Florida Catastrophic Storm Risk Management Center

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Granularity in the Florida Property Insurance Market

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EXECUTIVE SUMMARY

Much has been made in the press about north vs. south and inland vs. coastal subsidies with regard to property insurance rates and accuracy of pricing in the state of Florida. The discrepancies in rate accuracy however, are more localized than these broad comparisons. Even at the zip code level, expected loss costs vary enough to warrant more granular pricing of risk than is currently utilized in the territory-based property insurance rating systems. As evidence of the need for granular pricing with regard to the wind peril in the residential property insurance market, this paper examines the role that distance to the coast (distance-to-coast) plays in the relationship between expected loss costs and wind premiums in the coastal areas included in Citizen's Property Insurance Corporation's High Risk Account (HRA).

Empirical analysis is performed to determine whether the premiums charged within the Florida property insurance market are commensurate with the risk each location presents. The objective of this pre-loss analysis is to provide evidence regarding whether current homeowners premiums accurately reflect differences in expected losses both within and across different geographic regions.

The relative price of insurance was calculated based on a comparison of wind only premiums being paid in the Citizens HRA relative to the expected loss (average annual loss) as measured by modeled loss costs generated by modeling organizations. The results show wide variation in the magnitude of the prices paid for wind coverage in relatively small geographical areas. One conclusion of this research is that subsidies exist not only on the intercounty level but also at the intracounty, intraterritory and intrazipcode levels.

These results are important to insurers, insureds, citizens and politicians throughout Florida for a variety of reasons. There has been no work estimating the pre-loss accuracy of risk-based pricing in this market, and very little work estimating the post-loss subsidies due to the assessment structure (Cole et al, 2009). This paper introduces the possibility of a new rating variable, distance-to-coast, that appears to have many of the characteristics necessary for a useful rating variable. This research has implications on the public policy issue regarding whether policyholders in the state of Florida are paying too much or too little for their property insurance coverage. The fact that there is evidence that even in the Citizens HRA territories, policyholders closer to the coast are paying relatively less for insurance than those further inland alters the landscape of the political argument that it is a northern vs. southern counties or inland vs. coastal counties issue. The accuracy of insurance pricing is an intracounty, intraterritory and even intrazipcode issue. The impact that these subsidies may have on future exposure and coastal development could be substantial and requires further study. Authors on this paper were Charles M. Nyce and Patrick F. Maroney.

INTRODUCTION AND LITERATURE REVIEW

The problem of potential insolvency has long plagued the insurance industry. Of the 4,000 fire insurance companies that existed before the Great Chicago Fire of 1871 and the Boston Fire of 1872, only 1000 were still in business after those fires (Meier, 1988). The response by the states to the fire insurer insolvencies was to establish administrative organizations. Early regulation concerned agent licensing, setting reserve requirements, acting against collusive ratemaking, and collecting information about company operations (Meier, 1988).

The response by the industry was to establish State and local boards to set rates; these developed into regional organizations (Meier, 1988). The price of fire insurance was based on factors related primarily to loss. These included type of construction, territory and occupancy (Bickelhaupt, 1983).

Homeowners insurers have, in more recent years, been aided by technological advances to introduce new rating factors or variables and perform a sophisticated analysis of loss costs by peril with the result of more refined homeowners ratings (Kucera, 2008). In addition to construction type, fire protection class and territory, insurers now use code enforcement, protection devices (burglar alarms, fire alarms, sprinklers), mitigation credits, and age. Some companies also use credit scores and loss history in the ratemaking process, as well as breeds of dogs and the presence of trampolines.

In order to encourage mitigation, rates should be appropriate to the insured exposure, especially in light of increased concern about the affordability of homeowners insurance. Rate regulation has always been about consumer protection. Rates need to be adequate, not excessive and not unfairly discriminatory. Historically, consumer protection was addressed via solvency regulation and ensuring that rates are adequate. In some states however, the focus seems to have shifted from protection through solvency to protection from excessive rates, or more of a focus on affordability. This shift in the regulatory focus in some states has had profound effects on the homeowners markets (e.g. Florida and NC). Growth in residual markets (Newman, 2009), insurers restructuring books of business or exiting the market, calls for a federal catastrophe fund and other regulatory market interventions have drastically altered the functioning of homeowners insurance markets in catastrophe prone areas.

Since Hurricane Andrew in Florida, the private has struggled to adequately respond to the catastrophic risk of hurricanes. Andrew's insured losses exceeded $16 billion (Fronstin and Holtman, 1994). In the fall of 2004, four hurricanes made landfall: Charley, Francis, Ivan, and Jeanne as well as tropical storm Bonnie. In 2005 hurricanes Rita, Wilma, and Dennis struck Florida. The losses in Florida for 2004 and 2005 exceed $36 billion (Florida Office of Insurance Regulation, 2006).

Regarding the Florida market, the Governor's Property and Casualty Insurance Reform Committee stated that in 2006, "52 of Florida's 167 property insurance carriers requested significant rate increases (over 25 percent) related primarily to the considerable increase in their cost to purchase reinsurance and the heightened expectations of future losses related to hurricanes (wind losses arising from hurricane loss models). Increases in property values also have contributed to the rise in insurance premiums as have substantial increases in the cost of labor and materials to re-build after an event."[1] Many insureds do not understand that even if the value of their house declines the amount of

[1] Other explanations of rate increases include a re-evaluation of the catastrophic risk, including higher storm frequency and severity. Policyholders need to be educated that since the insurance policy pays replacement costs, falling housing prices do not mean falling insurance premiums as well.

insurance carried may not decline because mortgage lenders require insurance limits cover the more than the amount borrowed and policies are based on replacement cost, not market value.

The idea of permitting more flexible rates for homeowners and individualizing risk assessment are not new. The final report prepared by the Collins Center for Public Policy made these recommendations in 1995 (Collins Center, 1995). More flexible, risk based pricing provides incentive for mitigation.

The Catastrophe Landscape

The failure to recognize changing demographics within rating territories that were established several years ago fosters problems. Florida has grown dramatically to a current population of more than 18 million people. Additionally the coastal total insured value has risen to 2.5 trillion. This figure includes the cost to replace structures, contents, additional living expense, and business interruption insurance for residential and commercial property. (AIR Worldwide, 2008)

Most Floridians desire to live near the coast; 79% of the state's insured value consists of coastal exposure(AIR Worldwide, 2008).[2] The problem is exacerbated by the possible increase in hurricane activity. One expert has stated there has been "quite an intense increase in hurricane activity" and "we may be in this cycle for another 20 years." (Trenbeth, 2008)

States in addition to Florida have faced problems stemming from catastrophes. Hawaii experienced the Iniki Hurricane in 1992. California experienced the Northridge

[2] This measure of coastal exposure is not refined enough for rating purposes. Some of these coastal counties reach far inland (i.e. Okaloosa, Walton and Palm Beach, see Map 1) and may overestimate Florida's true "coastal" exposure.

Earthquake in 1994. The Gulf Coast states suffered Hurricane Katrina in 2005 and Texas experienced Hurricane Ike in 2008. Another significant catastrophe faced in many areas is the peril of flood. The flood insurance program has been provided by the federal government since 1961. While the federal government has chosen to insure the catastrophe of flood, it has not insured other catastrophes, such as hurricane and earthquake. For a more detailed discussion of the National Flood Insurance Program see Browne and Halek (2009) or Michel-Kerjan and Kousky (2009).

Hawaii set up the Hawaii Hurricane Relief Fund, California established the California Earthquake Authority, Texas has the Texas Windstorm Insurance Association, any most other coastal states have established property residual markets. Thus, the findings of this study will have implications not only for the political, regulatory, and insurance environment in Florida, but also will lead to a better understanding of the factors that affect pricing within insurance markets and, especially in those states which face catastrophes.

Residual Markets

Proper pricing is important to consumers to make sure they are paying the correct premium. It is also important to insurers because it influences how an insurer manages its book of business. Improper pricing may be one of the contributing factors to the growth of the residual market in Florida.

In 2002 the Legislature created Citizens Property Insurance Corporation by merging the Florida Residential Property-Casualty Joint Underwriting Association (FRPCJUA) and the Florida Windstorm Underwriting Association (FWUA). Citizens is tax-exempt and not-for-profit. The current policy count in Citizens exceeds one million policyholders.

The Florida Hurricane Catastrophe Fund (FHCF) was created as a mandatory reinsurance mechanism for property insurers in Florida. It provides reimbursement for the portion of an insurer's catastrophic hurricane losses above its retention level. Insurers that write covered policies must enter into a contract with the Florida Hurricane Catastrophe Fund and pay an annual reimbursement premium, as calculated by rules adopted by the Fund. For a complete discussion of the Florida residual market see Cole et al (2009), Newman (2009).

The Use of Rating Territories

This paper will examine the potential for premium inequities among homeowners. A threshold issue is the rating territories used by insurers. Territory boundaries were established years ago and include wide-spread geographic areas. Thus, the insured properties in the territory may lack homogeneity, which requires that the risk of loss of all members of the class should be as close as possible since the members pay the same rates. (Kucera, 2004) In other words, territories may have reflected homogeneous fire risk but not wind risk.

Furthermore, it has been noted that the procedures used by insurers for calculating territory rate relativities that include one-way loss ratios or pure premium analyses do not take into account the correlation between territories and other rating variables nor the different mix of business that exists within a territory. (Id). Insurers are generally required to estimate expected losses within classes of insureds with similar loss patterns. Rate equity exists when rate differentials are justified by cost differentials. Any system using rating variables or factors should utilize reliable predictors of loss that attribute losses accurately (Venezian, 1985). Thus, rates are determined for homogeneous groups who experience similar exposures (Ferreira, 1978). Technological improvements (data gathering, databases, simulation modeling) have allowed insurers to be more refined in their definitions of "homogeneous groups". The result is more numerous, smaller groups of homogeneous exposures.

The current environment in property insurance is analogous to the situation that existed with regard to private passenger automobile insurance thirty years ago. Insureds complained about auto insurance coverage being unavailable, unaffordable, and unfairly discriminatory.[3]

Insurers in the personal auto line of business have seen the difficulty that can arise in incorporating new rating variables into existing books of business. The political and public response to the use of insurance score[4] (Brockett and Golden, 2007) underlines the concern over disparate impact, unfair discrimination, and social acceptability of rating variables and can make more granular pricing difficult for insurers to incorporate.

Rating Exposures

A related question is whether the classifications or "risk classes" are appropriate. Actuarial Standard of Practice No. 12 concerns risk classification. The standard states that the primary purposes of risk classification are to be fair, permit economic incentives to encourage availability of coverage and to protect the soundness of the financial security system. The standard further states that a classification system is equitable "if material differences in costs for risk characteristics are appropriately reflected in the rate.

[3] For a detailed discussion of ratemaking inequities in auto insurance see Zietz et al (1996).
[4] Insurance scores, calculated by insurers, are very similar to credit scores.

Classification subsidies result when the price paid by an individual or class of individuals fails to reflect differences in cost among the risk classes." Standards recognized as useful in determining the fairness of classification variables are homogeneity, separation, reliability, causality, social acceptability and incentive value. (Shayer, 1986)

As stated above, homogeneity helps prevent policyholders with disparate loss expectations from being charged the same premium. Separation means that classes should be sufficiently different in loss expectations. Reliability means classifications are based on easily observable differences. Causality means the characteristics are directly related to loss. Social acceptability means the classification is consistent with public policy and incentive value means there should exist an incentive for the insured to adopt low risk characteristics.(Shayer, 1986)

EMPIRICAL ANALYSIS

The purpose of the empirical analysis is to determine whether and to what extent the premiums policyholders in Florida are paying for hurricane coverage are related to their exposure to losses from hurricanes. In other words, the results will provide some evidence as to whether current premiums accurately reflect differences in expected losses for insurance risks within specific geographic regions. Analysis is conducted at the state, county, territory and zip code levels. The study is important because it will identify locations that are mispriced on a more granular level. Underpriced risks would have an incentive to engage in mitigation measures if the premium savings realized were more aligned with actual risk reduction

Data and Summary Information

Data was obtained from Citizens representing more than 1.2 million policies in force during 2008. The dataset was then limited to only single family homes, in the High Risk Account (HRA). The HRA data was used to match premiums to expected losses (modeled loss costs – average annual loss) since both are based on wind only.[5] This avoids the issue of having premiums that reflect other perils in the multi-peril policies in the Personal Lines Account (PLA) and an expected loss measure that only reflects damage due to windstorms. It also removes any bias that may be introduced because of the variation in rating used by Citizens across their three accounts. After removing observations with missing data, there are more than 250,000 observations in the dataset. The dataset includes for each property: the premium paid for wind coverage, the policy limits, the modeled average annual loss (AAL) estimates from three modeling companies (RMS, AIR and EQE), the wind mitigation credit, the address, zip code, territory, county, longitude and latitude coordinates, the distance from the property to the coast, the age of the building, type of roof, type of construction, and the existence of opening protection.

The dependent variable, price, is calculated as:

$$\text{price} = \frac{\text{premium} - \text{modeled aal}}{\text{modeled aal}}$$

This variable is designed to compare how much an insured is paying for wind coverage relative to their expected loss as measured by the AAL. The amount being paid above expected loss, on a percentage of expected loss basis, is the price or cost of the insurance

[5] Modeled AALs underestimate the true loss costs because they do not include provisions for tropical storms, tornados, & other wind losses.

being provided.[6] If the value of this variable is 0, than the premium is the same as the expected loss. If the value of this variable is negative, the insured's premium is less than their expected loss. As the difference between the premium and the AAL increases the price increases. For example, if an insured had an expected loss of $75 and the insured charged a premium of $100, the price would be .33 = ((100-75)/75) or 33% of expected loss. Similarly, an insured with an expected loss of $300 and a premium of $400 would be paying the same price or the same relative amount for their insurance.

The premium paid by each insured is determined by Citizens following their rating formula[7]. Rating factors include (but are not limited to) occupancy (seasonal, owner occupied, condo), location, construction type, roof shape, opening protection, and others. For the HRA account, the property must be located in one of the HRA territories which cover coastal areas in 29 of Florida's 67 counties. There are some counties with coastal exposure (Citrus, Martin, Dixie and Taylor) that are not part of the HRA. In addition there are some counties where the HRA territories only cover a portion of their coastline (See Map 1). In general, Citizens has a $1M coverage limit but that is waived for more expensive properties that cannot obtain coverage in the authorized market.

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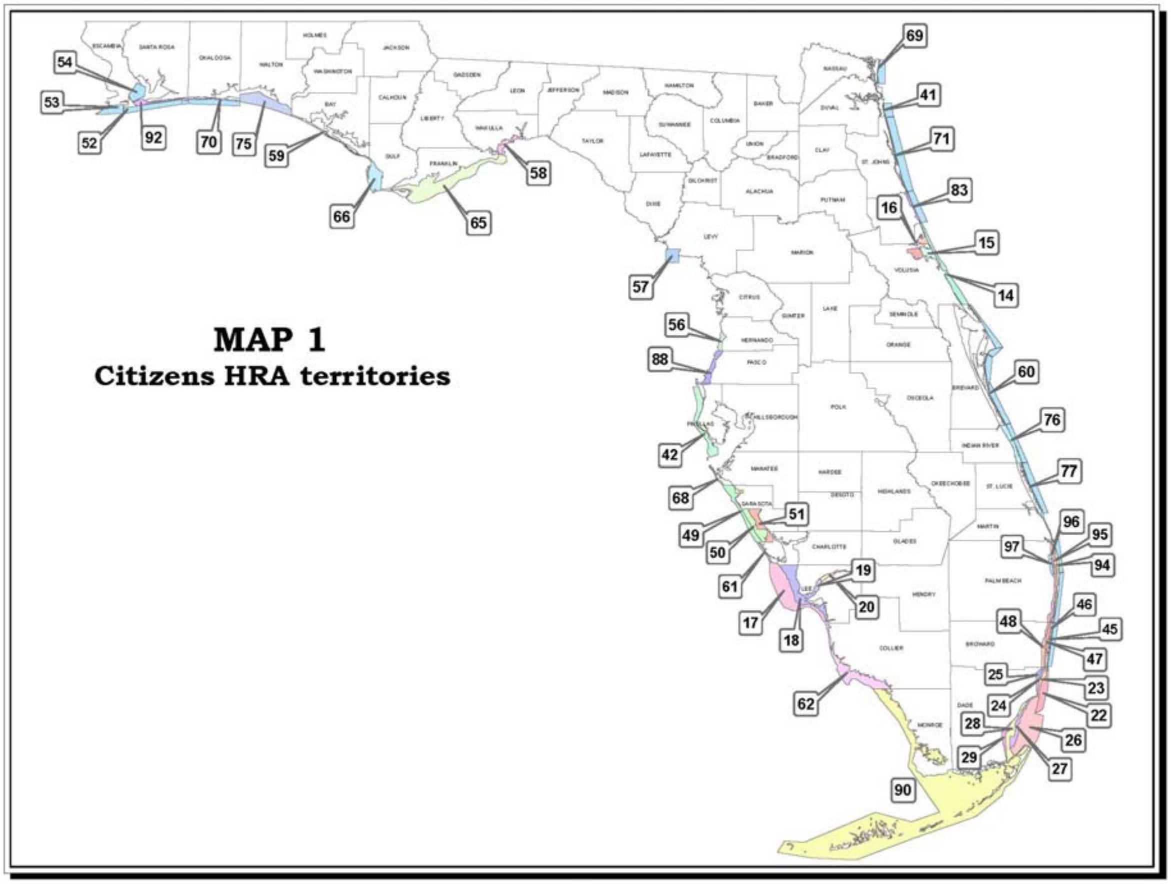
[6] The premium includes overhead costs and commissions that are not included in the expected loss. These costs are part of the cost of insurance and should not vary with distance-to-coast.

[7] Citizens' rating manuals are available on their website. www.citizensfla.com.



MAP 1
Citizens HRA territories

The modeled loss cost used in the analysis is RMS v6.0[8]. RMS v6.0 is a long term model approved by the Florida Hurricane Modeling Commission (FHMC) for use in rating in the State of Florida. In all, four AALs are in the dataset: RMS v6.0, RMS v7.0, AIR v95 and EQE v31. RMS v7.0 is a near term model and is not approved for use by the FHMC for rating in Florida. Table 1 contains the descriptive statistics for each of the four models. RMS v6.0 has the lowest AAL's for the Citizens HRA policies with an average of approximately $1500 and EQE v31 has the highest AAL's, averaging more than $2600. The 3-Blend AAL is the equally weighted average of the three models approved

[8] The results reported in the paper use RMS v6.0, the analysis was done using other modeled aal's including equally blending all three of the models approved by the FHMC which is used by the Florida Hurricane Catastrophe Fund in analyzing their book of business at the cell level. The results were consistent with the results reported here.

for use in FL (RMSv6.0a, AIRv95, and EQEv31). The 2-Blend AAL is the equally weighted average of the two most commonly used models (RMSv6.0a and AIRv95). The wide variation in modeled AALs makes economic interpretation of the results more difficult and is discussed later in the paper.

Table 1 – Modeled AAL's

Model	**RMS v7**	**RMS v6.0.a**	**AIR v95**	**EQE v31**	**3-Blend**	**2-Blend**
Mean	2302.94	1507.85	2570.98	2629.28	2236.04	2039.42
Median	1709.35	1108.06	1793.99	1866.108	1636.363	1498.48

The descriptive statistics for the dataset are shown in Table 2

Table 2 – Descriptive Statistics (n = 252,391)

Variable	Mean	Median	Variance	Min	Max
Price	1.05	0.57531	2.53483	-0.78438	52.6214
Premium	2383.35	1747	5723576	70	159014
Modeled AAL	1507.85	1108.06	2229810	12.4547	73469.9
Coverage A Building Value	299,585	212,000	9.43E+10	10000	1.63E+07
Distance to Coast	0.8236	0.351244	1.431827	6.21E-06	10.78469
Age	37.41	39	378.8102	1	209
Wind Mitigation Credit	491.77	98.814	1007624	0	44871.55
Wood (D)	0.205	0	0.163015	0	1
Masonry (D)	0.703	1	0.208964	0	1
Steel Frame (D)	0.092	0	0.08383	0	1
Shutters (D)	0.231	0	0.177477	0	1
Hip Roof (D)	0.306	0	0.212309	0	1
Gable Roof (D)	0.620	1	0.235696	0	1
Flat Roof (D)	0.075	0	0.068987	0	1

Table 2 shows that the average price in the dataset from Citizen's HRA is 1.05 and the median value is .575. The median price implies that most policies in the HRA account are being charged sufficient premium to cover the expected losses, and the associated expenses. However if all three of the approved models are blended together and equally weighted to determine the modeled AAL, the mean and median price becomes .274 and .06 respectively.

Methodology and Results

The purpose of the analysis is to determine if there is any evidence of systematic inaccuracies in pricing hurricane coverage in Florida's property insurance market. That is, are some policyholders paying more than they should for hurricane coverage in their homeowners' premiums, thus subsidizing other policyholders who are paying less? Rather than attempting to define how much each policyholder should be paying for hurricane coverage; the relative price measure is used.

State Level Analysis

It is intuitive that as the distance-to-coast increases, the expected loss due to windstorm damage in a state like Florida would decrease. Storm intensity decreases as the storm moves across land due to a lack of heat energy and moisture from tropical waters (Barnes, 2005) and therefore, inland properties would be expected to experience less damage than a coastal property exposed to the same storm. Table 3 contains the correlation coefficients for distance-to-coast compared to the total premium charged, and the various modeled AALs.

Table 3 – Correlations

Distance to Coast (DTC)

DTC	1.000
Total Premium	-0.1745
RMS v6.0a	-0.2836
3-blend Model	-0.1907
2-blend Model	-0.2479

Table 3 shows that as the distance-to-coast increases (the property is located further inland) the premium charged decreases. This holds true even over relatively small distances from the coast. This can be seen using the HRA data, where the maximum distance-to-coast for any property is less than 11 miles. It also appears that the modeled AALs have a stronger negative correlation to distance-to-coast and decrease at a faster rate than the premium charged.

To determine if distance-to-coast can be used to more granularly price, a regression model using the price or cost of insurance (defined above) as the dependent variable is regressed on the distance-to-coast and a variety of control variables including the value of the building insured (Coverage A Building Value), the age of the structure (Age), the dollar value of mitigation credits applied to the premium (Wind Mitigation Credit), and dummy variables for construction type (Steel Frame and Masonry included, Wood excluded), the use of opening protection (Shutters), and the type of roof (Hip Roof, Flat Roof included, Gable Roof excluded).

The coverage A building value is the value of the primary residence on the property and the insured value is listed on the policy declarations page. Both the total premium paid and the modeled AALs will reflect the value of the property being insured. All else being equal, the price for wind coverage (the dependent variable) should not vary with the coverage A building value. A positive relationship indicates that larger homes pay relatively more for insurance than smaller homes.[9]

The age of the home should be positively related to both the total premium paid and the modeled AAL, since newer homes are built to more stringent building codes and should suffer relatively less storm damage than older homes. Similar to building value, if both the premium paid and AAL accurately reflect the relative risk of older homes the age variable should not vary with the dependent variable, price. A positive relationship here would indicate that older homes pay relatively more for insurance than newer homes.

The wind mitigation credit variable is the dollar value of the mitigation credit that is applied to the property. Similar to the first two variables, both the premium and modeled AAL should reflect the mitigation credit and there is no apriori expectation as to the relationship between the price and the value of the wind mitigation credit. A positive relationship would indicate that properties receiving mitigation credits are still paying relatively more for insurance.

Table 4 contains the predicted results for each of the independent variables

Table 4 – Predicted Values

Distance to the Coast Effect on Price Predicted Signs	
Distance to Coast	+
Coverage A Building Value	+/-
Age	+/-
Wind Mitigation Credit	+/-
Steel Frame (D)	+/-
Masonry Construction (D)	+/-
Shutters (D)	+/-
Hip Roof (D)	+/-
Flat Roof (D)	+/-

[9] Similar results were achieved using total insured value in place of the coverage A building value.

Table 5 – State-wide Regression Results

Distance to the Coast Effect on Price (OLS – White Standard Errors)	
Distance to Coast	0.407*** (.0.0043)
Coverage A Building Value	3.81E-07*** (2.42E-08)
Age	-0.019*** (.0.000182)
Wind Mitigation Credit	0.0000572*** (7.72E-06)
Steel Frame (D)	-0.1974 *** (0.0114533)
Masonry Construction (D)	0.1489*** (0.0070199)
Shutters (D)	0.3622*** (0.0095785)
Hip Roof (D)	0.981*** (0.0073522)
Flat Roof (D)	0.0364*** (0.0065564)
Constant	0.7525*** (0.0136626)

# of Observations	252,391
Adjusted/Pseudo R^2	0.3480

Table 5 contains the regression results, which show that distance-to-coast is positive and significant at the 1% level. This result shows that as the distance from the coast to the property increases, the price or cost of insurance (as a percentage of expected loss) increases. That is, people living closer to the shoreline are paying relatively less for windstorm coverage than those living further inland. This would seem to add credence to the popular view that northern and inland counties are subsidizing southern and coastal counties in Florida. However, this result is generated using data from the HRA account only. This means that within very narrow (less than 11 miles) band close to the coastline, properties closer to the coast pay relatively less for wind coverage than those further inland. It also appears that larger newer homes are paying relatively more than older, smaller homes. Masonry structures pay relatively more than wood structures and steel frame structures pay relatively less. Masonry structures generally have lower expected losses than wood structures, therefore it appears that the premiums charged masonry structures does not fully reflect the reduction in expected loss. Similarly, hip roof and flat roof structures pay relatively more than gable roof structures which tend to have higher expected losses.

County Level Analysis

Table 6 contains the descriptive statistics (mean and median) on a county basis for the counties that have HRA policies. The counties paying the highest price are Walton and Bay counties at 3.68 and 3.26 respectively. The counties paying the lowest price are Manatee and Pinellas at -.19 and -.08 respectively. This implies that in Manatee and Pinellas the average policyholder is paying less than their expected loss for insurance while in Walton and Bay the average policyholder is paying more than three times (300% load) expected loss. Table 7 contains the differences between the mean price paid in the five highest versus the five lowest counties in terms of price. Analysis of variance (ANOVA) analysis shows that all differences reported in this table are significant at the 1% level. Map 2 shows the counties with the highest and lowest prices for wind coverage in the Citizens HRA account. While the counties with the highest prices are more diverse, it appears the counties with the lowest price are concentrated on the southern Gulf coast.

Table 6 – County Level Analysis

	Price	Premium	Model-AAL	Coverage A Value	Distance to Coast (DtC)	Age	(DtC) Significant in Reg. Model
Statewide							
Mean	1.048	2383.35	1507.85	299585	0.824	37.41	***
Median	0.575	1747.00	1108.06	212000	0.351	39.00	
County Mean Median							
Bay	3.260	1964.54	544.47	270878	0.276	21.83	***
	2.393	1508.00	458.27	185000	0.187	17.00	
Brevard	0.767	1715.91	1063.35	248377	0.111	33.67	***
	0.564	1462.00	920.31	198300	0.105	33.00	
Broward	0.617	2151.91	1473.23	248370	0.600	43.93	***
	0.427	1719.00	1178.68	184000	0.379	47.00	
Charlotte	0.206	1966.17	1872.04	383075	0.036	25.87	(Negative)***
	0.010	1600.50	1525.65	285000	0.020	23.00	
Collier	1.568	3938.83	1767.40	517672	0.082	20.95	***
	1.348	3022.00	1351.69	380000	0.028	19.00	
Dade	1.640	2939.85	1389.51	296301	1.880	41.30	***
	1.020	2110.00	1061.27	213590	1.483	46.00	
Duval	1.338	1214.24	565.95	360715	0.150	43.52	***
	0.949	902.00	447.78	274000	0.108	48.00	
Escambia	0.322	1550.53	1359.15	239620	0.626	41.58	***
	0.127	1218.00	1078.93	190197	0.454	40.00	
Flagler	2.318	924.30	360.12	313661	0.253	21.64	***
	1.140	712.00	319.08	212000	0.114	20.00	
Franklin	0.961	2558.57	1649.00	362560	0.096	20.75	***
	0.627	2171.00	1315.96	286500	0.068	18.00	
Gulf	2.063	1756.09	781.55	258479	0.248	16.88	***
	1.732	1603.00	583.55	218000	0.129	12.00	
Hernando	2.083	1054.68	437.57	211834	0.374	22.87	***
	1.273	970.00	403.97	194250	0.132	23.00	
Indian River	2.551	5977.12	1861.43	541868	0.140	23.86	
	2.246	4856.00	1513.45	416000	0.123	21.00	
Lee	0.469	2331.74	2293.28	399821	0.502	28.60	***
	0.070	1747.00	1539.50	284000	0.093	27.00	
Levy	0.175	739.63	768.02	198321	0.541	34.85	***
	-0.056	607.00	640.80	178000	0.063	29.00	
Manatee	-0.192	2126.90	2658.54	317063	0.062	36.43	

	-0.263	1640.00	2206.22	229000	0.054	38.00	
Martin	1.293	2807.50	1258.01	336589	0.489	30.89	***
	1.121	2442.50	1116.68	306000	0.394	36.50	
Monroe	0.127	3165.26	3001.69	358466	0.088	31.34	***
	0.016	2568.50	2612.69	280000	0.036	27.00	
Nassau	2.088	1180.07	452.30	348778	0.117	27.95	***
	1.210	897.00	388.93	266700	0.098	21.00	
Okaloosa	1.673	3919.04	1684.34	547869	0.235	18.41	
	1.356	3112.00	1394.08	430000	0.123	14.00	
Palm	0.711	2528.83	1626.49	293129	0.632	41.08	***
Beach	0.412	1834.00	1259.76	193000	0.518	43.00	
Pasco	2.529	1496.65	487.46	179755	0.681	31.43	***
	1.974	1328.00	429.73	152100	0.614	35.00	
Pinellas	-0.080	1867.97	2079.33	299906	0.042	43.09	(Negative)***
	-0.159	1518.00	1729.84	229000	0.029	47.00	
	0.191	2276.06	2065.51	355634	0.242	30.01	***
Santa Rosa	0.053	1837.00	1724.27	265000	0.181	33.00	
Sarasota	0.947	1658.56	1181.72	293743	0.893	31.77	***
	0.486	1254.00	806.49	211000	0.631	31.00	
St. Johns	1.448	1444.48	651.60	464482	0.131	26.47	
	0.914	967.00	506.00	308000	0.104	22.00	
St. Lucie	1.158	1613.31	814.93	167794	0.035	10.30	
	1.015	1462.00	675.28	153000	0.012	9.00	
Volusia	1.399	958.66	499.68	204452	0.662	41.13	***
	0.787	765.00	416.81	170000	0.211	45.00	
Wakulla	1.523	1092.18	602.81	231576	0.255	27.34	***
	0.758	965.00	545.30	196000	0.055	27.00	
Walton	3.682	3190.72	854.69	487603	0.397	12.24	***
	3.228	2452.00	649.57	359000	0.282	8.00	

*** - 1% level ** - 5% level *-10% level

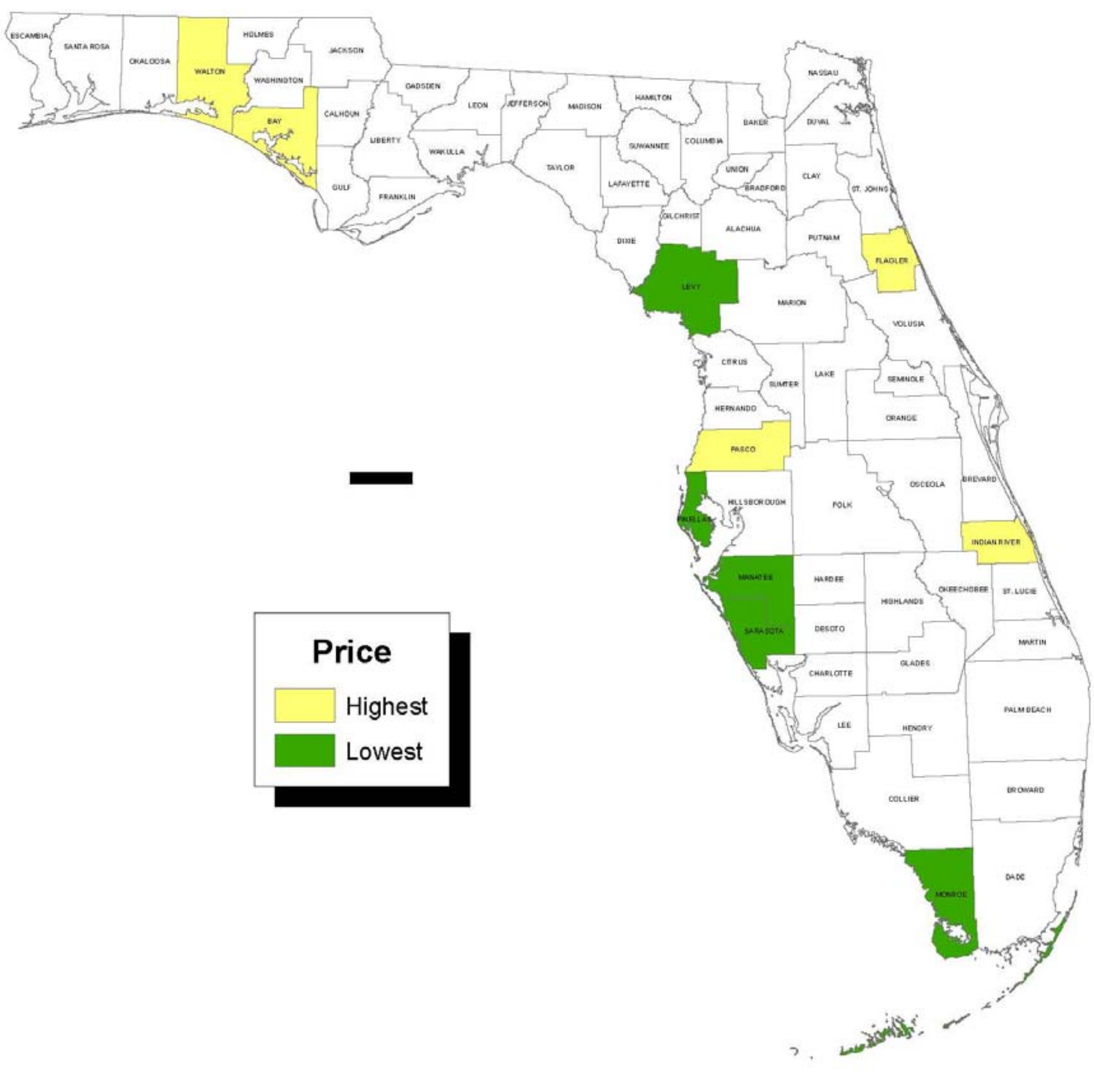
Table 7 – Means test for each county (Difference in Price)

	Bottom 5				
Top 5	Manatee	Pinellas	Monroe	Levy	Sarasota
Walton	3.87***	3.76***	3.55***	3.51***	2.74***
Bay	3.45***	3.34***	3.13***	3.09***	2.31***
Indian River	2.74***	2.63***	2.42***	2.38***	1.60***
Pasco	2.72***	2.61***	2.40***	2.35***	1.58***
Flagler	2.51***	2.39***	2.19***	2.14***	1.37***

***-All differences are significant at the 1% level

MAP 2

Counties with highest and lowest price for wind coverage

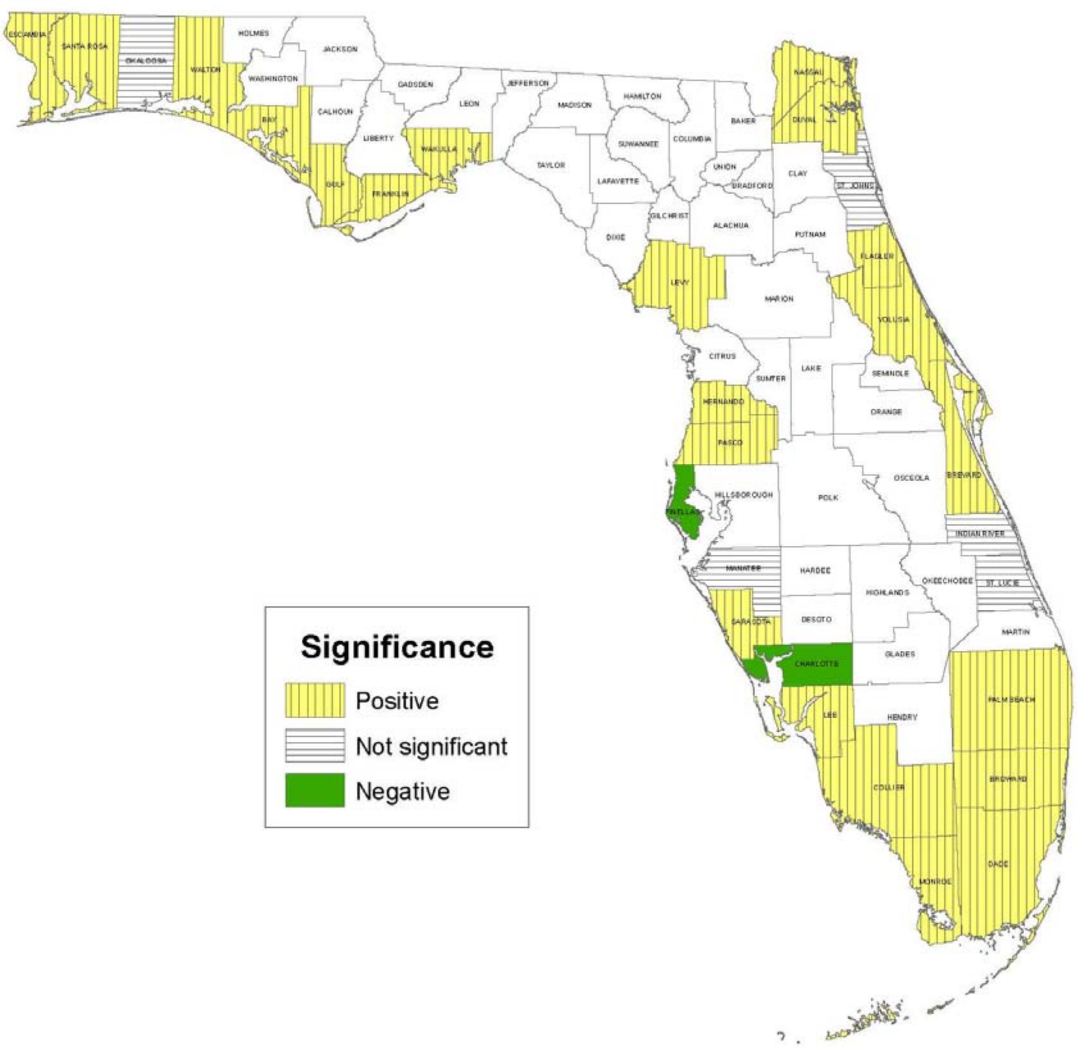


One method of determining whether the results that were shown at the state level hold for each of the coastal counties is to run a separate regression model for each county. Instead of showing the entire model results for each county, the far right column of Table 7 identifies the counties in which the distance-to-coast variable is positive and significant in the county regression model[10]. Map 3 highlights each of the coastal counties where HRA policyholders further inland are paying a higher price for insurance than those closer to the coast. As the map shows, the relationship between distance-to-coast and price holds for almost all coastal areas, not just southern Florida. The areas where the relationship was not significant or actually negative are in counties where the HRA territories are extremely narrow and there is little variation in the distance-to-coast variable.

[10] The same regression model run at the state level was run for each county.

MAP 3

Counties with distance-to-coast as a significant explanatory variable



Territory Level Analysis

Table 8 contains the descriptive statistics and regression results on a HRA territory basis. In many areas of Florida the HRA territories have a one to one matching with the county. However, in some of the more heavily populated areas in southern Florida there are multiple territories within a given county. The price paid within these counties does show significant interterritory variation. For example in Dade county, territory 23's mean price is .655 while the mean price paid in territory 29 is 2.74. This type of variation, in addition to the use of territory in rating, warrants analyzing price at the territory level. Table 9 contains the results of the means test to determine if there are statistically significant differences between territories within Broward and Dade counties in the price paid for insurance. Most of these territories have significantly different prices for wind insurance even though they reside in the same county. Map 4 highlights the territories in which the distance-to-coast variable is positive and significant in relation to the price paid for insurance.

Table 8 – Territory Level Analysis

Table 08 - Descriptive Statistics- Territory Level - Means

County	Territory	Price	Model - AAL	Distance to Coast (DtC)	# of obs	(DtC) Significant in Reg. Model
Bay	59	2.929	545.91	0.260	2070	***
Brevard	60	0.767	1063.35	0.111	1705	***
Broward	45	0.704	3007.75	0.066	1900	***
Broward	46	0.458	2271.14	0.123	11145	***
Broward	47	0.615	1274.06	0.511	14118	***
Broward	48	0.713	950.60	1.041	17214	***
Charlotte	61	0.159	2179.98	0.052	815	(Negative)***
Collier	62	1.568	1768.47	0.082	5933	***
Dade	22	1.208	3257.69	0.106	5386	***
Dade	23	0.655	1969.41	0.243	4050	***
Dade	24	1.104	1022.23	1.026	6666	***
Dade	25	1.306	968.18	2.013	9011	***
Dade	26	1.262	2584.37	0.638	2807	***
Dade	27	1.684	1372.49	1.307	12414	***
Dade	28	2.330	922.62	2.853	11820	***
Dade	29	2.741	596.50	6.022	4779	(Negative)***
Duval	41	1.338	565.95	0.150	1091	***
Escambia	52	0.262	2712.89	0.131	734	***
Escambia	53	0.121	1478.20	0.141	526	***
Escambia	54	0.352	1145.11	0.749	5031	***
Flagler	83	2.317	360.13	0.253	1925	***
Franklin	65	0.960	1665.86	0.097	1544	***
Gulf	66	2.059	786.22	0.242	937	***
Hernando	56	2.083	437.57	0.374	834	***
Indian River	76	2.551	1861.43	0.140	1835	
Lee	17	0.082	3073.62	0.149	6793	***
Lee	18	0.800	1068.94	0.243	2560	***
Lee	19	1.446	929.93	0.085	804	***
Lee	20	1.897	507.05	5.200	728	**
Levy	57	0.175	768.02	0.541	281	***
Manatee	68	-0.186	2630.58	0.062	1413	
Monroe	90	0.127	3001.69	0.088	15996	***
Nassau	69	2.088	452.30	0.117	558	***
Okaloosa	70	1.663	1760.26	0.136	562	
Palm	94	0.584	3411.66	0.129	4508	***

Beach						
Palm Beach	95	0.511	1811.91	0.241	11864	***
Palm Beach	96	0.739	1208.39	0.782	18809	***
Palm Beach	97	1.252	1094.11	1.546	4476	***
Pasco	88	2.529	487.46	0.681	5449	***
Pinellas	42	-0.080	2079.33	0.042	8595	(Negative)***
Santa Rosa	92	0.189	2074.79	0.247	1076	***
Sarasota	49	0.398	1675.96	0.345	12454	***
Sarasota	50	1.415	647.43	1.214	8506	***
Sarasota	51	2.144	528.35	2.617	2368	(Negative)**
St. Johns	71	1.448	651.60	0.131	1333	**
St. Lucie	77	1.158	814.93	0.035	283	
Volusia	14	1.053	616.11	0.163	7503	***
Volusia	15	1.344	303.13	1.279	3821	***
Volusia	16	10.274	113.52	5.038	317	***
Wakulla	58	1.499	595.17	0.246	395	***
Walton	75	3.754	853.19	0.408	4631	***

*** - 1% level ** - 5% level *-10% level

Table 9A - Means test for Broward County Territories (Difference in Price)

	Territory			
Territory	45	46	47	48
45				
46	.246***			
47	.08	.157***		
48	.01	.254***	.09***	

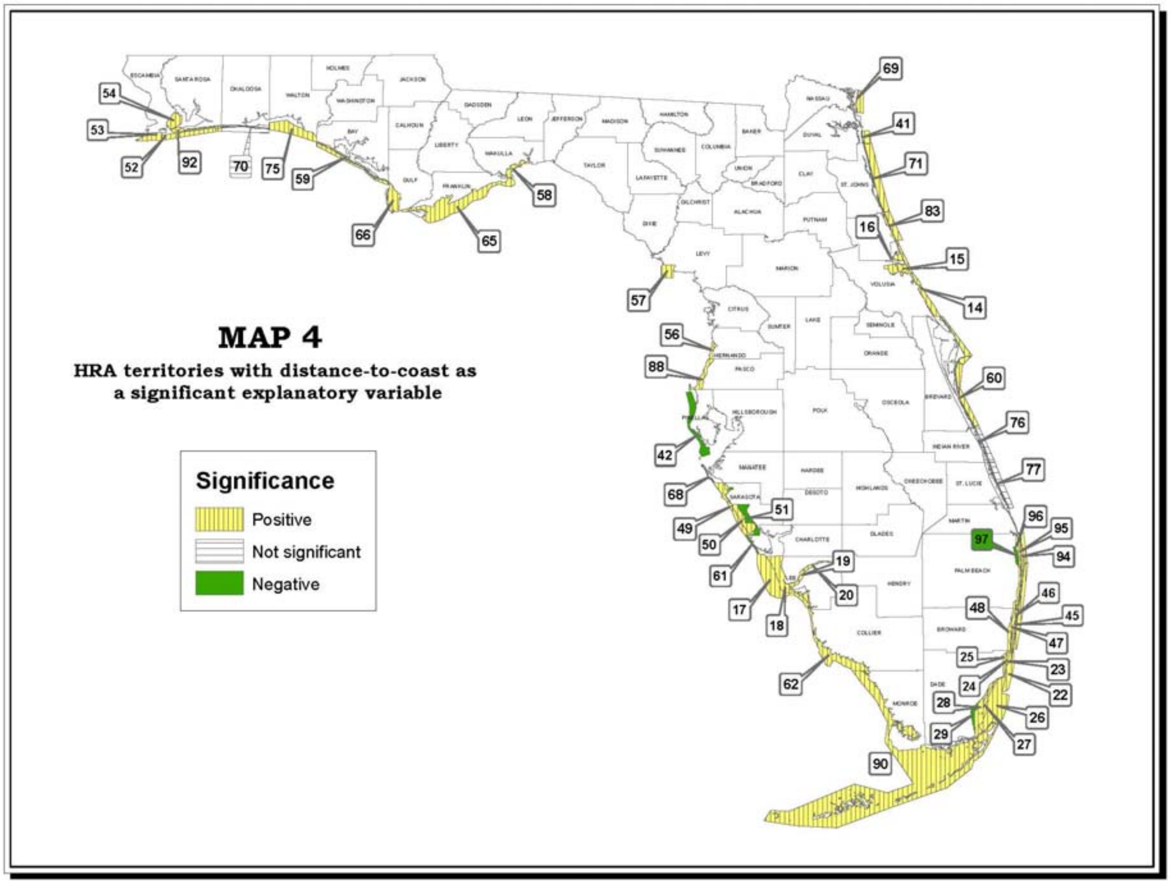
*** - significant at the 1% level

Table 9B - Means test for Dade County Territories (Difference in Price)

	Territory							
Territory	22	23	24	25	26	27	28	29
22								
23	.55***							
24	.10	.45***						
25	.10	.65***	.21***					
26	.05	.61***	.16**	.04				
27	.48***	1.02***	.58***	.38***	.422***			
28	1.12***	1.67***	1.22***	1.02***	1.07***	.65***		
29	1.53***	2.08***	1.64***	1.44***	1.48***	1.05***	.41***	

** - significant at the 5% level

*** - significant at the 1% level



Zip Code Level Analysis

To provide further evidence of the need to price property insurance more granularly than a traditional territory rating system, analysis of the relationship between distance-to-coast and the price of insurance was done at the zip code level. The results presented here focus on five counties: Broward, Dade, Manatee, Pasco, and Pinellas. Broward and Dade were chosen because the number of policyholders in Citizens HRA in these counties and the geographic size of the HRA territories covers a large number of zip codes. Manatee, Pasco and Pinellas were chosen because of their geographic proximity to one another and to determine why such radical differences in the results were obtained for those counties. Table 10 contains the descriptive statistics and regression results at the zip code level for the five counties. Maps 5-9 show the zip code level results for each county. Note that in both Pinellas and Manatee counties, the HRA territories and zip codes are only the barrier islands and peninsulas and do not include any of the mainland of Florida. This means that there is very little variation or depth to the distance-to-coast variable in these counties. This is in stark contrast to Pasco County where there is significant depth to the distance-to-coast variable and it is positive and significant in relation to the price variable.

In Broward and Dade counties, the zip code analysis shows that the distance-to-coast variable remains positive and significant even as the zip codes move 2-4 miles inland, not just on the immediate coastline.

Table 10 – Zip Code Level Analysis

Table 10 - Descriptive Statistics- Zip Code Level - Means

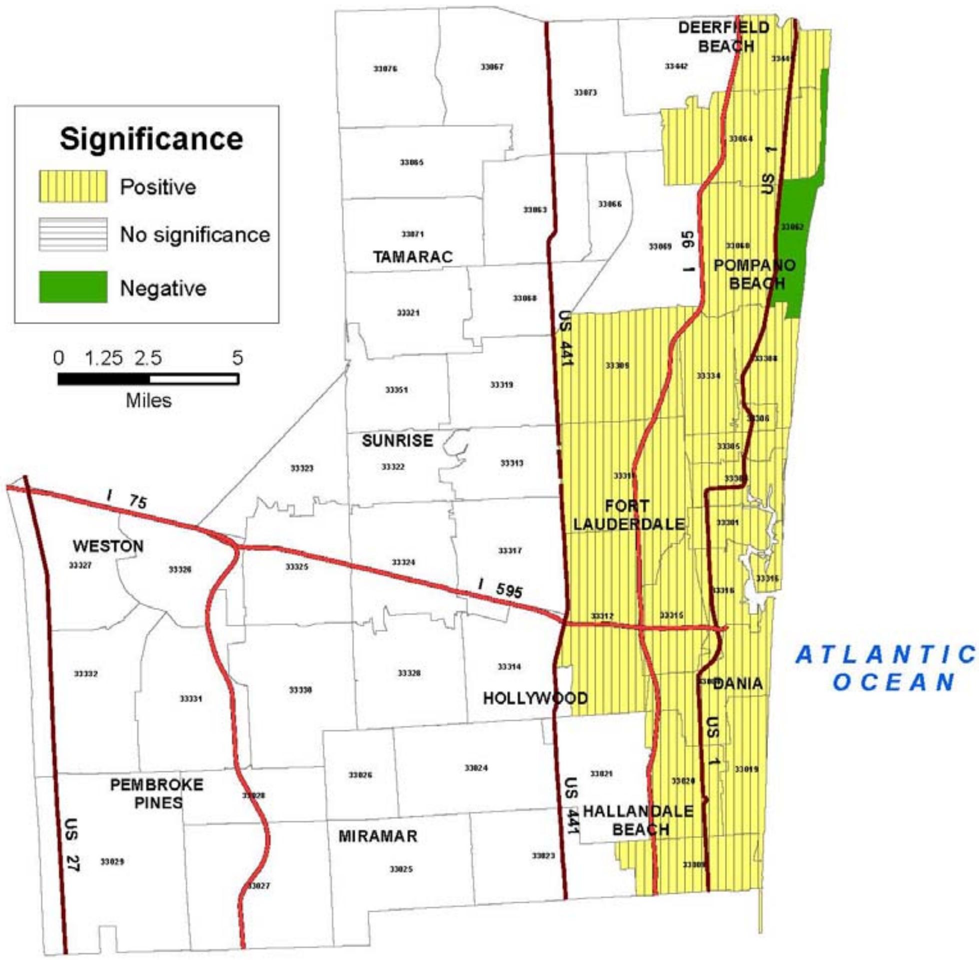
County	Zip	Prem. Load	Model - AAL	Distance to Coast (DtC)	# of obs	(DtC) Significant in Reg. Model
Broward	33004	0.489	1236.97	0.653	1486	***
Broward	33009	0.681	1375.36	1.071	1414	***
Broward	33019	0.512	1931.98	0.124	2045	***
Broward	33020	0.645	1018.85	1.345	4101	***
Broward	33060	0.770	1157.23	0.644	3546	***
Broward	33062	0.359	2183.48	0.093	2142	(Negative)
Broward	33064	0.420	1494.75	0.707	6136	***
Broward	33301	0.746	2612.42	0.150	1576	***
Broward	33304	0.501	1697.65	0.336	1513	***
Broward	33305	0.501	1793.06	0.124	1933	***
Broward	33306	0.525	1905.30	0.121	613	***
Broward	33308	0.802	1956.29	0.289	3368	***
Broward	33309	0.857	854.90	1.167	901	**
Broward	33311	0.831	874.34	0.638	2562	***
Broward	33312	0.681	1187.11	0.281	874	***
Broward	33315	0.653	1071.18	0.268	1971	***
Broward	33316	0.779	2558.95	0.092	1135	***
Broward	33334	0.752	1036.75	0.988	4315	***

Broward	33441	0.396	1481.25	0.615	2746	***
Dade	33032	2.446	686.20	4.118	3223	***
Dade	33033	2.806	602.59	5.854	4013	***
Dade	33035	2.944	512.05	7.316	918	(Negative)***
Dade	33127	0.977	872.44	1.003	726	
Dade	33129	0.856	2171.58	0.245	165	**
Dade	33133	0.945	2156.43	0.429	2860	***
Dade	33136	2.852	336.24	0.905	109	***
Dade	33137	0.614	2129.09	0.306	795	***
Dade	33138	0.950	1469.54	0.615	3146	***
Dade	33139	1.203	4081.55	0.085	534	***
Dade	33140	1.343	3668.86	0.104	1508	
Dade	33141	1.087	2691.42	0.059	1183	(Negative)***
Dade	33143	1.972	1973.78	0.915	1769	***
Dade	33146	2.022	1422.13	0.885	1126	***
Dade	33149	1.295	3484.94	0.164	798	**
Dade	33150	1.136	840.83	1.704	1223	*
Dade	33154	1.078	2656.25	0.111	941	(Negative)***
Dade	33156	2.513	1729.93	1.477	4489	***
Dade	33157	1.650	1143.10	1.681	6744	***
Dade	33158	2.099	1270.32	1.434	1632	***
Dade	33160	0.848	2965.92	0.093	724	***
Dade	33161	1.131	955.12	1.384	3784	***
Dade	33162	0.970	959.48	1.793	4158	***
Dade	33168	1.254	798.01	2.603	1531	**
Dade	33169	1.956	784.28	3.195	211	(Negative)
Dade	33170	2.194	643.52	4.349	639	***
Dade	33176	2.058	961.04	2.326	134	
Dade	33179	1.796	1281.11	1.548	1350	(Negative)***
Dade	33180	1.454	1424.48	0.928	1156	***
Dade	33181	0.679	1919.37	0.184	1050	***
Dade	33189	1.699	844.94	2.279	3368	***
Dade	33190	1.857	794.99	2.432	926	***
Manatee	34216	-0.211	2426.62	0.060	315	
Manatee	34217	-0.219	2081.90	0.075	586	**
Manatee	34228	-0.150	3431.03	0.049	532	**
Pasco	34652	2.434	613.20	0.274	1383	***
Pasco	34667	2.876	463.66	0.423	1142	***
Pasco	34668	2.467	541.96	0.397	340	***
Pasco	34691	2.435	423.51	1.051	2584	***
Pinellas	33706	-0.113	2021.99	0.044	3325	(Negative)***
Pinellas	33708	-0.194	1881.10	0.033	2149	(Negative)***
Pinellas	33715	-0.186	3681.28	0.048	681	(Negative)

Pinellas	33767	0.207	1978.45	0.045	936	(Negative)***
Pinellas	33785	-0.008	1592.77	0.041	929	(Negative)***
Pinellas	33786	0.082	2204.89	0.053	575	(Negative)*

*** - 1% level ** - 5% level *-10% level

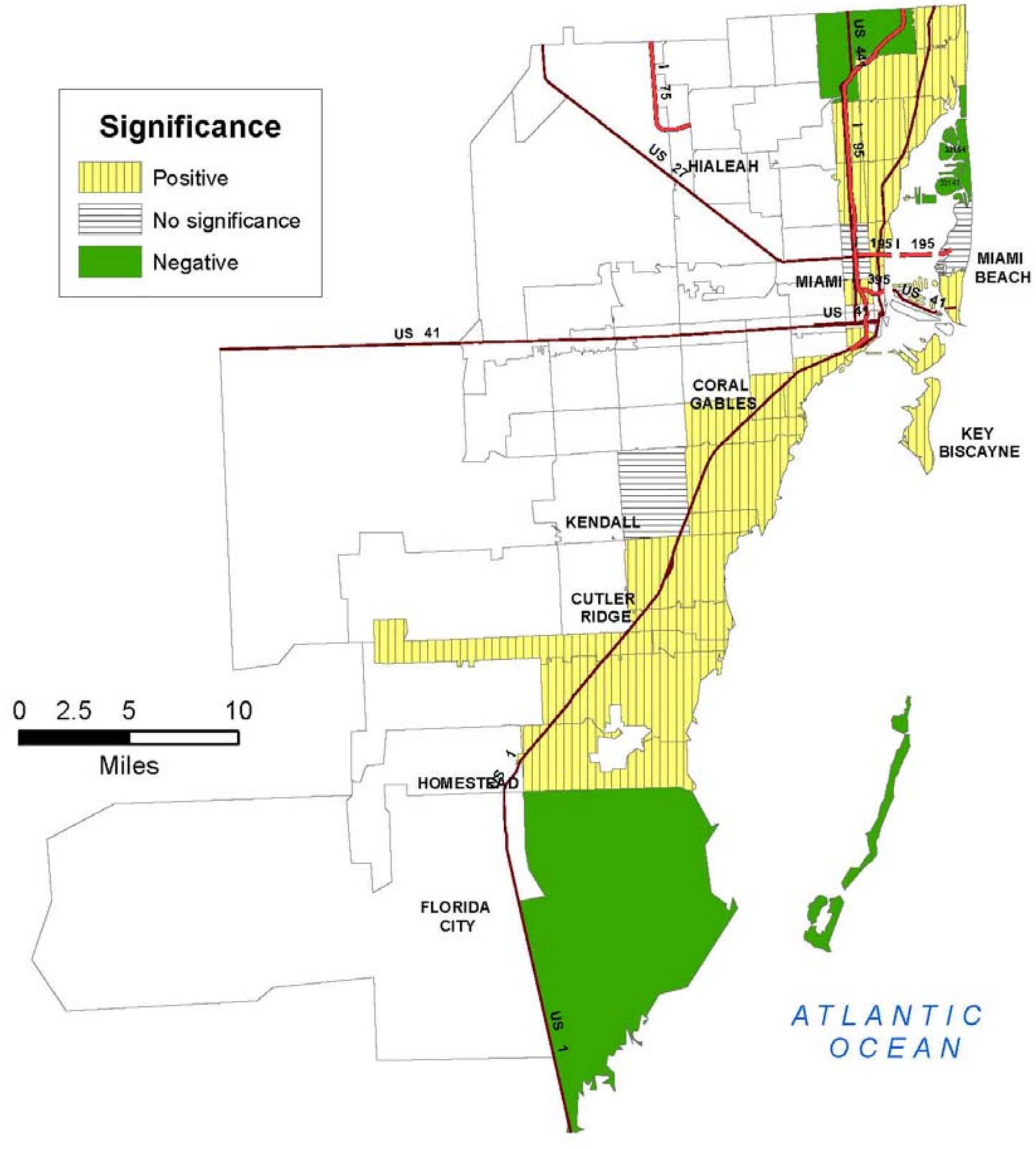
MAP 5
Areas of Significance in Broward County by Zip Code
only eastern portion of county shown

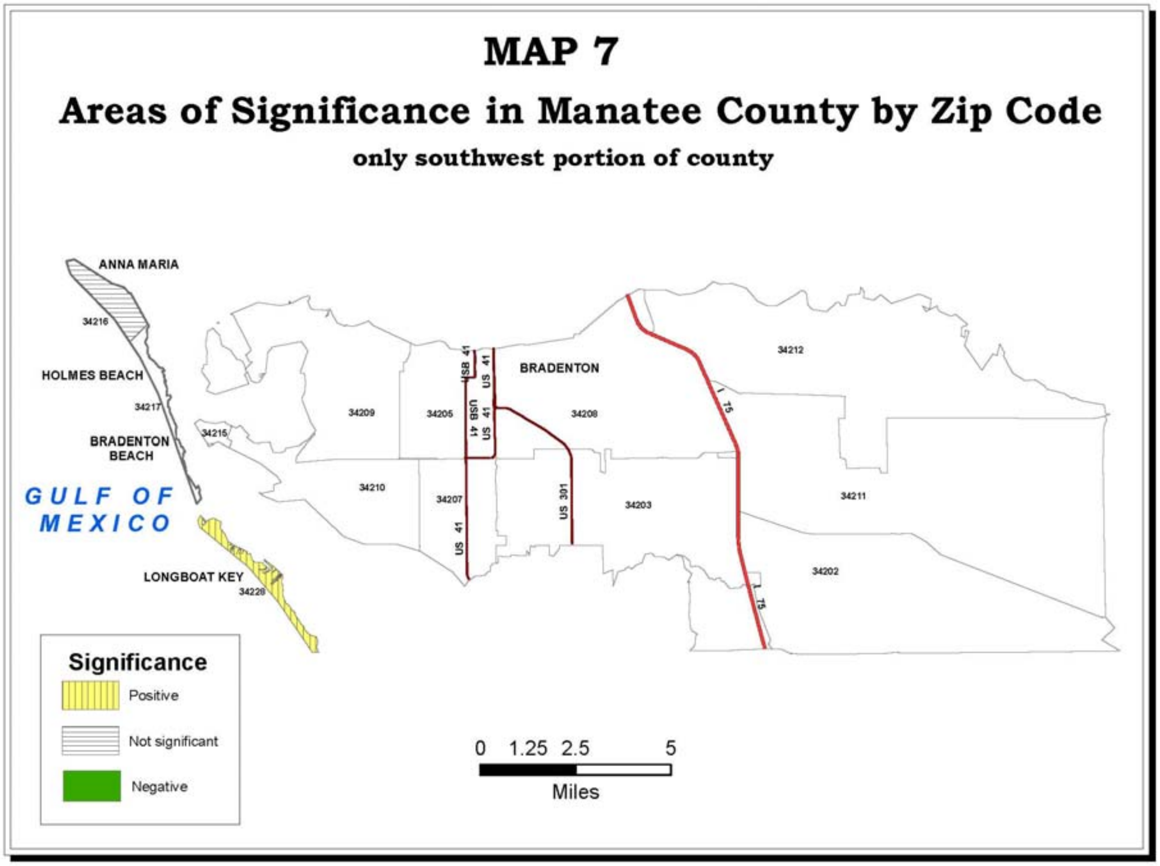


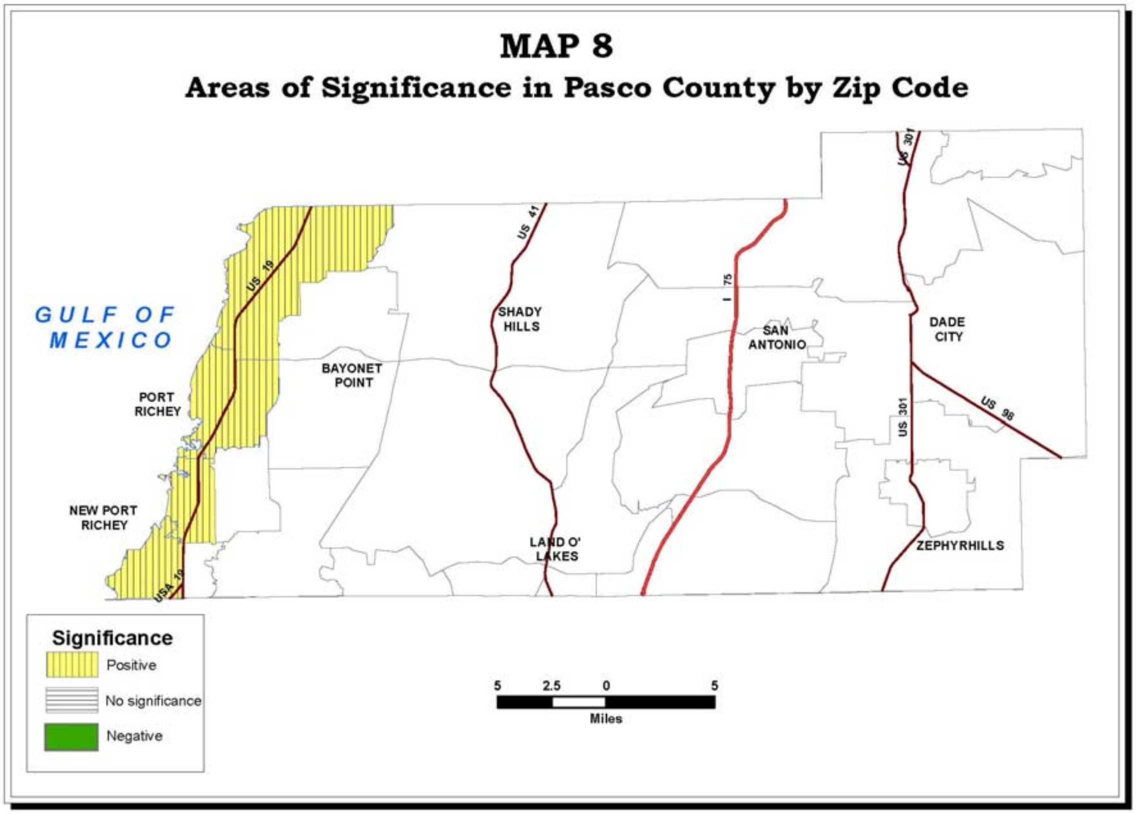
MAP 6

Areas of Significance in Miami-Dade County by Zip Code

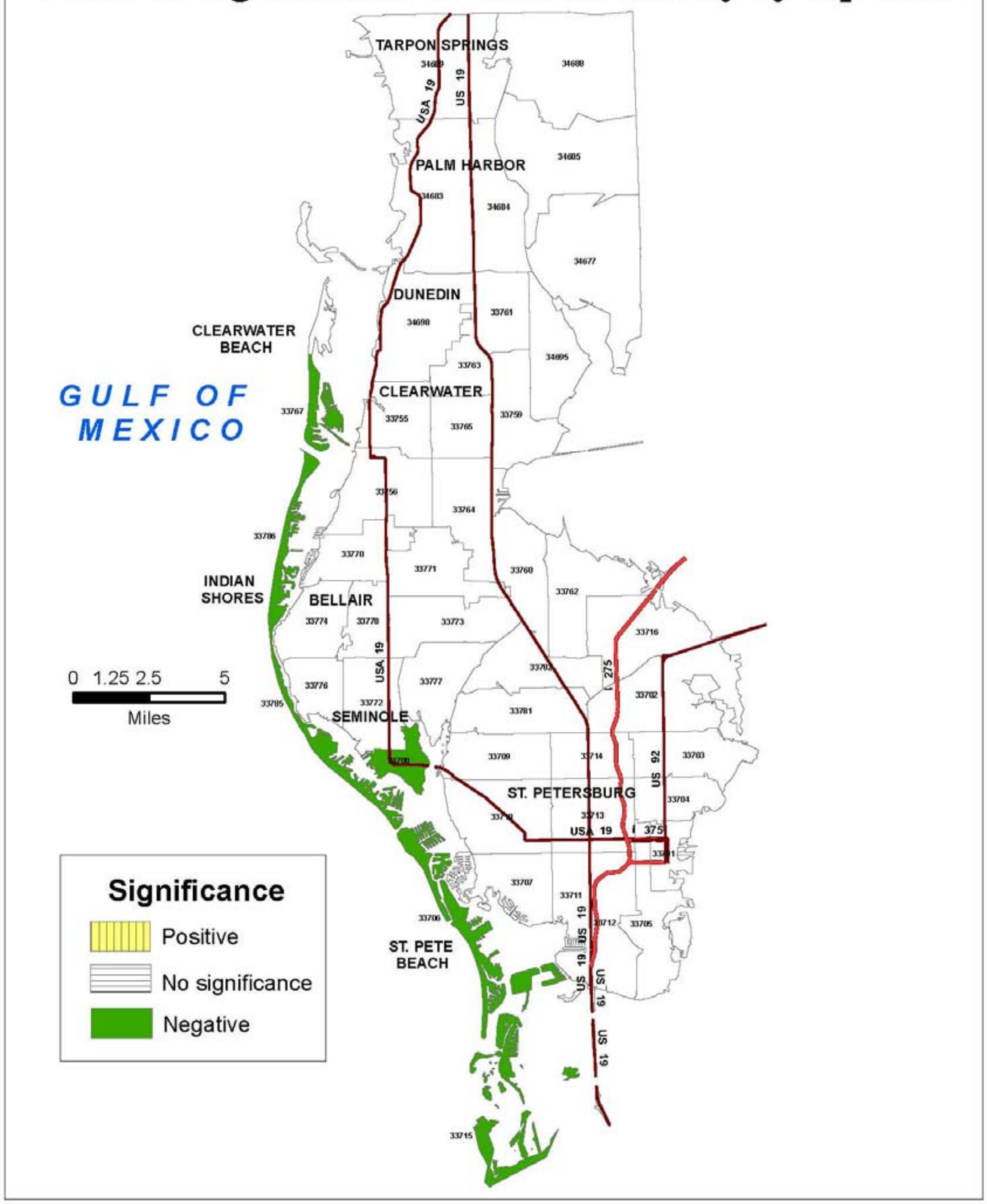
only eastern portion of county shown




MAP 7
Areas of Significance in Manatee County by Zip Code
only southwest portion of county
ANNA MARIA
34216
HOLMES BEACH
34217
BRADENTON BEACH
34215
GULF OF MEXICO
LONGBOAT KEY
34228
34209
34205
USB 41
US 41
BRADENTON
34208
34210
34207
US 301
34203
I 75
34212
34211
34202
Significance
Positive
Not significant
Negative
0 1.25 2.5 5
Miles


MAP 8
Areas of Significance in Pasco County by Zip Code
GULF OF MEXICO
US 19
US 41
I 75
US 301
US 98
USA 19
SHADY HILLS
SAN ANTONIO
DADE CITY
BAYONET POINT
PORT RICHEY
NEW PORT RICHEY
LAND O' LAKES
ZEPHYRHILLS
Significance
Positive
No significance
Negative
5 2.5 0 5
Miles

MAP 9
Areas of Significance in Pinellas County by Zip Code



Economic Interpretation of Results

Care must be taken when interpreting the results presented in this paper. Clearly, there is a significant and positive relationship between distance-to-coast and price of wind insurance along the coastal areas of Florida. This relationship holds in both Northern and Southern Counties as well as on the Atlantic and Gulf coasts. The areas where the relationship does not hold is typically defined by very narrow territorial definitions where there is not much variation in the distance-to-coast among the properties insured. This implies that including distance-to-coast as a rating variable for the wind exposure needs to be explored. It would appear that this variable meets many of the characteristics of rating variables: it is observable, quantifiable, and directly related to loss costs. It should also be socially acceptable, although future demographic research on exactly who is paying relatively more or less needs to be conducted to determine if there would be any disparate impact. A major issue with quantifying the results is the variation in the measure of expected loss, the modeled AAL. The state level regression implies that for every mile the distance-to-coast increases the price of insurance increases by 40%. However, this interpretation is subject to the use of RMS v6.0a as the modeled AAL. Using alternative models, including blending the models, as the modeled AAL still yields the same relationship, that distance-to-coast and price are positively and significantly related, however, the magnitude of that relationship changes. For example, by equally weighting all three models, at the state level the distance-to-coast is still positive and significant at the 1% level, however the price increases at 5.6% for every mile, not 40%.

CONCLUSION

Much has been made in the press about north vs. south and inland vs. coastal with regard to property insurance rates and accuracy of pricing in the state of Florida. The discrepancies in rate accuracy are more localized than these broad comparisons. Even at the zip code level, expected loss costs vary enough to warrant more granular pricing of risk than is currently utilized in the territory-based property insurance rating systems. As evidence of the need for granular pricing with regard to the wind peril in the residential property insurance market, this paper examines the role that distance-to-coast plays in the relationship between expected loss costs and wind premiums in the coastal areas included in Citizen's Property Insurance Corporation's High Risk Account (HRA).

Empirical analysis is performed to determine whether the premiums charged within the Florida property insurance market are commensurate with the risk each location presents. The objective of the pre-loss analysis is to provide evidence regarding whether current homeowners premiums accurately reflect differences in expected losses for different geographic regions.

The relative price of insurance was calculated based on a comparison of wind only premiums being paid in the Citizens HRA relative to the expected loss (average annual loss) as measured by weighted modeled loss costs generated by the modeling organizations. The results show wide variation in not only the magnitude of the prices, but also in who is underpaying/overpaying for insurance coverage. One conclusion of this research is that subsidies exist not only on the intercounty level but also at the intracounty, intraterritory and intrazip code levels.

These results are important to insurers, insureds, citizens and politicians throughout Florida for a variety of reasons. There has been no work estimating the size or duration of the pre-loss inaccurate risk-based pricing in this market, and very little work estimating the post-loss subsidies due to the assessment structure (Cole et al, 2009). This research has implications on the public policy issue of which policyholders in the state of Florida are paying too much or too little for their property insurance coverage. The fact that there is evidence that even in the Citizens HRA territories, policyholders closer to the coast are paying relatively less for insurance than those further inland alters the landscape of the political argument that it is a northern vs. southern counties or inland vs. coastal counties issue. The accuracy of insurance pricing is an intracounty, intraterritory and even intrazip code issue. The impact that these subsidies may have on future exposure and coastal development could be substantial.

REFERENCES

Actuarial Standard of Practice No. 12, Concerning Risk Classification, Actuarial Standards Board (1989).

AIR Worldwide release at www.air-worldwide.com) (June 11, 2008).

Barnes, Gary. "Hurricane." World Book Online Reference Center. 2005.

Bickelhaupt, David, General Insurance, Irwin, (1983).

Brockett, Patrick and Linda Golden, "Biological and Psychobehavioral Correlates of credit scores And Automobile Insurance Losses: Toward An Explanation Of Why Credit Scoring Works," Journal of Risk and Insurance, Vol. 74 Iss. 1, (2007).

Brown, Mark and Martin Halek, "Managing Flood Risk: A Discussion of the National Flood Insurance Program and Alternatives," (A Working Paper 2009).

Cole, Cassandra , David Macpherson., Patrick Maroney., Kathleen McCullough., James W. Newman, Jr., and Charles M. Nyce, "Subsidies in the Post-Loss Assessment Structure of Florida's Property Insurance Market" (A Working Paper 2009). Accessed at: http://www.stormrisk.org/admin/downloads/Post%20loss%20subsidies%20in%20the%20Florida%20Property%20Insurance%20Market%20-%20updated%20040609.pdf .

Collins Center, Academic Task Force on Hurricane Catastrophe Insurance (1995).

Ferreira, Joseph, Jr. "Identifying Equitable Insurance Premiums for Risk classes: An Alternative to the Classical Approach," in Automobile Insurance Risk Classification: Equity and Accuracy. Massachusetts: Division of Insurance (1978).

Florida Office of Insurance Regulation , Task Force on Long-Term Solutions for Florida's Hurricane Insurance Market , Final Report adopted March 2006.

Fronstin, P. and Holtmann, A. G. "The Determinants of Residential Property Damage Caused by Hurricane Andrew," Southern Economic Journal, (1994).

Governor's Property and Casualty Insurance Reform Committee Final Report, (November 15, 2006).

Kucera, Jeff, "A Fresh Look At Rating Territories for Auto and Homeowners Insurance," Insurance Journal (September 6, 2004).

Kucera, Jeff, AAIS Main Event, Vol. 32, No. 4 issue of Viewpoint (2008).

Meier, K.J., **"**The Political Economy of Regulation**:** The Case of Insurance," State University of New York Press - Albany, NY, (1988).

Newman, James W. Jr., "Residual Market Subsidies In Florida's Property Insurance Market." Accessed at: http://www.stormrisk.org/admin/downloads/4-13-09%20Newman%20Subsidy%20White%20Paper.pdf

Shayer, N. , "Driver Classification in Automobile Insurance," Automobile Insurance Risk Classification: Equity and Accuracy. Massachusetts: Division of Insurance (1978).

Trenbeth, Kevin, National Center for Atmospheric Research. (October 22, 2008). Accessed at www.usatoday.com

Venezian, Emilio C., "Interactions in Insurance Classifications," The Journal of Risk and Insurance, 52 (December 1985), pp 571-584.