CONSUMER FINANCIAL PROTECTION BUREAU | JANUARY 2025

Flood Risk and the U.S. Mortgage Market

cfpb Consumer Financial Protection Bureau

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1. Introduction

Flooding is currently the costliest natural disaster in the United States. Flood events can cause substantial property damage that directly impacts the financial circumstances of households,[1] and this damage is not covered under standard homeowners insurance. Households must pay for direct damages through some combination of self-insurance and optional or required flood insurance. There are also significant indirect damages that are not covered by insurance such as adverse effects on credit scores, delinquency rates, default rates, and household income.[2] Most existing studies of the effects of flooding are retrospective in nature by examining the effects of specific natural disasters on economic outcomes, rather than considering the potential economic impact of future flood risk.[3] This analysis compares differences in flood risk using multiple sources to increase our understanding of flood risk exposure in the mortgage market and among communities that may be more financially at risk after a flood event.

This report uses flood risk data from the Federal Emergency Management Agency (FEMA) and the First Street Foundation[4] to estimate how flood risk is correlated with consumer mortgage application decisions. Because flooding is directly tied to property damage, the focus of the analysis is on approved mortgage loan applications. The analysis shows that the flood risk exposure of the mortgage market is more extensive and more geographically dispersed than previously understood. This analysis documents differences in the characteristics of mortgage applicants, the underlying property, and the loan terms based on different measures of expected flood risk. Overall, the analysis provides a deeper understanding of the extent of flood risk exposure in the mortgage market and is of interest to policymakers intending to shore up the resilience of flood-prone communities.

Many earlier studies on flood risk rely on Special Flood Hazard Area data from FEMA, which is used to define whether or not a specific property is located in a FEMA-defined flood zone.[5] Properties with a mortgage that are in a Special Flood Hazard Area are required to purchase flood insurance through either a private insurer or FEMA's National Flood Insurance Program; whereas properties not located in a Special Flood Hazard Area are not required (but may opt to)

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[1] This report was prepared by Éva Nagypál and Judith Ricks in the Office of Research.

[2] See, for example, Banko-Ferran and Ricks (2018) and Ratcliffe et al (2019).

[3] See, for example, Phan (2024) for a study accounting for future flood risk.

[4] For a description of this data source, please see https://firststreet.org/.

[5] See, for example, Donnelly (1989), Harrison et al. (2001), Chivers and Flores (2002), Bin and Polasky (2004), Posey and Rogers (2010), Larsen (2012), Atreya et al (2013), Bin and Landry (2013), Beltran et al (2018), and Shr and Zipp (2019).

purchase flood insurance. We focus our discussion on the National Flood Insurance Program, which is the most common flood insurance homeowners purchase.

This study compares data from FEMA flood zone and flood risk measures to data from the First Street Foundation's Flood Factor to provide multiple views of flood risk. Property owners in FEMA flood zones have access to federally subsidized flood insurance that are based on Flood Insurance Rate Maps that designate properties as being in a Special Flood Hazard Area or other flood-risk area. FEMA also produces the National Risk Index, which is a broader measure of flood risk that is not tied to government-sponsored flood insurance access. The Flood Factor measure has two primary differences that generate a different view of flood risk compared to the FEMA data. First, the Flood Factor accounts for coastal flooding, as well as fluvial (i.e., rivers, streams, or ravines) and pluvial (i.e., stormwater or rainfall) flooding. The Special Flood Hazard Area measure largely only covers areas at risk for coastal flooding. The Special Flood Hazard Areas do not have significant inland coverage, which are the areas more at risk of fluvial and pluvial flooding. Second, Flood Factor includes two data measures: one captures a current picture of flood risk and the other captures a forward-looking measure of flood risk.[6] Both can be compared to the Special Flood Hazard Area measure to understand current and future differences in flood risk identification. Given these differences, the Flood Factor and FEMA data provide different views on the extent of flood risk exposure in the mortgage market.

To capture differences in flood risk exposure and financial risk, the analysis uses information on mortgage applications from the confidential Home Mortgage Disclosure Act (HMDA) data.[7] The confidential HMDA data include property-level geographic information not available in the public version of HMDA or other mortgage data sources. The confidential HMDA data are matched to the Flood Factor and FEMA flood risk-measures, providing a property-level measure of flood risk where available. The HMDA match also provides detailed demographic and mortgage characteristics for both mortgage applications and originated loans.

A goal of our analysis is to understand the extent of potential flood underinsurance for homeowners in the mortgage market. We define underinsurance as having insufficient insurance to cover the full cost of damage to the residence and its contents resulting from a flood

[6] The Flood Factor data are the only consumer-facing data on flood risk that are available in the marketplace. Flood Factor scores are being reported on real estate listing websites such as Redfin so that interested consumers can take this information into account.

[7] For details on the HMDA data, see e.g., Data Point: 2022 Mortgage Market Activity and Trends: https://www.consumerfinance.gov/data-research/research-reports/data-point-2022-mortgage-market-activity-trends/

event that would typically be covered under the National Flood Insurance Program.[8] This definition does not account for indirect costs to households (e.g., loss of income, damage to automobiles, and adverse credit events) and may underestimate the amount of underinsurance. In addition, we assume that all properties in a Special Flood Hazard Area take out the maximum National Flood Insurance Program coverage amount.[9] This definition underestimates the likelihood of being underinsured since total costs to households is underestimated, and it overestimates the share of covered properties since National Flood Insurance Program take up rates are less than 100 percent and borrowers do not necessarily purchase the maximum coverage amount.[10] Existing evidence shows that the probability a borrower has flood insurance coverage increases with proximity to the coast. This is due to mortgage lender requirements for borrowers to have flood insurance policies in Special Flood Hazard Areas—areas that tend to be in coastal counties. We use this definition of underinsurance to consider property- and borrower-level differences across estimated flood risk exposure in our data measures.

This analysis finds significant gaps in flood insurance coverage in non-coastal flood zones and that applicants in those areas are less likely to have the financial capacity to self-insure (i.e., pay out-of-pocket for the cost of flood damage to the property, structure, and contents). The key findings from the analysis are:

- **Assessment of flood risk exposure in the mortgage market varies drastically depending on the flood risk measure used.** Estimates from Special Flood Hazard Area designation suggest the lowest exposure to flood risk in inland areas and some coastal regions, while estimates from the National Risk Index and Flood Factor suggest significantly more exposure in inland areas and some additional exposure in coastal regions. For example, First Street identifies 2.4 times as many properties as having inland flood risk compared to FEMA.
- **The evidence suggests that around 6 percent of our sample of mortgages (roughly 440,000 properties) may be underinsured for flooding events.** The large differences between the National Risk Index and Flood Factor compared to the Special Flood Hazard Area designation suggest that many at-risk properties are not being properly identified. Because the majority of flood insurance is provided through

[8] We define insurance coverage consistent with the FEMA National Flood Insurance Program, which covers structural damage to the residence (e.g., foundations, electrical, and plumbing) along with damage to contents (e.g., clothing, furniture, personal electronics, etc.). See https://www.fema.gov/fact-sheet/protect-your-home-flood-insurance.

[9] The National Flood Insurance Program offers different policy coverage amounts with the maximum coverage for a single-family home being $250,000 for damage to the residence and $100,000 for damage to contents. See https://www.fema.gov/fact-sheet/flood-insurance-and-nfip.

[10] Existing evidence suggests that National Flood Insurance Program take up ranges between 30-100 percent for any individual Special Flood Hazard Area. See https://www.brinknews.com/the-3-maps-that-explain-residential-flood-insurance-purchases/.

the National Flood Insurance Program, the owners of these at-risk properties may not have flood insurance coverage and must either self-insure unless they purchase optional federally subsidized or private flood insurance.

- **Approved mortgage applicants in coastal flood zones are older, have higher credit scores and income, and have higher loan amounts and more money put down at approval than mortgage applicants for properties in minimal flood risk areas.** This suggests that applicants in coastal flood zones may have more financial capacity compared to applicants in minimal flood risk areas.
- **Approved mortgage applicants in inland flood zones have lower credit scores and income than approved mortgage applicants for properties in minimal flood risk areas.** These applicants may not be well positioned to self-insure against flood risk.
- **Approved mortgage applicants in inland flood zones also have relatively less money put down at approval.** This suggests that these applicants may be more at risk of becoming over-leveraged on their mortgage given a flooding event that affects the housing structure.

2. Data Description

This report uses two different data sources and multiple measures to estimate the level of flood risk in various regions. First, we analyze data from FEMA on Flood Insurance Rate Maps and the National Risk Index. Second, we analyze data from the First Street Foundation on current and expected flood risk. In our analysis, we compare the flood risk areas suggested by the various measures, then compare differences in the characteristics of mortgage applicants, the properties, and the loan terms.

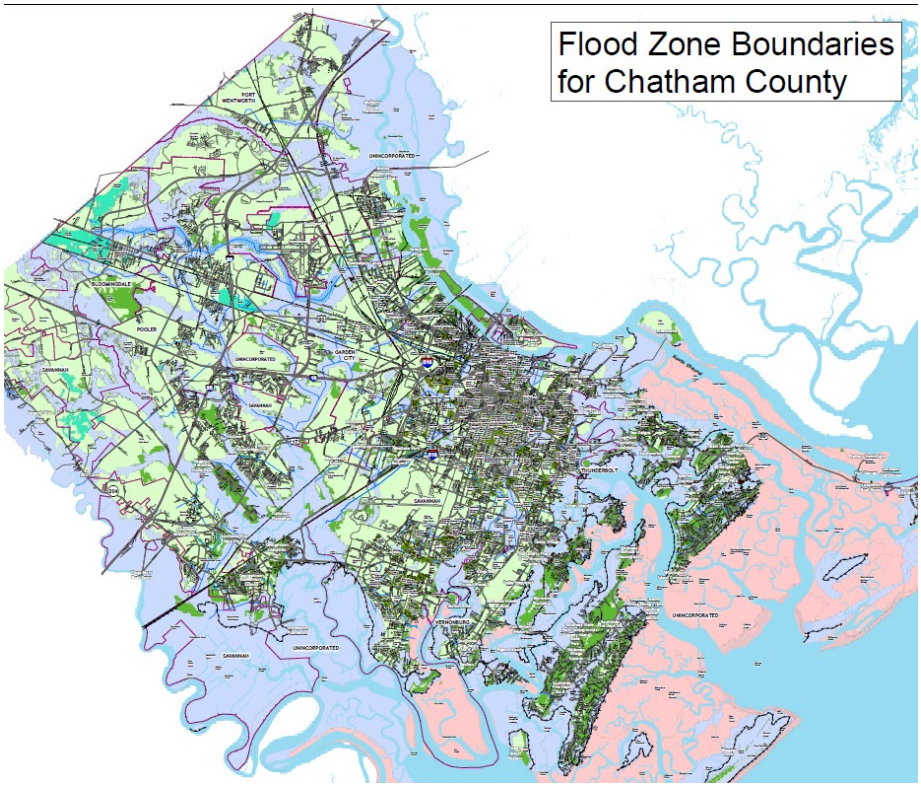
FEMA publishes Flood Insurance Rate Maps (Flood Maps) to determine access to federally subsidized flood insurance within the United States.[11] These maps define three categories of flood zones: Special Flood Hazard Areas have a 1-percent annual chance of flood ("100-year flood" or "the base flood"); moderate flood hazard areas are areas between the base flood limits and the 0.2-percent annual chance of flood ("500-year flood"); and minimal flood hazard areas are outside the Special Flood Hazard Area and higher in elevation than the moderate flood hazard areas. Figure 1 provides an example of a FEMA Flood Map for Chatham County in Georgia, which is a coastal county that includes the city of Savannah. The map is defined by geographic regions that are not property specific. In the figure, blue, red, and medium green areas are Special Flood Hazard Area zones where insurance is required for any government-backed mortgage; dark green and light green are the moderate and low flood hazard zones, respectively, where insurance is not required but available.

Our analysis of mortgage applications focuses on Special Flood Hazard Areas and moderate-flood zones as defined by FEMA Flood Maps. This is because FEMA uses these definitions to determine insurance coverage for the National Flood Insurance Program, which provides federally subsidized flood insurance to property owners, renters, and businesses with properties that are at-risk of flooding. Properties that lie within a designated Special Flood Hazard Area have access to the National Flood Insurance Program; and owners are required to purchase flood insurance if the property has a government-backed mortgage associated with it.[12] Regardless of the mortgage type, any properties located in low- and moderate-FEMA flood zones can purchase flood insurance through the National Flood Insurance Program but are not required to do so. Geographic regions that are not identified in FEMA Flood Maps do not have access to flood insurance through the National Flood Insurance Program and would have to either self-insure or purchase private flood insurance.

[11] For more information on FEMA flood zones see https://www.fema.gov/glossary/flood-zones.

[12] Government-backed mortgages include loans origination through, e.g., the Federal Housing Administration or Veterans Administration, and loans securitized through the Government-Sponsored Enterprises (Fannie Mae and Freddie Mac).

FIGURE 1: FEMA FLOOD MAP FOR CHATHAM COUNTY, GEORGIA

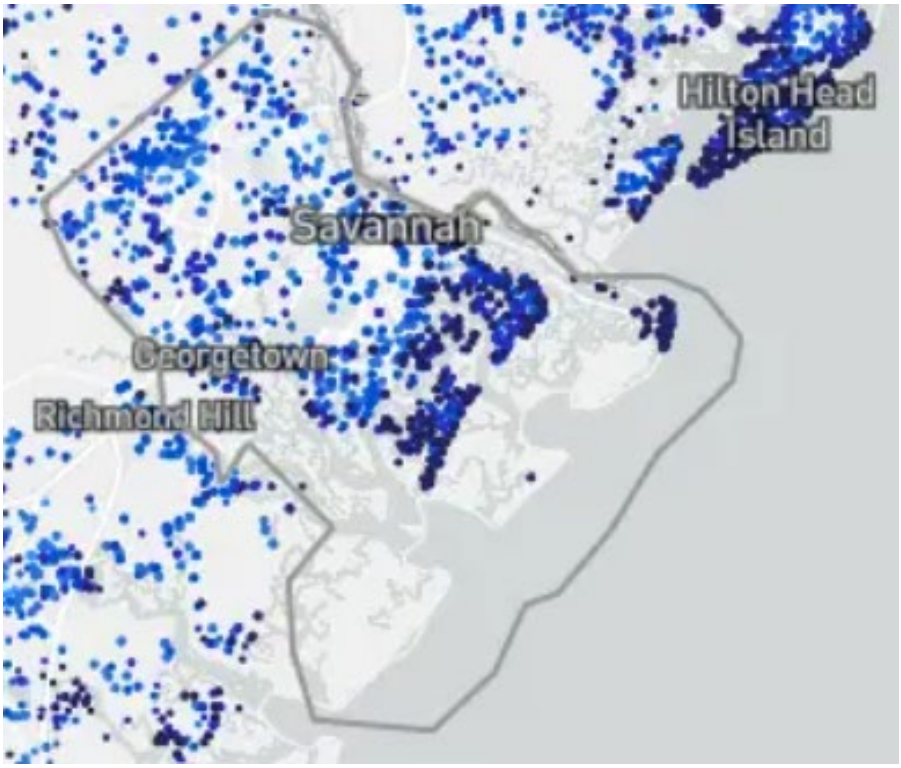


NOTE: Chatham County, GA, Department of Engineering. This figure is taken from the Chatham County, GA, Department of Engineering: https://engineering.chathamcountyga.gov/FloodZones/FloodZoneDefinitions.

FEMA also recently developed the National Risk Index (NRI) to improve identification of communities at risk of flooding. The NRI measures relative risk, and the underlying model has a broader scope than FEMA Flood Maps as it accounts for 18 natural hazards, annual expected loss, social vulnerability, and community resilience. We use the NRI to assess differences in flood risk identification across measures, but we do not use this measure in our analysis of mortgage application characteristics. This is because the NRI is computed at the county and Census tract levels, whereas our analysis requires property-level identification. Furthermore, National Flood Insurance Program coverage is based on Special Flood Hazard Area status not the NRI value. Thus, Special Flood Hazard Area provides a better understanding of the extent of underinsurance in the mortgage market.[13]

[13] For more details on the National Risk Index, see https://hazards.fema.gov/nri/learn-more.

FIGURE 2: FIRST STREET FOUNDATION FLOOD RISK MAP FOR CHATHAM COUNTY, GA



NOTE: First Street Foundation. This figure was taken from First Street Foundation: https://firststreet.org/county/chatham-county-ga/13051_fsid/flood (last pulled November 20, 2024).

Our second source of flood risk data comes from the First Street Foundation. We use data from the Flood Foundation Model, which measures the risk of flooding at any location in the contiguous United States. Each property is assigned a Flood Factor between one (minimal risk) and ten (extreme risk). Flood Factors are estimated based on the depth and likelihood of the physical structure being flooded. This is an important distinction because it relies on the structure's location within the property rather than the property's location within a region.[14] Figure 2 provides an example of a flood risk map from the First Street Foundation model for Chatham County, GA. The county boundary is outlined in gray. The map identifies properties with a spectrum of blue dots. Darker blue dots correspond to properties with a higher flood risk and lighter blue dots correspond to properties with lower flood risk. In addition, the First Street Foundation provides a 30-year out estimate of a property's Flood Factor. The underlying model

[14] For details on how Flood Factor is measured, see https://help.firststreet.org/hc/en-us/articles/360047585694-How-is-my-Flood-Factor-calculated.

for the 30-year out estimate is similar to the model used for current period estimates, but the 30-year out estimate is a forecast that accounts for expected changes in flood risk over time.

Our analysis uses snapshots of the FEMA Flood Maps, the National Risk Index, and Flood Factor from 2021. FEMA only provides static views for flood maps and the National Risk Index with the most recent update taking place in 2021. Historical FEMA flood maps and National Risk Index values are not available. Similarly, the First Street Foundation developed their models starting in 2020 and the data available to us was as of 2021. Thus, we apply the current flood measures to past data in our analysis of mortgage applications. In addition, the First Street Foundation provides forward-looking estimates of flood risk, which accounts for expected changes in flood risk over the next 30-year period. We use this forward-looking measure in our comparison of expected flood risk exposure.

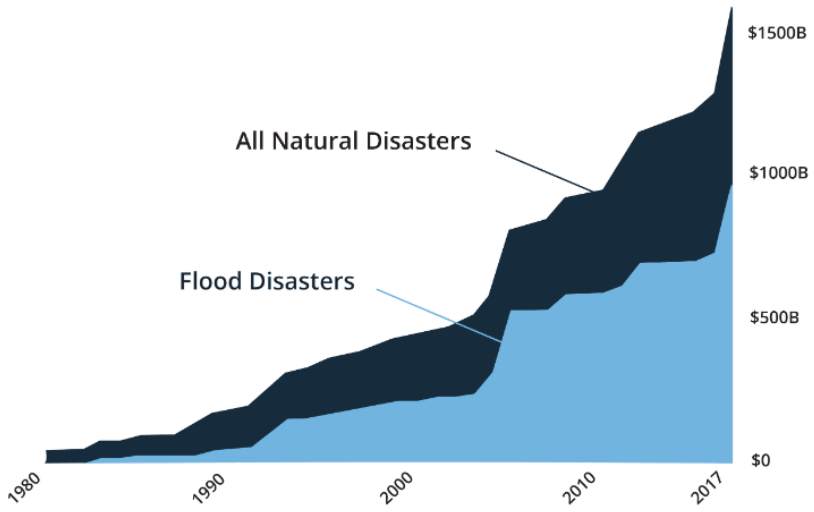
To evaluate the impact of flood risk in the mortgage market, we use mortgage data that has been reported to the CFPB under the Home Mortgage Disclosure Act (HMDA).[15] HMDA reporting institutions collect and report information about each mortgage application and the application outcome. The data include information about the disposition of each mortgage application and detailed information on originated loans. A key feature of the confidential HMDA data is that it includes the property address for the corresponding mortgage application, along with the timing of origination and detailed credit characteristics of the borrower. We geocode the HMDA data to the flood risk data at the property level for Special Flood Hazard Area and Flood Factor measures and at the census tract-level for the National Risk Index. This provides multiple views of flood risk for any property with HMDA mortgage applications in the United States. Our analysis on mortgage application characteristics uses approved HMDA applications data for 2012-2021. We focus on approvals for purchase loans because those borrowers are making active decisions on new properties and locations. Finally, we focus on the South Atlantic and East and West South-Central Census divisions because these regions capture the majority of flood risk in the United States.

[15] For details and history on the Home Mortgage Disclosure Act, see https://www.ffiec.gov/hmda/.

3. Understanding Differences in Flood Risk Measures

Flooding is the largest natural hazard risk in the United States as ninety percent of natural disasters in the United States involve flooding. Flooding events are frequent and can affect large geographic regions on a given occurrence, inflicting large amounts of economic damage and loss of life and property.[16] As seen below in Figure 3, flooding has cost U.S. taxpayers over $800 billion in direct flood damage since 2000, representing two thirds of natural disaster risk damages, which does not account for indirect effects of flooding (e.g., unemployment loss).

FIGURE 3: CUMULATIVE DOLLAR ESTIMATE OF DAMAGES FROM FLOODS AND ALL NATURAL DISASTERS, FROM 1980 TO 2022



NOTE: Flood Defenders. This figure is taken from Flood Defenders: https://www.flooddefenders.org/problem (last pulled November 20, 2024).

[16] Evidence from the Financial and Banking Information Infrastructure Committee shows that flooding is the most frequent severe weather threat and the costliest natural disaster and reports that ninety percent of all natural disasters in the U.S. involve flooding. See https://www.fbiic.gov/public/2010/mar/FloodingHistoryandCausesFS.PDF.

One reason why flood risk is so costly is because flood risk is prevalent in many places. Flood risk projections rely on a variety of climate-forecasting models to assess the likelihood and consequences of a flood event occurring. These models may account for certain types of flooding and not others or may weigh different types of flooding differently. As a result, flood prediction models can vary substantially and relying on a single measure can provide an incomplete picture of flood risk exposure.

In this section, we compare three measures of flood risk to assess both differences in estimated flood risk and whether some areas may have higher expected flood risk than previously determined. We focus on differences in the number of properties identified as having flood risk using Special Flood Hazard Area status, the National Risk Index, and Flood Factor. A major difference in Special Flood Hazard Area status and Flood Factor is that Special Flood Hazard Areas are based on the geographic location of the property and whether it sits in an area expected to severely flood, whereas Flood Factor will vary based on where the structure is located within the property. For example, consider a property located along a very steep riverbank where the residential structure sits at the very top. This property may be in a Special Flood Hazard Area but have a low Flood Factor score because the residential structure is unlikely to flood even if the river rises significantly. Differences in property flood risk identification arise because of differences in the underlying models.

Next, we match the flood risk measures to the HMDA data. The data show that using Flood Factor measure significantly increases the likelihood that a property in the South Atlantic is identified as being at risk of flooding, compared to the Special Flood Hazard Area measure: roughly 13.94 percent of HMDA mortgage applications in our sample are in areas with more than a 1 percent annual chance of flood risk using Flood Factor, whereas roughly 7.94 percent of the applications have this flood risk using Special Flood Hazard Area status.[17] Figure 4 below reports the percentage-point difference in high-flood-risk shares between Flood Factor estimate and the Special Flood Hazard Area designation estimate for HMDA mortgage application properties in the South Atlantic and East and West South-Central Census divisions. With some exceptions, Special Flood Hazard Area designation has similar coverage to Flood Factor in much of the West South-Central states. Special Flood Hazard Area designation coverage is mixed in coastal regions with some of coastal Texas showing significantly better identification of at-risk properties through Flood Factor.

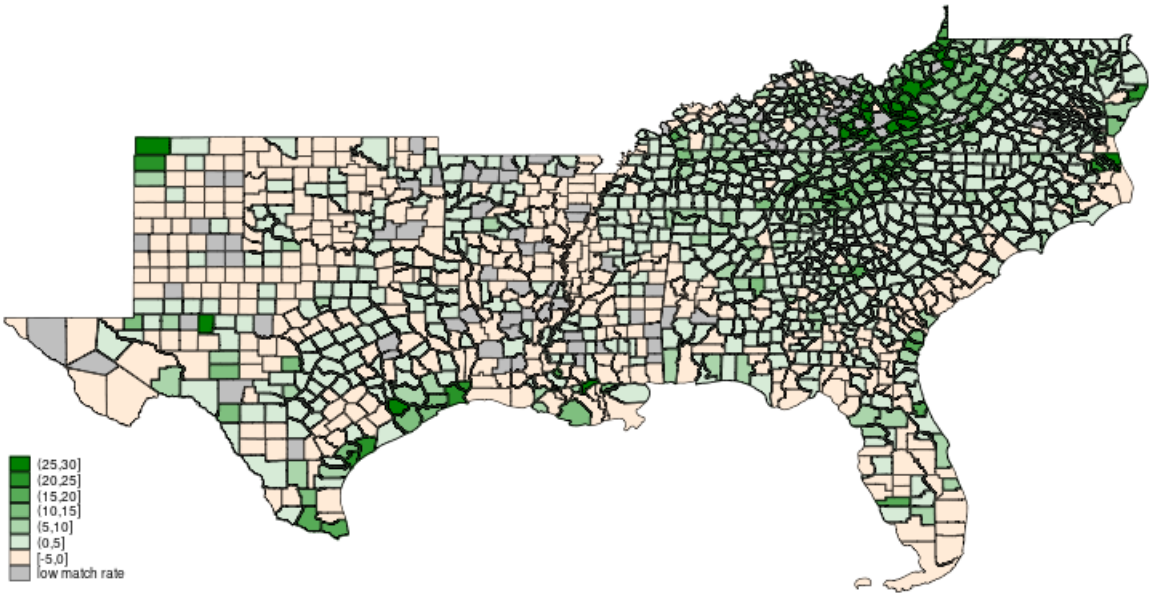
One stark example is in the Appalachian region. This is the dark green shaded region in Figure 4 covering western North Carolina, eastern Tennessee, eastern Kentucky, southwestern Virginia, and all of West Virginia. The figure shows that counties in the Appalachian region have

[17] Authors' calculations based on HMDA data.

significantly higher flood risk according to Flood Factor estimate. Most of these areas are not in Special Flood Hazard Areas and, therefore, do not have coverage available through the National Flood Insurance Program. In other words, property owners in these areas are identified as being at risk of flooding but likely to be underinsured with respect to flood risk.[18]

Similarly, we see differences when comparing the Flood Factor flood risk identification to the National Risk Index. Figure 5 reports the percentage-point difference in the high-flood-risk shares between the Flood Factor estimate and the National Risk Index estimate for flooding. The figure shows that Flood Factor indicates significantly more flood risk than NRI in some of western Maryland, south Florida, and Louisiana. Notably, the National Risk Index identifies more flood risk in northwestern Maryland near the Chesapeake Bay compared to Flood Factor. Overall, there are significant differences in flood risk identification across the two measures.

FIGURE 4: PERCENTAGE-POINT DIFFERENCE BETWEEN FLOOD FACTOR AND SPECIAL FLOOD HAZARD AREA OF HIGH-FLOOD-RISK PURCHASE APPLICATION SHARE, BY COUNTY (SOUTH ATLANTIC, EAST AND WEST SOUTH-CENTRAL DIVISIONS)



NOTE: HMDA data and First Street Foundation data

Although we do not directly compare Special Flood Hazard Area designation to the National Risk Index, Figures 4 and 5 suggest significant differences in the identification of flood risk

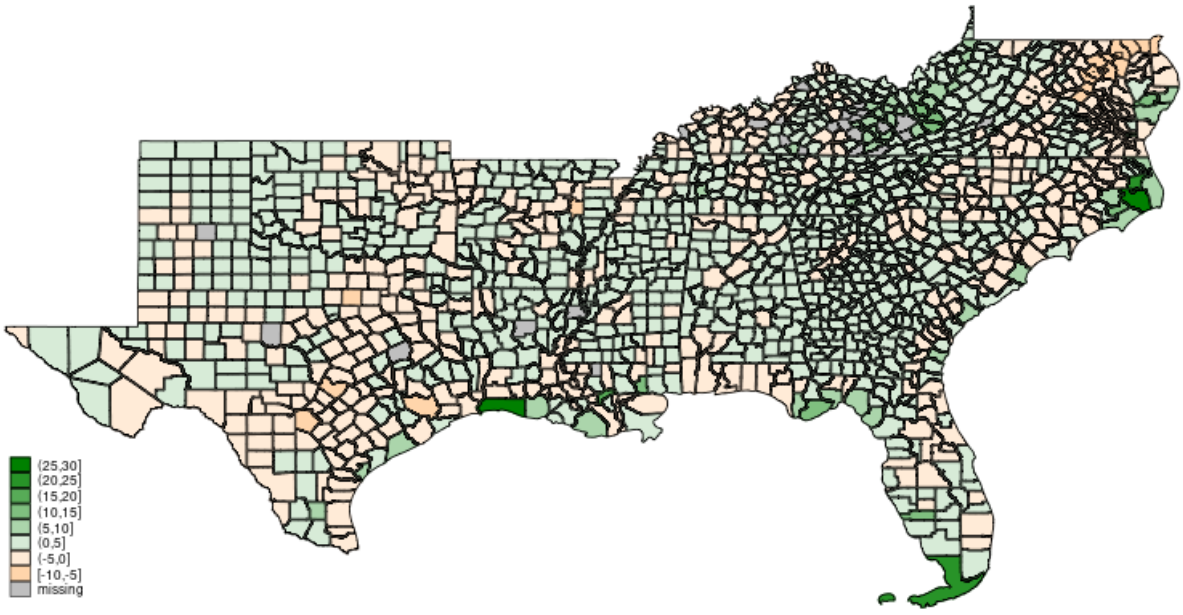
[18] Only a small fraction of homeowners carried flood insurance, https://www.wccbcharlotte.com/2024/10/08/97-of-nc-homeowners-dont-have-flood-insurance/.

between Special Flood Hazard Areas and the National Risk Index. For example, the figures suggest that the National Risk Index identifies higher flood risk in the Southern states but lower flood risk in the West South-Central states compared to Special Flood Hazard Area designation. The National Risk Index also appears to identify higher flood risk in the Appalachian region compared to Special Flood Hazard Area designation.

Finally, we consider how flood risk may change over time by comparing Flood Factor's measure of current flood risk to the 30-year out Flood Factor estimate. We do not do this for Special Flood Hazard Area and the National Risk Index because estimates of future flood exposure are not available. Figure 6 reports the percentage-point difference in the high-flood-risk shares between the current flood risk measure and the 30-year out flood risk measure. The figure shows that the areas most likely to see an increase in flood risk over the next 30 years are coastal regions. The estimated increase in flood risk exposure is greatest (dark green) in coastal Louisiana, North Carolina, Maryland, and Delaware. Generally, coastal regions appear most at risk of increased flood risk exposure compared to inland regions.

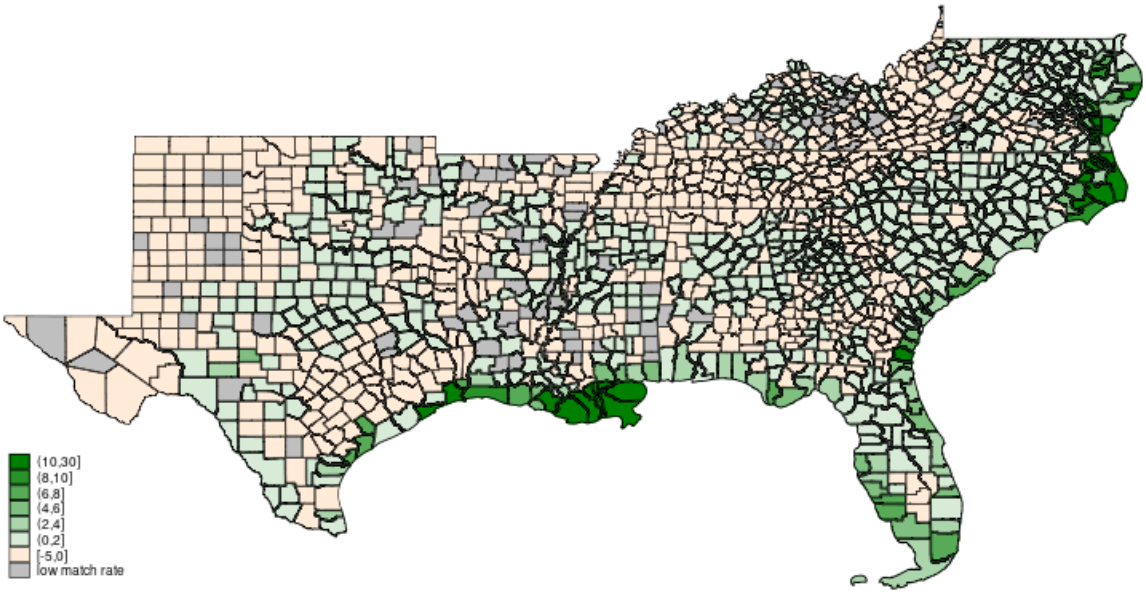
The data show that flood risk exposure is extremely different across measures. Data from Flood Factor suggest that flooding may be a risk for a significantly larger share of properties than may have been previously understood. Because FEMA flood insurance relies on a property being in a Special Flood Hazard Area, this implies that many properties that could benefit from FEMA flood insurance cannot access the program and are likely underinsured. Furthermore, flood risk is changing across geographies—properties that are not at risk today may become at-risk of flooding in the future. These properties also may be underinsured unless property owners are aware of changes in their property's likelihood of flooding.

FIGURE 5: PERCENTAGE-POINT DIFFERENCE BETWEEN FLOOD FACTOR AND NATIONAL RISK INDEX ESTIMATES OF HIGH-FLOOD-RISK PURCHASE APPLICATION SHARE, BY COUNTY (SOUTH ATLANTIC, EAST AND WEST SOUTH-CENTRAL DIVISIONS)



NOTE: First Street Foundation data and National Risk Index data

FIGURE 6: PERCENTAGE-POINT DIFFERENCE BETWEEN FLOOD FACTOR CURRENT AND 30 YEARS OUT ESTIMATES OF HIGH-FLOOD-RISK PURCHASE APPLICATION SHARE, BY COUNTY (SOUTH ATLANTIC, EAST AND WEST SOUTH-CENTRAL DIVISIONS)



NOTE: First Street Foundation data

4. Characteristics of mortgage applicants and applications

In this section, we use the matched 2018-2022 HMDA-flood risk data to analyze the characteristics of approved mortgage applicants for properties with varying levels of flood risk. We define four types of flood risk areas: minimal, moderate, coastal, and inland. In the FEMA data, minimal is outside of the 500-year flood plain and moderate is in the 500-year flood plain (as described in the data section). Coastal and inland are inside the 100-year flood plain. In the Flood Factor data, minimal is defined as a Flood Factor value of 1 and moderate is a Flood Factor value of 2-5. Coastal areas are defined as coastal counties with a Flood Factor value above 5, and inland areas are defined as non-coastal counties with a Flood Factor value above 5. FEMA and Flood Factor data are static measures from 2021. Table 1 shows the demographic and income characteristics of borrowers from approved applications in the HMDA data. Columns (1)-(4) report mean characteristics for FEMA data by risk definition, and columns (5)-(8) report mean characteristics for Flood Factor risk definitions. Starting with differences in the number of approved applications, areas with minimal flood risk have a difference of almost 900,000 approved mortgage applications (6.94 million in FEMA versus 6.08 million in Flood Factor) because FEMA identifies more geographies as being minimal risk compared to Flood Factor. There are more approved mortgage applications in the FSF moderate and coastal risk definitions compared to in the FEMA definitions. Notably, FSF identifies 2.4 times as many properties as having inland flood risk compared to FEMA (351,468 approved applications in Flood Factor versus 143,797 in FEMA). These differences and patterns are consistent with differences in the measures across areas discussed earlier in Section 3.

Turning to borrower characteristics, there are some differences in the types of approved mortgage applicants across risk definitions and data sources. Borrowers in coastal flood zones have higher incomes, are older and have higher credit score than borrowers in minimal or moderate or inland flood zone areas. This relationship holds for both the FEMA and Flood Factor risk measures. Borrowers in coastal flood zones are also more likely to be white. In contrast, borrowers in inland flood areas have lower credit scores and are lower income, younger, and less likely to be white.

TABLE 1: HMDA DEMOGRAPHIC CHARACTERISTICS OF MORTGAGE APPLICANTS AS A FUNCTION OF FLOOD RISK

Data Source	FEMA	FEMA	FEMA	FEMA	FF	FF	FF	FF
Risk Definition	Minimal	Moderate	Coastal	Inland	Minimal	Moderate	Coastal	Inland
Borrower Characteristics	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Share Preapproved	4.57%	4.48%	4.21%	3.84%	4.56%	4.60%	4.32%	4.04%
Median Income ($)	79,000	83,000	107,000	72,000	78,000	82,000	104,000	78,000
Median DTI	38.59	40.01	39.63	38.86	38.61	39.43	39.22	37.93
Median Credit Score	730	730	749	717	729	734	749	729
Median Age	40	41	47	39	40	41	47	39
Share of Non-white Applicants	31.10%	31.00%	22.20%	27.90%	31.30%	29.30%	24.00%	29.20%
Share of Female Applicants	32.70%	33.30%	30.10%	32.70%	32.80%	32.70%	30.30%	32.20%
Observations	6,937,287	308,933	450,670	143,797	6,082,227	922,168	484,824	351,468

Table 2 displays the property characteristics for approved applications by flood risk designation to study how the characteristics of properties vary with an area's flood risk. Again, the table is broken down by data source (FEMA versus Flood Factor) and risk definition. For both data sources, the median property price is highest for coastal regions, followed by moderate flood then minimal flood areas, and inland flood risk areas have the lowest median price. In coastal regions, the share of approved mortgage applications for second home purchase are 19 percent in the FSF definition and near 21 percent in the FEMA definitions. This is almost three times higher than in moderate flood zones where roughly 7 percent of approved mortgage applications are for second home purchases in both Flood Factor and FEMA. The share of investment properties is also highest in coastal risk areas (about 7 percent in Flood Factor and FEMA) compared to moderate (about 6 percent), minimal (about 5 percent), or inland flood risk areas (about 5 percent). Finally, inland flood zones have the highest share of approved mortgage applications for manufactured homes in both Flood Factor and FEMA. Using the FEMA definition, 9.90 percent of approved mortgage applications in inland flood zones are for manufactured homes, compared to 4.23 percent in minimal flood risk area. The comparable values for Flood Factor are 6.32 percent in inland flood risk areas and 4.36 percent in minimal flood risk areas.

TABLE 2: HMDA PROPERTY CHARACTERISTICS OF APPROVED MORTGAGE APPLICATIONS AS A FUNCTION OF FLOOD RISK

Data Source Risk Definition Property Characteristics	FEMA Minimal (1)	FEMA Moderate (2)	FEMA Coastal (3)	FEMA Inland (4)	FF Minimal (5)	FF Moderate (6)	FF Coastal (7)	FF Inland (8)
Median Property Price ($)	250,000	264,000	326,000	210,000	249,900	259,900	310,000	239,000
Share of Second Home	4.20%	6.98%	20.57%	5.66%	3.93%	7.14%	19.00%	4.83%
Share of Investment Property	5.25%	5.85%	7.04%	5.10%	5.17%	5.98%	6.82%	5.32%
Share of Manufactured Home	4.23%	2.86%	2.16%	9.90%	4.36%	2.98%	2.42%	6.32%
Share of Multi-Family	0.81%	1.90%	1.32%	0.97%	0.74%	1.51%	1.38%	0.99%
Observations	6,937,287	308,933	450,670	143,797	6,082,227	922,168	484,824	351,468

Finally, Table 3 displays characteristics of the loans by flood risk area for approved mortgage applications to study how the loans applied for vary with an area's flood risk. Coastal flood zone areas have the highest loan amounts and are more likely to be jumbo loans (above the conforming loan limit), consistent with the results on property value from Table 2. However, coastal areas report the lowest combined loan-to-value ratio (CLTV) at origination: 80 percent in FEMA and near 85 percent in FSF. In contrast, CLTVs are about 93 percent in moderate flood risk areas, 95 percent in minimal flood risk areas, and 95 percent in inland floods risk areas and roughly consistent for both FEMA and FSF. While the share of Federal Housing Administration (FHA) loans in coastal counties is around 13%, in the other areas (minimal moderate, and inland flood zones) it ranges between 19 and 22% .[19] Taken together, the average loan characteristics suggest that borrowers in non-coastal flood zones are more leveraged and may be more financially constrained compared to borrowers in coastal flood zones.

These results suggest important differences in the types of applicants with approved mortgage applications across flood risk areas. Applicants in coastal flood regions appear to be more financially well-off at application approval---they have higher income, are low credit risk, and are less leveraged. This suggests that approved mortgage applicants in coastal regions may be better able to withstand the financial strain after a flooding event. Furthermore, a large share of these applicants should have flood insurance through the National Flood Insurance Program, which can offset their expenses. In contrast, approved mortgage applicants in non-coastal flood

[19] Borrowers with FHA mortgages tend to have lower credit score, lower income, and are more likely to be minority borrowers. They also tend to originate mortgages at relatively higher loan-to-value ratios compared to conforming loans. See, e.g., https://files.consumerfinance.gov/f/documents/cfpb_data-point-mortgage-market-activity-trends_report_2023-09.pdf.

zones appear to be relatively more financially at-risk in the case of a disaster. These applicants have relatively lower incomes and credit scores, and they are more at risk of becoming over-leveraged given their high leverage at application approval. Furthermore, these borrowers are significantly less likely to be covered under the National Flood Insurance Program given the very large difference in the number of applications for properties in areas identified as non-coastal flood zones by FEMA versus Flood Factor. Given their financial profile at origination, these borrowers may not have the financial capacity to self-insure and their take up of optional public or private flood insurance is low overall.[20]

TABLE 3: HMDA LOAN CHARACTERISTICS OF APPROVED MORTGAGE APPLICATIONS AS A FUNCTION OF FLOOD RISK

Data Source	FEMA	FEMA	FEMA	FEMA	FF	FF	FF	FF
Risk Definition	Minimal	Moderate	Coastal	Inland	Minimal	Moderate	Coastal	Inland
Median Loan Amount ($)	220,285	230,743	273,547	187,049	220,000	227,617	259,250	209,305
Median Loan Term (months)	360	360	360	360	360	360	360	360
Share of FHA Loan	20.41%	21.80%	13.23%	22.24%	20.60%	20.34%	13.60%	19.41%
Share of VA Loan	11.92%	9.25%	7.28%	9.98%	11.93%	10.83%	8.70%	9.98%
Share of USDA Loan	3.18%	1.84%	0.71%	5.22%	3.27%	2.05%	0.88%	4.24%
Share of Jumbo Loan	3.71%	4.86%	11.57%	3.70%	3.56%	5.17%	10.43%	4.16%
Median Combined LTV	95	93	80	95	95	93.69	84.97	95
Observations	6,937,287	308,933	450,670	143,797	6,082,227	922,168	484,824	351,468

[20] See, e.g., Kousky and Shabman (2014) and Mota and Palim (2024).

5. Conclusion

Flooding is currently the costliest natural disaster in the United States. This report uses different data sources and measures of flood risk to examine the relationship between mortgage applications and flood risk. We show that Special Flood Hazard Area designation, the National Risk Index, and First Street Foundation's Flood Factor measure provide very different pictures of exposure to flood risk. Our analysis suggests a significant gap in the identification of properties at risk of flooding. Because flood insurance is mostly taken up through the National Flood Insurance Program, our analysis further suggests that there is significant underinsurance among mortgage applicants, since access to the National Flood Insurance Program relies on FEMA Flood Insurance Rate Map designations.

Two major hurricanes that impacted the United States in 2024, Hurricanes Helene and Milton, highlight this policy issue. The regions primarily affected were in Florida, Georgia, and Western North Carolina (Appalachia). This analysis suggests that homeowners in affected Georgia and North Carolina, especially the Appalachian region, are likely underinsured because the properties do not fall in Special Flood Hazard Areas. Earlier CFPB research that people in rural areas the regions hit hardest by Hurricanes Helene and Milton. are more likely to have lower incomes and higher debt burdens than other rural consumers and nationally. This may indicate that they may be less likely than consumers elsewhere to absorb the cost of private flood insurance or the financial shock of expenses due to flood damage.[21] In the case of Florida, many of the affected homeowners likely live in FEMA designated flood zones where coverage is required, which may limit the extent of underinsurance due to not having any flood insurance as compared to inland areas of Georgia and North Carolina. However, Florida homeowners affected by either Hurricane Helene or Hurricane Milton may remain underinsured to the extent that their existing flood insurance policies do not cover the full cost of damage to their property.[22]

Moreover, our analysis shows that coastal flood zones see approved mortgage applications from borrowers who are higher income, higher credit score, and older than approved mortgage applications outside of flood prone areas. Inland flood zones see approved mortgage applications from borrowers who are lower income, lower credit score, and younger than mortgage applications outside of flood prone areas. Because of differences in flood risk measures, the analysis suggests significant gaps in flood insurance coverage in non-coastal flood

[21] See Liu et al. (2022).

[22] See Kousky (2019).

zones and that applicants in those areas are less likely to have the financial capacity to self-insure and are potentially more at risk of their mortgage becoming over-leveraged.

Finally, we want to emphasize that this analysis necessarily offers a somewhat limited view of flood risk. Flood risk models require a variety of inputs and decisions to generate estimates of flood risk. This is best exemplified by our comparison of Special Flood Hazard Area status, the National Risk Index, and Flood Factor: three different models with three very different views of flood risk. While our analysis does suggest significant gaps in flood insurance coverage, the analysis may provide an incomplete picture of flood risk as other models may highlight other important differences that suggest certain groups of consumers or certain regions are vulnerable to flooding events.

APPENDIX A: BIBLIOGRAPHY

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