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William M. Doerner
Michael J. Seiler
Matthew Suandi

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FEDERAL HOUSING FINANCE AGENCY
400 7th Street SW
Washington, DC 20219, USA

Please address correspondence to Matthew Suandi (matthew.suandi@fhfa.gov). Helpful feedback was provided by Becka Brolinson, Rob Renner, Jessica Shui, and Vivian Wong. Thomas Williams provided excellent research assistance.

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Abstract

We find a puzzling increase in home valuations following the adoption of stricter flood standards. At the same time, we are observing shifts in appraisers' valuation practices. Specifically, appraisers reduce negative language, use fewer flood-zone comparables, and apply smaller adjustments to comparable sales, suggesting a behavioral adaptation rather than a market mispricing. Experienced appraisers are more likely to underappraise properties, yet appraisal values still generally match or exceed contract prices 89.2% of the time. These aforementioned changes and the underlying market dynamics are unlikely to be driven by changes in underlying flood risk. Future research on this topic is warranted.

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William M. Doerner
Federal Housing Finance Agency
Division of Research and Statistics
Office of Research and Analysis
400 7th Street SW
Washington, DC 20219, USA
william.doerner@fhfa.gov

Michael J. Seiler
Federal Housing Finance Agency
Division of Research and Statistics
Office of Research and Analysis
400 7th Street SW
Washington, DC 20219, USA
michael.seiler@fhfa.gov, mjseiler@wm.edu

Matthew Suandi
Federal Housing Finance Agency
Division of Research and Statistics
Office of Research and Analysis
400 7th Street SW
Washington, DC 20219, USA
matthew.suandi@fhfa.gov

1 Introduction

While access to flood risk information has been documented as creating a markdown in flood-prone areas, the exact effects of these disclosures—specially in the context of new or stricter regulations—remain an open question. Previous studies have explored how changes in disclosure laws or flood zone status can influence home valuations, liquidity, and buyer behavior. However, there is limited research on how appraisers respond to evolving disclosure requirements, particularly in regions with comprehensive new mandates. This paper addresses the gap by examining the effects of South Carolina's recent flood disclosure law changes on home valuations and appraiser behavior.

Nationally, flood-related damages in the United States have cost $46 billion, on average, in the last decade.[1] Given the scale of these losses, state legislatures and real estate boards are increasingly requiring disclosures. The information ranges from a simple acknowledgment from homeowners that their properties are in the 100-year floodplain to a full accounting of all federal disaster aid received by the seller and the previous owner. Advocates of these stronger disclosures maintain that more information leads to stronger underwriting and empowers consumers by promoting greater transparency in the housing market. Yet the implementation and in particular, enforcement of these regulations varies significantly across states and jurisdictions.[2]

We explore the impacts of the adoption of a revised Residential Property Disclosure Statement adopted by the South Carolina Real Estate Commission on February 15, 2023.[3] The revised statement adds a series of questions to the form regarding flood risk and flood history; in particular, it asks about repairs made to homes due to flooding that were not filed with flood insurance as well as the reception of federal flood disaster assistance.[4] These additional questions go above and beyond the previous form effective November 2019, which only inquired about erosion control, flood zone status, and Federal Emergency Management

[1]From CBO Publication 59971.

[2]We collect disclosure law statutory changes across all 50 states and find vast inconsistencies. A public comparison source is https://www.nrdc.org/resources/how-states-stack-flood-disclosure.

[3]It is important to note that this study does not use information about actual flood risk or the content of individual flood disclosures. Instead, we analyze how mortgage appraisers responded to a state-level regulatory regime change that expanded mandatory flood disclosure requirements. By focusing on appraisal practice following this legislative action, we aim to understand behavioral adjustments within the valuation process rather than the direct impact of disclosed flood risk.

[4]This policy change is necessarily independent of true, underlying flood risk. Nothing revealed by these disclosures will affect the likelihood of any individual property to suffer a flood event.

Agency (FEMA) claims. To the extent these questions reveal new, adverse, insights about properties to prospective buyers, intuitively, they should become capitalized into real estate values. Furthermore, such valuations could be reflected in adjustments to appraisal values, particularly as appraisers begin pulling in comparable properties which are also subject to enhanced disclosures during the sale process.

We aim to address three questions. First, do appraisers adapt the final appraisal value to more stringent flood disclosures? Second, do appraisers change how they select comparable sales in tracts with a history of significant flooding? Third, can we use information from appraisal reports to measure how professional evaluations are adjusted subsequent to the greater disclosure mandates? Through a difference-in-difference framework, we assess the statute's effects on property valuations, appraisal practices, and financial intermediary activity.

We document a curious puzzle: expanded mandatory flood disclosures in South Carolina appear to coincide with *higher* appraisal valuations in areas with a greater amount of flood insurance claims. At face value, this outcome seems paradoxical—greater transparency about flood risk should depress valuations. However, we document that what has changed not as much the final appraisal outcome, but the *path* appraisers take to arrive at that value. Specifically, we find shifts in appraiser behavior, including reducing the number of comparable sales located in FEMA defined floodplains, writing with fewer negative words when describing the subject property, and decreasing their use of adjustments to comparable sale prices.

Moreover, we find that less-experienced appraiser are more likely to assign premiums for homes post-disclosure. On the other hand, the most-experienced appraisers increase their valuations by less and are 2.3 percentage points more likely to underappraise, which is 19% of the pre-disclosures baseline of 12.2%. This is consistent with experienced appraisers using information from disclosure-exposed sales and local knowledge to provide appraisal values in greater alignment with underlying flood risk.

This paper highlights how professional valuation practices adapt to regulatory disclosures in housing markets. Section 2 discusses the relevant literature on appraisals and disclosure regulations. Section 3 details the appraisal data used in our analysis. Section 4 presents a framework for understanding appraiser behavior, while Section 5 outlines our empirical analysis of appraisal practices before and after the policy change. Finally, Section 6 offers concluding remarks and directions for future research.

2 Background on Flood Disclosures

This section provides an overview of the existing literature on flood disclosures and their impact on real estate markets, highlighting the challenges and varied regulatory approaches across the United States.

Severe weather events have spurred growing demand for comprehensive real estate disclosures to enhance transparency in home transactions (Contat et al., 2024*a*). Information on flood risk generally leads to flood risk discounts (Atreya and Czajkowski, 2019; Bernstein, Gustafson, and Lewis, 2019; Baldauf, Garlappi, and Yannelis, 2020; Holtermans, Niu, and Zheng, 2024; Murfin and Spiegel, 2020; Yi and Choi, 2020; Zhang and Leonard, 2019). Turnbull, Zahirovic-Herbert, and Mothorpe (2013) further explore how flood risk can affect home liquidity, identifying sensitivity to the level of flood risk and phases of the housing market.

Closely informing our analysis are a series of papers that study how disclosure of or assignment into flood zone status affects the capitalization of flood risk. Pope (2008) and Troy and Romm (2004) use changes to disclosure laws in North Carolina and California, respectively, and find subsequent discounts associated with flood zone status on the order of 4%. Using a natural experiment when flood maps changed, Shr and Zipp (2019) find that homes newly assigned to flood zones saw an 11% price decrease. Gibson and Mullins (2020) study three different events related to belief updating: reduced flood premium subsidies from the Biggert-Waters Flood Insurance Reform Act of 2012, damages from Hurricane Sandy, and changes in floodplain maps for homes not damaged by Sandy. For impacted properties, they find discounts of 3-5%, 5-7%, and 11% for various events, which suggests significant flood-risk belief updating. In a natural field experiment, Fairweather et al. (2024) find that not only does knowledge of flood risk impact willingness to pay, but its antecedents, initial search and the negotiation process, as well.

Ellen and Meltzer (2024) investigate the long-term effects of Hurricane Sandy on home prices and show that natural disasters can alter neighborhood demographics, with more significant negative impacts on lower-income residents and minorities.[5] Interestingly, home prices inside

[5] Addoum et al. (2024) find a consistent negative price impact on commercial real estate.

FEMA zones are more resilient in that they rebound faster than homes outside these areas, presumably because home buyers were already aware of flood risks inside the FEMA zone, whereas the realization of flood risk outside FEMA zones is new and relevant information to the market.[6]

Currently, the United States does not have a uniform national standard for flood disclosure requirements. Instead, regulations vary by state, creating a patchwork of policies that can potentially address regional differences in exposure to flood risk.[7] At the same time, such variations can impact the local market information available to potential homebuyers and, consequently, the knowledge of potential risks can influence property valuation in flood-prone areas.[8] Recently, several states have begun to pass increasingly restrictive requirements. State disclosure requirements vary depending on mandatory nature, scope, and enforcement.

Disclosure practices differ not only in terms of their mandatory nature, but also the scope of information required. A few states mandate disclosure of flood history regardless of the property's flood zone status, while others only require disclosure for properties in federally designated flood zones. Most states, though, do not mandate flood risk disclosures at all.[9] Additionally, many states require a general flood history disclosure, without specifics on the frequency, severity, or causes of past flooding. Moreover, there might be practical challenges

[6]For example, Niu et al. (2024) find property over-valuation happens when mortgage appraisers miss climate risks, but that can be corrected if appraisers gain more local experience through working in an area or personally experiencing a natural hazard. Galster, Galster, and Vachuska (2024) also examine the price discovery process after natural disasters and find not all ethnic groups are impacted to the same degree. For example, these authors find that Hispanics and Native Americans have a significantly higher impact rate than their White counterparts, who in turn are more exposed than Blacks and Asians. Historical examinations have been mixed on the impact of ethnicity, many times due to data limitations and/or quality. Whatever the impact, a necessary condition is that the information is new and relevant to home prices. This is demonstrated by Seiler and Yang (2023) who examine the impact of gun disclosure on home prices and find a very localized effect of less than 0.1 miles away from the gun owner. The authors were able to capture a temporary posting of a gun ownership map which was subsequently removed from a public source, but once the disclosure was out, home prices responded according. Whether the disclosure concerns gun ownership or flood risk, the take away is that without disclosure, it is unclear whether or not the market will ever become aware of a neighborhood characteristic that impacts home prices, something clearly material when identifying a willingness to pay for a home.

[7]The Natural Resources Defense Council has a scorecard that grades states based on flood disclosure requirements. Read more at https://www.nrdc.org/resources/how-states-stack-flood-disclosure.

[8]Also, the Urban Institute wrote a short piece on disclosure practices and mitigation resources with links to practices in several states at https://www.urban.org/urban-wire/without-robust-requirements-sellers-disclose-homes-flooding-history-buyers-are-more-risk.

[9]Gourevitch et al. (2023) find that exposure ranges in the hundreds of millions of dollars and that highly overvalued properties are often in places with no flood risk disclosure laws.

that could limit the ability for sellers to adopt disclosure requirements, and enforcement needs and capabilities also vary by state.[10]

Despite these challenges, some states have made significant strides in improving flood disclosure transparency. In particular, South Carolina has recently mandated some of the most comprehensive flood disclosures in the United States.[11] The South Carolina Real Estate Commission adopted a new disclosure form capturing information about flood history and coastal hazards on February 15, 2023. The form went into effect on June 1 of that year. Importantly, these revisions did not address whether the home was in a FEMA special flood hazard area or whether it was covered by an existing flood insurance policy—previous versions of residential disclosure forms already inquired about those pieces of information. Rather, the disclosure now requires more details about erosion effects and flooding. The commission added new questions asking about assessments for beach renourishment as well as details about erosion control structures. Sellers are likewise required to disclose whether the property has ever flooded from rising water, whether claims have been filed on the property, whether flooding-related repairs not filed with insurance were performed, and whether federal flood disaster assistance was received during their ownership.

3 Appraisal and Damages Data

Our primary source of data is the FHFA's Uniform Appraisal Dataset (UAD), the universe of home appraisals submitted to the Uniform Collateral Data Portal (UCDP) by originators. The FHFA releases quarterly aggregate statistics and an appraisal-level public use file (PUF). Those files provide information on a subset of the fields found on the standardized Uniform

[10]While appraisers and buyers are supposed to obtain flood disclosure information before contracts are finalized, the process may not always operate as intended. A major practical challenge is identifying potential risks. Based on conversations with practicing appraisers, the information may be gathered from multiple sources such as FEMA flood maps, flood insurance claims, real estate listing databases, county assessor offices, local government records, seller-provided documents, or real estate agents. A centralized or standardized repository does not exist, which means flood-related information may not be easily available or consistently provided. Presenting this information earlier in the home search process or pairing disclosures with educational resources about risk could help buyers, agents, and appraisers interpret the data more effectively. The practical challenge can delay or complicate the appraisal process.

[11]South Carolina Code of Laws Ann., Title 27, Chapter 50, Article 1 requires that an owner of residential real estate shall provide to a purchaser this property condition disclosure statement. In terms of timing, the statement states that "The owner shall deliver to the purchaser this disclosure before a real estate contract is signed by the purchaser and owner, or as otherwise agreed in the real estate contract." In other words, owners may deliver to prospective buyers the disclosure statement anytime prior to themselves signing the contract of sale, including after an offer has been submitted. Pages 4 of 5 solicit information about flood hazards. The disclosure form is at https://llr.sc.gov/re/recpdf/Property-Condition-Disclosure-Statement-06.01.2023.pdf.

Residential Appraisal Report (URAR) form and are updated on a quarterly basis.[12] In this paper, we use an internal, confidential version of the UAD which contains geographic location and additional variables not in the PUF. Fannie Mae and Freddie Mac have required submission of the UAD since 2011 from originators who intend to deliver them mortgages. The UAD and UCDP are components of the Uniform Mortgage Data Program (UMDP), a joint effort by Fannie Mae and Freddie Mac at FHFA's direction to improve mortgage data standardization and quality.

All records in the UAD describe dozens of subject property attributes, related comparable properties, and their reconciliations. This includes site location information, contract price, appraisal value, adjustments applied to other comparable properties to arrive at the appraisal value, and structural attributes. Of particular relevance to this study, the UAD also includes fields for whether or not a property is in a FEMA defined special flood hazard area, as well as whether or not the property is encumbered upon by adverse site conditions or external factors.[13] Besides the yes/no question, the appraiser is also afforded a free-form text field to describe the presence (or lack thereof) of adverse conditions and factors.

We anticipate the largest capitalization of mandatory disclosures to be in areas previously affected by significant flooding events. To identify such areas, we use disaster damages data from the Organizations Preparing for Emergency Needs Federal Emergency Management Agency (OpenFEMA) Dataset, specifically the Federal Insurance and Mitigation Administration (FIMA) National Flood Insurance Program (NFIP) Redacted Claims.[14] These data summarize claims submitted to and paid out from the policies issued under the NFIP, which is administered by FEMA. NFIP provides coverage for building structures, up to a cap of $250,000, as well as for contents and personal property within the structure up to a cap of $100,000. The publicly available claims dataset offers observations dating back to the

[12] Aggregate statistics and FHFA's Public Use File are at https://www.fhfa.gov/data/uniform-appraisal-dataset-aggregate-statistics and https://www.fhfa.gov/data/uad-appraisal-level-public-use-file-puf, respectively. Information is available for Enterprise Single-Family and Federal Housing Administration (FHA) Single-Family appraisals at various geographic levels of aggregation. Enterprise Condo appraisals area shared only in the UAD aggregate statistics. The Public Use File is a five percent nationally representative random sample of appraisal valuations for single-family mortgages.

[13] The exact phrasing of the question associated with this field reads: "Are there any adverse site conditions or external factors (easements, encroachments, environmental conditions, land uses, etc.)?"

[14] The FIMA NFIP Redacted Claims dataset is publicly available for nearly 2.7 million transactions and is downloadable at `https://www.fema.gov/openfema-data-page/fima-nfip-redacted-claims-v2`. Note that FIMA is the part of FEMA (not a typo) that manages mitigation against future losses from all hazards.

Table 1: Balance Table of Property Characteristics

	Low damage Mean/(SE)	High damage Mean/(SE)	Pairwise t-test Mean difference
Bedrooms	3.34	3.34	-0.001
	(0.003)	(0.006)	
Baths	2.61	2.75	0.136***
	(0.004)	0.008	
Square Feet	2070	2060	-4.740
	(3.27)	(6.26)	
Effective Age	9.5	10.2	0.738***
	(0.033)	(0.059)	
Lot Acreage	0.767	0.37	-0.397***
	(0.01)	(0.008)	
Garage	0.694	0.663	-0.031***
	(0.002)	(0.003)	
Underappraisal	0.11	0.099	-0.011***
	(0.001)	(0.002)	
Appraisal/Contract Ratio	103	103	-0.256
	(0.109)	(0.222)	
Appraisal Value	404,000	590,000	187,000***
	(1,180)	(4,280)	
N	65,819	18,655	

Note: The table shows summary statistics along with a difference-in-means test between areas that have low versus more damages. High damage is defined as a census tract experiencing damages in excess of $250,000 of flooding based on claims paid through FEMA's NFIP. Standard errors are listed in parentheses. Statistical significance is denoted as * for $p < 0.10$, ** for $p < 0.05$, and *** for $p < 0.01$. Source: FHFA's Uniform Appraisal Dataset (UAD) of mortgage appraisals and FEMA's National Flood Insurance Program (NFIP) of claims transactions.

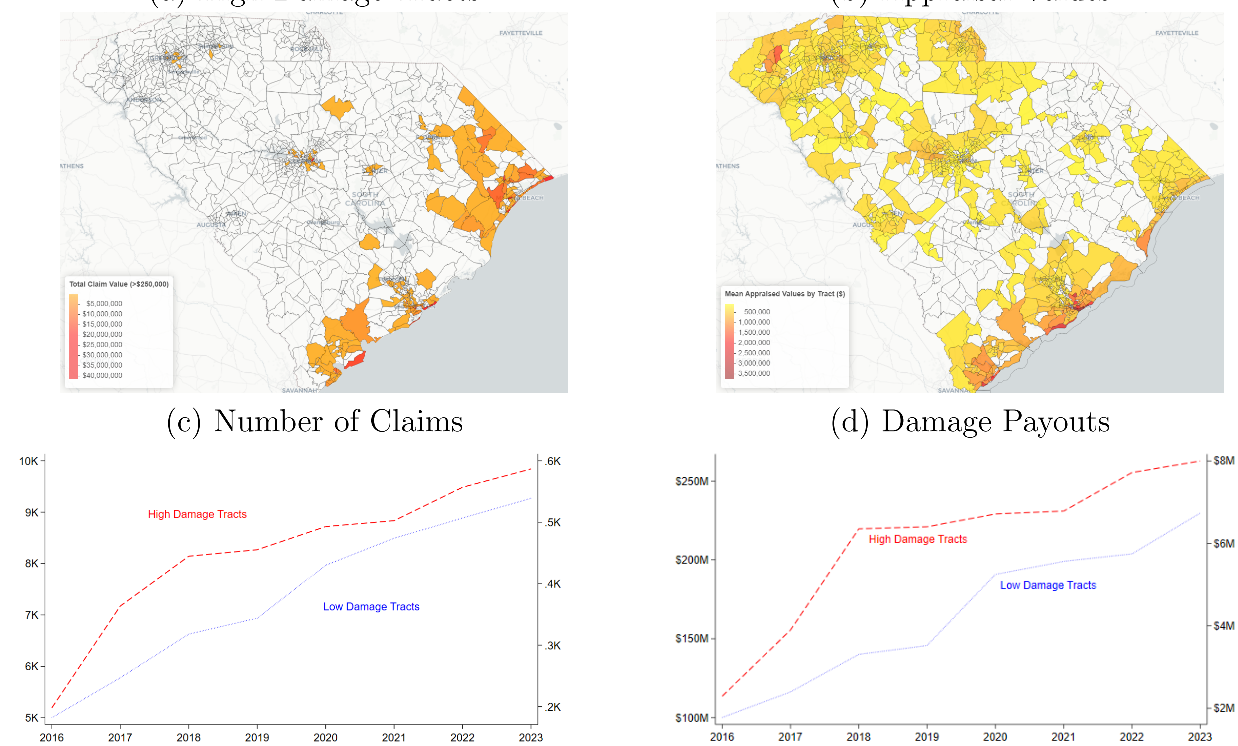
inception of the program in 1979. Although these data are redacted to protect policyholders personally identifiable information, they are geolocated to the block-group level.

We examine 84,474 appraisals completed in South Carolina from January 2022 through the second quarter of 2024 and merge them onto tract-level data on flood damages as measured by NFIP claims. We present summary statistics for these appraisals across a range of hedonic controls as well as valuation measures in Table 1. The first two columns report the mean and standard error (in parentheses) for these statistics computed separately across census

Figure 1: Flood Insurance Claim Payouts Across South Carolina

(a) High Damage Tracts (b) Appraisal Values

(c) Number of Claims (d) Damage Payouts



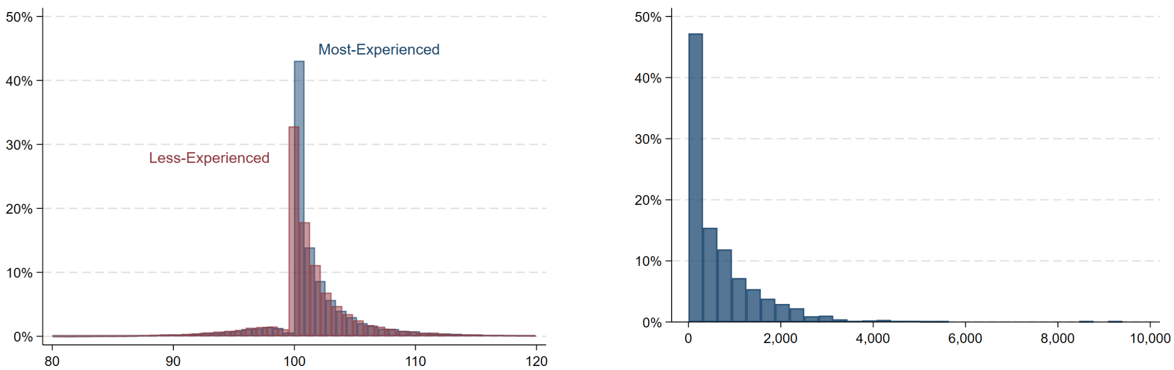
Note: The figure shows several perspectives of flood insurance claims that have been filed in South Carolina. Panel (a) is a map of all Census tracts (2010 geographic delineations) in South Carolina which have experienced greater than $250,000 in the FEMA's NFIP claims payouts. Darker shades of red indicate the largest payouts. Panel (b) is a map of appraisal values from mortgage appraisals by tracts. Panel (c) is a time series of filed claims segmented by the low and high damage tracts. Panel (d) is a time series of claims paid out with the same split by tracts. Source: Federal Emergency Management Agency's (FEMA's) National Flood Insurance Program (NFIP). Cumulative claims from 2016–2023.

tracts based on the amount of aggregate flood damage claims.[15] We use the $250,000 cutoff to align with the FEMA per-structure coverage maximum in its National Flood Insurance Program, but it is possible that multiple homes contribute to the calculations. We label the first column as "less damage" for places with lower claims amounts and the second column as "high damage" if an area experienced greater than $250,000 of flooding damage claims.

[15]Technically, the reported standard error in Table 1 is indistinguishable from the standard deviation obtained when computing the mean summary statistic conditional on having less or high damages. However, since we later conduct difference-in-difference estimations, a balanced table can also be constructed with a regression that controls for the damage claims variable. Adding the constant term to the estimated variable coefficient will recover the same value as the mean from a conditional summary statistic table. Including other fixed effects or interactions makes it more difficult to arrive at the same number as a conditional summary statistic with multiple filter controls. In such instances, it seems even more reasonable to refer to the number in parentheses as a standard error so we adopt this convention.

Figure 2: How Close Do Appraisers Get and How Much Experience Do They Have?

(a) Appraisal/Contract Ratio (b) Appraiser Experience



Note: The figure shows two histograms. Panel (a) is a histogram of the ratio of appraisal values to contract prices (trimmed to the domain as shown). Panel (b) is a histogram of appraiser experience as measured by the number of valuations completed by each professional mortgage appraiser. Source: FHFA's UAD appraisal reports from 2015 to 2024.

We find that properties in high damage tracts are generally comparable, that is they are statistically indistinguishable across attributes like bedrooms and square footage. There are some differences: homes in high-damage tracts tend to have more bathrooms, are slightly older, sit on smaller lots, and are less likely to have a garage. Valuations also differ, with appraisal values approximately 50% higher in high-damage tracts. Additionally, underappraisals—where the appraisal is lower than the contract price—are 1.1% less likely in high damage tracts. Interestingly, the average appraisal-to-contract ratio of 103% is statistically indistinguishable between low and high damage tracts. It is well-established in the literature that appraisals tend to equal or exceed transaction prices (Calem et al. (2021)). Consistently, in our data, 89.2% of properties are appraised at or above the contract price as shown in the Figure 2 that also illustrates the right-skewness of the distribution.

To provide further context for the South Carolina real estate market and its vulnerability to flood damage, we present Figure 1. Panel (a) maps the high-damage tracts across the state, which are primarily located around coastal population centers such as Myrtle Beach, Charleston, and Hilton Head Island. There are also inland areas impacted by flooding, particularly along the North Carolina border, as well as pockets in Florence and Greenville. In panel (b), we show that highly damaged tracts, being near amenity-rich coastal areas, also tend to have more expensive real estate valuations. Panels (c) and (d) show a time-series of how NFIP claim counts and dollars paid have accumulated in South Carolina since

2016. The left y-axis corresponds to high damage tracts and the right y-axis corresponds to low damage tracts. We observe significant spikes in claims following Hurricanes Florence, Irma, and Matthew between 2016 and 2018, with Hurricane Ian also contributing in 2022. Notably, there are nearly 17 times more claims and over 33 times more damage payouts in high-damage tracts compared to low damage areas. Together, these maps and charts provide a clear rationale for why flood history disclosures could enhance transparency and efficiency in flood-prone real estate markets.

4 Modeling Appraiser Behavior

The previous section highlights the geographic distribution of flood risks in South Carolina and the effect on real estate markets, particularly in high-damage tracts. Given the heightened flood risk and the potential for significant damage in these areas, appraisers play an important role in determining property values. They work for lending institutions, which often operate nationwide and may lack specific knowledge or presence in local markets to fully understand unique geographic risks. Appraisers are responsible for incorporating these risks into their professional valuations, often relying on available disclosure information. To derive testable assumptions, we model how appraisers perform evaluations as:

$$A(P, C, S, D, E) = \alpha \cdot P - \alpha \cdot P \cdot \delta \cdot D \cdot \rho(E) + \phi(C, S, D) \tag{1}$$

$$= \alpha \cdot P \left[1 - \delta \cdot D \cdot \rho(E)\right] + \phi(C, S, D) \tag{2}$$

which tells us that an appraisal value (A) is a function of contract price (P), adjustments to comparable sales (C), adverse site descriptions recorded in the appraisal report (S), flood disclosures (D), and appraisal experience (E).[16] We explore several key practical considerations—underappraisal, adjustments, and experience—to unpack appraisers' incentives and create predictions that can be tested on a unique database of appraisal reports.

The first term in Equation 1 is the baseline appraisal which is represented by $\alpha \cdot P$ and reflects an underappraisal when $\alpha < 1$. The easiest approach for an appraiser is to provide a valuation that exactly matches the contract price.[17] As we later demonstrate, this occurs

[16] We acknowledge that some might question whether the appraisal value actually reflects a fair market value, and others might point out the contract price should not be called the market value due to negotiation concessions or market bidding conditions. These are enduring philosophical debates that have no easy resolution. We can only observe the appraisal value as reported by the appraiser and the contract price as found on the initial order sent to an appraiser and known while performing the analysis.

[17] Let $\alpha = 1$ be completely insensitive to disclosures with $\delta = 0$, and forgo adjustments with $\phi(C, S, D) = 0$.

quite frequently. However, some appraisers make a concerted effort to conduct their analysis independently of the contract price. While this is commendable, deviations from that mark may introduce financial risks for both the borrower and the lender, such as higher loan amounts or down payments, potential losses in the event of defaults, and market distortions that inflate property values.[18]

The second term in Equation 1 accounts for the possibility that experienced appraisers may approach challenging assignments differently, such as valuing atypical homes or properties at risk of flooding that have not yet been impacted.[19] The expression $-\alpha \cdot P \cdot \delta \cdot D \cdot \rho(E)$ represents reductions in appraisal value due to flood disclosures (D) and the influence of appraiser experience (E) on underappraisal. The coefficient α remains a baseline underappraisal factor, δ reflects a sensitivity to disclosure requirements, and $\rho(\cdot)$ is a flexible functional form that incorporates an appraiser's experience.

The third term in Equation 1 allows an appraiser to adjust if they are uncomfortable with the initial appraisal value. In the model, this can be done by modifying comparable sales (i.e., selecting homes within flood zones) or highlighting problematic site conditions (e.g., being in a vulnerable watershed or having previously suffered flood damage). These adjustments are captured by $\phi(C, S, D)$ to describe revisions to comparable sales $(C_1, \ldots, C_j)$ and the inclusion of adverse site conditions (S) when flood disclosure requirements (D) are in place. Formally, this can be written as $\phi(C, S, D) = \eta \cdot \sum_{i=1}^{j} \left(I[C_i \notin \text{flood zone}] + C_{adj}(D, i) \right) + S_{adj}(S, D)$ where $I[C_i \notin \text{flood zone}]$ is an indicator for selecting comparables outside flood zones, $C_{adj}(i, D)$ are adjustments to the attributes or values of comparable sales for properties affected by disclosures, and $S_{adj}(S, D)$ are adjustments to adverse site descriptions when risks

[18] Although outside the scope of this paper, model complexity could be introduced to encourage appraisal values to deviate from contract price without exactly reflecting it. A revised optimization function could allow for small deviations while penalizing larger ones using a quadratic term, such as $\alpha(A-P)+\beta\cdot(A-P)^2$, where $\alpha \neq 1$ and $\beta \neq 0$. Alternatively, terms could be adjusted asymmetrically, placing greater emphasis on underappraisals or minimizing the weight on overappraisals. Incorporating such adjustments could offer a more nuanced explanation of why empirical studies frequently observe $A \leq P$, or why appraiser experience may be an important factor to explore in future research. Other potential areas for future modeling include the effect of individual workload, the distinction between overall experience and localized knowledge, and whether an appraiser works independently or belongs to an appraisal management company.

[19] Conceptually, one might expect that an appraiser would arrive at the same conclusion regardless of whether they are early in their career or a seasoned professional. However, by examining a change in disclosure requirements, we introduce a new factor that may be influenced by experience, which can be tested empirically. A positive finding would be valuable for policymakers, as it would suggest that appraisers should not be randomly assigned to areas subject to disclosure requirements or potential flood damage. Instead, additional training or targeted assignments based on familiarity with these areas could be beneficial.

are required to be disclosed.

To bring together the key practical considerations, these assumptions operate in a fluid and intuitive manner. An appraiser receives a report to conduct an appraisal, which includes the contract price. They start with a baseline appraisal value and may choose to adjust it downward or upward ($\alpha \neq 1$). The appraiser may also keep the baseline value ($A = P$) but make strategic adjustments to comparable sales and record additional concerns in text fields, as described earlier. Finally, an experienced appraiser may approach properties affected by flood disclosures with slight adjustments to their appraisal process.

The comparative statics derived from the combined model provide several important insights into the relationships amongst flood disclosures, contract price, and appraiser experience. Using Equation 1, the derivative of $A(P, C, S, D, E)$ with respect to flood disclosures is $\frac{\partial A}{\partial D} = \frac{\partial \phi}{\partial D} - \alpha \cdot P \cdot \delta \cdot \rho(E)$. When flood disclosures are required, an appraiser will strategically modify comparables and site descriptions ($\phi(C, S, D)$) to increase appraisal values (A). However, that may be mitigated by the reduction in appraisal values (A) from an experienced appraiser through $\rho(E)$. The effect of contract price (P) is captured by $\frac{\partial A}{\partial P} = \alpha - \alpha \cdot \delta \cdot D \cdot \rho(E)$. Appraisal value ($A$) and contract price ($P$) are directly related, even after disclosures ($D = 1$), unless strong experience effects ($\rho(E)$) substantially weakens the link. Finally, with regard to experience, $\frac{\partial A}{\partial E} = -\alpha \cdot P \cdot \delta \cdot \frac{\partial \rho}{\partial E}$. Experienced appraisers are more likely to underappraise ($A < P$) in response to flood disclosures, amplifying the downward adjustment in A.

In summary, appraisal value (A) is expected to generally increase even after disclosures ($D = 1$) as the baseline appraisal of αP is primarily influenced by downward adjustments due to flood disclosures and appraiser experience. Specifically, an appraiser aims to align A with P, which is the primary valuation anchor. Adjustments to comparable sales and adverse site descriptions (via $\phi(C, S, D)$) help offset the impact of flood disclosure, enabling the appraiser to justify the valuation and keep appraisal values in line with market trends. The relation between A and P would only weaken if appraiser experience significantly amplified the response to disclosures. A numerical simulation is provided in the Appendix.

5 Empirics and Results

We test the model framework by assessing how expanded flood disclosures affect real estate markets and practices. To do so, we specify a canonical, two-way fixed effects estimation strategy, which enables us to control for local market conditions as well as general seasonality and housing market trends, subject to certain assumptions and caveats, most notably that pre-treatment differences in the outcome variable are constant over time (parallel trends).[20] Specifically, we present results from a regression of the form:

$$Y_{it} = \alpha_g + \gamma_t + \beta D_{gt} + \theta_t X_{it} + \gamma_k + \epsilon_{it} \tag{3}$$

where α_g represents tract fixed effects, γ_t represents temporal year-quarter fixed effects and D_{gt} corresponds to the following indicator function:

$$D_{gt} = \begin{cases} 1 & \text{if } t \geq 2023q1 \text{ and tract } g \text{ is treated,} \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

We further include a vector of hedonic controls x_{it} for appraisal i in period t, which include the subject property's number of bedrooms, number of bathrooms, square footage, effective age, lot acreage, and the presence of a garage. Because of the richness of the UAD, we can also include fixed effects for individual appraisers, so that we are able to attenuate concerns that effects are being driven by time-invariant attributes of specific appraisers.

The first quarter of 2023 corresponds to the date on which the South Carolina Real Estate Commission voted to adopt a revised set of mandatory real estate disclosures, including additional questions on flood risk and history.[21] This constitutes the treatment in our difference-in-differences approach to estimate the causal effects of disclosure requirements on mortgage appraisals. Treatment areas are defined as census tracts wherein claims of greater than $250,000 have been made under FEMA's National Flood Insurance Program (NFIP) according to the OpenFEMA dataset. The threshold is the maximum value for which a single structure may be insured under the NFIP. Control areas are all other tracts.

[20] First, while we show that our estimates are largely robust to Wald tests for parallel trends, we also recognize that substantive concerns have been raised over the power and validity of these methods (Roth, 2022; Rambachan and Roth, 2023). We further implicitly assume that every treated home is treated simultaneously and remains treated for the remainder of the analytical period. For further discussion of the challenges of applying quasi-experimental methods to estimation of causal effects in the hedonic literature, see Contat et al. (2024*b*). Second, it is important to note that the analysis herein considers a single event—the approval by the South Carolina Real Estate Commission of an expanded questionnaire on flood and erosion as part of revised mandatory real estate disclosures. Hence, recent advances in estimating staggered or stacked difference-in-differences models are inappropriate for our context.

[21] The precise date of adoption was February 15, 2023. Meeting minutes of the Real Estate Commission are available at https://llr.sc.gov/re/minutes/minutes.aspx

Table 2 presents our estimates of the enhanced flood disclosure effect on three outcomes: the propensity for a property to be underappraised, the appraisal valuation, and the ratio of the appraisal's valuation to the contract price. The main coefficient of interest corresponds to the "High Damage Tract" row. Columns (1) to (3) do not include appraiser fixed effects, while columns (4) to (6) do include them. Results are unchanged in sign and magnitude irrespective of the inclusion of these fixed effects, suggesting that between-appraiser variation does not drive the observed effects in columns (1) to (3). Focusing on the last three columns, underappraisals in tracts with a history of flood damages are 1.9% more likely. Log appraisal values are 1.6% higher and the appraisal to contract ratio is statistically unchanged.

To substantiate the validity of this difference-in-differences approach, we implement tests for parallel trends prior to the treatment, which we present in Figure 3. Graphical inspection and Wald tests for whether the linear trends in the dependent variable are parallel between control and treatment suggest pre-treatment outcomes move in parallel with each other for the log appraisal value ($p = 0.8847$) and the appraisal value to contract price ratio ($p = 0.6516$). We marginally reject that trends are parallel in underappraisals in 2022 at the 10% level ($p = 0.0725$), although not at the 5% level.

These results are somewhat puzzling in light of a long literature which, by and large, identifies negative capitalization of flood risk.[22] But the nature of the revised disclosure statement warrants further discussion. Whereas much of the literature has focused on disclosures of flood risk that resulted in pecuniary consequences (being mapped into a special flood hazard area) or damages directly occurred because of a natural disaster, the revisions to the disclosure form are more nuanced, addressing erosion control, beach renourishment, and history of flood damages. Furthermore, relative to other information treatments of flood risk, the timing is important—most homeowners do not review disclosures until after being under contract.[23] Additionally, misinterpretation by consumers, who are eager and encouraged to complete the purchase, may be rife—consumers could perceive a flood-damage free history as a positive rather than a negative signal (a survivorship bias), even though nothing about the underlying flood risk has changed. Ultimately, these results speak to the need to carefully

[22] See Contat et al. (2024*a*) and Beltrán, Maddison, and Elliott (2019) for meta-analyses of this literature.

[23] Anderson et al. (2023) discuss the concept of a psychological (as opposed to legal) contract, explaining that once a meeting of the minds has occurred, parties to the contract tend to let their due diligence guard down and even mitigate new and relevant information that would otherwise dissuade them from moving forward. These behavioral considerations can lead to both confirmation and disconfirmation bias.

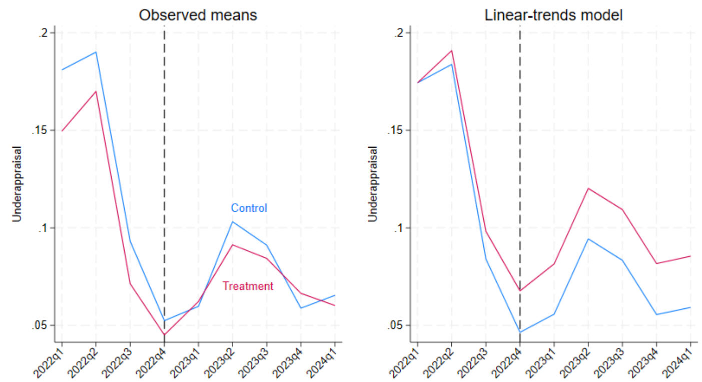
Table 2: Do Valuations Change Subsequent to Increased Mandatory Disclosures?

	No Appraiser Fixed Effect			Includes Appraiser Fixed Effect		
	(1)	(2)	(3)	(4)	(5)	(6)
	Underappraisal	Log Appraisal	Appraisal/Contract	Underappraisal	Log Appraisal	Appraisal/Contract
High Damage Tract	0.017***	0.016***	0.40	0.019***	0.016***	0.40
	(0.01)	(0.01)	(0.53)	(0.01)	(0.01)	(0.53)
Bedrooms	-0.00**	-0.04***	-0.35*	-0.00*	-0.03***	-0.26
	(0.00)	(0.01)	(0.21)	(0.00)	(0.01)	(0.21)
Baths	0.00	0.03***	0.03	0.00	0.02***	0.07
	(0.00)	(0.00)	(0.20)	(0.00)	(0.00)	(0.21)
Square Feet	-0.00***	0.00***	0.00***	-0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Effective Age	-0.00***	-0.01***	0.05**	-0.00***	-0.01***	0.05**
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.02)
Lot Acreage	-0.00***	0.02***	0.38***	-0.00***	0.02***	0.37***
	(0.00)	(0.00)	(0.12)	(0.00)	(0.00)	(0.11)
Garage	0.01	0.10***	-0.95***	0.01*	0.10***	-0.87***
	(0.00)	(0.00)	(0.23)	(0.00)	(0.00)	(0.21)
Appraiser FE	No	No	No	Yes	Yes	Yes
Census Tract FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
R_a^2	0.04	0.86	0.01	0.10	0.86	0.03
N	83,728	83,728	83,728	83,073	83,073	83,073

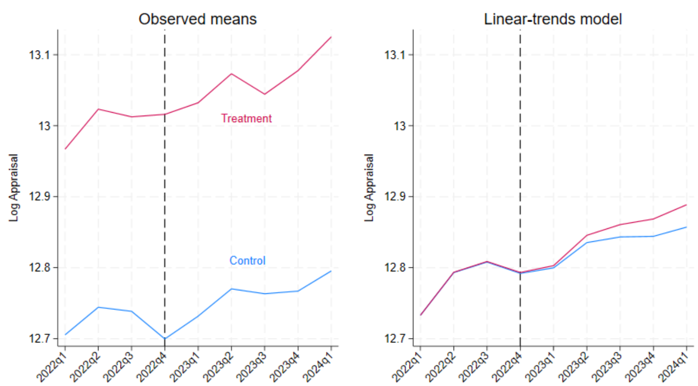
Note: The table shows difference-in-difference regression and covariate estimates for multiple outcomes about whether valuation measures change after enhanced flood disclosure requirements are implemented. Linear regressions have multiple fixed effects that allow for individual fixed effects with group-level outcomes for census tracts, quarterly period, and (as noted) appraiser identifiers with robust clustering of standard errors that are independent across census tract but permit within tract correlation. Standard errors are listed in parentheses. Statistical significance is denoted as * for $p < 0.10$, ** for $p < 0.05$, and *** for $p < 0.01$. Source: FHFA's UAD and FEMA's NFIP.

Figure 3: Diagnostic Visualizations Showing No Pre-Trend Differences

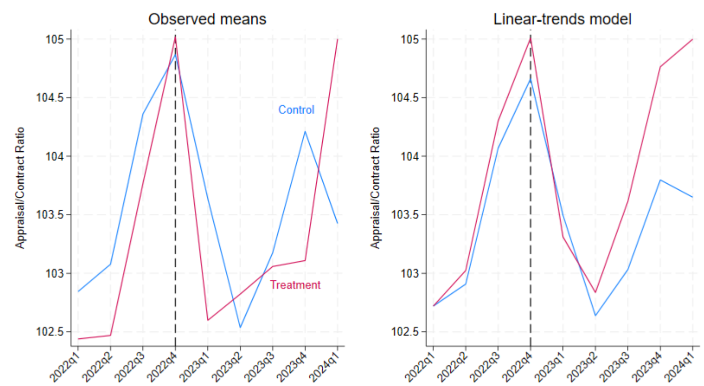
(a) Underappraisal



(b) Log Appraisal Values



(c) Appraisal/Contract Ratio



Note: The figure compares control and treatment groups to indicate that pre-trend patterns are similar. Series are presented both as observed means and linear-trend models to help demonstrate the series are close when rebased. Source: FHFA's UAD appraisal reports for South Carolina.

consider the sequencing and quantity of information delivered to consumers during the home-buying process.

5.1 Changes to Appraiser Behavior

One curiosity emerging out of Table 2 is that appraisal valuations appear to move upward. Even though comprehensive flood disclosures do nothing to change the underlying flood risk of any individual property, appraisers appear to be supporting increased consumer valuation of properties in tracts with a history of flooding. In this subsection, we describe three ways in which appraisers are adjusting their usage of fields on the appraisal form to support increased valuations: the location of their choice of comparable sales (comps), their description of the property, and their application of certain adjustments to the sale prices of comps.

In Table 3, we present our estimates of how appraisers adjust their choice of comparable properties in highly damaged tracts for three outcomes. The first outcome, UAD Flood Zones, reflects the ratio of comps that are present in a flood zone. The second outcome, NFHL flood zones, references the proportion of comparable properties located in flood zones as described by the National Flood Hazard Layer, colloquially known as FEMA Flood Maps. Comps Count refers to the number of comparable properties used by the appraiser. Results are shown without appraiser fixed effects in columns (1) to (3) and with appraiser fixed effects in columns (4) to (6). The main coefficient of interest with respect to the ratio of properties in flood zones, whether defined by appraisals or the NFHL, are similar in magnitude and statistical significance: appraisers seem to use modestly fewer (0.9 p.p.) flood zone properties as comparables following the disclosure requirements in highly damaged tracts. Interestingly, the estimate of High Damage Tract on the total number of comps, while smaller in absolute magnitude with the inclusion of appraiser fixed effects, becomes statistically significant at the 5% level. Without such fixed effects, the estimate is marginally insignificant.

Ex ante, we may have anticipated appraisers to choose more comps in flood zones. This is because expanded disclosures may reveal information about flood risk on properties which are located outside the Special Flood Hazard Area (SFHA), and the appraiser may want to bring in a property more likely to have capitalized that risk in a past transaction. Yet we see this is not the case, supporting the idea that appraisers are anchoring onto the contract price and taking steps to support increased consumer valuations. The decrease in the number of comps is likewise of interest—appraisers' judiciousness over inclusion of additional comps may be related to supporting higher fair market values.

Table 3: Do Appraisers Select Different Comparable Sales?

	(1) UAD Flood Zones	(2) NFHL Flood Zones	(3) Comps Count	(4) UAD Flood Zones	(5) NFHL Flood Zones	(6) Comps Count
High Damage Tract	-0.009*	-0.009*	-0.047	-0.009*	-0.009*	-0.040**
	(0.005)	(0.005)	(0.028)	(0.005)	(0.005)	(0.018)
Bedrooms	0.002	0.003	0.017*	0.002	0.003	0.008
	(0.003)	(0.003)	(0.010)	(0.003)	(0.003)	(0.006)
Baths	0.008***	0.009***	0.011	0.008***	0.009***	-0.002
	(0.003)	(0.003)	(0.009)	(0.003)	(0.003)	(0.007)
Square Feet	0.000***	0.000	0.000**	0.000***	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Effective Age	0.000	0.000	-0.008***	0.000	0.000	-0.007***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Lot Acreage	-0.000	-0.000	0.004	0.000	-0.000	0.005**
	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.002)
Garage	-0.009***	-0.007**	-0.013	-0.009**	-0.007**	-0.003
	(0.003)	(0.003)	(0.013)	(0.003)	(0.003)	(0.010)
Appraiser FE	No	No	No	Yes	Yes	Yes
Census Tract FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
R_a^2	0.61	0.57	0.04	0.61	0.58	0.54
N	83,728	83,728	83,728	83,073	83,073	83,073

Note: The table shows difference-in-difference regression results for multiple outcomes about whether comparable sales change after enhanced flood disclosures. Linear regressions have multiple fixed effects that allow for individual fixed effects with group-level outcomes for census tracts, quarterly period, and (as noted) appraiser identifiers with robust clustering of standard errors that are independent across census tract but permit within tract correlation. Standard errors in parentheses are listed in parentheses. Statistical significance is denoted as * for $p < 0.10$, ** for $p < 0.05$, and *** for $p < 0.01$. Source: FHFA's UAD and FEMA's NFIP.

In Table 4, we turn to an analysis of appraisers' use of a free-form text field on the URAP that asks: "Are there any adverse site conditions or external factors (easements, encroachments, environmental conditions, land uses, etc.)?" We studied six outcomes associated with this field. The field used is a simple dummy variable for whether the appraiser wrote anything in the field. Word count is the number of words used by the appraiser. The last four columns correspond to sentiment scores as ascribed to the text by the Valence Aware Dictionary and sEntiment Reasoner (VADER) package.[24] The package outputs a compound sentiment score, which is the sum of all valence scores assigned to words in the text then subsequently normalized to a number between -1 and 1. In addition, it also computes the proportion of words characterized as neutral, positive, or negative.

[24] A tool and open source files are available at `https://github.com/cjhutto/vaderSentiment`.

Table 4: Do Appraisers Adjust Adverse Site Descriptions?

	(1) Field Used	(2) Word Count	(3) Compound	(4) Neutral	(5) Positive	(6) Negative
High Damage Tract	-0.01**	-1.40*	0.14	-0.58	-0.08	-0.20***
	(0.00)	(0.81)	(0.44)	(0.37)	(0.11)	(0.06)
Bedrooms	-0.00	-0.48*	-0.12	-0.30**	0.06*	0.03
	(0.00)	(0.26)	(0.16)	(0.13)	(0.04)	(0.03)
Baths	-0.00	0.32	-0.00	0.01	-0.02	-0.04*
	(0.00)	(0.27)	(0.17)	(0.15)	(0.04)	(0.02)
Square Feet	0.00	0.00***	0.00***	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Effective Age	0.00	0.08***	-0.02	0.01	-0.00	0.01***
	(0.00)	(0.02)	(0.01)	(0.01)	(0.00)	(0.00)
Lot Acreage	0.00***	0.45***	0.07	0.30***	-0.01	0.02*
	(0.00)	(0.06)	(0.05)	(0.04)	(0.01)	(0.01)
Garage	-0.00	-0.62*	-0.01	-0.26	0.03	-0.02
	(0.00)	(0.35)	(0.25)	(0.20)	(0.06)	(0.04)
R_a^2	0.76	0.71	0.70	0.74	0.77	0.67
N	83,073	83,073	83,073	83,073	83,073	83,073

Note: The table shows difference-in-difference regression results for multiple outcomes about whether appraisers change how they use free-form text fields after enhanced flood disclosures. Linear regressions have multiple fixed effects that allow for individual fixed effects with group-level outcomes for census tracts, quarterly period, and appraiser identifiers with robust clustering of standard errors that are independent across census tract but permit within tract correlation. Standard errors in parentheses are listed in parentheses. Statistical significance is denoted as * for $p < 0.10$, ** for $p < 0.05$, and *** for $p < 0.01$. Source: FHFA's UAD and FEMA's NFIP.

We estimate that appraisers use the adverse site text field 1% less often in high damage tracts after enhanced flood disclosures. They are also more terse—using 1.4 fewer words, on average. While the overall sentiment of the text is unaffected, and the use of neutral or positive language is imprecisely estimated, appraisers use significantly fewer (20%) words with negative connotations after the policy change. These results are again consistent with appraisers selectively presenting information to support higher appraisal valuations following the rollout of expanded flood disclosures.

Ultimately, what matters for the sales comparison approach for appraisals is the adjustments to sale prices of comps, which is what we examine in Table 5. We address five outcomes in this table. First, Log Total Adjustment, is the inverse hyperbolic sine transformation of the mean of the adjustments applied to comps to arrive at the appraisal's valuation. The second, Date and Time, refers to the appraisers' use of a date and time adjustment on comps.

Table 5: Do Appraisers Change Adjustments to Comparable Sales?

	(1) Log Total Adjustment	(2) Date and Time	(3) Log Date and Time	(4) Concessions Adjustment	(5) Log Concessions
High Damage Tract	-0.50**	0.03***	-2.47***	-0.07***	-0.64***
	(0.19)	(0.01)	(0.32)	(0.01)	(0.10)
Bedrooms	0.07	-0.01***	-0.15***	0.03***	0.27***
	(0.07)	(0.00)	(0.05)	(0.00)	(0.03)
Baths	0.55***	-0.00	0.01	-0.01**	-0.08**
	(0.08)	(0.00)	(0.06)	(0.00)	(0.03)
Square Feet	0.00***	0.00*	0.00	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Effective Age	-0.10***	-0.00	-0.02***	0.00**	0.00
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)
Lot Acreage	0.15***	-0.00	0.01	-0.00***	-0.04***
	(0.02)	(0.00)	(0.01)	(0.00)	(0.01)
Garage	1.15***	-0.00	-0.01	-0.02***	-0.14***
	(0.11)	(0.00)	(0.08)	(0.00)	(0.04)
R^2_a	0.10	0.39	0.56	0.29	0.31
N	83,073	83,073	83,073	83,073	83,073

Note: The table shows difference-in-difference regression results for multiple outcomes about whether appraisers change their use of adjustments to comparable property sales after enhanced flood disclosures. Linear regressions have multiple fixed effects that allow for individual fixed effects with group-level outcomes for census tracts, quarterly period, and appraiser identifiers with robust clustering of standard errors that are independent across census tract but permit within tract correlation. Standard errors in parentheses are listed in parentheses. Statistical significance is denoted as * for $p < 0.10$, ** for $p < 0.05$, and *** for $p < 0.01$. Source: FHFA's UAD and FEMA's NFIP.

Log Date and Time in column (3) is the inverse hyperbolic sine of the amount of the mean date and time adjustments to comps. In column (4), Concessions Adjustment is a dummy variable for the use of adjustments to comps based on any financing concessions received by the buyer. Log Concessions in column (5) is the inverse hyperbolic sine of the mean of concession-related adjustments across all comps.

Our results are mixed in terms of direction and tend to reflect smaller adjustments across the board. We estimate that the average adjustments applied to comps is 50% smaller following announcement of the enhanced disclosures. Appraisers are 3 p.p. more likely to use date and time adjustments, a meaningful increase relative to the general use of these adjustments in our data of 31.6%. But greater use of these adjustments is complemented with smaller applications—these adjustments are 247% smaller after the policy change. Meanwhile, appraisers are less likely to adjust based on any financing concessions received by the buyer of a comp. When they do use these adjustments, these are likewise smaller by 64%. Taken together with the previous results, these estimates would suggest appraisers are choosing comps which have not capitalized flood risk in previous transactions, and hence need to adjust their valuations by less. But to the extent they do, they are more likely to use seasonal adjustments, although they use these in smaller magnitudes.

5.2 The Role of Appraiser Experience

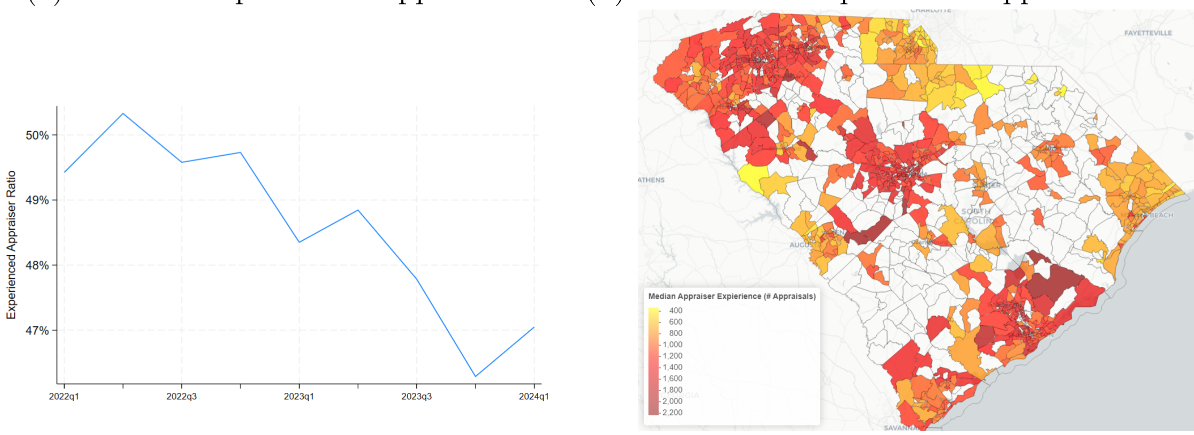
Is supporting increased consumer valuations a matter of experience? As seen in panel (b) of Figure 2, the distribution of appraiser experience is right-skewed. The average number of submitted reports by appraisers between 2015 and 2024 is 682, while the median number is 365. The top quintile of appraisers, those who completed at least 1,199 appraisals, accounts for 61% of all appraisals during this period, while those in the bottom quintile completed just 0.4%. One might hypothesize that "super-appraisers"—i.e., those in the highest quintile—are more resistant to pressure from their appraisal management company or lenders to support contract prices. Another plausible explanation is that experienced appraisers are more likely to have accumulated local knowledge necessary to assess flood risk and property history, even if sellers do not fully disclose this information. Yet across the entire sample and timeframe, inclusive of all tracts in South Carolina—an experience effect is not immediately apparent. The respective distributions of appraisal values to contract ratios as shared by experienced and less-experienced appraisers, as documented in figure (b), largely mirror each other.

We document the presence of experienced appraisers over time and space in Figure 4. Our analysis shows a slight decline in the proportion of experienced appraisers, defined as those in the top quintile, over the years in our sample. At the start of 2022, experienced appraisers conduct 49.5% of all appraisals, but by the first quarter of 2024, their share falls to 47%. Furthermore, experienced appraisers primarily work near major economic hubs in South Carolina, including Charleston, Columbia, and Greenville. In contrast, resort areas such as Myrtle Beach and Hilton head are predominantly served by less-experienced appraisers. This trend may raise concerns, particularly given coastal flood risks and the important role of local knowledge in accurately evaluating those risks.

To dive further into underappraisals given expanded disclosures, Figure 5 illustrates cross-sectionally how the share of underappraisal varies by appraisal experience. The top panels

Figure 4: When and Where Are Experienced Appraisers Operating?

(a) Share of Experienced Appraisers (b) Location of Experienced Appraiser Casework



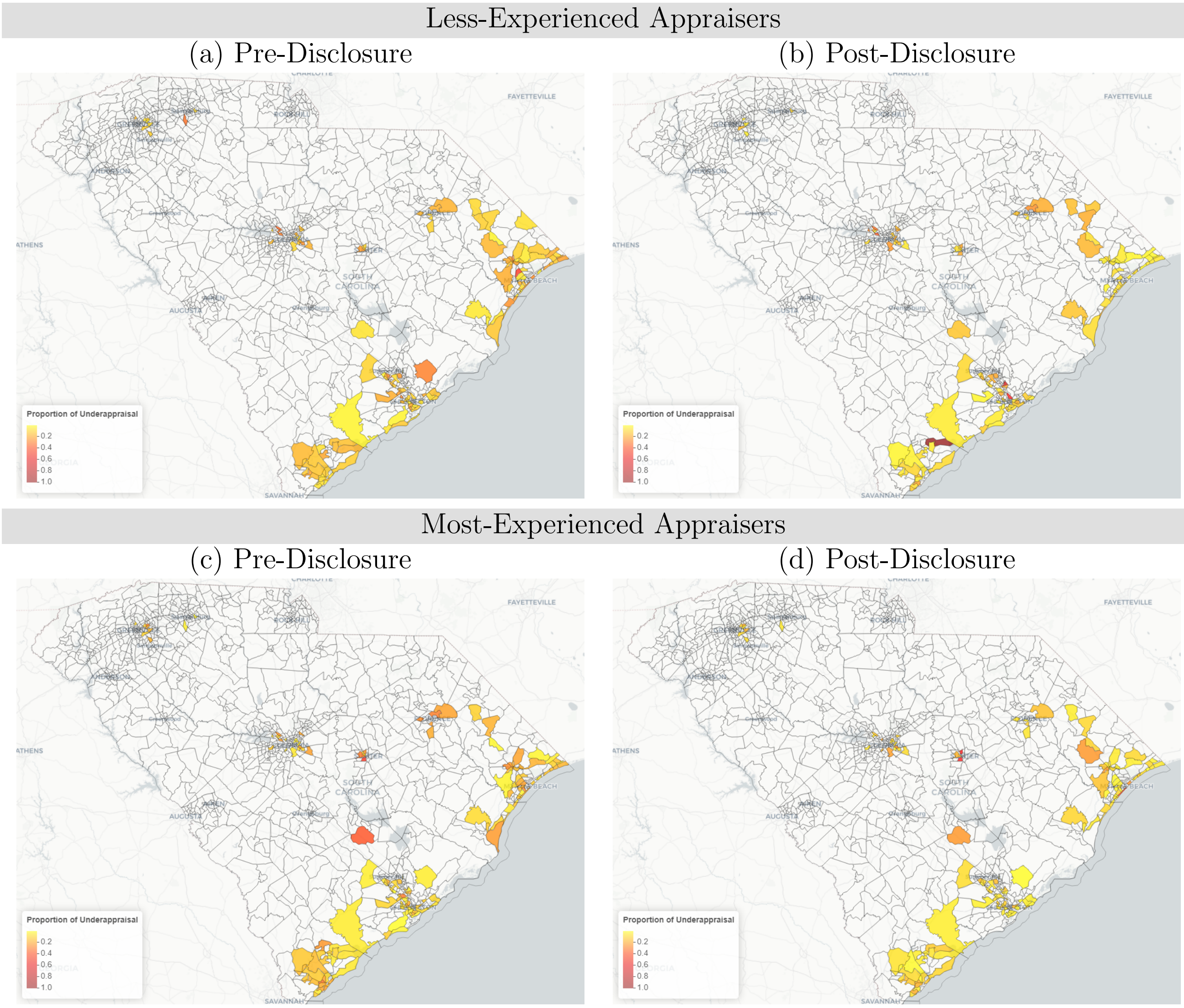
Note: The figure shows a histogram of appraiser experience as measured by the number of valuations completed by each professional mortgage appraiser. Source: FHFA's UAD appraisal reports from 2015 to 2024.

present maps for less-experienced appraisers, with panel (a) depicting pre-disclosure underappraisals and panel (b) showing post-disclosure underappraisals. Below, similar panels replicate the analysis for the most-experienced appraisers. Note the maps only depict information for high-damage tracts that have accumulated more than $250,000 in NFIP flood damage claims since program inception. We observe a general drop in underappraisals post-disclosure, regardless of experience (as indicated by lighter colors moving from left to right across both rows)—likely reflecting a broader cooling of real estate markets during the post-pandemic recession. However, damages remain concentrated along coastal areas, with the highest levels of underappraisal occurring in denser regions near places like Hilton Head, Charleston, and Myrtle Beach, where affluent residential developments are often located on low-lying land. This finding is consistent with the theoretical framework outlined in section 4 and the numerical simulation in the Appendix. The shading becomes lighter in denser coastal areas, which suggests declining underappraisals for all appraisers.

Another approach to examine appraiser behavioral is to compare experience with appraisal value, as shown in Figure 6. Rather than focusing on geographic location, we see whether more experienced appraisers handle a greater proportion of properties in high damage tracts (bottom versus top rows), whether they concentrate on evaluations with higher appraisal values (horizontal axis), and if these patterns change after post-disclosure (left to right).[25]

[25] Value is measured by appraisal value, and we filter out properties above $1 million for visual ease.

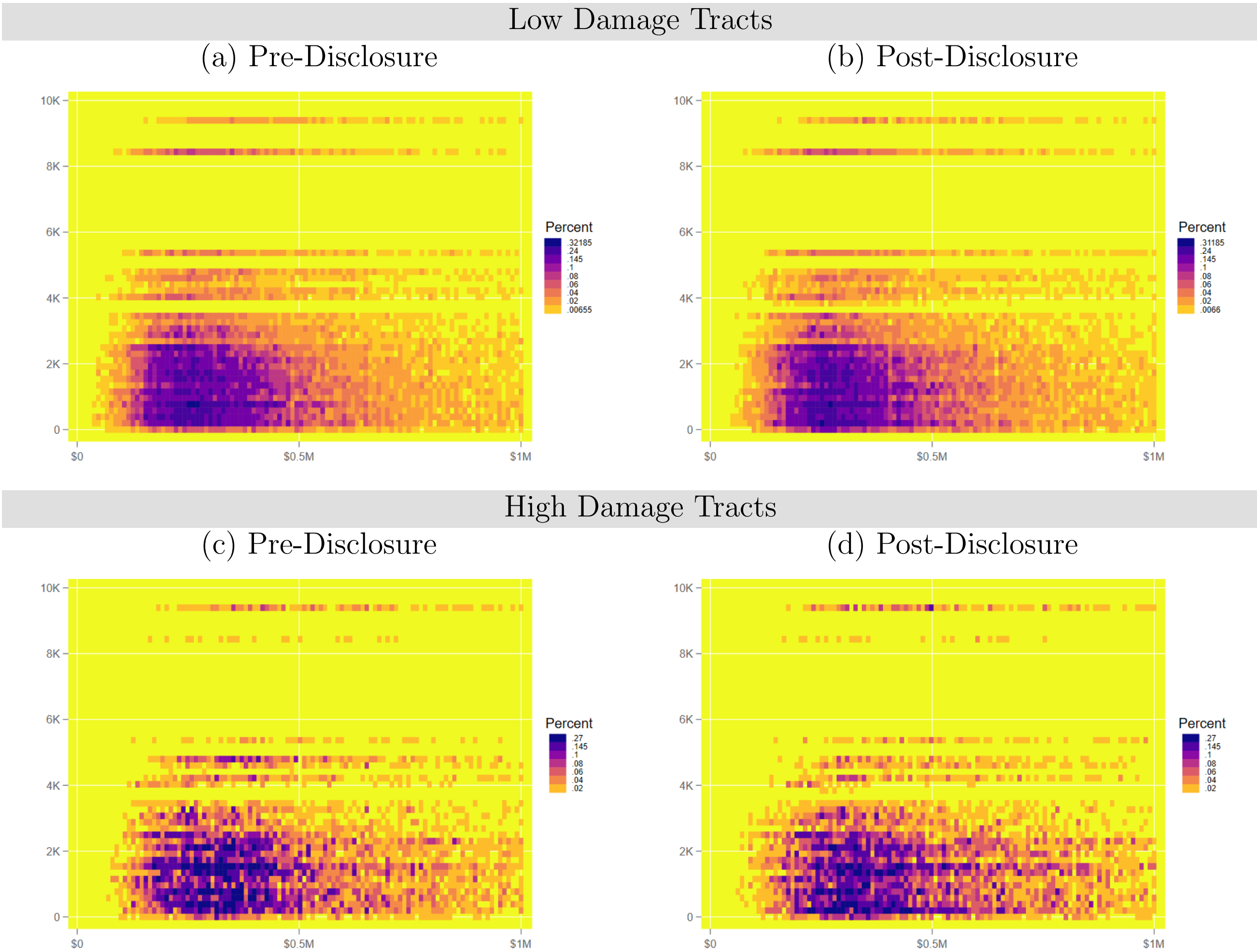
Figure 5: Underappraisals by Experienced Appraisers



Note: These maps show the proportion of underappraisals, or appraisals which come in under the contract price, at the tract-level. Tracts are selected based on having had more than $250,000 of NFIP flood claims since program inception. Panels are divided across columns into pre- and post-disclosure changes that expanded mandatory reporting requirements in 2023q1, as well as across rows by appraiser experience. Less-Experienced appraisers correspond to the 80% of appraisers who completed between 1 and 1,198 appraisals between 2015 and 2024, whereas Experienced appraisers are the 20% who completed at least 1,199 appraisals. Source: FHFA's UAD for computing appraisal ratios and FEMA's NFIP for flood policy damages payouts for 2022q1 to 2024q1.

The layout is similar to the prior figure, but the darker color gradient shows a greater percentage of appraisal activity (instead of underappraisals). The heatmap is like the contour regions presented earlier in the model framework. Here, a darker purple color indicates a

Figure 6: Appraisal Values by Appraiser Experience



Note: The heatmaps show how the frequency of appraisals changes after stricter flood disclosures depending on appraisal value (horizontal axes) and appraisal experience (vertical axes). Appraisal experience is measured by the number of reports completed between 2015 and 2024 (i.e., a fixed amount that does not change pre- or post-disclosure). Appraisal value is recorded on the appraisal form, measured as nominal dollar price, and filtered to show properties valued no more than $1 million. Panels are divided across columns into pre- and post-disclosure changes that expanded mandatory reporting requirements in 2023q1, as well as across rows by low and high damage tracts. High damage tracts have more than $250,000 of NFIP flood claims since program inception. Source: FHFA's UAD for computing appraisal ratios and FEMA's NFIP for flood policy damages payouts for 2022q1 to 2024q1.

greater sample concentration is predominantly located in the lower left of each figure where less-experienced appraisers assessed lower valued homes. Comparing across the rows, there is a larger dark mass in low damage tracts which indicates valuations are spread out slightly more for high damage tracts. Comparing across columns, the low damage tracts are fairly similar but the high damage tracts show the color gradient stretching further to the right (higher valued properties) and moving slightly down (less experienced appraisers). Overall, appraiser experience is not as common in high damage tracts after the disclosures, which could be due to appraisers retiring or an influx of newer appraisers. An important policy question is whether more experienced appraisers deliver better results in high-damage areas, despite a potential decline in work activity in those regions.

To address the potential gains from professional growth, we study the role of experience as a potential mechanism underlying our main results in Table 6. We estimate separate regressions for appraisers in the first through fourth quintiles of total appraisals completed between 2015 to 2024, compared to those in the fifth quintile. Notably, although the fifth quintile represents 20% of appraisers, it accounts for 57% of the appraisals in our sample. While less-experienced appraisers are no more likely to underappraise after the policy rollout, more-experienced appraisers are 2.3% more likely to underappraise, reflecting a 19 percentage point increase relative to the pre-disclosure baseline of 12.2%. Additionally, experienced appraisers appear to increase appraisal values by smaller amounts than their counterparts—we estimate a marginally significant 1.1% increase, on average, for experienced appraisers, compared to a 2.4% increase for less-experienced appraisers. However, this does not impact the tendency of appraisal values to match contract prices. While the coefficient for experienced appraisers is markedly smaller (0.14) than for less-experienced appraisers (0.88), it is imprecisely estimated.

Table 7 evaluates the robustness of the treatment effects under several estimation adjustments. Our analysis examines whether the observed changes in valuation measures persist across different methodologies and whether potential biases such as timing, renovation effects, or control group selection influence the results.

The first check stratifies the sample by structure size as shown by results beneath the first two shaded rows. For homes larger than 1,800 square feet, the post-disclosure treatment effects remain positive and statistically significant, with estimated effects ranging from 0.021 to 0.029. These results are consistent with earlier findings but demonstrate slightly larger effect sizes.[26] No significant post-disclosure effects are observed for smaller structures, which suggests that larger homes, which are typically underappraised and at higher appraisal valuation levels, benefit more from the enhanced disclosure requirements.

[26] Table 2 has a range of 0.016 to 0.019.

Table 6: Does Appraiser Experience Affect Valuations?

	Less-Experienced Appraisers			Most-Experienced Appraisers		
	(1)	(2)	(3)	(4)	(5)	(6)
	Underappraisal	Log Appraisal	Appraisal/Contract	Underappraisal	Log Appraisal	Appraisal/Contract
High Damage Tract	0.010	0.024***	0.88	0.023***	0.011*	0.14
	(0.01)	(0.01)	(0.55)	(0.01)	(0.01)	(0.86)
Bedrooms	0.00	-0.03***	-0.11	-0.01***	-0.03***	-0.33
	(0.00)	(0.01)	(0.32)	(0.00)	(0.01)	(0.27)
Baths	-0.00	0.02***	-0.38	0.01**	0.02***	0.34
	(0.00)	(0.01)	(0.26)	(0.00)	(0.00)	(0.30)
Square Feet	-0.00***	0.00***	0.00***	-0.00***	0.00***	0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Effective Age	-0.00***	-0.01***	0.11***	-0.00***	-0.01***	0.02
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.03)
Lot Acreage	-0.00	0.02***	0.47**	-0.00***	0.02***	0.32***
	(0.00)	(0.00)	(0.22)	(0.00)	(0.00)	(0.08)
Garage	0.00	0.09***	-1.01***	0.01**	0.10***	-0.81***
	(0.01)	(0.01)	(0.34)	(0.00)	(0.01)	(0.27)
R_a^2	0.04	0.86	0.07	0.09	0.86	0.02
N	34,609	34,609	34,609	48,461	48,461	48,461

Note: The table shows difference-in-difference regression results for multiple outcomes about whether more experienced appraisers respond differently to valuation measures after enhanced flood disclosures. Linear regressions have multiple fixed effects that allow for individual fixed effects with group-level outcomes for census tracts, quarterly period, and (as noted) appraiser identifiers with robust clustering of standard errors that are independent across census tract but permit within tract correlation. Columns represent subsample stratified regressions split across the distribution of appraiser experience such that the first three columns are for the first four quintiles while the last three columns are for the final quintile (high experienced appraisers). Standard errors in parentheses are listed in parentheses. Statistical significance is denoted as * for $p < 0.10$, ** for $p < 0.05$, and *** for $p < 0.01$. Source: FHFA's UAD and FEMA's NFIP.

Next, we stratify the sample by lot size, using a median split at 0.27 acres, with results below the third and fourth shaded rows. For smaller lots, the findings mirror those for larger structures, showing statistically significant treatment effects of similar magnitude. However, the results for larger lots are more muted, with the magnitude of underappraisal reduction roughly half the size. This variation may stem from jurisdictional differences in how land use regulations define lot size and density, which could introduce appraisal heterogeneity.[27]

We also consider the impact of subject property condition and construction ratings by including those as additional variables. Results are under the fifth shaded row. These covariates capture potential renovations or improvements, identified through subject property conditions and construction ratings. We also employ regular expression matching to analyze a descriptive text field about improved property conditions.[28] The resulting treatment effects are slightly lower, ranging from 0.012 to 0.016, but remain statistically significant, affirming the robustness of our earlier conclusions. This specification ensures that the observed effects are not driven by systematic differences in property condition or resilience features.

Last, we conduct a border discontinuity analysis using a triple-difference estimation. Results listed under the last two shaded rows compare Metropolitan Statistical Areas (MSAs) along the South Carolina–North Carolina and South Carolina–Georgia coastal borders.[29] In the comparison between Myrtle Beach (SC) and Wilmington (NC), the results indicate significantly fewer underappraisals in South Carolina post-disclosure. Why is this an opposite sign from earlier findings? The average appraiser experience in the Myrtle Beach is lower compared to the rest of the state and, taking that into account, the finding aligns with earlier results that regions with less experienced appraisers have lower levels of underappraisal.[30] Although results under the last shaded row exhibit statistical significance, the Hilton Head (SC) versus Savannah (GA) analysis does not yield conclusive results because it fails

[27] The same house size may be subjected to different county requirements like setbacks, lot sizes, or maximum dwelling units in certain neighborhood or character areas.

[28] Matching happens across action verbs (i.e., elevate, raise, fortify, reinforce, waterproof, floodproof, protect, shield, guard, brace, and strengthen) to identify what has been done to mitigate risks beyond descriptions of existing hazards. A renovation magnitude is difficult to establish via prose so we use a binary indicator whether there was any expressed improvement.

[29] Delineations follow OMB Bulletin 23-01 which was issued on July 21, 2023 and is available at `https://www.whitehouse.gov/wp-content/uploads/2023/07/OMB-Bulletin-23-01.pdf`. We shorten the official names of Myrtle Beach-Conway-North Myrtle Beach to be Myrtle Beach and Hilton Head Island-Bluffton-Port Royal to be Hilton Head.

[30] Lower experience is shown as lighter shade in the top-right of the state in panel (b) of Figure 4. North Carolina offers an added control feature because enhanced disclosures were not in effect until summer 2024.

Table 7: Robustness Checks for the Mandatory Disclosures Treatment

	No Appraiser Fixed Effect			Includes Appraiser Fixed Effect		
	(1)	(2)	(3)	(4)	(5)	(6)
	Underappraisal	Log Appraisal	Appraisal/Contract	Underappraisal	Log Appraisal	Appraisal/Contract
	Subsample Split of Smaller Structures (Below the Median of 1,800 Square Feet)					
High Damage Tract	0.008	0.008	-0.080	0.011	0.007	-0.096
R_a^2	0.049	0.791	0.025	0.105	0.799	0.056
N	41,827	41,827	41,827	41,428	41,428	41,428
	Subsample Split of Larger Structures (At Least the Median of 1,800 Square Feet)					
High Damage Tract	0.029***	0.021**	0.838	0.027***	0.022***	0.910
R_a^2	0.039	0.820	0.005	0.097	0.826	0.009
N	41,880	41,880	41,880	41,504	41,504	41,504
	Subsample Split of Smaller Lot Sizes (Below the Median of 0.27 Acres)					
High Damage Tract	0.021**	0.022***	-0.011	0.020**	0.022***	0.036
R_a^2	0.067	0.893	0.049	0.120	0.897	0.051
N	40,942	40,942	40,942	40,520	40,520	40,520
	Subsample Split for Larger Lot Sizes (At Least the Median of 0.27 Acres)					
High Damage Tract	0.017**	0.005	0.819	0.019**	0.004	0.787
R_a^2	0.032	0.868	0.001	0.088	0.874	0.026
N	42,740	42,740	42,740	42,367	42,367	42,367
	Additional Controls for Renovations: Property Condition, Construction Rating, and Condition Description					
High Damage Tract	0.016**	0.014***	0.480	0.017***	0.012**	0.511
R_a^2	0.051	0.878	0.019	0.103	0.885	0.033
N	83,718	83,718	83,718	83,063	83,063	83,063
	Subsample of Border Counties for South Carolina (Myrtle Beach) Versus North Carolina (Wilmington)					
High Damage Tract in SC	-0.036**	-0.006	1.140	-0.037***	-0.007	1.332
R_a^2	0.042	0.821	0.047	0.116	0.825	0.086
N	11,793	11,793	11,793	11,563	11,563	11,563
	Subsample of Border Counties for South Carolina (Hilton Head) Versus Georgia (Savannah)					
High Damage Tract in SC	-0.017	-0.043***	1.274	-0.015	-0.040**	0.386
R_a^2	0.024	0.877	-0.005	0.073	0.881	-0.007
N	6,053	6,053	6,053	6,029	6,029	6,029

Note: The table shows only treatment effects from difference-in-difference results for multiple outcomes about whether valuation measures change after enhanced flood disclosure requirements are implemented. As done in Table 2, the regressions include the same covariates and multiple fixed effects that allow for individual fixed effects with group-level outcomes for census tracts, quarterly period, and appraiser identifiers (the last three columns on the right) along with robust clustering of standard errors that are independent across census tract but permit within tract correlation. The additional information can be provided upon request, but it is suppressed here to facilitate a limited comparison (of treatment effect, goodness-of-fit, and sample size) across various subsample and full sample estimations as defined by the gray row headers. The resilience stems are regular expression matches for various mitigation actions like elevate, raise, fortify, reinforce, waterproof, floodproof, protect, shield, guard, brace, and strengthen. The last two subsamples of border discontinuities represent triple differencing or difference-in-difference-in-difference regression estimates of being in South Carolina for border counties in the Metropolitan Statistical Areas. Statistical significance is denoted as * for $p < 0.10$, ** for $p < 0.05$, and *** for $p < 0.01$. Source: FHFA's UAD and FEMA's NFIP.

pre-disclosure parallel trend assumptions. This discrepancy may reflect geographic and economic differences, as there is less social and economic integration across the southern border.

Overall, the robustness checks confirm the enhanced flood disclosures have a consistent and positive impact on appraisal outcomes across different specifications and subsamples. The results underscore the importance of disclosure policies in mitigating underappraisals, particularly for larger homes and properties in high-damage tracts.

6 Conclusions

In this study, we analyze how South Carolina's adoption of mandatory flood history disclosures affects property valuations and appraisal practices. Our findings indicate that the new requirements lead to modest increases in appraisal values. Because appraisal values rise with fair market values, the tendency of appraisals to meet or exceed contract price remains unchanged. However, appraisers do adjust their approach to valuations. They become more sensitive to flood risk, altering their selection of comparable sales in areas with a history of more significant flood damage. Additionally, appraisers reduce their use of negative language in property descriptions and modify how they adjust valuations of comparable properties, with a noticeable uptick in the use of date and time adjustments. Experience also plays a role: the most-experienced appraisers are more likely to underappraise properties following the introduction of enhanced disclosures. This highlights the important role appraisers play as financial intermediaries in real estate markets, particularly in communicating and capitalizing property-specific hazards, which aligns with lenders' underwriting incentives. These findings suggest that it may be worthwhile to reconsider how appraisers are assigned work, particularly in areas with a history of significant flood damage. Financial institutions might benefit from engaging experienced appraisers more frequently or promoting specialized training to ensure appraisals, when appropriate, can adequately convey potential asset risks.

Our findings document an intriguing adjustment in behavior following enhanced flood disclosures. While the final valuation outcomes remain fairly consistent with market prices, the methods appraisers use to arrive there have shifted in response to greater transparency. Future research might explore whether such adaptations generalize to other forms of financial disclosures. Particularly within real estate, other work could explore whether other states find similar results or it could explore how property-specific risk hazards—such as flood history, damages, claims, or insurance—affect appraisal practices. Comparing regional variations in flood disclosure laws could provide further insights into how markets convey, adapt to, and mitigate risks. Another avenue for investigation is whether these disclosure policies influence long-term real estate trends, such as housing affordability, ownership rates, and investment patterns in flood-prone areas. Understanding how appraisers' professional experience, affiliations, and responsiveness to disclosures shape appraisal outcomes could also deepen our understanding of appraisal dynamics amid regulatory changes.

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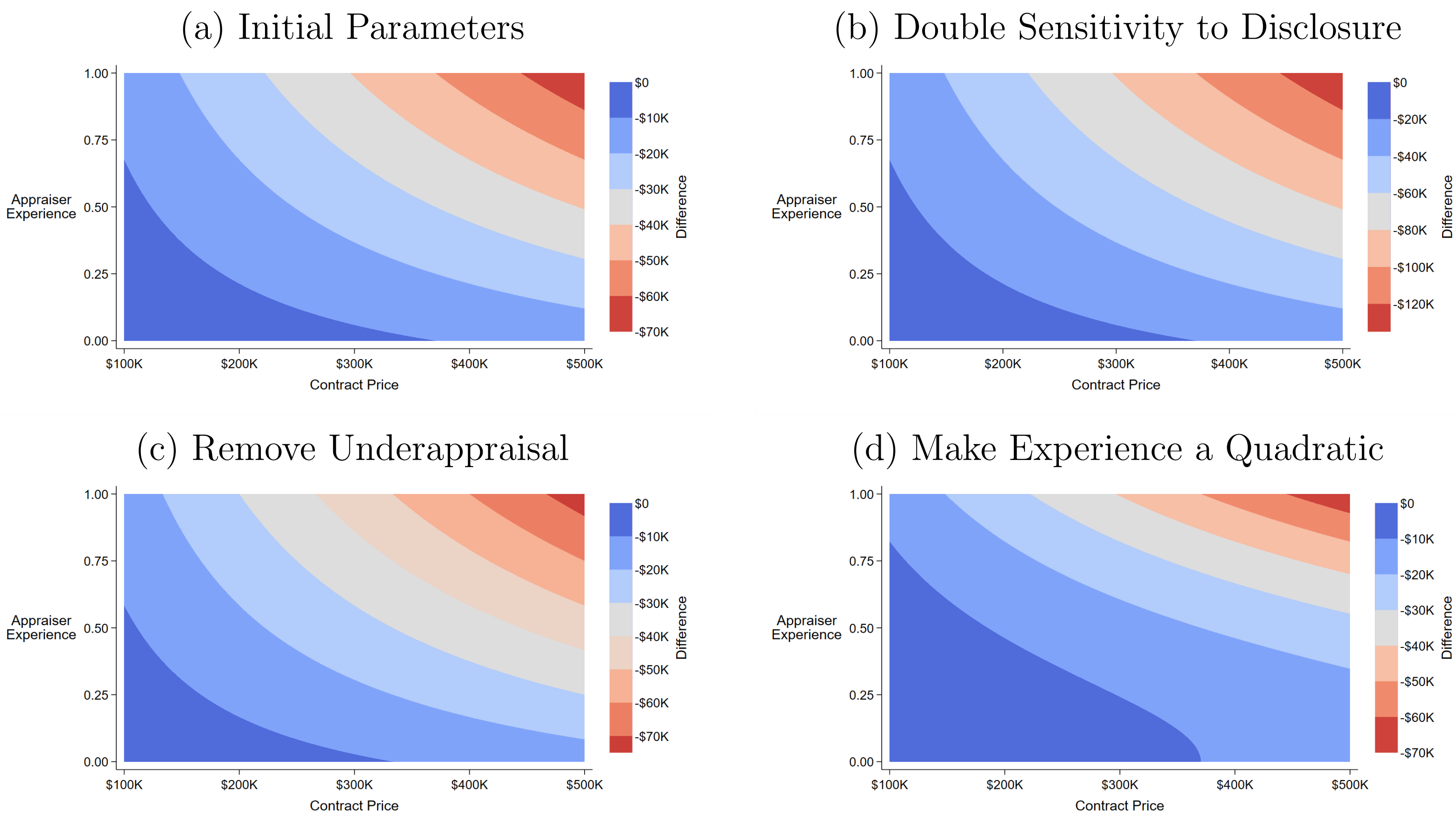
Appendix: Numerical Simulation for Appraisal Value

Based on the model in Section 4, we conduct a numerical simulation to show appraisal values are affected by key parameters before and after changes to disclosure requirements.

The numerical assumptions are as follows. The baseline underappraisal factor is set at $\alpha = 0.9$. This implies appraisers are, on average, underappraising properties at 90% of their contract price in the baseline case. The sensitivity to disclosures is set at $\delta = 0.3$. A low δ indicates that disclosures have a less negative effect on appraisal values. The appraiser experience effect $\rho(E)$ is parameterized to be $\rho(E) = 0.1 + 0.4 \cdot E$ with $E \in [0, 1]$ where $E = 0$ is least experienced. The implication is the effect of experience on underappraising grows at a constant rate from 0.1 to 0.5 across the domain of E. The adjustments from comparables and adverse site descriptions are set as $\phi(P) = 0.05 \cdot P$ for ease. This allows them to be a small proportional fraction of contract price where appraisers adjust upwards by 5% to compensate for factors such as neighborhood or flood disclosures. To make the actual graphics, we define the contract price domain to be $P \in [\$100,000, \$500,000]$ in 100 equal increments to allow us to capture effects across different property value ranges. The other axis of appraiser experience is defined as mentioned above, or $E \in [0, 1]$.

A grid is constructed for appraisal valuation based on different combinations of contract price and appraiser experience. Initially, we do the calculations with no disclosure effect ($D = 0$) and then do them again for a disclosure effect ($D = 1$). The numerical values are subtracted at every pairwise location to calculate a difference in appraisal values or $(D = 1) - (D = 0)$. The resulting contour heat map is in Figure 7. Cooler blue colors indicate smaller differences due to disclosures while warmer red colors signal a larger effect. The figure conveys that greater experience increases the downward revision to appraisal value when disclosures are implemented ($D = 1$). For inexperienced appraisers, the negative effect of disclosures may be small or even non-existent. For valuations, a higher contract price anchor leads to higher appraisal value, but the adjustment for disclosures and experience can vary significantly depending on experience or if initial parameter assumptions are adjusted. Several scenarios are offered, but all show that experience can still affect appraisal value and is more influential at higher contract price levels.

Figure 7: The Disclosure Effect on Appraisal Value



Note: The heatmap shows how appraisal value (A) varies with contract price (P) and appraiser experience (E) when $D = 0$ versus $D = 1$. The color gradient represents the difference in appraisal value due to disclosures, or the computed value if $D = 1$ less $D = 0$. Cooler blue colors indicate smaller differences due to disclosures while warmer red colors signal a larger (more negative) effect. Panel (a) shows calculations using the initial parameters as described in the text. Panel (b) doubles the sensitivity to disclosures, using $\delta = 0.6$. Panel (c) removes the underappraisal factor by increasing α to 1. Panel (d) increases the effect of appraiser experience by adjusting the equation to $\rho(E) = 0.1 + 0.4 * E^2$ to be quadratic instead of linear. Source: Author calculations.