated similar associations (available on request); waist circumference may better measure adiposity for this population.[12,13] We found no significant associations for average measured blood pressure or the risk of incident cardiovascular disease.

Table 3 shows results from our placebo regressions. Of the 15 baseline health outcomes, 1 showed a significant association with price growth at the 5% level. For self-reported expectations at baseline, 2 of the 7 were statistically significant. This finding may be random chance, or it may indicate that those in more rapidly appreciating neighborhoods had started out more optimistic about their economic prospects. Adding these significant characteristics as additional controls had no effect on the regression results in Table 2, up to the third decimal place. We interpret these findings as supporting our identifying assumption that, conditional on the controls in our main analyses, housing appreciation is not correlated with individual characteristics and thus slower appreciating houses represent a valid control group for faster appreciating ones.

DISCUSSION

The potential health effects of the dramatic housing market volatility over the past 2 decades are of increasing public health interest.[14,15] We found evidence that long-run changes in housing prices had an impact on several functional health outcomes for US adults in late middle age and older. Homeowners who lived in more rapidly appreciating communities had lower waist circumference and higher levels of self-reported and measured physical functioning compared with those who

TABLE 1—Analytical Sample Descriptive Statistics: DataQuick Valuation Estimates, 1988–2007; Health and Retirement Study, 1992–2006; United States

Variable	Main Sample		External Measures Sample	
	Owners (n = 4207), Median (IQR), Mean (SD), or %	Renters (n = 713), Median (IQR), Mean (SD), or %	Owners (n = 1985), Median (IQR), Mean (SD), or %	Renters (n = 350), Median (IQR), Mean (SD), or %
House price at baseline, thousands of $	112.5 (77.0–151.9)	107.8 (75.5–150)	112.8 (76.5–150)	108 (74.5–154)
House price in 2006, thousands of $	225 (150–355)	260 (170–425)	225 (150–342.5)	260 (165–430)
Housing equity at baseline, %	84 (50–100)		85 (53–100)	
Nonhousing wealth at baseline, thousands of $	58 (10–184)	2 (0–20.3)	61.5 (11–171.2)	1.2 (0–22.4)
Nonhousing debt at baseline, $	0 (0–2500)	0 (0–2500)	0 (0–2000)	0 (0–2500)
Birth year	1938 (6.8)	1938 (5.9)	1937 (7.0)	1938 (5.5)
Education				
> 12 yr	51.2	34.8	50.7	32.3
< 12 yr	14.6	31.6	15.5	33.1
Gender, race, ethnicity				
Male	43.7	39.1	45.2	36.6
White	85.2	64.8	85.7	64.9
Latino/Latina	5.6	16.1	5.4	16.3
Health behaviors at baseline				
Regular exercise	58.4	46.4	56.8	41.1
Ever smoked	59.9	64.1	58.5	65.7
Self-rated health at baseline	Very good (good–excellent)	Good (fair–very good)	Very good (good–excellent)	Good (fair–very good)
ADL difficulties at baseline, % reporting “yes”	40.0	46.7	39.6	46.3
Diagnosed hypertensive at baseline, % reporting “yes”	10.1	12.3	10.1	10.9
Outcome Variables (2006)				
ADL difficulties, % reporting “yes”	65.4	71.0		
Diagnosed CVD, % reporting “yes”	24.8	26.9		
Lung capacity (L/min)			347.2 (127.5)	294.8 (121.9)
Waist circumference (in)			39.3 (5.6)	40.0 (5.7)
Time to walk 98.5 in (seconds), % participating[a]			3.49 (1.72) 94.9	3.78 (1.45) 81.3
Success in balancing task,[b] % successful			54.0	45.4
Diastolic/systolic blood pressure, mm Hg			131.3/79.1 (19.7/11.2)	134.4/80.6 (21.2/12.9)

Note. ADL = activities of daily living; CVD = cardiovascular disease; IQR = interquartile range.
Source. Rows 1 and 2: DataQuick; rows 3–19: Health and Retirement Study.
[a]Only those aged 65 years and older were included in the timed walk sample (1376 homeowners, 333 renters).
[b]Because of incomplete interviews, 80 homeowners and 16 renters are missing from the full balance sample.

TABLE 2—House Price Change and Physical Health Outcomes in 2006: Health and Retirement Study, United States

Outcome Variable	All Homeowners	Stratified on % of Total Wealth Portfolio in Housing		
		95%–100%	1%–94%	0% (Renters)
Functional health outcomes				
ADL difficulties, % yes				
b (SE)	−6.3 (3.2)	−3.5 (5.8)	−7.1 (3.9)	5.6 (6.4)
P	.05	.55	.07	.38
Full balance, % yes				
b (SE)	10.4 (4.0)	13.9 (12.3)	10.3 (4.4)	−3.6 (10.6)
P	.01	.26	.02	.73
Able to attempt timed walk				
b (SE)	6.2 (3.2)	3.5 (12.3)	5.9 (2.9)	−10.8 (12.6)
P	.05	.78		.39
Timed walk, participants only, s				
b (SE)	−0.07 (0.16)	−1.3 (0.83)	−0.03 (0.19)	0.22 (0.60)
P	.66	.14	.89	.71
Lung capacity, peak flow, L/min				
b (SE)	−0.75 (10.4)	53.8[a] (29.1)	−5.5 (11.8)	−45.7 (26.1)
P	.94	.07	.64	.08
Cardiovascular risk outcomes				
Waist circumference, in				
b (SE)	−1.2 (0.63)	−1.8 (1.7)	−1.2 (0.63)	1.3 (1.4)
P	.06	.3	.07	.36
Incident CVD				
b (SE)	−1.0 (2.9)	−6.2 (7.9)	1.1 (3.3)	3.7 (6.7)
P	.73	.44	.74	.58
Systolic BP (mm Hg)				
b (SE)	1.8 (2.3)	2.1 (7.6)	3.2 (2.5)	−7.4 (6.0)
P	.42	.88	.2	.22
Diastolic BP (mm Hg)				
b (SE)	0.55 (1.3)	2.4 (4.3)	1.3 (1.4)	−3.3 (3.8)
P	.67	.58	.38	.38

Note. ADL = activities of daily living; BP = blood pressure; CVD = cardiovascular disease. Parameter estimates are log of 2006 house price and can be interpreted as the change in the outcome associated with moving from the 10th to the 90th percentile in terms of housing price appreciation. Standard errors are robust to heteroskedasticity, with clustering at the zip code level. Other covariates include house price at baseline, house price in 2006, housing equity at baseline, nonhousing wealth at baseline, nonhousing debt at baseline, birth year, education, sex, race, ethnicity, health behaviors at baseline, self-rated health at baseline, activities of daily living at baseline, and diagnosed hypertensive at baseline.
[a]Different from the 1%–94% column at $P < .05$.

lived in communities in the same metropolitan area that were more price stagnant. Results indicate that most of these effects were graded; estimated effects on owners were generally larger than those on renters, which may suggest that direct wealth effects are important beyond the local improvements that drive the price appreciations.

To our knowledge, this study is the first to use a quasi-experimental approach to estimate the effects of increases in housing wealth on physical health. Two articles have used such designs to examine the health consequences of changes in non-housing wealth. Meer et al. analyzed the impact of inheritance on self-reported health in the Panel Study on Income Dynamics, and found no association.[16] Interpretation of these findings is complicated in part by challenges inherent to analysis of self-reported health.[17,18] Furthermore, although the precise timing of inheritance may be quasi-random, individuals are likely to be able to anticipate it—so it may have effects even before it is observed in data—and its magnitude is likely related to other individual characteristics; these dynamics would generate residual confounding of the observed relationships.

Changes in asset prices may provide a more compelling source of quasi-random variation in wealth. Using an approach closely related to ours, Smith[19,20] examined health effects of changes in stock wealth during the 1990s, using data from the HRS and Panel Study on Income Dynamics and finding only very modest health effects. One key difference between this approach and ours is that detailed stock portfolio composition was unobserved in the data; therefore, it is impossible to distinguish empirically between 2 very different circumstances: (1) total wealth changed because stock that an investor held initially became more valuable or (2) total wealth changed because an investor reacted to changes in stock prices by changing his or her investments. This distinction is important because the former source of change in asset wealth is plausibly quasi-random, whereas the latter is almost certainly not. Housing wealth does not suffer from this problem—knowing the homeowners' address, we could isolate the change in their wealth portfolio specifically driven by a change in the price of their house. In fact, the effects we report here differ substantively from those reported by Smith. Another reason for this difference may be that housing wealth may play a different role than stock wealth. Home ownership may represent a form of precautionary saving, whereas financial capital may be more important as a source of nonlabor income. Comparing findings in this way across the literature may point the way for further research into health effects of different roles played by different forms of wealth.

The observed links between housing wealth and health may result from several different biological mechanisms. Housing wealth is an important buffer against economic shocks starting in late middle age, and as such may provide security and reduce stress for individuals and families in that stage of the life cycle[3,6,7] Additionally, an increase in wealth may directly affect consumption of health-

TABLE 3—Placebo Regressions—Baseline Outcomes and Subsequent Price Appreciation: Health and Retirement Study, United States, 1992–2006

Placebo	2006 Housing Valuation, ln (SE)	P (H_0: b = 0)
Baseline or prebaseline health outcomes		
ADL difficulties, % points	–2.8 (3.3)	.4
Diagnosed with CVD, % points	–2.1 (2.5)	.41
Diagnosed diabetic, % points	2.8 (1.7)	.1
Diagnosed hypertensive, % points	–10.0 (3.4)	< .01
Diagnosed lung disease, % points	0.3 (1.7)	.86
Diagnosed arthritis or rheumatism, % points	–0.9 (3.3)	.8
Diagnosed cancer, % points	–0.00 (1.5)	.99
Self-reported sight fair or poor, % points	1.0 (1.9)	.59
Uses a hearing aid, % points	0.4 (0.7)	.55
Correctly subtracted sevens 5 times, % points	5.2 (7.3)	.48
Recalled > 5 words after long delay, % points	4.4 (7.7)	.57
Recalled > 6 words after short delay, % points	9.5 (7.6)	.21
Height (measured in 2006), in.	0.09 (0.28)	.74
CAGE score > 1 (problem drinking or alcoholism risk), % points	2.7 (2.3)	.23
CES–D-8 score (depression), item count (0–8)	0.06 (0.09)	.48
Self-reported expectations (baseline)		
Rain tomorrow likely,[a] % points	–0.1 (2.4)	.97
Cost of living likely[a] to increase faster than income, % points	2.2 (2.8)	.43
Major economic depression likely[a] in the next decade, % points	–0.6 (3.7)	.88
Social Security payments likely[a] to decline, % points	3.1 (2.9)	.29
House prices likely[a] to grow faster than prices in general, % points	9.2 (4.3)	.03
Likely[a] to give help to offspring of ≥ $5000, % points	7.5 (3.6)	.04
Likely[a] to bequeath ≥ $10 000 to offspring, % points	5.7 (3.6)	.11

Note. ADL = activities of daily living; CAGE = "Cut down/Annoyed/Guilty/Eye Opener" inventory; CES–D–8 = Center for Epidemiologic Studies Depression Scale, 8-item instrument; CVD = cardiovascular disease.
[a]"Likely" means that the respondent rated the probability of the event happening as at least a 5 on a 10-point scale (0 = "absolutely no chance"; 10 = "absolutely certain").

promoting goods and services, including healthier food, leisure time, and preventive and curative health care. The specific pathways through which housing price increases improve health should be explored in detail. As previously discussed, we cannot distinguish pure wealth effects from health effects driven by local changes (such as positive changes in the labor market or local revitalization efforts). Improved local conditions could also improve health directly through channels such as improved access to good health providers and health-promoting improvements in the built environment. Although we have provided some preliminary explorations, further innovation will be necessary to disentangle the wealth effect of price change from the effects of changes in local conditions that drive these price changes.

Our use of externally assessed zip code–level housing price rather than individual-level self-reported home value data provided weaknesses and strength to our analysis. Use of zip code–level data reduced the power of our study but avoided some of the serious problems with self-reported home value data. First, homeowners could only self-report about their current homes, which would have excluded those who moved over follow-up from our analyses. Endogenous attrition of this sort would make it almost impossible to interpret results. Second, errors in the self-reported estimate of home values are likely to be correlated with health-relevant characteristics. For example, more optimistic individuals may be more likely to report higher estimates, introducing significant problems of confounding. Overall, we believe the advantages of the external valuations greatly outweighed their weaknesses.

One potential drawback to our study design is that housing markets have been observed to be less than perfectly efficient, especially over a short time span, which means that 2 houses with identical prices today do not necessarily have identical prospects in the very near future because it takes time for expectations to get built into prices. This time lag could potentially threaten our key identifying assumption—that is, controlling flexibly for initial housing prices would not be sufficient to ensure unconfounded comparisons. Nevertheless, we believe our follow-up period was long enough to minimize this concern; this belief was bolstered by the results of our placebo analyses and also by the fact that our results continued to hold even when we included additional controls for pre-baseline price trends (results not shown).

Although our study demonstrated important health impacts of medium-run appreciation in housing values, the impact of the sharp declines in recent years may be even larger.[21] The data needed to identify the health effects of the sharp declines over the past half-decade are only now becoming available.

Our results point to important policy implications for population health. The size and scope of swings in housing markets, and the impacts these swings have on Americans' later-life economic security, are amenable to policy. Recently, policy discussion has emerged over the advisability of continuing the past half-century of aggressive pro-homeownership policies.[22–24] Our results suggest that the often overlooked public health impacts of these policies should play a more prominent role in these discussions. ■

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Contributors

A. Hamoudi was responsible for the study design, data analysis and interpretation, and article preparation and

revision. J. B. Dowd was also responsible for the study design, interpretation, and article preparation and revision.

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Human Participant Protection

All data were secondary and nonidentifiable by the authors. The use of restricted geocoded Health and Retirement Study data was approved by the institutional review board of the University of Michigan.

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