Does the Internet Make Markets More Competitive? Evidence from the Life Insurance Industry

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Abstract:

The Internet has the potential to significantly reduce search costs by allowing consumers to engage in low-cost price comparisons online. This paper provides empirical evidence on the impact that the rise of Internet comparison shopping sites has had for the prices of life insurance in the 1990s. Using micro data on individual life insurance policies, the results indicate that, controlling for individual and policy characteristics, a 10 percent increase in the share of individuals in a group using the Internet reduces average insurance prices for the group by as much as 5 percent. Further evidence indicates that prices did not fall with rising Internet usage for insurance types that were not covered by the comparison websites, nor did they in the period before the insurance sites came online. The results suggest that growth of the Internet has reduced term life prices by 8 to 15 percent and increased consumer surplus by $115-215 million per year and perhaps more. The results also show that the initial introduction of the Internet search sites is initially associated with an *increase* in price dispersion within demographic groups, but as the share of people using the technology rises further, dispersion falls.

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1. Introduction

The last five years have witnessed an explosion in the growth of electronic commerce and Internet marketplaces as alternatives or supplements to traditional retail markets (McQuivey et al., 1998). Consumers can now go online and comparison shop between hundreds of vendors with much less effort than in the physical world. The traditional economic view suggests that, as a result, the Internet should reduce search costs for consumers and thereby reduce prices and make markets more competitive.

Despite this presumption of increased competition, however, existing empirical work on the Internet has not been as supportive of the theory as one might expect. Although, data availability has limited analysis of the sector (existing work has mainly entailed collecting prices on and offline for a specific category such as books), the results from this literature have not conformed to the traditional view of falling search costs. These studies have generally found large dispersion of prices online and prices either modestly lower or actually higher than their offline counterparts.[1] To the extent that there is a conventional wisdom in such a new area it is that the Internet may have increased product differentiation and price discrimination more than it has price competition.[2]

Because of the data constraint, however, little is known about the impact of the Internet on offline prices. Instead, most papers take offline prices as exogenous. In this paper, we will present the first empirical evidence on the impact of Internet competition on prices and dispersion offline. In this sense, our results are similar to the existing empirical literature on search.[3] By combining Internet and life insurance industry data sets over time, we are able to document how important the Internet—and the reduction in search costs that it creates—can be for market competition.

We examine term life insurance, a somewhat homogenous product with low marginal cost, for several reasons. First, in the mid-1990s, a group of Internet price comparison sites

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[1] Work by Lee (1997) on cars and Bailey (1998) on books, CDs, and software suggest that prices were actually higher online than in retail stores. More recent work by Brynjolfsson and Smith (1999) on books and CDs and by Clay et al. (2000) on books has found prices the same or lower online but that online price dispersion is quite high, perhaps greater than in retail stores.

[2] See the work of Bakos (1997; 1998) or the survey of Smith, Bakos and Brynjolfsson (1999). Although addressing a different question, the results of Goolsbee (2000a; 2000b) suggest that online buying is quite sensitive to local retail price variation generated by local sales tax rates. Recent work by Brynjolfsson and Smith (2000) analyzes detailed data on customer behavior at book shopbots and estimates the importance of price, brand, and other factors.

began that dramatically lowered the cost of comparing the prices (i.e. premiums) of term life policies across companies. This has the potential to have an important impact in an industry where high customer search costs create the potential for market power among existing merchants. Second, life insurance as an industry is quite important in its own right. It is one of the most widely held financial products in the United States and the face value of life insurance policies sold in 1998 exceeded $2 trillion. Premia typically amount to several percent of GDP annually (see ALCI, 1999; Cawley and Philipson, 1999). If the Internet reduces prices in this market, the potential welfare implications are enormous. Third, there has been a very serious price decline in the cost of term life insurance in the 1990s that is not well understood and has taken place concurrently with the rise of the Internet (see the description in Dugas, 1999). We will try to examine the ways in which they are related.

To analyze the relationship, we take individual policy-level micro data from LIMRA International on the prices of insurance policies as well as various owner and policy characteristics and match it to micro data on the growth of Internet usage and online insurance research from Forrester by the same owner characteristics. In essence we fit hedonic regressions for the price of life insurance on characteristics of the policies and the individuals and then include a measure of how likely the individual is to have used the Internet over time or to have researched insurance online.

The results indicate that once the online insurance sites began, the faster a group adopted the Internet, the faster prices of term life insurance fell for that group. The total impact of the rise from 1995 to 1997 reduced term life prices by 8 to 15 percent. This implies an increase in consumer surplus of about $115 to $215 million annually from these policies. The results are robust in that rising Internet use did not have any effect on prices during the period before the insurance websites existed, nor did it affect the prices of types of life insurance that were not covered by the websites (i.e., whole life policies). Neither can the results be explained by changes in mortality across groups. Interestingly, the data also show that the Internet-induced reduction in search costs actually increased price dispersion upon introduction. As it became more widespread, price dispersion fell.

[3] This includes the work on the impact of price advertising on pricing behavior such as Sorensen (2000), Milyo and Waldfogel (1999), Kwoka (1984), or Benham (1972). It also includes other work exploring the sources of price dispersion such as Van Hoomissen (1988) or Dahlby and West (1986).

The paper proceeds as follows: in section 2 we discuss the life insurance industry and the role of the Internet comparison sites. In section 3, we discuss the theory of search when customers have different search costs. In section 4 we discuss our data sources and the basic specification. In section 5 we present the basic results. In section 6 we consider alternative explanations of the results. In section 7 we examine price dispersion within groups. In section 8 we conclude.

2. The Life Insurance Industry and the Internet

A. Overview of Life Insurance

The market for life insurance is the largest private individual insurance market in the world. In 1998, over 52 million life insurance policies were purchased in the United States, with a face value of nearly $2.2 trillion dollars, bringing the total number of policies in force to 358 million, with a total face value of $14.47 trillion (ACLI 1999).

Life insurance can play a number of important roles in the portfolios of most households. The primary function of life insurance is to protect a primary earner's dependents against potentially catastrophic financial losses in the event of the death of the insured. As such, over half of all life insurance policies are purchased by individuals between the ages of 25 – 44 (LIMRA International, various years). Other possible reasons for owning life insurance include opportunities for tax-advantaged savings or the provision of liquidity to estates subject to U.S. estate tax laws (Brown 1999, Holtz-Eakin, Phillips & Rosen 1999).

There are many types of policies available. One distinction is between individual, group and credit life insurance. Individual life insurance policies are sold directly to individuals and are underwritten separately for each purchaser. Group policies are often provided by employers or unions, and are underwritten for the group as a whole. Credit life insurance is designed to guarantee payment of a mortgage or other loan in the event of the insured's death. Of 52 million policies sold in 1998, 22 percent were individual life policies but these policies account for 60 percent of the face value of coverage. This is because the group, and especially credit life policies, tend to be small.

Within individual life insurance policies, there are two basic types, term and whole. The total amount of coverage for policies bought in 1998 was split almost equally between term and whole life policies. Term life policies provide life insurance coverage for a specified period of time, such as 1-year or 5-years. When the term period ends, these policies provide no additional benefit to the insured. As such, term life policies are pure insurance over the period of the contract and are relatively homogenous. Whole life policies that are not term dependent (hence are also known as permanent life or cash value policies), and instead provide insurance over the "whole of one's life" (Graves 1994). In addition, these policies typically include a savings component that builds up a cash value over time. Policy owners can borrow against this cash value, and the accumulation in the cash value account is generally tax-deferred. If at any point the individual cancels the policy, the owner is entitled to receive the full cash value, minus a surrender fee and any outstanding policy loans. For these reasons, whole life policies have higher premiums per thousand dollars of coverage than do term policies.

B. Life Insurance and the Internet

By 1996, there were a number of insurance-oriented web sites that provided consumers with access to on-line quotes for insurance products. The customer would, essentially, answer the medical questionnaire online including age, gender, personal medical history and the like and then enter the amount of coverage they sought. The sites would then report numerous companies that would offer such a policy and would give a price quote from each. A simple example for a 30 year old non-smoker with no medical problems searching at www.quickquote.com is shown in box 1. Importantly, in almost all cases, the individual does not buy the product online directly from these sites. Indeed, most industry analyses have emphasized the conservative nature of the offline insurance business and their reluctance to conduct commerce online (see Temkin et al., 1998 and Klauber, 2000).

With these search services a connection to the offline seller remains. Consumers must still take a blood test, for example, to qualify for various policies. The sites are almost strictly a comparison/referral device. But with the the creation of these sites, the costs of comparing prices for a given set of risk factors, age, gender, etc. became extremely low. Users can get dozens of quotes in a matter of seconds that would previously have taken a great deal of searching. These Internet search sites essentially provided an information source between the consumer and the life insurance company that was formerly available only to brokers (see

Garven, 2000).[4] We do not have information on the total number of users of these types of sites in our sample but the data in Forrester's *Technographics 2000* database and in Clemmer et al. (2000) indicates that by 1999, more than 5 million households had researched life insurance online.

Two important aspects of the Internet insurance sites help us to distinguish the Internet/search cost hypothesis from alternative explanations of the price declines. First, the comparison sites have focused almost exclusively on term life insurance. This is the more commodity-like product and is, therefore, easy to compare. Whole life policies are more differentiated and the sites did not provide comparison quotes for them. Second, the comparison web sites mainly did not start until 1996, whereas Internet usage had already increased significantly for many groups prior to that time. Growth in Internet usage before 1996 should not affect competition in term life insurance, only growth after the comparison sites came online.

3. Literature and Theory: Search Costs, Pricing and the Internet

Our approach is to think of the Internet as reducing search costs and analyze its impact empirically. In that sense it is in the spirit of the empirical search models mentioned above. Since the original work on search theory of Stigler (1961), there have been numerous models analyzing the impact of search costs and differential information on the distribution of market prices.[5] The most relevant exposition for our empirical work is that of Stahl (1989).

The Stahl model begins with a fraction of customers, μ, having zero search costs and the other fraction having to pay a cost for every store they visit. The customers search stores sequentially and the Nash Equilibrium prices involve the stores choosing prices from a distribution rather than having a pure strategy. The positive search cost customers have a reservation price and stop searching when they find a price below that reservation price. The zero search cost customers sample all prices and buy from the lowest. We view the Internet comparison sites as being a technology like μ. For those with access to the insurance sites, search costs are close to zero.

[4] There are several major sites such as www.insweb, www.insure.com, www.accuquote.com, www.quotesmith.com, www.insuremarket.com, www.rightquote.com, and www.term4sale.com. They are reviewed periodically by www.gomez.com. Quotesmith began as a phone in comparison service and, in late 1995, became the first to provide quotes online.

[5] See the work of Diamond (1971), Salop and Stiglitz (1977), Varian (1980), Burdett and Judd (1983), Carlson and McAfee (1983), or Stahl (1989).

There are three basic results stated in the Stahl model that have direct bearing on our empirical work (and, in essence, summarize key findings of the search literature).

First, and most simply, when there are asymmetric search costs across customers (i.e., some have zero search costs and others do not), firms will tend to draw equilibrium prices from a random distribution rather than all of them charging a single market price. This means we should expect to see price dispersion in equilibrium.

Second, as the share of customers with complete information (μ) increases, the price distribution shifts downward monotonically. In other words, as the share of consumers with no search costs increases, average prices should fall.

Third, when μ is zero, the price distribution is degenerate at the monopoly price. When μ is one, the distribution is degenerate at the competitive price. As μ increases from zero to one, the distribution moves continuously from one to the other. This is important because it implies that the relationship between search costs and price dispersion is *not* monotonic. Increasing the share with no search costs will *increase* price dispersion for small enough starting levels of asymmetric information across consumers. If μ is large enough to begin with, then increasing μ will reduce dispersion. The large initial μ case is the one assumed by most empirical work on search. Since we will be observing the initial entry of the insurance websites, however, this may correspond with a starting μ close to zero. As the share using the Internet to compare prices online rises from zero, price dispersion should rise and then, eventually fall.[6]

Because we observe the increase in Internet usage over time for each group, we will treat this as observable variation in μ and see what happens to prices and dispersion in the data.

4. Data on Prices of Insurance and Internet Usage

[6] The theoretical literature has mainly focused on the distribution of list prices across stores whereas our data will be transaction prices and therefore weighted by quantity. Sorensen (1999) has suggested, in a slightly different model, that the maximum dispersion of list prices occurs at very low levels of search costs and that for plausible ranges, reducing search costs reduces dispersion. In our data, we will have transaction prices (i.e., quantity weighted) rather than list prices which is likely to influence this result. We simulated the Stahl model using a linear demand curve and the basic cost structure given in the numerical example of Stahl (1989) and computed the expected difference between the highest and lowest price and the variance. We found that the dispersion was increasing with μ up to about .1 in this case. We found similar results using expected order statistics and quantity weighting to check the influence of using transaction prices rather than list prices.

A. Data on Life Insurance

LIMRA International conducts annual surveys of purchases of individual life insurance contracts in the U.S. Each year, LIMRA uses a sample of approximately 30,000 policies issued by an average of 46 participating companies per year, collecting detailed information on the policy characteristics, and prices as well as some demographic information on the insured individuals including age, state of residence, occupation, and income. For purposes of this study, we have combined data from six Buyer's Studies covering the period 1992 through 1997. The LIMRA data are the most comprehensive in the industry and are widely used for empirical work on life insurance.[7] They do not include company identifiers, however, so we cannot include firm dummies.

Our primary concern will be with the prices of term life policies and how they respond over time as their buyers begin using the Internet. To keep the product as homogenous as possible for our pricing regressions, we restrict the sample to level term policies owned by the premium payer, insuring the life of only one person, for people aged 20-75, and without any other riders (such as a CPI cost-of-living adjustment, etc.). We also look only at terms of five years or less durations (about 70 percent of term insurance). We do this because during the late 1990s, state insurance regulators were discussing changes to reserve requirements for policies with long-term premium guarantees (now known as "regulation Triple X"). This regulatory action may have affected prices of longer-term policies in a way that is difficult to adequately control for.

Several individuals lack some of the requisite demographic or policy information so we must drop them. Even with these various restrictions, we still have almost 11,000 person-year observations and about one third of the total term life insurance in the sample. Summary statistics for the insurance variables are listed in table 1.

B. Data on Internet Use

It would have been easiest to estimate the impact of the Internet on prices if the LIMRA data had asked the individuals directly whether they had checked insurance sites online. Lacking such information, we instead create a measure of the probability of Internet usage for each individual in each year based on the person's observable characteristics. To compute this

[7] More details on these data can be found in LIMRA (1999).

measure, we turn to the Technographics 1999 survey of Forrester, a leading market research company on the information economy.

Forrester conducted a nationally representative survey of almost 100,000 people in late 1998 that gathered information on their computer ownership, Internet use, online buying behavior, and the like, as well as demographic and geographic information on the individuals.[8] One of the questions Forrester asks of those with online access is how long they have been online. Another is whether they have ever researched various products online and one of the products they report on is insurance. Importantly for our purposes, the Forrester survey collects age, state, occupation, and income information that we can match to the LIMRA data. Occupation and income are harder to match than age and state because the occupation codes do not match precisely across the two datasets and because the Forrester income is for the family while the LIMRA income is for the individual.

We compute for each age-state-year, age-occupation-year, occupation-state-year, and age-income-year the share of people in that group that had online access in December of that year. The retrospective data on online usage go back to 1994. For 1993 and 1992, we scale each groups' 1994 online usage by overall rate of growth of domain names as tabulated by the Internet Software Consortium (2000). In the few regressions where we use the early information, this adjustment had little impact on the results since online usage rates were extremely low in those two early years. The overall share of people with online access rose from 2.6 percent in 1992, to 5.1 percent in 1993, 8.9 percent in 1994, 15.7 percent in 1995, 26.7 percent in 1996, and 38.8 percent in 1997. Of key importance for our regressions is the considerable variation in both the levels and growth patterns of online usage between groups. Not all groups grew at the same rate over time.

Because we are concerned with the use of the Internet for comparing insurance prices, including a measure of Internet usage in a price regression is equivalent to assuming that the use of insurance sites is proportional to use of the Internet (i.e., some constant fraction of Internet users go to insurance shopping sites). Since the insurance sites largely did not begin until 1996, our basic measure of Internet use for the group will be zero until 1996 and then equal to the share of people online after that. We will also show results that compare the impact of Internet usage

[8] More details on the Forrester data can be found in Bernhoff et al. (1998) and Goolsbee and Klenow (1999).

in the earlier years on insurance prices to check if rising Internet use is spuriously correlated with prices.

C. Specification

Over the last half of the 1990s, life insurance consumers witnessed a large decline in the price of term life insurance. Without taking account of any controls, the average annual premium paid per $1000 for a renewable one year term policy was $3.20 in 1993 and by 1997 had fallen more than 20 percent to $2.50.

Ignoring other costs, the actuarially fair pricing of a one-year term policy that pays out a face value of F on the last day of the year will depend on the probability of dying during the period, q_a for an individual of type a, and on the interest rate r according to $P = q_a F/(1+r)$. Higher expected mortality rates (high q) and lower interest rates (r) raise the marginal cost and thus the premium. This approach is consistent with the typical regulatory approach of setting reserve requirements based strictly on interest rates and mortality (Graves, 1994). Extending this formula to multiple year policies is straightforward.

Our regressions will attempt to explain the price paid for term policies. The dependent variable is the log of the annual premium per $1000 of face value of insurance. We do not have a direct calculation of the survival probability for the individual so we include standard variables to proxy for it including age dummies, a non-smoking dummy, a gender dummy, marital status dummies, and a dummy for whether the policy is "rated" meaning the individual belongs to a special risk class because of some personal behavior such as being an amateur pilot. We also include state dummies and occupation dummies to account for differences in health or demographic characteristics across groups that are correlated with life expectancy as well as dummies for whether the policy was purchased from an own agent and whether it was a participating policy.[9]

In addition to these variables, we want to allow for economies or diseconomies of scale in the costs of policies of different sizes and lengths, as discussed in Cawley and Philipson (1999). Therefore we include policy length dummies and several terms for the value of the policy in real dollars (these are the log of the real amount, the real amount, and the real amount squared as well

[9] Participating policies are typically issued by mutual life insurers. They allow the policy owner to participate in the company's surplus via distribution of a policy owner dividend.

as dummies equal to one if the reported value was censored at the maximum value in the year). In practice, though significant, these non-linearities had little effect on our results as we tried various functional forms and got the same answers. We use the monthly CPI as the deflator and the inverse of one plus the Baa bond rate for the interest rate term (raised to the length of the policy for term lengths more than one year). We also include year dummies. The coefficient on the year dummies gives us a price index in log terms for the cost of identical term-life insurance over the period.

5. Basic Results

A. An Overview of Price Trends for Term and Whole Life Policies

The results from this regression are listed in column 1 of table 2. The explanatory power of the regression is high with an R^2 is .837. These variables explain a large fraction of the variance in policy prices. The coefficients on the explanatory variables are fully in line with expectations. Policies for men cost about 20 percent more than identical policies for females, for smokers, 45 percent more than for non-smokers. When interest rates rise (lowering the inverse interest rate term), this reduces prices. Most importantly, the results show a dramatic decline in prices of term life insurance, especially toward the end of the sample. Relative to real prices in 1992, prices for identical policies were about 1 percent lower in 1994 but almost 19 percent in 1996 and 27 percent lower in 1997.

Thus prices seemed to fall most at the time that the Internet insurance comparison sites came online. Whole life prices make an interesting comparison since the insurance sites did not cover such policies. Column 2 of the table repeats the specification of column 1 now for the price of whole rather than term policies.[10] Interestingly, at the start of the sample the whole and the term prices changes were very similar—term life prices in 1995 were 6.8 percent below 1992 levels, whole life prices were 6.7 percent below. In 1996 and 1997, however, prices dropped dramatically for term policies while whole life policies remained constant or even rose slightly.

B. Overview of Price Trends for Term Life Across Demographic Groups

[10] Since the whole life policies are not of limited duration, there is no way to limit the length of the policies to 5 five years or less. We estimate the policy length as being 80 minus age for women and 72 minus age for men. Given the longer time frame of these policies we use the five-year bond rate rather than the one year and include the interest rate on its own in the regressions, though this did not matter for the results.

Next, in table 3, we repeat the term life hedonic regressions but compare price changes among groups for which Internet usage grew at different rates to get suggestive evidence as to whether there is any apparent role for the Internet (all groups had close to zero Internet usage in 1992). Column 1, gives the results for policies in California, Virginia, and Washington—the states with the highest Internet penetration at the end of the sample (more than 40 percent in 1997). Column 2 looks at policies in Alabama, Louisiana, Kentucky, and Arkansas—the states with the lowest penetration at the end of the sample (about 25 percent in 1997). The results show that prices for identical policies in high Internet states fell significantly faster at the end of the sample (1997 prices were 32 percent below 1992 levels) than they did in low Internet states (1997 prices were about 13 percent below 1992 levels).

The same thing is true in columns 3 and 4 which compare policies for people in high skill occupation codes (professionals, students, and military) that had average Internet use of about 49 percent in 1997 to policies for people in low skill occupation codes (operatives, service workers, and farmers) that had Internet usage of 22 percent in 1997. In columns 5 and 6, we see that the price declines were also significantly larger for people under age 30 (Internet use of 46 percent in 1997) compared with people over age 45 (Internet use of 34 percent in 1997).

These regressions suggest a correlation between Internet use and price declines. In our attempt to attach a causal relationship between the two, however, we need more detailed data on Internet usage and we need to confront potential alternative explanations. We address these issues in the sections below.

C. Basic Results

In table 4, we add the probability of Internet usage (calculated from the Forrester data described above) to the price regressions. We compute the Internet usage in each year share for age-state, age-occupation groups, age-income, and occupation-state groups, as listed at the top of the column. The standard errors are corrected for the fact that the Internet usage variable varies only by group-year and not by individual-year. In every case, the coefficients are negative and significant suggesting that prices for identical term life policies for people in a given group fell more during those periods in which the group had faster adoption of the Internet.

Note that because there are age, occupation, state and year dummies in the regression, these results cannot be explained by level differences in price or life expectancy across groups or time periods. People age 25 to 30 may have lower life insurance prices than people age 45-50 because of health differences, lifestyle choices, and many other reasons and these reasons may be correlated with Internet usage but this will not appear as a positive coefficient on Internet usage in our regression. It will be absorbed in the age dummies.

The magnitudes of the coefficients indicate that increasing the share of a demographic group that uses the Internet by 10 percentage points lowers prices for that group by about 1.5 to 4.5 percent depending on the specification. Because of the potential measurement error in the occupation and income variables mentioned above, we will concentrate our results below on the age-state variation but the findings were very similar in almost every case, no matter which one we used.

In addition, the Internet usage variable seems to explain a large part of the total decline in prices over this period. In the baseline results without Internet use, as previously listed in column 1 of table 2, prices fell about 27 percent over the sample. In these specifications, once we control for the role of Internet usage, the year dummies are significantly less important. The total decline is only 6 percent and not significant in the age-state regression meaning that the growth in Internet usage can explain about three quarters of the total declines in term life prices. Even in the regressions where the Internet variable is measured with error (i.e., that include occupation or income) the Internet still appears to explain between one quarter and one half of the total decline.

As described above, the implicit assumption in these results is that a constant fraction of all Internet users check insurance sites online and this fraction does not vary across groups. Even with that assumption, unless the fraction is literally one, the coefficient will be modified by some unknown scaling factor. To loosen these restrictions, we turn to the question in the Forrester data about whether the individual with online access has ever researched insurance online. We compute the share of each group that has done so (as of 1998) and multiply it by the share with online access in each year. This gives us a measure of the share of the group that both has online access and has researched insurance online. This puts a reasonable scale factor on the results and simultaneously allows for different groups to have differing likelihoods of researching insurance online.

One problem with this measure is that since only 10% of online users report researching insurance and the mean share of Internet users is only about 27% in 1996 and 38% in 1997, there are many smaller demographic groups that suffer from small sample problems so the composite measure may tend to add noise to the Internet variable (i.e., the true share doing online research measure is roughly 2.7% in 1996 but this will tend to show up as zero in the data for small demographic groups). This measurement error will tend to bias the coefficient toward zero.

The results from using this insurance measure by age-state-year as the explanatory variable is presented in column 1 of table 5. Despite the added noise from the small sample problem, the coefficient is still positive and significant. Raising the share of the group using the Internet to research insurance online by 1 percent lowers prices by about 2.5 percent.[11] We will use this insurance research variable in the remaining results (though, as in this case, we got the same general results using the straight Internet usage variable in all the specifications).

Given the observed impact of the Internet on term life prices, we can make a back of the envelope calculation as to the gain in consumer surplus from the price declines generated by growth of the online comparison sites. We do this by multiplying the change in the price (8 to 15 percent in our specifications) by the total amount of term life that was sold in 1995 (the year prior to the introduction of these sites).

The total annualized new premiums of all individual life products sold in 1995 was $9.6 billion. According to LIMRA (2000), 15 percent of these premiums were for term policies, for a total of $1.44 billion of *new* term business. Our results indicated that the price declines resulting from the increase in online usage from 1995 to 1997 generated an annual increase in consumer surplus of about $115 to $215 million, quite large for a service used by only a small number of people. This figure may understate the magnitude of the impact of the Internet because new term policies are dwarfed by renewals of term policies, renewals might similarly decline since policy holders have the choice of replacing an expensive existing policy with a low priced alternative. There were roughly $7 billion of term life renewal premiums in 1995 (ACLI, 1999) so if the Internet caused a similar 8% to 15% reduction in these prices, that would add an additional $560 million to $1 billion in consumer surplus. On the other hand, it is important to emphasize again that since we do not know the identities of the companies in our sample, we cannot refute the

[11] A coefficient that exceeds one in absolute value, as it does here, is consistent with a search externality in the sense of Salop and Stiglitz (1977), i.e., when a large share of the members of a group begin using the Internet to research insurance, this can reduce prices for everyone in the group, not just the Internet users. Because our data, give the share of the entire group that researches insurance online rather than the share of the potential life insurance buyers in each group, however, we cannot be sure about the absolute magnitude of the coefficient so we will not pursue the externality point in the results that follow.

hypothesis that the Internet comparison sites caused people to choose policies from companies with lower quality along some dimension that we do not measure. If true, the change in price would not represent a pure increase in consumer surplus.[12]

In column 2 we consider the possibility that the impact of the Internet is non-linear. The initial introduction of the Internet may matter a lot for prices but once usage is widespread, the markets may be competitive. When we include a square term in the regressions, there is some evidence of non-linearity but it is only borderline significant. For most of the range in the sample, the marginal effect of increasing the share of the group researching insurance online is fairly constant so we will just include the linear term in the results that follow. At the 90th percentile in the data (about six percent of the group having researched insurance online), for example, the marginal effect is still 85 percent of the marginal effect at zero Internet use. The projected declines in the marginal effect due are mainly outside the observed values in the data. The impact of having a greater share of users online would be insignificantly different from zero when about 19 percent of the group researched insurance online (and the point estimate would be zero at 27 percent).

These basic specifications point to a correlation between the growth in Internet insurance site usage and declines in term life insurance prices. In the next section we consider the viability of some alternative explanations for these findings.

6. Alternative Explanations

A. Changes in Mortality

The most straightforward alternative explanation of the results is that changes in Internet use by a group are spuriously correlated with changes in the mortality rates for that group which will directly reduce the cost of life insurance. As a general matter, mortality improvements are important for insurance prices. Mortality has declined over most of the 20th century and, unsurprisingly, the price of term life insurance has, as well. Mortality improvement from 1992-1997, however, was gradual and will have a hard time explaining the sharp price declines witnessed at the end of the sample and significantly more for groups with a high propensity to use the internet.

[12] This is caveat may not be as relevant in our sample since our evidence is based on short-term policies and the primary measure of quality here—the likelihood that the company will pay upon death of the insurance holder—is partially insured by state insurance guarantee funds.

As a specific test of the importance of mortality changes, in column 3 we compute the log mortality rate for each age-state-year using population data from the Department of the Census and the number of deaths from the National Center for Health Statistics. We also tried including lags and leads of the mortality rate but the results were identical. Note that since we already include state, age, year, and occupation dummies, we are identifying the impact of changes in mortality relative to the group mean on the prices of insurance. The coefficient on log mortality is positive and significant on prices, as expected but the coefficient on the Internet term is not significantly different from the previous regression.[13]

Another second piece of evidence against the spurious correlation with life expectancy view is the evidence on whole life prices. Changes to life expectancy should influence both term and whole life policies. Since the comparison sites did not cover whole life policies, however, we do not predict any reduction in search costs in that arena and the Internet should have no effect on prices. The results are presented in column 4. Rising shares of the group using the Internet to research insurance is not associated with lower whole life prices at all. The coefficient is +.388 (and not significant) compared to the significant term life coefficient of –2.5.

B. Unobservable Differences Across Groups

Our results account for age, occupation, and state fixed effects. If there are distinct differences in the life expectancies of various interactions of those variables in a way that is correlated with Internet usage, this could bias our results. To deal with this issue, in column 5, we add age-occupation-state interaction dummies. When we do this the number of dummy variables relating to these factors rises from 68 to 2933. Now rather than just younger people having, on average, different prices than older people, high-skill different from low-skill, etc., we allow young, high-skill people in California to have different prices than young, high-skill people in Nevada and all the other permutations. Once we do this, we are identifying the impact of the Internet exclusively from the changes across time within a given group—whether prices

[13] An alternative mortality-based explanation is to argue that the sample of life insurance buyers changed in 1996, with less healthy individuals purchasing less insurance. To explain our results, however, this would require that the selection effect be stronger for groups with higher Internet use. To test for this, we ran a sample selection Probit on data from the 1992 and 1998 Surveys of Consumer Finances and found no evidence that the probability of owning term life insurance changed differentially by age, income, education, or occupation groups.

fall more for 30-35 year old service workers in Florida in those years in which their probability of using the Internet rose more.[14]

The results still shows the same effect of the growth of Internet usage and, if anything, are larger than before. The coefficient is –3.15 versus –2.53 before.[15] Note that the increase in the R^2 is modest despite the increase in the number of dummies. In both cases, it rises from about .84 to .88.

C. Spurious Correlation of the Growth of Internet Usage with Other Factors

Fundamentally, any alternative explanation of the results we have found must be based on the idea that the growth in Internet use for a group is correlated with some other unobserved factor that is reducing prices for that group.

One way to check this general hypothesis is by estimating the effect of Internet usage on insurance prices during the period when there were no online insurance sites (i.e., 1992 to 1995). During this early period, there is no reason for rising Internet usage to be correlated with lower insurance prices unless it is spuriously correlated with some other factor. In column 6 we add a variable that is equal to the share of the age-state-year with Internet access for 1992 to 1995 interacted with the share having researched insurance online and then zero in 1996 and 1997 (in addition to our standard measure that is zero from 1992 to 1995 and then positive in 1996 and 1997). The results show that prices fell significantly with the rising use of the Internet during the period when the insurance sites existed and with approximately the same magnitude as before, but that rising Internet usage had no significant effect on prices before the sites existed (and the point estimates are positive).

7. Price Dispersion and the Internet

The results confirm that, consistent with the theory of search, as the online insurance sites have made comparison shopping easier Internet users, average prices for such users have fallen significantly. Much of the existing empirical literature about the Internet (and about search theory, too) has examined whether price dispersion falls when search costs are lowered. We

[14] We do not include the full set of possible dummies by age x state x occupation x income because the remaining cell size for all but the largest groups would be extremely small.
[15] Again, the results were very similar using online insurance usage by age-occupation, age-income, etc. or using pure online usage rather than online insurance research. We do not report them here to save space.

have noted, however, that the theory does not have a monotonic prediction for price dispersion, especially when the starting share of fully informed consumers is low, as it is here. Further, our data is transaction, as opposed to list price data, so it will be weighted by volume. This will tend to accentuate the non-monotonicity of the relationship at low levels of Internet use.

Using our regression results, we can examine the amount of price dispersion within observable groups and correlate it to the share of people using the Internet to research insurance (our proxy for having no search costs). To do this, we take the residuals from the price specification in column 1 of table 2 and compute the standard deviation within age-state group for each year. This is the amount of price dispersion within a group that cannot be explained by the observable characteristics of the people or the policy types.

In column 1 of table 6, we regress these measures of price dispersion on the online insurance use measure by age-state-year as well as the square and the cube of the measure to allow for non-linearity (though the standard errors are not corrected for the fact that the residuals are themselves estimated). In column 2, we also allow for age, state, and occupation dummies. In both regressions, the results show evidence of non-linearity. We graph the predicted values as a function of the share in figures 1 and 2 (the values in figure 2 are net of the fixed effects).[16]

The evidence indicates that price dispersion within groups is actually rising with the share of people researching insurance online for low shares and then falling with the share online once that share exceeds about 5 percent. Although this may seem counter-intuitive, it is consistent with the theoretical predictions of the literature. When no one has access to full information, giving the information to a small number of people tends to increase the amount of price dispersion.

8. Conclusions and Future Directions

In this paper we have examined the market for term life insurance from 1992 to 1997 and documented that the growth of Internet price comparison sites appears to have made the market significantly more competitive. Controlling for policy characteristics and a variety of individual and group controls, we find that as the share of people in a group that use the Internet and research insurance online, the more their quality adjusted prices fall. The data also show,

[16] We found the same non-linear pattern using the inter-quartile range and the total range rather than the standard deviation. To save space, we do not report these results and figures here.

consistent with the theory, that increasing the probability of using the Internet tends to raise price dispersion initially and then reduce it as Internet usage continues to grow. The results seem somewhat robust: the growth of Internet use does not appear to reduce the price of whole life policies (which were not covered by the Internet insurance comparison sites), the growth of Internet use before 1996 (when insurance comparison sites did not exist) did not reduce prices and the results are not affected by adding detailed controls for changes in group specific mortality.

Overall growth of Internet usage can potentially explain a significant share of the large price declines of the 1990s. The rise of the Internet from 1995 to 1997 appears to have reduced term life prices by about 8 to 15 percent. Internet comparison sites, although seemingly a relatively modest niche of Internet commerce, have increased consumer surplus by at least $115 to $215 million per year and perhaps as much as $1 billion.

In this sense, our results show that, at least for some financial products, the ability of the Internet to reduce search costs can have a significant impact on market power. When it does so, it may lead to large consumer welfare gains, potentially at the expense of supplier profits. The implications for the market value of online and offline companies could not be more important.

TABLE 1: SUMMARY STATISTICS 1992-1997

Type	Term
Premium/($1000 of Face)	3.62
	(4.91)
Real Amount of Policy (in ‘000s of 1990 dollars)	132.97 (136.41)
Length of policy	2.27
	(1.86)
Non-Smoker	.774
	(.418)
Male	.666
	(.472)
Policy is Rated	.077
	(.266)
R^(Length)	.881
	(.095)
Participating Policy	.883
	(.321)
% Online	.169
	(.142)
N	10812

Source: Authors’ calculations using data from LIMRA International and Forrester.

TABLE 2: BASIC SPECIFICATION

Type	(1) Term	(2) Whole
D93	.0609 (.0133)	-.0597 (.0134)
D94	-.0146 (.0124)	-.0533 (.0111)
D95	-.0677 (.0128)	-.0671 (.0119)
D96	-.1874 (.0133)	-.0111 (.0148)
D97	-.2702 (.0131)	-.0031 (.0145)
No-Smoke	-.4596 (.0098)	-.1573 (.0079)
Male	.1867 (.0095)	.1035 (.0095)
Rated	.6140 (.0201)	.3365 (.0141)
R ^ Length	1.453 (.36118)	.8046 (.0494)
Participating	-.0001 (.0103)	-.0312 (.0092)
Own Agent	.0955 (.0249)	.4629 (.0173)
Others:	Amount, Length	Amount, Interest Rate,
Dummies:	Marital Status Age, State, Occupation	Marital Status Age, State, Occupation
R2	.837	.764
N	10812	29917

Notes: The dependent variable is the log of the annual premium per $1000 of face value of insurance. Variables are defined in the text. In addition to the coefficients listed, both regressions include the log of the real face value, the real face value, and the real face value squared, dummies if the face amount was censored at the maximum reported value, and dummies for marital status, as well age age, state, and occupation, as indicated at the bottom of the column. Column (1) concerns term life policies and the regression also includes dummies for policy length. Column (2) concerns whole life policies and the regression also includes policy length as defined in the text and the interest rate term itself as well as the interest rate term to the power of the policy length. Standard errors are in parentheses.

TABLE 3: RESULTS BY CATEGORY

Term Prices	(1)	(2)	(3)	(4)	(5)	(6)
Sample	STATE CA, WA, VA	STATE AL, LA, KY, AR	OCC High Skill	OCC Low Skill	AGE <30	AGE >45
D93	.0801	.1580	.0439	.0697	.0857	.1239
	(.0395)	(.0555)	(.0229)	(.0372)	(.0264)	(.0321)
D94	.0262	-.0399	-.0221	-.0195	-.0426	.0379
	(.0377)	(.0454)	(.0215	(.0359)	(.0257)	(.0325)
D95	-.0605	-.0788	-.1029	-.0171	-.1127	-.0095
	(.0354	(.0589)	(.0220)	(.0331)	(.0290)	(.0338)
D96	-.1932	-.092	-.203	-.1484	-.253	-.0996
	(.0377)	(.0503)	(.0227)	(.0384)	(.0276)	(.0328)
D97	-.3203	-.1254	-.3311	-.2293	-.3496	-.1411
	(.0411)	(.0526)	(.0218)	(.0413)	(.0260)	(.0344)
Others:	20 Vars	20 Vars	20 Vars	20 Vars	20 Vars	20 Vars
Dummies:	Age, State, Occupation	Age, State, Occupation	Age, State, Occupation	Age, State, Occupation	Age, State, Occupation	Age, State, Occupation
R2	.839	.828	.811	.866	.741	.820
N	1451	623	3347	1297	2248	205

Notes: The dependent variable is the log of the annual premium per $1000 of face value of insurance. All the regressions concern term life policies. The sample is restricted to the group listed at the top of the column. Variables are defined in the text. In addition to the coefficients listed, all the regressions include the variables listed at the bottom of the column. These are the same as those in column 1 of table 1. Standard errors are in parentheses.

TABLE 4: LOG REAL PRICE AS A FUNCTION OF INTERNET USAGE

Type	(1) Age x State	(2) Age x Occup.	(3) Age x Income	(4) Occup. x State
%USE INTERNET	-.5109 (.1189)	-.2269 (.0955)	-.3454 (.1078)	-.1819 (.0860)
D93	.0606 (.0143)	.060 (.011)	.0118 (.017)	.0605 (.0133)
D94	-.01 (.0149)	-.0142 (.0160)	-.0301 (.0135)	-.0142 (.0121)
D95	-.0681 (.0130)	-.0669 (.0146	-.0394 (.0151)	-.0672 (.0129)
D96	-.0515 (.0333)	-.1240 (.0289)	-.0955 (.0341)	-.1409 (.0269)
D97	-.0663 (.0499)	-.1757 (.0403)	-.1401 (.0454)	-.2005 (.0379)
Others: Dummies:	20 Vars Age, State, Occupation	20 Vars Age, State, Occupation	20 Vars Age, State, Occupation	20 Vars Age, State, Occupation
R2 N	.838 10812	.837 10812	.829 8676	.838 10806

Notes: The dependent variable is the log of the premium per $1000 of face value of insurance. All the regressions concern term life policies. The % USE INTERNET is the share of the group listed at the top of the column that had Internet access in the given year. Variables are defined in the text. In addition to the coefficients listed, all the regressions include the variables listed at the bottom of the column. These are the same as those in column 1 of table 1. Standard errors are in parentheses.

TABLE 5: FURTHER CONTROLS

	(1) Research	(2) Non-Linear	(3) Mortality	(4) Whole Life	(5) Interactions	(6) Early Years
%RESEARCH	-2.536	-3.966	-2.376	.3876	-3.157	-2.436
	(.3701)	(1.012)	(.3689)	(.3871)	(.4831)	(.3922)
(% RESEARCH) ^{2}		14.228				
		(8.503)				
%RESEARCH (use from 1992-95)						.6110
						(.7014)
Ln(Mortality)			.1072			
			(.0392)			
D93	.060	.0604	.0571	-.0597	.0409	.0587
	(.0161)	(.0143)	(.0144)	(.0142)	(.0146)	(.0148)
D94	-.0143	-.0143	-.0186	-.0533	-.0122	-.0188
	(.0128)	(.0128)	(.0129)	(.0117)	(.0147)	(.0136)
D95	-.0677	-.0677	-.0721	-.0671	-.0646	-.0765
	(.0129)	(.0129)	(.0131)	(.0126)	(.0152)	(.0171)
D96	-.1164	-.0909	-.1156	-.0215	-.1007	-.1176
	(.0161)	(.0228)	(.0159)	(.0181)	(.0200)	(.0162)
D97	-.1625	-.1351	-.1548	-.0177	-.1415	-.1650
	(.0214)	(.0292)	(.0216)	(.0212)	(.0263)	(.0216)
Others:	20 Vars	20 Vars	20 Vars	20 Vars	20 Vars	20 Vars
Dummies:	Age, State Occupation	Age, State Occupation	Age, State Occupation	Age, State Occupation	Age-Occ-St	Age, State Occupation
R2	.838	.839	.839	.764	.885	.838
N	10812	10812	10812	29917	10812	10812

Notes: The dependent variable is the log of the annual premium per $1000 of face value of insurance. Column (4) concerns whole life policies, while all other columns concern term life policies. The dependent variables are defined in the text. Each regression also includes the variables listed at the bottom of the column. Standard errors are in parentheses.

TABLE 6: PRICE DISPERSION

	(1) Standard Deviation	(2) Standard Deviation
% Research	3.871 (.971)	3.477 (.981)
(% Research)^2	-68.503 (29.503)	-50.555 (30.017)
(% Research)^3	307.002 (203.984)	187.001 (205.37)
Constant	.264 (.005)	--
Dummies	None	Age, State, Occupation
R^2	.028	.086
N	1248	1391

Notes: The dependent variable is the standard deviation of residuals from the price regression in column (1) of table 2. Standard errors are in parentheses.

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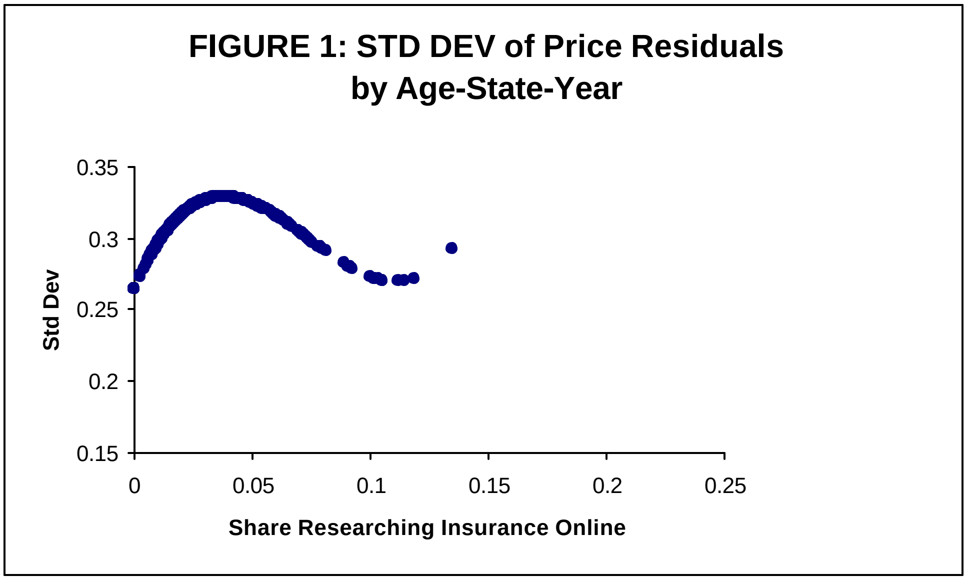
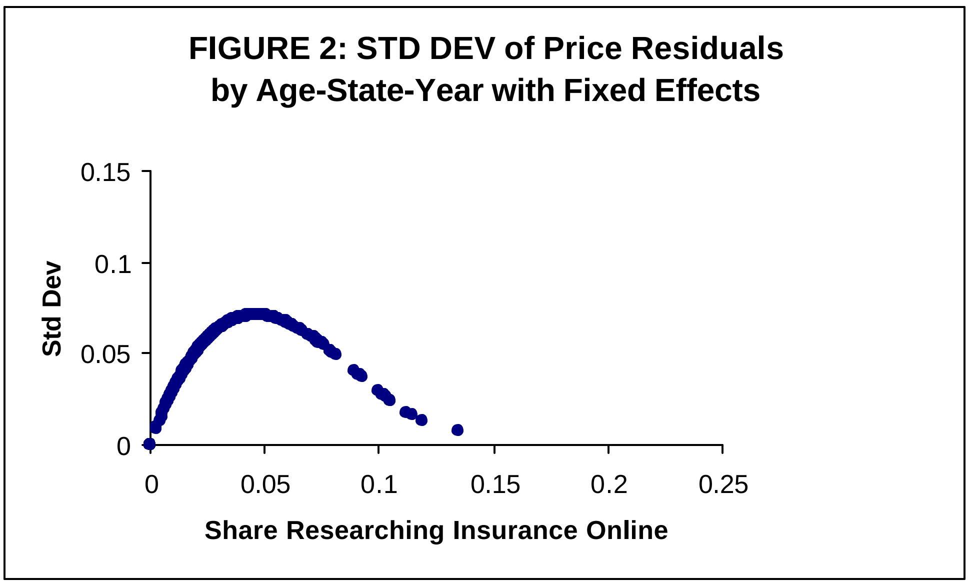


Source: Authors' calculations.



Source: Authors' calculations. The predicted values in figure 2 are net of the fixed effects.

Quotes...

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Annual Premiums	**5 Year Total**	**Company**	**Plan**
$450.00	$2250.00	SECURITY CONNECTICUT LIFE INSURANCE COMPANY	TERMSMART-5
$530.00	$2650.00	ZURICH KEMPER LIFE	SUPER-T 5
$565.00	$2825.00	CNA LIFE INSURANCE COMPANY	405G
$590.00	$2950.00	WESTERN-SOUTHERN LIFE ASSURANCE COMPANY	E-TERM 5 PREFERRED PLUS
$640.00	$3200.00	UNITED OF OMAHA	PRIORITY VALUE TERM 5
$700.00	$3500.00	WESTERN-SOUTHERN LIFE ASSURANCE COMPANY	E-TERM 5
$750.00	$3750.00	THE MIDLAND LIFE INSURANCE CO.	ALTERMATIVE FG

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