BACKGROUND AND SIGNIFICANCE

It is widely accepted that proper maintenance is essential in owning a home as the lack of maintenance will ultimately cost property owners more due to higher costs associated with repairs, renovations, or replacements (Van Zandt et al, 2011). However, little empirical evidence exists in the extant literature examining this relationship. Therefore, the purpose of this research is to develop a measure of maintenance behavior that takes advantage of recent work by Ioannides (2002) and Helms (2012). They empirically establish a positive feedback loop found between aggregate level and individual level renovation expenditures. We borrow from this idea of the influence of contextual effects on individual behavior by extending it beyond renovation expenditures to maintenance behavior. First, we operationalize maintenance behavior using aggregate level data and then test how well this construction performs in predicting individual property claims. We argue that using aggregate level maintenance data as a proxy for individual maintenance behavior has multiple benefits. Foremost, the ease of access to aggregate level data make analyses more accessible especially when compared to the enormously high cost of collecting individual data. Second, given the contagion effect that exists when individuals are surrounded by other poor-/well- maintained properties, we can easily derive potential individual property risk by analyzing aggregate data.

Capturing maintenance behavior of individual property owners is a daunting task for risk researchers. For entities with a vested interest in property risk, like insurers, the variety of behaviors related to property maintenance is seemingly limitless and includes minor items related to property security as well as major items like repairs of vital internal and external systems. To evaluate the importance of each behavior, researchers must capture each and associate them with property risk. To our knowledge, no current dataset exists which joins maintenance behavior and property risk. The few existing examinations of property risk are generally small in scale focusing on small localities (see Milstead and Miles, 2011; Turner and Ibes, 2011; or Goda and Yoshikawa, 2012) or niche-programs (e.g., Burns, 1983).

In addition to generalizability limitations, work related to maintenance behavior of property owners has relied on methodological tools that do not fully capture the complex phenomenon of preserving a property. Researchers commonly use imperfect proxy variables such as age of home, age of householder, income, marital status, renovation expenditures, and mobility to capture maintenance actions (Galster, 1983; Kanemoto, 1990; Harding et al., 2000; Coulson, 2011; Iwata, 2009 Davidson, 2000; Wiesel, 2013; Davidoff, 2004; Gyourko and Tracy, 2006; Keese, 2012). These metrics do not adequately account for the relationships among residents and their maintenance activities. More importantly, the current selection of proxy variables may be more related to socioeconomic status than maintenance behavior which could give spurious conclusions.

APPROACH

We use a unique dataset combining proprietary data from a large national insurer with neighborhood data from the United States Census Bureau's American Housing Survey (AHS). The AHS includes information on physical characteristics of the structure, property condition, upgrade and remodeling activities, and neighborhood quality. Each of these measures is directly affected by the survey respondent's maintenance behavior. For example, if the condition of the common area is poor as noted by the individual AHS respondent, we argue that the home is not as well maintained compared to another AHS respondent who reports no concerns in the common area. Likewise, if a respondent notes deficiencies in the property such as rats, holes in floors and walls, and/or electrical wiring problems, we argue that this property is not as well maintained when compared to properties with no reported deficiencies. Thus, we aggregate these survey responses to derive a measure of maintenance behavior at the neighborhood level.

We compare two separate derivations of neighborhood maintenance behavior and analyze their effect on individual property risk. We use a factor analytic technique (see Krishnan (2010)), and a more traditional method discussed in DeVellis (2012), where individual survey responses are averaged across neighborhood. We generate a maintenance index using each method and test its application in assessing

property risk. More specifically, each derived index is empirically linked to individual risk water claims. Maintenance behavior is hypothesized to have a strong impact on whether an individual has a water claim. Following the logic of Ioannides (2002) and Helms (2012), individuals who live in neighborhoods that are more poorly maintained should be at higher risk of loss compared to individuals in better maintained neighborhoods.

Table 1 displays preliminary results of this analysis. In the water claim model, several established covariates of claim risk are used as control variables to mitigate the effect of the proposed maintenance measure. Three models are displayed, the first model is fit to establish baseline estimates for estimating the effect of maintenance on water claim risk. The quadratic pattern of risk across age bands is present with the youngest and the oldest homes being the least likely to file a water claim. Claim risk peaks in the 16-20-year range. We believe this to be the point at which systems inside the home begin to fail. Homeowners begin to replace failing systems during this period which paradoxically causes subsequent aging to be related to decreased risk of filing a claim.

The second and third columns of Table 1 include the separate specifications of the maintenance behavior index. As theorized, the measures are in the expected direction with scores that indicate the poorest maintained neighborhoods exhibiting the highest risk. Compared to individuals living in the best maintained neighborhoods, individuals in poorly maintained neighborhoods are 7 and 12 percent (respectively) more likely to file a water claim.

Currently the only geographic summary available in the AHS is “Zone”, a non-descript area encapsulating 100,000 people. In some cities, zones might not be continuous. The same zone could encompass northern and southern parts of St. Louis, MO for example. This could explain the pattern in odds ratio estimates observed for the maintenance index created using factor analysis.

To broaden the impact of these findings and further explore the measurement of maintenance behavior, we are partnering with the Census to obtain access to the restricted use files so we can aggregate our measures to the Census tract level. While still not an ideal proxy for neighborhood, Census tracts are much better that Zone. In the coming months, we hope to reaggregate our maintenance

measures to the Census tract level, and refit the insurance claim models to facilitate a healthy discussion on the efficacy of our proposed measures. Ultimately, measures like these could be placed inside their own risk assessments. Generally, approving variables with governing bodies like Departments of Insurance are an insurmountable hurdle; however, the conceptual link between homeowner maintenance and risk is strong. If an empirical measure could capture this concept in a meaningful way, these hurdles could be easily overcome.

Table 1: Odds Ratio Estimates for Homeowner Water Claim Risk

Variable	Original Model	Index (FA) Model	Index (Individual) Model
Age of Home (Ref= less than 5 years)			
6-10 years old	1.5***	1.5***	1.5***
11-15 years old	1.7***	1.7***	1.7***
16-20 years old	1.8***	1.8***	1.8***
21-29 years old	1.6***	1.6***	1.6***
30-39 years old	1.5***	1.5***	1.6***
40-49 years old	1.4***	1.4***	1.4***
50 or more years old	1.0***	1.0	1.1***
Amount of Insurance Deductible	0.8***	0.8***	0.8***
Historical Loss Experience	1.3***	1.3***	1.3***
Payment Cancellations	1.2***	1.2***	1.2***
Size of Home	1.1***	1.1***	1.1***
Home Contents	1.2***	1.2***	1.2***
Geography	1.7***	1.7***	1.7***
Maintenance Group (Ref = Poor)			
Not Well	--	0.92***	0.96**
Well	--	0.97	0.91***
Very Well	--	0.93*	0.88***
AIC (smaller is better)	**223352**	**218780**	**223292**

* $p < 0.05$; ** $p < 0.01$; *** $p<0.001$

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