

Technology and Real Estate Brokerage Firm Financial Performance

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Abstract

This study investigates the impact of Internet usage on the financial performance of residential real estate brokerage firms using a database of over 1,700 observations. Factor loadings and a factor score for Internet usage are developed. The results show that Internet use is positively related to revenue and net income, and negatively related to net margin. In a second stage analysis, Internet use is found to be positively associated with franchise affiliation, affiliation with a referral/relocation network and firm size, while negatively related to firm age, single-office firms and location in the West and South (relative to the Northeast).

Introduction

In the early years of the Internet, some researchers often characterized it as a threat to the real estate profession, particularly in the area of residential real estate brokerage. Tuccillo (1997), for example, wrote about the "erosion of position power" of real estate brokerage professionals as information providers when the Multiple Listing Service (MLS) becomes publicly available.¹ Recently, more empirical evidence has become available about the Internet's use as a medium of information exchange for real estate firms.² These studies indicate that, in metropolitan markets in the U.S., it is common for REALTORS® and their residential brokerage firms to use the Internet in addition to the MLS to list, market and sell real estate properties and related services.

It has now become clearer that the Internet serves as an extension of the MLS as a marketing and communications tool. Indeed, placing brokerage firm listings on the Internet increases the visibility of the firm's listings, as well as the visibility of the firm's brand name.³ Most residential brokerage firms operate their own websites to promote their services and often place their listings on third-party websites. Homebuyers and sellers are, as well, increasingly using popular third-party Internet websites such as [REALTOR.com](#)®, Microsoft's [HomeAdvisor.com](#), and those of local newspapers and real estate magazines.⁴ [REALTOR.com](#), the largest residential real estate marketing website, serves as the official site of the National Association of REALTORS® (NAR).

The purpose of this study is to investigate the impact of Internet usage as a marketing and communications tool on the revenues, net income and net profit margin of residential real estate brokerage firms.⁵ The results show that the use of the Internet is positively related to the financial performance of residential brokerage firms. Internet usage is also modeled as a dependent variable. These findings indicate a relatively small impact of age, franchise and region on Internet usage, but firms affiliated with a referral/relocation network along with larger sized firms are much more likely to use the Internet. This paper's findings should help extend our knowledge concerning Internet use and residential brokerage firm profitability.

Internet Use in the Residential Real Estate Brokerage Industry

The use of the Internet creates both opportunities and challenges for real estate brokerage firms. The various web applications, such as having a specific firm website, placing listings on the web and the number of third-party websites on which the firm's listings appear, all provide brokerages with a marketing and communications tool that can reach across the United States. These technologies also create new competition for the real estate brokerage industry, as well as new expenses. Several studies have looked at Internet usage and its effects on real estate brokerage.

Bond, Seiler, Seiler and Blake (2000) examine the extent to which real estate brokers use the Internet for marketing real estate. Their study of 249 Ohio real estate brokerage firms in early 1999 indicates that only 41 firms maintained their own website, but 80 of the remaining 208 firms listed their properties on someone else's server. These researchers suggest that smaller firms do not want to avoid the expense of operating their own sites. Seventy firms indicated that they planned to add a site in the future and the remainder indicated that websites were too expensive, unprofitable, unnecessary, or that they did not know how to maintain the site. The average number of website "hits" was 440 per day; however, it was a vastly skewed distribution with the median being only five while one firm received as many as 5,393 hits per day. These findings indicate that most real estate brokerage firms are aware of the opportunities and threats of the Internet; based upon their perceptions, however, they responded differently.

Muhanna (2000) collected information about Internet use by real estate brokerage firms from a telephone survey using a questionnaire; a random selection of 197 principal brokers were contacted with 150 completed interviews selected from 3,200 principal brokers in Ohio, supplied by the Ohio Association of Realtors. They find that 59 firms (39%) established their own website while 54 firms (36%) share the web server with a third party; 35 of the 59 firms (59%) list their properties on their site. In this study, Internet adopters tend to be at least twice as large as non-adopters and 2.6 times as large in terms of sales volume. Interestingly, 79% of firms view the Internet as an opportunity and 78% disagree

that the Internet is a threat. Therefore, while the popular press and academicians appear to have emphasized the potential threats of the Internet, most real estate brokerage firms seem to view the Internet more as an opportunity.

Seiler, Seiler and Bond (2001) use survey data from 3,222 Ohio real estate brokerage firms to investigate the use of information technology. Their results indicate that 95.5% of firms use computers, and 91.4% of those firms have access to the Internet. While 34.4% of surveyed firms have a webpage, the variance is very large. Only 14.1% of single-agent firms maintain a webpage while all respondents of large firms indicate that their firm maintained one. These findings are consistent with Muhanna (2000) in that large firms tend to be the adopters.

Brokerage Firm Productivity and Income

Prior research has examined the factors that influence brokerage firm and individual REALTOR® productivity and income. A summary of the factors that positively influence residential brokerage firm revenues and income, as reported by Benjamin, Jud and Sirmans (2000) literature review, is shown in Exhibit 1.⁶

Multiple Listing Service, Franchise Affiliation and X-Efficiencies

The MLS provides a conduit by which brokerage firms can share information with each other and with clients, arguably similar to the Internet. Research by Wu and Colwell (1986) examines the equilibrium relationship between housing prices and real estate brokerage. They find that the presence of a MLS increases house values, but not necessarily commission rates and brokerage firm revenues.

Early research shows that franchise affiliation increases brokerage income. Frew and Jud (1986) find that franchise affiliation has a positive effect on brokerage

Exhibit 1 | Factors Influencing Residential Brokerage Firm Revenues and Incomes

Factor	Positive
MLS Affiliation	Yes
Franchise Affiliation	Yes
Size of Salesforce	Yes
Quality of Display Advertising	Yes
Age of Firm	Yes

Note: The source is Benjamin, Jud and Sirmans (2000).

firm sales and house prices, and Colwell and Marshall (1986) find that the size of the salesforce, presence of a franchise and quantity of display advertising positively affect market share of listings and sales for brokerage firms. Richins, Black and Sirmans (1987) also find that franchise affiliation has a positive effect on market performance.

Other studies have examined economies of scale or scope in the real estate brokerage industry. Zumpano, Elder and Crellin (1993) find modest economies of scale except for very large residential brokerage firms. They also report that larger brokerage firms do not have a competitive advantage over smaller firms regarding unit costs. In a 1994 article, Zumpano and Elder find that economies of scope (resulting from a balanced mix of listings and sales) minimize costs because specializing in either listings or sales may be sub-optimal. In a more recent study, Anderson, Fok, Zumpano and Elder (1998) use a national sample of real estate brokerage firms and a classical stochastic frontier to measure X-inefficiencies. The authors find that the average brokerage firm operates close to its efficient frontier, indicating that real estate brokerage firms are relatively efficient.

Jud, Rogers and Crellin (1994) find that the productivity of the firm or number of homes sold by a brokerage firm rises with the firm's age, size and MLS affiliation. They use data from a NAR national sample to estimate revenue and production functions for real estate brokerage firms. The authors also report that franchise affiliated firms sell more properties than non-affiliated firms and that affiliation yields positive net benefits, estimating that franchise affiliation yields on average a 9% increase in net revenues after subtracting the royalties, fees and other charges associated with affiliation.

Technology and Internet Use

In an early article regarding the use of the Internet, Baen and Guttery (1997) predict that improvements in computer technology would substantially increase efficiency in areas of real estate brokerage, as well as in finance, appraisal, leasing and title insurance. In real estate marketing, for example, they predict that complete property-specific and market information would be available to all market participants and that the increased productivity (sales) per full-time agent in large markets would result in a gradual decline in the total number of active real estate agents; also decreasing real estate commissions and fixed marketing fees per transaction would be prevalent. They conclude that there would be a downsizing in terms of the number of service providers, as well as a reduction in the total cost per transaction. Although no direct linkage is made to firm financial performance, their analysis suggests that changes in technology (including the use of the Internet) would exert downward pressure on the revenues and profits of many firms at the same time benefiting fewer (larger) firms and leading to increasing consolidation of the industry. Subsequent studies look at the financial benefits of using technology.

A 1999 paper published by the NAR suggests that real estate sales are influenced by new information technologies. Real estate professionals have adopted information technology to attract and retain clients as an extension of their traditional "high touch," people-to-people business approach to doing business. Almost 90% of REALTORS® surveyed use a computer, and the rate of usage is indifferent to age, experience and level of education. This 1999 NAR report shows that REALTORS who use computers earn on average \$22,600 more than non-computer-using REALTORS®.

Three recent papers investigate the impact of new information technology on the earnings of brokers and their agents. Sirmans and Swicegood (2000), Jud, Winkler and Sirmans (2002) and Benjamin, Jud, Roth and Winkler (2002) find that information technology has a positive impact on the earnings of real estate licensees such as REALTORS.⁷ Benjamin, Jud, Roth and Winkler show that the increase in information flow that is enabled by technological advances, such as the Internet, allows for greater individual REALTOR agent productivity and income. Greater individual real estate agent productivity and efficiency made possible by use of the Internet and its related services could, therefore, lead to greater brokerage firm income.⁸

Ford and Rutherford (2001) study 50,078 residential sales in the Dallas-Fort Worth area during 1999, providing more direct evidence of a positive link between firm income and Internet use. After controlling for physical characteristics and market conditions, they find that houses listed on the Internet take about 6.1% longer to sell, but sellers receive about a 1.4% higher price. A survey of real estate professionals by the authors indicates that 93% of respondents place at least some MLS listings on the Internet and 88% place all listing on the MLS website. Seventy-eight percent of respondents believe that Internet listing increases the number of inquiries and 41% attribute one or more sales to the Internet listings.

Tse and Webb (2002) examine the impact of monthly web page views (hits) on the number of transactions (scaled by brokerage firm marketing staff and agents) for a large brokerage firm in Hong Kong from January 1996 through April 1999, holding constant advertising expenses and the number of firm branches. Their results indicate that a 1% increase in the number of page views leads to about a 0.2% increase in the number of transactions per staff member. When relating page views to compensation, the authors conclude that a 1% increase in page views increases the agent's commission by about 0.4%. These results suggest that total revenues of the firm are influenced by a firm's decisions about Internet use.

This widening of real estate information availability via the Internet should allow market participants to make better informed decisions with lower search costs. Zumpano, Johnson and Anderson (2003) use 1,778 surveys from the NAR 2000 Home Buying and Selling Survey to investigate search duration and intensity of consumers who either purchased or sold a home during 1999. Testing for sample-selection bias, they find the Inverse-Mills ratio to be statistically insignificant in

both the duration and intensity models. Internet use is found to increase search intensity, but not to reduce search time. That is, the Internet permits market participants to learn more about properties, but within the same period of time as buyers who did not use the Internet to assist in their search. Their results differ somewhat from D'Urso (2002), who also uses the NAR 2000 survey but finds that use of the Internet increases search durations. The author concludes that although the search duration increases, the Internet as a source for exploring more choices for the homebuyer is a primary advantage.

Empirical Model

In a competitive market, brokerages must find ways to differentiate themselves from their competitors including the use of marketing tools. Investment in technologies, particularly in the implementation of elaborate websites, gives firms the ability to market and communicate with housing consumers using similar technologies. Muhanna (2000) and Bond, Seiler, Seiler and Blake (2000) offer evidence that Internet use has shown substantial growth in residential real estate brokerage, and that respondents expect a substantial increase in revenues because of Internet use. Tse and Webb (2002) provide evidence that the number of transactions and commissions of sales staff is linked to webpage viewing. In addition, from an agent's perspective, studies by Sirmans and Swicegood (2000), Jud, Winkler and Sirmans (2001) and Benjamin, Jud, Roth and Winkler (2002) find a positive relationship between the use of information technology and the earnings of real estate licensees. Although use of technology increases firm costs, research findings argue for an increase in both firm revenues and income.

Zumpano, Johnson and Anderson (2003) find clear evidence of an increase in search intensity on behalf of the buyer with Internet use. The effect of Internet use on search duration, however, is less certain as shown by conflicting findings by Ford and Rutherford (2001), D'Urso (2002) and Zumpano, Johnson and Anderson (2003). Therefore, the effect of search duration on firm revenues is unclear.

These studies suggest that employing brokerage firm characteristics and Internet technology usage as variables, a general form of the financial performance (*Fin. Per*) model of firm respondents can be constructed as follows:⁹

$$\text{Fin. Per.} = f(\text{Reloc}, \text{Fran}, \text{Age}, \text{Oneoff}, \text{Mfirm}, \text{Lfirm}, \text{West}, \text{South}, \text{Midwest}, \text{InternetScore}). \quad (1)$$

Where:

Fin. Per. = The financial performance of the firm, where performance is measured by:

Lrev = The natural log of total revenue,

Linc = The natural log of net income, and

Lnetmargin = The natural log of net margin.

Reloc = A dummy variable indicating if the firm is affiliated with at least one referral/relocation network;

Fran = A dummy variable indicating if the firm is affiliated with a franchiser;

Age = The age of the firm in number of years;

Oneoff = A dummy variable indicating if the brokerage firm only has a single office;

Mfirm = A dummy variable indicating if the firm is medium-size (11–200 salespersons);

Lfirm = A dummy variable indicating if the firm is large-size (more than 200 salespersons);

West = A dummy variable indicating firm location in the West census region;

South = A dummy variable indicating firm location in the South census region;

Midwest = A dummy variable indicating firm location in the Midwest census region;¹⁰ and

InternetScore = A factor score measuring the firm's usage of the Internet.

The Internet variable or *InternetScore*, which represents the multifaceted use of Internet technology, is found through a factor analysis of four Internet usage variables:

$$\text{InternetScore} = f(\text{Website}, \text{Weblist}, \text{Numwebs}, \text{Emailx}) \quad (2)$$

Where:

Website = A dummy variable indicating if the residential brokerage firm has a website;

Weblist = A dummy variable indicating if the firm places their residential listings on the web;

Numwebs = The number of third-party websites on which the firm's listings appear; and

Emailx = A dummy variable indicating if the firm's sales staff is encouraged to be accessible by email.

Website indicates if the residential real estate brokerage firm has a website to promote the firm's services¹¹ *Weblist* represents whether or not the firm places their own residential listings on the web. *Numwebs* measures the number of third-party websites such as REALTOR.com on which a firm's listings appear. Placing listings on third-party websites increases the visibility of the firm's listings and the firm's brand name. *Emailx* reflects whether or not the residential brokerage firm's sales staff is encouraged to be accessible by email.¹²

Survey Data and Empirical Results

Data for the analysis of brokerage firm Internet usage was obtained from a recent NAR survey. During Spring 2001, the economic research group of NAR sent a firm profile questionnaire to 9,321 real estate brokerage firms.¹³ Respondents returned 2,792 useable surveys, representing a 30% response rate.¹⁴ In order to obtain a sample of real estate firms that focus primarily on residential real estate, if less than 50% of a respondent's business was from residential brokerage, it was removed from the sample. This restriction plus missing responses to key variables reduced the sample to 1,792 useable observations.

Exhibit 2 presents the summary statistics for the 1,792 observations. The exhibit indicates that a variety of residential real estate brokerage firms exist with a large diversity of firm characteristics. Ninety-eight percent of the respondents have firms that are members of at least one referral/relocation network (*Reloc*). Corporate relocations and international transactions are usually the types of business originating from a brokerage firm's relationship with referral/relocation networks. Twenty-six percent of the respondent firms are affiliated with a national or regional franchiser (*Fran*) to improve firm productivity through better name recognition and training, enhanced advertising and greater agent recruitment. The average age of the residential real estate brokerage firm (*Age*) is 21 years, with a very large standard deviation of 17.8. A majority of firms (60%) have only a single brokerage office (*Oneoff*).

The average size of the salesforce employed in the office where respondents work is measured by two variables. *Mfirm* is a dummy variable representing medium-size firms with 11-200 salespersons and is 39% of the sample. *Lfirm* represents large-size firms with more than 200 salespersons and comprises 5% of the sample. A firm with ten or less salespersons is the holdout.

The largest percentage of respondent brokerage firms is located in the West (*West*), the area of brokerage firm location reported by 26% of respondents. Among the other regional areas, 33% of the firms are located in the South (*South*) and 23% the Midwest (*Midwest*). Firms located in the Northeast comprise 18% of the sample.

Internet Usage Variables

Approximately 85% of the survey respondents have a website (*Website*) to promote the firm's services, while 80% of the respondent firms place their firm's property listings on the Internet (*Weblist*).¹⁵ The number of third-party websites such as REALTOR.com on which a firm's listings appear is represented by the variable *Numwebs* and has a mean of 2.93. Approximately 58% of the respondents work at residential brokerage firms that encourage their sales staff to be accessible by email (*Emailx*).

Exhibit 2 | 2001 NAR Brokerage Firm Questionnaire Summary Statistics

Variable	N	Mean	Std. Dev.
Revenue	1,792	29,333,148.16	305,505,615.00
Lrev	1,792	14.05	2.29
Net Income	1,143	1,680,723.94	11,830,838.21
Linc	1,143	11.78	2.19
Net Margin	1,143	18.56	19.07
Lnetmargin	1,143	2.43	1.05
Reloc	1,792	0.98	0.13
Fran	1,792	0.26	0.44
Age	1,792	20.91	17.78
Oneoff	1,792	0.60	0.49
Mfirm	1,792	0.39	0.49
Lfirm	1,792	0.05	0.22
West	1,792	0.26	0.44
South	1,792	0.33	0.47
Midwest	1,792	0.23	0.42
Website	1,792	0.85	0.35
Weblast	1,792	0.80	0.40
Numwebs	1,792	2.93	1.54
Emailx	1,792	0.58	0.49
InternetScore	1,792	0.01	0.99

Notes: In Spring 2001, the NAR sent a firm profile questionnaire to 9,321 real estate brokerage firms. Respondents returned 2,792 useable surveys, representing a 30% response rate. In order to obtain a sample of only residential real estate brokerage firms, if less than 50% of a respondent's business was from residential brokerage, it was removed from the sample. This restriction together with non-responses to particular variables reduced the sample to 1,792. Only 1,143 firms responded to the *Net Margin* question. Net income was defined as $Net\ Income = Net\ Margin * Revenue$.

Financial Performance

The survey asked respondents about the total revenue received by their firm and about its net margin. As shown in Exhibit 2, the average firm revenue of the responding firms is approximately \$29.3 million. The standard deviation of firm revenue is very high, measuring about \$305.5 million. The high standard deviation stems from the presence of a few very large firms at the high end of the

distribution. The median firm in the sample has revenues of only \$1 million. A total of 1,143 firms responded to the net margin question. The average net margin of those responding was 18.6%. The median response was 11.5%. Net income was calculated as the product of total revenue multiplied by the net margin. The mean net income of firms was approximately \$1.68 million. The median value of net income was \$120,000.

Two-Step Procedure

To examine the multifaceted effects of Internet usage on brokerage firm financial performance, a two-step procedure was employed. First, factor loadings were developed for the four different measures of Internet usage. Three regression analyses of brokerage firm financial performance were then performed using a variety of firm characteristic variables and the primary factor score for Internet usage.

In Exhibit 3, the first factor loadings from the factor analysis performed on the four Internet variables are shown. All four of the Internet variables are positively related to the primary Internet technology factor. Results from the factor analysis reveal that the Internet technology variables have one common factor, with eigenvalues exceeding 1.0 and with a cumulative explained variation of 52.77%.¹⁶ The eigenvalue of the primary factor (*InternetScore*) is 2.11. The results indicate that all of the Internet-use variables are positively related to the primary Internet technology factor (*InternetScore*).

In the regression analysis of financial performance, shown in Exhibit 4, three performance measures were employed: total revenue, net income and net margin. All of the dependent variables appear in log form. The regressions shown in Exhibit 4 are estimated using weighted least squares to correct for sample heteroscedasticity¹⁷ The weights used in this procedure are the sample weights from the NAR survey, and they are designed to reflect the differential probability of firm and item nonresponse in the NAR survey.¹⁸

Exhibit 3 | Technology Factor Analysis

Technology Variable	Factor Loading	Factor Variance	Scoring Coefficient
<i>Website</i>	0.8741	0.8813	0.4142
<i>Weblist</i>	0.8904	0.8701	0.4219
<i>Numwebs</i>	0.6688	0.9991	0.3169
<i>Emailx</i>	0.3262	0.9999	0.1545

Notes: The eigenvalue is 2.1106 and the proportion of variance is 0.5277.

Exhibit 4 | Regression Analysis of Brokerage Firm Financial Performance

Variable	Dependent Variable = log (Revenue)			Dependent Variable = log (Net Income)			Dependent Variable = log (Net Margin)		
	Coef.	T-Value	Std. Beta	Coef.	T-Value	Std. Beta	Coef.	T-Value	Std. Beta
<i>Intercept</i>	11.694	38.04*	—	8.305	19.72*	—	1.559	7.22*	—
<i>InternetScore</i>	0.555	14.97*	0.330	0.444	8.89*	0.263	-0.090	-3.52*	-0.101
<i>Fran</i>	0.294	2.48**	0.051	-0.148	-0.92	-0.026	-0.242	-2.92*	-0.081
<i>Reloc</i>	0.377	1.45	0.030	2.758	7.59*	0.210	1.898	10.18*	0.273
<i>Age</i>	0.020	6.31*	0.133	0.014	3.19*	0.093	-0.007	-3.35*	-0.094
<i>Oneoff</i>	-0.113	-1.03	-0.022	0.005	0.04	0.001	0.085	1.21	0.034
<i>Mfirm</i>	1.745	10.12*	0.221	0.496	2.33**	0.069	-0.963	-8.82*	-0.254
<i>Lfirm</i>	3.374	6.44*	0.132	2.672	3.69*	0.102	-0.950	-2.55**	-0.069
<i>West</i>	0.249	1.75	0.056	0.168	0.90	0.039	0.048	0.51	0.021
<i>South</i>	0.274	1.94	0.060	-0.103	-0.56	-0.023	-0.261	-2.74**	-0.109
<i>Midwest</i>	0.194	1.27	0.036	-0.102	-0.52	-0.020	-0.186	-1.86	-0.069

Notes: For Dependent Variable = log (Revenue), $N = 1,792$; Adj. $R^2 = .271$; and Model F -Value = 57.58. For Dependent Variable = log (Net Income), $N = 1,143$; Adj. $R^2 = .158$; and Model F -Value = 22.37. For Dependent Variable = log (Net Margin), $N = 1,143$; Adj. $R^2 = .208$; and Model F -Value = 31.02.

*Indicates significance at the .01 level, using a two-tailed test.
 **Indicates significance at the .05 level, using a two-tailed test.

Results from the weighted regression models with the three measures of brokerage firm financial performance as dependent variables are reported in Exhibit 4.¹⁹ Each of the three financial performance models is statistically significant at the .01 level or better, with model F-Values ranging from 57.58 in the total revenue model to 22.37 in the net income model. The adjusted *Res* vary from .27 in the total revenue model to .16 in the net income model.

The use of Internet technology, as measured by the Internet technology factor (*InternetScore*), is statistically significant at the .01 level or better in each of the three financial performance equations. Internet technology use is positively associated with total revenue and net income. It is negatively related to net margin, suggesting that Internet technology increases costs. But the positive association with net income indicates that the lower margins are compensated by higher turnover (sales).

In the revenue equation, the standardized beta coefficient for *InternetScore* is 0.33; this beta coefficient indicates that a one-standard deviation change in Internet use is associated with a 0.33 standard deviation change in the log total firm revenue. Likewise, in the net income equation, the standardized beta coefficient is 0.26, suggesting that a one-standard deviation change in the use of Internet technology relates to a 0.26 standard deviation change in the log of net income. Looking at Exhibit 2 reveals that a one-standard deviation change in the *InternetScore* is approximately equal to 1. The estimated regression coefficient on *InternetScore* in the revenue equation is 0.55, indicating that a one-unit change in *InternetScore* is associated with a 55% change in total revenue. Thus, a 1-unit increase in *InternetScore* (a one-standard deviation change) is estimated to generate a 55% increase in revenue. Similarly, a 1-unit increase in *InternetScore* produces a 44% increase in net income.

The *Fran* variable is positively and significantly related to total revenue, but it is not significantly related to net income. Franchise affiliation is negatively and significantly related to net margin. Thus, the results indicate that the higher costs of franchise affiliation offset the higher revenues, resulting in no significant changes in net incomes of affiliated firms. In contrast, affiliation with a referral/relocation network (*Reloc*) appears to raise both net income and net margins but has no significant impact on total revenues.

Among the other variables that influence firm performance, age of the firm (*Age*) is positively associated with total revenue, and net income and negatively related to net margin. The effects of firm size are similar to those of age. Larger firms generate higher revenues and incomes but have lower net margins. Having only a single office (*Oneoff*) has no significant effect on firm performance. The effects of firm location, as measured by the variables *West*, *South* and *Midwest*, seem to have only a marginal effect on performance. The only significant regional effect appears in the net margin equation, where location in the South is associated with a lower net margin.

Exhibit 5 | Regression Analysis of Technology Factor Score

Variable	Coefficient	T-Value	Std. β -Value
<i>Intercept</i>	-1.345	-6.95*	—
<i>Fran</i>	0.378	5.01*	0.110
<i>Reloc</i>	1.015	6.19*	0.136
<i>Age</i>	-0.004	-2.05**	-0.046
<i>Oneoff</i>	-0.281	-4.04 *	-0.092
<i>Mfirm</i>	1.094	10.23*	0.234
<i>Lfirm</i>	1.248	3.75*	0.082
<i>West</i>	-0.621	-6.94*	-0.235
<i>South</i>	-0.410	-4.56*	-0.151
<i>Midwest</i>	-0.139	-1.43	-0.044

Notes: The Dependent Variable = *InternetScore* (Factor Score for Internet Technology Usage). $N = 1,792$; Adj. $R^2 = .156$; and Model F -Value = 38.03.
 * Indicates significance at .01 level, using a two-tailed test.
 ** Indicates significance at .05 level, using a two-tailed test.

Characteristics of Technology Users

In order to more closely examine the predictive characteristics for use of the Internet by residential brokers, the Internet factor score is used in a second regression analysis to determine which of several firm characteristics are more related to Internet usage than other characteristics. The dependent variable here is the technology factor score. As shown in Exhibit 5, Internet use is positively associated with franchise affiliation, affiliation with a referral/relocation company and firm size. It is negatively related to firm age, having only one office and location in the West and South (relative to the Northeast).

Conclusion

Technology provides both opportunities and challenges for real estate brokerage firms. As Internet use and its related services such as email provide brokerages with a growing marketing and communication tool that facilitates real estate transactions, the Internet also creates new competition. As residential real estate brokerage firms increase their use of Internet technology, brokerage firm income levels may be impacted. Given the growing and widespread use of the Internet as a real estate marketing and communications tool, it is important to examine how the Internet affects the income levels of residential real estate brokerage firms.

Using a database of over 1,700 usable observations from the NAR 2001 survey of real estate firms, this paper examines the impact of Internet usage on the revenues and net income of residential real estate brokerage firms. The results show that the use of the Internet is positively related to the revenues and net income of residential brokerage firms. Specifically, these results show that when residential real estate brokerage firms increase their use of the Internet by one standard deviation unit, their revenues rise by 0.33 standard deviation units and their earnings by 0.26 standard deviations units. These findings support the idea that Internet usage creates additional revenue and net income.²⁰

Internet use was also found to be positively associated with franchise affiliation, affiliation with a referral/relocation network and firm size. However, it is negatively related to firm age, having only one office and location in the West and South (relative to the Northeast).

While the home buying/selling transaction may well remain "high-touch," with buyers and sellers relying on real estate professionals to satisfy key needs for security and accountability and to optimize gross sales price, the adoption of marketing and communications technologies that increase a brokerage firm's effectiveness will be essential for continued success. The findings of this paper help to extend our knowledge concerning Internet use and brokerage firm productivity and income. 1

Endnotes

1. Real estate brokers and their agents historically have been the gatekeepers of property information through the traditional Multiple Listing Service (MLS). By cooperating and sharing information through the MLS, brokers and their agents have reduced the cost and raised the efficiency of housing search. Use of the Internet by home buyers and sellers has expanded the demand for access to real estate related information. Homebuyers and sellers can now surf the Internet and review the majority of "for sale" property listings. As consumers have become more Internet information "empowered," the value proposition for real estate brokerage has shifted. Thus, the Internet could bring about a change in real estate marketing times, transaction prices and services that real estate professionals provide for clients.
2. See, for example, Baen and Guttery (1997), Tuccillo (1997), Aalberts and Townsend (1999), Bardhan, Jaffee and Kroll (2000), Bond, Seiler, Seiler and Blake (2000), Muhanna (2000), Jud and Roulac (2001) and Ford and Rutherford (2001).
3. Bardhan, Jaffee and Kroll (2000) identify four stages of business web use beyond the preliminary web connection stage including: (1) home page with company information; (2) web-based marketing and publicity; (3) virtual store or office with services or sales on the web; and (4) web-supported inter-firm linkages for brokerage production or services. 4
4. In the 2001 NAR Profile of Residential Real Estate Brokerages, 85% of the firms responding operate their own website. Potential buyers also search available properties by location or zip code through third-party websites such as NAR's Realtor.com and HomeAdvisor.com. The search may be narrowed by specifying information on price

range and amenities. Tours of home interiors through a 360° view of each room are also available on some websites. Websites may provide neighborhood demographic and quality of life data such as tax rates, school test scores, crimes rates, etc., as well as links to service providers such as mortgage bankers, home improvement contractors, moving companies, utility companies, appraisers, etc. Some sites provide tools such as personal budget planning and mortgage loan calculators. Most importantly, real estate websites give basic information about the home purchasing and the mortgage application processes.

5. Our focus is on the marketing and communications benefits of Internet usage. Many residential brokerage firms, however, use extensive print media and traditional direct marketing such as mailings to promote their property listings and services. The 2001 NAR survey did not include questions about traditional advertising expenditures (print, radio, and TV) nor do we cover these aspects of marketing in our study.
6. Many past studies have examined the determinants of real estate sales agent and broker income. In an extensive literature review of these prior studies, Benjamin, Jud and Sirmans (2000) report that many factors influence real estate licensee income both positively and negatively. The positive factors are: number of hours worked, experience, education, firm size, manager/ownership interest, firm reputation, franchise affiliation, working in a metro area, professional designations, level of job satisfaction and having personal assistants. The factors that negatively affect licensee income include: selling residential property, holding a sales license as opposed to being a broker, having a perceived negative image of the industry and being female.
7. For a study of extensions of the human capital theory factors that influence real estate licensee income including psychological factors and management systems, see Abelson, Kacmar and Jackofsky (1990).
8. Increased capital investment by real estate brokerage firms may be required for greater technology use, but increased capital expenditures could then reduce brokerage firm profitability levels.
9. Our earnings model posits that Internet usage influences revenues and profits; revenues and profits, however, could also influence Internet usage. The use of simultaneous regression equations for revenues or net income and the Internet factor is problematic because of the need to identify variables that impact only the Internet factor score but not earnings. Using a different modeling approach, future research might investigate the potential causality linkage between Internet usage and earnings.
10. The regional dummy variable classifications are taken from the U.S. Department of Commerce, Bureau of Economic Analysis. The Northeast region is omitted; thus, the estimated coefficients for the regional variables reflect average differences between the particular regions and the Northeast area.
11. To generate business, an interesting variety of valuable information is typically contained on the firm's website: information such as brokerage firm agent profiles, market demographics including school information, and prior sales prices, as well as agent contact information.
12. To reduce the loss of potential and existing customers, many real estate brokerage firms have organizational policies that require or strongly encourage the use of email for communication (see NAR, 2001).
13. The NAR is comprised of real estate professionals who are involved in all aspects of the real estate industry (but mostly brokers and real estate salespersons) and who subscribe to a strict code of ethics.

- 14 Given that large residential real estate brokerage firms have historically lower response rates to NAR surveys, extra surveys were sent to larger-sized firms (greater than 200 licensees) and medium-sized firms (11-200 licenses). These additional surveys were sent to ensure a representative response by firms. Responses were then weighted by firms as per the membership rolls included in the NAR database system (NRDS).
- 15 A variety of information such as brokerage firm agent profiles, availability of homes for sale and their prices, and market demographics is typically contained on residential brokerage firm websites.
- 16 The second factor has an eigenvalue of .941 and an explained variation of 23.53%, while the third factor has an eigenvalue of .70 and an explained variation of 17.46%. The pattern relating the four Internet usage variables to the second and third factors, however, has no logical explanation, nor were any of these factors statistically significant in the regression analysis.
- 17 In matrix notation, let W be a diagonal matrix containing the sample weights w along the diagonal and zeros elsewhere, and let y and X be the usual matrices associated with the left- and right-hand side variables. The weighted least squares estimator is: $b_{wLS} = (X' W' W X)^{-1} X' W' W y$ (see Greene, 1996).
18. Historically, NAR's surveys of real estate brokerages had suffered from a biased response where smaller brokerages responded at a rate significantly higher than that of larger brokerages. For the 2001 survey, NAR stratified the brokerage industry's firms into four different groups. NAR then "over sampled" firms with 11 to 200 agents and those with more than 200 agents relative to firms with just one agent and those with 2 to 10 agents. These "larger" firms received the survey twice to induce a greater response. A weight was developed to control for both the over sampling of firms with 11 or more agents and for the different response rate for each of the four stratified groups.
- 19 The regression also reports the standardized beta values that are useful in interpreting the impact of the *Internetscore* or Internet factor score variable. It shows the standard deviation change in the dependent variable for a one standard deviation change in the independent variable. The size of the standardized coefficient measures the relative impact of each variable. Note that revenues and net incomes are most sensitive to changes in Internet use.
- 20 Our earnings model posits that Internet usage influences revenues and profits; revenues and profits, however, could also influence Internet usage. The use of simultaneous regression equations for revenues or net income and the Internet factor is problematic because of the need to identify variables that impact only the Internet factor score but not earnings. Using a different modeling approach, future research might investigate the potential causality linkage between Internet usage and earnings.

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