

Flood Exposure, Assessed Losses, and Resale Prices:\ Evidence from Florida

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Abstract

A resale discount measured with a property appraiser's write-down may reflect a sale the appraiser has seen. I link Florida repeat sales to water depth at the parcel in six hurricanes, field damage assessments, and building permits, none produced by an appraiser. My flag for a large write-down by the appraiser rises with depth and inspectors' damage class, but 79 percent of homes with a foot of water or more carry none. Homes with a foot or more resell 5.3 log points below tract peers. In resales two years or more after the storm, each foot of depth goes with a price 0.6 log points lower; the interval excludes zero with county clusters, the p -value with four storm clusters is 0.11, and the interval for one indicator of a foot or more includes zero. The larger discount on flagged homes is concentrated in early resales, even with little or no recorded water, so it is not the price effect of flooding. Inundated homes are resold more often than others of the same tract and flood (hazard ratio 1.10); trimming bounds under that direction include zero, and an inverse-probability-weighted difference is negative. Among homes with no water, prices are 0.5 log points lower per ten percentage points of the block group inundated; this slope is imprecise without Hurricane Ian and, within Ian, as large before the storm. For collateral valuation, insurance and disaster aid, the absence of a flagged write-down does not show that a home stayed dry.

Keywords: Flood depth; House prices; Repeat sales; Property assessment; Damage assessment; Sample selection

JEL classification: Q54, R31, R21, G21

1 Introduction

A low sale price after a flood can reflect damage to the building, a change in the value of its location, or the particular homes and owners that return to the market. Studies that cover many floods measure damage with records prepared after the event. In Florida the only parcel-level record that covers every flood is the write-down of improvement value on the tax roll, and the county property appraiser who records it can see a sale before the roll is closed. A low price may therefore produce the measured damage as well as result from it, and a resale discount estimated from that record cannot rule this out.

This paper measures flood exposure at the parcel without the appraiser. I locate the 2,188,312 Florida single-family parcels of a repeat-sales sample and link them to the depth of water at the parcel in six hurricanes from 2017 to 2024, to damage classes recorded by inspection teams, and to building permits. No property appraiser produces these measures, and the depth and inspection records cannot respond to a sale price. With them I report how far the assessment record agrees with water at the parcel, a resale discount for inundated homes that does not rest on the assessment record, bounds for selection into resale with inundation as the treatment, and a price comparison for homes that stayed dry in inundated block groups. These results matter wherever a recorded loss stands in for a physical one. For collateral valuation, an appraiser or an automated valuation model that draws comparables from the months after a flood needs to know whether the low prices of written-down homes measure flooding or the way write-downs come to be recorded. For insurance, a loss model calibrated to assessed write-downs inherits whatever the assessment misses. For disaster aid, a program that directs funds by recorded damage leaves out the inundated homes that carry no record. For lending, loan-to-value limits in an exposed area depend on whether the discount is confined to homes that took water and on whether it is still present after the first resales.

The data are Florida sales from 2001 to 2025, annual tax rolls, and National Flood Insurance Program (NFIP) claims. A heavy flood is a block-group event with claims on at

least 5 percent of parcels, and the assessment flag is my indicator for a large relative write-down of improvement value on the appraiser's roll in the year of such a flood. Parcels are followed across rolls under one identity, the county number and the parcel identifier reduced to its letters and digits, because a key that follows the spelling of each roll hides the resales that straddle a respelling. Price comparisons are between pairs of sales of the same home and pairs of other homes in the same census tract with the same purchase and resale years. Depth comes from flood models, radar imagery and surveyed high-water marks, and it is known for 98.1 percent of the homes at risk in the six storms.

The assessment flag carries information about damage but records it incompletely. Within the same block group and flood, a home with 3 ft of water or more is 16.1 percentage points more likely to be flagged than a home with no water, and 51 percent of the homes that inspectors rated as major damage or destroyed are flagged, against 14 percent of the homes rated minor or less. But 78.5 percent of the homes with 1 ft of water or more carry no flag, and 17.5 percent of the flagged homes have no modeled water.

Homes with 1 ft of water or more in a heavy flood resell 5.34 log points below tract peers (s.e. 1.83; 95 percent interval -8.99 to -1.69), on 5,719 pairs from 24 counties. When the resale is dated two calendar years or more after the storm, each foot of depth goes with a price lower by 0.60 log points (s.e. 0.19; interval -0.99 to -0.22 ; wild-bootstrap $p = 0.029$ with counties as clusters and 0.11 with the four storms as clusters). One indicator for 1 ft or more is less precise in those sales: its coefficient is -3.70 log points and its interval, -7.73 to 0.33 , includes zero. Compared with homes of the same block group in the same flood, homes with 1 ft or more sell 4.02 log points lower (interval -7.55 to -0.48). The discount on flagged homes is larger, and on the same pairs it is concentrated in resales dated in the flood year or the next: flagged homes with no water or under 1 ft sell 13.60 log points below tract peers when they resell early and no lower than unflagged homes with as little water when they resell later. The early discount on flagged homes is therefore not the price effect of flooding.

I estimate the direction of selection into resale before bounding its effect. Inundated homes are resold more often than homes with less water in the same tract and flood, with a hazard ratio of 1.10 (interval 1.02 to 1.20). Trimming bounds under that direction are -9.27 and 1.86 log points, with a 95 percent interval from -13.83 to 4.63 , and do not sign the discount; a difference weighted by the inverse probability of resale is -6.46 log points (s.e. 1.78). For homes with no water at the parcel, the primary specification relates the price change to the inundated share of the block group: prices are lower by 0.54 log points for each 10 percentage points of the share (s.e. 0.23; wild-bootstrap $p = 0.041$). The evidence for this area effect is limited. The slope is imprecise without Ian ($p = 0.14$), a placebo with randomly assigned shares gives it a p -value of 0.076, and for Ian and Idalia taken singly a slope of the same size is present before the storm. Permits, improvements recorded on the roll and insurance payments do not measure repair precisely enough to estimate its return.

The paper connects the repeat-sales selection problem studied in this journal by Gatzlaff and Haurin (1997) with the measurement of disaster effects in public data examined by Contat et al. (2025). Its coverage of several storms complements the event-specific evidence of Ortega and Taşpınar (2018) and Le (2024) on damage and recovery after Hurricane Sandy, and it relates to work on flood capitalization and housing-market adjustment, including Beltrán et al. (2019), Graff Zivin et al. (2023), Zhang and Leonard (2019) and Bui et al. (2024). The contribution is evidence on what an administrative damage record measures when it is set against independent measures of water and damage, and a resale discount for inundated homes that does not depend on that record. Section 2 describes the data and the measures, Section 3 the comparisons, and Section 4 the results. Estimates for the assessment flag, robustness checks and the mortgage aggregates are in Online Resource 1.

2 Data and measures

2.1 Sales, tax rolls and parcel identity

Florida Department of Revenue sale data files and annual tax rolls provide prices, dates, property characteristics, qualification and change codes, and assessed values (Florida Department of Revenue, 2025). Consecutive sales of the same single-family parcel are paired if land use is unchanged, the holding period is at least six months, and both prices are between \$30,000 and \$20 million. Pairs with an absolute log price change above 1.5, or above 0.6 per year held, are excluded. These outcome screens can remove unusually large losses, so the results concern the retained distribution. For sales from 2009 on, qualification codes 01 and 02 identify arm's-length transfers. Earlier sales carry no code and are screened: an improved single-parcel sale without a change code and with a price between 0.5 and 3 times just value. On coded sales of 2010 to 2016 the screen retains 97.2 percent of qualified sales, and 68.5 percent of the sales it retains are qualified. I therefore call the full series eligible sales and report the sample with a first sale in 2009 or later, the coded sales, beside it.

A parcel must keep one identity from roll to roll, because pairs of sales, year-to-year changes in assessed value and the population at risk of resale are all formed within a parcel. Some counties respell the parcel identifier between rolls. Hyphens or blanks are added or dropped, and Orange and Pasco counties changed the order of the section and range digits. A key built from the identifier as it stands on each roll then gives one parcel two keys: a respelling between two sales removes the pair and makes the home appear not to have been resold. I define the identity of a parcel as its county number and its identifier reduced to letters and digits, in upper case; in the county and roll years in which more identifiers match the statewide cadastral layer after the section and range digits are exchanged than before, the exchange is applied to every identifier of that county and year (38 county-years in the two counties). Under the earlier key, 16.5 percent of the parcels linked to the cadastral layer carried two keys. Under this rule none does. A parcel that a county renumbered still has

two identities, which no rule of this kind can join; its earlier number is not in the cadastral layer. All estimates use this identity. Online Resource 1, Section ??, documents the rule (Table ??), describes how the files were rebuilt with it, and compares the main estimates under the two keys (Table ??). Under the single identity the pair file holds 11.6 percent more pairs, and the population at risk after a heavy flood is 2.3 percent larger. No estimate of that table moves by more than 0.43 of its standard error; two intervals change sides, and the table marks them.

The pair file holds 2,992,632 single-family pairs. Of these, 2,919,043 meet two sample conditions: the home is not written down in or before the year of its first sale, and the claims-rate proxy reported in Online Resource 1 is defined, so that the flag and the proxy are estimated on the same pairs. The price regressions of Section 3.1 absorb an effect for every tract, purchase year and resale year, and a pair that is alone in its cell contributes nothing to them. The regression sample is therefore the 2,616,077 pairs that share a cell with at least one other pair. The later-resale sample, which leaves out the pairs with a flood or a write-down in year S whose second sale is dated before $S + 2$, holds 2,543,118 pairs after the same step. The preprocessing replaces parcel identifiers by a one-way hash and never reads owner or address fields.

2.2 Flood events and the assessment flag

The event file uses redacted NFIP claims located by census block group (Federal Emergency Management Agency, 2026). A named storm within a year forms one event, and unnamed claims are grouped by month. A block-group event qualifies with at least three claims and claims on at least 1 percent of the residential parcels on the roll of 1 January of the year before; it is a heavy flood at 5 percent or more. These ratios depend on insurance coverage and claim filing and are not the share of homes physically flooded. The parcel count is dated before the flood; the claims are observed during and after it. Claims from 1978 on are used as flood history, so that a recent event is not treated as a block group’s first only because

earlier claims were ignored. A flood in a county and year in which parcels cannot be followed to the roll that fixes the geography has no parcel count dated before it; it classes no home, and pairs of sales that span it are dropped (Online Resource 1, Section ??).

Improvement value is just value minus land value. For each pair of annual rolls, the change in a home's log improvement value is measured relative to the block-group median change. I define the assessment flag as a relative decline of more than 0.2 log units, about 18 percent, in the year of a heavy flood. The threshold is mine; the appraiser records values and not a damage category. A home is classed once in each holding period, at the first qualifying flood of its block group after its last eligible sale, and the same rule classes homes that resell and homes that do not. Under this definition 18,687 flagged and 129,919 unflagged homes are at risk of resale after a heavy flood, and 2,786 of the flagged homes form a pair of the pair file (Online Resource 1, Tables ?? and ??). The flag is a proxy for a large recorded loss in the improvement component of value. It can record wind damage, other deterioration or an assessment revision, and it can miss damage common to the block group because the median is subtracted. A pair of sales that carries a disaster change code without a write-down is not flagged, because the code is recorded only when a home is sold and cannot class homes that do not resell; such pairs keep an indicator of their own. The roll dated 1 January of the year after the flood is prepared during that year, so sales in the flood year and early in the next can inform the recorded write-down. This is the concern that the independent measures address.

2.3 Independent measures of water, damage and repair

Location. The statewide cadastral layer of the Florida Department of Revenue carries a polygon and the roll's parcel identifier for every parcel (Florida Department of Revenue, 2026). I use the centroid of the polygon. The identifier matches for 97.6 percent of the 2,188,312 parcels of the pair file and of the population at risk (Online Resource 1, Table ??).

Depth. The depth of water at the parcel comes from a different source for each storm.

For Hurricane Irma (2017) I use the modeled depth grids that FEMA released after landfall, which cover storm surge in eleven coastal counties on 7.6 m cells, and I take the largest of the nine cells around the centroid (Federal Emergency Management Agency, 2017). For Hurricanes Ian (2022) and Idalia (2023) I use the maximum-depth hindcasts of the Rapid Infrastructure Flood Tool (RIFT) of the Pacific Northwest National Laboratory, which report depth classes on 60 m cells; I use the class midpoints (Pacific Northwest National Laboratory, 2024). For Hurricanes Helene and Milton (2024) I use the building-level depths that ICEYE derived from radar imagery in the counties it mapped (ICEYE, 2024) and the RIFT product elsewhere, a hindcast for Helene and the forecast of 9 October for Milton. For Hurricane Michael (2018) I found no depth grid. I interpolate the surveyed elevations of the six nearest high-water marks of the U.S. Geological Survey within 8 km to a water surface, subtract the ground elevation at the centroid from the 3D Elevation Program, and define depth for parcels within 5 km of a mark (U.S. Geological Survey, 2026). Depth is grouped into four bins: no water, under 1 ft, 1 to 3 ft, and 3 ft or more. As a bin, under 1 ft means some water and less than 1 ft. Where homes with 1 ft or more are set against all other homes with a known depth, in Sections 4.3 and 4.4, I call the others homes with less water; they have no water or under 1 ft. Heavy floods before 2017 have no depth source.

The sources differ in quality. At 343 high-water marks surveyed after Ian, the RIFT depth class has a correlation of 0.57 with the surveyed height of water above ground, and its level is too high, as expected of a 60 m cell that averages over streets, canals and yards. The surface built from Michael’s marks has a leave-one-out correlation of 0.59 with the surveyed heights. The FEMA grids for Irma are the weakest source: they show no water at 54 percent of the Irma marks inside them, most of which are riverine (Online Resource 1, Table ??). Depth thresholds are therefore thresholds of these sources and are best read as ordered classes. Error of this kind biases the depth coefficients toward zero.

Field assessments. Inspection records rate a structure on the scale of FEMA’s individual-assistance program: unaffected, affected, minor, major or destroyed. I use the initial damage

assessments of structures in Fort Myers Beach after Ian, the damage surveys of the Florida Division of Emergency Management for Ian, Idalia, Debby (2024), Milton and the Broward County flood of April 2023, and the structure observations of search-and-rescue teams after Debby (Florida Division of Emergency Management, 2024). A record is assigned to the nearest parcel centroid within 40 m. These records are made by emergency-management, building and search-and-rescue staff. I found no parcel-level damage layer produced by a property appraiser, so every field record used here is independent of the assessment. The records cover few homes, in the places inspectors chose to visit.

Permits and assistance registrations. Building permits with a parcel identifier or a location, a date and a type are public for unincorporated Hillsborough County from May 2020, the City of Orlando from 2014, Miami-Dade County from mid-2022, the City of Cape Coral from August 2024, the City of St. Petersburg, whose renovation applications I date by year and month, and the City of Miami, whose records begin after Irma. I found no usable permit history for unincorporated Lee County, for Collier, Sarasota and Pinellas counties outside St. Petersburg, or for the cities of Tampa, Fort Myers and Naples, and the Charlotte County layer holds new construction only; Online Resource 1, Table ??, records the search. Permits therefore cover little of the flooded area. A repair permit is one whose type or description names roofing, a storm or damage, demolition, elevation, rebuilding, repair, remodelling or alteration (Online Resource 1, Table ??). Two further records of repair are already in the files: the improvements that the tax roll records after a flood, in new-construction value, living area or effective year built, and NFIP building payments by block group and flood. As a check on the depth sources I also aggregate registrations of FEMA’s Individuals and Households Program by ZIP code and disaster (Federal Emergency Management Agency, 2026); across ZIP codes the share of parcels with 1 ft of water or more has a correlation between 0.51 and 0.91 with the share of registered owner-occupied houses that report flood damage (Online Resource 1, Table ??).

Coverage. The six storms with a depth source account for 114,515 of the 148,606 homes

at risk in heavy floods and for 90 percent of the flagged homes, and depth is known for 98.1 percent of them. Coverage is 99.9 percent or more for Ian, Idalia, Helene and Milton, 91.9 percent for Irma and 75.5 percent for Michael. Among the pairs that meet the sample conditions of Section 2.1, 13,793 of the 29,541 with a heavy flood between the sales have a known depth, and 10,995 of those share a cell with another pair and so enter the depth regressions (Online Resource 1, Table ??). Online Resource 1, Table ??, lists the host and the retrieval date of each file.

3 Empirical comparisons

The regressions estimate changes in transaction prices. A price can be thought of as the value of land and location plus the contribution of the structure. Flood damage lowers the second component and repair can restore it, while information, insurance costs and local demand can change the first. An assessment flag is a proxy for a large recorded loss in the structure, and depth at the parcel is a measure of physical exposure; neither is an observation of the change in either component. Tract cells and county-month effects remove price changes shared by the comparison area. The coefficients for a home and the coefficients for its surrounding area are therefore distinct relative-price comparisons, not additive parts of one total loss.

3.1 Resale prices

For a pair of sales i of a home in tract c and county k , bought in month m_0 of year y_0 and resold in month m_1 of year y_1 , the specification for the assessment flag is

$$\Delta p_i = \alpha_{cy_0y_1} + \mu_{km_1} - \mu_{km_0} + \delta D_i + \beta_U U_i + \lambda' Z_i + \varepsilon_i, \quad (1)$$

where Δp_i is the change in the log price, D_i indicates a flagged home in a heavy flood between the sales, U_i an unflagged home in a heavily exposed block group, and Z_i collects indicators for the other pairs with a flood or a write-down: write-downs without a flood, smaller floods,

and a flood before the first sale. The tract-by-purchase-year-by-resale-year cells compare pairs with the same holding window, following repeat-sales reasoning (Bailey et al., 1963; Case and Shiller, 1989), and the county-month effects absorb the county price path. The coefficient δ compares flagged homes with tract peers.

For a pair whose first qualifying flood between the sales is a heavy flood of one of the six storms, and whose parcel has a known depth d_i , depth replaces the flag:

$$\Delta p_i = \alpha_{cy_0y_1} + \mu_{km_1} - \mu_{km_0} + \sum_{b=0}^3 \gamma_b 1[d_i \in b] + \lambda' Z_i + \varepsilon_i, \quad (2)$$

where $b = 0$ is no water, $b = 1$ under 1 ft, $b = 2$ 1 to 3 ft and $b = 3$ 3 ft or more, and Z_i now also holds the pairs of heavy floods without a known depth. The coefficient γ_b compares homes of a depth bin with tract peers. I report three versions: all sales; pairs kept only if the second sale is dated two calendar years or more after the flood, written $S + 2$ for a flood in year S ; and a specification with an effect for every block group and flood and indicators for the decade of construction, in which the depth coefficients are identified from homes of the same block group in the same flood. The $S + 2$ restriction matters for the flag because the roll that records a write-down for year S is prepared during $S + 1$; a sale in $S + 2$ or later cannot have informed it. It is applied to depth for comparability. Depth also enters as a continuous measure, in feet and in $\log(1 + \text{feet})$, beside an indicator for a heavy flood with a known depth, so that the slope is identified from differences in depth among the homes of heavy floods. The slope is the specification I report for later resales, where one indicator for 1 ft or more has little power.

All price regressions start from the regression sample of Section 2.1; the later-resale, coded-sale and leave-one-storm-out estimates use the subsets named in the tables. Standard errors are clustered by county, and intervals use the t distribution with 66 degrees of freedom for the 67 counties. When two coefficients come from different regressions on the same pairs, the standard error of their difference uses the county-level influence scores of both.

Coefficients are reported in log points, 100 times the coefficient on the log price change. For the later-resale estimates I add wild cluster bootstrap p -values with the null imposed (Cameron et al., 2008), with counties as clusters and, as a check on dependence across the counties hit by one storm, with storms as clusters. Intervals are pointwise and are not adjusted for multiple comparisons. The exclusions of single storms, the coded-sale sample and the timing interactions are sensitivity analyses and were not preregistered.

3.2 The flag against the independent measures

The flag is compared with depth and with the field damage class on the population at risk of resale, whether or not a home is later sold. A linear probability model relates the flag of a home to its depth bin, or to its field class, with an effect for every block group and flood. To examine whether flags follow sales, I relate the flag to the timing of the first resale after the flood, with and without the depth bins.

3.3 Selection into resale

Prices are observed only for homes that are resold. Let $R_i(d)$ indicate that home i is resold in a pair of the price sample under treatment status d , and $Y_i(d)$ the excess appreciation of that pair: its log price change minus the mean change of the pairs of homes not written down in the same tract, first-sale year and second-sale year, net of county-month effects. The object is the difference among homes that would resell under either status,

$$\Delta^* = E^*[Y_i(1) - Y_i(0) \mid R_i(1) = R_i(0) = 1], \quad (3)$$

in a population standardized to the treated homes' distribution over tract-by-flood-year cells. Following Lee (2009), trimming bounds Δ^* under conditional independence within cells and monotonicity: the treatment moves the resale decision of every home in the same direction. If the treatment weakly raises resale, the treated homes that resell are trimmed to the ratio

of the two resale rates, from the top and from the bottom of their distribution of Y , and the two trimmed means give the bounds; if it lowers resale, the comparison homes are trimmed. The direction is estimated before the bounds are computed. A linear probability model relates resale within 12, 24, 36 and 60 months of the flood, and by the end of the sale files, to an indicator for 1 ft of water or more, with an effect for every tract and flood; a proportional-hazard model of the first resale (Cox, 1972), stratified by tract and flood, gives the same comparison as a hazard ratio. These regressions are run on the homes at risk, which lie in 25 counties or fewer, and their p -values and intervals use the t distribution with one degree of freedom fewer than the number of counties in the regression. I report the bounds under the direction that these estimates support at the 5 percent level. Trimming is exact: the weighted tail mean splits the weight of the observation at the cutoff. Standard errors come from 999 samples of counties drawn with replacement, with every step recomputed in every draw, and intervals use the critical value of Imbens and Manski (2004). The treatment is 1 ft of water or more, compared with homes with less water in the same tract and flood.

Bounds allow selection on the outcome and are wide when the resale rate is low. As a complement I weight each resold home by the inverse of the probability that it is resold in the price sample, estimated by a logit on years since purchase, the period of purchase, the assessment flag, the claims share of the block group and the storm, separately for treated and comparison homes, and I report the weighted difference in mean Y with the same cell weights and county bootstrap. This estimate is valid if, given those characteristics and the treatment, resale is unrelated to the price change.

3.4 Homes without water in inundated block groups

The area comparison stacks the six storms and concerns homes with no water at the parcel. For each storm, the exposure of a block group is the share of its single-family parcels with 1 ft of water or more. The comparison homes lie in block groups of the same county that none of the storms inundated and that have no qualifying NFIP flood. The estimating equation

is a repeat-sales event study,

$$\Delta p_i = \alpha_{sky_0y_1} + \mu_{skm_1} - \mu_{skm_0} + \theta_{e(m_1)} - \theta_{e(m_0)} + \varepsilon_i, \quad (4)$$

with cells and month effects specific to the stack s and county k , event-time terms for treated homes only, and the year before the storm omitted. The primary specification multiplies the event-time terms by the inundated share, so that θ is a slope: the price change of a home with no water per unit of the share of its block group that was inundated, with never-inundated block groups at zero. I chose this specification after the binned version described below had been estimated and before the slope itself was estimated. It is therefore fixed with respect to its own estimates and not with respect to the binned ones. I also report the slope with the square of the share, among block groups with some inundation only, by storm and with each storm left out, and a binned version in which the treated block groups are those with a share of at least 10 percent or at least 25 percent. I report the average coefficient for years 0 to 4 and for years -6 to -2 . The second is a check on the comparison: a coefficient different from zero before the storm means that treated and comparison block groups were already on different price paths. The storms of 2022 to 2024 contribute short post-storm histories, so the coefficient for years 0 to 4 is not a balanced five-year effect. Standard errors are clustered by county, and because few counties are treated I also report wild cluster bootstrap p -values with the null imposed (Cameron et al., 2008). Because the share varies by block group within a county, I add a placebo in which never-inundated block groups receive the shares of randomly drawn inundated block groups of the same storm.

3.5 Interpretation

The coefficients are adjusted associations among eligible resales. Depth is not assigned at random: homes that take more water lie lower and nearer the coast or a river, and they can differ in age, construction and price path. The cells compare appreciation over the

same years within a tract, the block-group specification compares homes within the same flood, and the same regression for pairs sold before the storm serves as a check. Depth also measures water and not wind, so a home with heavy wind damage and no surge is classed as dry. The advantage of depth over the flag is that no step in its construction can respond to a sale price. The sale files end in late 2025, so the floods of 2024 are followed for 12 to 16 months.

4 Results

4.1 What the assessment flag records

Table 1 compares the flag with depth for the 112,301 homes at risk whose depth is known. The share flagged is 6.1 percent among homes with no modeled water, 16.9 percent under 1 ft, 19.2 percent from 1 to 3 ft and 22.4 percent at 3 ft or more. Within the same block group and flood, a home with 3 ft or more is 16.1 percentage points (s.e. 4.9) more likely to be flagged than a home with no water; without the floods of 2024 the difference is 9.5 points (s.e. 3.6). The flag therefore carries information about water at the parcel.

The flag and the depth sources also disagree for many homes. Of the homes with 1 ft of water or more, 78.5 percent are not flagged. Of the flagged homes, 17.5 percent have no modeled water and a further 7.2 percent have some water under 1 ft, 24.7 percent together. The share of flagged homes with no modeled water is 45 percent for Michael and 79 percent for Milton, storms with heavy wind damage away from the surge, and 5 percent for Ian. These shares overstate the disagreement between the flag and flooding, because the depth sources are imperfect: a 60 m model cell can be wet where a house is dry, and a home outside the modeled surge can have taken rain or river water.

The field assessments allow a comparison that does not rest on a flood model. Among 669 homes that inspection teams rated as major damage or destroyed, 51 percent carry the flag; among homes rated unaffected, affected or minor it is 14 percent (panel C). Within

Table 1: The assessment flag against depth at the parcel and field damage class

	Homes	Flagged (%), by depth				Flagged:	≥1 ft:
		None	<1 ft	1–3 ft	≥3 ft	no water (%)	no flag (%)
<i>A. Share of homes with an assessment flag</i>							
All six storms	112,301	6.1	16.9	19.2	22.4	17.5	78.5
Ian 2022	44,689	5.5	6.2	9.1	22.7	4.9	79.0
Helene 2024	42,077	6.8	32.1	32.4	26.5	25.9	70.2
Without floods of 2024	64,624	5.7	6.8	8.6	21.8	10.2	81.0
Without Ian	67,612	6.2	20.3	22.7	21.6	29.5	77.7
<i>B. Flag on depth within block group and flood (percentage points)</i>							
All six storms	112,284		10.4 (6.1)	13.3 (6.8)	16.1 (4.9)		
Without floods of 2024	64,617		2.1 (0.7)	3.5 (1.1)	9.5 (3.6)		
<i>C. Flagged (%) by field damage class</i>							
	Homes	Unaffected	Affected	Minor	Major	Destroyed	
All field assessments	1,213	2 [243]	8 [64]	28 [237]	47 [570]	75 [99]	
Ian 2022	543	–	50 [10]	45 [141]	65 [342]	76 [50]	

Notes: Single-family homes at risk of resale after a heavy flood (Section 2.2), with depth known (panels A and B) or with a field assessment (panel C). Flag: a decline of more than 0.2 log units in improvement value relative to the block-group median in the flood year. Depth: Section 2.3. Panel A: percent of homes flagged, by depth bin (<1 ft: some water and less than 1 ft); the last two columns give the percent of flagged homes with no modeled water and the percent of homes with 1 ft or more that are not flagged. Panel B: linear probability regressions of the flag on the depth bins with an effect for every block group and flood, in percentage points relative to homes with no water; standard errors clustered by county in parentheses. Panel C: percent flagged by field damage class on the FEMA individual-assistance scale, with the number of homes in brackets. Rows by storm are in Online Resource 1, Table ??.

block group and flood, homes rated major or destroyed are 20.6 percentage points (s.e. 4.3) more likely to be flagged than homes rated affected or minor. The field sample is small and local; Ian supplies 543 of its 1,213 homes, most of them in Fort Myers Beach. The flag thus rises with the damage class that inspectors recorded, and it misses about half of the homes they rated major or destroyed.

If appraisers often wrote a home down after seeing its sale, flags would be more frequent among homes that resell soon after the flood. The data show no such pattern. For floods observed for 24 months, 8.1 percent of the homes first resold in the flood year or the next are flagged, against 12.0 percent of the homes first resold later and 15.7 percent of the homes not resold. Within block group and flood the early-minus-later difference is -5.6 percentage points (s.e. 3.0), and -5.6 (s.e. 2.9) with the depth bins added (Online Resource 1, Table ??). The incidence of the flag does not depend positively on an early resale. Whether the size of

an early write-down follows the sale price is a question about prices, taken up in Section 4.3.

4.2 Resale prices by depth

Table 2 reports equation (2). Homes with 1 ft of water or more in a heavy flood resell 5.34 log points (s.e. 1.83; 95 percent interval -8.99 to -1.69) below tract peers, on 5,719 pairs in 24 counties and 6 storms. The coefficients are ordered by depth: -0.41 log points for homes with no water, -2.19 under 1 ft, -3.49 from 1 to 3 ft and -6.90 (s.e. 1.56) at 3 ft or more. Each foot of depth goes with a price lower by 0.98 log points (s.e. 0.21). Within heavily exposed block groups, homes with 1 ft or more sell 4.72 log points below homes with no water (interval -8.29 to -1.15).

For collateral that remains in an exposed area the relevant estimate is the discount in later resales, dated after the first sales and after the roll that could reflect them. When exposed homes are kept only if the second sale is dated in $S + 2$ or later, each foot of depth goes with a price lower by 0.60 log points (s.e. 0.19; 95 percent interval -0.99 to -0.22 ; wild-bootstrap $p = 0.029$), and a unit of $\log(1 + \text{feet})$ with a price lower by 2.20 log points (s.e. 0.79; $p = 0.034$). I report the slope as the later-resale result because it uses the variation in depth among inundated homes, which one indicator leaves out; the inundated homes of these sales have 5.3 ft of water on average. The indicator for 1 ft or more has a coefficient of -3.70 log points (s.e. 2.02), and its interval, -7.73 to 0.33 , includes zero (wild-bootstrap $p = 0.076$). By bin, homes with 1 to 3 ft sell 2.80 log points below tract peers (s.e. 2.10) and homes with 3 ft or more 4.58 (s.e. 2.13), and homes with 1 ft or more sell 3.12 log points below homes with no water in the same heavily exposed block groups (interval -5.99 to -0.25). For second sales in $S + 3$ or later the slope is -0.61 (s.e. 0.24; wild-bootstrap $p = 0.11$).

These later sales come from four storms. Of the 3,222 inundated pairs, 1,855 follow Ian, 653 Irma, 495 Michael and 219 Idalia; the floods of 2024 contribute none, because the sale files end in 2025. The slope per foot is -0.51 (s.e. 0.14) for Ian, -0.70 (s.e. 0.50) for Irma,

Table 2: Resale prices by depth of water at the parcel (log points)

	All sales	Sales in $S + 2$ or later	Without Ian
<i>A. Relative to tract peers</i>			
Per foot of depth	−0.98 (0.21) [−1.39, −0.57]	−0.60 (0.19) [−0.99, −0.22]	−1.69 (0.47) [−2.63, −0.74]
wild-bootstrap p	0.004	0.029	0.002
No water	−0.41 (1.16)	−0.47 (1.23)	−0.99 (1.40)
Under 1 ft	−2.19 (1.52)	−1.91 (1.62)	−3.25 (1.78)
1 to under 3 ft	−3.49 (2.15)	−2.80 (2.10)	−4.76 (2.85)
3 ft or more	−6.90 (1.56)	−4.58 (2.13)	−8.67 (2.23)
1 ft or more (one indicator)	−5.34 (1.83) [−8.99, −1.69]	−3.70 (2.02) [−7.73, 0.33]	−6.37 (2.46) [−11.29, −1.45]
wild-bootstrap p	0.017	0.076	0.015
1 ft or more minus no water	−4.72 (1.79) [−8.29, −1.15]	−3.12 (1.44) [−5.99, −0.25]	−5.33 (2.39) [−10.10, −0.56]
<i>B. Within block group and flood</i>			
Per foot of depth	−0.90 (0.31) [−1.51, −0.29]	−0.59 (0.34) [−1.28, 0.09]	−1.43 (0.48) [−2.40, −0.47]
1 ft or more	−4.02 (1.77) [−7.55, −0.48]	−3.09 (1.59) [−6.26, 0.08]	−4.69 (2.19) [−9.06, −0.32]
3 ft or more	−5.39 (2.03)	−3.59 (2.19)	−6.55 (2.39)
Pairs with 1 ft or more	5,719	3,222	2,346
counties; storms	24; 6	23; 4	17; 5
Pairs with no water	4,402	2,517	3,646
Pairs	2,616,077	2,543,118	2,602,775

Notes: Dependent variable: change in the log price between two sales of the same single-family home, times 100. All regressions include tract $\times$ first-sale year $\times$ second-sale year cells, county $\times$ month effects for both sales, and the indicators of equation (1) for pairs without a known depth. Depth indicators apply to pairs whose first qualifying flood between the sales is a heavy flood of one of the six storms with a depth source. Panel A: coefficients relative to tract peers; the four depth bins are one regression (under 1 ft: some water and less than 1 ft), and the rows per foot of depth and for 1 ft or more are separate regressions. Wild-bootstrap p : wild cluster bootstrap by county with the null imposed. Panel B adds an effect for every block group and flood and indicators for the decade of construction; coefficients are relative to homes with no water in the same block group and flood. Sales in $S + 2$ or later: pairs with a flood or a write-down in year S are kept only if the second sale is dated in $S + 2$ or later. Pairs: the regression sample of Section 2.1 and its subsets. Standard errors clustered by county in parentheses; 95 percent intervals in brackets use t_{66} . Further samples and specifications are in Online Resource 1, Tables ?? and ??.

−1.81 (s.e. 0.49) for Michael and 1.34 (s.e. 0.82) for Idalia. With storms in place of counties as clusters, which leaves four clusters with inundated homes, the wild-bootstrap p -value is 0.11 for the slope and 0.016 for the indicator (Online Resource 1, Tables ?? and ??). A comparison with homes outside the flooded area gives a larger later discount. Against homes of never-inundated block groups of the same county, matched on the years of both sales and

the decade of construction, homes with 1 ft or more in heavily flooded block groups sell 9.71 log points lower 24 to 59 months after the storm than in the year before it (s.e. 2.75; wild-bootstrap $p = 0.004$), and homes with no water in the same block groups 4.63 lower (s.e. 2.45; Online Resource 1, Table ??).

In all sales the coefficient for 1 ft or more is -4.36 (s.e. 1.82) in the coded-sale sample, -4.76 without the floods of 2024 and -6.37 (s.e. 2.46) without Ian, which supplies the largest share of the inundated pairs. Leaving out one storm at a time moves it between -4.73 and -6.37 (Online Resource 1, Table ??). Other depth sources for the storms of 2024, the depth at the centroid cell for Irma, and thresholds of any water and of 2 ft give similar estimates (Online Resource 1, Table ??).

Panel B compares homes with other homes of the same block group in the same flood. The coefficient for 1 ft or more is then -4.02 log points (s.e. 1.77; interval -7.55 to -0.48) for all sales and -3.09 (s.e. 1.59; interval -6.26 to 0.08) for sales in $S + 2$ or later. The slope per foot is -0.90 (s.e. 0.31) for all sales and -0.59 (s.e. 0.34) for later sales, where its interval includes zero. The within-event estimates for 1 ft or more are smaller than those against tract peers, by about a quarter in all sales and a sixth in later sales. That is what error in depth at the scale of a block group would produce, and it is also what a difference between more and less exposed block groups, unrelated to water at the parcel, would produce.

Homes sold before a storm differ little by the depth they would later record: the coefficient for 1 ft or more is -0.20 log points (s.e. 0.12), and -0.59 (s.e. 0.17) for second sales in the five years before the storm, about a tenth of the estimate after it (Online Resource 1, Table ??). The exception is Michael, where homes later inundated had already appreciated 5.42 log points less. Modeled water outside block groups with a qualifying NFIP flood has no price association: the coefficient is -0.12 (s.e. 0.24) on 24,260 pairs. The few resold homes with a field assessment agree in sign and order with the depth estimates (Online Resource 1, Table ??).

4.3 Depth, the flag, and the timing of the resale

On the pairs with a known depth the two measures can be set side by side (Online Resource 1, Table ??). Relative to the other homes of the same heavy floods, flagged homes resell 6.73 log points lower (s.e. 2.80) and homes with 1 ft or more 4.32 lower (s.e. 1.71); the interval of the difference, -2.80 to 7.60 , uses the covariance of the two estimates. Homes with 1 ft or more and no flag, 4,809 pairs, sell 3.61 log points below unflagged homes with less water (s.e. 1.61). An appraisal that treats the absence of an assessed loss as the absence of damage would miss this discount.

The two measures differ in timing. Table 3 splits both by the date of the second sale, in regressions on all pairs of the regression sample. The coefficient for 1 ft or more is -6.21 log points for second sales in the flood year or the next and -4.46 (s.e. 1.78) for later sales, a difference of -1.74 (interval -6.00 to 2.51). The later coefficient differs from the -3.70 (s.e. 2.02) of Table 2 because of the sample and not the specification: this regression keeps every pair and gives early resales coefficients of their own, so that early resales still enter the tract cells and the county-month effects, whereas Table 2 drops the pairs with a flood or a write-down whose second sale is dated before $S + 2$. For the flag on the same pairs the two coefficients are -14.51 and -1.12 , a difference of -13.39 (interval -22.98 to -3.80). Flagged homes with less water that resell early, 172 pairs, sell 13.60 log points below tract peers. When they resell later they sell 4.15 log points above unflagged homes with less water (s.e. 2.32), a difference whose interval includes zero. Flagged homes with 1 ft or more sell 17.21 log points below tract peers early and 7.28 later, against 4.15 and 4.06 for unflagged homes with 1 ft or more.

The depth discount is of similar size in early and later sales. The flag discount is concentrated in early sales, though not confined to them. Among homes with less water it is absent later. Flagged homes with 1 ft or more sell 3.22 log points below unflagged homes with 1 ft or more in later sales (s.e. 1.64; the interval includes zero), and on the full sample, which includes the floods without a depth source, flagged homes resell 9.08 log points below

Table 3: Depth, the assessment flag, and the timing of the second sale (log points)

	Early sales	Later sales	Early minus later
<i>A. Depth at the parcel (relative to tract peers)</i>			
1 ft of water or more	−6.21 (2.23)	−4.46 (1.78) [−8.02, −0.91]	−1.74 (2.13) [−6.00, 2.51]
Less water (none or under 1 ft)	0.28 (1.69)	−1.83 (1.18)	
1 ft or more minus less water	−6.49 (2.18)	−2.63 (1.49)	−3.86 (1.89)
Per foot of depth	−1.38 (0.31)	−0.58 (0.19)	−0.79 (0.27)
<i>B. Assessment flag on the same pairs (relative to unflagged homes of the same floods)</i>			
Assessment flag	−14.51 (3.84)	−1.12 (1.75) [−4.62, 2.38]	−13.39 (4.81) [−22.98, −3.80]
<i>C. Four classes (relative to tract peers)</i>			
Flagged, 1 ft or more	−17.21 (3.85)	−7.28 (2.13)	
Flagged, less water	−13.60 (1.93)	2.04 (2.37)	
Not flagged, 1 ft or more	−4.15 (2.56)	−4.06 (1.80)	
Not flagged, less water	1.28 (1.92)	−2.11 (1.18)	
Flagged minus not flagged, less water	−14.88 (2.97)	4.15 (2.32) [−0.48, 8.77]	
1 ft or more minus less water, not flagged	−5.43 (2.42)	−1.95 (1.45)	
Pairs: flagged, 1 ft or more	368	542	
Pairs: flagged, less water	172	222	
Pairs: not flagged, 1 ft or more	2,123	2,686	
Pairs: not flagged, less water	1,980	2,902	
Pairs in the regression		2,616,077	

Notes: Dependent variable, cells and effects as in Table 2. Each panel is one regression on all pairs of the regression sample, with the indicators for pairs of heavy floods with a known depth split by the date of the second sale; the row per foot of depth is a further regression. Early sales: second sale in the year of the flood or the next; later sales: in $S + 2$ or later. Less water: no water or under 1 ft. Panel B includes an indicator by timing for every pair of a heavy flood with a known depth. Table 2 estimates the later coefficient without the pairs resold early. Standard errors clustered by county in parentheses; 95 percent intervals in brackets use t_{66} .

tract peers (s.e. 2.18) in all sales and 4.33 (s.e. 1.60) in sales dated in $S + 2$ or later (Online Resource 1, Tables ?? to ??). The pattern is consistent with write-downs whose size follows an early low price, and with wind or other damage that the depth sources do not record and that is repaired before a later sale. The records do not separate these readings. Under either one, the early discount on flagged homes should not be used as the price effect of flooding.

The records that bear on repair do not measure it precisely enough to estimate its return (Online Resource 1, Tables ?? and ??). Permit records that carry repairs and cover the

months after a flood exist for 12.6 percent of the homes at risk, nearly all in unincorporated Hillsborough County and the City of St. Petersburg after Idalia, Helene and Milton. In that population a repair permit follows the flood more often for deeper water and for flagged homes, but among the 317 homes at risk with 1 ft or more that are resold, 21 have a repair permit dated before the resale. In the regression sample of Section 2.1 these are 19 of 237 pairs, too few for an estimate by permit status. The tax roll records an improvement before the resale, in new-construction value, living area or effective year built, for 48 percent of the inundated homes resold in $S + 2$ or later. Those homes sell 0.68 log points below tract peers (s.e. 2.68) and the inundated homes without a recorded improvement 4.72 below (s.e. 1.83), a difference of 4.05 (interval -0.01 to 8.10). Homes with less water show a larger difference between improved and unimproved homes, 8.63 log points, so the roll does not show that improvement removes the discount that goes with depth. Inundated homes of block groups with NFIP building payments per inundated home above the median sell 1.14 log points higher in later resales than those below it (interval -4.39 to 6.66). Each additional \$10,000 per inundated home goes with a later price higher by 0.27 log points (s.e. 0.13), a slope that is absent in all sales and that reflects damage and coverage as well as repair.

4.4 Selection into resale

The bounds of Section 3.3 depend on whether inundation lowers or raises resale, and I estimate that direction before applying them. Panel A of Table 4 compares homes with 1 ft of water or more with homes with less water in the same tract and flood. Inundated homes are resold more often. The unadjusted rates do not show this, because inundated homes are concentrated in tracts and floods with little resale. Within 12 months of the flood the difference is 0.49 percentage points (s.e. 0.20; $p = 0.020$), where 4.7 percent of the homes with less water are resold; within 36 months it is 1.78 points (s.e. 0.69), and by the end of the sale files 1.15 points (s.e. 0.33; $p = 0.002$). The differences at 24 and 60 months have the same sign and are less precise. A proportional-hazard model of the first resale, stratified by

Table 4: Resale of inundated homes, selection bounds and weighting

<i>A. Resale: 1 ft of water or more against less water (none or under 1 ft), same tract and flood</i>					
	12 months	24 months	36 months	60 months	End of files
Resold (%): 1 ft or more; less water	4.8; 4.7	9.1; 10.3	12.9; 15.2	32.9; 30.9	12.5; 12.5
Difference (percentage points)	0.49 (0.20)	0.80 (0.56)	1.78 (0.69)	2.16 (1.65)	1.15 (0.33)
p	0.020	0.17	0.020	0.22	0.002
Hazard ratio	1.11	1.11	1.15	1.12	1.10
	[1.02, 1.20]	[1.02, 1.21]	[1.07, 1.23]	[1.03, 1.21]	[1.02, 1.20]
Homes at risk	112,294	64,623	59,669	14,980	112,294
Counties: difference; hazard ratio	25; 25	24; 25	18; 25	11; 25	25; 25
<i>B. Price difference among resold homes (log points)</i>					
	Treated resold	Difference in means	Bounds, higher resale	Interval of the bounds	Weighted by resale probability
1 ft or more: cells 10–90% inundated	2,447	−3.82 (1.51)	[−9.27, 1.86]	[−13.83, 4.63]	−6.46 (1.78)
without Ian	1,879	−3.90 (1.78)	[−9.70, 2.06]	[−15.51, 5.59]	−6.87 (1.96)
first resale in $S + 2$ or later	1,411	−1.79 (1.17)	[−7.02, 3.42]	[−11.53, 6.61]	−1.24 (1.78)
1 ft or more: all cells	3,206	2.10 (2.59)	[2.10, 2.10]	[−7.54, 6.25]	−3.11 (2.10)
3 ft or more: cells 10–90%	976	−6.06 (2.21)	[−13.98, 2.62]	[−19.94, 6.64]	−8.02 (2.10)

Notes: Population: single-family homes at risk of resale after a heavy flood with depth known. Less water: no water or under 1 ft. Panel A: any eligible resale within the horizon, for floods observed that long, or by the end of the sale files. Difference: linear probability regression on 1 ft of water or more with an effect for every tract and flood; standard errors clustered by county in parentheses. p : two-sided p -value of the difference from the t distribution with degrees of freedom equal to the number of counties of the column minus one. Hazard ratio: proportional-hazard model of the first resale stratified by tract and flood, censored at the horizon or at the end of the sale files, with its 95 percent interval from the t distribution for the counties of the hazard model. Panel B: treated and comparison homes are compared within tract $\times$ flood-year cells, with weights that give each cell the weight of its treated homes; a home is resold if it is resold in a pair of the price sample with a peer not written down. Outcome: log price change of the pair minus the mean change of the pairs of homes not written down in the same tract, first-sale year and second-sale year, net of county $\times$ month effects. Difference in means: treated minus comparison among resold homes, with its bootstrap standard error. Bounds: treated homes are trimmed by one minus the ratio of the resale rates, the direction of selection found in panel A; where the treated rate of a row is the lower one no trimming is called for and the bounds equal the difference in means. Interval of the bounds: the lower bound minus, and the upper bound plus, the critical value of Imbens and Manski (2004) times the bootstrap standard error of that bound. In the all-cells row the treated rate is the lower one in the sample and the higher one in 33 percent of the bootstrap draws, which are then trimmed; the standard errors of the two bounds are 4.91 and 2.12, so the interval is wider than, and not centered on, the interval of the difference in means. Weighted: resold homes weighted by the inverse of the estimated probability of resale. Standard errors from 999 county bootstrap draws of the whole procedure. Further rows are in Online Resource 1, Tables ?? to ??.

tract and flood, gives a hazard ratio of 1.10 (95 percent interval 1.02 to 1.20), and between 1.10 and 1.15 when the spell is censored at 12, 24, 36 or 60 months; each of these intervals excludes one. The data therefore reject lower resale of inundated homes, and the bounds to report are those under higher resale.

Panel B reports the bounds with 1 ft of water or more as the treatment. Inundation is common where it occurs: 52 percent of the homes at risk with a known depth have 1

ft or more, and in some tracts nearly all do. Weights that standardize to the inundated homes' distribution over cells then place most of the comparison weight on the few homes with less water in nearly saturated cells; with all cells, the most heavily weighted 1 percent of resold comparison homes carry 37 percent of the weight. I therefore report first the cells in which 10 to 90 percent of homes are inundated. In those cells 10.2 percent of inundated homes and 9.3 percent of the others are resold in a pair with a peer, and the difference in means among resold homes is -3.82 log points (s.e. 1.51). With inundation raising resale, 8.7 percent of the resold inundated homes are trimmed, the bounds are -9.27 and 1.86 log points, and their 95 percent interval, -13.83 to 4.63 , includes zero. The bounds do not sign the discount. A difference in resale of under one percentage point is a large share of a resale rate near 10 percent, and the bounds allow the additional resales to come from either end of the distribution of price changes.

Weighting by the inverse probability of resale is a complement that rests on a different assumption (Section 3.3). The weighted difference is -6.46 log points (s.e. 1.78; interval -9.95 to -2.98), and -1.24 (s.e. 1.78) for first resales dated in $S + 2$ or later. Weighting corrects for selection on these recorded characteristics only, where the bounds allow selection on the price change itself. For all resales, selection on what is recorded does not account for the discount, and selection on the price change cannot be excluded; for later resales neither the bounds nor the weighted difference is informative.

4.5 Homes without water in inundated block groups

The primary specification of the area comparison is continuous. As Section 3.4 states, I chose it after the binned estimates of panel B were known and before the slope was estimated. The price change of homes with no water at the parcel is related to the share of the block group's homes with 1 ft of water or more, with the homes of never-inundated block groups of the same county at a share of zero (Table 5, panel A). In the years after the storm, homes with no water sell 0.54 log points lower for each 10 percentage points of the inundated share (s.e.

Table 5: Homes with no water at the parcel, by the inundated share of the block group (log points)

	Before	After	p	Tracts	Pairs	Counties
<i>A. Homes with no water: slope per 10 percentage points of the inundated share</i>						
All storms	−0.17 (0.18)	−0.54 (0.23)	0.041	3,778	488,318	46
without Lee County	−0.23 (0.19)	−0.50 (0.26)	0.085	3,575	449,491	45
without the storms of 2024	−0.38 (0.17)	−0.64 (0.28)	0.047	3,694	431,939	45
without Ian	0.17 (0.30)	−0.51 (0.31)	0.14	2,799	245,300	46
block groups with some inundation only	−0.48 (0.17)	−0.38 (0.21)	0.11	3,777	488,168	45
Placebo: randomly assigned share		0.01 (0.11)	0.076		1,182,435	
<i>B. Homes with no water: block groups at or above a threshold of the share</i>						
10 percent or more	1.46 (0.70)	−2.01 (1.02)	0.092	1,687	72,938	42
without Lee County	1.38 (0.72)	−2.03 (1.04)	0.094	1,557	67,556	41
25 percent or more	1.23 (1.24)	−3.73 (1.24)	0.007	662	14,708	35
without Lee County	0.89 (1.28)	−3.83 (1.28)	0.011	577	13,078	34
<i>C. Homes with 1 ft or more, block groups at 10 percent or more</i>						
All storms	1.49 (0.95)	−7.37 (3.13)	0.024	1,592	39,370	39

Notes: Stacked repeat-sales comparison of equation (4), one stack per storm with a depth source. Inundated share: the share of the block group’s linked single-family parcels with 1 ft of water or more in the storm. Comparison: pairs of homes in block groups of the same county with no parcel at 1 ft or more in any of the storms, under 2 percent of parcels with any water in the storm, and no qualifying NFIP flood. Panel A: the event-time terms are multiplied by the inundated share; treated homes are homes with no water at the parcel in block groups with at least one parcel at 1 ft or more, and coefficients are per 10 percentage points of the share. Placebo: never-inundated block groups only, each with the share of a block group drawn at random from the inundated block groups of the same storm; mean and standard deviation of the slope over 499 draws, and the share of draws with a t ratio as large as that of the first row. Panels B and C: indicators for treated homes of block groups at or above the threshold. Before: average coefficient for years −6 to −2; after: years 0 to 4; the year before the storm is omitted. Standard errors clustered by county in parentheses; p : wild cluster bootstrap with the null imposed. Tracts, pairs and counties: treated units with a sale on each side of the storm. Further rows are in Online Resource 1, Tables ?? and ??.

0.23; 95 percent interval −1.01 to −0.07; wild-bootstrap $p = 0.041$), which implies 1.35 log points at a share of 25 percent. The slope for the years before the storm is −0.17 (s.e. 0.18). Leaving one storm out moves the slope between −0.60 and −0.50; the wild-bootstrap p -value is at most 0.14, without Ian. Without Lee County the slope is −0.50 (s.e. 0.26; $p = 0.085$). The square of the share adds no information (Online Resource 1, Table ??).

The estimates by storm, a comparison among block groups with some inundation, and a placebo qualify the slope. By storm the slope after the storm is negative for each of the six storms. For Ian and Idalia, which supply most of the treated pairs, the slope before the storm is as large: −0.56 (s.e. 0.15) before and −0.58 (s.e. 0.13) after for Ian, and −0.57 (s.e. 0.26) and −0.58 (s.e. 0.28) for Idalia. In these two storms, homes with no water in block

groups with larger shares were priced lower in the earlier years as well as in the later ones, relative to the year before the storm, so their slopes do not date the difference to the storm. The pooled slope before the storm is near zero because the slopes before Irma, Michael and Helene are positive (Online Resource 1, Table ??, panel C). Without the never-inundated comparison, the slope is -0.38 (s.e. 0.21; $p = 0.11$), and the slope before the storm is -0.48 (s.e. 0.17): prices in block groups with larger shares had risen relative to those with smaller shares up to the year before the storm and fell relative to them after it. In a placebo, each never-inundated block group receives the share of a block group drawn at random from the inundated block groups of the same storm. Over 499 draws no slope is as large as the estimate, but 12 percent of the draws have a t ratio above 1.96 in absolute value: the county-clustered standard error understates the dispersion of a regressor that varies by block group. Measured against the placebo t ratios, the estimate has a p -value of 0.076.

Panel B gives the binned version. In block groups where at least 10 percent of homes had 1 ft or more, homes with no water sell 2.01 log points lower after the storm (s.e. 1.02; wild-bootstrap $p = 0.092$), and where at least 25 percent did, 3.73 lower (s.e. 1.24; $p = 0.007$). These are averages over block groups whose shares lie above the threshold, and they exceed what the slope implies at the threshold itself. The coefficients for the years before the storm are 1.46 (s.e. 0.70) and 1.23 (s.e. 1.24): relative to the comparison, these homes were priced higher in the earlier years than in the year before the storm. At the 10 percent threshold that difference is distinguishable from zero, so their relative price was already falling, and part of the binned estimate may continue that decline. The pooled slope shows no such difference before the storm; the slopes of single storms do. All of these estimates share further limits. A home that a 60 m model cell shows as dry may still have taken water, and Lee County after Ian differs from the other areas: the binned estimate for its homes with no water is -20.42 log points (s.e. 4.60, clustered by tract) against -2.34 (s.e. 0.56) in the other counties that Ian flooded. Homes with 1 ft or more in block groups at the 10 percent threshold sell 7.37 log points lower (s.e. 3.13; $p = 0.024$), a larger difference than against tract peers, as it

should be if part of the loss is common to the neighborhood. A comparison of tracts defined by NFIP claims, by flood-year cohort, is in Online Resource 1, Table ??.

4.6 Mortgage aggregates

As supporting context, Online Resource 1, Table ??, compares Home Mortgage Disclosure Act originations with recorded sales in census tracts with a heavy flood and in matched never-flooded tracts of the same county. An index of recorded sales without a matching home-purchase origination rises by 3.26 points after a heavy flood (s.e. 1.41), and by 2.10 (s.e. 1.21) outside Lee County; loan-term and denial estimates are small and imprecise. These aggregates cannot distinguish credit supply from borrower demand or cash purchases, and they do not establish a lending mechanism for the price results.

5 Conclusion

A tax-roll write-down is the only parcel-level damage record that covers every flood in Florida, and it is set by an official who can see sale prices. This paper sets that record against the depth of water at the parcel, field damage assessments and building permits for the storms of 2017 to 2024, on files in which each parcel keeps one identity across rolls.

The assessment flag rises with depth and with the damage class that inspectors recorded, so it carries information about damage. It is an incomplete record of inundation: 78.5 percent of the homes with 1 ft of water or more carry no flag, and 17.5 percent of the flagged homes show no modeled water. Flags are not more frequent among homes that resell soon after the flood.

Homes with 1 ft of water or more resell 5.34 log points below tract peers, and the interval excludes zero. In resales dated two years or more after the storm, each foot of depth goes with a price lower by 0.60 log points, with an interval that excludes zero under county clustering, with and without the wild bootstrap (with the four storms as clusters the p -value

is 0.11); one indicator for 1 ft or more gives 3.70 log points with an interval that includes zero. Within the same block group and flood, inundated homes sell 4.02 log points below homes with no water. The depth measures are built without reference to sale prices. The larger discount on flagged homes is concentrated in early resales, and it appears there even where little or no water is recorded, so it is not the price effect of flooding.

Inundated homes are resold somewhat more often than other homes of the same tract and flood. Under that direction of selection, trimming bounds include zero; a difference weighted by the inverse probability of resale is negative, and it corrects only for recorded characteristics. Homes with no water sell 0.54 log points lower for each 10 percentage points of their block group that was inundated, a slope with a wild-bootstrap p -value of 0.041. It is less precise when Ian is left out and when it is measured against a placebo, and for Ian and Idalia taken singly a slope of the same size is present before the storm. I do not regard the area effect as established. The binned estimates at thresholds of a tenth and a quarter of homes may in part continue a relative decline that began before the storm. Permit records, improvements recorded on the roll and insurance payments are too sparse or too indirect to show whether repair closes the gap.

For collateral valuation, the implication is that an early resale of a flagged home is a poor comparable for the loss from flooding, and that a later resale of an inundated home is a better one. For insurance and disaster aid, the flag, which is my threshold of 0.2 log units on the appraiser's write-down of improvement value, is absent for most homes that the depth sources show as inundated, although error in those sources overstates that share. A measure of water at the parcel identifies homes that sell at a discount whether or not they are flagged. For lending, the estimate relevant to collateral that remains in an exposed area is the discount two years or more after the storm; it rises with depth, at about 0.6 log points per foot, and it is not established for a home at the 1 ft threshold. Depth grids of uniform quality for every storm, permit histories for the coastal counties, and longer follow-up of the floods of 2022 and 2024 would allow the return to repair and the discount near the 1 ft

threshold to be estimated.

Data and code availability

The underlying sources are the public records described in Section 2. The replication files contain a source manifest with the address, retrieval date and hash of each file; the analytic extracts with anonymous parcel keys and a data dictionary; the scripts that build the extracts from the public files; and a master script that re-estimates from the extracts every table of the paper and of Online Resource 1 and rebuilds both documents. Online Resource 1, Tables ?? to ??, compares the estimates across machines and lists the script behind every table. The raw rolls, sale files, rasters and parcel coordinates are not redistributed.

Statements and Declarations

Competing interests and funding. Declarations that identify the author are provided separately to the journal.

Use of large language models. Claude (Anthropic) was used in preparing the analysis code and the manuscript, including the reconciliation of units, the single parcel identity across tax rolls, the retrieval and linkage of the independent measures of water and damage, and the estimates reported in this version. ChatGPT/Codex (OpenAI) assisted with a methodological review of an earlier draft, with its restructuring, with code inspection and with document preparation. Every estimate comes from the public records described in the data section of the paper; no observation or estimate was generated by a language model. No large language model is an author. The author is responsible for the data, the analyses, the references and the final text.

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