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Wildfires, Hazard Disclosure and Land Development Trends

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Introduction

In the United States, wildfires are among the most destructive natural hazards and endanger valuable natural resources along with human life and property. Due to the low frequency nature of wildfires, landowners may be poorly informed about the true risk posed by wildfire near their home and as a result, may develop properties in areas they would avoid if adequately informed. In response, many communities have adopted hazard disclosure requirements to educate new residents about the potential risks of wildfire on their properties.

Research Questions

1. How do hazard disclosure requirement impact land development trends on very high and high severity parcels relative to medium severity parcels?
2. What is the impact of proximity to recent large wildfires on land development decisions?

Econometric Model of Land Development

The primary specification for my analysis is a linear probability model of the binary development decision ($Y_{it} = 1$), estimated with parcel based fixed effects to reduce bias from temporally invariant and unobserved parcel attributes. Let H_{it} be a vector of hazard severity, divided into medium (the baseline), high and very high classes. The variable τ is a post-regulatory dummy variable that takes on a value of one for all years after the hazard disclosure policy was introduced (1992-2004). F_{it} is a vector of dummy variables that capture whether a recent large wildfire occurred near the parcel in the recent past. X_{it} is a vector of other temporally varying parcel attributes, T_{it} is a vector of yearly dummy variables and μ_{it} is a parcel specific intercept, respectively.

Linear Probability Model of Land Development Decisions:

$$Y_{it} = \tau \cdot H_{it}\beta_1 + F_{it}\beta_2 + X_{it}\beta_3 + T_{it}\beta_4 + \mu_i + \varepsilon_{it}$$
$$\varepsilon_{it} \sim N(0, \sigma^2)$$

Study Location and Data Overview

I use a spatially and temporally explicit panel dataset of parcel subdivisions from 1985-2004 in El Dorado County, California. El Dorado County is prone to long dry summers and is naturally susceptible to periodic wildfire ignition. Nevertheless, human life and property are increasingly threatened due to the growing magnitude and frequency of wildfires. Hazard disclosure requirements were adopted in 1992 to mitigate risked posed by wildfire and affect any property sold in a State Responsibility Area (SRA). To complement this policy, the state of California simultaneously began publicly publishing county specific hazard severity maps. Hazard severity is grouped into three possible classes: very high, high and medium.

Susceptibility to wildfire risk is established based upon fire hazard severity data provided by the California Department of Forestry and Fire Protection (Cal FIRE). I also determine the proximity of each parcel to several large wildfires (>10 acres) that occurred in and around El Dorado County from a sample of mapped wildfires produced by Cal FIRE. Figure 1 provides a map of the locations of subdivisions and wildfires in the years 1985-2004 and Figure 2 provides a map of hazard severity classes in El Dorado County, respectively.

Figure 1: Subdivisions and Mapped Wildfires in El Dorado County (1985-2004)

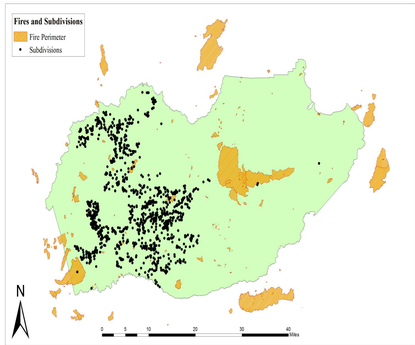
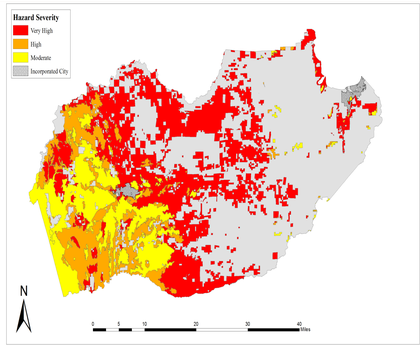


Figure 2: Cal FIRE Hazard Severity for El Dorado County



Linear Probability Model Results

Variables	(1) Coefficient	(1) Standard Error	(2) Coefficient	(2) Standard Error	(3) Coefficient	(3) Standard Error
Post-reg. Hazard Severity Class						
Treat · High Severity	-0.00146	0.00144	-0.00355*	0.00170	-0.00118	0.00289
Treat · Very High Severity	-0.00275*	0.00129	-0.00554**	0.00174	0.00184	0.00262
Treat	-0.00026	0.00196	-0.00454	0.00276	0.01325	0.00258
Fire Event 1 Year Prior						
Fire within 0-1.25km	-0.00988*	0.00452	-0.00520	0.00516	-0.00033	0.01727
Fire within 1.25-5km	0.00266	0.00237	0.00263	0.00305	-0.00160	0.00467
Fire within 5-7.5km	0.00735**	0.00262	0.00310	0.00341	0.01514	0.00813
Fire Event 2-5 Year Prior						
Fire within 0-1.25km	0.00180	0.00374	-0.00060	0.00469	0.02234*	0.01117
Fire within 1.25-5km	0.00274	0.00168	0.00257	0.00220	0.00827	0.00454
Fire within 5-7.5km	0.00488**	0.00171	0.00473*	0.00236	0.01756**	0.00546
Time Varying Parcel Attributes						
Forest Area (%)	-0.00052**	0.00016	-0.00086*	0.00037	-0.00113	0.00099
Forest Area within 500 m (%)	0.00011	0.00010	-0.00031	0.00033	-0.00137	0.00100
Developed Land within 500m (%)	0.00214**	0.00012	0.00200**	0.00015	0.00466**	0.00041
Annual Time Fixed Effects	Yes		Yes		Yes	
Parcel Level Fixed Effects	Yes		Yes		Yes	
Parcels	5,921		2,972		5,921	
Observations	105,912		53,491		38,730	

Notes: (1) Includes all observations 1985-2004, (2) Parcels within 2 km of medium hazard severity class border, (3) Falsification test for pre-hazard severity time trends (1985-1991), false treatment in 1988
**p<0.01, *p<0.05

Conclusions

The 1992 hazard disclosure policy significantly reduced probability of development on very high and, to a lesser extent, high severity parcels, relative to the baseline category of medium severity parcels. Following large wildfire, parcels located within 1.25 km are less likely to develop the following year. However, parcels further removed in time and distance are statistically more likely to develop following wildfire events. This result suggests a possible misperception of wildfire risk that is consistent with the "gambler's fallacy," or the mistaken belief that because a low probability event occurred in the recent past, it is less likely to occur in the future.