Optimal Economies of Scope in the Residential Real Estate Brokerage Industry

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Abstract of
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Recent studies of scale economies on residential real estate brokerages, using an efficient frontier, find increasing returns to scale for nearly the entire range of brokerage sizes, as measured by revenue units.[1] However, the lower per unit cost of producing listing and sales may partially be explained by economies of scope. Economies of scope exist if producing sales and listings jointly in a single brokerage firm is more cost efficient than producing them in two separate brokerage firms that specialize. This study seeks to identify the inefficiencies in real estate brokerage. This is accomplished by first estimating economies of scope by specifying and estimating a composed-error translog cost function using Bayesian parameter estimates. Substantial economies of scope are found in the residential real estate brokerage industry. The results indicate that a firm that balances their output, rather than specializing in sales or listings, has an almost 53% cost saving advantage.

[1] See Anderson, Lewis, and Zumpano (2000a and 2000b).

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I. Introduction

The cost efficiency of a residential brokerage is a multi-faceted problem. Several measures of cost efficiency can be used, including X-efficiency, scale efficiency, scope efficiency, relative efficiencies, technical efficiency, allocative efficiency, and overall efficiency as well as a handful of other measures. Recent studies of scale economies on residential real estate brokerages, using an efficient frontier, find increasing returns to scale for nearly the entire range of brokerage sizes, as measured by revenue units.[2] However, the lower per unit cost of producing listing and sales may partially be explained by economies of scope. Economies of scope exist if producing sales and listings jointly in a single brokerage firm is more cost efficient than producing them in two separate brokerage firms that specialize.

Summarizing the real estate transaction, Zumpano and Elder (1994) note that the main function of the traditional residential real estate brokerage firm is to obtain listings and to generate sales.[3] In order to generate listings, licensed salespersons seek out properties to place under contract with the brokerage to sell. Subsequently, the salesperson attempts to convince the home-seller that he/she should list the property with their firm, instead of a competing firm. Once a property lists with an agent, the salesperson helps decide upon the asking price, helps the sellers prepare their home for viewing, markets their home using numerous methods, aids in the negotiation process,

[2] See Anderson, Lewis, and Zumpano (2000a and 2000b).

[3] Certainly other production opportunities are present such as consulting, land developments, construction, property management, and numerous others.

and finally, assists in transferring the property at closing. On the selling side, the licensed salesperson would attempt to find and screen qualified potential buyers and show potential buyers the property. The selling agent may also help the buyer in obtaining financing and works with the buyer by bringing his/her offers to the seller.

Shilling et al. 1992) note that the use of the Multiple Listing Service (MLS) makes the distinction between the two outputs very readily identifiable. This distinction between the two outputs and the ability of firms to choose to specialize in one or the other of the two sides of the transaction brings about the question of what is more efficient—joint production or specialized production. This question is becoming even more relevant with the rapidly changing institutional arrangements in the real estate brokerage industry. Today, there are buyer's agents, disclosed dual agents and facilitators. These different firm arrangements impact product mix, and may, ultimately, influence the efficiency of the market. For example, a buyer's agent might not take any listings, but instead focus on only selling residential property, while facilitators or disclosed dual agents would generally be offering a balanced composition of listings and sales.

The increase in affinity programs within the residential real estate industry also impacts product mix.[4] Affinity programs may facilitate one-stop shopping for consumers of residential real estate brokerage services (Lewis, Anderson and Zumpano 2000). E-Home, a new Internet start-up that began on-line in late fall of 1999, offers a wide array of products and services to its clients—again altering the traditional product mix in the

[4] Affinity relationships provide commission rebates, discounts, and other goods and services to individuals who are members of professional organizations, trade associations, unions, or organizations who have an agreement with a real estate company.

real estate brokerage market. In these times of changing product mix, it is important to understand the impact of the product mix on the operational efficiency of real estate brokerage firms.

The objective of this study is to identify the inefficiencies in real estate brokerage. This is accomplished by first estimating economies of scope (by specifying and estimating a composed-error translog cost function using Bayesian parameter estimates, as in Lewis and Anderson (1999)). The results of this estimation will provide an overall X-efficiency measure, a measure of the service-specific economies of scale from the efficient frontier, and finally, an estimate of optimal scope economies. From these results, it can be ascertained for the first time where most of the inefficiencies occur in real estate brokerages. Moreover, how the changing market structure and increases in technology will impact the residential real estate brokerage market in the years to come should also become clearer.

The remainder of this study is organized as follows. Section II defines scope economies. Section III explains the reasons why scope economies may exist. Section IV reviews the literature. Section V discusses the data. Section VI describes the methodology used to determine the degree of scope economies. Section VII presents the results and Section VIII concludes.

II. Economies of Scope

In order to examine the impact of product mix on the performance of real estate brokerage firms, it is necessary to first determine if scope economies exist. Economies of scope measure a firm's efficiency with respect to the breadth of a firm's outputs (i.e., product mix). Thus, the efficiency of a multi-product firm needs to be examined by estimating scope economies. If economies of scope exist, it may be possible to reduce the cost of producing listings by being a producer of sales or vice versa. Adding new services or deleting services generally involves changing the types and amounts of a variety of inputs and consequently is a long-run decision.

Most residential real estate brokerages produce at least two clearly defined services (listings and sales). These multi-service firms use inputs that contribute simultaneously to the production of listings and sales. Whenever it is less costly for a single firm to produce two or more products together than for separate firms to produce the same level of output for each product, economies of scope exist. Let C(L,0) be the total cost of producing a given level of listings by a single-service brokerage and C(0,S) be the total cost of producing a given level of sales by a single-service firm. C(S,L) represents the cost of a single firm jointly producing the same levels of listings and sales. Economies of scope exist if,

$$C(L,S) < C(L,0) + C(0,S)$$

The degree to which economies of scope exist can be estimated by:

$$Scope = \frac{\left[C(\overline{P}, \hat{L}, S^m) + C(\overline{P}, L^m, \hat{S}) - C(\overline{P}, \overline{L}, \overline{S})\right]}{C(\overline{P}, \overline{L}, \overline{S})} \quad (1)$$

Where C is the cost frontier, $\overline{P}$ is a matrix of average input prices, $\overline{L}$ is the sample mean number of listings, $\overline{S}$ is the sample mean number of sales, L^m is a small value of listings (the sample minimum), S^m is a small value of sales (the sample minimum), $\hat{L} = \overline{L} - L^m$ and $\hat{S} = \overline{S} - S^m$. Scope measures the percentage cost savings from producing chosen quantities of listings and sales jointly in a single brokerage firm versus producing them in two different brokerage firms, each of which specializes in either listings or sales. When production involves economies of scope, the sum of the separate costs of producing listings and sales by separate firms exceeds the cost of producing listings and sales jointly by the same firm and *Scope* is positive. If diseconomies of scope exist, the sum of producing listings and sales by separate firms is less than producing listings and sales jointly by the same firm and *Scope* is negative. The greater the economies of scope the greater the value of *Scope*.

III. Why do Economies of Scope Exist?

The possible reasons for the existence of economies of scope can be varied. Some brokerage firms may benefit from economies of scope because sales and non-sales labor, physical capital and promotional inputs can be jointly used to produce both listing and sales. Some products are complements in production. When the inputs are shared, not necessarily even in fixed proportions, capital and labor expenditures may contribute to the production of more than one service. If it is impossible to capitalize on economies of scale due to lack of demand, resources can be used more efficiently if another service is offered to fully employ the resources. In some industries, the shared resources that lead to economies of scope may be the inputs used to produce the services or it may involve the administrative and marketing resources of the firm. In the case of residential real estate brokerages, both types of inputs are used for each listing and sale. For instance, placing a sign in the yard of a listed house not only attracts potential buyers of the home, but also potential clients that would also like to list their home. In some cases, the production process may involve joint products or services for which the production of one results in the production of another good or service at little or no extra cost.

Brokerage firms can also participate in other activities other than listing and selling. They can also consult, develop land, manage property and/or do leasing, amongst other things. It is also possible for residential real estate brokerage firms to use economies of scope as a barrier to entry. The existence of economies of scope may enable a brokerage to make the entry of new competitors into the market more difficult. Industries that face economies of scope tend to have lower costs per unit and can undercut competitors that do not operate with optimal economies of scope. Although firms can enter the industry with the same cost structure if they also produce at the optimal economies of scope, it is generally more costly to enter in more than one market and to produce both products or services than to enter just one of the markets. The initial capital cost would typically be higher and it is generally more difficult for new firms to raise investment capital. Consequently, the large capital investment required would tend to discourage some firms from entering both markets and producing at the optimal economies of scope.

A third reason for economies of scope is risk reduction. The existence of economies of scope may also diversify risk, just as diversifying a portfolio may reduce risk. Putting “all the eggs in one basket” can be very detrimental to the firm when a downward trend in demand for that service comes.

A fourth reason for economies of scale is the fact that some outputs have complements in consumption. These products or services are used together and are frequently purchased together. Real estate brokerage firms often benefit from economies of scope in this way because in selling a property, the client may also purchase a new property from the same firm. The firm would therefore be able to set prices and quantities that maximize the total profit from both services. Another benefit from consumption complements is that the firm can inherently advertise the two services at the same time.

IV. Literature Review

In the residential real estate brokerage market, only one study exists that directly estimates economies of scope. Zumpano and Elder (1994) estimate scope economies by employing the maximum likelihood technique on a tranlsog cost function. Zumpano and Elder express the real estate firm as a multi-product firm that jointly produces listings and sales. The results of this study shows statistically significant economies of scope, suggesting that firms which produce a mixture of services—both listings and sales, are more efficient than firms who specialize in the production of either listings or sales.

Anderson et al. (1998) notes that scale and scope economies should be estimated from an efficient frontier to be specified correctly.[5] The Zumpano and Elder (1994)

[5] Deviations from the efficient frontier have been termed X-inefficiencies in the finance and economics literature. For a discussion of X-inefficiencies in real estate refer to the review article by Anderson, Lewis, and Springer, 2000.

study does not use an efficient frontier technique, but instead a single error, translog cost function. Berger, Hunter, and Timme (1993) state that evaluating data from the efficient frontier could confound scope economies with X-inefficiencies. The empirical evidence suggests that this may indeed be the case, since Berger and Humphrey (1991) found scope diseconomies of 10 to 20 percent on the frontier and scope diseconomies in the 1,000's when the entire data set was employed. Moreover, Mester (1993) found large differences in the measurement of scope when using efficient verse non-efficient frontier methods. Hence, in order to get a robust estimate of the impact of joint production and how the new market arrangements and the Internet will ultimately influence performance, it is necessary to estimate economies of scope from the efficient frontier.

V. Data Construction

This study utilizes a national data set of residential real estate brokerage firms provided by the National Association of REALTORS®. The information includes the number of real estate listings and sales by each firm, net income, and the firm's cost of listing and selling residential real estate. Other studies (Zumpano, Elder, and Crellin, 1993; Zumpano and Elder, 1994; Anderson, Fok, Zumpano, and Elder 1998; Anderson, Lewis, and Zumpano, 1999; Anderson, Lewis, and Zumpano, 2000; and Lewis and Anderson, 1999) have used a similar data source. Only firms that obtain at least 75 percent of their revenues from residential transactions are included. In order to be X-efficient, the firms must choose the optimal amounts of inputs and the optimal allocations of inputs such that total costs are minimized for a given number of listings and sales[6]. Total costs consist of commissions paid to selling agents, the value of non-selling services provided by broker-owners, advertisement and promotional costs, the cost of buildings and occupancy, and all other production related expenditures. The selling expenses include MLS fees that vary directly with sales, bonuses of sales managers (based on sales-staff performance), commissions paid to owners, and commissions paid directly to the sales staff. Within these expenses, the costs of affinity relationships are implicitly included.

The cost function that will be estimated expresses total costs as a function of listings, sales and five input prices. Hence, the inputs of total cost are converted into four input prices. The prices of sales labor (P_L), non-sales labor (P_{NS}), physical buildings and capital (P_B), advertising and promotions (P_{AD}) and other inputs (P_O) are included. Wages of employees are total sales-related expenses plus salaries of all clerical, secretarial, and sales managers' divided by the number of full-time equivalent employees. The rents on physical capital are total occupancy expense divided by the number of real estate offices. Advertising and promotion expenses are expressed as a percentage of revenue transactions. And, "other" inputs are also expressed as a percentage of revenue transactions. All of these input prices are expressed relative to the price of other inputs (P_O) and put in natural log form so that the estimated model, by construction, is homogeneous degree one.

[6] From the parameter estimates of this efficient frontier, economies of scale and/or scope can be shown to exist or not.

VI. Methodology

In order to estimate scale and scope economies, a stochastic cost frontier with Bayesian statistics is used. Since this procedure is a parametric technique, it is assumed that the cost frontier follows the following translog functional form:

$$1n\ TC\left(P_i, Y_i\right) = B_o + \sum_{i=1}^{4} B_i\ 1n\ P_i + \sum_{i=1}^{4}\sum_{j=1}^{4} B_{ij}\ 1n\ P_i\ 1n\ P_j + B_{16}\ 1n\ S + B_{17}\ 1n\ L + B_{18}\ 1n\ S^2 + B_{19}\ 1n\ L^2 + v_i + z_i \qquad (2)$$

where TC is the total cost of production sales (S) and listings (L). Total costs also depend on four input prices: P_S, P_{NS}, P_B, P_{AD}. As stated previously, the estimated model has been constructed to be homogenous degree one. v_i represents the random measurement error, while z_i represents each brokerage firm's inefficiency. The random measurement error is two-sided and normally distributed with mean zero and variance σ^2, while the inefficiency measurement can only be positive and has a shape parameter λ.

In order to estimate the cost frontier, Bayesian statistics and normal assumptions about the priors are used.[7] The Gibb Sampler allows the construction of the posterior marginal density functions for each parameter estimated. 297 parameters are estimated: 276 individual brokerage inefficiencies ($\varepsilon_\iota - \varepsilon_{276}$), 19 translog frontier parameters (B_1-B_{19}), the overall inefficiency of the industry (λ), and the model's variance (σ^2). Using the Gibb Sampler, each parameter is iterated 11,000 times and then the first 1,000 iterations are dropped to avoid sensitivity to starting values. Thus, the final results consist of a matrix with dimensions 10,000 by 197. From this matrix, all parameters of interest can be calculated with confidence intervals showing the precision of the estimates.

The estimation of Ray Scale economies and scope economies follows from Baumol et. al (1982). Both scale and scope economy estimates have corresponding 90% confidence intervals.

VII. Results

Any conclusions with respect to scale and scope economies should first be referenced by a means table. Table 1 contains the minimums, maximums, means and variances for natural logarithmic total costs, relative input prices, number of sales and number of listings.

Table 2 represents the translog cost frontier's parameters with corresponding 90% confidence intervals. One note concerning concavity violations: B_{18} and B_{19} should be negative, but at the means of the posterior marginal distributions, both parameters are positive. It is possible to impose monotonicity and concavity on the cost frontier's parameters, but that has not been done at this juncture. Also note from Table 2, the industry X-efficiency term, λ, is approximately 10% meaning that real estate brokerage firms could reduce their cost of producing a given level of listings or sales by only 10%. These results are consistent with past literature which indicates that these brokerages tend to be relatively cost X-efficient.

[7] See Lewis and Anderson (1999) for all assumptions and more details about Bayesian estimation.

Table 3 and Table 4 depict the product-specific returns to scale results. The results in Table 3 and Table 4 are calculated by using:

$$\frac{1}{\partial TC/\partial L} \quad \text{and} \quad \frac{1}{\partial TC/\partial S} \tag{3}$$

for three levels of output: the first, second and third quartile. If increasing returns to scale exist, returns to scale will be greater than one, while if decreasing returns to scale exist, returns to scale will be less than one. Constant returns to scale exist where returns are equal to one.

From the results, returns to scale are greater than one for all sized firms and for both services: listings and sales. The results for economies of scale with a multi-product cost frontier seem to support most past research that used a single product cost frontier, but tend to be exaggerated relative to these past studies. All firms have substantial returns to scale. Although a majority of other studies find increasing returns to scale, the results for this study are more modest. The only other study using a multi-product cost function, Zumpano and Elder's (1994), actually find diseconomies of scale.

The economies of scale results in this study seem more intuitive than Zumpano and Elder because those firms that specialize tend to be very small firms. For instance, a buyer's brokerage tends to substitute away from listings and specializes in sales, but they do not replace the business that they forego with enough sales. That is, it may be that the market does not allow them to benefit from economies of scale that they face, because of lack of demand for the service. This is a prime reason for economies of scope to exist. If a firm is facing economies of scale, but cannot increase output due to a lack of demand, increasing the breadth of the product line can decrease the unit costs. The results of this study indicate that the optimal scale of output is several times greater than the largest listing or selling firm in the sample. This particular result means some degree of distortion due to the violations of concavity.

Substantial economies of scope are found in the residential real estate brokerage industry. In fact the results show that a firm that balances their output, rather than specializing in one or the other, has an almost 53% cost saving advantage. A tight high-density region compounds the overwhelming evidence. The probability that the economies of scope fall between 46% and 59% is 90%.

VIII. Conclusions

In this study a stochastic cost frontier is estimated assuming a translog functional form with Bayesian statistics. Estimates are made of the parameters of the frontier, overall X-inefficiency, service-specific returns to scale and scope economies. Evidence supporting previous research that brokerages are relatively X-efficient and have increasing returns to scale and scope is found.

From the results, it is evident that there are significant economies of scope and that the recent trends towards specialized brokerage agencies will have few economic benefits to sustain them. Any continued trends to expand the number of specialized brokerages will only cause the industry to become less efficient. Agencies that provide a range of services, like listings and sales, can benefit from their scope economies and should also tend to expand the depth of their businesses to benefit from the great potential embedded in their economies of scale.

Table 1: Summary Statistics in Natural Logarithmic Form and Relative to P_{O}.

	P_S	P_{NS}	P_B	P_{AD}	Q_S	Q_L	TC
MINIMUM	1.29	0.96	1.03	-1.99	2.20	2.30	4.43
MAXIMUM	6.59	5.65	7.28	-0.40	9.27	9.27	12.56
MEAN	4.28	3.62	4.58	2.19	5.14	5.17	7.97
VARIANCE	0.66	0.74	1.09	0.28	1.33	1.37	1.93

Table 2: Stochastic Translog Cost Frontier Parameter Results. The posterior means of the marginal density functions are reported with 90% confidence intervals.

	Coefficient	Highest Density Region
Intercept	**2.12**	**1.29, 2.95**
B_1	**-0.19**	**-0.59, 0.20**
B_2	**0.18**	**-0.13, 0.49**
B_3	**0.63**	**0.38, 0.87**
B_4	**0.62**	**0.19, 1.03**
B_5	**-0.01**	**-0.08, 0.05**
B_6	**0.03**	**-0.01, 0.065**
B_7	**-0.03**	**-0.06, 0.00**
B_8	**0.08**	**0.01, 0.15**
B_9	**0.04**	**-0.06, 0.12**
B_{10}	**0.06**	**-0.01, 0.12**
B_{11}	**-0.13**	**-0.24, -0.02**
B_{12}	**-0.11**	**-0.17, -0.05**
B_{13}	**-0.01**	**-0.09, 0.08**
B_{14}	**0.08**	**0.02, 0.14**
B_{15}	**0.35**	**-0.01, 0.71**
B_{16}	**0.13**	**-0.23, 0.48**
B_{17}	**0.01**	**-0.03, 0.04**
B_{18}	**0.04**	**0.00, 0.07**
B_{19}	**0.04**	**.001, 0.07**
σ^2	**0.06**	**0.04, 0.07**
λ	**0.10**	**0.04, 0.16**

Table 3: Sales-specific Returns to Scale Using the Ray-Scale Technique.

	Returns to Scale	Highest density region	Increasing, Decreasing, or Constant Returns
25^{th} percentile	2.57	1.93, 3.43	Increasing
50^{th} percentile	2.50	1.93, 3.28	Increasing
75^{th} percentile	2.46	1.82, 3.40	Increasing

Table 4: Listing-specific Returns to Sale Results Using the Ray-Scale Technique.

	Returns to Scale	Highest density region	Increasing, Decreasing, or Constant Returns
25th percentile	2.41	1.84, 3.22	Increasing
50th percentile	2.29	1.80, 2.95	Increasing
75th percentile	1.78	1.41, 2.28	Increasing

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