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An Examination of Profitability in Spatial Markets: The Case of Life Insurance Agency Locations

John M. Clapp, Joseph A. Fields and Chinmoy Ghosh

Abstract

This article analyzes the effect of location on the profitability of life insurance agencies, where profitability is measured by the amount of output per unit of expenses. The model posits that satisficing and spatial information barriers lead to persistently profitable market niches. The results reveal significant variation over metropolitan areas in the production, cost, and profitability of life insurance field offices. Profitability is positively related to the number and size of policies and growth of the metropolitan area and negatively related to population size. Reduction of overhead via a lower number of clerical positions generally contributes to profitability. Because of information barriers, specific niches exist for agencies so that it is worthwhile for firms to invest in a systematic analysis of locational and demographic factors when planning distribution systems.

Introduction

The profitability of metropolitan locations for life insurer field offices is important for several reasons.[1] The last decade has witnessed sustained growth in the services sector of the U.S. economy and life insurers are the third largest holders of assets among the nation's financial institutions. Identification of factors which might improve the choice of profitable locations for field offices is critical to the success of insurers. In the labor intensive insurance industry, the success of an agency is often attributed to the skill of branch managers. While the quality of labor is an important determinant of success, research on location decisions in the industrial sector indicates that other factors are also

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John M. Clapp is Professor of Finance and Joseph Fields is Associate Professor of Finance and Chinmoy Ghosh is Assistant Professor of Finance at the University of Connecticut.

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[1] The term "field office" is used to mean managerial agencies. Over 90 percent of all life and health insurance is sold through agencies.

significant.[2] Moreover the profitability of insurance agencies may depend on locational factors that are different from those for manufacturing facilities.[3]

A major objective of this study is to investigate the effect of location on the profitability of life insurance agencies. Locations are taken as given, so that the *ex post* effects of location decisions on profitability are evaluated. It is hypothesized that profitability is systematically related to characteristics of field offices and their metropolitan areas.[4] Thus, this study is motivated by the notion that readily available data on metropolitan area characteristics can be used, together with prudent agency management, to improve profits.

Despite the importance of the agency distribution system in life insurance, the location and operation of individual agencies has been a neglected area of research. The investigation of locational factors has mainly focused on the role of financial services in economic development (See Daniels, 1979; Marshall, 1983; and Beyers and Alvine, 1984).[5] The first attempt to explore insurance agency locations appears in Noyelle and Stanback (1983), who studied the distribution of field offices of the Aetna Life and Health Insurance Company. They hypothesize that three factors are likely to influence insurance agency locations: proximity to customers, proximity to major financial markets and the supply of white collar workers. Their most significant finding is that although the location of field offices is generally population serving, there is a tendency for agencies to be more numerous in certain areas than is justified by population alone. A potential explanation of this result is that factors other than population density influence the choice of locations. Noyelle and Stanback were constrained in their analysis because of a lack of data.[6] Indeed, problems related to data have inhibited the effort to understand the locational decisions of financial services firms. This study extends Noyelle and Stanback's analysis with a rich and unique data base. Data from the Census of Population and Housing and the Agency Expense and Performance Study of the Life Insurance Marketing Research Association (LIMRA) were used to explore the influence of locational, organizational, environmental, and direct cost variables on a proxy for profitability of life insurance agencies. The model is based on the premise that insurance agents try to maximize commissions subject to the constraint that costs incurred in personal contacts with their clients are minimized.[7] The

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[2] For an in-depth review of the theoretical and empirical research on the location/site choice of industrial facilities, see the survey article by Stevens (1985) and the book by Smith (1981).

[3] See Wasylenko (1985), page 2. The factors that Wasylenko identifies as likely to be different among industries include spatial distribution of relevant nonlabor inputs, labor skills and costs, markets for products, and transportation costs for inputs and outputs.

[4] The model of satisficing and information barriers motivates the presence of persistent profitable opportunities. See the literature review for a discussion of imperfections in insurance markets.

[5] Issues related to operations have been addressed in Cummins (1977) and Fields and Murphy (1989) who respectively study returns to scale for property and liability and life insurance agencies.

[6] They considered only Aetna field offices and related them only to population.

[7] A more general version of this argument can be found in Wasylenko (1985, page 29) who observes that " . . . service establishments are presumed to increase their profits by locating in

model therefore is sensitive to the definition of the target clientele of the agency. The target clientele of each agency is assumed to extend to the Metropolitan Statistical Area (MSA) in which the agency is located.[8]

The results indicate that there is significant spatial variation in the profitability of insurance agencies. Environmental and organizational variables and factor costs are found to affect profitability. The variables that influence the profitability of agencies include: number of policies written, average premium per life insurance policy, number of clerical employees, wage rate, rent, population growth, and competition. The results also indicate that the type of city (as defined by Noyelle and Stanback, 1983) influences the functional relationship between profitability and other explanatory variables. Consistent with the findings in location studies in the manufacturing sector, specialized locational niches exist for life insurance field offices.

A review of the relevant theoretical models and empirical evidence on locational decisions is presented below. The literature on least cost industrial location, especially the models of Smith (1981) and Webber (1984), provide the motivation for the choice of variables and the development of testable hypotheses. The analysis of demand for insurance services is based on the work of Craig, Ghosh, and McLafferty (1984) and Church and Stimson (1983), who studied location decisions of the retail goods and services industries. The data and estimation technique are discussed next, followed by an examination of the results and then conclusions.

Literature Review

Research from different perspectives argues that imperfect information concerning market demand, production costs or quality of life can deter entry, creating sustained profitable market niches (e.g., Pauly and Satterthwaite, 1981). For the insurance industry, imperfect information and the associated costs are largely due to the costs consumers face in acquiring information about the alternative products offered by competing firms. Rather than searching for the most attractive policy and service record, insurance buyers often find it less costly to rely on word-of-mouth reputation (Berger, 1988). This lack of information and interest on the part of consumers may frustrate competitors' attempts to communicate price and quality information, thereby constituting a potential deterrent to entry for new firms and providing a source of excess profits for established firms. This can create imperfect competition in insurance markets (Federal Trade Commission, 1979). An additional factor that can discourage entry and perpetuate profitable niches is the expected reaction of existing agents to competitors' attempts to penetrate a given market (Eaton and Lipsey, 1978). It is conceivable that the more informationally inefficient the market, the stronger

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areas with more consumer demand as well as with lower costs."

[8]The MSA was chosen because it is defined as the central city and suburbs that are associated through commuting to work. Thus, the MSA represents a market area in which commuting provides access between insurance agents and clients (see discussion on cost-efficient locations).

the resistance to competitive forces. Under this scenario, although there may be a tendency towards equalization, it is not apparent that the distribution of agencies will equalize profits.

To identify the characteristics of profitable locations for insurance agencies, the location analysis literature is followed to focus on the attributes relating to environment, organizational structure and management preferences. A useful concept is that firms must "satisfice" by finding locations where marginal revenue is at least equal to marginal cost (Smith, 1979). Once that has been accomplished, the location decision may be influenced by preferences and other social factors. Webber (1984) argues that satisficing is the same as maximizing when firms receive costly information, and make location decisions, in a sequential fashion. In general, satisficing behavior allows long-run equilibrium profits to be unequal across locations. Schmenner, Huber, and Cook (1987) have skillfully turned the satisficing hypothesis into empirically testable propositions. They hypothesize that economic factors interact with organizational characteristics and management attitudes. Schmenner, Huber, and Cook found that the use of objective and subjective moderator terms significantly improved the predictive ability of the economic factors.

The data base employed here allows economic, organizational, and environmental factors to be taken into account. Economic variables likely to affect the profitability of agency operation are examined across locations. The organizational structure of insurance field offices is relatively simple, consisting primarily of sales agents, one or two managers, a few office workers and some office equipment. Therefore, some of the organizational characteristics considered in the industrial location literature may not be critical in insurance agency location. In this article, organizational complexity is indicated by the number of employees and amount of production as measured by total premiums.

Are insurance agents sensitive to environmental characteristics in their choice of a location? If agents are influenced by the same metropolitan characteristics as other migrants, certain types of locations may attract more agents. Metropolitan areas that attract migrants should provide growing markets for insurance, providing more business opportunities for the agents. Two general approaches are found in the literature to test environmental influences on location selection. Schmenner, Huber, and Cook gathered data on management attitudes towards environmental attributes through a survey and found that this information improved the power of their model. In the absence of such primary information, the alternative approach is to use data on the environmental attributes of the area. For example, Herzog and Schlottmann (1986) use data on the quality of life indicators published in the *Rand McNally Places Rated Almanac* (Boyer and Savageau, 1981) to analyze migration of households. Their model relies on the notion that people "vote with their feet" and choose a high quality metropolitan area when they relocate. Herzog and Schlottmann report that the Places Rated Almanac variables have significant explanatory power in relocation decisions. This study's approach is similar to Herzog and Schlottman's in that this study uses the classification scheme developed by Noyelle and Stanback (1983) to examine the effect of city type on the operation of agencies.

Demand for Agency Services

Analysis of the demand for insurance services begins with market size measures suggested by Church and Stimson (1983), and Craig, Ghosh, and McLafferty (1984). These include population, population density, and income. Goldsmith (1983) argues that the demand for insurance is monotonic with income. The demand for insurance at a given agency is also a function of the amount of competition in the area. This follows directly from Central Place Theory: that the sizes of trade areas are reduced as more competitors enter the market.[9] Competition also has an indirect impact on production costs and productivity. An implication of the models of monopolistic competition—the most relevant for spatially distributed insurance agencies (Clapp, 1985)—is that increased competition reduces demand per agent. Thus agencies are forced to spread fixed costs over a smaller demand (lower volume). Consequently, unit costs are increased and profitability reduced by a larger number of agents per unit of demand.

Finally, it is postulated that MSA type, as determined by Noyelle and Stanback (1983) is an important element in the decision model. Noyelle and Stanback hypothesize that the "diversified advanced service centers" attract business services such as accounting, advertising, law, finance, and insurance. Thus, it is reasonable to expect higher demand for insurance in these MSAs than in "specialized advanced service centers," consumer-oriented centers or production centers.[10]

Cost-Efficient Locations

There are several important differences between the location decisions of insurance agencies and typical retail firms. In the insurance business, the majority of sales are by field agents, not through the mail or telephone (Clapp, 1985) and the average sales are relatively large. As a result, the micro location decision for a life insurance agency will be governed primarily by the characteristics of the city rather than neighborhood characteristics, such as traffic counts that are critical in retail location decisions. All that is required of an agent is the ability to reach a group of clients within a reasonable commuting time.

Transportation costs are therefore important expenses for insurance agents. Clapp (1983) observes that transportation costs are relevant in two ways:

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[9] For a simple analysis of central place (CP) theory and its implications for size of the firm's market area in a competitive market, see Heilburn (1987, pp. 81–87). In the CP model, the reactions of existing firms to new entrants can create pure profits in long run equilibrium (Eaton and Lipsey, 1976, 1978).

[10] Few consumer-oriented centers are included in this data base, so this group was eliminated from further consideration.

face-to-face contacts between sales agents and prospective or existing clients; and commuting to work for managers and staff. This study deals with transportation costs by using the MSA as a unit of analysis. Accordingly, the population of the MSA represents the prospective clientele.

Turning to other production costs, the wages of clerical and managerial workers are important factor costs. In addition, diversified advanced service centers may provide larger pools of skilled managerial and salesagent labor. A more competitive labor market may imply higher labor efficiency and lower wage rates. Therefore, it may be argued that city type may affect the profitability of agencies.

Sales agents are paid by commission, the rate of which is closely regulated for firms in this sample since all the firms do business in New York and therefore pay commissions at New York rates.[11] Nonlabor costs at agencies include taxes and rent, with rent accounting for a larger share of agency expenses. State and local taxes are also included in the analysis.

Demographic characteristics are often important determinants of operating costs. Population density is negatively related to land availability and positively related to congestion and transportation costs (Wheaton, 1986, and Carlino, 1978). Similarly, costs such as wages and rents are positively associated with population size, although these may be partially offset by reduced taxes per unit of public service (urbanization economies) and lower labor turnover costs (localization economies).[12]

The Model and Estimation Technique

This section uses the theory discussed above to develop a testable model of the profitability of insurance field offices. The objective of the analysis is to identify the MSA characteristics that are conducive to profitability. Throughout this article, profitability is measured by the level of production (P) per dollar cost (C), where P is the total first year commission from all lines of insurance and C is total expenses for a given level of activity.[13] Industry professionals report that agency managers are interested in maximizing commission dollars because revenues to the agency are often highly correlated with commissions. Since revenues attributed to the agency and total expenses

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[11] See Weisbart (1975) for a discussion of the effect of New York State regulation on the distribution of life insurance.

[12] Carlino (1978) discusses the effect of population size on wages and land values and presents empirical evidence of the wage effect. A summary of urbanization and localization effect is contained in Smith (1981).

[13] The terms "production" and "cost" are used in the sense generally found in the insurance industry. There is no attempt to examine production or indirect cost functions. Ordinary life and health insurance sold to individuals and franchise group products are included in the P variable. Large group policies are not included in these data.

are not available in an appropriate format, profits are not directly measured. Instead, production per unit cost is used as a proxy for profitability.[14]

If a model in which insurance markets are spatially efficient (i.e., an alternative to the literature discussed in the literature review) is considered, then spatial competition may equilibrate profits across MSA's. To elaborate the efficient markets hypothesis, an MSA with high revenue potential per agent will attract new field offices. This will lower revenue for existing agents, bid up the costs of production and eliminate abnormal profits. Thus, the search for locational factors that increase profits is a test of market efficiency in spatially separated markets. If markets are efficient (and the model of satisficing and information barriers is incorrect) then significant coefficients on locational variables will not be found. In essence, predicting the direction of relationships between profits and location is contingent on the nature of competition in the market.

The Estimating Equations

Three equations: production, which measures output in terms of commissions per agent (not to be confused with a production function); cost, which measures total expenses of the agency (not to be confused with an optimized cost function); and profitability are estimated. Identification of the significant factors in the production and cost equations will facilitate interpretation of the profitability equation. Both OLS and seemingly unrelated (SUR) estimates were obtained but only the OLS estimates are reported (see discussion below).

Production Equation: Production (P/A) is measured in terms of dollar amount of first-year commissions per agent. A model of total output (if the dependent variable were P) may fit well simply because of scale effects. Scaling the dependent variable removes this effect allowing measurement of the nonscale effects in isolation. Discussions with professional agents and managers indicate that field offices attempt to maximize commissions. This goal is reasonable when one considers that field offices are only concerned with the production of policies that meet prospective standards. The risk associated with claim payment is borne by the insurer, not the agency.

Similar to other financial service firms, insurers have lower unit costs when dealing with large transactions (Crane, Kimball, and Gregory, 1983; and Fields and Murphy, 1989). Consequently, a measure of average policy size is used as an independent variable to control for differences in scale across agencies. To measure output one must also consider the number of policies written by an agency. Both variables are expected to be positively related to production per agent. When relevant spatial market characteristics are added, the estimating equation for the level of activity at field offices can be specified as:

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[14]More complete definitions of production and cost are found in Appendix 1. The maximization of the P/C ratio is not the same as maximization of profits but factors that contribute positively to P/C will generally be positively related to profits.

$$P/A = f(\text{NUM}^+, \text{PREDEN}^+, \text{ASUP}, \text{AGENMKT}^-, \text{POPDEN}^+, \text{POP}^+, \text{GROWTH}^+, \text{MSATYPE}) \quad (1)$$

where,

P/A	=	Dollars of production per agent measured by commissions from all lines of insurance at each agency;
NUM	=	Number of new life insurance policies written during the year by agency i;
PREDEN	=	Average premium per new life insurance policy at each agency;
ASUP	=	Total premiums in the MSA per household divided by median household income;
AGENMKT	=	Number of agents in the market area (MSA) divided by market aggregate income;
POP	=	Total population in the MSA;
POPDEN	=	Population per square mile;
GROWTH	=	Growth in total production, 1970–1980;
MSATYPE	=	MSA classification from Novelle and Stanback (1983) entered as dummy variables (See Appendix 1).[15]

The hypothesized relationships between the explanatory variables and production are represented by the superscripts. Predicted relationships follow directly from the above discussion of theory. Missing superscripts indicate that the relationships are not predicted from theory. PREDEN and NUM represent ordinary life insurance data because, for the typical agency in the sample, this accounts for almost 90 percent of commissions.

It may be argued that the typical agency will have higher activity levels in MSA's with larger market potential as measured by higher premium per dollar of income (ASUP). Alternatively, ASUP may indicate the level of saturation in the demand for insurance, which would imply a negative relationship between ASUP and production. Since theory has ambiguous implications for the sign of the relationship, a superscript is omitted on ASUP in equation 1.

Competition for the market, measured by AGENMKT, should be negatively related to production. Total market size and density (POP and POPDEN) should be positively related to production. The variables GROWTH and MSATYPE capture the qualitative characteristics and environmental influences of the location. It is predicted that larger growth and classification as diversified advanced service centers should have a positive contribution to the production of insurance services.

Cost Equation: The cost of producing insurance services is also measured on a per agent basis, and as a function of agency specific variables and MSA characteristics, may be represented as:

[15] The models are estimated separately for each MSA type because the dummy variable on city type is mutually exclusive and the incidence of D1 and D2 cities dominates that of non D1, D2 cities. Thus a model that tests the two effects jointly would suffer from collinearity.

$$\text{C/A} = f(\text{NUM}^+, \text{PREDEN}^+, \text{EMP}^+, \text{AGENMKT}^+, \text{POP}, \text{POPDEN}, \text{WAGE}^+, \text{RENT}^+, \text{TAXRATE}^+, \text{MSATYPE}) \quad (2)$$

where,

C/A = Total expenses per agent at each agency. It includes wages paid (exclusive of commissions), travel, telephone expenses, utilities, and other expenses;
EMP = Number of clerical employees;
WAGE = Median wage for clerical workers in the MSA;
RENT = Rent per square foot of office space;
TAXRATE = A measure of tax effort (i.e., tax collection divided by the tax base).

The level of output, as measured by the number and size of policies and the number of employees at an agency should be positively related to costs. Location theory suggests a positive sign for AGENMKT as competition raises costs, because competitors bid for scarce resources. POP and POPDEN are difficult to predict as large cities can have higher costs because of congestion and other diseconomies, but increased costs may be offset by the cost savings associated with a larger number of potential customers within a given radius. Finally, the factor cost variables (WAGE, RENT, TAXRATE) should be positively related to the costs of production.

Profitability Equation: The third model examines the relationship between the *ex post* profits of field offices and the characteristics of the agency and its location. Profitability, EFF (for effectiveness), is measured as total output divided by total expenses (P/C). The relationship between profitability and agency/locational characteristics is represented as:

$$\text{EFF} = f(\text{NUM}, \text{PREDEN}, \text{EMP}^-, \text{POPDEN}, \text{WAGE}^-, \text{TAXRATE}^-, \text{RENT}^-, \text{AGENMKT}^-, \text{GROWTH}^+, \text{MSATYPE}, \text{POP}^-) \quad (3)$$

As already noted, the extant theory does not predict the signs of a number of variables because cost and revenue effects tend to work in opposite directions. For the factor prices it is hypothesized that the signs should be negative. If other locational factors are held constant, increased factor prices should decrease the ratio of production to costs. Signs on EMP, AGENMKT and GROWTH are predicted in a straightforward manner from their signs in the production and cost equations.

Moderated Equations: Two other forms of each of the three basic models are tested to examine the impact of environmental attributes on cost, production and profitability. The literature on location decisions of industrial facilities suggests that management decisions are influenced by environmental factors. MSATYPE is used as a proxy for environmental characteristics. In the basic models—equations (1), (2) and (3)—MSATYPE enters as dummy variables. However, as reported by Schmenner, Huber, and Cook, environmental characteristics can significantly influence the importance of traditional factors in the model. In order to examine the effect of interactions between MSA type and the key agency and locational variables, separate dummy variables were introduced for each MSA.[16] Following the procedure in Schmenner, Huber, and Cook, cross-product moderator terms are used to measure how environmental factors interact with the traditional determinants of locational decisions. The signs and significance of these cross-product terms test the hypothesis that environmental factors exert a general influence on other aspects of the location decision. This allows examination of the effect of MSA type within the context of a more traditional locational analysis.

Estimating Form: In order to estimate equations 1 to 3, an Ordinary Least Squares (OLS) procedure was employed.[17] Of the forms examined, the double log form (i.e., both dependent and independent variables expressed in logs) was superior in terms of the behavior of the residuals as there is some indication of heteroskedasticity in the linear forms of the model. The residuals from the transformed models are examined for heteroskedasticity via the Breusch-Pagan test (1979). This test (see Appendix 2) indicates no residual heteroskedasticity at the 5 percent level of significance.

Data Sources

Several sources of data including 1980 Census of Population and Housing, and the "1980 Agency Expense and Performance Study" conducted by LIMRA were used in this analysis.[18] Most of the variables concerning locational characteristics are taken from the Census data while the agency specific variables are supplied by LIMRA. The demographic data relates to the MSA in which the field office is located. The description and sources of the variables are presented in Appendix 1.

The data needed for the three models were available for 129, 126, and 126 agencies, respectively.[19] Table 1 provides a summary of sample of sample statistics for the data set. The range of values on the variables reveals that

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[16] The classification scheme developed by Noyelle and Stanback (1983) is based more on the functional characteristics of the cities than their size. All three groups include large, medium sized and relatively smaller cities. For example, the D1 group of cities includes New York, Chicago, Columbus, OH, and Little Rock, AK. D2 cities include Detroit, Washington, D.C., Columbia, S.C. and Kalamazoo, MI. Buffalo, San Diego, Grand Rapids, MI, Tampa and Fort Lauderdale are among the third group of cities.

[17] Appendix 3 makes the case for SUR estimation for equations 1 and 2 and argues that equation 3 should not be included in the SUR system. When OLS was compared to SUR estimates for equations 1 and 2, no differences were found in signs or in significance at the 5 percent level. The SUR estimates do not appear to dominate the OLS estimates in terms of standard error for this sample.

[18] The use of 1980 data limits the results for making future location decisions. No data on variable and universal life insurance or on the use of brokers were available; these activities have grown since 1980.

[19] The data points represent 72 different MSA's from 36 states. The states with no data appear to follow no specific geographic pattern. So that all areas of the country are represented. The state with the highest number of agencies in the sample is California (22). Ten states each have one agency. The states that are not included in the sample are AL, DE, ID, KY, ME, NH, NM, ND, RI, SC, SD, VT, WV AND WY.

managerial agencies of a wide spectrum of sizes are represented in the data set. The locational variables also show a wide range in values for the variables examined. One limitation of the data is that the smallest MSAs are not well represented in the sample. This may be due to more complete data for larger locations or the tendency of managerial agencies to locate in larger towns.

Table 1

Descriptive Statistics

Variable	N	MEAN	MAXIMUM	MINIMUM	STANDARD DEVIATION
P	133	169,346	1,198,058	716	179,706
C	133	168,020	1,419,435	18,156	193,146
EFF	133	1.095	3.908	.039	.535
AGENTS	133	10.37	42.0	1.0	7.28
NUM	133	517.86	1,638	14.0	380.52
PREDEN	133	521.85	2,303	134.3	440.47
ASUP*	131	.808	4.630	.014	.461
AGENMKT*	131	.005	019	.002	.002
POPDEN	131	871.66	12,108	49.58	1,351
GROWTH	131	1.195	2.193	.851	.263
D1	133	.639	1.0	0	.482
D2	133	.240	1.0	0	.429
EMP	133	3.99	29.5	0	.326
TAXRATE	129	287.82	664.0	84.0	114.84
RENT	133	255.15	351.0	196.0	26.99
WAGE	133	255.15	351.0	196.0	26.99
POP	131	2,198,876	9,120,346	307,863	2,089,672

*Indicates that the values have been multiplied by 1 million.

Discussion of Results

The regression parameters of the production, cost and profitability equations [equations (1), (2), and (3)] are presented in Tables 2, 3, and 4. In each table the first regression constitutes a test of the basic hypothesis implied by least cost location theory, spatial competition and central place theory. The other regressions include cross-product terms to test for interaction effects between MSA type and the demographic characteristics of the agency. Parsimony dictates that only variables that are significant in the basic equations are considered for inclusion as cross-product terms.

Production Equation: The results for the production equations are contained in Table 2. Consistent with the hypotheses the number and size of life insurance policies are significant determinants of the commissions generated by the average agent. This suggests that the field offices which have a bigger share of the market for larger policies are more productive than other agencies. Since PREDEN is specific to each field office, a potential implication of the result is that it serves as a measure of market niches within a metropolitan area. Population size has a positive sign but is not significant. Population growth enters the equation with the hypothesized sign and is significant at the 1 percent level. The coefficient for the number of insurance agents per unit of demand, AGENMKT, is positive and significant, which is inconsistent with the notion that competition reduces demand for each agent. It may be observed that in cross sectional analysis it is often difficult to capture supply effects. In a longitudinal study such effects may be captured if supply and demand have a tendency to reach equilibrium. In the context of the present model, one can argue that competition among additional agents is overwhelmed by the favorable market factors that influence production. The result is also consistent with the argument that in order to survive in a highly competitive market, agents have to sell more policies. Finally, ASUP is positive, but not significant.

The environmental proxies (D1 and D2) are not significant in the basic equation although they have the expected signs. However, the equations with cross-product terms reveal some interesting patterns. The D1*NUM variable is positive and significantly associated with production. Apparently, agencies producing large numbers of policies are more productive in diversified advanced service centers. The D1*PREDEN variable has a positive sign and is significant at the 10 percent level indicating that the market niche in terms of size of policy is also related to the D1 location classification. The D2*NUM variable has a negative sign and is significant at the 5 percent level in the third regression in Table 2. This suggests that salespeople in large agencies are less productive in specialized advanced service centers.

Cost Equation: Table 3 contains estimates for the basic cost equation (equation 2) and its extensions. Most of the variance in expenses per agent appears to be explained by agency characteristics or the cross-product of city type and agency variables. Table 3 shows that the basic model provides a good fit but that only one locational variable appears to have a significant effect on expenses per agent. The variables NUM and PREDEN have positive coefficients as predicted. Clerical employment (EMP) is positively related to per agent costs. The results relating to factor costs are mixed. TAXRATE is not significant, a result which is consistent with some of the evidence from industrial location literature.[20] RENT has a positive and significant sign, not an unexpected result. WAGE has a negative sign in the cost equation, which is inconsistent with our expectations, but is not significant. Stiglitz (1987) argues that the traditional use of wage rates as a factor price may be inappropriate as

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[20]The evidence on the impact of tax differentials on location decisions is mixed. For references on this issue, see Schmenner, Huber, and Cook (1987). In their own analysis of location decisions of manufacturing facilities, Schmenner, Huber, and Cook (1987) find that excepting for the most independent plants, the effect of tax rates on plant location choice is "notably weak." The present findings also support Wasylenko's (1985) observation that firms in industries other than manufacturing and wholesale trade may follow consumer markets and place less emphasis on fiscal considerations like tax rates. In contrast, manufacturing and wholesale trade firms are more concerned with cost.

Table 2
Production Equation

Variable	Basic Model Estimates (t-stat)	D1 Crossproduct Estimates (t-stat)	D2 Crossproduct Estimates (t-stat)
INT	3.495	3.313	2.797
	(1.717)*	(0.880)	(1.081)
NUM	0.621	0.413	0.690
	(13.213)***	(5.037)***	(12.321)***
PREDEN	0.743	0.588	0.764
	(16.511)***	(6.682)***	(15.592)***
ASUP	0.026	0.017	0.018
	(0.788)	(0.515)	(0.545)
AGENMKT	0.254	0.252	0.241
	(2.466)**	(2.230)**	(1.734)*
POPDEN	0.009	0.055	0.049
	(0.209)	(1.222)	(1.021)
GROWTH	0.479	0.798	0.527
	(3.131)***	(2.333)**	(3.213)***
POP	0.074	0.011	0.026
	(1.104)	(0.153)	(0.361)
D1	0.008	-1.096	0.017
	(0.090)	(-0.223)	(0.187)
D2	-0.093	-0.056	1.440
	(-0.969)	(-0.496)	(0.290)
D1*NUM		0.308	
		(3.050)***	
D1*PREDEN		0.196	
		(1.922)*	
D1*AGENMKT		-0.054	
		(-0.307)	
D1*GROWTH		-0.314	
		(-0.865)	
D2*NUM			-0.241
			(-2.171)**
D2*PREDEN			-0.124
			(-0.992)
D2*AGENMKT			0.031
			(0.181)
D2*GROWTH			0.101
			(0.250)
Adjusted R^2	0.738	0.753	0.742
F-value	41.350	31.260	31.950
Prob > F	0.001	0.001	0.001
N	129	129	129

NOTE: Coefficients are significant at the * = .1, ** = .05, *** = .01 levels.

Table 3

Cost Equation

Variable	Basic Model Estimates (t-stat)	D1 Crossproduct Estimates (t-stat)	D2 Crossproduct Estimates (t-stat)
INT	6.769 (3.099)***	8.644 (3.212)***	7.328 (3.171)***
NUM	0.101 (1.906)*	–0.086 (–1.024)	0.155 (2.541)**
PREDEN	0.241 (4.382)***	0.207 (2.179)**	0.206 (3.552)***
EMP	0.678 (14.739)***	0.506 (7.785)	0.766 (15.020)***
AGENMKT	0.058 (0.500)	0.105 (0.921)	0.132 (1.189)
POPDEN	–0.037 (–0.822)	0.018 (0.391)	0.016 (0.356)
WAGE	–0.200 (–0.840)	–0.248 (–1.093)	–0.209 (–0.937)
RENT	0.518 (1.624)*	0.567 (1.350)	0.759 (2.219)**
TAXRATE	0.001 (0.013)	0.010 (0.139)	0.018 (0.250)
POP	0.036 (0.563)	–0.021 (–0.318)	–0.017 (–0.270)
D1	0.039 (0.386)	-2.023 (–0.596)	0.041 (0.427)
D2	–0.004 (–0.036)	–0.077 (–0.720)	–0.118 (–0.032)
D1*NUM		0.255 (2.339)**	
D1*PREDEN		–0.002 (–0.017)	
D1*EMP		0.252 (2.965)***	
D1*RENT		0.248 (0.432)	
D2*NUM			–0.188 (-1.664)*
D2*PREDEN			0.094 (0.681)
D2*EMP			–0.331 (-3.719)***
D2*RENT			–0.030 (–0.048)
Adjusted R^2	0.796	0.820	0.825
F-value	45.290	39.030	40.261
Prob > F	0.001	0.001	0.001
N	126	126	126

NOTE: Coefficients are significant at the * = .1, ** = .05, *** = .01 levels.

wage differences may reflect differences in productivity. The differences in productivity across MSAs have been attributed to: educational quality and nutritional effects (Stiglitz, 1987), technology (Carlino, 1978; and Beeson, 1987), and unionization (Schmenner, Huber, and Cook, 1987). Thus, the negative coefficient on the wage variable may be attributed to higher productivity of the labor force in high wage areas.

Moving to the second column in Table 3, there are no significant locational terms. RENT remains positive and has a t-value greater than one, but is not significant at the conventional levels. The D1*NUM cross product is positive and significant indicating that the cost of generating a large number of policies is higher in D1 locations. The D1*EMP cross product term is positive and significant. Therefore, it is more expensive to hire a large number of clerical employees in D1 cities. In the third regression the variables NUM, PREDEN, EMP and RENT are all positive and significant at the 5 percent level. The D2*NUM variable is negative and significant indicating that large output is less related to cost in D2 locations than in other cities. The D2*EMP variable is negative and significant indicating that expenses associated with large clerical staff are lower in cities with D2 classifications.

Profitability Equation: Table 4 contains estimates for the profitability equation (equation 3). The positive and significant coefficients for NUM and PREDEN imply that larger output is cost justified. EMP is negative and significant, when interpreted in conjunction with NUM and PREDEN it appears that a larger clerical force adds to expenses and reduces profitability after holding constant for output.

Turning to the metropolitan area characteristics, RENT is negative and significant, the interpretation being similar to that for EMP. WAGE is positive and significant at the 5 percent level. This confirms the earlier conjecture that the negative sign associated with WAGE in the cost equation reflects the higher productive efficiency of the high wage labor force. POP has a negative sign and is significant at the 1 percent level. Thus, the diseconomies of population size appear to overwhelm the economies associated with operating in large cities. The positive and significant sign associated with GROWTH indicates that opportunities for insurance agencies are in the growing cities, not necessarily in the large ones. AGENMKT is negative and significant. It may be recalled that this variable was negative but not significant in the cost equation but significantly positive in the production equation, contrary to theory. However, as predicted by theory, competition has a discernibly negative impact on the proxy for profitability.[21]

The scale of profitable agency operations is influenced by the type of city. The cross-product terms suggest that insurance field offices are more profitable in D1 cities as NUM increases, but less profitable as EMP increases.

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[21] An anonymous referee suggests that the negative coefficient for AGENMKT may be explained by twisting. One way for agents to compete in a saturated market is to convince policyholders to cash in an existing policy and purchase a new policy. Unfortunately data on renewal rates are not available for this sample.

Table 4
Profitability Equation

Variable	Basic Model Estimates (t-stat)	D1 Crossproduct Estimates (t-stat)	D2 Crossproduct Estimates (t-stat)
INT	0.999 (0.478)	2.708 (0.772)	3.459 (1.699)*
NUM	0.466 (11.366)***	0.324 (4.696)***	0.541 (11.271)***
PREDEN	0.407 (7.140)***	0.231 (2.159)**	0.470 (7.705)***
EMP	-0.508 (-12.095)***	-0.299 (-4.746)***	-0.599 (-12.224)***
POPDEN	0.050 (1.111)	-0.055 (-1.196)	0.048 (1.000)
WAGE	0.463 (2.292)**	0.356 (1.092)	0.424 (1.797)*
TAXRATE	0.020 (0.308)	-0.016 (-0.258)	0.007 (0.106)
RENT	-1.283 (-4.022)***	-0.634 (-1.375)	-1.517 (-4.334)***
AGENMKT	-0.234 (-2.321)**	-.172 (-1.50)	-.234 (-1.44)
POP	-0.318 (-1.767)*	-0.376 (-1.749)*	-0.267 (-0.940)
GROWTH	0.446 (2.655)***	0.194 (0.522)	0.479 (2.886)***
D1	-0.101 (-1.110)	-0.574 (-0.118)	-0.123 (1.281)
D2	-0.152 (-1.535)	-0.126 (-1.125)	-0.777 (0.144)
D1*NUM		0.256 (3.012)***	
D1*PREDEN		0.323 (2.584)**	
D1*EMP		-0.369 (-4.500)***	
D1*WAGE		0.110 (0.273)	
D1*RENT		-1.466 (-2.395)**	
D1*AGENMKT		-0.103 (-0.440)	
D1*POP		0.100 (0.242)	
D1*GROWTH		0.406 (1.074)	
D2*NUM			-0.235 (-2.304)**
D2*PREDEN			-0.195 (-1.189)
D2*EMP			-0.304 (3.040)***
D2*WAGE			0.044 (0.086)
D2*RENT			0.766 (0.945)
D2*AGENMKT			0.088 (0.425)
D2*POP			-0.109 (-0.290)
D2*GROWTH			-0.092 (-0.197)
Adjusted R^2	0.685	0.738	0.711
F-value	23.770	18.760	18.643
Prob > F	0.001	0.001	0.001
N	126	126	126

NOTE: Coefficients are significant at the * = .1, ** = .05, *** = .01 levels.

Profitability increases more rapidly with PREDEN in D1 cities than in other locations, suggesting that diversified advanced service centers are more sensitive to the need to produce a large number of high premium policies with minimal clerical input. The results for specialized advance service centers (D2) are in contrast with those for diversified advance service centers (D1). In D2 cities, the cross-product terms indicate that producing a larger number of policies does not increase profitability as strongly as in other cities. Larger clerical employment reduces profitability at a slower rate in D2 cities: there is a positive sign on the EMP*D2 cross-product but the sum of this coefficient with the one on EMP is negative. This indicates that smaller, more labor intensive agencies are relatively profitable in D2 cities. Agencies in D1 cities might improve profitability by limiting clerical employment. Agencies in D2 cities would generally find it advantageous to offer a more labor-intensive product.

Conclusions

This analysis shows a great deal of systematic variation across metropolitan areas in the output, expenses, and profitability of life insurance agencies. Agency specific characteristics, especially the number and size of policies, are positively related to profitability. This confirms the assertions of Crane, Kimball and Gregory (1983) and Fields and Murphy (1989) concerning account size and scale effects. The size of the clerical staff (EMP) result supports the notion that lower overhead significantly contributes to profitability across locations. Profitability is positively related to metropolitan area growth and negatively related to population size. The city classifications suggested in Noyelle and Stanback (1983) have a substantial effect on profitability. Agencies in niches that produce a large number of policies per clerical employee do particularly well in cities classified as diversified advanced service centers. Agencies writing fewer policies per clerical employee (i.e. providing higher levels of service to the typical policyholder) are more profitable in specialized advanced service centers. These findings suggest that profitable market niches can be found, and that factor inputs must be adjusted to suit the niche.

These results indicate that barriers to entry in the insurance market may be more substantial than one would expect from an industry with relatively low capital requirements. If entry were free, profits would be equalized across metropolitan areas; but, several area characteristics are significantly related to the proxy for profitability. This finding may be explained by incomplete information (information barriers) with respect to demand, growth of demand and/or competition for insurance services across metropolitan areas. These findings suggest that a systematic analysis of spatial information can identify profitable locations. Since the cost of analysis is relatively low, it would appear worthwhile for financial service firms to invest in a systematic analysis of locational and demographic factors.

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Appendix 1

Metropolitan-Area Variables

AGENMKT - This is a measure of competition within markets. It is the ratio of licensed ordinary life insurance agents in the area to aggregate income (The product of household income and number of households). Aggregate income is used as a proxy for the size of the market. The aggregate income is obtained from the Census tape and data on competitive agents is from the LIMRA report *Handbook of Ordinary Life Insurance Data-Annualized Premiums. Number of policies and Volume Produced by Ordinary Agencies in the United States and Canada.*

ASUP - It is a measure of saturation of insurance demand. This is constructed as the ratio of premium for all lines of life and health insurance (including franchise group) per household divided by income per household. The premium data are collected from the *Handbook of Ordinary Life Insurance Data*, the household incomes are collected from the Census.

Commissions - Total first-year commissions from all lines of insurance for each agency in the sample.

C (costs) - This includes all noncommission expenses incurred including travel, telephone, rental expenses, etc., for each agency in the sample.

Dummy Variables D1, D2 Stanback - This classification scheme was developed by Noyelle and (1983). D1 has a value of 1 if the MSA is a "Diversified Advanced Service Center" and 0 otherwise; D2 has a value of 1 if the MSA is a "Specialized Advanced Service Center" and 0 otherwise. Both D1 and D2 are set to zero if the MSA is not classified as either of the above.

EMP - The total number of support employees in each agency as reported by LIMRA.

GROWTH - The rate of growth of the MSA population from 1970 to 1980. The population figures were obtained from the 1970 and 1980 Census.

INCOME - Data from the 1980 Census tape were collected on the median household income by MSA.

NUM - The total number of policies written by each agency.

POPDEN - The population density within the MSA. Population is taken from the Census, the area within the MSA is obtained from the State and Metropolitan Area Data Book.

POP80 - The population of the MSA in 1980 as reported by the Census.

PREDEN - This is the average premium collected per life insurance policy. The number of policies and total premium for each agency was supplied by LIMRA.

RENT	- Median rental expenses for housing by MSA is used to represent rental costs, these were collected from the Census.
TAXRATE	- This represents a statewide index of tax effort as computed by the Advisory Commission on Intergovernmental Relations (1986). The tax effort for a state is created by dividing the state's actual tax collections by its estimated tax capacity and multiplying by 100. The resulting number is interpreted as a measure of how much the state chooses to exploit all its potential tax bases relative to other states. The analysis uses the tax efforts base for various states for 1979.
WAGES	- The average hourly earnings of production workers on manufacturing payrolls were obtained for each state from the Employment and Earnings document of the Bureau of Labor Statistics. The wages for clerical workers may be obtained by using a constant country-wide scaling factor. For these purposes this number is arbitrary.

Source: All variables are from the AEPS study unless otherwise noted.

Appendix 2

The assumption of the ordinary least squares model requires that the E(uu') = I. In cross section this usually requires that the model be examined for nonconstant variances. One of the more flexible tests for heteroskedasticity is the Breusch-Pagan test. In this test the OLS residuals from a model with the form

$$y = X\beta + \mu_i$$

are examined. The u_i are assumed to be normally and independently distributed with a variance of

$$\sigma^2 = h(z'\alpha)$$

where the operator h denotes some unknown form. Alpha is a p*1 vector of coefficients unrelated to B and z' is a p*1 vector of variables thought to influence heteroskedasticity. The first element in z' is taken to be unity. Thus the null hypothesis is

$$H_o = \alpha_2 = \alpha_3 = \alpha_4 = 0$$

The alternative hypothesis, heteroskedasticity, is given by nonzero coefficients. The remaining z values are variables thought to be related to a change in the variance of the residuals. This often includes the explanatory variable in the structured relationship. Standardized residuals are then regressed against the vector of z variables. The test statistic is one half the explained sum of squares from the model. This statistic will be asymptotically X^2 distributed. This procedure was repeated on each of the models specified earlier. No significant heteroskedasticity was found at the five percent level of significance in the double log form of the models.

Appendix 3

The purpose of the Appendix is to provide theory for using seemingly unrelated regressions (SUR) for equations (1) and (2) but not for equation (3). The production equation can be rewritten more compactly as:

$$P/A = \alpha_0 Z^{\alpha_1} Y^{\alpha_2} e^{\epsilon_1} \tag{A1}$$

where X represents **NUM**, **PREDEN**, and other variables common to production and cost equations; and Y represents **ASUP** and **GROWTH**, both omitted from the cost equation.

The cost equation can be rewritten as:

$$C/A = \beta_0 Z^{\beta_1} X^{\beta_2} e^{\epsilon_2} \tag{A2}$$

where X represents **WAGES**, **RENT**, and other variables omitted from the production equation.

The profitability equation is (A1)/(A2):

$$\frac{P}{C} = \frac{\alpha_0}{\beta_0} Z^{\alpha_1-\beta_1} Y^{\alpha_2} X^{-\beta_2} e^{\epsilon_1-\epsilon_2} \tag{A3}$$

Since this is just a transformation of (A1) and (A2), there is clearly a relationship between the random term in (A3) and those in (A1) and (A2).

More generally, the random disturbance terms should be viewed as the sum of many omitted variables (times their coefficients). But, a variable that influences ϵ_1 will undoubtedly influence ϵ_2 in the same way; i.e., production and cost are generally influenced in the same way by the same variables. Z is just a subset of these same variables that were considered important enough to measure and include in the regressions. Therefore, a clear case exists for **SUR** for equations (A1) and (A2).

To see the reasons for omitting (A3) from the **SUR** system, write (A1) and (A2) in logs:

$$\ln P/A = \ln\alpha_0 + \alpha_1 \ln Z + \alpha_2 \ln Y + \epsilon_1$$

$$\ln C/A = \ln\beta_0 + \beta_1 \ln Z + \beta_2 \ln X + \epsilon_2$$

$$Y = \gamma_0 + \begin{array}{cc} \ln Z & 0 \\ 0 & \ln Z \end{array} \gamma_1 + \begin{array}{cc} \ln Y & 0 \\ 0 & \ln X \end{array} \gamma_2 + \begin{array}{c} \epsilon_1 \\ \epsilon_2 \end{array} \tag{A4}$$

$$\text{where } Y = \begin{array}{c} P/A \\ C/A \end{array} \quad \gamma_0 = \begin{array}{c} \ln\alpha_0 \\ \ln\beta_0 \end{array} \quad \gamma_1 = \begin{array}{c} \alpha_1 \\ \beta_1 \end{array} \quad \gamma_2 = \begin{array}{c} \alpha_2 \\ \beta_2 \end{array}$$

Equation (A4) can be estimated by **SUR** (GLS) methods if contemporaneous correlation exists between ϵ_1 and ϵ_2.

Should (A3) be included in the same set of SUR equations? No, because (A3) can be rewritten as:

$$\ln P/C = \mu_0 + U \begin{matrix} \ln Z & 0 \\ 0 & \ln Z \end{matrix} \mu_1 + U \begin{matrix} \ln Y & 0 \\ 0 & \ln X \end{matrix} \mu_2 + U_\epsilon \qquad \text{(A5)}$$

$$\text{where } \mu_1 = \begin{matrix} \alpha_1 \\ -\beta_1 \end{matrix} \qquad \mu_2 = \begin{matrix} \alpha_2 \\ -\beta_2 \end{matrix} \qquad \epsilon = \begin{matrix} \epsilon_1 \\ -\epsilon_2 \end{matrix}$$

$$\text{and } U = (1\ 1)$$

But equation (A5) uses the same set of regressors (multiplied by U) as equation (A4). According to Judge, Griffiths, Hill, Lutkepohl, and Lee (1985, pp. 468–69), one cannot improve efficiency in a similar situation where one equation has variables that are a subset of variables in the other equation. More generally, efficiency gains tend to be higher when explanatory variables in different equations are *not* highly correlated and when the disturbance terms are highly correlated.