The Demand for Homeowners Insurance with Bundled Catastrophe Coverages*

Wharton Project on Managing Catastrophic Risks

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Martin F. Grace
Georgia State University

Robert W. Klein
Georgia State University

Paul R. Kleindorfer
University of Pennsylvania

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Abstract

In this paper, we estimate the demand for homeowner insurance in Florida. Since we are interested in a number of factors influencing demand, we approach the problem from two directions. We first estimate two hedonic equations representing the premium per contract and the price mark-up. We analyze how the contracts are bundled and how contract provisions, insurer characteristics and insured risk characteristics and demographics influence the premium per contract and the price mark-up. Second, we estimate the demand for homeowners insurance using two-state least squares regression. We employ ISO's indicated loss costs as our proxy for real insurance services demanded. We assume that the demand for coverage is essentially a joint demand and thus we can estimate the demand for catastrophe coverage separately from the demand for non-catastrophe coverage. Two notable results are that catastrophe coverage is more price sensitive than non-catastrophe coverage and that catastrophe coverage is a normal good whose income elasticity is considerably lower than non-catastrophe coverage, which appears to be a superior good.

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I. Introduction

A. The Problem of Catastrophic Risk

The risk of natural disasters in the U.S. has significantly increased in recent years, straining private insurance markets and creating troublesome problems for disaster-prone areas. The threat of mega-catastrophes resulting from intense hurricanes or earthquakes striking major population centers has dramatically altered the insurance environment. Estimates of probable maximum losses (PMLs) to insurers from a mega-catastrophe range from $50-$115 billion depending on the location and intensity of the event (RMS/ISO, 1995).[1] Under current conditions, many insurers could become insolvent or financially impaired if a mega-catastrophe occurred, with rippling effects throughout insurance markets and the economy (ISO, 1996a).[2]

Increased catastrophe risk poses difficult challenges for insurers, reinsurers, property owners and public officials (Kleindorfer and Kunreuther, 1999). The fundamental dilemma concerns insurers' ability to finance low-probability, high-consequence (LPHC) events, which generates a host of interrelated issues with respect to how the risk of such events are managed, financed and priced at various levels (Russell and Jaffe, 1997). Insurers have sought to raise their prices and decrease their exposure to catastrophe losses, while looking for efficient ways to diversify their exposure through reinsurance and securitization.

However, state legislators and insurance regulators have resisted insurers' efforts to raise prices and terminate policies in an attempt to preserve the availability and affordability of insurance coverage (Klein, 1998). Regulatory restrictions have been complemented by state residual insurance mechanisms with significant flaws (Marlett and Eastman, 1997). Government policies have imposed significant cross-subsides from low-risk to high-risk areas as well as cross subsidies from non-catastrophe lines of insurance to the catastrophe lines. These policies distort incentives and undermine the ability of market forces to make necessary adjustments and operate effectively in managing catastrophe risk (Grace, Klein and Kleindorfer, 1999).

B. Overview of Study

As concerns about natural disasters have assumed center stage, economists have begun to explore the special problems they pose and their implications for insurance markets. Understandably, recent research on catastrophe risk has focused on the topics of industry capacity, reinsurance, securitization, and mitigation. Yet, much less is known about the microeconomics of catastrophe insurance markets at the primary level (i.e., transactions

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[1] These maximum probable loss (PML) estimates are based on a 500-year "return" period. In other words, the probability that a loss would occur in any given year that would exceed the PML is one in 500.

[2] An Insurance Services Office (1996a) study estimated the impact of severe catastrophes on the financial condition of 80 insurer groups that report detailed statistical data to ISO. Utilizing catastrophe models, ISO estimated that a mega-catastrophe causing $50 billion or more in insured losses could result in 36 percent of insurers becoming insolvent and many more becoming financially impaired, depending on their location. The ISO analysis included estimates of the impact of insurers' reinsurance arrangements based on information available from Best's Reports. The companies in the ISO sample represented approximately 28 percent of total industry property insurance premiums. For a model and further estimates of industry capacity to cover catastrophe losses, see also Cummins, Doherty and Lo (1999).

between primary insurers and individual consumers). Analyzing the supply of and demand for catastrophe insurance and integrating this analysis with research on risk diversification and mitigation is essential to formulating a more complete picture of the catastrophe risk problem and evaluating viable solutions.

Consequently, a study of the industrial organization of residential/catastrophe insurance markets under regulatory constraints is an important component of the Wharton Project for Managing Catastrophic Risks. This component has several primary objectives:

1. Assessment of insurers' exposure to catastrophe losses and its implications for the financial viability of the industry and the distribution of costs among different stakeholders;

2. Analysis of the industrial organization of catastrophe insurance markets and the structure and dynamics of supply and demand under current and alternative institutional scenarios;

3. Examination of the influence of reinsurance, securitization and mitigation on the supply of catastrophe insurance at the primary level;

4. Evaluation of the degree of rate inadequacy and cross subsidies for catastrophe insurance coverages and the expected effects of easing various regulatory constraints; and

5. Identification of other policy and regulatory reforms that could improve the management of catastrophe risk and their likely micro and macro effects.

This paper is the fourth in a series of research papers that constitute the first significant attempt to examine the nature of the supply of and demand for insurance against natural disasters at a detailed, micro-economic level.[3] Our examination has been made possible with the unprecedented assembly of an extensive, detailed database on residential insurance transactions affected by catastrophe risk.[4] These data are supplemented by information on insurer financial and organizational characteristics and the demographics of residential households at a Zip code level.

Our study is exploring several significant aspects of residential insurance markets threatened by natural disasters. Our initial work encompasses: 1) the key determinants of the demand for residential/catastrophe insurance and their effects on the quantity, quality and price of insurance purchased; 2) the influence of insurer cost structures and other factors on the amount of insurance supplied; and 3) the effect of regulatory price restrictions and cross subsidies on residential insurance transactions. Among the phenomena we seek to illuminate are the sensitivity of demand and supply to prices, policy features and the bundling/unbundling of perils and coverages. We also are interested in how insurers' scale, scope and spatial economies interact with risk concentration and solvency in influencing the supply of insurance.[5]

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[3] A "master monograph" (Grace, Klein and Kleindorfer, 2000) is available that presents additional information about this research, including discussion of the institutional context for catastrophe insurance markets and detailed descriptions of the data used.

[4] These data were provided to the authors on a confidential basis by the Insurance Services Office (ISO). The insurers included in this database granted explicit permission for the authors to use these data under a confidentiality agreement.

[5] Scale economies occur when a firm's average cost per unit of production decreases as it expands output. Spatial economies occur when a firm's average costs decrease as its operations or sales become more geographically concentrated. For example, it may be more efficient for an insurer to service 1,000 policies

In this paper, we focus our analysis on demand side of homeowners insurance transactions in Florida. We also have data that we will employ to develop a corresponding demand model for New York. Further we hope to build a complementary supply model for both states and also integrate transactions for dwelling fire and extended coverage.[6] This will enable us to compare the implications of the different market and regulatory environments in these two states.

C. Summary of Initial Findings

At least two interesting observations arise from this analysis. First, we find that catastrophe coverage is more price sensitive than non-catastrophe coverage. Second, catastrophe coverage is a normal good whose income elasticity is considerably lower than non-catastrophe coverage, which appears to be a superior. Our observations concerning other statistical results remain more tentative until we refine the specification of our model.

The paper proceeds as follows: Section II provides background on the demand for insurance that we will use in our methodology; Section III contains a description of the methodology and the results; Section IV summarizes the results of our analysis and briefly describes future research directions.

II. The Demand for Homeowners Insurance in Florida

A. Introduction to the Demand Analysis

To obtain estimates of the demand for homeowners insurance products, significant amounts of micro-level data are required. With the assistance of the Insurance Services Office (ISO), we obtained information from a group of primary insurers writing business in Florida and New York that report detailed premium and exposure data to ISO. We use the data for the four-year period 1995-1998 for the analyses that are reported here.[7]

The database contains full homeowners premium and exposure data for 60 companies, comprising some 20 groups, taken as a snapshot in the first quarter of each of the four years, 1995-1998. Each exposure record contains slightly aggregated information on similar groups of policies in every Zip code in which reporting companies did business. The information contains relevant data regarding the characteristics of the policies actually purchased by homeowners for each such company, including premiums, structural information on the nature of the insured property, and coverages purchased. Additionally, we have compiled

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concentrated in a given metropolitan area than geographically dispersed throughout a state. Finally, economies of scope refer to cost savings obtained from the joint production and marketing of certain products and services. For example, an insurer may reap scope economies from marketing and underwriting homeowners and personal auto insurance to the same insured. See Grace, Klein and Kleindorfer (1999) for a more detailed discussion of scale economies, spatial economies and scope economies in homeowners insurance.

[6] A small but significant proportion of homes (roughly 10 percent) are insured by dwelling fire policies that also may include extended coverage. These transactions are of interest as they represent a different approach to covering property risks than the more common homeowners multiperil package policies. The less bundled nature of these contracts may be more attractive to some insurers and homeowners when high catastrophe risk causes high prices for homeowners multiperil policies.

[7] The sample of insurers was drawn from the top 50 insurer groups in New York and Florida in terms of market share. It should be noted that our database contains only a subset of insurers that report statistical data to ISO. While a cross-section of companies is represented in terms of size, organizational forms, and distribution systems, large direct writers that do not report to ISO are not included in this analysis. In subsequent analyses, we hope to include data from large insurers who do not report data to ISO. Further, we have not yet compared our sample companies with all companies writing homeowners insurance in New York and Florida to see how accurately or sample reflects the total markets in these states.

financial and organizational data on the insurers in our sample, as well as household economic and demographic data (from the 1990 Census) by Zip code.

By analyzing locational information (Zip code, standard ISO reporting territory and community characteristics), information on the company selling the policy, and Census information on the socio-demographic characteristics of each Zip code, a very rich picture of the nature of demand for homeowners insurance coverage can be deduced using standard econometric techniques. It should be noted that the database constructed has exposure records for Florida and New York for both homeowners multiperil coverages as well as dwelling fire and extended coverage policies that offer less bundled coverages for non-catastrophe and catastrophe perils. This paper will focus only on homeowner multiperil coverage policies in Florida, leaving to a later paper the joint analysis of multiperil and dwelling fire policies as well as an analysis of the supply and demand for homeowners insurance in both Florida and New York. The peril of interest in this vein of research is windstorm, particularly hurricanes.[8] We first provide a brief introduction to the foundations of the modeling used in this process.

B. Modeling the Demand for Insurance Products

Introduction to the Structure of Demand for Homeowners Insurance

There are several features of this market that serve to constrain and structure the analysis of demand. First, we assume that homeowners insurance, including coverage against windstorm damage, is essentially mandatory, although some homeowners may elect a "no coverage" policy, i.e., they have no property insurance.[9] (Consider this "no coverage" option as purchasing an insurance product with "infinite deductibles" at a price of zero.) Also, insureds may elect to exclude wind coverage from their policy. Second, as a number of previous analyses have shown (e.g., Joskow, 1973; Cummins and Weiss, 1991; and Grace, Klein and Kleindorfer, 1999), the market for homeowners insurance products is workably competitive.[10]

The basic demand problem for the homeowner is to select a single optimal policy from among the menu of policies offered in the market. This involves a complex tradeoff among the various attributes of the coverage and options purchased, the characteristics and needs of the homeowner, and the perceived quality of the companies from which coverage can be purchased. Demand in this market arises from the optimal consumer choice of a bundle of product and company attributes, given the personal characteristics of each homeowner and the economic and demographic characteristics of the neighborhood (i.e., Zip code) where he resides. The feasible set of such "bundled products" is the set of insurance policies, coverage options, and company attributes that can be sustained in a competitive equilibrium under certain regulatory constraints.[11]

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[8] In later work we may attempt to model the supply and demand for earthquake insurance in states such as California and Missouri. However, the data for such an analysis is more limited and the role of the California Earthquake Authority presents some special challenges.

[9] Lenders typically require hazard insurance for homes with mortgages. It is possible that some homeowners without a mortgage have opted not to purchase insurance. We shall control for this in the models below using census data (as of 1990) on the percent of homeowners having mortgages in each ZIP code represented in our sample. However, insurers typically require homeowner to insure 80 percent (or more) of the value of real estate (as the land is not insurable). It is quite possible that people might still have mortgage payments to make, but opt out of insuring because the mortgage is less than 20 percent of the property's value.

[10] Indeed, the standard structural and performance benchmarks, such as concentration ratios and various financial indicators of profitability and excess profits, would underscore this statement.

[11] In this paper, we do not explicitly model or estimate the effects of regulatory constraints. We have conducted some preliminary analysis in this area and will incorporate a regulatory component in future papers.

The theoretical foundation for this demand analysis, and the interacting market equilibrium, are based on a model of price-quality competition (e.g., Gal-or, 1983). In a competitive market, the differences in what homeowners are willing to pay for various features will be reflected in the price at which various bundled products with these features sell. Thus, what we model is essentially a regression of observed price in the market against various features of the products sold and the companies that sell them. We are interested in the factors that appear to influence demand and whether these factors appear reasonable on the basis of theory. Since there is considerable evidence that many homeowners do not search thoroughly for "best offers", we are also interested in aspects of the market that appear to arise from behavioral considerations (e.g., Kunreuther, 1998b), including the price dispersion of similar policies offered in the same territory.[12]

At the outset, we rely on the following features of the homeowners insurance market in our modeling. While the structure of this market may be workably competitive, it is nonetheless a regulated market (Klein, 1998). On the demand side, this does not occasion any theoretical difficulties as the model we develop attempts only to explain, for policies actually offered in the market, how various features are valued, within the feature (e.g., various deductible levels) and across features (e.g., deductible levels versus type of coverage). It is important to bear in mind that, because of regulation, the set of policies offered in the market, and their prices in particular, are not necessarily the result of a perfectly competitive market.

We assume that the set of policies offered by companies, together with their underwriting and marketing strategies, are expected profit maximizing, subject to imposed regulatory constraints. This suggests that companies find the regulatory policies imposed not so onerous as to cause them to leave the state. Nonetheless, because of such policies, catastrophe coverages in some areas might require "underbracing" or cross subsidies from other lines of business, non-catastrophe coverages and catastrophe coverages in other areas. These cross subsidies may be sustainable in equilibrium if they allow insurance companies to earn a reasonable rate of return on all lines of business and if they are supported by consumer preferences for certain feature bundles and cross-marketing. The continuation of these cross subsidies over time implies some further inertia that may, at least in part, be due to regulatory restrictions on terminating policies and other insurer and consumer considerations.[13] Beyond the obvious implications for understanding rate adequacy and precision, this suggests the importance of detecting cross-marketing synergies in the demand and supply analysis, as well as detecting trends in the aggregate supply of particular insurers in terms of increasing the diversification of their portfolios of insurance policies.

Defining Price and Modeling Demand for Homeowner Policies

Assume that a particular homeowner, with characteristics Z (income, family status, type of structure, etc.), faces a choice among different policy options for insuring his home, where the set H gives the available policy options in the homeowners market. A typical such option "h" in the set H would be one offered by firm i (with characteristics X_i) with certain policy features such as deductible levels, loss settlement provisions (i.e., actual cash value or replacement cost), and premium $P(h)$. The homeowner must choose one of the options in H

[12] We should note that one source of price dispersion is the fact that insurance companies differentiate themselves in term of underwriting stringency. Insurers with more stringent underwriting standards, labeled "preferred insurers", tend to have the lowest prices. "Standard" and "non-standard" companies tend to have higher prices. Some insureds may pay higher than necessary prices if they would qualify for coverage from a preferred insurer, but intentionally or inadvertently purchase coverage from a standard or non-standard insurer.

[13] See Bartlett, Klein and Russell (1999) for a discussion of how regulation-imposed insurance price subsidies may be sustained for a period of time.

and does so by maximizing his expected utility over the risks or gambles implied by each choice *h*. Let us represent this expected utility *U(h, P(h))* in quasi-linear form[14] as:

$$U(h, P(h), Z) = V(F(h), Z) - P(F(h), Z) \quad (1)$$

where *V* represents, for a consumer of type *Z*, the consumer's willingness to pay for various coverages or "features" of an insurance policy and *F(h)* represents the vector of such features, including the characteristics of the company offering the policy that may make a difference to consumers. Note that both *V* and *P* are shown to depend on only the vector of features *F* and the characteristics of the homeowner (possibly only the type of structure, but perhaps also such locational characteristics as community rating or location of nearest fire department). This is without loss of generality since one of these features could itself be the premium level *P(h)*. The homeowner then maximizes the function *U(h, P(h), Z)* over the set *H*. Assuming that the features can be more or less continuously varied (that is, there is a rich menu of policies available in the market), we can represent the choice problem as choosing an insurance policy by choosing optimal features of the policy. This leads to a solution to the homeowner's maximization problem characterized by $MV/MF_i = MP/MF_i$, which of course varies with consumer characteristics *Z*. From this logic, one can understand the structure of demand in this market by examining the structure of how premiums vary with policy features.[15] This leads to estimation problems of the following general type, neglecting for the moment the details here of functional form:

$$P(F, X, Z) = aF + bX + cZ + \varepsilon \quad (2)$$

where we have separated the policy features into categories: those pertaining to the policy itself (the vector *F*); those that pertain to the company (the vector *X*); and those pertaining to neighborhood characteristics (the vector *Z*). In this model, *P(F, X, Z)* could be either the total premium for a given policy or more likely, normalizing by units of coverage (e.g., the expected or indicated loss costs), premium per unit of coverage.

"Price" for insurance products, as for other products and services, is defined on the basis of value-added per unit (in this case, per dollar) of output. At the policy level, this value-added measure of price can be captured by subtracting the discounted value of expected losses covered by the policy from the policy's premium.[16] Denoting by *L(F, Z)* the expected losses for a policy *h* with features *F* and by *P(F, X, Z)* its premium, we obtain the following

[14] As Willig (1976) has shown, this form, with constant marginal utility of income, is appropriate for demand modeling when the good in question does not absorb a significant fraction of the homeowner's budget, a reasonable assumption in the case of insurance (the typical homeowners insurance premium is around $300-$500 and somewhat higher in catastrophe-prone areas). This is not to say, of course, that there are no income effects across consumers, only that the marginal utility of income for each consumer is assumed constant over the range of policy options offered.

[15] Indeed, if V and P are estimated using bilinear or translog families of functions, then knowledge of one will lead (up to a constant of integration) to knowledge of the other.

[16] Note that we do not consider the effects of taxes in this model. See Myers and Cohn (1987) and Cummins (1990) for a more detailed discussion of "price" in the insurance context. See also Cummins, Weiss and Zi (1999) for a related empirical study of price and profitability using frontier efficiency methods. As noted in the latter paper, the definition of price in (3) properly accounts for the insurer's expenses and the opportunity costs of the owner's capital invested in the insurance business.

definition of price *p(F, X, Z)* for a homeowners policy *h = (F, X, Z)* characterized by the parameters *(F, X)* and indexed by consumer and loss characteristics *Z*:

$$p(F,X,Z) = \frac{P(F,X,Z) - PV((L(F,Z))}{PV(L(F,Z))} = \frac{(1+r)P(F,X,Z) - L(F,Z)}{L(F,Z)} \quad (3)$$

where *PV(L(F, Z)) = L(F, Z)/(1+r)* is the present value of expected losses on the policy for the policy period and "*r*" is the insurer's return on equity for the period. *L(F,Z)* is the indicated loss costs per unit of coverage for the policy features (*F*) and structure (*Z*) in question. We will, in fact, directly estimate (3) using a functional form similar to (2). For the ISO database underlying this study, we have information on the premium charged for each policy (or group of identical policies), "*r*" is the average ratio of investment income to earned premiums for insurers, and *L(F, Z)* represents the advisory Indicated Loss Costs (ILC), as computed using ISO filed loss cost manuals and rules, for the policy characteristics *(F, Z)*.[17]

We further analyze the Indicated Loss Costs. We employ our indicated loss costs as a measure of real insurance services output. Using ISO loss cost filing information, we calculated an expected indicated loss cost for each contract.[18] That is, ISO loss cost information can be used to determine the expected loss costs for a given homeowners policy form that covers a brick house in Zip code 30029 with certain specified coverage provisions and endorsements/exclusions, such as ordinance/law coverage. ISO also has provided information on catastrophe loss costs and a non-catastrophe loss costs that we have applied to each possible combination of location, policy form, and additional contract terms. Thus, we can estimate three additional regressions.

Indicated loss costs for a particular policy are an estimate of the expected claims costs (including claims adjustment expenses) of insurance coverage under the terms of that policy for a particular house. Thus, indicated loss costs are a proxy for the amount of insurance embodied in a specific policy. One could also employ the Coverage A limit as a proxy for the insurance embodied in a policy. However, while the Coverage A limit reflects the homeowners perceived value of the home, it does not necessarily reflect the risk of loss to the home.[19] It is essentially the maximum possible loss rather than the expected loss.[20] We will therefore focus on indicated loss costs.

As mentioned above, three loss cost equations will be estimated. The first is for the

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[17] We discuss the ISO procedures briefly in Grace, et. al., (1999) and in Grace, et. al. (2000). For the moment, the reader should take these advisory Indicated Loss Costs as our best estimates of the expected annual costs resulting from policy features, structural characteristics and location of a property. The non-catastrophe portion of Indicated Loss Costs is based on actuarial experience and the catastrophe portion is based on catastrophe modeling results. As discussed below, the expected loss costs implied in individual insurers' prices can vary from the ISO Indicated Loss Costs, which represent overall industry projected costs. Also, Indicated Loss Costs are not necessarily the same loss costs approved by regulators.

[18] ISO advisory loss costs filings and associated information present indicated, filed and implemented (i.e., approved) loss costs for a "base" policy and a number of rating factors and rules which effectively enable one to calculate a loss cost for a particular policy, reflecting a set of standard coverage and risk characteristics.

[19] Insurers typically require homeowners to insure at least 80 percent of the insured value of their home (e.g., its market value or replacement cost) and are reluctant to sell coverage significantly exceeding market value or replacement cost. Most insurers use a model or formula to estimate the market value or replacement cost of a home.

[20] Actually, the maximum expected loss encompasses the limits of all non-liability coverages minus deductibles, but other coverage limits are typically stated as percentages of the Coverage A limit. The standard HO3 policy contains standard percentage limits for these other coverage, but insureds may select alternative limits.

catastrophe coverage and the second is for the non-catastrophe coverage. The third will be for the total coverage.

They will be of the following form:

$$(4) \qquad L(F,Z)_{i=C,NC,TOT} = \beta_1 F + \beta_2 Z + \beta_3 X + \beta_4 P + e$$

where $L(F,Z)_i$ reflects the quantity demanded of real insurance services measured by the Indicated Loss Costs for catastrophe, non-catastrophe, or total coverage, *F* represents a vector of policy form terms, *Z* represents a vector of neighborhood characteristics, *X* represents a vector of company characteristics, and *P* represents price.

These general forms of the Premium equation (2), the Price equation (3) and the Loss Cost equations (4) will serve as the basis for our estimation procedures. They incorporate both non-catastrophe perils and catastrophe perils or windstorms. The reader may think of these simply as separate features of the policy in question. We are interested in identifying the separate effects of these factors in our empirical analysis.

Hypotheses

The received theory on factors influencing demand for insurance products is rich and long, both in terms of the rational consumer model (e.g., Arrow, 1971) as well as in behavioral and experimental studies of protective behavior (e.g., Kunreuther, 1998b). The basic theory recognizes that, through pooling, insurance provides a mechanism to reduce the volatility of losses at a price, the "risk premium" or loading, that risk averse consumers are prepared to pay. Competition then assures that the coverages that are provided in the market are produced efficiently so as to minimize the total costs of providing such coverages, including the capital costs backing these policies. Behavioral and experimental studies of insurance underwriters and consumers (Kunreuther, et al., 1995 and Kunreuther, 1996), however, show that both the supply and demand of insurance is more complicated in reality. This is especially true in areas like catastrophe insurance where understanding and evaluating the peril itself is more difficult. Thus, in what follows, we begin with the standard hypotheses derived from the normative theory based on risk pooling among risk averse individuals. We are also interested in such issues as price dispersion (for similar policies), which would suggest less-than-complete consumer search or other "market imperfections" on the demand side.

C. Descriptive Statistics for Various Policies in Florida

The basic contract features of the Florida policies are summarized in Table 1. The HO3 policy is the typical contract sold. It has coverages for the home and attached structures, detached structures, personal property, loss of use, personal liability, and medical payments to others. There are also options (not shown in Table 1) to cover personal property at a greater value than the standard limits, or to cover liability at a greater level than the standard limit ($100,000), e.g., 10 percent of the home's insured value. The major difference between an HO3 policy and an HO5 policy is that the HO5 policy has broader coverage provisions built in. While replacement cost coverage on personal property or contents is optional for the HO3 policy, it is a standard term of the HO5 policy.[21] Ordinance or law coverage is typically

[21] Under the standard HO3 policy, the dwelling and other structures are covered on an "open perils" basis with losses settled according to the replacement cost of destroyed property. Contents or personal property are typically covered on a "named perils" basis with losses settled according to their actual cash value. Actual cash value is equal to replacement cost minus estimated depreciation or estimated market value. For other, more limited policy forms, all coverages are on a "named perils" basis, and losses may be settled according to replacement cost or actual cash value depending on the specific policy form and coverage (see Rejda, 1998).

chosen as an endorsement on HO3 policies while it is a standard coverage in HO5 policies.[22] Also, HO3 policies typically cover contents on a “named-perils” basis, while HO5 policies typically cover contents on an “open-perils” basis.[23] Finally, there is a wind device protection credit that consumers in Florida can obtain if they have installed specified mitigation features, such as storm shutters or roof tie-downs.

Table 1
Comparison of Florida Homeowners Contracts Basic Terms

	Policy Form		
Contract Terms …	HO3 Typical	HO5 Most Comprehensive	HO8 Least Comprehensive
Insurance Covers …	Everything Except Exclusions (all perils)	Everything Except Exclusions (all perils)	Only Specifically Included Items (named perils)
Home	x	x	x
Other Attached Property and Structures	x	x	x
Personal Property	x	x	x
Loss of Use	x	x	x
Personal Liability to Others	x	x	x
Medical Payments to Others	x	x	x
Replacement cost Coverage or Repair	Repair but Endorsement Available (contents)	Replace	Repair (contents and Home)
Ordinance or Law Coverage	Endorsement Available	x	Endorsement Available?

Source: Authors' analysis of Standard ISO Contracts for Florida

The difference between the HO3 and HO5 policies and the HO8 policies is the overall comprehensiveness of the coverage. HO5 and HO3 contracts provide open-perils coverage (except HO3 provides named-perils coverage on contents) except those specifically excluded while the HO8 policy covers a less inclusive list of named perils. HO8 policies have been designed primarily for homes in older urban areas.[24]

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[22] Ordinance or Law Coverage will upgrade a rebuilt house after a covered loss to the current building code. Without the coverage, the house will be "repaired" or rebuilt according to code only as long as doing so does not exceed the Coverage A limit on the policy.

[23] ”Named-perils coverage encompasses a long list of perils, including windstorms, but if losses are caused by a peril not listed, the burden of proof is on the insured to show the loss is covered. Under “open-perils” coverage, all perils are assumed to be covered unless specifically excluded and the burden of proof is on the insurer to show that a particular loss is caused by a specifically excluded peril.

[24] HO-8 policies cover a more limited set of perils than other policy forms and theft coverage is restricted to property on the premises with a limit of $1,000. Also, as HO8 policies are often written on old homes, the insurer agrees to repair or replace a damaged home with materials of like kind and quality but not necessarily original materials or special workmanship such as plaster walls or intricate wooden moldings.

Table 2

Some Descriptive Statistics on Florida Homeowners Contracts with Various Contract Terms

(contracts are summed to the level of the Zip code)

HO 3 Contracts

Variable Label	N	Mean	Std Dev	Minimum	Maximum
Premiums Per Contract In Zip Code	41,089	760.51	1927.20	2.00	17268.18
Log Of Premium Per Policy	41,089	6.44	1.60	0.69	9.61
(Premiums - Indicated Loss Costs)/Indicated Loss Costs	41,089	1.21	1.89	0.00	4.90
Log Of (Price + 1)	41,089	0.04	1.75	-8.10	1.59
Dummy For Windstorm Protection Credit	41,089	0.06	0.59	0.00	1.00
Fire Deductible In $	41,089	368.65	784.29	100.00	1200.00
Wind Deductible In $	41,089	346.05	1176.77	0.52	5000.00
Dummy Variable Of Ord Or Law Coverage	41,089	0.63	1.09	0.00	1.00
Dummy Value Of Subline = 1 If Replacement Cost	41,089	0.92	1.07	0.00	1.00
Dummy Var =1 If Wind Portion Transf'D To Pool	41,089	0.00	0.00	0.00	0.00
Ratio of ISO ILC for Cats to Total ISO ILCs	41,089	0.46	0.85	0.03	0.91
Log Of Iso Cat Related Indicated Loss Costs	41,089	5.50	4.66	2.03	10.14
Log Of Iso Non-Cat Related Indicated Loss Costs	41,089	5.74	1.45	4.38	9.03
Percent of Total Zip level Policies that are HO3	96.44%				

HO 5 Contracts

Variable Label	N	Mean	Std Dev	Minimum	Maximum
Premiums Per Contract In Zip Code	1,457	934.34	1859.98	18.00	8856.33
Log Of Premium Per Policy	1,457	6.61	1.49	2.89	8.96
(Premiums - Indicated Loss Costs)/Indicated Loss Costs	1,457	0.78	1.24	0.06	3.03
Log Of (Price + 1)	1,457	-0.42	1.71	-4.53	1.21
Dummy For Windstorm Protection Credit	1,457	0.01	0.11	0.00	1.00
Fire Deductible In $	1,457	490.45	590.17	150.00	1200.00
Wind Deductible In $	1,457	477.84	690.23	1.62	5000.00
Dummy Variable Of Ord Or Law Coverage	1,457	0.00	0.00	0.00	0.00
Dummy Value Of Subline = 1 If Replacement Cost	1,457	1.00	0.14	0.00	1.00
Dummy Var =1 If Wind Portion Transf'D To Pool	1,457	1.00	0.14	0.00	1.00
Ratio of ISO ILC for Cats to Total ISO ILCs	1,457	0.47	0.76	0.03	0.89
Log Of Iso Cat Related Indicated Loss Costs	1,457	6.14	4.68	2.69	9.90
Log Of Iso Non-Cat Related Indicated Loss Costs	1,457	6.34	1.61	4.88	8.63
Percent of Total Zip level Policies that are HO5	3.54%				

HO 8 Contracts

Variable Label	N	Mean	Std Dev	Minimum	Maximum
Premiums Per Contract In Zip Code	60	498.72	143.94	308.00	889.00
Log Of Premium Per Policy	60	6.18	0.27	5.73	6.79
(Premiums - Indicated Loss Costs)/Indicated Loss Costs	60	1.75	0.66	0.64	2.76
Log Of (Price + 1)	60	0.50	0.44	-0.45	1.02
Dummy For Windstorm Protection Credit	60	0.00	0.00	0.00	0.00
Fire Deductible In $	60	303.72	158.60	250.00	666.67
Wind Deductible In $	60	301.66	161.09	166.96	666.67
Dummy Variable Of Ord Or Law Coverage	60	0.85	0.38	0.00	1.00
Dummy Value Of Subline = 1 If Replacement Cost	60	0.00	0.00	0.00	0.00
Dummy Var =1 If Wind Portion Transf'D To Pool	60	0.00	0.00	0.00	0.00
Ratio of ISO ILC for Cats to Total ISO ILCs	60	0.23	0.22	0.07	0.74
Log Of Iso Cat Related Indicated Loss Costs	60	4.04	1.27	2.81	6.62
Log Of Iso Non-Cat Related Indicated Loss Costs	60	5.44	0.28	5.10	6.42
Percent of Total Zip level Policies that are HO8	0.14%				

Table 2 shows descriptive statistics on the various contracts in Florida during the period 1995-1998. These data are aggregated at the Zip code level by certain contract characteristics.[25] We see that HO3 contracts make up the majority of contracts written in the

[25] Contracts for Tables 2 and 3 were aggregated by: 1) whether the contract had replacement cost coverage; 2) whether the contract excluded the windstorm peril (which often may be insured separately through the wind pool but not necessarily); 3) whether the contract was in a Zip code that was in the top 25 percent, middle 50 percent, or bottom 25 percent of median home values in the state; and whether its 4) wind or 5) fire deductibles were above the mean.

state by the sample companies during this period. Overall, HO3 contracts account for approximately 96.44 % of all contracts written by the sample companies. The other two policies, HO5 (3.54%) and HO8 (0.14%) account for the remainder of the transactions sampled. It is apparent that most homeowners purchase HO3 policies and may select endorsements to supplement the standard HO3 coverages and limits.

The average HO3 premium is less than the average HO5 premium while the average HO8 premium is less than the average HO3 premium. This makes intuitive sense. The HO3 is the typical policy sold and it is more expensive than the less inclusive HO8 policy, but not as expensive as the more comprehensive HO5 policy. Further the price mark-up differs among the policies. The mark-up is the variable we employ as our definition of price and is defined as (1+r)(Premiums-Indicated Loss Costs)/Indicated Loss Costs.

HO5 contracts have the highest average deductible followed by HO3 and then by HO8 polices. We can also look at some of the contract terms across polices. While not many people obtained the wind protection credit, many purchased the additional ordinance or law coverage. Further, persons who purchased HO8 polices seem to live in areas with a lower ratio of catastrophe loss costs to total loss costs than people who purchased HO5 or HO3 polices.

D. Descriptive Statistics for Bundled Contracts

Table 3 shows the average premiums and prices for bundled and unbundled HO3 contracts and for the average HO5 and the average HO8 policy. It should be noted that the average premium per contract for the HO5 policy is $934 and for the bundled HO3 policy with open perils/replacement cost coverage on contents, ordinance and law coverage and a wind device protection credit is $1067. It is interesting to note that there were 65 observations for the fully bundled HO3 policy while there were 1,457 for the HO5. These are essentially similar polices with different relative demands and different prices. Figure 1 shows the graphical relationship between the bundled contract terms and premiums and price mark-ups using the data from Table 3.

Table 3. Bundled versus Unbundled Premiums and Prices: Average for Contract Terms

Variable Label	N	Mean	Std Dev	Minimum	Maximum
Premiums in Zip code (Average for all policies)	41,089	760.51	1927.20	2.00	17268.18
Premiums w/ Replacement Cost, Ord Law, Off Premise Cov Bundle	65	1067.43	1361.86	376.00	7229.50
Premiums with Ord or Law Coverage	14,212	813.56	1387.35	4.00	10442.50
Premiums w/ Ord Law Cov + Off Prem Theft coverage	9,786	826.40	1591.59	11.00	10442.50
Premiums w/Ord Law Cov + Replacement Cost Cov	128	1051.37	1260.94	250.00	7229.50
Premiums with Replacement Cost Coverage	30,630	773.72	2171.53	3.00	17268.18
Premiums w/ Winstorm Protection Credit	1,477	680.51	756.94	3.00	7229.50
Premiums w/Off Premises Theft + Replacement Cost Cov	1,021	692.00	801.77	3.00	7229.50
Premiums w/NO Endorsements	1,524	574.8606	634.691	2	6293.67
Premiums Per Contract In Zip Code **HO5**	1,457	934.34	1859.98	18.00	8856.33
Premiums Per Contract In Zip Code **HO8**	60	498.72	143.94	308.00	889.00
PRICE1 Average Price (price1=price+1)	41,089	1.21	1.89	0.00	4.90
PRICE1 for Replacement Cost, Ord Law, Off Prem Cov Bundle	65	0.96	0.55	0.32	2.61
PRICE1 with Ord or Law Coverage	14,212	1.26	1.45	0.01	4.71
PRICE1 w/ Ord Law Cov + Off Prem Theft coverage	9,786	1.25	1.61	0.01	4.65
PRICE1 w/Ord Law Cov + Replacement Cost Cov	128	0.94	0.49	0.32	2.61
PRICE1 with Replacement Cost Coverage	30,630	1.20	2.08	0.00	4.90
PRICE1 w/Off Premises Theft coverage	1,477	1.47	0.82	0.00	3.68
PRICE1 w/ Winstorm Protection Credit	1,021	1.46	0.84	0.00	3.17
PRICE1 w/NO Endorsements	1,524	1.24	0.76	0.01	4.36
PRICE1 In Zip Code **HO5**	1,457	0.78	1.24	0.06	3.03
PRICE1 In Zip Code **HO8**	60	1.75	0.66	0.64	2.76

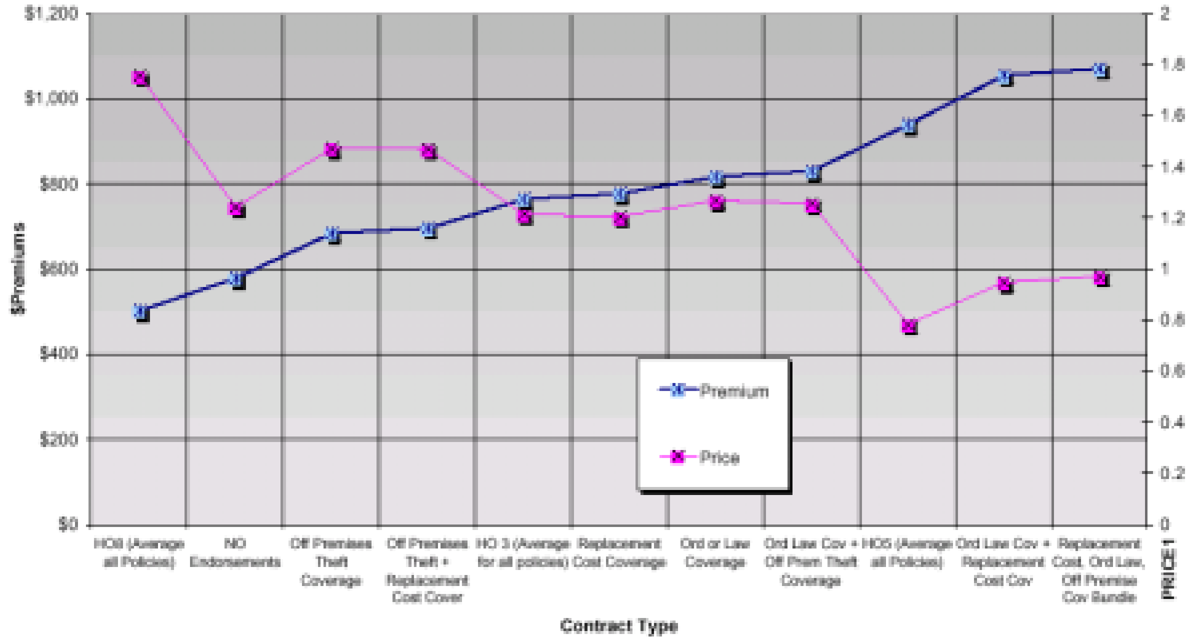

Figure 1. Average Premiums and Average Mark-up by Contract Type
(Sorted in Order of Increasing Premium)

III. Demand Estimation for Florida Homeowners Policies

In this section we undertake two related analyses. The first is an examination of the determinants of premiums and prices for HO3 policies in Florida. We then estimate the demand for homeowners insurance in Florida using two-stage least squares regression. We are interested in how the quantity of insurance demanded changes as price and other variables change.

We focus on HO3 policies in the remainder of the paper because they account for approximately 95 percent of all policies in the sample. Further, by focusing on one product first, we can understand issues that will lead to more efficient modeling of other products.

A number of interesting problems develop in estimating demand. First is the issue of the level of aggregation one uses to estimate these models. It is possible to estimate the model at the individual contract level, but at some future time we need to be able to calculate cross elasticities of demand for the various contract terms. Thus, if we were to estimate the demand model at the individual contract level, there would be no observations for contracts not purchased.

Also, the market in which the consumer makes purchases is larger than the "home." This means that some homeowners may shop for insurance and that the demographic characteristics of a consumer’s neighborhood (in addition to the consumer's home characteristics) may influence the type of insurance he purchases. Because we have the Zip code location of the insured house and we have access to Zip code level information from the Census, we assume, for now, that a consumer shops in a market defined by his Zip code.[26]

A second problem is that the demand for homeowners insurance is derived from the

[26] We recognize that some Zip codes are quite large geographically and many are diverse demographically, but this is the smallest level of aggregation that will permit analysis of our data. Further work will also attempt to take into account the spatial relationships among the Zip codes or other markets.

demand for housing. We account for the demand for housing by including the Census value for the Zip code's median housing cost as an endogenous variable. This variable reflects the value of housing services to the homeowner and is employed in housing demand studies as a proxy for the quantity of housing services demanded. Factors expected to influence housing demand include such Zip code characteristics as median income, median travel distance to work, and Census reported housing characteristics for the Zip code and these factors are used as instrumental variables.

We first estimated several models of the form (2) for PREMS (premium per contract) and PRICE1 (the price mark-up + 1) in order to understand the statistical association between observed premiums and prices and various explanatory variables in our Florida database. Our primary interest is to determine the factors that appear to vary more or less significantly than the expected loss costs and expense costs associated with these factors might suggest.

For example, as deductibles increase for a particular property, the expected loss costs and associated expense costs facing an insurer offering coverage for that property should decrease, all else equal. If price and premium levels for policies with different deductible levels exactly tracked the changes in the ISO advisory indicated loss costs for different deductibles, then additional variables in an estimated demand equation to reflect the level of deductibles purchased should have no additional effect.

More generally, if there were no significant (perceived) quality differences in the coverage or policy services offered by different companies, one might hypothesize that the ISO indicated loss costs would capture all the observed variation in policy premium and price. We will see that, in fact, this is not the case, perhaps reflecting price-quality tradeoffs and associated differences in company-specific attributes in the market. Indeed, a variety of factors beyond the ISO indicated loss costs influence observed premiums for and prices of insurance coverage in these markets. These factors include not only insurer characteristics, but also contract provisions, insured risk characteristics and economic/demographic variables. Reflecting the structure of (2), the factors of interest are separated into three groups:

- F = Policy features or contract terms;
- X = Characteristics of the company (in the State) that might be factors influencing demand (company effects);
- Z = Characteristics of the structure, location and other factors influencing the expected losses on the policy over the period of insurance coverage (insured risk characteristics and neighborhood and demographic effects).

For uniformity, we annualize all period (i.e., quarterly) values, such as losses, premiums, etc.

Tables A1-A3 in the appendix to this paper provide a list of the potential *(F, X, Z)* variables available for use in this analysis. Note that Table A1 contains both information specific to the policy issued as well as to the type of structure insured. It also includes certain structural and protection features of the structure and the community in which it is located. The information in Table A1 is available for over 1.8 million house-years in New York and nearly 900,000 house-years in Florida, or approximately 450,000 house-years in New York and 225,000 house-years in Florida, for each of the four years studied. In the data used below, however, we have a smaller set of usable data. In Florida, we have approximately 663,500 house years over the four-year period and in New York we have approximately 1.3 million house years. Some of the difference is due to incompatible records, the generation of new Zip codes over the reporting period (making their integration with collateral census data difficult), and missing information on some records.

A. PREM and PRICE1 Regression Estimation

We first estimate PREM and PRICE1 regressions using ordinary least squares (OLS) regression. These are essentially hedonic equations that allow us to see how policy terms, insured risk characteristics, firm characteristics, and neighborhood variables affect the premium per contract and the price mark-up.

In interpreting these results, it is important to recall what we expect to be measuring with our two dependent variables. We report two sets of results in Table 4: 1) the log of Premium per contract (LPREMS); and 2) the log of PRICE1 (LPRICE1). PREMS is the premium for a given exposure and is the total amount of money that the insured pays for his policy.[27] PRICE1 is the transformed price variable PRICE + 1 = (1+r)[PREMIUM-ILC]/ILC (adding 1 to PRICE simply assures that our price measure in (3) is always positive).

Conceptually, the premium per policy consists of the expected loss cost (i.e., "pure premium") and the insurer's loading for expenses and profit. In terms of the supply function, some of our explanatory variables would be expected to affect one or the other component, but some variables may affect both components at different rates. For example, because of insurers' fixed costs in servicing a given policy, a variable that has a positive effect on the expected loss cost may also have a positive but smaller relative effect on insurers' expenses, i.e., loss costs increase at a greater rate than expenses. Hence, the coefficients for certain variables in the PREMS equation reflect a variable's combined effects on the loss cost portion and expense loading portion of the premium.

Further, it should be noted that we are using ISO indicated loss costs as an explanatory variable, which may differ from the indicated or regulator-approved loss costs assumed by each insurer in their pricing. We can calculate the former; we can only infer the latter. Hence, the effect of a given contract provision or risk factor (e.g., the type of structure or its location) on PREMS, represented by the coefficient for the variable, could also reflect deviations in insurers' estimations of expected loss costs (or the loss costs effectively approved by regulators) from ISO indicated loss costs.

Overall, when PREMS is the dependent variable, the independent variables are intended to account for the premium effects of calculated ISO indicated loss costs, deviations of insurer expected loss costs from ISO indicated loss costs, and other factors that would be expected to affect the expense and profit loadings that insurers build into the premiums they charge.

PRICE is intended to measure the "loading" received by insurers <u>in relation to the amount of risk protection</u> (i.e., the expected payout on the policy) received by the insured, which is viewed as the real cost of insurance. When the loading is measured this way, a variable that has a positive effect on expected loss costs may have a negative effect on PRICE (the relative loading or price mark-up). This occurs when a variable increases expected loss costs at a greater rate than insurers' expenses.

Additionally, we are using ISO indicated loss costs in the denominator for PRICE as a proxy for the amount of risk protection the insured receives, rather than the indicated or regulator-approved loss costs assumed by each insurer in their pricing. Hence, the coefficients for certain variables in the PRICE1 equation could also reflect deviations in insurers' estimates of expected loss costs (or the loss costs effectively approved by

[27] When there is more than one house-year reported in a given exposure record, which occurs when more than one contract shares exactly the same characteristics, PREMS is calculated as the total premiums for that record divided by the number of in-force house years, i.e., the premium per house covered. Similar adjustments are made for other "amount" fields, such as the total amount of insurance in force (the sum of the Coverage A limits on the homes represented in the data record), to transform all data elements to a per-house basis.

regulators) from ISO loss costs.[28]

Table 4
OLS Regressions for LPREMS and LPRICE1 for Florida HO-3 Contracts
Premiums and Price Markups

	Panel A. Dependent Variable is Log of Premiums/Contract				Panel B. Dependent Variable is Log of Price1 (Mark-up)			
Variable	Coef.	Std. Err.	t stat	P>|t|	Coef.	Std. Err.	t stat	P>|t|
% Of Contracts In Zip W/Ord Or Law Coverage	-0.005	0.005	-0.973	0.331	0.008	0.005	1.668	0.095
% Of Contracts In Zip W/ Replacement Cost	-0.052	0.006	-8.280	0.000	-0.043	0.006	-6.655	0.000
% Of Contracts In Zip W/ Windstorm Protection Credit	0.025	0.008	3.193	0.001	0.027	0.008	3.381	0.001
% Of Contracts W/ Wind Portion Transferred To Pool	0.312	0.015	20.642	0.000	-0.464	0.015	-30.029	0.000
Log Of Coverage A	0.112	0.006	19.352	0.000	0.276	0.006	46.519	0.000
Wind Deductible In $	-0.0001	0.000	-7.909	0.000	-0.0001	0.000	-8.200	0.000
Fire Deductible In $	0.0002	0.000	12.947	0.000	0.0001	0.000	5.887	0.000
Log Of Iso Cat Related Indicated Loss Costs	0.080	0.002	52.908	0.000	-0.277	0.002	-179.707	0.000
Log Of Iso Non-Cat Related Indicated Loss Costs	0.459	0.006	74.252	0.000	-0.312	0.006	-49.388	0.000
% Of Contracts In Zip W/Frame Construction	0.013	0.026	0.493	0.622	0.166	0.026	6.284	0.000
% Of Contracts W/Brick Construction In Zip	-0.058	0.026	-2.272	0.023	0.115	0.026	4.367	0.000
Protection Code (1 =Highest)	0.010	0.001	11.176	0.000	0.010	0.001	10.766	0.000
% Of Houses W Contracts Built After 1960	-0.004	0.014	-0.311	0.756	-0.016	0.014	-1.132	0.257
Log Of Median Age Of Householder In Zip	-0.138	0.016	-8.777	0.000	-0.157	0.016	-9.734	0.000
Ratio Of Select Owner Costs To Med. Inc.	4.984	0.500	9.978	0.000	5.569	0.511	10.900	0.000
Log Of Median Income In Zip	0.060	0.012	4.954	0.000	0.165	0.012	13.305	0.000
% Of People > 25 Who Completed Grade 12	-0.005	0.000	-20.893	0.000	-0.006	0.000	-26.567	0.000
Log Of Median Home Value	0.119	0.009	13.079	0.000	0.017	0.009	1.789	0.074
Best Strength Category 1 (1 Is High)	-0.309	0.017	-17.989	0.000	-0.295	0.018	-16.807	0.000
Best Strength Category 2 (1 Is High)	-0.223	0.017	-12.869	0.000	-0.226	0.018	-12.730	0.000
Best Strength Category 3 (1 Is High)	-0.133	0.021	-6.227	0.000	-0.116	0.022	-5.305	0.000
Best Strength Category 7 (1 Is High)	-0.250	0.018	-13.838	0.000	-0.242	0.019	-13.048	0.000
Log Of Auto Premiums Sold By Company In State	-0.022	0.001	-35.758	0.000	-0.020	0.001	-32.591	0.000
Log Of Life Premiums Sold By Related Company In St	0.009	0.001	16.502	0.000	0.008	0.001	14.873	0.000
Log Of Total Assets	0.015	0.001	16.690	0.000	0.017	0.001	18.014	0.000
Direct Writer Form Of Mktg System	0.245	0.007	35.774	0.000	0.230	0.007	32.894	0.000
Stock Form Of Organization	0.130	0.007	19.657	0.000	0.151	0.007	22.318	0.000
Dummy For Year = 1996	0.216	0.004	48.991	0.000	0.178	0.005	39.601	0.000
Dummy For Year = 1997	0.389	0.010	38.802	0.000	0.347	0.010	33.914	0.000
Dummy For Year = 1998	0.462	0.010	46.636	0.000	0.411	0.010	40.504	0.000
Intercept	1.412	0.112	12.627	0.000	0.701	0.114	6.124	0.000
Number of observations	51,453				51,453			
R^2	0.647				0.650			

Of course, there are many other influences on the relative loading or price mark-up charged by insurers. It is important to keep in mind our assumption that this market is workably competitive. However, this does not imply price or premium uniformity since there are still potential significant variations in underwriting stringency, firm and product quality and service delivery features and some of these can be expected to survive in a competitive equilibrium. Since we also include the ISO indicated loss costs as explanatory variables in our hedonic equations, the other explanatory variables should reflect the effects of factors that are not reflected in the ISO ILCs. Thus, our statistical results include the effects of both consumer preferences for various policy features and efficient modes of delivering these features under competition, i.e. the alternatives consumers will actually see in the market.

In sum, the statistical relationships we observe between the explanatory variables and premiums and prices in these hedonic equations can be influenced by both supply-side and demand-side factors, imperfections in our measurement of expected loss costs, and our

[28] We should also note that ISO indicated loss costs do not include a "risk premium" factor, reflecting the additional return that should be earned by the insurer for the possibility that actual losses will exceed expected losses. This is especially important for the catastrophe portion of insurers' costs, as these losses are highly volatile from year to year. Some insurers may include a "risk premium" in their loading and others may not. This risk premium should reflect the cost of objective risk to the insurer, which could be realized in the cost of diversifying or transferring this risk or the extra return that owners will demand for retaining this risk.

specification of the explanatory variables, as well as omitted variables. For any one variable, some of these effects may move in the same direction and others may move in opposite directions. This makes it difficult to sort out what is driving the statistical relationships we observe. Hence, we must be cautious in interpreting the results of these hedonic equations.

B. Premium Regression Results

Table 4 Panel A shows the results of the premium regression. We estimated this regression with three sets of explanatory variables: Policy Form variables, Demographic variables, and Firm Characteristics.

Policy Form and Insured Risk Characteristics

Policy Form variables consist of various coverage options and risk characteristics of the insured home. The effects of these variables on expected loss costs might be expected to dominate the statistical relationship between these variables and the premium per contract. In other words, policy features that expand coverage and risk characteristics that indicate a higher expected frequency and/or severity of loss might be expected to have a positive statistical association with PREMS through their impact on expected loss costs and vice versa. Many of these variables may also affect insurers' expense costs, although at different rates than their effects on loss costs.

However, we also include the ISO indicated catastrophe and non-catastrophe loss costs as explanatory variables. Hence, the coefficients for these Policy Form variables should account for the effects of deviations of insurers' expected loss costs from the ISO indicated loss costs for these variables, as well as other factors discussed above.

As expected, the catastrophe and non-catastrophe ISO indicated loss costs are positively and significantly related to premiums. The non-catastrophe loss cost elasticity (or sensitivity) is more than five times the size of the catastrophe loss sensitivity. This reflects the fact that non-catastrophe losses are more frequent and appear to have a stronger relationship to premiums.

The log of Coverage A is significantly positive, which suggests that this variable has a positive effect on premiums in addition to that reflected in the coefficients for the ISO indicated loss costs. In fact, a 10 percent increase in the Coverage A limit will lead to an additional 1.1 percent increase in premiums. Conversely, higher wind deductibles and the percentage of brick homes are significantly negative, which suggests that these variables have a negative effect on premiums in addition to effects of these variables that are captured in the coefficients for the ISO indicated loss costs.

On the other hand, the percentage of contracts with a windstorm protection credit, the percentage of contracts with the wind peril excluded, higher fire deductibles, and better municipal protection services are significantly positive. These results may be caused by a negative deviation between how insurers estimate the effect of these characteristics on loss and expense costs (and ultimately premiums) and how these characteristics affect ISO's indicated loss costs and their relationship to premiums. In other words, insurers may effectively use smaller adjustment factors (i.e., discount expected loss costs less) for these characteristics than those used in the ISO indicated loss costs.

Other factors also may cause or contribute to these results. For example, it is possible that the choice of mitigation and qualifying for the associated credit is endogenous and may depend upon the fact that people who invest in wind protection may live in higher-risk areas. Thus, the premium could be higher for these insureds, even with the credit they receive for wind protection devices. Also, in our data, it appears that only HO5 policies have the wind peril excluded. Since the HO5 contract is considered the "best" homeowners policy, it is likely to be sold in high-income areas and premiums for HO5 policies are likely to be higher for that very reason. Thus, this variable could actually account for some unidentified neighborhood effects.[30]

Analogously, the percentage of contracts with replacement cost coverage on contents is significantly negative, which leads to a similar explanation. This could reflect a negative deviation of insurers' expected loss costs from ISO indicated loss costs, and/or it could be caused by other factors. For example, the choice of replacement cost coverage on contents could be endogenous and reflect the fact the homeowners who tend to choose this option may tend to have lower expected loss costs for reasons not yet captured in our model.

Other Policy Form variables are not statistically significant. The ISO indicated loss costs may be accounting for all of the effects of these variables on premiums, or other factors may be responsible which we cannot yet discern.

Demographics

The demographic variables employed in the regression are intended to reflect neighborhood effects on the premium per contract. The calculated ISO indicated loss costs are not altered for variations in the demographic variables, but there may be some multicollinearity between these variables and the ISO indicated loss costs. For example, there is a demographic variable for the log of median home value, which we would expect to be positively correlated with the Coverage A limits (which is used in the ISO loss cost calculation) for insurance contracts in our sample.

The coefficients for the ratio of selected owners costs to median income, the log of median income, and the log of median home value are significantly positive in the PREMS regression. These results are consistent with an intuition that income and home value have a positive effect on the demand for insurance, which may underlie their positive association with how much homeowners pay for their insurance. These variables also may be positively associated with insurers' costs in terms of the expected payout on a given policy beyond what would be captured in the ISO indicated loss costs. For example, higher income insureds may schedule higher limits on certain items, such as jewelry or home entertainment systems, or may have higher-quality homes and furnishings, which may not be reflected in the ISO loss costs but should be reflected in an insured's premium.[31]

More specifically, selected ownership costs include mortgage payments, utilities, and the like and are significantly and positively related to the premiums. One can think of this ratio as an indicator of the value of housing services. Thus, Zip codes with homes that have relatively high values of housing services generally have higher premiums, all other things equal.

This is slightly different than the median home value, which is also positively related to premiums, as expected. The median home value is based on the occupant's perception of the market value of his home (in his response to this question from the Census) and should reflect how the market might value the house, but the ratio of housing cost to income reflects some of the choices the homeowner makes regarding the house and thus reflects a private value of housing services generated by the home.

The log of the median age of the householder in a Zip and the percentage of adults (over age 25) who have a high-school education are significantly negative. The first results may be due to older homeowners' experience with insurance products. Older homeowners, and homeowners who have stayed with the same insurer for a number of years, may be perceived more favorably from an underwriting perspective and may benefit from "persistency

[30] Here again, the choice of a fire deductible is not exogenous as is assumed in this model of premiums. Other tests will be undertaken to determine whether the deductibles are endogenous.

[31] Presumably, high-quality features should be reflected in the value of a home and the Coverage A limit, but this may not always be the case.

discounts" offered by insurers. The second result is consistent with the notion that education is associated with people being more able and/or willing to shop for insurance and compare alternatives.

Firm Characteristics

Finally we look at a set of insurance company characteristics that might influence the premium. These include the strength of the company as measured by its A.M. Best Rating and the cross selling opportunities for two common personal lines, life insurance and auto insurance. It also covers the size of the company, which might reflect some brand awareness, as well as its ownership structure (stock or mutual) and the company's marketing/distribution system.[32]

The A.M. Best ratings of companies' claims paying ability (i.e., financial strength) are coded as Category 1-Category 9. There are no companies in Categories 5, 6, 8, and 9 in our sample. Category 1 is A+ and A++, Category 2 is A- and A, Category 3 is B, B+, and B++, Category 4 is B-, and Category 7 is D. Note, Categories 1, 2, 3, and 7 are specified as separate dummy variables, with Category 4 serving as the base case (equal to zero). Hence, these dummy variables reflect the effect of strength categories that are either higher or lower than the middle Category 4. All of the strength categories are negative. Thus, both high-rated and low-rated companies have lower premiums, compared to medium-rated companies. Our hypothesis was that higher quality companies would have higher premiums, all other things being equal. This is not the case in Florida for our sample companies.

There are potentially two factors that may explain the result. The first is that high-rated companies may be subject to greater regulatory price compression in Florida. The firms with a larger state market share and higher financial ratings are likely to be subject to greater regulatory pressure as their rates have a larger impact on the market and regulators may believe they have more resources to sustain price limits.[33] They also may tend to be "preferred" companies in terms of the stringency of their underwriting and price levels. Together, these factors could lead to the observed negative relationship between a high A.M. Best Rating and premiums.[34] On the other side, according to our hypothesis, lower-rated companies must compensate for their lower quality by offering consumers lower rates.

The second factor concerns the new firms created recently to depopulate the state's insurer of last resort. These new firms were given cash bonuses to take contracts from the Florida JUA. While the homes taken from the JUA tend to be higher risk than the homes that remained in the voluntary market, the subsidies may have permitted these insurers to charge the ex-JUA homes lower premiums than they would have otherwise.

A company's total private passenger auto premiums in Florida are also negatively related to homeowner's premiums. This could reflect the economies in servicing multiple contracts with a single customer. In contrast, there appears to be evidence of diseconomies in the cross marketing of life insurance, suggested by the negative coefficient for the log of life insurance premiums sold by a company's affiliates in Florida.[35]

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[32] The reader should note we measure these characteristics at the individual company level, rather than the group level. Some characteristics will be the same for all companies within a group and others will vary. In subsequent research, we will account for a company's affiliation to a particular group as an explanatory variable. All non-stock companies, such as reciprocals, were categorized as mutuals. Companies with direct response or exclusive agent distribution systems were classified as direct writers, and all other companies, including those with mixed systems, were classified as independent agent companies.

[33] This aspect of insurance regulators' behavior is supported by empirical surveys of regulators by Klein (1995).

[34] In future iterations of this research we hope to better control for underwriting stringency.

[35] Insurers typically offer discounts for insureds who purchase auto and home insurance from the same

Large firms (as measured by the log of total assets) appear to have higher premiums. There are potentially two reasons for this. The first is that larger firms have invested in reputation and that size is a proxy for reputation, all other things held constant. Firms with better reputations may also provide higher quality service. Alternatively, there is evidence that the mean size insurer has increasing returns to scale and thus will have higher average costs than a larger insurer (Cummins, Weiss, and Zi, 1999). We do not test for this effect here as it more properly belongs in the analysis of supply, which we will undertake in our next paper.

We also include marketing and organizational form control variables. Both direct writers and stock companies appear to have higher premiums. We do not make an inference yet about the signs of these variables because we do not know how well our sample represents the Florida market. Our database may be more heavily weighted by transactions with stock companies and independent agent companies than the market as a whole. Thus, these variables act as controls until we can determine the characteristics of the Florida market as a whole and compare it to our sample of firms.

C. Results for the Price Mark-Up Regression

Table 4 Panel B shows the results of the price equation regression. We examine the various components of the regression results separately. First, we look at the policy form variables that include insured risk characteristics, then the demographic neighborhood variables, and we finish with the firm specific variables.

Policy Form Characteristics

As with the premium regression, we estimate the influence of a number of contract specific variables on the price mark-up. As discussed above, we do not necessarily expect these variables to affect the price mark-up in the same direction that they affect the premium per contract.

Catastrophe and non-catastrophe indicated loss costs are both strongly and negatively related to the price mark-up. This suggests that as the indicated losses are larger, there is a reduction in the mark-up for both catastrophe and non-catastrophe costs. This result is consistent with the fixed cost explanation or "scale economies effect" discussed above.[36] Note again, that the catastrophe and non-catastrophe costs have different sensitivities. The mark-up is more sensitive to the non-catastrophe indicated losses, than to the indicated catastrophe losses.

The percentage of contracts with replacement cost coverage on contents is significantly negative. This may reflect an additional scale economies effect on the price-mark-up for broadening this aspect of coverage, beyond that which is captured by the ISO loss cost variables. Analogously, three variables, which we would expect to reduce loss costs, have a positive relationship to the price mark-up which may reflect an extra scale diseconomies effect, beyond that captured by the ISO indicated loss costs. These variables are the

company. This reflects efficiencies in servicing policies and underwriting. On the other hand, these efficiencies may not apply to cross selling of home and life insurance, but consumers may perceive advantages to purchasing home and life insurance from the same company and are willing to pay extra for this option. Note also that our variables only show the total amount of auto and life business sold by insurers in Florida and not necessarily the amount of auto and life insurance they sell to their homeowners insureds.

[36] In this context, we use the term "scale economies effect" to characterize the efficiencies gained in servicing a policy with broader coverage and/or higher expected loss costs, rather than the relationship between an insurer's scale of output and its average costs. These policy-servicing efficiencies would be expected to cause the price mark-up on expected loss costs to decrease as expected loss costs increase, all other things being equal.

percentage of policies with a wind protection device credit, the fire deductible,.[37]

However, some variables that expand or reduce coverage have coefficients with signs that are the opposite of their expected effects on the relationship between expenses and loss costs. As the percentage of contracts with ordinance or law coverage increases, the price mark-up increases. This may reflect a relationship between this variable and a homeowners overall demand for insurance. In other words, homeowners who select ordinance/law coverage may have a higher demand for insurance and be willing to pay a higher loading or risk premium for it. The same could be said for the log of Coverage A, the percentage of homes with frame or brick construction, and insured homes with higher protections codes (lower quality since protection code = 1 is the best), which are also significantly positive. The positive coefficient for protection code also may stem from regulatory price compression if coastal areas tend to have less extensive municipal protection services and rates are more constrained in these areas by regulators because of their higher catastrophe risk.

Similarly, we see two variables that reduce coverage and/or expected loss costs, yet they are negatively associated with the price mark-up. These variables are the percentage of contracts with the wind peril excluded and the wind deductible. Reducing the insurer's exposure to wind losses could lower the risk premium they require to write an insurance policy, which would have a negative effect on the price mark-up.[38] These variables also may reflect decreased homeowners' demand for insurance coverage, which could have a negative effect on the risk premium they are willing to pay.[39]

Demographics

The results for the demographic variables in the PRICE1 regression appear to be consistent with the explanations we offer for their coefficients in the PREMS regression. Zip codes with older homeowners apparently pay a lower price mark-up, as do people in Zip codes with higher percentages of people with a high school education. These results may be explained by greater search activity by older and educated consumers and persistency discounts, as postulated above.

Median income, median home value, and a higher ratio of select homeowner costs to income are positively related to the price mark-up. This may reflect cost factors not reflected in our calculated indicated loss costs or a positive relationship between these income-related variables and the demand for additional insurance services, as we hypothesized for the premium regression.

Firm Characteristics

There are also a number of firm characteristics that are correlated with the price mark-up. Across the board, the various levels of insurer financial strength as rated by A.M. Best are significantly negative, as they were in the PREMS regression. The strongest firms (Category 1 and 2) have the lowest price mark-up, but the weakest firms in the sample (Category 7) also

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[37] Another possible explanation is that there are extra costs in inspecting windstorm mitigation measures in a home.

[38] Note, the homeowner could still save money with a higher wind deductible because of the decrease in the expected loss cost, even if they price markup on the expected loss was higher with a higher wind deductible. This explanation would be consistent with the negative coefficient we find for the wind deductible when the premium is the dependent variable.

[39] Again, as no HO-3 policy had wind excluded, this variable may reflect some unidentified neighborhood effect.

have lower price mark-ups than medium-rated insurers (Category 4). Again, this may be due to the regulatory environment in Florida, as discussed for the premium regression results.

In terms of cross-marketing opportunities, the amount of auto premiums sold by the company is negatively related to the price mark-up. This makes sense as insurers often provide price discounts to policyholders that insure both their homes and autos with the same company. In contrast, there appears to be an increase in the price mark-up for those firms who have sister companies selling life insurance in the state. This is consistent with our results for the premium equation and again may indicate that consumers value purchasing home and life insurance from the same company.

We see that larger firms (with size measured by the log of total assets) have higher price mark-ups. This is not necessarily a sign of inefficiency, as we do not have controls for service quality. However, as explained above, large firms are likely to have invested in reputation through advertisements and the size variable as employed in this regression may be correlated with service quality.

We also refrain from trying to explain the positive coefficients for direct writers and stock insurers in the PRICE1 regression, for the same reasons we defer the discussion of these variables in the premium regression.

D. Estimation of Quantity Demand

Table 5 shows the results of our two-stage least squares estimation of the demand for homeowners insurance in Florida. In this estimation, we employed the indicated loss costs as our proxy of the quantity of insurance demanded. We also employed PRICE1 as our proxy for price. In the model estimated in Table 5, both PRICE1 and the ratio of selected home ownership costs to income are endogenously determined in the first stage regressions.[40]

We also estimate the demand for catastrophe coverage separately from the demand for non-catastrophe coverage. We can think of the HO3 policy as a joint (or bundled) product where the coverages for both catastrophe and non-catastrophe perils are built into the contract. By estimating the two demands separately, we are acknowledging that different factors may affect the demands for insurance for these two perils.

Table 5 Panel A shows the results for the demand for catastrophe coverage (i.e., the catastrophe portion of total indicated loss costs), while panel B shows the demand for non-catastrophe coverage (i.e., the non-catastrophe portion of indicated loss costs). Two important results need to be discussed: 1) the price elasticity of demand; and 2) the income elasticity of demand. The coefficient on the log of PRICE1 (LPRICE1) for catastrophe coverage is approximately -2.675 and this represents the price elasticity of demand. Essentially, this result indicates that a 10 percent increase in the price mark-up will yield a 26 percent decrease in the quantity of catastrophe coverage demanded. This is highly elastic. In contrast, the elasticity for non-catastrophe coverage is approximately -0.369. A 10 percent increase in the price mark-up yields a 3.6 percent decrease in the quantity of non-catastrophe coverage demanded. If the demands are estimated together so that the quantity demanded is the sum of catastrophe and non-catastrophe indicated loss costs, the overall price elasticity (not shown in the table) is -1.32. Thus, we see very different behavior by estimating the price elasticities for catastrophe and non-catastrophe coverages separately.

[40] In the model estimated in Table 5, both PRICE1 and the ratio of selected ownership costs to income are endogenously determined in the first stage regressions. This is intended to remove endogeneity from the results shown in the second-stage regression results presented in Table 5.

Table 5
Two Stage Least Square Results
Florida HO3 Contract Demand Equations

	Panel A. Dependant Variable is the Log of the Cat Indicated Loss Costs				Log of the Non-Cat Indicated Loss Costs			
Variable	*Coef.*	*Std. Err.*	*t stat*	*P>|t|*	*Coef.*	*Std. Err.*	*t stat*	*P>|t|*
Ratio Of Select Owner Costs To Med. Inc.	42.942	2.765	15.531	0.000	39.122	1.167	33.511	0.000
Log Of (Price + 1)	-2.674	0.020	-135.953	0.000	-0.369	0.008	-44.374	0.000
% Of Contracts In Zip W/ Replacement Cost	0.005	0.018	0.300	0.764	0.297	0.008	38.447	0.000
% Of Contracts In Zip W/Ord Or Law Coverage	0.195	0.013	15.606	0.000	-0.021	0.005	-3.996	0.000
% Of Contracts In Zip W/ Windstorm Protection Credi	0.275	0.022	12.397	0.000	-0.154	0.009	-16.483	0.000
% Of Contracts W/ Wind Portion Transferred To Pool	-2.500	0.042	-58.976	0.000	0.419	0.018	23.387	0.000
% Of Contracts In Zip W/Frame Construction	0.096	0.075	1.268	0.205	0.122	0.032	3.832	0.000
% Of Contracts W/Brick Construction In Zip	0.047	0.075	0.619	0.536	-0.044	0.032	-1.401	0.161
Fire Deductible In $	0.0004	0.000	13.059	0.000	0.00037	0.000	25.904	0.000
Wind Deductible In $	0.0001	0.000	3.329	0.001	0.00005	0.000	5.217	0.000
% Of Houses W Contracts Built After 1960	0.003	0.041	0.070	0.944	0.082	0.017	4.734	0.000
% Of Homes In Zip (1-4 Units)	0.189	0.070	2.717	0.007	0.169	0.029	5.737	0.000
Median Year Homes Were Built In Zip	-0.018	0.001	-19.403	0.000	-0.010	0.000	-25.392	0.000
% Condo Housing Units In Zip	0.402	0.086	4.697	0.000	-0.279	0.036	-7.723	0.000
% Of People 65+ In Zip	-0.111	0.117	-0.951	0.342	0.029	0.049	0.581	0.562
Protection Code (1 =Highest)	0.071	0.003	21.654	0.000	0.036	0.001	26.314	0.000
Best Strength Category 1 (1 Is High)	-0.548	0.050	-11.026	0.000	-0.005	0.021	-0.258	0.796
Best Strength Category 2 (1 Is High)	-0.399	0.050	-7.949	0.000	0.123	0.021	5.806	0.000
Best Strength Category 3 (1 Is High)	-0.243	0.062	-3.888	0.000	0.009	0.026	0.353	0.724
Best Strength Category 7 (1 Is High)	-0.339	0.052	-6.502	0.000	0.054	0.022	2.467	0.014
Log Of Median Age Of Householder In Zip	11.175	1.174	9.522	0.000	3.252	0.496	6.563	0.000
Log Of Median Householder Age * Log Of Med. Inc.	-1.027	0.116	-8.821	0.000	-0.321	0.049	-6.536	0.000
% Of People > 25 Who Completed Grade 12	-0.006	0.001	-8.020	0.000	-0.011	0.000	-31.428	0.000
Dummy For Year = 1996	0.361	0.013	27.392	0.000	-0.061	0.006	-10.879	0.000
Dummy For Year = 1997	0.990	0.029	33.952	0.000	0.213	0.012	17.335	0.000
Dummy For Year = 1998	1.090	0.029	37.278	0.000	0.175	0.012	14.181	0.000
% Of Housing Units Occupied By Owner	-0.003	0.001	-4.703	0.000	-0.003	0.000	-9.217	0.000
% Of Population In Urban Areas	0.002	0.000	9.424	0.000	-0.001	0.000	-17.289	0.000
% Of Married Couples With Children	0.007	0.001	7.476	0.000	-0.004	0.000	-10.716	0.000
Log Of Auto Premiums Sold By Company In State	-0.039	0.002	-23.340	0.000	-0.009	0.001	-13.568	0.000
Log Of Life Premiums Sold By Related Company In S	0.041	0.002	26.384	0.000	0.013	0.001	19.185	0.000
% Of Housing Units That Have A Mortgage	-0.003	0.001	-3.990	0.000	-0.004	0.000	-13.719	0.000
% Of Housing Units With Mort. Cost >30% Of Inc.	0.010	0.002	5.329	0.000	-0.002	0.001	-2.068	0.039
Log Of Median Income In Zip	4.671	0.456	10.241	0.000	2.352	0.193	12.214	0.000
Intercept	-9.911	4.858	-2.040	0.041	1.895	2.051	0.924	0.356
Marginal Effects Measured at the Means								
Log Of Median Age Of Householder In Zip	0.642	0.122	5.263	0.000	-0.043	0.051	-0.838	0.402
Log Of Median Income In Zip	0.656	0.038	17.111	0.000	1.096	0.016	67.703	0.000
Number of observations	51453				51453			
R^2	0.585				0.454			

Another interesting observation is that while we cannot separate the two products, changes in external factors, including public policy changes, could influence the demand for both products jointly. For example, a change in tax policy that would allow insurers to establish tax-favored catastrophe reserves could increase the amount of insurance protection that is purchased. Our analysis suggests that small reductions in the overall price mark-up (which includes taxes on catastrophe reserves carried in the form of additional surplus) will have a greater than proportional effect on the demand for insurance. In other words, favored tax treatment for catastrophe reserves could foster better risk management by homeowners through the purchase of adequate insurance, rather than relying on externalizing their losses to other parties and/or retaining greater risk and the negative effects of this greater risk.[41] We

[41] This externalization could occur through mortgage defaults, bankruptcy, tax deductions for uninsured

intend to more specifically estimate the demand and supply effects of changing the tax treatment of catastrophe reserves in future work.

We also see that the income elasticity of the demand for catastrophe coverage, reflected by the coefficient for the log of median income shown near the bottom of the table under marginal effects (measured at the means), is approximately .656. This implies that a 10 percent increase in the median income in a Zip code yields a 6.5 percent increase in the quantity of catastrophe insurance demanded. The income elasticity for non-catastrophe insurance is 1.09. Thus, a 10 percent increase in median income will yield a 10.9 percent increase in the quantity demanded. This suggests that non-catastrophe coverage is a "superior good" while catastrophe coverage is merely a "normal good".[42] In both cases, as income increases demand increases, but in the case of non-catastrophe coverage demand increases more than proportionately with income.[43] When we analyze the combined demand for catastrophe and non-catastrophe coverages, rather than their separate demands, the income elasticity is .98.

Contract Specific Variables

Contract provisions that expand coverage would be expected to increase the demand for insurance (holding price and other factors constant), and provisions that reduce coverage would be expected to decrease demand. Factors indicating higher risk also would be expected to increase the demand for insurance and vice versa.

Replacement cost coverage on contents is positive but insignificant for catastrophe insurance demand, and significantly positive for non-catastrophe insurance demand. The stronger association for non-catastrophe insurance may be due to homeowners' concern about the threat of theft.

Ordinance/law coverage is significantly positive for catastrophe insurance demand and significantly negative for non-catastrophe insurance. A stronger positive association for catastrophe insurance could be explained by the greater relevance of ordinance/law coverage for the windstorm peril for which damage or destruction of the principal dwelling is the greatest concern. Publicity concerning the need for homeowners to repair or rebuild their homes according to current codes after a hurricane could increase this demand. The negative coefficient for non-catastrophe insurance is more difficult to explain and may be due to model specification errors.

The windstorm protection credit is significantly positive for catastrophe insurance demand and significantly negative for non-catastrophe insurance. The first result makes intuitive sense. The credit lowers the premium for the insured and contributes to homeowners' incentives to invest in wind mitigation measures. It also will have greater value as the wind peril and the catastrophe portion of the premium increases. The negative coefficient for non-catastrophe insurance has no obvious explanation. We would expect it to have no relevance to non-catastrophe insurance demand, but the bundling of the catastrophe and non-catastrophe coverage in most contracts may play a role.

The exclusion of the wind peril is significantly negative for catastrophe insurance

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catastrophe losses, and other demands on public services. We also know from the economic theory of expected utility under uncertainty that risk averse individuals value the reduction in uncertainty provided by insurance and will increase their utility by purchasing more insurance if the price mark-up of insurance decreases.

[42] Note these are terms used by economists to characterize the relationship between income and demand and are not normative valuations of which is a "better" product.

[43] Increased demand for higher liability limits as household income increases could contribute to the relatively high income elasticity of non-catastrophe coverage.

demand and significantly positive for non-catastrophe insurance. For these policies, the wind peril could be transferred to the wind pool or not covered at all. In either instance, the homeowner may find this less desirable than having their primary insurer cover the wind peril.[44] Excluding the wind peril could have a positive effect on the demand for non-catastrophe coverage if homeowners seek to expand the latter to compensate for their lack of wind coverage. Endogeneity also may play a role here if homeowners who exclude or have wind coverage transferred to the pool also tend to have more expensive homes which would increase non-catastrophe indicated loss costs, our measure of quantity demanded.

For both demands, we see that the deductibles are positively related to the quantity demanded. Thus, as deductibles increase, quantity demanded increases all other things equal. This makes sense and is consistent with theory **[?]**. Owners with newer houses (built after 1960) also appear to have higher demands for both types of coverage.

Frame construction is positively related to the demand for both catastrophe and non-catastrophe coverage, while brick construction is also significantly positive for catastrophe coverage and statistically insignificant for non-catastrophe coverage. As these factors represent higher risk relative to the base case (superior fire resistant homes), this is consistent with our intuition that greater risk increases the demand for insurance. The same could be said for higher protection codes, which are also significantly positive for the demands for catastrophe and non-catastrophe coverages.

The percentage of insured homes built after 1960 does not have a statistically significant relationship to the demand for catastrophe coverage and a significantly positive relationship to non-catastrophe coverage. Since newer homes would be expected to be lower risk, all else equal, factors other than the hypothesized "risk-demand relationship" may be contributing to these results. Owners of newer homes may have a greater demand for non-catastrophe insurance for various reasons, despite the fact that homes should have a lower risk of loss.

Demographics

We have a number of variables that describe the housing stock and the population in Florida Zip codes. Some of these variables convey additional information about the characteristics of consumers (and their homes) buying homeowners insurance, including the consumers represented in our sample. Other variables indicate neighborhoods effects, i.e., the influence of characteristics of a homeowner's area on his demand for insurance.

Starting with the housing stock, the greater the number of residential structures (1-4 unit structures) in a Zip code, for which homeowners are eligible to purchase homeowners insurance, the greater is the demand for both catastrophe and non-catastrophe coverage. Note this is a neighborhood effect, suggesting that homeowners in areas with greater residential density have a greater demand for risk protection. This contrasts with the percentage of owner-occupied housing units, which is negatively associated with the demands for both coverages. There is no obvious intuition for this result, other than the possibility that this variable is correlated with the number of secondary or vacation residences, which could have a negative effect on the demand for insurance.

The percentage of condos in the Zip (which is a control variable for housing mix) affects the demands for catastrophe and non-catastrophe insurance differently. For catastrophe coverage it is positively related to demand, while for non-catastrophe coverage it is negatively related to demand. The latter is understandable. The greater the percentage of housing units that are condos in a market, the less demand there would be for homeowners coverage, all other things being equal**[?]**. It is not clear why this variable is related to

[44] It also should be noted that the wind pool may charge higher premiums for wind coverage than insurers. Our two-stage procedure would not control for this price effect as our price measure only reflects the coverage provided by the primary insurer and not the wind pool.

catastrophe coverages, although it may be that the percentage of condos is related to beachfront exposures in a Zip, which could explain the positive association with the demand for catastrophe coverage.[45] The percentage of people living in urban areas in a Zip also is positively associated with the demand for catastrophe coverage, but negatively related to the demand for non-catastrophe coverage. This may reflect the greater population density along coastal areas.

The median year of the Zip code housing stock is negatively related to the demand for both types of coverage. This contrasts with our results for newer homes reflected in our transaction data on home characteristics. We need to explore these results further and test alternative specifications before we speculate on what these results mean.

Moving to population characteristics, Zip codes with higher percentages of high school graduates have lower demand for both types of coverage. The cause of this result is unclear as one might expect that homeowners with greater education may be more aware of catastrophic and non-catastrophic perils, which would have a positive effect on demand. Alternatively, higher educated homeowners may be more adept at finding ways to economize on their coverage, such as installing safety devices that would decrease expected loss costs, our measure of the quantity of risk protection purchased. The education variable also could be positively correlated with omitted variables that decrease indicated loss costs.

Zip codes with high percentages of married couples with children have a higher demand for catastrophe coverage, but a lower demand for non-catastrophe coverage. The first result is consistent with our hypothesis that having children increases a homeowner's desire for risk reduction and insurance, but the negative coefficient for non-catastrophe insurance is puzzling. It is possible that families with children tend to face tighter budget constraints for what they can spend on insurance. In this instance, higher premiums because of their exposure to catastrophe risk may force these families to economize on the amount of non-catastrophe risk protection that they purchase.

Finally, since Florida is a retirement state, we are interested in how age affects the demand for insurance. After controlling for the interaction effect of income, we find that age is positively related to the demand for catastrophe coverage, but its relationship to the demand for non-catastrophe coverage is not statistically significant. The average median age of the householder in Florida is 50. Thus, at this level, we see a strong age effect on the demand for catastrophe coverage, but as the percentage of retirees goes up, we see a diminishing effect on the demand for catastrophe coverage. This may reflect a shortening time horizon as the homeowner ages. This may imply that older consumers do not expect to be faced with a catastrophe claim in the next few years and do not value the coverage as highly as younger homeowners.

The ratio of selected home costs to median income is significantly positive for both the demand for catastrophe insurance and the demand for non-catastrophe insurance. This is consistent with our hypothesis that the greater the demand for or value placed on housing services, the greater the demand for insurance.

Curiously, the percentage of homes with mortgages is negatively associated with the demand for catastrophe and non-catastrophe insurance. Since lenders typically require homeowners to carry hazard insurance, our a priori expectation was that having a mortgage increases the demand for insurance. A second variable, the percentage of housing units where mortgage payments exceed 30 percent of household income, is significantly positive for

[45] We should also note that while we have excluded HO6 (condo-owners) policies from our sample, it is possible that some condo-owners policies are still in our database because they were not specifically identified as such. Since condo-owners policies only insure the contents and furnishings of a condo unit (the structure is insured by a separate commercial policy), the expected loss costs for these policies will tend to be lower, implying a lower demand for coverage based on our measure of quantity.

catastrophe insurance and significantly negative for non-catastrophe insurance. Although homeowners with mortgages may be required to buy an insurance policy, budget constraints (particularly in the face of higher catastrophe insurance premiums) may prompt these homeowners to economize on the amount of insurance they purchase to the extent that their lenders allow.

Firm Characteristics

At this stage of the analysis, we limit firm specific variables to those that we believe may affect consumer demand. We did include A.M. Best ratings because consumers can use these easily as an indicator of company quality or financial strength when they decide to purchase insurance.[46] For catastrophe coverages, we see that all of the coefficients are significantly negative on the Best Strength Category variables (recall Category 4 is the omitted category). However, for non-catastrophe coverage the strength variables are significantly positive (Categories 2 and 7) or insignificant. That is, there are very different relationships for the two coverages. It is conceivable that consumers value financial strength differently for catastrophe coverage and non-catastrophe coverage, where the latter involves more frequent claims. Catastrophe insurance may be viewed as an unfortunate necessity, particularly for homeowners in high-risk areas forced to pay high premiums, for which quality considerations take a back seat to saving money on premium expenditures.

The negative coefficients for high rating categories for catastrophe insurance also may reflect the dominance of factors other than consumers' presumed greater attraction for strong companies. What we may be observing is an endogenous relationship between catastrophe indicated loss costs and the regulatory constraints placed on strong insurers to continue writing coverage in high-risk areas.

In terms of cross marketing effects, the amount of auto insurance written in Florida by an insurer is negatively related to the demand for both catastrophe and non-catastrophe coverages. Thus, as the insurer sells more auto insurance in the state, it is likely to sell less homeowners insurance, as reflected by the amount of indicated loss costs. This result may be due to an increasing tendency by individual companies to specialize in either auto or home insurance.[47] In contrast, we see that life insurance sales by affiliated companies within the same group are positively related to the sale of homeowners insurance. This latter result is consistent with our hypothesis that consumers view buying life insurance and home insurance from the same company as a benefit. It would be interesting to see if this is true in other states. We will undertake a similar analysis for New York to compare and contrast the results.

IV. Summary and Description of Future Work

This paper is part of an ongoing project to estimate the supply and demand for residential property insurance in Florida and New York. We examine in an exploratory manner, the demand for homeowners insurance in Florida. We estimate these models with a 2SLS approach to account for the endogeneity of a number of important explanatory variables. We first examine the hedonic forms of the price and premium OLS regressions to understand how policy terms, insured risk factors, neighborhood variables, and firm characteristics influence premiums and price mark-ups. We also examine the quantity of of catastrophe versus non-

[46] The significance that consumers attach to financial strength ratings is uncertain, but there is reason to expect that these ratings have some relevance. Insurers typically advertise their Best ratings and agents typically convey this information to consumers.

[47] We should also note that we measure this variable at the company level rather than the group level. A group may segregate its homeowners insurance and auto insurance in different companies within the group.

catastrophe insurance demanded to show that there are some potentially important differences in the factors affecting the demands for these two coverages.

The results for the hedonic premium and price equations suggest that many factors affect these outcome measures. In other words, variations in our calculated ISO indicated loss costs do not fully account for variations in the premium per policy or the price-mark up. We believe that one contributor to premium and price dispersion is the deviation of insurers' assumed loss costs from ISO indicated loss costs. We also hypothesize that, in a workably competitive homeowners insurance market subject to certain regulatory constraints, varying consumer preferences and insurer product and service differentiation further contribute to premium and price dispersion.

Two interesting and plausible observations arise from the demand analysis. First, we find that catastrophe coverage is more price sensitive than non-catastrophe coverage. Second, catastrophe coverage is a normal good whose income elasticity is considerably lower than non-catastrophe coverage, which our results suggest is a superior good.

The results for other variables hypothesized to affect demand are more mixed in terms of our ability to offer plausible explanations. Among the results that tend to be more robust, it appears that factors associated with higher risk tend to increase the demand for insurance. Also, greater demand for housing services, in turn, appears to increase the demand for insurance. The effects of various coverage provisions on demand are less predictable. Homeowners may tradeoff certain coverage enhancements and reductions as their premiums increase due to higher catastrophe risk. We need to refine the specification of our model before we can draw stronger inferences from our empirical estimates.

In future work we will examine both New York and Florida. This will allow a comparison of two regulatory regimes and two different markets. In addition to homeowners insurance, we will also include data on the dwelling, fire and extended coverage contracts sold in each state. These latter coverages are substitutes for more bundled homeowners insurance policies. Additionally, we will refine our model specification to more accurately measure certain factors and incorporate potentially important omitted variables, such as underwriting stringency and quality of service. Finally, we also will estimate the supply of homeowners insurance in the state markets that we would include in a joint estimation of supply and demand.

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Table A1
Features of Policies and Structures

Variable	Short Description	Comments and Codings
YEAR	Year (1995-1998)	0 (1995), 1 (1996), 2 (1997, 3 (1998)
ZIP	Zip Code	Zip code
STATE	State	Separate Panels for FL & NY
TERRIT	Territory	Location Identifier for Cat-Losses
POLICY	Policy Form HO1 (NY only), HO3, HO5, HO8	Dummy Variables to Reflect Policy Form Coverages
SUBLINE	Subline	Reflects Loss Settlement Basis(Dummy variable :1 if Replacement Cost Coverage)
EXCIND	Exception Indicator	Dummy Variable: 1 = Wind Transferred to Pool
STEX	State Exception Indicator	Dummy Varaible = 1 if Wind Device Protection Credit
ORD_LC	Ordinance or Law Coverage	Dummy Variable: 1 = Coverage Pays Additional Cost Required To Repair a Damaged Home According To Current Building Codes
FAM	Number of Families	Dummy Variable: 1 = Multiple Families
TYPECON	Type of Construction Frame Brick Superior Fire Resistant	Dummy Variables to Reflect Different types of Structures
YEARCON	Year of Construction	Dummy Variable: 1 = Constructed after 1960
WIND_DS	Wind Deductible Size ($'s)	Wind Deductible Converted to $'s if Expressed as Percentage of COVA
FIRE_DS	Fire Deductible Size ($'s)	Fire Deductible Converted to $'s if Expressed as
PROTCD	Protection Code	Ordinal Ranking Variable for the Structure (1-10), the Lower the Better
BCEG	Building Code Effectiveness Grading	Community Grading
COVA	Coverage A Limit	Dollar Amount of Coverage A Limit
COVCPCT	Coverage C as Percent of COVA	In Standard Policy, COVCPCT = 50%
COVELIM	Coverage E (Liability) Limit	Converted to $'s if expressed as Percentage of
ILC	Total ISO Indicated Loss Costs	Dollar Amount
ILC_C	ISO Indicated Loss Costs Cat Portion	Dollar Amount
ILC_NC	ISO Indicated Loss Costs NonCat Portion	Dollar Amount
PREMS	Annualized Premium Limit	Dollar Amount
PRICE	Annualized Price	(1+r)(PREMS-ILC]/[ILC]
PRICE1	1 + Annualized Price	Linear Transform of PRICE =PRICE + 1

Table A2
Company Data from NAIC and AM Best

Variable Name	Short Description	Comments and Codings
MKT_CODE	Marketing System Employed by the Firm Agent = 1 if an "agency writer" Direct =1 if a "direct writer"	Dummy Variables to Represent Various Forms of Marketing and Distribution Systems
Company ID	Various Identifiers for the Company and the Group in Which it Operates	Link to AMBest Data
CAPSURP	Capital and Surplus	Total Firm C&S
BCAR	Best Capital Adequacy Ratio	This is a risk-based capital measure
FSC	Best Financial Size Category	Discrete size categories based on Adjusted Policy Holder Surplus
STRENGTH	Best Strength Category	Numeric coding from 1 to 9 Reflecting AMBest Rating, where 1 is the best (A++)
RATING	AMBest Rating	Alpha Numeric Coding of Best Rating
TOTASS	Total Assets	In $
LTOTASS	Log of Total Assets	In Log $
SOBnRAT	State Line of Business Concentration	The % of Total Firm Business in top "n" States in which it does business, a geographic concentration indicator
HOME1	Homeowners is First Line of Business	Dummy Variable if HO is the highest % of Direct Premiums Written (DPW) to Total DPW for the Firm
HOME2	Homeowners is Second Line of Business	Defined as in HOME1
LOBnRAT	n-Line of Business Concentration Ratio	Percent of writings in the top "n" Lines of Business divided by DPW
FLAUTO/ NYAUTO	Total of Personal Auto Lines Premiums in each State	An Indicator of Cross-Marketing potential for the Firm
FLHOTOT/NYHOTO	Percent of Business in State (FL & NY)	Ratio of Homeowners to Total DPW in the respective State

Table A 2 Continues on Next Page

Table A2: Company Data (Continued)

Variable Name	Short Description	Comments and Codings
FLLPREM/ NYLPREM	Total Life Insurance Premiums written by Companies in Same Group as the Firm	An Indicator of Cross Marketing potential for the Firm
HOMEDPW	Sum of HO Premiums in the State	
LHOMEDPW TOTDPW	Log of HOMEDPW Total of Direct Premiums Written Nationwide	
TOTHODPW	Total Direct Homeowners Premiums Written Nationwide	
Organizational Form: Stock Mutual	Organizational form	Dummy Variables to reflect Organizational Form Mutual =1 if a mutual Stock= 1 if a stock
HO_EX	Homeowners Line Expenses	Direct Loss Adjustment Expenses Incurred + Brokerage Fees and Taxes, Licenses & Fees for HO Line
HO_EX_RT	Expense Ratio for Homeowners Line	Ratio of HO_EX to Homeowners DPW in the State
IEE_EX	Unallocated Homeowners Line Expenses	Amount of total Homeowners expense that remains unallocated after allocations to all States.
C_OUT	Total Number of Claims Outstanding for the year in question and the previous two years	
C_REPT	Total Number of Claims Reported during the year in question and the two previous years	
C_RAT	Ratio of total number of claims outstanding to the number of claims (Reported and Outstanding)	A Quality of Service Measure
TOT_PD	Total Paid Claims From Past Three Years, in the year in question and the previous two years	
TOT_UNPD	Total Unpaid Claims from Past Three Years, the year in question and the previous two years	
TOT_RAT	Ratio of Unpaid Claims to Total Claims, i.e. the ratio of TOT_PD to TOT_UNPD	A Quality of Service Measure

Table A3
Census Variables Employed

Avg HHInc	Average Household Income in the Zip code
Median HHInc	Median Householder Income In The Zip Code
MortOwn_	% Of Housing Units That Have A Mortgage
MortO30_	% Of Housing Units In Which Mortgage Is Greater Than 30% Of Household Exps
AvAgeHH	Average Age Of Householder
OwnOcc_H	% Of Housing Units Occupied By Owner
PI_RtIn	% Of Income That Constitutes Retired Income
Edu_12th	Percentage Of People Above 25 Who Have Completed 12Th Grade
Edu_coll	Percentage Of People Above 25 Who Have A College Degree
P_White	% Of Whites Among The Population In The Zip
MedianYB	Median Year Structures Were Built In The Zip
MedianVA	Median Value Of Structures In The Zip
Pop_Urb	% Of Population That Is In The Urban Areas In The Zip