Does Floodplain Regulation Move New Housing to Safer Ground?*

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Policy Motivation. Floodplain regulation is designed to reduce the vulnerability of new development to flooding, but it also changes the cost of building across space. In FEMA's Special Flood Hazard Areas (SFHAs), additional requirements apply inside a discrete regulatory boundary, while underlying flood risk might vary more continuously. The boundary can therefore create a spatial regulatory notch: two nearby parcels with similar flood exposure may face different development and housing costs depending on which side of the line they fall. We ask whether developers respond to this notch by changing where they build, generating spatial bunching around the regulatory boundary. We focus on three questions:

1. Does new construction bunch just outside the regulated area?
2. Does this spatial response move development onto genuinely lower flood-risk land?

Existing work shows that flood risk is at least partially capitalized into housing markets (Bernstein et al., 2019; Baldauf et al., 2020; Murfin and Spiegel, 2020) and that flood-related regulation can affect development levels (Druckenmiller et al., 2024; Ostriker and Russo, 2026). We instead focus on regulatory leakage around the floodplain designation boundary, studying how development responds on both sides of this line. This allows us to identify potential spillovers of floodplain regulation into nearby unregulated areas. These types of spillovers may reduce the efficacy of floodplain regulation if the policy reduces construction inside SFHAs by simply displacing development to nearby unregulated locations with the same level of flood risk.

Data. We assemble parcel-level data across the entire United States. We obtain the near universe of parcel locations and property characteristics from Cotality (formerly Corelogic). We measure new construction using permitting data from BuildZoom. We measure regulatory exposure using FEMA SFHA designations, including historical vintages of these maps that trace inland (A) and coastal (V) zone boundaries over time. Finally, we use an independent measure of property-level flood risk from a state-of-the-art hydrological model developed by the First Street Foundation (CITE). Together, these data allow us to locate each new structure relative to the regulatory SFHA boundary in effect when it was permitted, and to measure the flood risk of its site independently of that designation.

Motivating Evidence. Florida provides a useful motivating example because of its high exposure to flood risk and extensive development near FEMA flood zones. Figure 1 plots the spatial distribution of new construction around SFHA boundaries (Panel a) under two contrasting profiles of physical flood risk measured using First

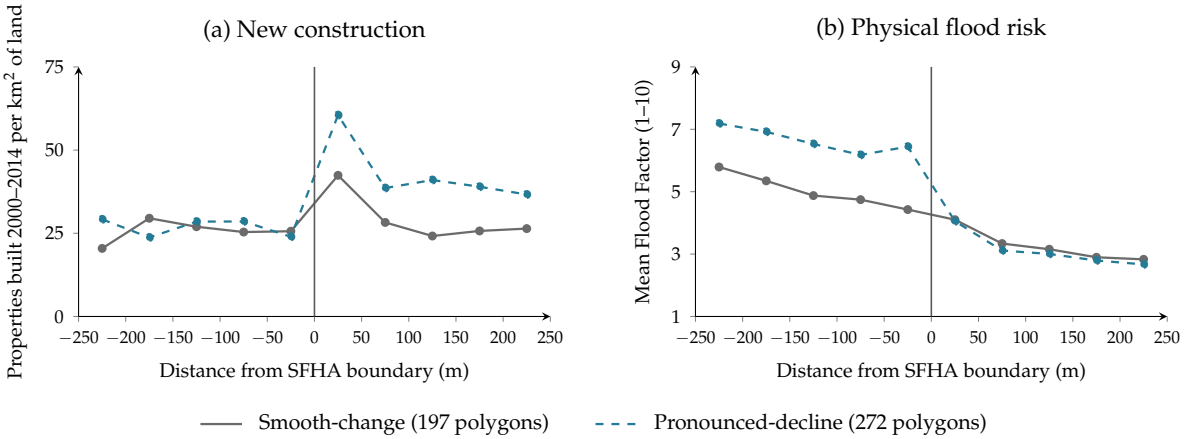


Figure 1: Descriptive profiles around FEMA SFHA boundaries in Florida. Panel (a) reports properties built between 2000 and 2014 per square kilometer of land, in 50-meter distance bins. Panel (b) reports mean First Street Flood Factor in the same bins. Negative distances indicate locations inside SFHA zones and positive distances locations outside. SFHA polygons are classified as having either a smooth-change (gray solid lines) or pronounced decline (blue dashed lines) in flood risk at the boundary according to changes in Flood Factor across their boundary (−50/0 versus 0/50 meters) relative to the preceding within-SFHA change (−100/−50 versus −50/0 meters). Smooth-change polygons (197) have changes differing by no more than 0.25 points, excluding polygons with a mean Flood Factor of 1 in all three bins. Pronounced-decline polygons (272) have a boundary decline of at least one point and at least twice any positive preceding within-SFHA decline. The groups comprise 469 of the 996 polygons with at least one Flood Factor observation in each classification bin. The figure uses the January 17, 2024 FEMA boundary.

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Street's Flood Factor (Panel b). We examine two types of SFHA boundaries: those with a pronounced decline in flood risk at the boundary (blue dashed lines) and those with smooth changes in flood risk at the boundary (gray solid lines). In the pronounced-decline group, mean Flood Factor falls by 2.39 points across the SFHA boundary, compared with only 0.33 points in the smooth-change group. In the latter, the reduction in Flood Factor at the boundary closely matches the 0.31-point reduction observed over the same distance (50 meters) but within the SFHA. Yet new construction density peaks in the first 50 meters outside the SFHA in both groups. That is, in the 42% of SFHA in this sample that fall into the smooth-change group, this concentration of construction directly outside the SFHA occurs without a corresponding discontinuity in physical flood risk at the regulatory boundary. This observation raises the possibility that floodplain regulation often shifts development toward unregulated land without commensurate reductions in physical flood exposure. Whether this concentration reflects a causal response to floodplain regulation remains an empirical question.

Empirical Design. For each new-construction permit, we identify the FEMA flood map in force at the permit date and compute the parcel's signed distance to the contemporaneous SFHA boundary, with negative values denoting locations inside the regulated area and positive values locations outside. Notably, rather than measuring construction relative to a single current flood map, we evaluate each development decision against the regulatory boundary that applied when the permit was issued.

We interpret the SFHA boundary as a spatial analogue of a tax notch. In standard bunching applications, a discrete change in regulatory stringency induces individuals to adjust a choice variable, such as taxable income, generating excess mass on one side of the threshold and missing mass on the other (Saez, 2010; Kleven and Waseem, 2013). Here, the choice variable is location. Crossing the SFHA boundary changes the regulatory treatment of new construction, so developers may respond by changing where they build. If this margin matters, the spatial distribution of development should display excess mass immediately outside the regulated area and missing mass immediately inside it.

We adapt standard bunching methods to this spatial setting. We partition parcels into narrow bins of signed distance from the boundary and measure new development relative to the amount of land available for development in each bin, rather than using raw construction counts. We then estimate a smooth counterfactual development profile using observations away from an excluded window around the boundary and extrapolate this profile into the excluded region. Let n_b denote observed development in distance bin b and $\hat{n}_b$ its counterfactual value in the absence of the notch. We define excess mass outside the boundary as

$$B = \sum_{d_b \in (0, d_U]} (n_b - \hat{n}_b),$$

and missing mass inside as

$$M = \sum_{d_b \in [d_L, 0)} (\hat{n}_b - n_b).$$

Following the bunching literature, we will report both the raw excess and missing mass and normalized measures relative to the counterfactual density at the threshold, with uncertainty obtained by bootstrap (Chetty et al., 2011; Kleven and Waseem, 2013). Because, in some cases, the regulatory boundary changes over time, different map vintages can define new spatial thresholds. After constructing the period-specific bunching distributions, we recenter each contemporaneous SFHA boundary at zero. A permit located 50 meters outside the boundary in force at its permit date is therefore assigned $d = 50$, regardless of the geographic location or vintage of that boundary. We first estimate bunching separately by period or map vintage and then pool the recentered distributions to obtain aggregate estimates.

Identification requires that, absent the regulatory notch, development intensity would evolve smoothly with distance through the boundary. Unlike standard tax-bunching settings, regulatory boundaries may coincide with spatial variation in underlying determinants of development. We assess the plausibility of this assumption in two ways. First, we identify boundaries characterized by similar changes in flood risk across the regulatory boundary and in the preceding within-zone distance interval. Restricting the analysis to these boundaries helps separate responses to the regulatory discontinuity from sorting driven by sharp changes in physical flood risk. Second, following the pre-reform validation approach of Caicedo et al. (2022), we exploit historical FEMA map revisions to examine construction density around future SFHA boundaries before and after regulatory classifications. We focus on areas newly incorporated into the SFHA, where land on both sides of the future

boundary was previously classified as outside the SFHA. Comparing construction density along the same boundary before and after remapping allows us to assess whether bunching emerges only after regulatory classification changes, rather than reflecting pre-existing spatial patterns of development.

The bunching estimates answer our first research question: whether there is spatial bunching around the regulatory notch. A positive and significant B would indicate excess construction immediately outside the regulated area, while a positive M would indicate missing construction inside. We estimate both quantities relative to a smooth counterfactual distribution of development intensity, without imposing a mass-conservation restriction, as in Kopczuk and Munroe (2015) and Caicedo et al. (2022). We assess the sensitivity of these estimates to alternative specifications of the counterfactual and the choice of excluded distance bins. We then characterize the risk profile associated with this spatial response. For each distance bin, we measure parcel-level Flood Factor for the excess mass outside the boundary and for the locations associated with missing development inside. If the excess construction outside the SFHA is located on substantially lower-risk land than the missing construction inside, the spatial response would also represent a movement toward safer locations. If instead the two risk profiles are similar, the response would mainly shift development across the regulatory line without an equivalent reduction in physical flood exposure. This allows us to assess whether the spatial spillover induced by the regulatory boundary improves the physical safety of new development or constitutes a potential unintended consequence of the policy.

We complement the baseline design with a set of identification and robustness checks. First, we exploit changes in FEMA boundaries over time. For permits issued before a map revision, later boundaries provide temporal placebos: bunching around a future regulatory line would suggest that persistent geography, rather than the regulation in force, helps generate the observed spatial pattern. Conversely, after a revision, we compare bunching around the contemporaneous boundary with bunching around obsolete boundaries. We also assess robustness to alternative bin widths, excluded windows, counterfactual functional form assumptions, and definitions of developable land.

Our contribution is to bring spatial behavioral responses into the evaluation of floodplain regulation. Like other place-based environmental policies, floodplain regulation may be subject to leakage: if construction shifts across the boundary rather than being deterred, estimates of development effects inside regulated areas may overstate the policy's effect on reducing flood exposure. In cases where regulation reallocates development across space without meaningfully reducing the physical risk of new construction, it may impose the costs of distorting where development occurs without delivering its intended benefits. Indeed, prior work shows that constraints on where housing can be built are costly (Hsieh and Moretti, 2019). Conversely, where development is displaced to systematically lower-risk locations, the spatial response is a benefit of the policy: it reduces flood exposure while largely preserving the supply of new housing. Our analysis allows us to distinguish between these two cases.

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