Reverse Mortgage Collateral: Undermaintenance or Overappraisal?

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Abstract

Using information on mortgages insured by the Federal Housing Administration, this article examines the disproportionate decline in collateral values associated with reverse mortgages. Properties securing reverse mortgages sell at a sharp discount in foreclosure relative to similar properties securing forward purchase loans. This discount, however, does not increase over time as expected of depreciation related to property undermaintenance. Further, a similar discount is observed on forward refinance loans. An overestimate of the collateral value at origination, rather than subsequent level of property maintenance, may be responsible for greater-than-expected loss severities.

Introduction

Recent regulatory attention has been brought to the possibility of a moral hazard problem in the Federal Housing Administration's (FHA's) reverse mortgage insurance program. As the principal balance of a reverse mortgage approaches the value of the collateral (that is, the borrower's home equity is exhausted), the homeowner has less incentive to maintain the property. The dearth of regular home repairs and improvements may cause the value of the collateral to depreciate, magnifying losses for FHA. The U.S. Department of Housing and Urban Development (HUD) has proposed countering this misalignment of incentives with periodic property inspections. If the property is found to be in disrepair, the mortgage servicer could draw on any remaining reverse mortgage proceeds to cover property preservation expenses.

Higher-than-expected loss severities on reverse mortgage foreclosures, however, could also be the result of optimistic estimates of collateral value driven by exaggerated property appraisals when the loan was originated. Appraisers seeking future business have little incentive in

jeopardizing a loan closing by underestimating the collateral value, and borrowers are not constrained by the ability to repay a reverse mortgage, unlike a traditional forward loan. As a consequence, a moral hazard problem also exists at the outset of a reverse mortgage.

This article compares the prices of foreclosed properties with reverse mortgages against similar forward mortgages to examine differences in foreclosure discounts. The timing of these discounts may shed light on whether a collateral value issue exists and which moral hazard problem dominates. The results should help inform the best course of action to minimize losses in FHA's Home Equity Conversion Mortgage (HECM) insurance program.

Background

Assumptions about the future level of house prices drastically impact the projected losses on HECM books of business. For example, the update to Moody's forecast of the Federal Housing Finance Agency's (FHFA's) purchase-only repeat-sales house price index (HPI) used by the independent actuarial review in 2015 showed faster appreciation in the next 3 years followed by higher house prices in all future years compared with the 2014 forecast. The revised economic scenario increased the economic value of the HECM program in fiscal year 2015 by nearly $4.8 billion. For comparison, the overall economic value of HECM program in fiscal year 2015 was estimated to be less than $6.8 billion (IFE, 2015). Trends in national house prices, however, may not be representative of the collateral in FHA's reverse mortgage portfolio. Demand for reverse mortgages may vary by household and market characteristics associated with house price declines (that is, adverse selection), and obtaining a reverse mortgage may be associated with behavioral changes that compound such declines (that is, moral hazard).

Evidence of variation in house price changes associated with homeowner age has been found across several data sets and different time periods. Using four cohorts of homeowners who were at least age 62 between 1968 and 1983 in the Panel Study of Income Dynamics, Quercia (1997) found the average annual house price appreciation rate of older homeowners through 1989 generally exceeded the 4-percent average assumed by Szymanoski (1994). The results among a more limited sample tailored to resemble the demographics of reverse mortgage borrowers (that is, housing rich and cash poor older homeowners) were more ambiguous, however, with at least one cohort experiencing significantly lower house price appreciation than expected. Davidoff (2004) used the American Housing Survey to compare house prices between 1985 and 2001 and found homeowners who were at least age 75 in 1985 experienced house price appreciation 2 to 3 percentage points less than younger households experienced. Rodda and Patrabansh (2005) used the Health and Retirement Study and Census Public Use Microdata Sample and similarly found that older homeowners saw house price appreciation rates in the 1990s that were 1 to 3 percentage points less than rates that younger households saw. Capone, Chang, and Cushman (2010), on the other hand, used internal FHA data to simulate potential discounts to the market rate of house price appreciation until the expected number of terminations with negative equity was equal to the actual number of loss events. On average, they found no discount was needed to account for the likelihood of negative equity among HECM borrowers. In fact, they found that older HECM borrowers had fewer loss events than predicted.

Rodda and Patrabansh (2005) discussed several possible reasons why market conditions that reverse mortgage borrowers experience may diverge from national trends. Older homeowners are disproportionately located in Sun Belt markets with a relatively elastic supply of housing, which tempers house price increases. At the same time, reverse mortgages can be used to insure against house price declines, because they are nonrecourse loans and the amount of credit available in reverse mortgages is based on the original property value instead of the mark-to-market value, which creates an adverse selection problem. Szymanoski (1994) argued, "The ability of potential borrowers to use the asymmetric information they possess on local property value trends to their advantage may be limited." Shan (2009), however, found that HECM origination volume is positively associated with past house price appreciation but negatively associated with future appreciation. Haurin et al. (forthcoming) similarly find greater HECM originations in states with a history of house price volatility *and* high current deviation in house prices from their long-term average. Both findings support the hypothesis of adverse selection in demand for reverse mortgages, in which borrowers seek to lock in credit lines before collateral values decline.

At the microeconomic level, owner age is correlated with the length of tenure and the building age. Estimates of house values of older homeowners, particularly self-reported estimates, may be both biased and heteroskedastic. Owners may overvalue their homes due to an endowment effect (Thaler, 1980), and the variance in those estimates may increase with tenure as owners become farther removed in time from their last market transaction. Moreover, older properties will tend to be less homogenous after years of renovations and home improvement projects, confounding the selection of appropriate comparable sales by even experienced real estate professionals (Rodda and Patrabansh, 2005).

The length of tenure may also be associated with behavioral differences. Overall, Quercia (1997) found that older homeowners, particularly elderly households that are housing rich and income poor, also have higher rates of early reverse mortgage termination than expected. Davidoff and Welke (2007) built a theoretical model in which household characteristics associated with demand for reverse mortgages may be also related to increased mobility but, all else equal, obtaining a reverse mortgage reduces the likelihood of moving. In particular, households that heavily discount future consumption may desire the ability to quickly tap home equity through a reverse mortgage but, unable to borrow the full value of their home, may also subsequently sell the property to cash out the remaining equity.[1] Capone, Chang, and Cushman (2010) find that assuming a market rate of house price appreciation over-predicts the number of HECM loss events among early terminations but underpredicts loss events among longer durations. Assuming a house price appreciation rate 1 percentage point lower than the market best predicts loss events after approximately 5 years.

Rodda and Patrabansh (2005) noted that the difference between "movers" and "stayers" has implications for maintenance. Approximately two-thirds of the value of residential real

[1] Davidoff and Welke (2007: 24) noted that poor health may be responsible for both the higher rates of mobility and discounting future consumption. "[R]everse mortgage borrowers have a need for immediate cash due to health reasons, and then die or exit their homes due to death or severe illness."

estate is in the housing structure, with the remainder in the value of the underlying land.[2] Without regular maintenance, the value of the structure will depreciate over time. The U.S. Department of Commerce's Bureau of Economic Analysis assumes an 80-year service life for new one- to four-unit structures and an average depreciation rate of 1.14 percent, with home repairs and additions depreciating at a faster rate. The Lincoln Land Institute assumes a 1.5-percent depreciation rate for housing structures (Davis and Heathcote, 2007). These estimates, however, are net of maintenance and repair expenditures. Harding, Rosenthal, and Sirmans (2007) estimated the typical gross depreciation rate is approximately 2.5 to 2.9 percent. "At this rate, after fifty years the original housing capital would have fallen more than 75 percent in value" (Harding, Rosenthal, and Sirmans, 2007: 4).

Although older homeowners have an incentive to maintain the quality of their housing consumption, they may also disinvest from housing wealth by substituting other consumption for regular home repairs, allowing the property to depreciate. This informal extraction of home equity is consistent with the life cycle hypothesis of housing consumption discussed by Artle and Varaiya (1978). In fact, Davidoff (2004) found that homeowners older than age 75 undertake fewer projects and spend $500 per year less on home improvement and repairs, including $100 less on routine maintenance, after accounting for differences in length of tenure. In general, older homeowners may be less able or willing to either undertake or even oversee necessary actions to maintain property conditions.

On the other hand, explicitly extracting home equity through a reverse mortgage may enable older homeowners to improve the quality of their housing consumption. The proceeds of a reverse mortgage can be used to fund home improvements designed to let a homeowner "age in place." The Joint Center for Housing Studies of Harvard University (2014) found that only 57 percent of existing homes have more than one of five housing features designed to improve accessibility.[3] To the extent that the proceeds of a reverse mortgage allow homeowners to undertake necessary home repairs, their use will be associated with a relative increase in property values compared with homes owned by other older households. As noted, however, atypical home improvements can make finding comparable home sales necessary for valuation difficult and limit demand. Moreover, Miceli and Sirmans (1994) and Shiller and Weiss (2000) show how the limited liability of reverse mortgages creates a moral hazard problem. Once any remaining home equity has been exhausted, borrowers have little investment incentive to protect the value of the collateral. Undermaintenance, whether by accident or design, is a concern for the economic value of a reverse mortgage program.

Citing Capone, Chang, and Cushman (2010), the actuarial review also applies a house price discount factor that adjusts expected property values below that derived from the house value at origination with an HPI adjustment (IFE, 2015). The house price discount factor varies

[2] The Federal Reserve's Flow of Funds (table B.101) estimates the value of real estate held by households in the first quarter of 2016 at $25.8 billion and the replacement-cost value of residential structures owned by households at $15.3 billion, or roughly 68 percent. Value estimates from the Lincoln Land Institute are slightly higher ($27.3 and $17.4 billion, respectively) but with a comparable ratio of 64 percent (Davis and Heathcote, 2007). Also see Albouy and Ehrlich (2015).

[3] The five features are (1) ramp entries, (2) single-floor living, (3) extra-wide hallways and doors, (4) accessible electrical controls, and (5) lever-style handles on doors and faucets.

by whether the property value at origination was above or below the local median value and by the age of the loan. The formula described corresponds to a premium (negative discount) on the HPI during roughly the first 3 years (that is, house values are assumed to experience above-market appreciation), after which house values are discounted over time up to 20 percent for properties originally valued above the local median and 25 percent for properties originally valued below the local median. This discount has substantial implications for the estimated financial health of the Mutual Mortgage Insurance Fund that finances the HECM program.

Contractual requirements for routine maintenance can address concerns about the collateral values. Shiller and Weiss (2000: 6) note, however, "[M]any risk-sharing contracts with homeowners specify that the maintenance should be kept up for the contract, and the homeowners are subject to penalties if it is not. In practice, it may be very difficult to enforce such contract provisions." Davidoff and Welke (2007: 7) similarly argue, "Practically, the maintenance requirement cannot be enforced after closing, because it would be unlikely for a court to force a senior citizen out of their home for failure to perform maintenance." Nevertheless, FHA is considering requiring periodic inspections of HECM properties and allowing the cost of inspection and any required repairs to be included "as a reasonable and customary charge that may be collected and added to the borrower's loan balance."[4] Exterior inspections are already required at least every 30 days if the borrower is in technical default for failing to pay property taxes and insurance.

A downside to frequent property inspections also exists, however. A class action filed in May 2016 alleges that two mortgage companies undertook "repeated, unreasonable, and unnecessary inspections," sometimes including multiple inspections in a single day (Bahrampour, 2016). After the borrower's credit is exhausted, HUD ultimately pays for these property inspections, up to the maximum claim amount.[5] Whether periodic property inspections are needed and at what frequency should be determined by evidence of the presence and degree of excessive depreciation associated with undermaintenance in the reverse mortgage program.

An alternative hypothesis for lower collateral values associated with reverse mortgages is that the original value of the property was overestimated. Mortgage underwriting often restricts loan amounts to a given percentage[6] of the collateral value, typically defined as the lesser of the transaction price or appraised value. Cho and Megbolugbe (1996), however, noted that appraisals also suffer from a moral hazard problem that encourages an upward bias in property value estimates.

> [T]he buyer and seller have a vested interest in completing a transaction. Loan originators have a vested interest in completing sales. No sale means no income for the originators or real estate agent. The appraiser understands the financial implications of having no

[4] "Strengthening the Home Equity Conversion Mortgage Program." 81 Federal Register 31770 (May 19, 2016) (amending 24 CFR 30 and 24 CFR 206).

[5] The maximum claim amount is the lesser of the appraised value at origination and the FHA loan limit for a given metropolitan area.

[6] The FHA HECM program has principal limit factors that vary by the borrower's age and mortgage interest rates.

> transactions and, at the same time, wants repeat business via referrals. Accordingly, real estate agent, buyers, originators, and appraisers have aligned interests: to complete and close the transaction. The way to ensure the deal is to appraise slightly high. The appraiser asks for or receives the transaction price and then adds a bit to it. Since mortgage lenders employ the minimum of sales price or the appraisal, whichever is lower, in determining the loan value, no further information is added because of the appraisal. Therefore, it is only the carriers of the default risk who lose in the transaction. (Cho and Megbolugbe1996: 46)

In the case of the vast majority of reverse mortgages, the carrier of the default risk is FHA.

Empirical evidence of the upward bias in appraisals is found in the skewness toward overappraisals and also the remarkable share of appraisals precisely equal to the transaction price (Calem, Lambie-Hanson, and Nakamura, 2015; Cho and Megbolugbe 1996; Conklin et al., 2016). Although borrower characteristics should not influence property valuations, this phenomenon is particularly noticeable among credit-constrained borrowers. Conklin et al. (2016) found the likelihood of an at-price appraisal increases 8.1 percent if the combined loan-to-value ratio exceeds 100 percent, with similar but smaller effects at 90- and 80-percent thresholds.

Appraisal bias has been known to be a problem for refinance loans, given that no market transaction price is available against which to compare the valuation. For example, Agarwal, Ambrose, and Yao (2016) compared repeat sales (purchase-purchase loan originations) with similarly paired loan originations on the same property in which the first loan origination is a refinance. They found that house price returns are 8.4 percent less when the initial value is obtained from an appraisal for a refinance instead of a market sale. Lower returns are consistent with an inflated appraisal. Likewise, reverse mortgages rarely have a purchase price.[7] Moreover, large forward mortgages (including refinancings) buoyed by exorbitant appraisals create an excessive debt burden; the size of the loan amount consequently is limited by consideration of the borrower's ability to repay, commonly measured by a debt-to-income ratio. A reverse-mortgage borrower, however, faces no such hardship or consideration of ability to repay. The only limitation of the availability of credit is how much FHA is willing to insure.

New oversight regulations have been found to reduce appraisal bias. For example, Agarwal, Ambrose, and Yao (2016) found that the Home Valuation Code of Conduct, which the government-sponsored enterprises Fannie Mae and Freddie Mac adopted, reduced appraisal bias by 3.6 percentage points. The *FHA Single Family Housing Policy Handbook 4000.1* (HUD, 2015) requires lenders to select certified appraisers from a list maintained by FHA of qualified appraisers.[8] These appraisers "must avoid conflicts of interest and the appearance of conflicts

[7] A HECM for Purchase program that allows seniors to purchase a new principal residence and obtain a reverse mortgage in a single transaction was introduced in January 2009. These loans, however, account for a small share of reverse mortgage originations (IFE, 2015).

[8] Before December 1994, HUD field offices assigned appraisers on a rotational basis designed from a fee panel to ensure independence. The Cranston-Gonzalez National Affordable Housing Act of 1990, however, allowed lenders the opportunity to select appraisers, which quickly became the dominant procedure; in 1996, FHA discontinued the rotational assignment. FHA states that "although some former fee panel appraisers have alleged that some appraisers have performed poorly, either by design or due to a lack of skills and understanding of HUD's procedures, no statistical or other basis exists for concluding that the appraisal system is flawed" (GAO, 1997: 8).

of interest," (HUD, 2015: 64) including undue influence from anyone compensated based on the successful loan closing. Further safeguards include prohibition on "appraiser shopping" by ordering multiple appraisals, withholding or threatening to withhold timely payment or future business from an appraiser, requesting or conditioning business on a preliminary estimate, and "any other act or practice that impairs or attempts to impair an Appraiser's independence, objectivity, impartiality or violates law or regulation" (HUD, 2015: 66).

Whereas undermaintenance is expected to be associated with depreciation over time, an overappraisal at origination is expected to be associated with a decline in observed value regardless of loan age. As a consequence, the timing of foreclosure discounts may also indicate their source.

Data and Methodology

To evaluate differences in collateral risk, we compare the change in valuations of properties with reverse mortgages against change in comparable properties with forward loans, both home purchase and refinance. Data come from information on properties with FHA-insured mortgages that are sold through foreclosure. On one hand, properties that go through foreclosure may not be representative of the typical FHA-insured mortgage. On the other hand, the foreclosed property value most directly affects loss severity in FHA's portfolio. In addition, the real estate owned process should create similar measures of collateral values for both forward and reverse mortgages.

We use a propensity score-matching process to ensure greater comparability between properties secured by forward and reverse mortgages. A propensity score (the probability a loan is a reverse mortgage compared with a forward purchase or refinance mortgage) is estimated using a multinomial logistic regression stratified by census division with regressors, including property and borrower characteristics. The propensity score is then used to match with replacement each reverse mortgage with at least two forward purchase mortgages and two forward refinance mortgages in the same state (and select counties with at least 1,000 HECMs sold in foreclosure).[9] One sample is matched to all foreclosed HECMs. A second sample is matched only to those HECMs assigned to HUD,[10] which reduces the sample size but provides a richer set of variables to use in the propensity score-matching process and subsequent analysis.

By conditioning the analysis on household, property, and market characteristics, this article does not address the likelihood that reverse mortgage originations are disproportionately associated with risks to collateral values. Propensity score matching, particularly on origination date and location, is meant to control for possible adverse selection in order to focus on

[9] Matching is accomplished using the *psmatch2* program created for Stata by Leuven and Sianesi (2003).

[10] In the HECM program, mortgagees have the option to assign loans to HUD when the principal balance, including accrued interest and mortgage insurance premiums, equals or exceeds 98 percent of the maximum claim amount. HUD is then responsible for the foreclosure process when the borrower defaults or occupancy is terminated. A reverse mortgage servicer more commonly acquires title to the property through foreclosure and files a claim if the proceeds of the foreclosure sale are not sufficient to extinguish the debt. Information about the foreclosure sales price for these loans, however, is available only for foreclosures completed after 2012.

the potential moral hazard problems after origination. Periodic property inspections would address only the latter problem. In addition, FHA historically has been opposed to regionally risk-based pricing and program requirements that would be needed to address the former.

Exhibit 1 shows how propensity score-matching and weighting improve the similarity of property characteristics, reducing the importance of covariates in subsequent modeling. The first sample contains 29,405 reverse mortgages matched with 24,841 forward purchase mortgages and 19,434 forward refinances. The second sample contains 2,878 reverse mortgages matched to 4,266 purchase loans and 3,346 refinances.

The first set of models simply estimates the change in house values between loan origination ($t = 1$) and foreclosure ($t = 2$), accounting for change in local house prices and the type of loan.

$$\Delta HouseValue = \alpha + \beta(\Delta HPI) + \delta(LoanType_1) + \varepsilon \quad (1)$$

Change in house value ($\Delta HouseValue$)[11] is evaluated using both the annualized log difference used by Davidoff (2004) and the compound annual growth rate, or CAGR, favored by Rodda and Patrabansh (2005). $LoanType$ indicates reverse mortgages compared with forward loans (purchase and refinance).

The change in the local HPI (ΔHPI) establishes a baseline expectation of market changes in house prices. We use a recently released developmental repeat-sales HPI created by the FHFA at the five-digit ZIP Code level (Bogin, Doerner, and Larson, 2016). Leventis (2007) noted that the repeat-sales index created by the Office of Federal Housing Enterprise Oversight (now the FHFA) is not a perfect constant quality index but instead measures the change in house prices net of depreciation, maintenance, and home improvement. He estimates that the net quality drift is most likely negative (that is, depreciation outweighs maintenance); as a consequence, change in the repeat-sales index is likely biased downward.

In an alternative specification, we directly model house values in foreclosure based on the value at origination adjusted by changes in local house prices, original loan type, and length of time between valuations.

$$Value_2 = \alpha + \beta\left(Value_1 \times {HPI_2}/{HPI_1}\right) + \gamma(LoanType_1) + \delta(LoanType_1 \times Time_{1,2}) + \varepsilon \quad (2)$$

Both the value in foreclosure and the estimated market value (adjusted original valuation) are logged.[12] The interaction between $LoanType$ and $Time$ provides the estimate of the difference in rates of depreciation relative to house price changes in the market. In addition, the coefficient of the uninteracted $LoanType$ captures any time invariant discounts associated with reverse mortgages.

Reverse mortgage servicers can force borrowers to draw from their credit balances for certain expenditures, including inspections and property preservation actions that might affect

[11] Consistent with common underwriting practice, the house value is determined in every specification as the lesser of the appraised value and, if available, the sales price.

[12] Because the dependent variable is logged, effects are interpreted as exponentiated estimated coefficients (for example, $e^{\gamma} - 1$).

Exhibit 1

Propensity Score Matching (1 of 2)

	Unmatched			Sample 1			Sample 2		
	Forward		Reverse	Forward		Reverse	Forward		Reverse
	Purchase	Refinance		Purchase	Refinance		Purchase	Refinance	
A. Matching statistics									
Observations (unweighted)	597,023	142,505	29,405	24,841	19,434	29,405	4,266	3,346	2,878
Weight				1.18	1.51	1.00	3.13	3.92	1.00
				(3.45)	(4.36)	(0.00)	(10.65)	(12.95)	(0.00)
Propensity score				– 0.45	– 0.48	– 0.35	– 2.57	– 2.03	– 2.33
				(1.96)	(1.93)	(2.13)	(2.67)	(2.48)	(2.76)
B. Primary borrower									
Age	34.1	41.1	76.9	37.1	44.3	76.9	36.2	42.0	82.0
	(10.5)	(11.9)	(7.8)	(11.1)	(11.7)	(7.8)	(10.2)	(10.9)	(6.6)
Gender[a]									
Male	67.6%	67.2%	41.6%	41.0%	47.9%	41.6%	38.0%	43.5%	38.8%
Female	31.8%	31.0%	57.9%	58.7%	51.3%	57.9%	61.8%	56.3%	61.0%
Race/ethnicity[a]									
White	58.2%	67.4%	70.4%	67.5%	72.6%	70.4%	68.0%	69.6%	68.2%
Black	19.4%	13.9%	19.7%	21.5%	15.7%	19.7%	9.0%	9.3%	9.6%
Hispanic	16.5%	10.1%	4.4%	4.0%	4.8%	4.4%	2.6%	1.5%	2.5%
Asian	1.1%	0.9%	0.5%	0.4%	0.4%	0.5%	0.5%	0.3%	0.5%
Other/not available	4.8%	7.7%	5.0%	6.6%	6.6%	5.0%	19.9%	19.4%	19.2%
Co-Borrower share[a]	40.3%	43.5%	22.2%	21.8%	27.4%	22.2%	26.6%	29.9%	27.2%
C. Property characteristics									
Original value[a]	$101,654	$153,377	$196,820	$179,609	$216,773	$196,820	$139,396	$182,876	$155,635
	(51,468)	(69,872)	(113,356)	(120,687)	(111,484)	(113,356)	(77,675)	(99,596)	(95,077)
Closing date[a]									
Before 2005	72.2%	34.5%	15.4%	25.2%	13.1%	15.4%	85.3%	66.2%	77.0%
2005 to 2008	22.8%	52.5%	63.9%	51.7%	66.6%	63.9%	14.4%	32.7%	22.0%
After 2008	5.0%	13.0%	20.7%	23.1%	20.3%	20.7%	0.3%	1.0%	0.9%
Location[a]									
California	8.0%	2.8%	14.7%	14.7%	14.7%	14.7%	15.0%	15.0%	15.0%
Florida	6.0%	4.1%	15.4%	15.4%	15.4%	15.4%	5.6%	5.6%	5.6%
Other	86.0%	93.1%	69.9%	69.9%	69.9%	69.9%	79.4%	79.4%	79.4%
Square footage[b]	1,346	1,454	1,393	29,405	1,556	1,393	1,371	1,479	1,406
	(542)	(506)	(460)	(1,545)	(523)	(460)	(480)	(477)	(438)

Exhibit 1

Propensity Score Matching (2 of 2)

	Unmatched			Sample 1			Sample 2		
	Forward		Reverse	Forward		Reverse	Forward		Reverse
	Purchase	Refinance		Purchase	Refinance		Purchase	Refinance	
Bedrooms[b]									
One	1.1%	1.0%	1.6%	0.9%	0.9%	1.6%	1.5%	1.7%	1.5%
Two	21.0%	17.1%	30.9%	18.8%	16.2%	30.9%	33.8%	25.0%	30.9%
Three	62.0%	64.2%	56.5%	57.9%	60.2%	56.5%	55.3%	59.5%	56.5%
Four	13.0%	15.4%	9.2%	17.2%	19.4%	9.2%	7.7%	11.5%	9.2%
Five or more	3.0%	2.3%	1.9%	5.2%	3.3%	1.9%	1.8%	2.3%	1.8%
Bathrooms[b]									
One	42.4%	37.1%	45.1%	34.2%	32.0%	45.1%	47.3%	39.8%	45.1%
Two	48.7%	52.7%	50.4%	53.3%	57.2%	50.4%	49.1%	53.5%	50.3%
Three or more	8.9%	10.3%	4.6%	12.5%	10.8%	4.6%	3.6%	6.7%	4.6%
Building age[b]	54.1	46.9	57.8	46.8	45.0	57.8	58.5	54.2	57.8
	(28.5)	(28.6)	(23.0)	(28.0)	(26.6)	(23.0)	(23.2)	(22.8)	(22.9)
D. Foreclosure characteristics									
Time between valuations[a]	5.7	5.2	7.7	8.0	7.3	7.7	10.3	9.0	10.1
	(3.0)	(2.4)	(2.4)	(3.0)	(2.1)	(2.4)	(3.1)	(2.7)	(3.2)
Estimated market value	$105,234	$133,329	$169,715	$165,310	$181,487	$169,715	$143,572	$163,020	$153,210
	(50,023)	(58,047)	(107,176)	(120,056)	(98,925)	(107,176)	(76,163)	(79,447)	(82,180)
CAGR	1.2%	– 2.7%	– 2.0%	– 1.4%	– 2.6%	– 2.0%	0.1%	– 1.4%	– 0.3%
	(4.9)	(5.4)	(3.1)	(3.2)	(3.3)	(3.1)	(3.3)	(3.8)	(3.5)
Appraised value “as is”[c]	$77,118	$88,559	$107,735	$129,730	$124,707	$107,735	$96,428	$105,080	$108,147
	(47,889)	(55,483)	(76,172)	(119,765)	(87,826)	(76,172)	(68,816)	(65,703)	(76,258)
Appraised repaired value[c]	$78,975	$89,881	$109,137	$131,401	$126,497	$109,137	$98,147	$106,734	$109,566
	(50,263)	(57,947)	(76,275)	(119,920)	(91,590)	(76,275)	(69,194)	(65,707)	(76,355)
Foreclosure price	$71,432	$79,484	$102,814	$122,850	$116,301	$102,814	$88,671	$96,323	$99,753
	(47,980)	(52,026)	(79,819)	(116,773)	(83,995)	(79,819)	(65,923)	(62,971)	(73,071)
CAGR	– 8.3%	– 15.4%	– 10.8%	– 7.1%	– 10.5%	– 10.8%	– 6.4%	– 8.7%	– 6.4%
	(16.3)	(11.1)	(7.8)	(7.4)	(7.1)	(7.8)	(8.3)	(6.8)	(7.0)

CAGR = compound annual growth rate.

[a] Used in matching sample 1 and sample 2.

[b] Used in matching sample 2 only.

[c] Available only for all loans in sample 2.

Note: Standard deviations presented in parentheses.

the ultimate resale price of the property. The sum of these unscheduled disbursements and corporate advances, scaled by the estimated market value of the property, is also included as a covariate to control for maintenance expenditures that servicers imposed.

We further use repeat nonforeclosure sales to investigate the accuracy of the initial valuation for reverse mortgages. To be specific, we analyze forward and reverse originations in which FHA had also previously insured a mortgage on the same property ($t = 0$).

$$Value_1 = \alpha + \beta\left(Value_0 \times {}^{HPI_1}/_{HPI_0}\right) + \gamma(LoanType_1) + \delta(Time_{0,1}) + \varepsilon \quad (3)$$

We estimate this model using most transaction pairs in which both loan originations were endorsed on or after 1980. We also analyze a subpopulation of the first sample of foreclosed properties. We use a third propensity score-matching process to ensure that property characteristics are properly balanced across loan types. Transaction pairs are restricted to where the first origination was for a home purchase mortgage, which is assumed to most accurately reflect the true market value. This earlier valuation is then adjusted by the five-digit ZIP Code HPI constructed by FHFA to estimate the market value of the property at the time of the subsequent loan origination, which may be for purchase, refinance, or a reverse mortgage.

Finally, this earlier valuation can also be used to estimate the market value of the property in foreclosure in the third sample, without being confounded by possible appraisal inflation.

$$Value_2 = \alpha + \beta\left(Value_0 \times {}^{HPI_2}/_{HPI_0}\right) + \gamma(LoanType_1) + \delta(LoanType_1 \times Time_{1,2}) + \varepsilon \quad (4)$$

All coefficients are estimated with robust standard errors unless otherwise noted and weighted in accordance with the propensity score-matching process.

Findings

Panels A and B of exhibit 1 show how borrower and property characteristics vary among purchase, refinance, and reverse mortgages and how using propensity score matching helps narrow these differences. Reverse mortgage borrowers obviously are older than borrowers using forward mortgages, but they also are more likely to be non-Hispanic White, female, and single (no co-borrower). The original value of the collateral used in underwriting is higher for reverse mortgages, despite having comparable square footage and typically fewer bedrooms and bathrooms. In part, this higher value is because reverse mortgage originations are concentrated in high-cost markets, like California and Florida. Reverse mortgages also were disproportionately originated at the peak of the national housing market, although the distribution of origination dates is skewed by the fact that the first sample includes nonassigned HECM claims only after 2012 due to data limitations. The second sample using only assigned reverse mortgages shows a greater share of originations between 2005 and 2008 than FHA-insured purchase loans but a smaller share than refinance loans.

Panel C of exhibit 1 shows these loans in the foreclosure process. Whereas the average loan age of a forward mortgage in foreclosure was more than 5 years, the average loan age was nearly 8 years for reverse mortgages; however, assigned HECMs in foreclosure averaged

just 3 years. As expected, given their higher original property values, reverse mortgages in foreclosure also had higher estimated market values based on local HPI adjustments. Yet the average change in market house prices between origination and foreclosure was -2.0 percent compared with a positive 1.2 percent for forward purchase mortgages. This pattern again reflects the fact that reverse mortgages were disproportionately originated at the peak of the market in states that experienced substantial house price volatility, which is consistent with Shan (2009) and Haurin et al. (forthcoming). The appraised value in foreclosure and actual foreclosure price for reverse mortgage properties are also larger on average. Before matching, the average annual change between the original value and foreclosure price is -8.3 percent for purchase loans, -15.4 percent for refinance loans, and -10.8 percent for reverse mortgages. Among the first sampled of matched loans, the comparable changes are -7.1, -10.5, and -10.8 percent. These declines suggest that reverse mortgages depreciate at roughly equal rates to similar properties with forward refinance loans, but at a higher rate than properties with forward purchase loans.

Exhibit 2 shows the results of a simple regression based on the first sample of matched loans. The dependent variable is the annualized change in house values from closing to foreclosure, calculated either by the log difference divided by loan age (column 1) or the formula for compound annual growth (column 2). The explanatory variable is whether the loan is a forward or reverse mortgage. The results show that properties securing a reverse mortgage have an average change in house value that is roughly 2 percentage points less than comparable properties securing forward loans, which is statistically significant. This result persists even when the annualized change in local house prices is included as a covariate (columns 3 and 4).

Exhibit 3 replicates the previous analysis but disaggregates forward loans by purpose, either home purchase or refinance. In this specification, reverse mortgages have average annual changes in house prices 3.0 to 4.0 percentage points less than comparable forward loans for home purchase. Forward loans for refinance, however, also show a higher depreciation

Exhibit 2

Change in House Values: Forward and Reverse Mortgages

	(1) Annualized Log Difference	(2) Compound Annual Rate	(3) Annualized Log Difference	(4) Compound Annual Rate
Loan type				
Reverse	– 0.0225***	– 0.0197***	– 0.0224***	– 0.0195***
	(0.0011)	(0.0010)	(0.0010)	(0.0009)
HPI change			1.1626***	1.0605***
			(0.0197)	(0.0169)
Constant	– 0.0957***	– 0.0879***	– 0.0718***	– 0.0670***
	(0.0010)	(0.0009)	(0.0009)	(0.0008)
N	73,680	73,680	73,680	73,680
F	392.0819	399.8092	2,352.1941	2,476.7237
R^2	0.0131	0.0149	0.1881	0.2186

HPI = house price index.
*Statistically significant at the * .05 level; ** .01 level; *** .001 level.*
Notes: Forward mortgage loans are the reference category for loan type. Robust standard errors are presented in parentheses.

Exhibit 3

Change in House Values: Purchase, Refinance, and Reverse Mortgages

	(1) Annualized Log Difference	(2) Compound Annual Rate	(3) Annualized Log Difference	(4) Compound Annual Rate
Loan type				
Forward				
Refinance	– 0.0378***	– 0.0341***	– 0.0239***	– 0.0217***
	(0.0019)	(0.0017)	(0.0017)	(0.0015)
Reverse	– 0.0414***	– 0.0367***	– 0.0343***	– 0.0303***
	(0.0014)	(0.0012)	(0.0013)	(0.0011)
HPI change			1.1182***	1.0186***
			(0.0193)	(0.0165)
Constant	– 0.0768***	– 0.0709***	– 0.0608***	– 0.0570***
	(0.0012)	(0.0011)	(0.0011)	(0.0010)
N	73,680	73,680	73,680	73,680
F	458.2409	454.3332	1,784.5602	1,859.0306
R^2	0.0407	0.0484	0.1989	0.2319

HPI = house price index.
*Statistically significant at the * .05 level; ** .01 level; *** .001 level.*
Notes: Forward purchase loans are the reference category for loan type. Robust standard errors are presented in parentheses.

rate (or lower appreciation rate) of between 2.1 and 3.7 percentage points. Nevertheless, the difference between reverse mortgages and forward refinance mortgages is still statistically significant at least at the 5-percent level in every specification.

Instead of estimating the change in house prices, the next set of models estimates the foreclosure price or appraised value while controlling for the estimated market value based on house price changes in the local market between closing and foreclosure. Interacting loan type with time shows the average annual change in house value. As noted, the change in market house prices is net of average home improvements and repairs, meaning any estimated difference constitutes additional depreciation. Exhibit 4 shows that the foreclosure price has a statistically significant and substantial negative constant term but is highly sensitive to the estimated market value. The combination of these estimated coefficients is likely related to a foreclosure discount that varies with market conditions. The discount is small in strong housing markets with high house prices but increases when house prices decline. For example, the estimated coefficients from the model presented in column 1 indicate that an average property securing a home purchase loan (the default) will immediately sell for 6.2 percent less if in foreclosure, assuming no time has passed since closing and no change has occurred in house prices. If house prices increase 10 percent, then the foreclosure discount narrows to 3.1 percent, and, if house prices decline 10 percent, then the foreclosure discount increases to 9.6 percent. Overall, these models predict roughly 70 percent of the variation in foreclosure sales price in the first sample.

Column 1 of exhibit 4 shows that reverse mortgages depreciate relative to the estimated market value by roughly 0.4 percent per year. Forward purchase loans, however, depreciate at a rate of 2.6 percent more per year. Refinance loans show no evidence of change in house value associated with time. The difference between reverse mortgages and forward purchase loans is

Exhibit 4

Foreclosure Sale Price

	(1)	(2)	(3)	(4) Second Sample
Loan type				
Forward				
Refinance	– 0.3743***	– 0.3744***	– 0.3713***	– 0.1770***
	(0.0274)	(0.0274)	(0.0272)	(0.0454)
Reverse	– 0.4094***			
	(0.0201)			
Assigned		– 0.2507***	– 0.2503***	– 0.0083
		(0.0381)	(0.0380)	(0.0477)
Not assigned		– 0.3864***	– 0.3337***	
		(0.0205)	(0.0212)	
Loan age				
x Forward				
Purchase	– 0.0258***	– 0.0258***	– 0.0260***	– 0.0126***
	(0.0019)	(0.0019)	(0.0019)	(0.0035)
Refinance	– 0.0011	– 0.0011	– 0.0014	– 0.0009
	(0.0032)	(0.0032)	(0.0032)	(0.0036)
x Reverse	– 0.0042**			
	(0.0014)			
Assigned		– 0.0102**	– 0.0104**	– 0.0084*
		(0.0035)	(0.0035)	(0.0035)
Not assigned		– 0.0087***	– 0.0083***	
		(0.0016)	(0.0016)	
Estimated value	1.3453***	1.3459***	1.3269***	1.4628***
	(0.0135)	(0.0135)	(0.0138)	(0.0243)
HECM disbursements			– 0.0138***	– 0.0215
			(0.0010)	(0.0161)
Constant	– 4.3417***	– 4.3496***	– 4.1229***	– 5.9874***
	(0.1546)	(0.1547)	(0.1588)	(0.2962)
N	73,680	73,680	73,680	10,490
F	1,913.881	1,440.5071	1,684.8376	599.4402
R^2	0.7067	0.7072	0.7101	0.6005

HECM = Home Equity Conversion Mortgage.
*Statistically significant at the * .05 level; ** .01 level; *** .001 level.*
Notes: Forward purchase loans are the reference category for loan type. Robust standard errors are presented in parentheses.

statistically significant, but the difference between reverse mortgages and forward refinance loans is not. The categorical variable capturing loan type alone shows that forward refinance and reverse mortgages are associated with a substantial (more than 30 percent) discount in foreclosure price relative to purchase loans, but that this discount does not vary with the age of the loan.

Column 2 of exhibit 4 breaks reverse mortgages into those assigned to HUD and those in which the servicer independently executed the foreclosure sale and subsequently filed a claim. The results pertaining to forward mortgages are largely unchanged. The additional depreciation rate associated with reverse mortgages increases, such that house prices on assigned reverse mortgages fall an additional 1.0 percent below market value each year and nonassigned

reverse mortgages fall an additional 0.9 percent. Both estimates are significantly smaller than that estimated for forward purchase mortgages and are not significantly different from each other. A statistically significant difference exists, however, between assigned and nonassigned reverse mortgages in the time invariant discount. An assigned reverse mortgage is associated with an additional 22.2-percent foreclosure discount compared with a forward purchase loan, while a nonassigned reverse mortgage is associated with a 32.1-percent additional discount. Column 3 includes the amount of unscheduled disbursements and corporate advances that servicers may have drawn for property inspection and preservation actions on reverse mortgages. The coefficient on such disbursements is negative, indicating that an increase in disbursements equal to 1 percent of the estimated market value is associated with roughly a 1.4-percent decline in the foreclosure price. Including disbursements for reverse mortgages does not substantively affect the estimated coefficient on other variables.

The last column of exhibit 4 replicates the previous model, using the second sample of mortgage, which is smaller but more accurately matched by property characteristics and foreclosure process. Note that this sample has no nonassigned reverse mortgages, but all foreclosures are conducted directly by HUD. The model predicts roughly 60 percent of the variation in the foreclosure price and produces smaller rates of depreciation overall. Forward purchase mortgages are associated with statistically significant additional depreciation of roughly 1.2 percent per year. Reverse mortgages are associated with a somewhat smaller additional depreciation rate (0.9 percent per year), a difference that is not statistically significant. The coefficient on the interaction between forward refinance loans and time is negative but not significantly different from zero. On the other hand, forward refinance loans show a substantial time invariant foreclosure discount (16.2 percent) beyond that observed for forward purchase loans. Reverse mortgages that had also been associated with disproportionate time invariant discounts in the first sample of loans are not associated with a statistically significant discount in the second sample compared with purchase loans.[13] Again, the amount of HECM disbursements does not have a statistically significant effect, nor does its inclusion substantially affect the estimated coefficient on other variables.[14]

Exhibit 5 replaces the foreclosure sales price with appraisal estimates of the house value. Although appraised values only approximate market prices, these estimates typically occur 2 to 3 months before the sales price and, therefore, might more accurately reflect differences in maintenance related to borrower behavior rather than neglect suffered during the foreclosure process. In addition, appraisal estimates are provided both "as is" as well as "if the property were to be repaired to meet minimum property standards."

Nevertheless, the results are largely similar. The first column of exhibit 5 models the appraised value "as is." Forward purchase loans are associated with additional depreciation of roughly 1.3 percent. Forward refinance and reverse mortgages are not associated with statistically significant depreciation (and the difference with forward purchase loans is statistically

[13] The general foreclosure discount associated with forward purchase loans is 27 percent, assuming no change in market house prices and no time between valuations, which is substantially higher than that found in the first sample.

[14] Regression model output without HECM disbursements is not shown.

Exhibit 5

Foreclosure Appraised Value

	(1) Appraised Value (As Is)	(2) Appraised Value (Repaired)	(3) Probability Repairs Needed
Loan type			
Forward			
Refinance	– 0.1573***	– 0.1397***	0.0188
	(0.0380)	(0.0371)	(0.1409)
Reverse			
Assigned	– 0.0695	– 0.0458	0.0544
	(0.0366)	(0.0347)	(0.1164)
Loan age			
x Forward			
Purchase	– 0.0129***	– 0.0099***	0.0523***
	(0.0026)	(0.0024)	(0.0083)
Refinance	– 0.0042	– 0.0022	0.0613***
	(0.0035)	(0.0035)	(0.0125)
x Reverse			
Assigned	– 0.0031	– 0.0021	0.0393***
	(0.0026)	(0.0024)	(0.0077)
Estimated value	1.3631***	1.3156***	– 0.0589
	(0.0213)	(0.0200)	(0.0413)
HECM disbursements	– 0.0199	– 0.0153	– 0.0314
	(0.0137)	(0.0106)	(0.0371)
Constant	– 4.6797***	– 4.1227***	– 0.4002
	(0.2607)	(0.2461)	(0.4906)
N	10,490	10,490	10,490
F	750.1686	791.8967	105.6237
R^2	0.7026	0.716	0.013

HECM = Home Equity Conversion Mortgage.
*Statistically significant at the * .05 level; ** .01 level; *** .001 level.*
Notes: Forward purchase loans are the reference category for loan type. Robust standard errors are presented in parentheses.

significant). Forward refinances, however, are associated with significant time invariant discounts relative to forward purchase mortgages. In contrast with the first sample, the time invariant discount among reverse mortgages is not statistically significant in the second sample.

Approximately 28 percent of observations required some amount of repairs, defined as a difference between the "as is" and repaired appraisal estimates. The share, however, was less than 26 percent among reverse mortgages compared with nearly 30 percent among forward loans (purchase and refinance). Among houses needing repairs, the average difference in appraisal estimates was roughly $5,900 for forward purchase loans but only $5,500 for reverse mortgages. Despite these differences, the results are surprisingly similar to the model of the "as is" appraisal estimate. The relative time invariant price discounts are smaller. The difference in estimates of additional depreciation among forward purchase and refinance loans is also smaller and significant at least at the 5-percent level; however, the difference in estimates of additional appreciation among reverse mortgages is not statistically significant.

The last column of exhibit 5 replaces the appraised foreclosure value with the likelihood of needing some amount of repairs, represented by a binary dependent variable and a probit model. The likelihood of needing repairs increases with time for all loan types; however, the increase in likelihood is smallest among reverse mortgages. The difference between reverse mortgages and forward purchase loans is statistically significant, but the difference between reverse mortgages and forward refinance loans is not significant. Estimated coefficients on the estimated market value, amount of HECM disbursements, and the categorical variables representing loan type are not statistically significant.

Instead of estimating the foreclosure price, exhibit 6 presents the results of estimating the original value on which the loan was underwritten. The true market value of the collateral is estimated by adjusting a previous FHA-insured purchase price on the same property by changes in local area market house prices. The first column of exhibit 6 presents the results of all such transaction pairs.[15] More than 3 million such pairs are analyzed on roughly 2.5 million properties. The data include nearly 34,000 pairs in which the subsequent origination is a reverse mortgage. The results show substantial bias among forward refinance and reverse mortgage appraisals. Refinances are associated with home appraisals that are 10.6 percent higher than the appraisals on home purchase loans after accounting for changes in local house prices. Reverse mortgages are associated with appraisals that are 15.9 percent higher. In contrast with the effect of time on the foreclosure sale price, the length of time between valuations is associated with an increase in subsequent house valuations.

Exhibit 6

House Value at Loan Origination

	(1) All Pairs[a]	(2) Subsample
Loan type		
Forward		
Refinance	0.1006***	0.0688***
	(0.0005)	(0.0193)
Reverse	0.1476***	0.0628*
	(0.0018)	(0.0260)
Loan age	0.0043***	0.0072***
	(0.00004)	(0.0020)
Estimated value	0.8301***	0.9492***
	(0.0028)	(0.0238)
Constant	1.9745***	0.6228*
	(0.0320)	(0.2834)
N	3,005,898	419
F	23,2312.3115	473.2407
R^2	0.7533	0.8654

[a] *Clustered by property for repeated transactions.*
*Statistically significant at the * .05 level; ** .01 level; *** .001 level.*
Notes: Forward purchase loans are the reference category for loan type. Robust standard errors are presented in parentheses.

[15] Clustered standard errors are used to account for multiple transaction pairs based on the same property. Properties with more than four associated originations are excluded to avoid likely data problems.

The second column of exhibit 6 is based on a subgroup of the first matched sample similarly linked to previously FHA-insured home purchase loans on the same property. The sample size is substantially smaller: just 87 reverse mortgages are matched to 332 forward loans. The results confirm upward bias in refinance and reverse mortgage appraisals relative to home purchase originations; however, the magnitude of the bias is much smaller (roughly 7 percent for each).

Exhibit 7 shows the effect of reestimating the market value of the foreclosure sale. The first column estimates the market value by adjusting the value at origination. The second column estimates the market value by adjusting the price from a previous home purchase origination. The time invariant discount is substantially reduced when using the previous home purchase origination as the basis for estimating the market value; however, the small sample size prevents definitive statements on statistical significance. To illustrate the overall findings, exhibit 8 simply plots the change in average valuations between the previous purchase, subsequent loan origination, and ultimate foreclosure sale relative to the change predicted by the ZIP Code HPI. Forward refinance loans and reverse mortgages deviate substantially higher than forward purchase loans at the point of loan origination, but valuations converge in foreclosure. The foreclosure sale price is below market expectations.

Exhibit 7

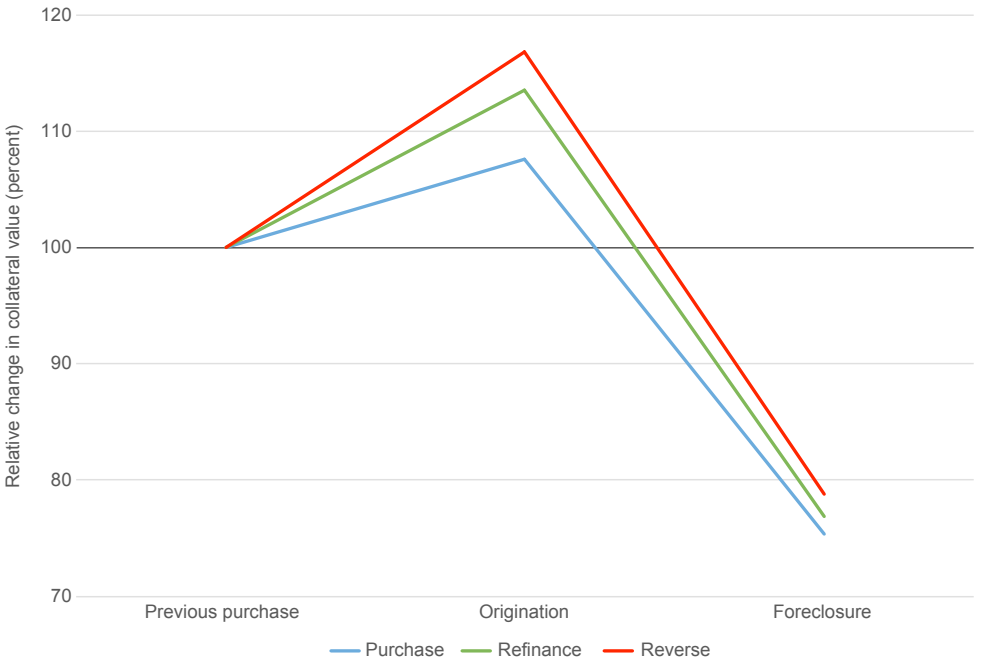
Value Estimated by Repeat Sales

	(1)	(2)
	Estimated Market Value Based on …	
	Value at Origination	Previous Home Purchase
Loan type		
Forward		
Refinance	– 0.1731	– 0.0574
	(0.2263)	(0.2162)
Reverse	– 0.3396	– 0.0624
	(0.3069)	(0.3017)
Loan age		
x Forward		
Purchase	– 0.0131	– 0.0155
	(0.0212)	(0.0206)
Refinance	– 0.0029	– 0.0138
	(0.0122)	(0.0122)
x Reverse	0.0293	0.0045
	(0.0267)	(0.0272)
Estimated value	1.4973***	1.5251***
	(0.0693)	(0.0743)
HECM disbursements	– 9.5318	– 8.4012
	(7.8660)	(7.4942)
Constant	– 6.2426***	– 6.4178***
	(0.8643)	(0.9362)
N	419	419
F	99.6729	95.942
R^2	0.6464	0.647

HECM = Home Equity Conversion Mortgage.
*Statistically significant at the * .05 level; ** .01 level; *** .001 level.*
Notes: Forward purchase loans are the reference category for loan type. Robust standard errors are presented in parentheses.

Exhibit 8

Change in Average Valuations Relative to Local HPI



HPI = house price index.
Note: 100 percent equals the five-digit ZIP Code HPI.

Conclusion

Properties securing reverse mortgages sell disproportionately below expected prices in foreclosures relative to forward purchase loans. Consistent with previous studies on the difference in appreciation rates between older and younger households (Davidoff, 2004; Rodda and Patrabansh, 2005), reverse mortgages are associated with a 2 to 4 percentage point decline in the average annual rates of change in collateral values. This discount could be mistaken as excessive depreciation due to property undermaintenance. Such depreciation, however, is expected to cause the property value to diverge from market house price changes over time. This article finds that the discount is largely time invariant. The discount is also observed among refinance loans.

Unscheduled disbursements and corporate advances by the servicer do not ameliorate the discount associated with reverse mortgages. In fact, more disbursements are associated with a lower foreclosure price. The causal interpretation of this finding, however, is difficult: funding for property preservation should increase the value of the collateral but should be drawn only for properties with evidence of undermaintenance.

The primary culprit of the discount is likely an inflated estimate of the collateral value at loan origination. Using a repeat-sales methodology, we find that refinance loans are associated with valuations up to 11 percent higher than purchase mortgages, comparable to findings in

previous research (Agarwal, Ambrose, and Yao, 2016). Reverse mortgages, which do not need to consider the ability of the borrower to repay the loan, are associated with valuations that are up to 16 percent higher. The effect of overinflated appraisals would be an unexpected decline in the subsequent transaction price, regardless of the length of time between valuations.

A larger foreclosure discount among nonassigned reverse mortgages compared with foreclosures disposed of through HUD suggests yet another moral hazard problem, in which servicers in charge of the foreclosure process have little incentive to maximize the resale price when losses are insured by FHA. Selection bias, however, may be present in the process of which properties are assigned to HUD. More research is needed into when and why a servicer may exercise the option to assign loans after exceeding the 98-percent threshold.

In general, these findings do not support a policy of periodic property inspection of reverse mortgages. The collateral value associated with reverse mortgages does not deteriorate with time to any greater extent than does the value observed with forward purchase mortgages, for which no inspection requirement exists. Instead, more attention must be paid to the appraisal process at loan origination. All new applications for FHA insurance assigned after June 27, 2016, are required to submit appraisals through an Electronic Appraisal Delivery portal. Electronic appraisal data hopefully will provide FHA the information needed to monitor the accuracy of appraisals more closely and systematically. Further, the actuarial review of the reverse mortgage program should consider using automated valuation models to estimate current market values of HECM properties instead of relying on the initial value, scaled by an HPI and a "maintenance-risk adjustment factor." Although existing HECMs are still likely to suffer disproportionate loss severities, given inflated past appraisals, at least these losses can be expected and the issue can be addressed for future endorsements.

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