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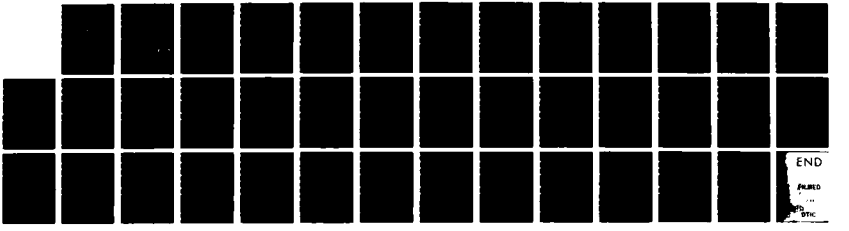

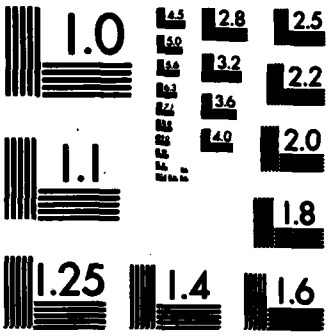

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A study of factors responsible for the variation in failure rates on clinical dental licensing examinations among the states was conducted. A recursive, three-equation path model was used and parameters were estimated via ordinary least squares. The exogenous variables were socio-economic, geographic, and characteristics of state dental practice acts. The endogenous (response) variables were dental income, supply pressure, and a logistic function of the failure rate. The analysis showed statistically significant effects of region and supply pressure on failure rate. Decomposition of the equations of the

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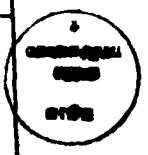
model into direct and indirect effects showed that the amount of sunshine a state received had a strong direct effect on both supply pressure and failure rate, and an indirect effect on failure rate. States with high supply pressure have the most entry barriers for licensure. The results are consistent with previous econometric studies and strongly suggest that organized dentistry in many of the sunbelt states uses licensure as a gate to restrict competition and maintain a favorable economic climate. Public policy impacts of dental licensure practices are discussed.



REGULATION OF THE PROFESSIONS: RESULTS FROM DENTISTRY

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I. INTRODUCTION

Licensure is the major form of regulation of the health professions. It is justified by the states under the rubric of protecting the health, welfare, and safety of the public (Wing, 1976), by ensuring that health care providers meet minimum standards. The perceived threat posed to the public welfare of unregulated professions is that the public would make poor consumption decisions by selecting incompetent practitioners. Some researchers have argued that while risks are inherent in the purchase of any goods or services, the health care market differs from any other markets in that the probability of making a poor decision is high, and its consequences are great (Arrow, 1963). These suboptimal outcomes are attributed to market imperfections, deviations from the assumptions of a competitive market. Imperfections in health care market include variable quality of care, restricted entry into the professions, the consumer's imperfect knowledge of health care, and the interdependence between supply and demand (Rushefsky, 1981).

Researchers have suggested that professional licensure may have impacts besides consumer protection. Holmes (1956) describes the motive of a profession seeking licensure as the improvement of scientific standards, increasing the level of competence, and limiting competition by restricting membership. Other efforts common to occupational and professional licensure include the enhancement of the group's prestige, the control of entry into the profession, and the control of competitive activity (Monaghan, 1961), of which the latter two are of most interest

to economists (Grant, 1942; Key, 1958).

The gravamen of the criticisms made by economists is that through licensure the states have granted the professions monopolistic powers, and the professions have used those powers to maximize their benefits while imposing additional costs on the consuming public. The professions, qua producers, exercise these powers and limit the supply of services by erecting entry barriers. These barriers include the limited number of student positions in training programs, and the cost of training and licensing (Maurizi, 1974).[1,2] The reduced supply of health practitioners results in less competition and higher costs.[3] The additional cost to new entrants produces a monopoly return for existing (licensed) practitioners. These additional costs are shared by consumers in the form of higher prices and potential entrants in the form of barriers to entry (Rottenberg, 1980).

A re-examination of the licensure system and its impact on the dental market is particularly important amid congressional efforts and other actions, at the federal and state level, to encourage competition in the medical and dental sectors. In addition, other competitive innovations such as the dental clinics located at shopping centers, and franchised dental practices, may provoke anticompetitive responses (through the licensure system) which need to be understood.

Surprisingly, concomitant with the rise in interest in competition, is the concern in many states that there will be an "over-supply" of dentists by 1990, or sooner. In response to this concern, some state professional associations, such as the North Carolina State Dental

Society, are actively lobbying to reduce the size of dental school classes.

The purpose of this study is to re-explore the extent to which entry barriers operationalized by failure rates on clinical licensing examinations (an element of the licensure process), have been used in the past by the dental profession to protect its self-interest. The findings are examined for implications regarding responses to new competition initiatives. The dental profession was selected for this analysis because it is a well-established, major profession, and has been the subject of previous research, the results of which can be used to compare with ours.

II. PREVIOUS RESEARCH

Researchers investigating the licensing examination as an entry barrier have focused primarily on its effect on interstate mobility and dental income and not, as in this paper, on the determinants of the failure rate. Using data from the 1949 National Income Division Survey and the 1950 Census, Holen (1965) examined the interstate mobility of physicians and dentists and found that it was 1.7 times lower for dentists than physicians. This difference was due partly to the almost total lack of reciprocity in dentistry and "the exclusionary practices of various state licensing boards . . . ." In addition, Holen found the zero-order correlation between income and pass rate on the state licensing examinations to be .53 (significant) for dentistry and not significant (value unreported) for medicine. The analysis was restricted to 23 states for which data were available. The states

were, for the most part, populous, with heavy concentrations of professional workers. By concentrating on the industrialized states, however, the analysis was insensitive to the behavior of many of the boards of examiners of the sunbelt states; these are the states that one would expect to experience increased supply pressure (excess demand to practice in a given state). Excess demand, hereafter called supply pressure, is measured by the ratio of new applicants to the number of licensed practitioners in the state.

Maurizi (1969) used mean dental income, per cent change in dental income, average annual temperature, failure rate on dental licensing examinations, *per capita* income, and dentist-to-population ratio in a model to explain the interstate mobility of dentists. He found a strong, positive relationship ($r=.71$) between dental income and the difficulty of entry as measured by the failure rate on the licensing examination for 1960.

Maurizi (1974) used supply pressure and dental income to explain variations in the pass rate on licensing examinations. The coefficients on pressure and dental income were of the expected signs and significant at the .01 and .05 levels, respectively, for 1940, and at .01 and .10, respectively, for 1950. The R^2 for 1950 was .51 while the R^2 for 1940 was not reported. A substantial limitation of the analysis resulted from the paucity of data because only 16 states were used in 1940 and 19 were used in 1950; furthermore, the states were not identified. Consequently, the results are difficult to interpret and the power of the statistical test is reduced.

Maurizi (1975) used a regression model with dentists' experience

and education, *per capita* income, dentists per 100,000 population and dentists' self-employment status as independent variables to predict hourly income. He found that dentists in states with high failure rates earned $.70 per hour more than dentists in states with average failure rates.

Boulier (1980) (who updates Holen, 1965) used 1965-1970 census data and found the interstate mobility rate of dentists to be 2.8 times lower than that of physicians a 38 per cent decrease in the 15 years between studies. The substantial variation in mobility rates between dentists and physicians, as found by both Holen (1965) and Boulier (1980), is consistent with the hypothesis that state licensure policies are substantially more restrictive for dentistry than for medicine. In a simulation of the effect of nationwide reciprocal licensure, Boulier found that there would be a "considerable redistribution of dentists" if licensure laws were lifted. In California, for example, the number of dentists would increase 34 per cent, output would increase 42 per cent, while the average price per visit would fall 16 per cent, and mean gross dental income would fall 12 per cent. Both welfare gain and dental income varied widely by state, so that some states showed losses in dental income and welfare losses.

Conrad and Emerson (1981) tested the independent effects of provisions of dental licensing acts presumed to limit competition on fees and dental income. The independent variables included the existence of advertising restrictions, restrictions on task delegation to auxiliaries, restrictions on ownership and organization of dental practices, reciprocal

licensing arrangements, and limits on the number of hygienists a dentist could employ. The authors found statistically significant positive correlations between fees and office limitations (.34), fees and lack of reciprocity (.30), and income and office limitations (.25).

Thus, previous researchers have explored the effects of restrictive licensing practices on fees and interstate mobility. In doing so, they have estimated primarily single-equation regression models that treat the failure rate, the empirical measure of restrictive licensing, as an exogenous variable. The limitation of this type of approach is that failure rate is endogenous to the licensing system. To ignore this, as well as the determinants of the failure rate, leaves unexplored the inter-relationships among fees, income, interstate mobility, and licensure. We try, in this research, to fill the gap by modeling and estimating the joint determination of income, excess demand, and failure rate. The ultimate goal is to better understand variation in failure rates across states. In the only other attempt, Lipscomb (1979) developed a comprehensive econometric model of the dental sector. In doing so, he estimated a simultaneous equation model which included the determination of the pass rate on licensing examinations but he failed to include measures of supply pressure (excess demand).

III. DENTAL LICENSING EXAMINATION

Because it is the cornerstone of our analysis, and a departure from previous research, it is important to digress to an explanation

of the licensing examination. While there exists a centralized examination of academic knowledge administered by the National Board of Dental Examiners, there is no such examination of clinical skill. Over the years, each state has administered its own practical examination. During this examination a candidate performs clinical procedures under the scrutiny of members of a board of examiners. In almost all states, candidates are responsible for bringing their own patients to the examination. The substance of the examination and the standards for grading it were, and continue to be determined by the boards of examiners in each state. In 1969, the Northeast Regional Board of Dental Examiners was established to administer a regional clinical examination, the results of which would be accepted by all member-states as proof of clinical competence.[4] Similarly, the Central Regional Testing Service was established in 1972,[5] the Southeastern Regional Testing Service was established in 1976,[6] and the Western Regional Examination Board was established in 1977.[7] Today, 30 states and the District of Columbia participate in regional examinations while the remaining states continue to administer unique examinations.

IV. ANALYTICAL FRAMEWORK

To test hypotheses about barriers to entry, and highlight important inter-relationships, this analysis explores the relationship among failure rate, an outcome of the licensure process, economic and demographic variables, and characteristics of the licensure examination. As mentioned before, analysts have used failure rate to explain variations in interstate mobility (Holen, 1965; Boulier, 1980), dental income (Holen, 1965; Maurizi, 1969, 1975), and quality of care (Holen

et al., 1979). These analyses assume failure rate to be an exogenous factor. Lipscomb (1979) used dentist-to-population ratio, *per capita* income, and characteristics of the licensing examination to explain variations in failure rate. While the model filled some of the voids left by earlier analyses, it did not explain the complexity of the relationship and did not include supply pressure.

Our model focuses on explaining variations in failure rate among states. We have expanded on the work of Maurizi (1974) and Holen (1965) by developing a multi-equation system and by including more states in the analysis[8] and we have added to the work of Lipscomb (1979) by including supply pressure and per cent possible sunshine in our model. Thus, our model adds to the understanding of how boards of dental examiners respond to additional competitive pressures.

The unit of analysis is the state. The year 1970 was selected for analysis because it was used by Boulier (1980) and was the last year before regional examinations, a potential confounding factor, played a substantial role in the overall examination picture.

A three equation model has been used to analyze the relationship between exogenous variables (PWHCOL, SUN, PCI, DPOP, GOLD, RECIP) and endogenous variables (DDSINC, PRES, FAIL). Since two of the endogenous variables (DDSINC, PRES) were both hypothesized to be both response and explanatory variables, a multi-equation model is appropriate to account for variation in the endogenous variables, taking the exogenous variables as given (Marsden, 1981).

Dependent Variables

Failure rates of dental licensing examinations (FAIL) have been used as dependent and independent variables in analyses of the dental market. Their primary use has been to gauge entry restrictiveness (Holen, 1965; Maurizi, 1969; Boulier, 1980). The failure rate is also one of the most direct means available to organized dentistry to control the entry of political and economic competition (Lipscomb, 1979). The supply pressure (PRES) in a given state is defined as the ratio of examinees to licensed dentists and gauges the "potential" competition for patients that each dentist faces. Median dental income (DDSINC) is a measure of the desirability of a state for a dentist. In a competitive marketplace, dental income should fall as the dentist-to-population ratio rises, *ceteris paribus*.

Independent Variables

Independent variables are of three types. First, there are demographic characteristics of states which might make a state a more or less attractive location for a newly licensed dentist. Included in this group are the percentage of each state's population that is white collar (PWHCOL) and its *per capita* income (PCI). These are taken to be indicators of relative demand for dental services in the state. We hypothesize the greater is PWHCOL, *ceteris paribus*, the greater is dental income. In addition to the direct influences of PWHCOL and DDSINC on FAIL, they are hypothesized to be positively associated with FAIL through their influence on DDSINC.

The second group of independent variables are nondemographic

variables relating to the attractiveness of the state; DPOP, the dentist-to-population ratio, and SUN, the annual average number of hours of sunshine in 1970 divided by the number of daylight hours. DPOP has been chosen to measure the degree of economic competition in the state. SUN, one of the elements of a state's environment, is likely to make a state more attractive, *ceteris paribus*. It is also hypothesized that DPOP is negatively related to PRES and positively related to FAIL. We expect high dentist-to-population ratios to discourage dentists from taking the licensing examination, and to provide the impetus to state examining boards to increase their standards on licensing examinations.

Finally, there are variables reflecting characteristics of each state's licensing examination. RECIP is a binary variable which measures whether a state has reciprocal licensing agreements with other states. RECIP is hypothesized to have a negative impact on supply pressure and failure rate. GOLD is a binary variable which measures whether a state requires a condensed gold restoration on the licensing examination. States which require a gold restoration are introducing an entry barrier by requiring a demonstration of competence in a technique that is difficult, and infrequently performed in clinical practice. GOLD and RECIP were used by Holen *et al.* (1979) as a measure of licensing stringency. GOLD is hypothesized to have a positive relationship with the failure rate and negative relationship with supply pressure.

The dependent and independent variables, their means and sources

of data from which they are taken are shown in Table I. Zero order correlation coefficients for dependent and independent variables are shown in Table II.

V. DATA SOURCES

Failure rate (FAIL) data were obtained from the American Dental Association Division of Educational Measurements. The data were collected by the American Dental Association (ADA) from the state boards. Income (DDSINC) is median net income of all dentists for 1970, taken from the 1971 Survey of Dental Practice conducted by the Bureau of Economic Research and Statistics of the American Dental Association. DDSINC reflects the income of salaried and nonsalaried dentists and may be biased upward or downward depending on the proportion of salaried dentists (who are expected to have lower incomes, on the average) included in the sample. The bias will be downward in states where salaried dentists are a large proportion of the total dentists, as for example in a small state with large military bases.

As previously mentioned, supply pressure (PRES) represents the number of dentists who took the licensing examination in a state in 1970 divided by the number of dentists licensed in that state. These figures were obtained from Distribution of Dentists By Region and State, 1970 published by the American Dental Association Bureau of Economic Research and Statistics and are based on the number of dentists listed in the ADA Directory as of December 1970. Retired dentists and 1970 graduates were included.[9] The number of examinees was obtained from the American Dental Association Division of Educational Measurements.

Per capita income (PCI), per cent white collar (PWHCOL), and SUN for 1970 were obtained from Statistical Abstracts, 1971 and are based on census data. Dentist-to-population ratio (DPOP) was calculated from the number of dentists, 1970, provided by the ADA, and state population estimates given in Statistical Abstracts, 1971.

The presence (1) or absence (0) of reciprocal licensing in 1970 (RECIP) and the presence (1) or absence (0) of a condensed gold restoration on the 1970 examinations (GOLD) were obtained from the American Dental Association Bureau of Economic Research and Statistics which collects this information from the state boards of dental examiners.

VI. ESTIMATION

Given a description of the model and the data, we present equations (1)-(3) which represent the model that is estimated via multi-equation path analysis. The hypothesized signs that were discussed in Section V are shown on top of each independent variable.

$$DDSINC = f(\overset{+}{PWHCOL}, \overset{+}{SUN}, \overset{+}{PCI}) \quad (1)$$

$$PRES = g(\overset{-}{DPOP}, \overset{-}{GOLD}, \overset{-}{RECIP}, \overset{-}{SUN}) \quad (2)$$

$$FAIL = h(\overset{+}{PRES}, \overset{+}{DDSINC}, \overset{+}{DPOP}, \overset{+}{GOLD}, \overset{-}{RECIP}, \overset{+}{SUN}, \overset{-}{PCI}) \quad (3)$$

The advantage of using path analysis, rather than other multi-equation techniques such as two-stage least squares, lies in its ability to illuminate the direct and indirect mechanisms by which the explanatory variables affect the endogenous response variables (Marsden, 1981). It is also very useful in finding the most parsimonious model when the number of observations, in this case fifty, is extremely

limited. In addition, a path diagram is an excellent means of reifying the multi-equation model. While this can be done with other multi-equation techniques with similar results, it is substantially more difficult.

The three-equation model is recursive; it assumes one-way causation and that observed disturbances in the three equations are uncorrelated with each other or with the exogenous variables. In addition, since path analysis is based on multiple regression, all standard statistical assumptions are satisfied.[10] To see that the model is recursive, notice that PRES and DDSINC are both independent variables in the FAIL regression, since it is hypothesized that DDSINC and PRES positively affect the failure rates.

The first step was to estimate the three equations - three endogenous and six exogenous variables - using multiple regression techniques. Ordinary least squares regression was used to estimate the DDSINC and PRES equations. Since FAIL represents a proportion whose values range between 0 and 1, equation (1) was estimated by logit analysis. Using the results of the initial estimations, all paths with structural coefficients less than the absolute value of .1 were trimmed on the grounds that their influence was too small to warrant inclusion in the final model. This was done to minimize the reduction in degrees of freedom. The use of a criterion of trimming based on substantive importance rather than statistical significance is an accepted procedure (Kerlinger and Pedhazur, 1973) and is particularly useful when there is a small sample size and a suspicion of heteroskedasticity. In

addition, this trimming procedure is in line with the goal of explaining variations in the dependent variables using the fewest theoretically meaningful variables. In this case, the variables that were trimmed were not only substantively unimportant but were also statistically insignificant in the original model; their omission did not affect the parameter estimates of interest or the R^2's. In return for omission of the trimmed variables, the ratio of independent variables to observations was reduced, yielding more efficient parameter estimates.

VII. FINDINGS

Trimming all coefficients less than the absolute value of .1 resulted in dropping PCI from all equations as well as dropping the following paths: GOLD to FAIL, RECIP to FAIL, DPOP to PRES. The trimmed model is, therefore, represented by the following equations:

$$DDSINC = f'(PWHCOL, SUN) \quad (4)$$

$$PRES = g'(DDSINC, DPOP, GOLD, RECIP, SUN) \quad (5)$$

$$FAIL = h'(PRES, DDSINC, DPOP, SUN) \quad (6)$$

The direct effects in the trimmed model were determined by the structural coefficients and indirect effects were computed using path tracing rules (Heise, 1975). The estimated parameters can be found in Table III and Appendices A and B. Path diagrams of the trimmed and untrimmed models are shown in Figures 1 and 2, respectively.

Insert Figures 1 and 2 here →

Since the focus of this article is on the failure rate as a measure of restrictiveness in the licensure process, we will concentrate on estimates of equation (6), the failure rate regression. The overall model explains a good proportion of the variance (R^2=.52); dropping

GOLD, RECIP, and DPOP from the FAIL equation resulted in a minimal decline in explanatory power (from an R^2 of .53 in the untrimmed model). Since this equation was estimated using logit, it should be noted that parameter estimates vary with different values of the independent variables, a point to which we will return later.

The regression results support our hypotheses for PRES and SUN. PRES and SUN are positively related to failure rates. The results for PRES suggest that the more examinees there are who are potential competitors to already existing dentists, the more likely the failure rate will be high. Similarly, SUN makes a state more attractive to entering dentists; hence, its positive association with FAIL. DPOP and DDSINC also have positive coefficients indicating partial support for our hypothesis that strong competition and high dental income fuel high failure rates. However, these coefficients are only marginally significant at conventional levels.

Since equation (6) was estimated using logit, the estimated slope coefficients vary with different values of the independent variables. In order to get a "feel" for this variation, predicted failure rates for the mean, minimum and maximum values for each of the independent variables in the FAIL regression, *ceteris paribus*, are presented in Table IV. As can be seen, as supply pressure increases in all 50 states, from the lowest to highest value, predicted failure rates rise from 3.6 per cent to 46 per cent. As the dentist population ratio rises, predicted failure rates increase from 3.5 per cent to 5.2 per cent. Equivalent statistics for DDSINC and SUN are 6.2 per cent to 9.8 per cent and 7.9 per cent to 30.4 per cent, respectively.

VIII. STATISTICAL DECOMPOSITION

Path coefficients can be decomposed into direct and indirect components in order to illuminate the impacts of exogenous variables on endogenous variables. The sum of the path coefficients is the implied slope which can be interpreted as coefficients in a reduced form regression equation. The direct effects represent the standardized slope coefficients[11] from the failure regression which have been discussed in the previous paragraph. The indirect effects are the impacts of the independent variables in the three equation system which result from their influence on the other two (PRES, DDSINC) structural equations. Results of the decomposition are shown in Appendices C, D, and E. A summary of these results can be viewed in Table V. First, these results confirm the previously discussed structural estimates for FAIL that the most important variables explaining failure rate were PRES and SUN. However, unlike PRES - which only affects FAIL directly - SUN influences FAIL directly, as well as indirectly, through its impact on PRES and DDSINC. As previously mentioned, SUN is positively associated with FAIL, indicating support for the hypothesis that boards of examiners in the sunbelt actively try to restrict supply by increasing the failure rate. This behavior may be viewed as a state-level response. The statistically significant association between SUN and PRES indicates a more individual response by potential licensees; namely, the more attractive the state, the more likely they are to sit for the licensing examination, *ceteris paribus*. SUN can also be viewed as a weak proxy for demand in that there has been substantial migration into the sunbelt states over the past two decades. This can explain the positive and

significant relationship between SUN and DDSINC.

DDSINC and DPOP also have indirect effects on the failure rate through supply pressure, in addition to the direct effects previously noted. Using the same analogy for DPOP as with SUN, states can directly affect the failure rate in response to an increase in DPOP - dentist supply. However, the negative indirect effect of DPOP on PRES is also complementary to the effort of states in the sense that new dentists who perceive greater competition for their services (higher DPOP's) will not sit for examinations in those states. The negative impact of DDSINC on PRES is counter-intuitive but not statistically significant. Perhaps potential examinees view states with high dental income as areas with too much competition despite the prediction of economic theory, hence they choose to sit for the examination elsewhere.

Finally, PWHCOL, GOLD, and RECIP have interesting indirect effects on FAIL, although they do not come into the equation directly. While not statistically significant, the impact of PWHCOL on PRES is consistent with the hypothesis that dental incomes are greater where demand is higher. GOLD has a positive, statistically significant influence on FAIL (through PRES). The presence of the requirement to perform a gold restoration as part of a licensing examination appears to effectively deter examinees. Again, this is an impact that complements efforts by states to restrict the in-migration of dentists by increasing failure rates.

The negative coefficient on RECIP in the PRES equation is also consistent with the hypothesis that lack of reciprocity serves as an entry barrier. States that maintain reciprocal licensing agreements

are probably those in which it is least desirable to locate. They also have no reason to strengthen entry barriers by making the licensing examination more difficult to pass; this explains why RECIP does not directly influence FAIL.

The effect of dentist to population ratio on failure rate is the result of a positive direct effect and a negative indirect effect (through supply pressure). Therefore, the following scenario is suggested. A high dentist-to-population ratio tends to discourage potential entrants because of the high likelihood of competition. This lowers supply pressure. Despite the negative relationship, the total effect of DPOP on FAIL is positive because regardless of the supply pressure, boards of examiners in states that have high dentist-to-population ratios still try to limit the number of entrants.

The presence of direct effects of RECIP and GOLD on PRES, and the absence of direct effects on FAIL, suggest that the licensing examination is the mechanism used by state boards to discourage individuals from taking the licensing examination. The negative effect of RECIP on PRES is due to the fact that states with reciprocity are inherently less attractive and generally attract fewer dentists than states without reciprocity (no entry barrier). Similarly, the condensed gold restoration requirement does appear to be a mechanism to restrict entry in states with high supply pressure.

IX. DISCUSSION

The results of this analysis are largely consistent with our hypotheses, and with previous research. The results are consistent

with the suggestion that boards of dental examiners in some states use the licensing process to restrict competition through such actions as directly increasing the failure rate or indirectly by requiring gold restorations, which discourages potential entrants from sitting for the examination. Such actions appear to enhance the economic position of licensed dentists. Thus, through the boards of examiners, the dental profession in many states appears to act as a cartel which controls the amount of services provided by regulating the number of providers. We must acknowledge, however, that the power of the boards to limit competition in this manner is constrained by political factors. For example, boards in many states may attempt to restrict entry to a small enough number of dentists to protect the profession's wealth position but at the same time allow enough dentists to enter so as not to call attention to their restrictive actions - attention that might stimulate litigation and legislative action.

The states have allowed the dental profession to be self-regulating on the assumption that the public will benefit by the resulting higher quality care. While states justify licensure as a quality assurance mechanism, this research is consistent in the belief that some states use licensure as an entry barrier in order to reduce competition. Recently, dentists nationwide have become alarmed over a perceived drop in demand for dental services attributed to the poor state of the economy. At the same time, the dentist-to-population ratio also has been rising in many states. The longer both trends persist, the greater will be the pressure on the state boards to restrict entry even more. If the pressure is strong enough, it may extend to states that currently

do not have restrictive licensing policies.

These practices highlight several public policy issues. Recently, debate in the Congress has centered around whether the professions, including the dental profession, should be exempt from the scrutiny of the Federal Trade Commission. The final decision not to exempt the professions has rekindled and reinforced efforts to strike down anti-competitive behaviors, particularly price fixing. While price fixing may be the outcome of monopolistic policies, a more comprehensive enforcement effort to monitor activities that make monopolistic practices easier is probably warranted. Failure to do so may ultimately lead to the establishment of new entry barriers and may frustrate current attempts to foster greater competition among providers.

* * * * * * *

The opinions and assertions contained herein are those of the authors and do not reflect the viewpoint of the U. S. Army Medical Department or the Department of Defense.

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FOOTNOTES

• [1] The professions "set" training cost by requiring a minimum amount of training.

• [2] The licensing "fee" can be very high in dentistry. Dentists are responsible for obtaining patients for the clinical portion of the examination. Thus, the costs of taking the California licensing examination for a dentist living in New York, would include travel and subsistence expenses for himself and his patient(s).

• [3] Also to be considered, is the cost to those who cannot afford treatment in the noncompetitive market.

• [4] The Northeast Regional Board is recognized by Maine, Vermont, New Hampshire, Massachusetts, Connecticut, New York, New Jersey, Ohio, Rhode Island, Pennsylvania, Illinois, Michigan, West Virginia, Maryland, and the District of Columbia.

• [5] The Central Regional Testing Service is composed of Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin, and Wyoming.

• [6] The Southeastern Regional Testing Service is composed of Virginia, Tennessee, Arkansas, and Kentucky.

• [7] The Western Regional Examination Board is composed of Montana, Arizona, and Utah.

• [8] Income data were not available for Delaware and Alaska.

• [9] The directory tapes contain nonmembers as well as members.

•[10] The relations among the variables in the model are assumed to be linear, additive, and causal.

•[11] Slope coefficients are standardized by dividing each estimated slope parameter by its standard deviation.

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FIGURE 1.

TRIMMED PATH DIAGRAM OF DENTAL FAILURE RATE

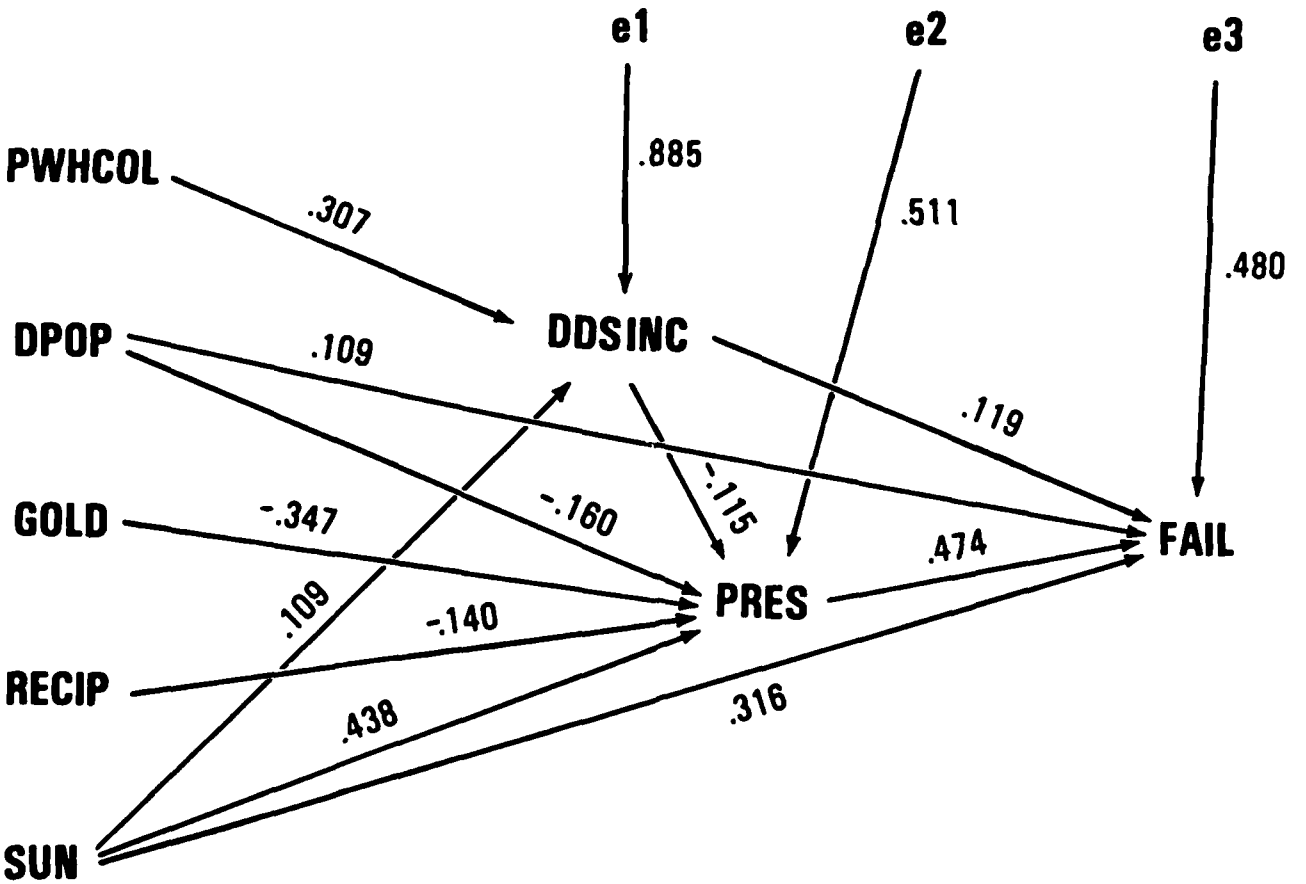
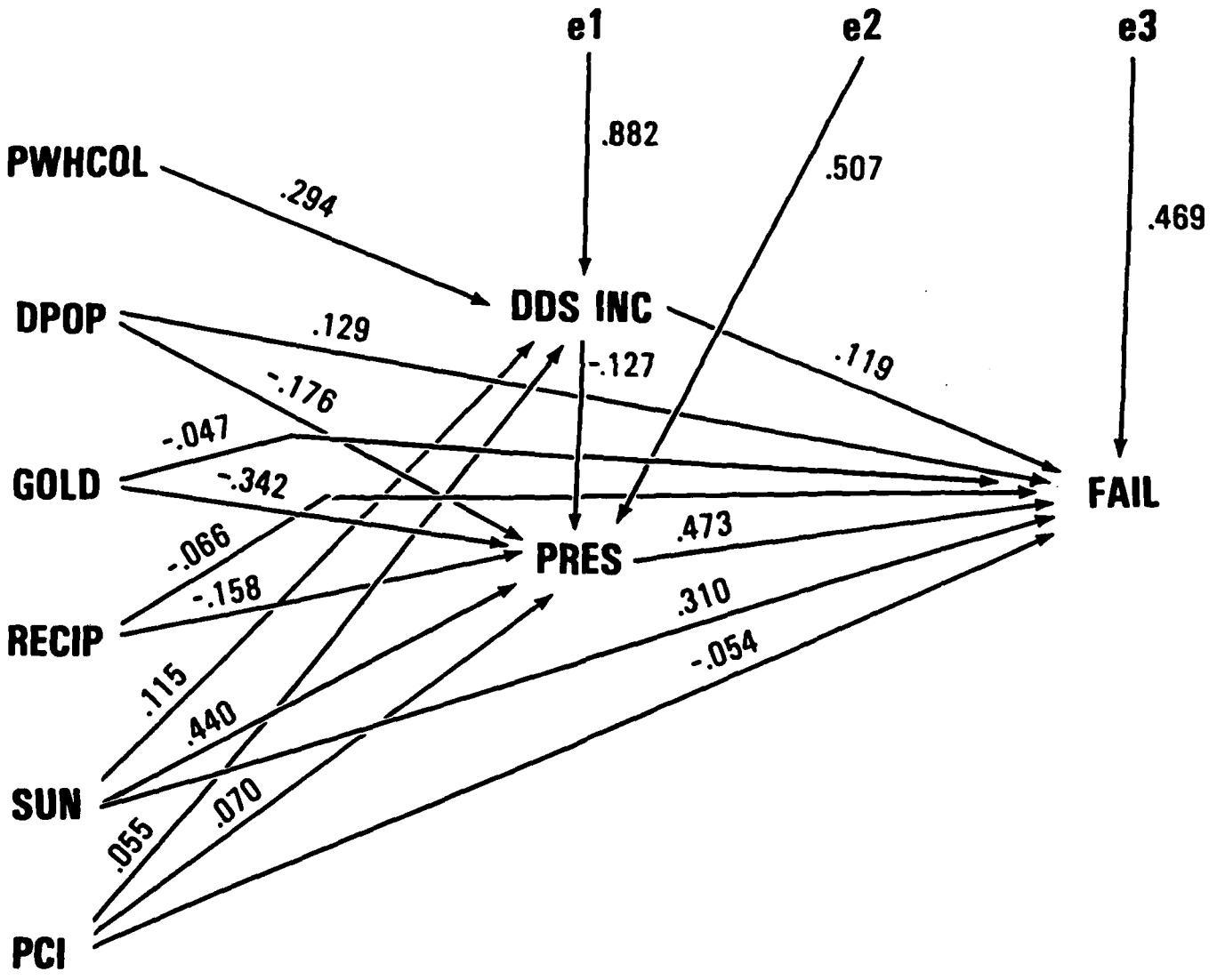


FIGURE 2.

UNTRIMMED PATH DIAGRAM OF FAILURE RATE



LEGENDS

FIGURE 1. Three-equation path model re-estimated after insignificant paths were trimmed.

FIGURE 2. Initial three-equation path model.

TABLE I

VARIABLE DEFINITIONS AND DESCRIPTIVE STATISTICS

ENDOGENOUS VARIABLES

Name	Description	Mean	Standard Deviation
DDSINC*	Median Dental Income	28,368	3,023
FAIL†	Failure Rate Logit	.516	.828
PRES†‡	Supply Pressure	68.9	42.55
	Failure Rate†	10.3	11.82

EXOGENOUS VARIABLES

RECIP¶	Reciprocal Licensure	.34	.48
GOLD¶	Gold Restoration Requirement	.46	.503
DPOP‡§	Dentists Per 10,000 Population	5.02	1.40
PCI§	Per Capita Income	5,041	2,850
PWHCOL§	Per Cent White Collar	46.6	4.89
SUN§	Per Cent Possible Sunshine	61.86	9.32

* Survey of Dental Practice, 1971, American Dental Association

† American Dental Association Division of Educational Measurements

‡ Distribution of Dentists By Region and State, 1970

¶ Facts About The States For The Dentist Seeking A Location

§ Statistical Abstracts, 1971.

TABLE II

ZERO ORDER CORRELATIONS

	PWHCOL	DPOP	GOLD	RECIP	SUN	PCI	DDSINC	PRES	FAIL
Per Cent White Collar	1	-.024	-.033	.026	.114	.236	.321	.032	-.132
Dentists Per 10,000 Population		1	.213	-.103	-.046	.249	.072	-.162	-.005
Gold Requirement			1	.015	.258	.085	-.059	.460	.369
Reciprocal Licensure				1	-.296	.231	-.240	-.013	-.281
Per Cent Sunshine					1	-.072	.149	.067	.456
Per Capita Income						1	.111	-.002	-.087
Median Dental Income							1	-.048	.151
Supply Pressure								1	.519
Failure Rate Logit									1

TABLE III

ESTIMATED PARAMETERS OF TRIMMED MODEL

FAIL* DEPENDENT VARIABLE

Exogenous Variable	Raw Parameter	Standardized Parameter	t
Intercept	3.41		4.54
PRES	.012	.474	.89
DDSINC	.0000316	.119	2.28†
DPOP	.062	.108	.82
SUN	.030	.316	1.39

*FAIL = L´ (PRES, DDSINC, DPOP, SUN)

R^2 = .52

†Significant at .05 level

TABLE IV

PREDICTED FAILURE RATES (p) OVER RANGE OF EACH CONTINUOUS INDEPENDENT VARIABLE*

Independent	Minimum	p (%)	Mean	p (%)	Maximum	p (%)
PRES	9.38	3.60	68.9	7.00	271.9	46.3
DDSINC	22,364	6.20	28,368	7.40	37,702	9.80
DPOP	1.59	3.50	5.02	4.30	8.09	5.20
SUN	32	7.90	61.90	17.5	86	30.4

* Holding other variables constant.

TABLE V

DECOMPOSITION OF EFFECTS IN FAILURE RATE MODEL

Dependent Variable	Predetermined Variables	Total Effect	Indirect Effects Via: Dental Income	Indirect Effects Via: Supply Pressure	Direct
Dental Income (DDSINC)	PWHCOL	.307	-	-	.307*
	SUN	.109	-	-	.109*
Supply Pressure (PRES)	PWHCOL	-.035	-.035	-	-
	DPOP	-.160	-	-	-
	GOLD	.347	-	-	.347*
	RECIP	-.140	-	-	.140
	SUN	.425	-	-	.438†
	DDSINC	-.115			-.115
Failure Rate (FAIL)	PWHCOL	.020	.02	-	-
	DPOP	.032	-	-.076	.109
	GOLD	.164	-	.164	-
	RECIP	-.066	-	-.066	-
	SUN	.531	.214	.012	.316†
	DDSINC	.065	-	-.054	.119
	PRES	.474	-	-	.474†

* Significant at 0.05 level (two-tailed).

† Significant at 0.01 level (two-tailed).

APPENDIX A

ESTIMATED PARAMETERS OF TRIMMED MODEL

PRES* DEPENDENT VARIABLES

Independent Variable	Raw Parameter	Standardized Parameter	t
RECIP	-9.197	-.139	-.93
GOLD	21.72	.347	2.31†
DDSINC	-.0012	-.115	-.68
DPOP	-3.53	-.160	-1.92
SUN	1.63	.438	3.39‡
Intercept	7.27		-.18

* PRES = g' (RECIP, GOLD, DDSINC, DPOP, SUN)

R^2 = .487

† Significant at .05 level

‡ Significant at .01 level

APPENDIX B

ESTIMATED PARAMETERS OF TRIMMED MODEL

DDSINC* DEPENDENT VARIABLE

Independent Variable	Raw Parameter	Standardized Parameter	t
PWHCOL	61.839	.307	1.43
SUN	39.334	.109	.88
Intercept	24,347		5.19

* DDSINC = f (PWHCOL, SUN)

R^2 = .438

APPENDIX C

EFFECT OF DECOMPOSITION OF RELATIONSHIPS OF INDEPENDENT VARIABLES WITH FAILURE RATE IN 1970

Prior Variable	Implied Slope	Direct Effect	Indirect Effect	Total Effect	Non-* Causal	Per Cent† Explained
Per Cent White Collar	.072	0	.020	.020	.052	28
Dentist-Population Ratio	.050	.09	-.076	.032	.017	66
Gold Requirement	.306	0	.164	.164	.142	54
Reciprocal Licensure	-.223	0	-.066	-.066	-.157	89
Per Cent Sunshine	.593	.316‡	.215	.531	.063	89
Dental Income	.144	.119	-.054	.065	.079	45
Supply Pressure	.635	.474‡	0	.474	.161	74

* Inconsistencies due to rounding.

† 1-(non-causal effect/implied slope) X 100.

‡ Significant at 0.01 level (two-tailed).

APPENDIX D

EFFECT OF DECOMPOSITION OF RELATIONSHIPS OF INDEPENDENT VARIABLES WITH SUPPLY PRESSURE IN 1970

Prior Variable	Implied Slope	Direct Effect	Indirect Effect	Total Effect	Non-* Causal	Per Cent† Explained
Per Cent White Collar	.002	0	-.036	-.035	.037	-
Dentist-Population Ratio	-.090	-.160	0	-.160	.070	22
Gold Requirement	.422	.347‡	0	.347	.075	82
Reciprocal Licensure	-.245	-.140	0	-.140	-.105	57
Per Cent Sunshine	.559	.438¶	-.013	.425	.134	76
Dental Income	-.040	-.115	0	-.115	.075	-

* Inconsistencies due to rounding.

† 1-(non-causal effect/implied slope) X 100.

‡ Significant at 0.05 level (two-tailed).

¶ Significant at 0.01 level (two-tailed).

APPENDIX E

EFFECT OF DECOMPOSITION OF RELATIONSHIPS OF INDEPENDENT VARIABLES WITH DENTAL INCOME IN 1970

Prior Variable	Implied Slope	Direct Effect	Indirect Effect	Total Effect	Non-* Causal	Per Cent† Explained
Per Cent White Collar	.319	.307‡	0	.307	.013	96
Dentists Per 10,000 Population	-.012	0	0	0	-.012	100
Gold Requirement	.018	0	0	0	.018	100
Reciprocal Licensure	-.024	0	0	0	-.024	100
Per Cent Sunshine	.144	.109	0	.109	.035	76

* Inconsistencies due to rounding.

† 1-(non-causal effect/implied slope) X 100.

‡ Significant at 0.05 level (two-tailed).

END

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