

A Microeconomic Study of Commercial Real Estate Brokerage Firms

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Abstract. While residential brokerage has been widely studied, the operating characteristics of income property brokerage firms have received little attention in the literature. In this paper, we analyze results from a survey of income property brokers to measure profitability, scale effects, and expenditures at the firm level. We find that while scale economies exist for expenses, net income per producer falls as firms grow; the optimally sized firm is comparatively small. Although inconsistencies with results from recent residential brokerage studies may relate to the survey period, they may also support a view that residential and income brokerage firms are structurally different.

Introduction

The operations of brokerage firms that specialize in income-producing real estate can be quite different from those of brokerages that primarily handle single-family transactions. For example, the higher prices observed in commercial real estate sales, the frequent need for brokers to help in arranging tax-free exchanges or complex financing, and the common involvement of brokers in commercial property lease negotiations¹ can necessitate physical facilities and human capital for income property brokers that differ considerably from those possessed by residential specialists. Yet, as is true of residential brokers as well, organizations that facilitate the sale and leasing of income property can display marked intra-industry differences. Such firms vary by region across the country, by the sizes of their operations, by their abilities to generate revenues and profits, and with various structural and operating characteristics. It is therefore interesting that, despite the importance of commercial real estate in our economy, the importance of the brokerage function in facilitating exchanges of income-producing real estate, and the considerable attention given in the literature to residential real estate brokerage, there has been little research on the role of the factors noted above in determining the financial performance of commercial real estate brokerage firms. This lack of attention to income property brokers seems particularly curious in that economic explanations for brokers' presence in real estate markets, such as the informational needs of buyers and sellers who transact infrequently in a changing environment (see Yavas, 1994), would seem even more applicable to income property than they are to residential.

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The Nature of Income Property Brokerage

While all possible reasons for this disparity in the literature's residential and commercial brokerage treatment would be impossible to identify, there are a few that would seem particularly compelling. First, there are far more residential property transactions than commercial, so most brokers are destined to specialize in the marketing of homes, and most parties interested in brokerage industry research will express that interest from the residential perspective. Second, because many residential specialists handle (especially smaller) income property transactions as a sideline, there exist comparatively few firms (and, as a result, little available data on firms) that specialize in the commercial side of the market. Third, just as the financing of single-family properties is sufficiently standardized that a vast secondary home mortgage market has evolved, single-family transactions themselves are sufficiently similar, at least within a given market area, that the broker's duties, the level of service provided, and the compensation earned may tend to follow patterns that are easily analyzed. The commercial property specialist firm, on the other hand, may provide services that vary greatly from one transaction to another, with compensation varying accordingly.² Finally, one party that has followed residential real estate brokerage industry activities, and that in the process has compiled data (or provided an impetus for private data collection), is the federal government. For example, the Federal Trade Commission completed a widely cited 1983 study of the industry's practices. To our knowledge, Washington has not shown a comparable interest in the commercial brokerage business.³

Perhaps earlier authors simply have felt no need to view income property brokerage as an activity distinct from its residential counterpart. Noting that states do not impose special licensing requirements for income property marketing activity,⁴ and that some practitioners are active in both market sectors, these analysts may have felt that residential and income property brokerages are structurally similar. Yet brokerage firms specializing in income properties have, particularly in recent years, faced an environment that may have caused their business operations to differ structurally from those of single-family brokers.⁵ For example, Rand (1993) observes that commercial real estate brokerage has become a more consultative activity as income property transactions have become increasingly complex. When commercial real estate brokers engage in "counseling," the compensation arrangement can involve minimum fees for professional advice and services even if no transaction is completed (see White, 1989).⁶ Another recent phenomenon has been the establishment of commercial brokerage networks, through which firms share not just referrals, but also electronic databases and strategic ideas, with colleagues in different geographic areas in order to increase market shares (see Rand, 1993).

Perceiving a need for more in-depth discussion of factors affecting commercial brokerage, we have employed data from a 1992 survey in analyzing the profitability, and other operating performance aspects, of firms that specialize in the sale and leasing of income-producing real estate. The paper is organized as follows. A brief review of some important articles in the relevant literature is presented in the second section. The data set is described in the third section. The regression models are introduced in the subsequent section, followed by a description of the empirical results. The concluding section provides a summary and discusses limitations inherent in the findings.

A Review of the Relevant Literature

Much has been written on factors that affect real estate brokerage performance at the sales agent level.⁷ Most earlier entries in the literature on brokerage *firm* performance have focused on questions surrounding efficiency of the market, compensation arrangements and agency problems. As noted earlier, such studies generally have focused on residential brokerage firms. Our interest in this previous literature relates to studies involving agents' impact on their firms' profitability.

Crockett (1982) offers a model of firm profitability in which the firm hires agents until the marginal revenue to the firm from an additional transaction equals the cost of an additional sales agent's activity (which relates to competition in the market); he notes that the attendant risk is borne largely by the agents, rather than by the firm. Schroeter (1987) and Knoll (1988) treat the profit maximization decision as relating to waiting-time preferences of the clients whose homes are for sale, with trade-offs between the magnitude of the commission and time on the market (or the number of houses that the brokerage attempts to sell). Chinloy (1988) finds that an agent provides maximum value to his or her firm after gaining two years of experience, whereas the net value to a firm of an inexperienced salesperson is negative (Glower and Hendershott, 1988, had found the individual producer's income to be maximized at seventeen or eighteen years of experience). He offers an option-based model, with value viewed as a function of the firm's ability to generate gross commissions, the splitting of gross commissions between firms and agents, and the present value of administrative costs (the firm's ability to alter the commission splits is treated as an option). Larsen and Park (1989) find, in a survival regression study, that the reduction in a sales agent's commission split can increase the likelihood that a residential property will be sold, and that the firm will receive revenue, if the accompanying savings permits the seller to state a lower reservation price. Colwell and Marshall (1986) examine the determinants of a brokerage firm's market share; they find firm size, display advertising and franchise affiliation to be important factors.

A number of other studies have addressed the issue of scale effects. Hughes (1995) poses the interesting question of whether available economies of scale accrue only to firms that have reached a critical size, and the more interesting question of whether a given residential brokerage firm might be large because it has developed comparative advantages, rather than facing advantages because of its size. Yang and Yavaş (1995) find that, in the presence of a multiple listing arrangement, buyers will find no incentive to deal with a larger firm if their concern is minimizing time on the market; the effect of scale economies thereby is reduced. The authors note that their result contrasts with those of the earlier Larsen and Park (1989) and Sirmans, Turnbull and Benjamin (1991) studies regarding economies of scale; this finding also contrasts with that of Hughes (1995), who finds a positive scale effect with regard to transaction price. Miceli (1992) assumes that residential brokerages face scale economies in terms of the number of listings per agent, though not necessarily in terms of the number of agents per firm. Glower and Hendershott (1988) find evidence of decreasing returns to hours worked per week, at the individual level. Crockett (1982) states that real estate brokerage firms should expect to face diminishing marginal returns.

A recent study that has been of particular interest to us is Zumpano, Elder and Crellin (ZEC) (1993). Like most earlier works, the authors' focus is on residential brokers. As in our analysis, however, the authors of that study analyze operating expenses and a "size

effect” for the firm; they find economies of scale for all but the largest sized residential brokerage firms.⁸ This finding holds both when size is measured as the number of properties listed and sold, and when size reflects (as in our study) the number of sales agents. As ZEC have done for residential brokerages, our study of the operating performance of firms that specialize in selling or leasing income property considers the role of economies of scale through an analysis of the impact that firm size has on operating expenses, but we extend our analysis to also address the relationship between firm size and gross (or net) income. We further address whether there is an optimal size for commercial real estate brokerage firms; and we investigate optimal strategies for brokers of commercial property to follow, when allocating budgets among expense categories, in order to maximize profits.

Data Collection and Survey Description

The data for this study were obtained from a nationwide survey, commissioned by the Research and Publication Committee of the Society of Industrial and Office Realtors® (SIOR) and conducted by Sherman, Torres and Lai early in 1992. The twenty-nine-item questionnaire was sent to 888 SIOR members across the United States, and 215 of the recipients responded. SIOR restricts its membership to individuals and firms that meet rigorous income property experience and dollar volume standards; the residential broker that handles an occasional commercial transaction would not qualify. The respondents include some of the largest U.S. firms that specialize in the sale and leasing of industrial, retail and office properties. Some of the responses had to be excluded from the working data because of missing or incomplete information. Responses were also excluded if they suggested unrealistic values, such as negative gross income or a negative expense level.

The time period during which the survey was administered has been described as follows in the introduction to the report of the results:

In the fall of 1991, the industrial and office real estate markets in most metropolitan areas across the country were soft. Additionally, the U.S. economy was in a recession, the overall real estate market was weak, and many experts predicted, with some notable exceptions, a continued weakening of industrial and office real estate markets over the next 12 months.⁹

When the firms were responding to the survey, then, they had been enduring the problems of a weakened economy and a depressed commercial real estate market. Because these conditions had existed for several years prior to the survey period, those who answered the survey questions had seen many commercial real estate brokerage firms close their doors, and had seen many of the firms that survived consolidate or merge into different organizational structures. As a result, the survey data reflect the views of managers who had gained important insights from surviving the adverse economic, and income property, environment of the late 1980s and early 1990s. Exhibit 1 provides a summary of the survey data.

Exhibit 1 Data Summary

Variable	Number Valid Responses	Mean	Std Dev.	Min.	Max.
<i>GI</i>	114	1,417,266	8,407,172	7,000	90,000,000
<i>IND</i>	192	6.4453	14.3832	0	130
<i>OFF</i>	192	4.4818	6.9235	0	40
<i>APP</i>	192	0.3021	1.1314	0	10
<i>DEV</i>	192	0.2005	0.6412	0	6
<i>PRP</i>	192	2.4922	11.7495	0	140
<i>RTL</i>	192	1.2240	2.3860	0	14
<i>INV</i>	192	0.9896	1.9576	0	12
<i>MTG</i>	192	0.1458	0.9207	0	10
<i>CON</i>	192	0.1875	0.6021	0	4
<i>OTH</i>	192	1.7969	9.8876	0	100
<i>NE</i>	192	0.1563	0.3640	0	1
<i>GL</i>	192	0.1615	0.3689	0	1
<i>SO</i>	192	0.2448	0.4311	0	1
<i>SW</i>	192	0.1302	0.3374	0	1
<i>WE</i>	192	0.1771	0.3827	0	1
<i>ADV</i>	106	33,648	37,251	1	183,000
<i>PROM</i>	104	22,333	30,398	200	197,000
<i>WAGE</i>	101	196,456	253,694	1,030	1,552,700
<i>OCC</i>	100	71,775	88,602	1,800	444,200
<i>OE</i>	104	106,750	118,497	1	848,400
<i>SIZE</i>	184	18.9076	26.4816	1	156

where

GI = gross income for the firm as a whole;

IND = number of agents engaged primarily in sale/leasing of industrial real estate;

OFF = number of agents engaged primarily in the sale/leasing of office real estate;

APP = number of agents engaged primarily in real estate appraisal;

DEV = number of agents engaged primarily in development activities;

PRP = number of agents engaged primarily in property management activities;

RTL = number of agents engaged primarily in the sale/leasing of retail property;

INV = number of agents engaged primarily in the sale of investment property;

MTG = number of agents engaged primarily in mortgage brokerage;

CON = number of agents working primarily as consultants;

OTH = number of other full-time producers employed;

NE, GL, SO, SW, WE = dummy variables relating to the firm's location.

They represent, respectively, the Northeast, Great Lakes, Southern, Southwestern, and Western regions. There is also a Mid-Continent region; this region serves as the base (it is omitted from the computations);

ADV = total advertising expense, including newspapers, television, radio, signs, direct mail and brochures, and other advertising and public relations expenditures;

PROM = total payments made to sales agents to promote sales effort; these outlays include costs of travel and entertainment, education, sales awards, incentives, gifts, contributions, or other promotional costs;

WAGE = total salary and wage expense, including management salaries, secretarial/clerical salaries, employee benefit costs, and payroll taxes;¹⁰

OCC = the firm's total occupancy expenses, including rent and utilities;

OE = total office operating expenses, including professional dues, licenses, MLS fees, telephone and postage charges, legal and accounting fees, insurance premiums, auto expenses, office equipment and supply costs, interest on loans, taxes assessed on personal property, and other miscellaneous items;

SIZE = total number of full-time producers employed.

Model Specification and Empirical Results

The Measure of Productive Output

If economies of scale exist in the management of real estate brokerage firms, then a larger firm should face a lower average cost for producing a unit of output than does its smaller counterpart. Do such increasing returns exist? We address this issue by analyzing both expenses and revenues as functions of a firm's size, measured in terms of the number of full-time agents employed in all of the firm's various revenue-generating activities. We have chosen gross income, or total revenue, as the measure of output generated by an income property-oriented brokerage firm (note that Abelson, Kacmar and Jackofsky, 1990, suggest gross commissions as the output measure for residential brokerage firms; as do Jud, Rogers and Crellin, 1994).

Other studies of (residential) brokers have employed different measures of output; Crockett (1982) and Zumpano and Elder (1994) utilize the number of transactions, while Schroeter (1987) measures output as a function both of transaction quantity and of the average speed with which a sale is completed, and Hughes (1995) suggests transaction price as an output measure.¹¹ Transaction activity may, in fact, be a useful measure of output for a residential brokerage firm; if residential properties within the studied market are relatively homogeneous, then the number of transactions completed, the quantity of services provided by a broker (which tend to be fairly standardized for residential transactions),¹² and the firm's gross or net income should be highly correlated. A measure relating to transactions can be quite misleading, however, as an indicator of output in the more heterogeneous realm of income-producing real estate, particularly when the data relate to brokerage firms in different market areas. Not only do typical transactions differ in size across market areas; the types of services that the income property broker provides can also differ considerably from one transaction to another.

In summary, a measure of gross income, or total revenue, should capture the effect of added service provided to the client through the brokerage firm's expertise in such areas as construction, leasing, financing, or appraisal. It is, in fact, the maximization of profit (which relates to gross income), rather than the maximization of transactions or of services provided, that the firm's owner should seek to attain.

The Size Effect of Commercial Real Estate Brokerage Firms

Suppose that a firm's gross income and expense functions take the following form:

$$GI_i = \Omega_1 SIZE_i^{\alpha_1} e^{\varepsilon_1}, \quad (1)$$

$$EX_i = \Omega_2 SIZE_i^{\beta_1} e^{\varepsilon_2}. \quad (2)$$

We can restate the model in log-linear form by taking natural logarithms of equations (1) and (2):

$$\ln GI_i = \ln \Omega_1 + \alpha_1 \ln SIZE_i + \varepsilon_1, \quad (1a)$$

$$\ln EX_i = \ln \Omega_2 + \beta_1 \ln SIZE_i + \varepsilon_2, \quad (1b)$$

where

EX_i = the i th firm's total expenses incurred in generating gross income,

$$\Omega_1 = e^{(\alpha_0 + \alpha_2 INDP_i + \alpha_3 OFFP_i + \dots + \alpha_{10} OTHP_i + \alpha_{11} NE_i + \dots + \alpha_{15} WE)}, \quad (3)$$

$$\Omega_2 = e^{(\beta_0 + \beta_2 INDP_i + \beta_3 OFFP_i + \dots + \beta_{10} OTHP_i + \beta_{11} NE_i + \dots + \beta_{15} WE)}, \quad (4)$$

P (as in $INDP$ or $OFFP$) denotes a conversion to percentages, and other variables are as described in Exhibit 1. In order to measure the possible existence of economies of scale, we transform variables such as IND and OFF , which measure the number of full-time producers pursuing each of the business activities in which the firm is involved, into percentages of full-time workers whose efforts are devoted to those activities (the number of full-time producers is a monotonic function of gross income). A variable such as $INDP$ or $OFFP$, as shown in equations (3) and (4), is simply $IND/SIZE$ or $OFF/SIZE$.

As noted earlier, ZEC (1993) find that a residential brokerage firm's operating cost per full-time producer decreases (over most reasonable ranges) as the firm's size, in terms of full-time producers employed, decreases. The existence of such economies of scale implies that EX is a concave function of $SIZE$, such that total operating expense increases with the size of the operation, but at a decreasing rate. In other words, the marginal expense that the firm must incur in supporting one additional producer decreases as the firm becomes larger. A useful question to address is whether such economies of scale are displayed by commercial real estate brokerages, as well. Therefore, the first hypothesis to be tested, Hypothesis 1, can be stated as:

$$H_0 : \beta_1 \geq 1 \text{ or } \beta_1 \leq 0;$$

$$H_A : 0 < \beta_1 < 1.$$

On the other hand, we also expect, in accordance with the law of diminishing marginal returns, that the marginal contribution of one additional full-time agent diminishes as the firm grows larger. One argument for this expectation is that, as the number of producers in a firm increases, these individuals must eventually compete with each other for clients within the market area. Another is that, as the firm grows, it may have to hire agents who are less skillful.¹³ In either case, when the demand for brokerage services in a region is limited, the marginal quantity of revenue introduced by the additional producer is likely to decrease. An implication is that GI is also a concave function of $SIZE$. Hypothesis 2 therefore is:

$$H_0 : \alpha_1 \geq 1 \text{ or } \alpha_1 \leq 0;$$

$$H_A : 0 < \alpha_1 < 1.$$

In addition, because there is an upper bound on the total of revenues that brokerage firms in a particular market area can realize, we expect that the marginal contribution to gross income for a given firm declines more rapidly than does operating expense (for which there is no upper bound). We therefore expect the *GI* curve to demonstrate more concavity, relative to *SIZE*, than does the *EX* curve. Hypothesis 3 therefore is:

$$H_0 : \alpha_1 \geq \beta_1;$$

$$H_A : \alpha_1 < \beta_1 .$$

The regression results allow us to reject the null hypothesis in each of the three cases. These results are summarized in Exhibits 2 and 3.

As Exhibit 2 (which relates to expenses) indicates, the coefficient on the *LNSIZE* variable is significantly greater than zero and, by comparing the coefficient to the standard error of .084535, we find its value also to be significantly less than one. Recall that the economy-of-scale effect refers to the decreasing marginal cost for producing services as the firm size increases. If economies of scale are present, then it is cheaper for the firm to bear the expenses of one additional producer as the firm's size increases. Such a condition exists for all potential levels of output; the average expense decreases monotonically with respect to the size of the firm. The first hypothesis therefore is supported empirically. This result is consistent with the finding of ZEC (1993) (along with Zumpano and Elder, 1994) that the operations of (residential) real estate brokerage firms are characterized by economies of scale.¹⁴ In a similar manner, Exhibit 3 (which relates to gross income) shows the coefficient on the *LNSIZE* variable to be significantly

Exhibit 2
Total Expenses vs. Size of the Firm

Variable	Coefficient	T-Ratio
Intercept	5.6425	4.292
<i>LNSIZE</i>	0.8702**	10.294
<i>INDP</i>	5.0200**	3.901
<i>OFFP</i>	5.2457**	3.991
<i>DEVP</i>	5.5354**	3.811
<i>PRPP</i>	3.7749**	2.615
<i>RTLTP</i>	4.6001**	3.008
<i>INVP</i>	5.9983**	3.679
<i>MTGP</i>	13.6625*	1.746
<i>CONP</i>	2.9503	1.591
<i>OTHP</i>	3.4743**	2.350
<i>NE</i>	0.4186	1.200
<i>GL</i>	-0.0967	-0.312
<i>SO</i>	0.4735	1.632
<i>SW</i>	-0.0188	-0.056
<i>WE</i>	-0.0475	-0.144
Adjusted <i>R</i> ²	0.5857	

* coefficient significantly different from zero at a 90% confidence level

** coefficient significantly different from zero at a 95% confidence level

Exhibit 3
Gross Income vs. Size of the Firm

Variable	Coefficient	T-Ratio
Intercept	7.3812	4.942
<i>LNSIZE</i>	0.6919**	7.458
<i>INDP</i>	3.6325**	2.477
<i>OFFP</i>	3.4277**	2.285
<i>DEVP</i>	3.9177**	2.333
<i>PRPP</i>	2.9109*	1.823
<i>RTL P</i>	3.5235**	2.011
<i>INVP</i>	4.8228**	2.572
<i>MTGP</i>	24.8551**	3.146
<i>CONP</i>	4.1885**	2.159
<i>OTHP</i>	2.2195	1.318
<i>NE</i>	0.5501	1.399
<i>GL</i>	0.2217	0.638
<i>SO</i>	0.8285**	2.597
<i>SW</i>	0.5626	1.518
<i>WE</i>	0.5627	1.559
Adjusted R^2	0.4664	

*coefficient significantly different from zero at a 90% confidence level

**coefficient significantly different from zero at a 95% confidence level

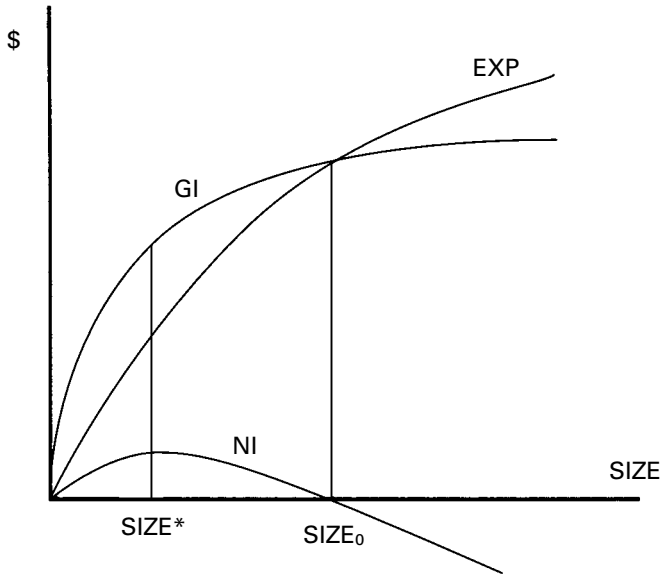
greater than zero. Furthermore, by comparing the coefficient value to its standard error of .092779, we see that the *LNSIZE* coefficient is also significantly less than one. Thus, the second hypothesis is also supported at a 95% confidence level.

Gross income and total operating expense are plotted together in Exhibit 4; each is shown as a function of the size of the firm. Because the regression results indicate that α_0 is greater than β_0 , the slope of the *GI* curve should become steeper than that of the *EX* curve as the number of full-time producers approaches zero. An implication is that, for a relatively small brokerage firm, gross income initially increases more rapidly than does total operating expense. The difference between *GI* and *EX* is the firm's measured net income, shown in Exhibit 4 as *NI*. Because *GI* increases more rapidly than does *EX* as the firm grows, *NI* increases as a relatively small firm adds full-time producers, but this measure soon peaks and begins decreasing.

A Further Analysis of Net Income

Coefficients for the different types of producers affect the *GI* and *EX* functions through Ω_1 and Ω_2 . The magnitude of each coefficient determines the slope of the *GI* or *EX* function as the size of the firm approaches zero. The base case for equations (1) and (2) involves an operation devoted 100% to appraisal activity. A positive sign on a coefficient indicates that the marginal gross income (or the marginal expense) increases as the indicated type of business activity accounts for a higher percentage of the firm's operation. Consider, for example, some of the figures shown in Exhibit 3. The Ω_1 of the gross income for an appraisal-oriented firm in the Mid-Continent region is $\exp(7.3812)$,

Exhibit 4
Optimal Firm Size



or approximately 1,605; the interpretation is that a brokerage firm employing one full-time producer and devoting all of its efforts to appraisal activity receives, on average, \$1,605 per year in gross income.¹⁵ The Ω_1 for a firm devoted solely to the sale and leasing of industrial property is $\exp(7.3812 + 3.6325) = \exp(11.0137)$, or approximately 60,700; a one-agent brokerage firm focusing on industrial real estate would be expected to generate gross income of \$60,700 per year. A higher coefficient implies a higher gross income within a particular business sector. As the firm devotes a higher percentage of its efforts to activities with higher coefficients, its gross income is expected to increase. Based on data from the 1992 survey, various activities have displayed the capacity to generate gross income, in descending order, as follows: mortgage brokerage, investment property, consulting, development, industrial property, retail property, office property, property management, other activities, and appraisal.

In a similar manner, Exhibit 2 shows that the total annual operating expense for a brokerage firm employing one full-time producer engaged entirely in appraisal activity is $\exp(5.6425)$, or \$282, while that for a one-agent brokerage firm devoted entirely to industrial real estate would be $\exp(5.6425 + 5.0200)$, or \$42,723. Based on the survey results, total operating expenses attributable to the various activities, in decreasing order, are: mortgage brokerage, investment property, development, office property, industrial property, property management, retail property, other activities, consulting, and appraisal.

Of course, the firm's goal is to maximize net income (the difference between gross income and operating expenses), not merely to maximize revenues or to minimize expenses. An examination of Exhibits 2 and 3 together therefore yields a meaningful measure of profitability. The fact that α_1 is less than β_1 indicates that *GI* exhibits more concavity with respect to *SIZE* than does *EX*. As a result, when the slope of the *GI* curve

shown in Exhibit 4 decreases faster than does the slope of the *EX* curve, the rate of increase in the slope of the *NI* curve decreases. This result implies that there exists a particular *SIZE** such that *NI* is maximized. The indicated *SIZE** represents the optimal number of full-time producers for a firm with specified operating characteristics.

We can solve algebraically for the optimal size. Because net income is simply gross income minus operating expenses, we can compute:

$$NI_i = GI_i - EX_i = \Omega_1 SIZE_i^{\alpha_1} - \Omega_2 SIZE_i^{\beta_1}. \quad (5)$$

The firm has reached its optimal size when *NI* is maximized. We can solve for this value through the first-order condition:

$$\frac{\partial NI_i}{\partial SIZE_i} = \Omega_1 \alpha_1 SIZE_i^{\alpha_1 - 1} - \Omega_2 \beta_1 SIZE_i^{\beta_1 - 1} = 0. \quad (6)$$

Rearranging equation (6), we find the optimal size for the firm as described to be:

$$SIZE^* = \left(\frac{\Omega_1 \alpha_1}{\Omega_2 \beta_1} \right)^{\frac{1}{\beta_1 - \alpha_1}}. \quad (7)$$

For an average firm located in the Mid-Continent region, with *INDP*=43.4%, *OFFP*=24.7%, *DEVP*=2.1%, *PRPP*=9.9%, *RTL*P=6.1%, *INVP*=5%, *MTGP*=0.3%, *CONP*=1.5%, and *OTHP*=5.3%, the optimal number of full-time producers is approximately four. The stated percentage figures can be interpreted as percentages of total productive *hours* that the full-time agents have devoted to each of the firm's activities; they need not relate to the number of *individuals* assigned to particular tasks (the percentages are independent of the number of producers). The optimal size increases as the percentage of the firm's workers engaged in mortgage and construction activity increases. The minimum optimal size would be observed for a firm engaged solely in the selling and leasing of office space. Through the use of equation (7), the manager of an income property brokerage firm can estimate the optimal number of employees in light of the firm's operating and locational characteristics.

Effectiveness of Operating Expense Control in Improving Gross Income

The data from the SIOR survey are also useful in addressing interesting questions regarding a brokerage firm's budget allocation and control among different expense categories. To examine the impact of each type of expense, we can perform log-linear regressions. The log-linear production function takes the following form:

$$GI_i = ADV_i^{\alpha_1} PROM_i^{\alpha_2} WAGE_i^{\alpha_3} OCC_i^{\alpha_4} OE_i^{\alpha_5} e^{(\beta_1 IND_i + \beta_2 OFF_i + \dots + \beta_{15} WE_i + \varepsilon_i)}. \quad (8)$$

Equation (8) specifies a type of Cobb-Douglas production function,¹⁶ in which gross income is determined through several different inputs. Because our expectation is for diminishing marginal returns to spending on the various inputs, the value of each α should lie between zero and one. The regression results are as shown in Exhibit 5.

Exhibit 5
Estimation of Cobb-Douglas Production Function

Variable	Coefficient	T-Ratio
<i>ADV</i>	-0.043258	-0.504
<i>PROM</i>	0.073100	1.037
<i>WAGE</i>	0.181018*	1.958
<i>OCC</i>	0.055280	0.455
<i>OE</i>	0.523812**	3.670
<i>IND</i>	4.235674**	2.865
<i>OFF</i>	3.935196**	2.758
<i>DEV</i>	4.669693**	3.084
<i>PRP</i>	3.721372**	2.308
<i>RTL</i>	4.146346**	2.601
<i>INV</i>	4.359694**	2.669
<i>MTG</i>	0.246874	1.191
<i>CON</i>	5.104869**	2.950
<i>OTH</i>	3.582587**	2.362
<i>NE</i>	0.247257	0.970
<i>GL</i>	-0.018393	-0.086
<i>SO</i>	0.189147	0.862
<i>SW</i>	0.252562	1.043
<i>WE</i>	0.043922	0.191
<i>SIZE</i>	-0.046420	-0.900
Intercept	-0.569086	-0.334
Adjusted R^2	0.6733	

* coefficient is significantly different from zero at a 90% confidence level

** coefficient is significantly different from zero at a 95% confidence level

The size of a particular coefficient can be interpreted as the effectiveness of the attendant expense category in generating additional gross income. Each of the coefficients is significantly less than one, a result that confirms the presence of diminishing marginal returns to expenses in the determination of gross income. We further find that all but one (advertising) of the major expense categories has a coefficient with a value between zero and one, as had been expected. Only in two cases, however, is a coefficient both significantly greater than zero and significantly less than one. According to the values computed, the two most effective ways for a commercial real estate brokerage firm to increase its revenues are to increase office operating expenses (such categories as telephone, legal and accounting, postage, and computer usage); and to increase salaries paid to managers, clerical/secretarial workers, market researchers, or others not compensated as a function of the volume and prices of transactions. The latter result may reflect the market difficulties that prevailed in the year when the survey was distributed. In light of the seeming relationship between staff support and increased revenue, it is interesting that salary and administrative outlays were the expense categories most often noted by survey respondents as having been monitored closely, and even cut back, relative to previous years.

Increases in advertising and promotional expenses appear not to have been effective in generating added gross income.¹⁷ This unusual result may also reflect the difficult market

environment that existed at the time of the survey; incentive awards and extra advertising outlays may have little impact when real estate's tax benefits have recently been curtailed, values are perceived to have fallen, and institutional lenders have been withdrawing from the market. The expenditures that do seem to have increased gross income may reflect benefits sustained through commercial real estate firms' consulting and other non-sales activities.

The multi-product nature of the generalized Cobb-Douglas production function generates figures representing both the proportion of the firm's activity that has been devoted to each product line and the impact of money spent in the various input categories (with output measured in terms of gross income). By adding the *ADV*, *PROM*, *WAGE*, *OCC*, and *OE* coefficients together, we gain insights into the returns to scale present among commercial real estate brokerage operations. If the sum of the five expense category coefficients is greater than unity, then there are increasing returns to scale; if the sum is less than unity, then there are decreasing returns to scale; and if the sum is equal to one, then there are constant returns to scale. As Exhibit 5 shows, the sum of the coefficients is .7900, a value that indicates the existence of *decreasing* returns to scale. This result suggests that many brokerage firms specializing in income-producing real estate would benefit by reducing their operating expenses.

The latter result is further confirmed by the negative coefficient on the *SIZE* variable (albeit the magnitude of this coefficient is not statistically significant). This negative sign is consistent with the finding, as indicated in the previous section, that a commercial brokerage firm engaged in the activities specified should employ only about four full-time agents. Although such an optimal size may seem quite small in light of the existence of some very large commercial brokerages, the magnitude is not inconsistent with outcomes in some earlier works.¹⁸ Within the relevant range of sizes, which includes organizations employing from 1 to 156 full-time producers in our data, we find that a firm's relative profit generally would decrease with size.¹⁹

Furthermore, a firm can apply the above results in determining the optimal allocation of capital. We find the optimal capital allocation by maximizing the firm's net income, subject to a budget constraint. The solution takes the following functional form:

$$\begin{aligned} \text{MAX}_{\{ADV, PROM, WAGE, OCC, OE\}} NI \\ &= GI - ADV - PROM - WAGE - OCC - OE \\ &= ADV^{\alpha_1} PROM^{\alpha_2} WAGE^{\alpha_3} OCC^{\alpha_4} OE^{\alpha_5} e^{(\beta_1 IND + \beta_2 OFF + \dots + \beta_{15} WE)} \\ &\quad - ADV - PROM - WAGE - OCC - OE, \end{aligned} \quad (9)$$

$$\text{s.t.} \quad ADV, PROM, WAGE, OCC, OE \geq 0 \quad (10)$$

and

$$ADV + PROM + WAGE + OCC + OE \leq F, \quad (11)$$

where *F* is the maximum budget available to the firm. This optimal level of capital spending will differ, depending on the brokerage firm's involvement in each of the various

types of business activity, and depending on its location within the country. Geographic location serves as a proxy for market conditions, which differ from one area to another; therefore, despite the fact that physical and human capital are mobile, the optimal size for a commercial brokerage firm located in one region may differ from that for a firm in a different region.

Conclusions and Limitations

The analysis presented in this paper develops techniques that a commercial real estate brokerage organization can utilize in identifying more suitable operating strategies. One finding is that optimal size is a function of the percentage of its productive effort that the firm devotes to various types of business activity. We further find that, while an analysis based on expenses alone yields results consistent with earlier studies' findings of economies of scale in (residential) brokerage firms, an analysis involving net income shows that decreasing returns to scale characterize commercial brokerages. Another finding is that, based on a generalized Cobb-Douglas production function (and on the data available), some spending categories have unexpected impacts on gross income. To the extent that this result can be generalized, an implication is that commercially oriented real estate brokerage organizations should reevaluate their expenditure patterns, in that some outlays that might intuitively be expected to lead to higher gross inflows appear not to do so. For example, our results show that, in order to increase its gross income, a firm should reduce amounts spent on advertising, whereas it should increase its spending on modern office technology and on staff support.

Our results indicate that commercial real estate brokerage firms exhibit both economies of scale and diminishing marginal returns with respect to the number of full-time agents. The existence of economies of scale suggests that average production cost decreases as the number of full-time agents increases. The existence of diminishing marginal returns suggests that average revenue also decreases with the number of full-time agents. When average revenue decreases faster than average cost (a condition suggested by the empirical results), average net income decreases with the size of the firm. As the firm becomes larger than the optimal size (which we find to be relatively small), its net income decreases as new agents are added.

The inconsistency of our results with recent residential brokerage studies may lend support to a view that the real estate brokerage industry's residential and income sectors are structurally different. We must emphasize, of course, that the survey data relate only to one operating year; and because the market environment during that year was unusually poor, it is far from certain that the results are relevant to periods characterized by different conditions. Furthermore, the coefficients may be quite sensitive to general economic trends, in light of the cyclical nature that many observers feel characterizes the real estate industry (particularly as it relates to income-producing properties). In addition, any study of the real estate brokerage industry may be hampered by the possibility, suggested by Colwell and Marshall (1986) and by Zumpano and Elder (1994), that economies involving the capital and goodwill that lead to real estate sales productivity are owned at the agent, rather than at the firm, level. Therefore, we must exercise caution in generalizing the results and the overall implications.

Indeed, the major contributions of this work may be its offering of a model for analyzing the behavior of firms specializing in the brokerage of income-producing real

estate, and its demonstration of the usefulness of survey data on this important sector of the economy.²⁰ It is our hope, and our recommendation, that real estate professional associations provide support for further surveys of the operating features of commercially oriented brokerage firms, and that researchers devote additional effort to this important industry whose analysis has been vastly overshadowed by that of its residential counterpart.

Notes

¹It seems to be primarily in unusual cases, such as New York City's rent-controlled market (an example offered in Knoll, 1988), that brokers earn commissions from lessees for arranging residential leases.

²Crockett (1982) notes the capital-intensive nature of the information-related services that brokers are uniquely qualified to provide. He observes that industry pricing reflects a "full-service" assumption, such that the individual transactor must pay for a multi-product brokerage service even if some of the traditional services are not desired (a practice criticized by Epley and Banks, 1985, who encourage unbundling). At this time, Crockett's observation would certainly seem less applicable to income property brokerage than to residential.

³A precedent for this differential treatment involves the spate of federal laws, enacted largely in the late 1960s and early 1970s, that protects household credit users, but not business borrowers, from potentially misleading lender practices (on the logic that business owners are more sophisticated than households and therefore do not require the same degree of government protection). In a similar manner, the government may view buyers or sellers of income-producing real estate as sufficiently knowledgeable, or well advised, that they do not require federal guidance in navigating the markets.

⁴Licensing and certification requirements that now apply to the appraisal profession do restrict some appraisers to valuing residential properties.

⁵Webb (1988) finds in an industry survey that income property brokerage is viewed as the most profitable activity in which brokers can engage; and the belief, held by more than half of those responding, that brokers should concentrate their efforts in a primary line of business, suggests that even more firms may come to focus on the sale and leasing of income property.

⁶One such arrangement calls for a commission if the broker negotiates a sale, or a fee if the broker uses some other means, such as a refinancing, for solving the client's problem (see Epley and Banks, 1985). Brokerages that engage in substantial counseling activity are likely to employ professional staffs that are paid salaries plus shares of profits (see White, 1989).

⁷For example, Glower and Hendershott (1988), in a study based on survey data that included both residential and commercial producers, focus on the measurement of income for managers or agents, rather than for firms. Webb (1981) examines the impact that brokers exert on the sales prices of multifamily residential properties. Chinloy (1988) determines that sales agents working on the commercial/investment side of the market can expect higher incomes than do their colleagues focusing on residential property. Abelson et al. (1990) link performance to the number of years that the individual has spent with his or her firm and in the residential brokerage industry.

⁸While the database for that study included firms that handled some commercial property transactions, any broker whose business was less than 75% residential was excluded from the working data.

⁹From Sherman, Torres and Lai (1992), p. vii.

¹⁰Because our analysis focuses on the firm, and not on the individual agent, we disregard the commission share paid to the agent, while treating the commission share retained by the firm as a component of gross income. Note that ZEC (1993) treat the broker/owner's commission share as an expense of the firm; we implicitly treat the owner and the firm as a single entity. It is unclear

whether our differing approaches to measuring revenues and expenses might cause some of the differences in our ultimate findings regarding scale effects.

¹¹There are other measures that researchers have used in measuring residential brokerage productivity. Colwell and Marshall (1986) select market share per salesperson, while Okoruwa and Jud (1995) offer buyer satisfaction, as measures of broker productivity. Nelson and Nelson (1995) offer a quality measure in the client's willingness to recommend the broker to others. Defining the quality of output for a service-oriented business can be difficult, however; McDaniel and Louargand (1994) note that service quality is intangible, and that production of the service cannot occur separately from its consumption. Johnson, Dotson and Dunlap (1988) add that services must be customized for the particular client and cannot be inventoried to meet fluctuating demand. Furthermore, the latter authors had found residential real estate brokers' clients to be most concerned with "assurances" (e.g., the amount of communication), whereas McDaniel and Louargand find that the "reliability" (e.g., agent qualifications and company reputation) of broker services is more important.

¹²We recognize that, because of technology and other factors, the residential brokerage industry is undergoing changes. For example, some home brokers may come to earn substantial revenues by offering computerized loan origination services (see Harris, 1995), and the recent buyer brokerage phenomenon is likely to lead to some changes in the service mixes and compensation plans offered (see, for example, Colwell, Trefzger and Treleven, 1994).

¹³Firms that are growing sometimes seem to forestall the latter eventuality by luring top producers away from competitors. To the extent that such activity occurs, it provides support for the view that the supply of well-qualified agents is relatively fixed (within a given market area and a relevant time period).

¹⁴A reviewer has suggested that the phenomenon present may be economies of *scope*, which involve benefits of joint production of multiple outputs, rather than economies of *scale*, which relate to the quantity of one output created. While this suggestion raises interesting questions, we find it difficult to draw clear distinctions between scale and scope when the output is a service that cannot easily be exported to new market areas. For example, does the addition of appraisal to a brokerage operation reflect perceived benefits of offering two services jointly (scope) with the same asset base (office, computers, data) or a perceived need to increase the volume (scale) of business from a limited local clientele? Often-cited early treatments of general scale and scope issues include Panzar and Willig (1977, 1981). An interesting analysis involving scale and scope issues in residential real estate brokerages is presented in Zumpano and Elder (1994).

¹⁵This low revenue relates to the unlikely case of a one-producer firm that calls itself a broker, and is an SIOR member, yet devotes all of its effort to appraisal work.

¹⁶This type of relationship is also called a multiplicatively separable function (see Silberberg 1978, p.322). The more general representation of such a function is $y = A(\alpha_1 X_1^\rho + \dots + \alpha_n X_n^\rho)^{-1/\rho}$. As ρ approaches 0, the form reduces to Cobb-Douglas, or multiplicatively separable, in form: $y = AX_1^{\alpha_1} X_2^{\alpha_2} \dots X_n^{\alpha_n}$, where $\sum_{i=1}^n \alpha_i = 1$ represents constant returns to scale, $\sum_{i=1}^n \alpha_i > 1$ represents increasing returns to scale, and $\sum_{i=1}^n \alpha_i < 1$ represents decreasing returns to scale.

¹⁷While perhaps counterintuitive, this finding is not unprecedented. Colwell and Marshall (1986) find, for example, that classified and *Yellow Pages* advertising do not significantly affect market share per salesperson. On the other hand, Crockett's (1982) belief that advertising outlays reflect the volume of listings suggests the possibility of a collinearity problem.

¹⁸Chinloy (1988) observes that, with regard to commercial property leasing, a small number of "superstar" performers generates a high percentage of a typical firm's output. Furthermore, Zumpano and Hooks (1988) report that a nationwide survey showed slightly more than half of all Realtor® member firms to have five or fewer producers; while Webb (1988) finds that a majority of firms employ fewer than ten salespeople; ZEC (1993) report a 1990 average firm size of approximately eight sales agents, with more than half of all firms staffed by five or fewer individuals; and Crellin, Frew and Jud (1988) find the average firm to have eight producers.

(A particularly interesting result of the latter study is that individual agents' earnings rise with firm size; an implication may be that firm owners have too often focused on maximizing gross rather than net incomes.) Our finding that the number of agents should be relatively small may also be consistent with Crockett's (1982) view (although his focus is on residential firms) that the brokerage marketplace is inefficient in terms of excess agents.

¹⁹Our finding that a reduction in firm size might be accompanied by an increase in profitability may not be entirely inconsistent with that of Zumpano and Elder (1994), who find evidence that, while larger brokerage firms face relative cost advantages, their smaller counterparts can benefit from choosing appropriate mixes of services. Furthermore, a move toward reductions in the staff of direct producers in the name of greater profitability might be consistent with our observation that brokers are making increasing use of unlicensed assistants. Commercial real estate brokerage firms may have become too large as technology has allowed decisionmakers to be more productive, a phenomenon that has occurred in other information-based industries as well.

²⁰Zumpano and Hooks (1988) and Zumpano and Elder (1994) express the concern that data has been unavailable on the cost structure of brokerage firms; the type of survey upon which this study is based may be a step toward remedying that problem.

References

- Abelson, M. A., K. M. Kacmar and E. F. Jackofsky, Factors Influencing Real Estate Brokerage Sales Staff Performance, *Journal of Real Estate Research*, 1990, 5:2, 265–75.
- Chinloy, P., The Real Estate Brokerage: Commissioned Sales and Market Values, *Journal of Real Estate Research*, 1988, 3:2, 37–51.
- Colwell, P. F. and D. W. Marshall, Market Share in the Real Estate Brokerage Industry, *AREUEA Journal*, 1986, 14:4, 583–99.
- Colwell, P. F., J. W. Trefzger and R. A. Treleven, Residual Share Contracts for Compensating Buyer Brokers, *Real Estate Review*, 1994, 24, 82–86.
- Crellin, G. E., J. R. Frew and G. D. Jud, The Earnings of Realtors®: Some Empirical Evidence, *Journal of Real Estate Research*, 1988, 3:2, 69–78.
- Crockett, J. H., Competition and Efficiency in Transacting: The Case of Residential Real Estate Brokerage, *AREUEA Journal*, 1982, 10, 209–27.
- Epley, D. R. and W. Banks, The Pricing of Real Estate Brokerage for Services Actually Offered, *Real Estate Issues*, 1985, 10, 45–51.
- Glower, M. and P. H. Hendershott, The Determinants of Realtor® Income, *Journal of Real Estate Research*, 1988, 3:2, 53–68.
- Harris, J. C., Expanding Brokerage Services: Computerized Loan Origination, *Tierra Grande*, 1995, 2, 20–2.
- Hughes, W. T., Jr., Brokerage Firms' Characteristics and the Sale of Residential Property, *Journal of Real Estate Research*, 1995, 10:1, 45–56.
- Johnson, L. L., M. J. Dotson and B. J. Dunlap, Service Quality Determinants and Effectiveness in the Real Estate Brokerage Industry, *Journal of Real Estate Research*, 1988, 3:2, 21–36.
- Jud, G. D., R. C. Rogers and G. E. Crellin, Franchising and Real Estate Brokerage, *Journal of Real Estate Finance and Economics*, 1994, 8, 87–93.
- Knoll, M. S., Uncertainty, Efficiency, and the Brokerage Industry, *Journal of Law and Economics*, 1988, 31, 249–63.
- Larsen, J. E. and W. J. Park, Non-Uniform Percentage Brokerage Commissions and Real Estate Market Performance, *AREUEA Journal*, 1989, 17, 422–38.
- McDaniel, J. R. and M. A. Louargand, Real Estate Brokerage Service Quality: An Examination, *Journal of Real Estate Research*, 1994, 9:3, 369–89.
-

- Miceli, T. J., The Welfare Effects of Non-Price Competition Among Real Estate Brokers, *AREUEA Journal*, 1992, 20:4, 519–32.
- Nelson, S. L. and T. R. Nelson, RESERV: An Instrument for Measuring Real Estate Brokerage Service Quality, *Journal of Real Estate Research*, 1995, 10:1, 99–113.
- Okoruwa, A. A. and G. D. Jud, Buyer Satisfaction with Residential Brokerage Services, *Journal of Real Estate Research*, 1995, 10:1, 15–21.
- Panzar, J. C. and R. D. Willig, Economies of Scope, *American Economic Review*, 1981, 71, 268–72.
- , Economies of Scale in Multi-Output Production, *Quarterly Journal of Economics*, 1977, 91, 481–93.
- Rand, E., Should You Join a Commercial Network? *Real Estate Today*, 1993, 26, 41–44.
- Schroeter, J. R., Competition and Value-of-Service Pricing in the Residential Real Estate Brokerage Market, *Quarterly Review of Economics and Business*, 1987, 27, 29–40.
- Sherman, L. F., K. Torres and N. Lai, Real Estate Firm Operations Survey, Society of Industrial and Office Realtors®, 1992.
- Silberberg, E., *The Structure of Economics: A Mathematical Analysis*, New York: McGraw-Hill, 1978.
- Sirmans, C. F., G. K. Turnbull and J. D. Benjamin, The Markets for Housing and Real Estate Broker Services, *Journal of Housing Economics*, 1991, 1, 207–17.
- Webb, J. R., The Assimilation of New Services into the Real Estate Brokerage Firm, *Journal of Real Estate Research*, 1988, 3:2, 165–75.
- , The Effects of Real Estate Brokerage on Selling Price, *Real Estate Issues*, 1981, 6, 19–21.
- White, J. R., Counselors: Professionally Motivated Business People, *Real Estate Issues*, 1989, 14, 49–50.
- Yang, S. X. and A. Yavaş, Bigger is Not Better: Brokerage and Time on the Market, *Journal of Real Estate Research*, 1995, 10:1, 23–33.
- Yavaş, A., The Economics of Brokerage: An Overview, *Journal of Real Estate Literature*, 1994, 2, 169–95.
- Zumpano, L. V. and H. W. Elder, Economies of Scope and Density in the Market for Real Estate Brokerage Service, *Journal of the American Real Estate and Urban Economics Association*, 1994, 22: 497–513.
- and G. E. Crellin, The Market for Residential Real Estate Brokerage Services: Costs of Production and Economies of Scale, *Journal of Real Estate Finance and Economics*, 1993, 6, 237–50.
- Zumpano, L. V. and D. L. Hooks, The Real Estate Brokerage Market: A Critical Reevaluation, *AREUEA Journal*, 1988, 16:1, 1–16.

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