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The Demand for Homeowners Insurance with Bundled Catastrophe Coverages

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-stage 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. We determine that price elasticities are less elastic for catastrophic coverage than for non-catastrophic coverage. Further estimated income elasticities suggest that homeowners insurance is an inferior good. Finally, we conclude based on the results of a selection model that our sample of ISO reporting companies well represents the demand for insurance in the Florida market as a whole.

The Demand for Catastrophe Insurance with Bundled Catastrophic Coverages

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

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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).

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, researchers have begun to explore the special problems disasters pose as well as 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 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.

This paper constitutes the first significant attempt to examine the nature of the 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.

We explore several significant aspects of residential insurance markets threatened by natural disasters. Our initial work encompasses the key determinants of the demand for residential/catastrophe insurance and their effects on the quantity, quality and price of insurance

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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.

purchased. Among the phenomena we seek to illuminate are the sensitivity of demand to prices, policy features and the bundling/unbundling of perils and coverages.

In this paper, we focus our analysis on demand side of homeowners insurance transactions in Florida. Further we hope to build a complementary supply model for both states and also integrate transactions for dwelling fire and extended coverage.[5]

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 when we examine markets where both HO3 and HO5 policies are sold. When we look only at HO3 policies, however, the reverse is true. Second catastrophic coverage is an inferior good. Thus, as income rises the demand for catastrophic coverage is reduced. In contrast, the demand for non-catastrophic coverage is positively related to income and is a normal good. Overall, however, the demand for homeowners insurance is an inferior good.

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

[5] 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.

1995-1998 for the analyses that are reported here.[6]

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 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.[7] We first provide a brief introduction to the foundations of the modeling used in this process.

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[6] 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.

[7] 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.

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.[8] (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.[9]

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.[10]

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,

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[8] 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.

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

[10] 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 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.[11]

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

[11] 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.

further inertia that may, at least in part, be due to regulatory restrictions on terminating policies and other insurer and consumer considerations.[12] 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* 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[13] as:

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

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

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

[13] 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.

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.[14] This leads to estimation problems of the following general type, neglecting for the moment the details here of functional form:

$$P(F, X, Z) = aF + bX + cZ + e \qquad (2)$$

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.[15] 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 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*:

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

[14] 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.

[15] 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.

(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).[16]

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.[17] 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

[16] 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.

[17] 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.

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.[18] It is essentially the maximum possible loss rather than the expected loss.[19] We will therefore focus on indicated loss costs.

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

$$L(F,Z)_{i=C,NC,TOT} = b_1F + b_2Z + b_3X + b_4P + e \quad (4)$$

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

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[18] 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.

[19] 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.

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.[20] Ordinance or law coverage is typically chosen as an endorsement on HO3 policies while it is a standard coverage in HO5 policies.[21] Also, HO3

[20] 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).

[21] 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.

policies typically cover contents on a "named-perils" basis, while HO5 policies typically cover contents on an "open-perils" basis.[22] 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.

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.[23]

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.[24] We see that HO3 contracts make up the majority of contracts written in the 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

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[22] "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.

[23] 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.

[24] 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.

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.

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 for HO3 contracts and then for both HO3 and HO5 contracts.

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.[25]

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

[25] 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.

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.[26] 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

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[26] 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.

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 in relation to the amount of risk protection (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 regulators) from ISO loss costs.[27]

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

[27] 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.

demand-side factors, imperfections in our measurement of expected loss costs, and our 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. Initial Hedonic Regression Results for *LPRICE1* and *LPREMS* Regressions

Table 4 Panel A shows the results of the premium (*LPREM*) regression and Panel B shows the price (*LRPICE1*) regression results. We estimated these regressions with three sets of explanatory variables: Policy Form variables, Demographic variables, and Firm Characteristics.

What we show here is a representative set of regressions. We also estimated a number of alternative specifications. The regression estimates in Table 4 thus show a reduced form of the effect of various variables on prices and premiums. To examine each coefficient to determine its proper sign is not helpful at this stage because of the interaction of supply and demand influences in the reduced form. What we desire to point out here is that even including loss costs, demographic, contract and firm specific variables we still do not get much above a 68 percent level of explanatory power for either model. In contrast, contract terms by themselves result in explanatory power of approximately 50 percent.

To see how demand is ultimately influenced by prices and policy variables, bundling of contract terms, demographics, and firm specific variables, we must estimate a slightly different model that can take into account the endogeneities implicit in a demand model. We undertake this analysis in the next section.

C. Estimation of Quantity Demand

Table 5 shows the results of our two-stage least squares estimation of the demand for HO3 contracts for homeowners insurance in Florida. In this estimation, we employed the indicated loss costs (in the logged form) as our proxy of the quantity of insurance demanded. We also employed PRICE1 in the logged form as our proxy for price. In the model estimated in Table 5, a number of variables are estimated as endogenous. First, PRICE1 is estimated as an endogenous variable in the first stage. This is standard for demand models. We also must account for a number of other possible endogenous variables reflecting housing value, deductibles, and the choice to invest in wind protection devices.

We also estimate the demand for catastrophe coverage separately from the demand for non-catastrophe coverage. We have estimated catastrophic related indicated loss costs for each policy in the sample. ISO employed RMS to use their CAT model to develop these costs. In addition we have ISO estimated non-catastrophic indicated loss costs which are loss costs developed by ISO based on previous claims. Thus, we can think of the homeowners 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). Panel C shows the market observable bundled result. Initially, two important results need to be discussed: 1) the price elasticity of demand; and 2) the income elasticity of demand. In panel C of Table 5 we see the coefficient on the log of PRICE1 (LPRICE1) for catastrophe coverage is approximately -1.15 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 11.5 percent decrease in the quantity of catastrophe coverage demanded. This is approximately unit elastic. If we examine the two bundled goods separately, we see evidence of very different behavior. The elasticity for catastrophe coverage (panel A) is positive, but not significantly different from zero and is quite inelastic. In contrast, if we look at Panel B of Table 5, we see that the demand elasticity for non-catastrophic coverage is –1.425. Thus, a 10 percent increase in price will yield a 14.25 percent decrease in quantity demanded. This is a relatively elastic demand.

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.[29] We 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 in Panel A (under marginal effects), is approximately –4.495 This implies that a 10 percent increase in the median income in a Zip code yields a 45 percent decrease in the quantity of catastrophe insurance demanded. This is highly sensitive. In contrast, the income elasticity for non-catastrophe insurance is positive and is estimated to be 0.567. Thus, a 10 percent increase in median income will yield a 5.67 percent increase in the quantity demanded. When we analyze the combined demand for catastrophe and non-catastrophe coverages, rather than their separate demands, the income elasticity is approximately –0.784. Thus overall, insurance is an inferior good.

The empirical conclusion that insurance is an inferior good has a basis in theory. Arrow (1964) conjectured that individuals have declining absolute risk aversion. This implies that as income increases the demand for insurance should diminish. Mossin (1968), in turn, proved that if a person faced a price of insurance greater than the actuarially fair value, but below the price at which no insurance would be purchased, and the consumer exhibited decreasing absolute risk aversion, then the amount of insurance coverage fell as wealth increased. Mossin did not consider the case where higher incomes might generate more assets at risk and thus the higher income person would have greater losses to insure against.

Further, Briys, Dionne and Eeckhoudt (1989) have pointed out, the income demand elasticity for insurance will be positive if and only if absolute risk aversion does not decrease

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

significantly rapidly enough or if and only if the variation of risk aversion is lower than a minimal bound. Cleeton and Zellner (1993) undertake a similar analysis and operationalize Briys *et al.'s* conclusion slightly differently. They find that the income elasticity of demand for insurance will be positive over all prices if $f_a + ? > 1$ where f_a is the elasticity of relative risk aversion to initial income and *?* is the elasticity of the amount at risk with respect to initial income. This implies that if potential losses change as wealth changes (which makes sense in our case as wealthier people may buy more expensive houses, exposing themselves to higher potential losses.) we may see a positive relationship between income and insurance purchased. That is, as income increases, we see an increase in non-catastrophic insurance purchased net of any decreasing effect on the demand for insurance due to decreasing absolute risk aversion.[30]

Insured Risk Characteristics and Contract Terms

The type of home construction is positively related the demand for cat and non-cat coverage while positively related to non-catastrophic cover. This seems to suggest that relative to the omitted classification of house construction (superior fire resistant (SFR)) that owners of brick and frame houses believe their housing needs more catastrophic protection relative to the SFR housing.

The median year that housing was built in the zip is negatively related to the demand for both coverages. This comports with intuition as newer houses built to more modern building codes are less "risky" all other things held constant than older homes. In addition, zip codes in areas with good municipal protection services (fire and police) would have lower demands on the margin for insurance coverage. We find evidence of this as shown in table 5. As the protection code increases (moving to lower quality municipal services), the demand for insurance for both types of coverage increases.

Contract provisions that expand coverage would be expected to increase the demand for insurance if the marginal benefit of expanded coverage is greater than the marginal cost in terms

[30] We estimated a regression between the log the median home value and the log of income holding other things constant such as the characteristics of the house, insurance prices, and neighborhood characteristics constant. The elasticity of median house value with respect to income our measure of *?* was estimated to be 1.04. Thus, as long as f_a was greater than (approx) -.039 we would expect to see a positive elasticity between income and the amount of

of a higher price. Similarly, 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 significantly negative for catastrophe insurance demand, and significantly positive for non-catastrophe insurance demand. Consumers do not value this coverage for catastrophic cover. 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 both catastrophe insurance and non-catastrophic coverage. A strong 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 windstorm protection credit is endogenously determined in our model. This credit is available for those who choose to purchase special shutters, for example. It is significantly positive for both catastrophe and non-catastrophic insurance demand. This makes intuitive sense for the catastrophic coverage demand. 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. 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.

For both demands, we see that the fire deductibles are positively related to the quantity demanded. A priori one can suppose that as the deductible increases the "quantity" of insurance demand decreases and that a deductible should be negatively related to quantity demanded. However, when the level of a deductible increases the price of coverage changes too. Thus, as deductibles increase, it is possible the quantity demanded increases all other things equal. This makes sense if the marginal benefit of a premium decrease due to the increasing deductible is greater than the marginal cost of a lower amount of insurance coverage.

If deductibles do not affect the quantity demanded this implies that consumers have properly

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insurance purchased.

maximized their utility taking into account the trade-off between increased deductibles and lower prices. If we look at the wind deductible coefficients in Table 5 we see that they are both statistically different from zero. The coefficient on the catastrophic demand is positive (but zero at three significant digits) while it is significantly negative (but zero at three significant digits) in the non-catastrophic. This suggests that the wind deductible can be used to increase catastrophic coverage on the margin, while it has the opposite effect on the demand for non-catastrophic coverage. While the coefficients are significant for all deductibles for catastrophic and non-catastrophic insurance, the estimated coefficients are quite small and may not be different from zero in any economic sense.

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, we examine the median value of homes in the zip code. This is also an endogenously determined variable. We use this to control for the consumer's choice of housing. Since insurance is a derived demand from the demand for housing we need to account for the choice of housing in the model. For catastrophic coverage we see that this coefficient is positive (and relatively large) which suggests that consumers with higher values of homes have a higher demand for catastrophic coverage. In contrast, the reverse is true for non-catastrophic coverage. Overall, the result in panel C suggests the effect of home value on the demand for insurance is significantly positive.

The number of residential structures (1-4 unit structures) in a Zip code, for which homeowners are eligible to purchase homeowners insurance, is a neighborhood control variable and can be thought of as a measure of housing (in contrast to apartments or condo) density in the Zip code. It is positively related to the demand for non-catastrophe coverage and negatively related to the demand for non-catastrophe coverage.

The percentage of condos in the Zip (which is an additional a control variable for housing mix) also 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 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.[31]

Moving to population characteristics, Zip codes with higher percentages of high school graduates and college-educated consumers have lower demand for both types of coverage (See the marginal effects section of Table 5). 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.[32] 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. One should note Zip codes with higher percentages of college educated consumers appear to have higher demands than those zip codes with high percentages of high school graduates. This is seen by the fact that the coefficient on college education, while negative, is lower in absolute value than the coefficient on the percentage of high school graduates in the Zip code.

The percentage of people living in urban areas in a Zip code also is positively associated with the demand for catastrophe coverage, but negatively (although quite small in magnitude) related to the demand for non-catastrophe coverage. This may reflect the greater population density along Florida's coastal areas.

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

[31] 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.

[32] Recall that our measure of the real insurance services provided is the loss costs. Thus higher educated people may engage in personal risk management to reduce these loss costs.

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.

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 the marginal effect age is insignificantly related to the demand for the bundled coverage, but its relationship to the demand for both cat and non-catastrophe coverage is negative and significant. Thus as the mean age rises in a zip code, demand is lower. However, as the percentage of retirees goes up (as measured by the percentage of people in the zip code that are 65 or older) , we see a negative effect on the demand for non-catastrophe coverage just as we see for the median age of the householder in the zip code. However, we also see a positive and statistically significant relationship between the percent of people in the zip code over 65 years of age and the demand for catastrophic cover.

The percentage of homes with mortgages is positively associated with the demand for catastrophe insurance and positively associated with the demand for 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 set of variables, the percentage of housing units where mortgage payments exceed 20, 24, 29, 30, percent of household income, is significantly positive for catastrophe insurance and significantly negative for non-catastrophe insurance. (The percentage of costs greater than 35 percent is omitted to avoid multicollinearity).We employ this ratio as a proxy for equity in the home. As the ratio of mortgage expenses to household income increases we might conjecture that the householder has a lower level of equity in the house. If that conjecture holds, as this ratio increases, then the option to default on a mortgage after a catastrophic loss increases in value. Thus, zip codes with consumers with higher ratios of mortgage expenses to income are less likely to demand catastrophic coverage. This is what we observe. Those Zip codes with lower levels of mortgage expense ratios have higher demand for catastrophic cover, all other things equal. In contrast, if we look at panel B for the case of non-catastrophic coverage, we see little difference in the influence of the ratio of mortgage expenses to household income. For smaller, not-cat expected losses it appears that the consumer's demand for insurance does not change as much as the ratio of mortgage expenses to income.

Although homeowners with mortgages may be required to purchase an insurance policy by lenders as a precondition for obtaining the mortgage, 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 included the typical organizational form and marketing variables as controls, as well as the size of the firm in terms of total assets. Further we look to examine cross marketing effects and the influence of A.M. Best Ratings. We included 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.[33]

Our results suggest that direct writers have a positive influence on the demand for catastrophic coverage and a negative influence on the demand for non-catastrophic coverage. Further, stock companies exhibit the same pattern. These essentially are control variables reflecting the structure of the companies in the Florida homeowners market.[34] We also note that large firms (in terms of total assets) are related to higher demand. This may be due to greater name recognition or economies of scale.

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

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[33] 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. The ratings descriptions (Superior (A++, A+), Excellent(A,A-), and Very Good (B+, B++, Adequate (B, B-), are A.M. Best's categories and are ranked in order of highest to lowest. The omitted category is not rated companies.

[34] As shown below in Table 6, after controlling for whether the firm reports to ISO, the results are essentially unchanged. However, we do not control for the selection affect of the decision to enter Florida, just the decision to report to ISO.

increasing tendency by individual companies to specialize in either auto or home insurance.[35] 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.

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 effects of the A.M. Best Ratings for the top three categories are significantly greater than the Non-Rated Companies on catastrophic cover. Thus, consumers value the ratings to help them discern companies for catastrophic coverage. In contrast only the Excellent and Superior categories had a significant influence in the demand for non-catastrophic cover. This seems to make some sense as consumers will be more sensitive to a company if it is more likely to suffer financial distress from a catastrophe, but less sensitive to the a company's financial strength if the risks are individually smaller and less likely result in the failure of a company. Overall, the effect of the top three rating classifications is significantly positive, so it appears that for the bundled good that the ratings are important.

We also estimate in a similar fashion the demand for HO3 and HO5 policies. These results are presented in Table 6. As mentioned above, HO3 policies represent a much greater number of policies than HO5. Thus, our sample of zip code contract combinations where there is both HO3 and HO5 policies being sold is smaller. By adding HO5 polices to the model we obtain similar results for most variables. For cat coverage the major changes for the elasticities are that the HO3 demand elasticity is now negative and is estimated to be –1.124. The HO5 price elasticity for catastrophic coverage is –1.219 and the cross-elasticity of demand is very low, but positive at 0.090. A positive cross price elasticity indicates that the two services are substitutes while a

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[35] 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.

negative elasticity would imply that the two services are complements. Logic dictates that people can only buy one contract and that HO3 and HO5 contracts should be substitutes in consumption. However, the cross elasticity is quite low which suggests that the consumers do not place a high value on the substitutability between the products.

For the non-catastrophic demand the results are also qualitatively similar. The HO3 demand elasticity is about one-half in size compared to the case when HO3 contracts are estimated singly. The HO5 demand elasticity is much more inelastic, however. Further, the two are again substitutes.

Finally the income elasticity for catastrophic cover is lower in absolute value as the income elasticity estimated from the HO3 only model in Table 5, while the non-catastrophic income elasticity is about the same.

The results of the model shown in Table 6 contain one additional variable. This is the exclusion of wind peril coverage where the wind portion is excluded or transferred to a windstorm pool and it only applies to HO5 policies. The exclusion of the wind peril is significantly negative for catastrophe insurance 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.[36] 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.

One further concern is raised is whether our sample companies are representative of the Florida market. We address this in the next section.

D. Demand for Homeowners' Policies Controlling for Selection

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[36] 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.

One of the concerns of our model is that the companies reporting to the ISO may not represent the universe of companies writing in the Florida market. In our sample we have some 60 different companies in the sample over the four years. In Florida, over the time period we study, this represents about 30 percent of the total homeowners' premiums written in each year. The firms that report to ISO may be significantly different than the other firms in the market. Thus, we control for this result by estimating a probit regression that attempts to classify those companies that participate from those that do not. This selection model employs firm specific characteristics to determine whether the firm is an "ISO Reporter".

The regression we estimate is:

Probit (ISO Reporter=1/0 otherwise) =

f(log of total assets,
log of Florida homeowners premiums,
Best Capital Adequacy Ratio,
business concentration ratio (top four lines),
geographical four state concentration ratio,
percent of claims paid within two years,
percent of claim value paid within two years,
Stock Dummy, Direct Writer Dummy, and year dummies).

From this regression we obtain the inverse Mills ratio for each observation as $l = -f(X'b)/\Phi(X'b)$ from the estimates of the probit regression where $f(*)$ represents the normal density function and $F(*)$ represents the cumulative normal distribution function (See Green 2000). This variable can then be employed in the demand equation to account for the fact that some firms report to ISO an others do not. In our model the coefficient on l in the demand represents the effect on the quantity demanded for a firm that is a participant in the ISO Reporting scheme. If the coefficient is positive (negative) then the mean level of demand is higher (lower) relative to firms who do not report to ISO.

For the model where we estimated the demand for HO3 contracts (Table 7) the selection indicator (l) is significantly positive for both catastrophic and non-catastrophic coverage, thus implying that the ISO Reporting companies are more likely to be providing coverage than those that do not report to the ISO. Thus, the mean level of insurance demanded is higher for reporting companies than non-reporting companies.

Table 8 contains the results of a model accounting for selection when we estimate the demand for both HO3 and HO5 contracts. We see that the selection term for cat coverage is not significant, but it is significant for non-cat coverage demanded. This suggests that reporting companies operating in markets where both HO3 and HO5 contracts are sold do not have higher mean levels of demand for their cat coverage. Overall (and for non-cat coverage), the reporting companies have higher mean demands for their products than non-reporting companies.

The results for the contract and policy terms, demographic, and firm specific variables shown in Tables 7 and 8 are not qualitatively different than those reported in tables 5 and 6. Thus the fact that a firm reports to ISO does not have a material economic effect upon the other variables that influence demand. The major exception is that for the ISO reporting companies in Tables 7 and 8 the A.M. Best Ratings are no longer significant.

E. Summary

The main elasticity results are summarized in Table 9. We see that in general the price elasticity for catastrophic insurance is more elastic than for non-catastrophic coverage. Further, the income elasticity for catastrophic demand is also greater than for non-catastrophic coverage. By moving from the HO3 only results to those that include HO5 policies we see that the cat coverage elasticity of demand becomes lower and negative, and the non-catastrophic cover elasticity is also lower. We also see that HO3 and HO5 policies are substitutes as the Cross-Elasticity of Demand is positive but low in absolute value suggesting that these goods are not close substitutes.

It is important to note that the HO3 samples (Tables 5 and 7) and the HO3 and HO5 samples (Tables 6 and 8) are very different. We have not made an attempt to determine the differences yet. For example, HO5 policies are not offered in every zip. This could be for demand reasons (no one desires to purchase them) or it could be for supply reasons (no firm desires to sell them in that market). This needs to be address in the future.

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 HO3 and HO5 insurance contracts 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-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 OLS 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 an inferior good whose income elasticity is considerably lower higher than non-catastrophe coverage. Finally, we also not that the overall income elasticity ofr the bundled good is negative consistent with theory.

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 as measured by home values, 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. Finally, we note that there does not appear to be an important material difference between the ISO companies that report and those that do not report.

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.

References

Arrow, Kenneth J., 1971, *Essays in the Theory of Risk Bearing* (Chicago: Markham Publishing Co.).

Bartlett, Dwight K., Robert W. Klein, and David T. Russell, 1999, Attempts to Socialize Insurance Costs in Voluntary Insurance Markets: The Historical Record, *Journal of Insurance Regulation* 17: 478-511.

Berger, Allen N., J. David Cummins, and Mary A. Weiss, 1997, The Coexistence of Multiple Distribution Systems for Financial Services: The Case of Property-Liability Insurance, *Journal of Business* 70: 515-546.

Brown, Mark and Robert E. Hoyt, 1999, The Demand for Flood Insurance: Empirical Evidence, Working Paper at SSRN.com http://papers.ssrn.com/paper.taf?ABSTRACT_ID=169448.

Briys, Eric, Georges Dionne, and Louis Eeckhoudt, "More on Insurance as a Giffen Good," *Journal of Risk and Uncertainty*, 2 (1989): 415-420.

Cleeton, David, and Bruce Zellner, "Income, Risk Aversion, and the Demand for Insurance," *Southern Economic Journal*, 60-1(1993): 146-56.

Collins Center for Public Policy, 1995, *Final Report of the Academic Task Force on Hurricane Catastrophe Insurance* (Tallahassee, Fla.).

Cummins, J. David, 1990, Multi-Period Discounted Cash Flow Ratemaking Models in Property-Liability Insurance, *Journal of Risk and Insurance* 57: 79-109.

Cummins, J. David, Neil A. Doherty and Anita Lo, 1999, Can Insurers Pay for the 'Big One'? Measuring the Capacity of an Insurance Market to Respond to Catastrophic Losses, Working Paper, The Wharton School, University of Pennsylvania, Philadelphia.

Cummins, J. David, Mary Weiss, and Hong Min Zi, 1999, Organizational Form and Efficiency: The Coexistence of Stock and Mutual Property-Liability Insurers , *Management Science* 45: 1254-1269.

Froot, Kenneth A. and Paul G. J. O'Connell, 1999, On the Pricing of Intermediate Risks: Theory and Application to Catastrophe Reinsurance, in Kenneth Froot, ed., *The Financing of Catastrophe Risks* (University of Chicago Press).

Gal-or, E., 1983, Quality and Quantity Competition. *Bell Journal of Economics* 14: 590-600.

Grace, Martin, Klein, Robert W. and Kleindorfer, Paul R., 1999, The Supply of Catastrophe Insurance under Regulatory Constraints, Working Paper, Wharton Managing Catastrophic Risks Project, University of Pennsylvania, Philadelphia.

Grace, Martin, Klein, Robert W. and Kleindorfer, Paul R., 2000, The Supply and Demand for Residential Property Insurance with Bundled Catastrophe Perils, Working Paper, Wharton Managing Catastrophic Risks Project, University of Pennsylvania, Philadelphia.

Green, William, 2000, *Econometric Analysis*, (Prentice Hall: Upper Saddle River, NJ).

Greenwald, Bruce C. and Stiglitz, Joseph E., 1990. Asymmetric Information and the New Theory of the Firm: Financial Constraints and Risk Behavior, *American Economic Review*, 80: 106-165.

Herring, Richard J. and Prashant Vankudre, 1987, Growth Opportunities and Risk-Taking by Financial Intermediaries, *The Journal of Finance* 52: 583-599.

Insurance Information Institute, 1997, *The Fact Book 1998: Property/Casualty Insurance Facts* (New York, N.Y.).

Insurance Services Office, 1994a, *The Impact of Catastrophes on Property Insurance* (New York, N.Y.).

Insurance Services Office, 1994b, *Catastrophes: Insurance Issues Surrounding the Northridge Earthquake and Other Natural Disasters* (New York, N.Y.).

Insurance Services Office, 1996a, *Managing Catastrophe Risk* (New York, N.Y.).

Insurance Services Office, 1996b, *Homeowners Insurance: Threats from Without, Weakness Within* (New York, N.Y.).

Joskow, Paul L., 1973, Cartels, Competition and Regulation in the Property-Liability Insurance Industry, *Bell Journal of Economics* 4: 375-427.

Klein, Robert W., 1996, *Urban Homeowners Insurance Markets in Missouri* (Kansas City, Mo.: National Association of Insurance Commissioners).

Klein, Robert W., 1998, Regulation and Catastrophe Insurance, in Howard Kunreuther and Richard Roth, Sr., eds., *Paying the Price: The Status and Role of Insurance Against Natural Disasters in the United States* (Washington, D.C.: Joseph Henry Press): 171-208.

Kunreuther, Howard, Jacqueline Meszaros, Robin Hogarth, and Mark Spranca, 1995, Ambiguity and Underwriter Decision Processes, *Journal of Economic Behavior and Organization* 26: 337-352.

Kunreuther, Howard, 1996, Mitigating Disaster Losses through Insurance, *Journal of Risk and Uncertainty* 12: 171-187.

Kunreuther, Howard, 1998a, Insurability Conditions and the Supply of Coverage, in Howard Kunreuther and Richard Roth, Sr., eds., *Paying the Price: The Status and Role of Insurance Against Natural Disasters in the United States* (Washington, D.C.: Joseph Henry Press): 17-50.

Kunreuther, Howard, 1998b, The Role of Insurance in Dealing with Catastrophic Risks from Natural Disasters, in Robert W. Klein, ed., *Alternative Approaches to Insurance Regulation* (Kansas City, Mo.: National Association of Insurance Commissioners).

Kleindorfer, Paul and Howard Kunreuther, 1999, Challenges Facing the Insurance Industry in Managing Catastrophic Risks, in Kenneth Froot, ed., *The Financing of Catastrophe Risks* (University of Chicago Press).

Marlett, David C. and Alan Eastman, 1997, The Estimated Impact of Residual Market Assessments on Florida Property Insurers, paper presented at American Risk and Insurance Association 1997 Annual Meeting, San Diego, C.A.

Mossin, Jan, Aspects of Rational Insurance Purchasing, *Journal of Political Economy* 76 July (1968): 553-68.

Myers, Stewart and Richard Cohn, 1987, Insurance Rate Regulation and the Capital Asset Pricing Model, In J. David Cummins and Scott E. Harrington, eds., *Fair Rate of Return in Property-Liability Insurance* (Norwell, MA: Kluwer Academic Publishers).

Risk Management Solutions, Inc. and Insurance Services Office, Inc., 1995, *Catastrophe Risk* (Menlo Park, C.A. and New York, N.Y.).

Rothschild, Michael and Joseph Stiglitz, 1976, Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information, *Quarterly Journal of Economics* 90: 629-650.

Russell, Thomas and Dwight M. Jaffee, 1997, Catastrophe Insurance, Capital Markets, and Insurable Risk, *Journal of Risk and Insurance* 64: 205-230.

Scherer, F. M. and Ross, 1990, Industrial Market Structure and Economic Performance, 3rd ed. (Chicago: Rand McNally).

Willig, Robert D., 1976, Consumer Surplus without Apology, *American Economic Review* 66: 589-97.

Appendix A
Data in Florida Demand and Supply Study

Table A1: Features of Policies and Structures

Variable Name	Short Description	Comments and Codings
COMPNO	Company Number (1-83)	Link to Company Data
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
STEXCIND or STEX	State Exception Indicator	Dummy Variable: 1 = Off-Premises Theft Coverage
ORD_LC or ORD	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 SFR	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 Percentage of COVA
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 COVA
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 the NAIC Annual Statement, Supplemented by Data from the AMBest Key Rating Guide as Indicated

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	AM Best 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 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	Log of HOMEDPW	
TOTDPW	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: Socio-Demographic Data Used in the Demand Analysis
All data taken at the ZIP-Code level from the 1990 Census Data

Median Householder Income In The Zip Code
% Of Housing Units That Have A Mortgage
% Of Housing Units In Which Mortgage Is Greater Than 30% Of Household Exps
Average Age Of Householder
% Of Housing Units Occupied By Owner
% Of Income That Constitutes Retired Income
Percentage Of People Above 25 Who Have Completed 12Th Grade
Percentage Of People Above 25 Who Have A College Degree
Median Year Structures Were Built In The Zip
Median Value Of Structures In The Zip
% Of Population That Is In The Urban Areas In The Zip
% Of Population That Is In The Rural Areas In The Zip
Number Of People Above The Age Of 16
Number Of People Above The Age Of 25
% Of Married Couples With Children In The Population