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DENSITY DEPENDENCE IN THE EVOLUTION OF POPULATIONS OF NEWSPAPER ORGANIZATIONS*

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Abstract

A model of density dependence is proposed to explain regularities in the growth and decline of organizational populations. Density--the number of organizations--is assumed to be a function of the social processes of legitimation and competition. At low levels of density, the model predicts that the legitimation process will dominate and will lead to high organizational founding rates and low organizational mortality rates. At high levels of density, competition will dominate and as a result founding rates will decline and mortality rates will rise. The model is tested with hazard function models using data from nine separate newspaper industries spanning the nineteenth and twentieth centuries and covering over 5200 newspapers. The findings provide strong empirical support for the model except in the smaller industries.

DENSITY DEPENDENCE IN THE EVOLUTION OF POPULATIONS OF NEWSPAPER ORGANIZATIONS

Recent studies of a variety of types of organizations show a common pattern in the evolution of organizational populations over time. Railroads, labor unions, banks, and newspapers each emerge as organizations in small numbers, increase rapidly in population size, and then stabilize or decline in numbers (see Carroll 1984 and Hannan and Freeman 1986).

Why do the number of organizations in a population typically follow this long-term concave pattern of growth and decline? Several answers come to mind. Perhaps some organizational populations exploit ephemeral resources. They grow rapidly while the resource abounds and then decline as the resource fades. For instance, ethnic voluntary associations and firms that serve immigrant communities may flourish during periods of peak immigration and then decline in numbers as immigration slows and ethnic and linguistic populations assimilate. Such a process can apparently account for the histories of populations of non-English language newspapers in the United States (Park 1929) and local life assurance societies (Lehrman 1986).

A second possibility is that organizational forms embody historically-specific social and material technologies (Stinchcombe 1965). Older populations eventually lose their competitive edge as new technologies emerge and social and political conditions change. For example, widespread distribution of electricity apparently eliminated populations of many kinds of firms such as ice houses and local breweries.

Changing political conditions and legal rulings eliminated others such as slave plantations and opium dens.

A third possibility, considered here, is that the characteristic trajectory of initial growth then stability reflects the combined operation of processes of legitimation and competition (Hannan and Freeman 1988). Growth in numbers of organizations in a population triggers opposing processes of legitimation and competition. At low densities, growth in numbers mainly legitimates the population and the organizational form it uses. So in this range, founding rates rise and mortality rates fall with increasing density. But once density becomes high relative to the levels of resources in the system, further increases in density mainly strengthen the effects of competition within the population. So in the higher range of density, founding rates fall and mortality rates rise with increasing density.

It should be clear that these three scenarios are compatible with each other. The evolution of organizational populations probably depends on fluctuations in availability of essential resources, the rise of competing organizational forms using different social and material technologies, and processes of competition and legitimation.

Here we concentrate on processes of legitimation and competition (although we shall introduce some rudimentary controls for the other two scenarios). We do so because these two processes are the main mechanisms of change in two of the most vigorous strands of contemporary organization theory: neo-institutional theory (Meyer and Scott 1983) and population-ecology theory (Carroll 1988; Hannan and Freeman forthcoming), respectively. It has become commonplace to pit these perspectives against

one another as rival theories for explaining change in the world of organizations. Three kinds of differences are commonly noted. DiMaggio and Powell (1983) claim that ecological theory seeks to understand variability while institutional theory attempts to explain the absence of variability, the similarities among organizations. Others (e.g., Fombrun 1986) suggest that institutional theory relies on symbolic elements in the environment as causally important while ecological theory draws attention to material aspects of the environment. Meyer and Scott (1983) suggest that the two theoretical programs refer to different parts of the world of organizations, an "institutional sector" and a "competitive sector" that operate according to different rules, with legitimation dominating in the former and competition dominating in the latter.

While institutional and ecological theories do differ in important ways, the distinctions just noted are not as fundamental as many believe. First, any acceptable theory of variability must explain low levels of variability as well as high ones. It is hardly useful to try to develop different theories to explain different levels of some outcome. Where the two sets of theorists seem to disagree is in their initial assessments of how much variability actually exists in the organizational world. This is an empirical problem that presumably can be resolved as evidence is brought forth. Second, any general theory of organizational change must deal with the consequences of change in both material and social environments. Much recent ecological research emphasizes the effect of social and political conditions on populations of organizations such as newspaper publishing firms (Carroll and Delacroix 1982; Delacroix and Carroll 1983; Carroll and Huo 1986; Amburgey et al. 1988), labor unions

(Hannan and Freeman 1987, in press; Carroll and Huo 1988), social service providers (Singh et al. 1986), and voluntary associations (McPherson 1983; McPherson and Smith-Lovin 1988). The theoretical value of these studies lies in showing that selection processes can be driven by non-material resources as well as by material ones. Third, there does not seem to be any good reason for suspecting that some organizations are shielded completely from competition processes and others from legitimation processes.[1] Most organizational populations probably face both, although the salience of the each process likely varies over the history of the population. The attentiveness of organizational theorists to only one or the other process probably results from the common static and short-term research designs which highlight a point in time where one process overwhelms the other.

We think that the most important differences between neo-institutional and ecological theory concern levels of analysis and mechanisms of change. Although the issue is rarely discussed explicitly in treatments of institutional theory, the common assumption is that change in the distributions of organizational structures arises mainly by <u>adaptive change of individual organizations</u>. Population-ecology theory assumes that individual organizations have modest capacities to make major changes in structure (Hannan and Freeman 1984) and that change in the distributions of organizational structures comes about mainly by the entry of new organizations and the demise or merger of old ones. Usually this process is characterized by some systematic correspondence between, on the one hand, the forms of old and new organizations, and on the other hand, the states of the environment at the two points in time. Since

populations are defined by organized forms, ecological theory thus posits a model of selective change of populations of organizations. So the two bodies of theory operate at different levels of analysis, organizational and populational, and rely on different mechanisms of change, adaptation and selection.

We think that some institutional processes operate at the population level. For instance, when a small publisher pursues costly legal action that changes accepted notions of freedom of speech, the action may be financially devastating for his firm and force it to close. But the institutional consequences of the action may very well benefit publishers who come later and attempt to do exactly the same thing which had previously been considered illegal or unacceptable. Formulating institutional processes at the population level also makes it possible to integrate the most important insights of each line of theory (Hannan, in press). It further allows us to escape the artificial juxtaposition of the two theories as incompatible. Below we discuss an approach to modeling density dependence in rates of founding and mortality that provides a concrete example.

One benefit of formulating institutional processes at the population level is that it opens new possibilities for empirical analysis. Too often neo-institutional research proceeds by creating and destroying "strawmen", stylized and oversimplified models of rationalistic organizations (for examples, see Fennell 1980; Meyer, Scott and Deal 1981; Rowan 1982; Tolbert and Zucker 1983). Supposedly the failure of a rationalistic model to fit the data gives credence to one and only one alternative--an institutional model of change at the level of individual

organizations. Since there are many rival hypotheses to such rationalistic models (e.g., Cohen, March and Olsen 1972), this is a very weak form of verification of any one of them. We think that institutional arguments deserve more systematic empirical study. Reshaping the arguments at the population level is one step in this direction.

The model of legitimation and competition described in the next section has been developed in the context of studies of the ecology of labor unions in the United States from 1836 to 1985 (Hannan and Freeman 1987; in press). It has subsequently been applied to a variety of other kinds of organizations as we describe below. This paper applies the model to data on a very different kind of population: newspapers in Argentina, Ireland, and seven metropolitan areas of the United States. Our objective is to learn whether processes of legitimation and competition can account for the founding rates and mortality rates of newspapers and whether the processes hold cross-nationally. Although we do not claim to treat them with equal effort, we shall also consider briefly whether resource fluctuations and historical obsolescence can also explain these rates.

I. A Model of Density Dependence in Vital Rates

This section reviews an ecological model of density dependence in founding rates and mortality rates in organizational populations (Hannan, in press). The model assumes that legitimation and competition are functions of density, the number of organizations in the population.[2]

How does the legitimacy of an organizational form vary with the number of organizations in the population? Current institutional theory

stresses legitimacy as taken-for-grantedness (Meyer and Rowan 1977; Meyer and Scott 1983). From this perspective, it seems clear that extreme rarity of a form poses serious problems of legitimacy. When few instances of a form exist, it can hardly be taken as the "natural" way to achieve some collective end. On the other hand, once a form becomes prevalent, it seems unlikely that increases in numbers will have much effect on its taken-for-grantedness. Other theorists define legitimacy as the endorsement of a form by powerful actors in the environment (Stinchcombe 1968). Similar arguments about the effects of density on legitimacy apply in this case as well. Therefore, we argue that legitimacy grows monotonically with density, but at a decreasing rate.

In the case of competition, it seems likely that variations in the upper range affect founding rates more strongly than do variations in the lower range. When numbers are few, adding an organization to the population increases the frequency and strength of competitive interactions slightly if at all. But when density is high, addition of an organization increases competition, adjusting for availability of resources. So we assume that growing density increases competition at an increasing rate.

The model as it has been described so far does not determine the shape of the relationship between density and the organizational founding rate. Depending on the strength of the various effects, the relationship can be positive (if legitimation processes dominate competitive ones), negative (if competitive processes dominate) or nonmonotonic (if different processes dominate in different ranges). Hannan (in press) argued that competition increases more rapidly than legitimation at high density,

implying that the relationship between the founding rate and density is nonmonotonic. That is, the legitimacy process dominates when density is sparse and the competition process dominates when density is high. Such a relationship is depicted graphically in Figure 1.

[Figure 1 about here]

The next step is to build a model based on functional forms consistent with these qualitative predictions. Hannan (in press) argued that the founding rate is proportional to the legitimacy of the organizationl form and inversely proportional to the level of competition within the population:

$$\lambda(t) = \alpha(t)\ L(t) \ / \ C(t) \qquad (1)$$

where $\lambda(t)$ is the founding rate, $L(t)$ is the level of legitimacy, $C(t)$ is the level of competition, and $\alpha(t)$ is a function summarizing the environmental conditions which affect the rate.

According to the arguments outlined above, organizational density increases legitimacy at a decreasing rate. Hannan (in press) assumed the relationship

$$L(t) = N(t)^{a_1} \qquad o < a_1 < 1 \qquad (2)$$

where $N(t)$ denotes density. And, competition increases with density at an increasing rate. Hannan (in press) assumed that

$$C(t) = \exp[a_2\ N(t)^2] \qquad a_2 > o \qquad (3)$$

Replacing L(t) and C(t) in equation (1) with these functions gives a model for the founding rate in terms of density:

$$\lambda(t) = \alpha(t)\ N(t)^{a_1}\ \exp[-a_2\ N(t)^2] \qquad (4a)$$

$$o < a_1 < 1;\ a_2 > o \qquad (4b)$$

According to this model, the founding rate has a nonmonotonic relationship with density.

Parallel arguments can be made for the mortality rate--but with the rate proportional to C(t) and inversely proportional to L(t). This assumption, along with the assumptions in (2) and (3), leads to models of density dependence with the form of (4a) but the expected signs of the coefficients in (4b) reversed. When Hannan and Freeman (in press) applied such a model to data on mortality rates of American national labor unions, they had difficulty obtaining estimates (due to the failure of maximum likelihoods programs to converge). So they used instead a slightly different model:

$$\mu(t) = \beta(t)\ \exp[b_1 N(t) + b_2 N(t)^2] \qquad (5)$$

where $\mu(t)$ is the mortality rate, $\beta(t)$summarize the effects of environmental conditions, and the coefficients of density are expected to obey the restrictions $b_1 < o$ and $b_2 > o$.

There are two ways of motivating this alternative model of nonmonotonic effects of density on the rate. The first is to assume that legitimation is an exponential function of density, meaning that it increases at an increasing rate with density. The second is to assume that legitimation is a log-quadratic function of density with positive

first-order effect and negative second-order effect. Such a function implies that legitimation eventually declines at high densities, which is not consistent with the general line of argument we pursue. However, if we restrict attention to the range over which the log-quadratic relationship is positive, this model gives a potentially useful approximation to the relationship assumed in (2). We think that the second motivation is a more useful one in the present context.

It turns out that nonmonotonic models like (5) fit better than models like (4) for both the founding rates and mortality rates of newspapers.[3] So we report estimates of these models below. In the case of foundings, we hypothesize that estimates of the model[4]

$$\lambda(t) = \exp[a_1 N(t) + a_2 N(t)^2] \qquad (6a)$$

will show coefficients with the pattern

$$a_1 > o;\ a_2 < o;\ |a_1| > |a_2| \qquad (6b)$$

In the case of mortality, the predictions are reversed. The model

$$\mu(t) = \exp[b_1 N(t) + b_2 N(t)^2] \qquad (7a)$$

is expected to show coefficients which obey the constraints

$$b_1 < o;\ b_2 > o;\ |b_1| > |b_2| \qquad (7b)$$

Despite its mathematical simplicity, the non-linearity of the model of density-dependence makes the relationships between observable variables complex. For clarity, we present a simplified diagram of these relationships in Figure 2. The top half of the diagram shows the effects

predicted to operate at low levels of density. Here the relationships between the observable variables density, foundings and mortality operate primarily through the first unobservable variable, legitimacy. In the lower half of the diagram, the expected effects at high density are shown. Here the relationships between the observable variables are reversed because they operate primarily through the second unobservable variable, intensity of competition.

[Figure 2 about here]

In empirical testing the key issue is whether these non-monotonic models improve over simpler models with only monotonic dependence of each rate on density and whether the inequalities implied by the theory, restrictions (6b) and (7b), hold. A secondary but important issue is whether the point of inflection falls within the observed range of density. So in estimating models with this form, we check first to see whether parameters without any restrictions have the predicted signs and second whether the implied behavior of the process over the range of density is nonmonotonic.

II. Previous Research on Density Dependence

In the first study of the effect of organizational density on vital rates, Hannan and Freeman (1987) estimated models similar to those discussed in Section I using data on the life histories of national labor unions in the United States over the entire history of the population, 1836-1985. They found that density had a nonmonotonic effect on the founding rate of national unions. As predicted, both first-order and

second-order effects of density differed significantly from zero at the .01 level in the predicted directions. According to their estimates, the founding rate rose five-fold as density grew from zero to roughly 100. From that point, the founding rate fell sharply with increasing density. In fact, the predicted rate at the observed maximum of 211 unions matches the rate when there are only 20 unions in existence.

In a later companion paper, Hannan and Freeman (in press) found that the rate of disbanding of national labor unions was also a nonmonotonic function of density. The first-order effect of density on the disbanding rate was positive and the second-order effect was negative, as predicted. Each differed significantly from zero as well. The qualitative behavior of these estimates of the disbanding process agrees with the prediction of the model discussed above. The disbanding rate fell by three-quarters as density rose from zero to roughly 120 and then grew sharply with increases in density beyond that level. The implied disbanding rate at the observed maximum of density of 211 unions is again the same as when there are 20 unions. So, for both founding and mortality rates, the hypothesized nonmonotonic pattern of density effects holds in the case of American national labor unions.

Prompted by these findings, researchers have recently applied the density model to a variety of other kinds of organizational populations. In a study of semiconductor manufacturers in the U.S., Hannan and Freeman (forthcoming) report that rates of leaving the population over the forty year history of the industry reflect a pattern of density dependence strikingly similar to that reported for labor unions. However, rates of entry into this industry appear to have been monotonic functions of

density, increasing at a decreasing rate as organizational density of the industry increased. In this case, there is no evidence that competition dominates legitimation at high densities in affecting the founding process.

Barnett and Carroll (1987) studied patterns of organizational founding and mortality in the population of independent local telephone companies in several Iowa counties from 1900 to 1917. They report that rates vary with density in the manner predicted by the model, although only for the density of their largest subpopulation, mutual telephone companies. The other smaller subpopulation, commercial telephone companies, does not show the expected effect.

Delacroix, Swaminathan, and Solt (1987) studied exits from the population of California wine producers from 1940 until 1985. Their estimates show at best weak support for the model. While they do report two equations with the predicted first and second-order effects of density (Table 3, Equations 3-5 and 3-6), many of their other equations show different, inconsistent effects. Most frequently, density has no significant effects in the equations they report. Delacroix et al. (1987) conclude that density dependence is not a very good model for mortality in this population. Their preferred model is one using prior foundings and prior failures as predictors of organizational mortality. Each of these variables shows significant negative effects.

In a study of voluntary social service organizations in Toronto from 1970 to 1982, Tucker et. al. (1988) compared the effects of density with those of two environmental changes in governmental fundings (one change increased funds for programs of this kind, the other introduced budgetary

restraint). For organizational foundings, they report estimates with the expected effects of density (Table 8-1, second equation). However, they conclude on the basis of additional analysis that effects of density interact with the changes in governmental funding. Specifically, they found that the model of curvilinear density dependence held during the period of increased funding, but not at other times. For organizational mortality, their estimates also show significant first and second order effects--exactly opposite of that predicted by the model, however. That is, the death rate increased initially with rises in density but then levelled off and declined.

Finally, in a study of the medical diagnostic imaging industry, Mitchell (1987) investigated the effects of density on the rates of entry into new technologically-based industry segments (e.g., x-ray technology, CAT scanners). Using data covering the period 1959 to 1986, Mitchell found the expected nonlinear relationship between density and entry rates. That is, the coefficient associated with the first-order density term was positive and significant while the second-order density term was negative and significant.

While the findings in these studies tend on the whole to support the model of density dependence, there are obviously important exceptions. How might these be explained?

An easy answer recognizes that these studies examine very different types of organizations and argues that the model discussed above might hold only for certain organizational forms. Just because it is easy does not mean that this answer should be slighted. However, other possibilities for explaining these findings should be explored before the

model is abandoned, especially when the consequence involves a retreat to ad hoc theorizing about differences among organizational forms.

One of the main differences--perhaps the primary one--between these more recent studies and the Hannan and Freeman union studies concerns time frames. The Hannan and Freeman data cover the entire history of a population from its emergence to the present day. These data span almost 150 years. The other studies cover periods of only 40 years (semiconductor manufacturers), 17 years (telephone companies), 45 years (wine producers), 27 years (diagnostic imaging manufacturers), and 13 years (voluntary social services). Moreover, only the semiconductor and diagnostic imaging studies can claim to have information on the earliest parts of the industry. Excluding data on the formative period is particularly problematic for studying the legitimacy component of the density model since strong effects of density are predicted in this early period. There is no reason to expect that these effects should be observable at late stages of a population's development. In fact, the model predicts that competition will dominate at this point. A similar argument could be made about exclusion of the later phases of population evolution (whether by research design or by the censoring imposed by current time) as it pertains to the competition component of the model.[5]

In sum, we argue that studies of density-dependent processes of legitimation and competition should investigate the entire histories of mature organizational populations. The studies that have done so have produced findings that largely agree with the qualitative predictions of the model. Here we present findings from the most comprehensive analysis

to date. We investigate the founding and mortality rates of nine populations over most of their entire histories.

III. Legitimation and Competition in Newspaper Industries

In this section, we sketch an outline of some of the actions and circumstances which increased both legitimacy and competition in the evolution of newspaper industries. We focus on the American industry.

Legitimation. Because it is part of the Bill of Rights, many Americans believe that freedom of speech for the press has always been unconditionally guaranteed. In fact, it still exists only within limits, and these limited freedoms are the result of decades of struggle and conflict.

The earliest American papers had trouble staying open unless they received the explicit blessing of authorities. The first known newspaper, Publick Occurences Both Foreign and Domestick, published only one issue in Boston in 1690 before its owner was thrown in jail for printing "the truth as he saw it" (Emery and Emery 1984). No other paper appeared until 1704 when John Campbell's Newsletter began. Campbell was the postmaster and his paper was printed only after all copy had been cleared with the governor. Later postmasters continued publishing newspapers and these always noted that they were published "by authority."

In 1721 James Franklin's New England Courant boldly challenged the notion of official sponsorship. Although his efforts landed him in jail one year later, his paper lasted five years and had a profound influence on the development of an independent press. By 1785, all thirteen

colonies had witnessed the emergence of a newspaper, most of which were private enterprises.

Failure rates of the early newspapers were extremely high. Of the more than 2100 papers founded prior to 1820, more than half are estimated to have closed within two years (Emery and Emery 1984). Although financial difficulties, indicating a lack of full consumer acceptance, account for most of these failures, there were also legal, political and civil difficulties. Dueling among printers and with their foes, for instance, was not uncommon. Foremost among these difficulties, however, was the problem of libel which could result in jail sentences or bankruptcy. Despite the historical prominence accorded the celebrated Zenger trial of 1735, it was not until 1805 that a permanent law allowed the introduction of evidence as to the truth of an alleged libel as legitimate defense (Mott 1962). Earlier, courts had not usually allowed such evidence and recognized the principle, "the greater the truth, the greater the libel" (Emery and Emery 1984).

Until 1830, newspapers in the U.S. were generally of two kinds. There were the mercantile papers of the large cities which reported commercial news. And there were, most of all, the partisan papers which printed political news and especially opinions. These papers usually received funding directly by political parties and candidates, to whom they remained unflinchingly loyal. Both kinds of enterprises were typically small, one-man operations: the reporter, the editor, the business manager and the printer were all the same person.

The emergence of the so-called Penny Press in the 1830s marks the beginning of a new kind of independent, mass-based newspaper (Schudson

1978). Receiving their name from their price of one cent, penny papers aimed for large circulations. The sales and advertising income which accrued from their broad social base (or niche) allowed these papers political independence from the parties. Editorially, the penny papers were conscientiously non-judgmental: accounts of trials and the like were often published verbatim from the official records. Although such actions were called sensational by the established press of the day, at least one scholar credits the Penny Press with inventing the concept of "news" (Schudson 1974). In any case, it is clear that mid-nineteenth century witnessed a new interest in "facts" in journalistic reporting.

By the late nineteenth century, newspaper reporting had become a profession. College education was viewed as an asset by prospective employers; and press clubs were started in many cities. The reporter's goal was "to get the facts and be colorful" (Schudson 1978:71). The informational component of journalism stressed fairness, objectivity and dispassion (Schudson 1978).

Each of these developments led to an increased acceptance of the newspaper and its taken-for-granted right of existence and value as a source of information. Yet the process by which this occurred was slow and gradual, with fits and starts. For instance, duels were not uncommon until at least the mid-nineteenth century (Mott 1962). Challenges to a free press were more likely in the newly settled areas of the South and the West. Thus, while national events set the stage for legitimation, the battle was fought afresh in new local industries through the expanding nation. There were also occasional relapses, most notably when many

German and socialist papers were squeezed out of business during World War I.

Today the freedom of the press is firmly established. Indeed, newspapers often are given more credibility than the government. Yet important issues continue to require resolution including those related to prior restraint, libel, censorship, and confidentiality of sources. Nonetheless, even should the press lose many of these battles, it is highly unlikely its legitimacy will be threatened or that many newspapers will be forced to close.

Competition. Journalism history throughout the nineteenth century abounds with accounts of bitter newspaper rivalries. Yet from the perspective of organizational mortality, competition intensified in the twentieth century.

The best data on competition and consolidation in the newspaper industry concern only English-language general circulation dailies (see Rosse et al. 1975; Emery and Emery 1984). The peak number of these papers occurred sometime immediately prior to World War I, when approximately 2200 papers were in operation. That number was almost triple the number operating in 1880, 850 newspapers. Between World War I and II, the industry witnessed a decline to about 1750 dailies. Since 1945, the number has remained roughly stable, with periodic small fluctuations.

These national trends mask an underlying process of severe local competition. Within cities, there has been a steady downward trend toward a single daily. In 1880, slightly over 61 percent of all cities with dailies had two or more competing dailies. By 1910, the percentage had declined to approximately 57; and by 1930 it had dropped to about 20

percent. The pattern proceeded without relent so that in 1981 only 1.9 percent of all cities with dailies had more than one.

The usual explanation for the "evolution of one newspaper cities" relies on economies of scale (Rosse 1978; 1980; Bogart 1981; Høyer 1975). Economies of scale occur in newspaper production because the bulk of production cost is tied to the first copy of each printing; marginal cost declines sharply for additional copies. Economies of scale also exist for distribution. However, because daily newspapers rely primarily on income from advertising, the strongest effect of scale probably occurs through the incentives created by advertising rate schedules. Typically, advertisers can reach more potential consumers for less money by buying space in the largest circulation paper of an area rather than by spreading their ads around. Thus, a small loss of circulation can result in a large loss of advertising revenue (Bogart 1981).

Once a newspaper achieves a size advantage over its local rivals (for whatever reason) it becomes extraordinarily difficult for the smaller competitors to survive. In the long run, the equilibrium outcome of the process triggered by this condition is a local monopoly. Exceptions to this rule usually occur in only the largest markets or where the competitors manage to differentiate themselves sufficiently in that they serve different markets or that they have some special appeal to certain submarkets. Thus, while the daily markets have consolidated in unprecedented ways, there has been a concomitant upswing in the viability of specialized newspapers (Emery and Emery 1984; Carroll 1987).

IV. Design of the Newspaper Studies

The data we analyze come from studies that attempted to define and enumerate the complete historical populations of newspapers in nine fairly autonomous localities. Although all newspaper markets are geographically delimited, they vary significantly in scope and size. Most countries, including Argentina and Ireland, have newspaper industries which are essentially national in character (Bagdikian 1971). By contrast, American newspapers depend primarily on local markets which are bounded geographically by individual metropolitan areas.

Because of these differences in scope, different geographical units were used to define relatively independent populations of newspapers. For Argentina and Ireland, the nation-state and its political boundaries were used. For the U.S., standard metropolitan statistical areas (SMSAs) were used. Because so many papers have been founded in the U.S., seven SMSAs were selected quasi-randomly. The selection was done in a manner that introduced variation in geographical region and human population size. The areas are San Francisco-Oakland-San Jose, California; Little Rock, Arkansas: Springfield, Missouri; Shreveport, Louisiana; Elmira, New York; Lubbock, Texas; and Lafayette, Louisiana.

For each of these nine localities, numerous archival sources were used in an attempt to compile the complete historical populations of newspapers. The cornerstones of this effort were compilations of library newspaper holdings put together by councils of librarians (British Museum 1905; British Library 1975; Brigham 1947; Lathem 1972; Gregory 1937) and

annual directories of advertising agencies (Rowell, various years; Ayer, various years). Numerous other area-specific sources were also used when available (Fernandez 1943; Galvan-Moreno 1944; Anonymous, n.d.; Duggett 1939; Tinker 1932; Grose 1977; Wheeler 1973; Taft 1964; Louisiana Historical Records Survey 1941; Historical Records Survey Program 1941; Historical Records Survey 1942). A more complete description of these sources and their quality can be found in Carroll (1987).

These sources generally provide an extraordinary degree of coverage of the industries studied. In most instances we have reason to believe that a fairly complete historical population has been assembled. The most glaring exception is Argentina, where the sources found cover systematically only the nineteenth century. There is also reason to believe that a few early newspapers in Ireland might have been excluded.

The coding procedures recorded every newspaper leaving a trace in the historical records. When available, the exact dates of a newspaper's founding and demise were coded.[6] In other cases, a paper's appearance and disappearance in a periodical directory was used to infer the approximate, usually annual, dates of founding and closure. When extreme uncertainty was encountered about one or the other dates, it was coded as missing. Table 1 gives a summary of the total number of newspapers recorded for each area as well as other information discussed below.

[Table 1 about here]

Density. A measure of density was constructed separately for each of the nine localities. Because of imprecision in many of the dates, this variable was calculated only on an annual basis. It counts the number of newspapers recorded as existing at any time during the year. In order to

avoid problems of endogeneity, the models we report below use this variable lagged one year--that is, one year prior to the events that are being predicted.

Figure 3 shows plots of newspaper density from 1800 to 1975 for each of the nine industries (see also Table 1 for descriptive statistics). Six of these exhibit the long-term concave pattern of growth and decline that motivated this paper. Of the other three industries, one (Argentina) is interrupted by a lack of data at what would appear to be its approximate peak, assuming that it follows the general pattern. The other two (Lubbock and Lafayette) have apparently been too sparsely populated to show any kind of discernible pattern.

[Figure 3 about here]

Industry Age. As Table 1 and the plots in Figure 3 indicate, the nine industries differ considerably in the date at which their first newspaper appears. We take these dates as the approximate beginnings of the separate industries. Accordingly, we constructed for each industry a variable called "industry age" by calculating for each spell the time (in years) elapsed from the date of its first recorded newspaper to the beginning of the spell. Although somewhat crude, we use this variable in the analyses below in order to control for the possible historical obsolescence of the newspaper organizational form (see Høyer 1975 for a similar argument). More specifically, we are interested in isolating the effects of density from general temporal trends. Given the temporal regularity of the density patterns observed above, this control seems especially pertinent.

Political Turmoil. Previous research on newspapers in Argentina, Ireland, and the San Francisco area shows that political turmoil coincides with increased foundings and that papers founded in turmoil-ridden periods have higher death rates (Carroll and Delacroix 1982; Delacroix and Carroll 1983; Carroll and Huo 1986). For our purposes here it is useful to think of political turmoil as an ephemeral resource that sustains a higher carrying capacity of newspapers. So in the analysis below we use as a control a dummy variable which indicates years of turmoil for these three areas.

Population Dynamics. Other important ephemeral resources presumably affect organizational foundings and closures rather quickly. For this reason, we also use the number of foundings and the number of closures in the immediately preceding year as controls. Consistent with previous findings, we use these variables in both their linear and quadratic forms (see Delacroix and Carroll 1983; Carroll and Huo 1986; Hannan and Freeman 1987). Models with these variables also allow the separation of the effects of transitory changes in density (due to foundings and closures in the prior year) from the effects of longer-term (presumably more systematic) changes in density. This separation is important because Delacroix et al. (1987) have argued that the effect of transitory population changes dominate those of density for business organizations.

V. Models and Methods

Models. The models we use are known as rate or hazard function models. They use as the dependent variable an unobservable construct called the instantaneous rate of transition. In formal terms, the rate is defined as

$$r(t) = \lim_{\Delta t \to 0} \frac{\Pr[\text{event between } t,\ t + \Delta t \mid \text{at risk at } t]}{\Delta t}$$

where Pr [·] is the probability of an event occurring in the interval between t and t + Δt given that the sample unit is at risk to experience the event (for further details see Tuma and Hannan 1984).

To model the founding process, we use the locality as the unit of analysis and treat foundings as events in a point process. We make the process a function of density and other variables by using Cox's (1975) proportional hazards model. Specifically, the model is

$$\lambda_i(t) = h(t)e^{c_1 X_{i1}(t) + \cdots + c_n X_{in}(t)} \qquad (8)$$

where h(t) is an unspecified disturbance and the X(t)'s are the covariates expected to affect the process.

For mortality, we use the Gompertz specification of the hazard function. This model is

$$\mu_j(t) = e^{d_1 X_{j1}(t) + \ldots + d_n X_{jn}(t)}\, e^{d_0 t} \qquad (9)$$

where d_o measures the effects of age dependence and the X(t)'s are again the covariates. This model has the advantage of parameterizing the effects of organizational age, which are expected to be negative because of the "liability of newness" (Stinchcombe 1965; Freeman et al. 1983).

Methods. Estimates of models for founding rates are obtained by analyzing the intervals between events with partial likelihood (Cox 1975). The observations are the durations between the foundings in the population. When more than one founding occurs within a year, the durations are allocated proportionally. Ordinarily, all but the last of the spells for each locality ends with an event; the last is censored on the right at the end of the observation period. In order to deal with

temporally changing covariates, durations that exceed one year are split into yearly segments so that covariates such as density can be updated to current values. Each of the "split" spells but the last (the one ending with a founding) is treated as censored on the right (see Tuma and Hannan 1984). Because all covariates are industry-specific and are treated as constant within years, the artificial ordering created by the assignment of founding dates within years of multiple foundings does not pose a problem.

In estimating models of mortality, we also use maximum likelihood procedures. The observations are the lengths of observed newspaper lifetimes and an index that distinguishes censoring on the right from mortality. In order to allow values of the covariates to vary over the lifetimes, we broke each newspaper's history into a sequence of yearly spells with all but the last spell censored on the right. Age of newspaper, age of industry, and the values of covariates are updated at the beginning of each year for each newspaper. However, all covariates are treated as constant within years.

Partial likelihood estimates for founding were obtained by using the routines in the BMDP computer package (Dixon 1981). Maximum likelihood estimates for mortality were found by using Tuma's (1980) special purpose program RATE.[7] The models were estimated without any constraints. The key issue in reviewing the estimates of the effects of density concerns whether the inequalities in (6b) and (7b) hold in strong statistical fashion.

VI. Findings

We first report estimates of the founding models and discuss their implications. We then turn to the mortality models. For both processes we begin with estimates of models with density (first and second-order terms), industry age and political turmoil (where available) as covariates. We then report estimates of models that include prior foundings and prior closures (both with first and second-order terms) as well.

Foundings. Table 2 contains the partial likelihood estimates of the founding models. For all nine industries, density has the expected nonmonotonic effect. Consistent with the predictions in (6b), the estimated coefficients of the first-order terms are positive and those of the second-order terms negative. After adjustment of the decimal on the second-order terms (to compensate for a prior adjustment for good estimation), the absolute magnitudes of the estimated coefficients agree with predictions as well. Moreover, for seven of the nine industries, the estimates for both of the density terms differ significantly from zero as well.

[Table 2 about here]

The control variables for ephemeral resources (political turmoil) and historical obsolescence of the form (industry age) also show strong significant effects. Industry age has a consistently negative effect on the founding rate, suggesting that entrepreneurial activities decline as the industries grow older. Political turmoil has positive effects,

consistent with previous research and with the view that selection in newspaper industries is partly shaped by larger political changes.

Table 3 also reports estimates of models that add effects of prior foundings and closures. While these measures of population dynamics occasionally have statistically significant effects, no consistent pattern is apparent in the estimates for either of them. Inclusion of these variables also does not alter much the previous estimates for the other variables, except that the second-order effect of density for Elmira is no longer significant. In general, the model of density dependence appears to behave as expected.

[Table 3 about here]

Just how strong is the effect of density? The plots in Figure 4 show the predicted effects of density on the baseline rates (using the significant estimates in Table 3) across the observed ranges of the density variables (enclosed by the vertical dotted lines). While the size of the multiplier effects varies considerably across the different industries, in every instance the predicted maximum effect of density falls well within the observed range. We conclude that the founding process for newspapers is typically density dependent and that it behaves in a manner consistent with the model of legitimation and competition discussed above.

Mortality.

Table 4 reports estimates of the models of organizational mortality. In all equations, the coefficient associated with age is negative and significant, thereby indicating a liability of newness. Industry age consistently shows a significant negative effect, suggesting that

industrial maturation implies something more than just historical obsolescence of the form (otherwise industry age would show positive effects). Political turmoil shows mixed results.

The effects of density are not consistent across industries. In eight of the twelve equations the predicted pattern of coefficients is found. However, these are statistically significant only for the San Francisco-Oakland-San Jose industry. Moreover, for two of the industries, Argentina and Shreveport, significant effects opposite of that predicted are found.

[Table 4 about here]

Table 5 reports estimates of models with the population dynamics variables reports. Although these variables often do not have significant effects, when they do the estimates consistently show the same pattern. For both prior foundings and prior deaths, the first-order terms are positive when significant and the second order terms negative.

Density effects also show a pattern once population dynamics are taken into account. In all but two industries, the predicted directions and absolute magnitudes of the coefficients are found. However, both the first-order and second-order terms are statistically significant only for the three largest industries, San Francisco-Oakland-San Jose, Argentina, and Ireland. We will discuss the possible reasons for the weaker (and occasionally reverse) effects for the other localities in the discussion section below.

[Table 5 about here]

Figure 5 shows plots of the predicted density effects for the three industries where they are significant (using estimates from Table 5).

Dashed vertical lines again enclose the observed ranges of density. Here the predicted inflection points of density all fall relatively near the observed peak value. Surprisingly, this suggests that the legitimation component of the density model dominates throughout most of the study period. Still, the significance of the second-order term suggests that competition is an important part of the evolution of these populations of organizations.

VII. Discussion

We began by identifying three general theoretical scenarios that might account for the rise and decline of organizational populations. They are: (1) the exploitation of ephemeral resources, (2) the obsolescence that comes from the historical specificity of organizational forms, and (3) the density dependent processes of legitimation and competition. Our study of nine newspaper industries focused on the last of these, although we did not completely ignore the other two scenarios.

The evidence we have examined points to the merit of all three types of explanations. Newspaper foundings and closures showed some sensitivity to political unrest and to recent fluctuations in prior foundings and closures. Similarly, both processes showed some dependence on the time elapsed since the emergence of the population. While turmoil and prior vital events are not perfect measures of ephemeral resources, and while industry age is not the most direct way to measure historical obsolescence, all these variables are plausible proxies. The encouraging--albeit occasionally inconsistent--performances of these

imperfect measures suggests to us that the underlying theoretical scenarios have predictive power and deserve more direct study in the future.

The strongest evidence we reviewed concerns density dependent processes of legitimation and competition. Even after controlling for ephemeral resources and historical obsolescence, organizational density consistently showed nonmonotonic effects of the kind predicted. For foundings, we found the expected pattern in all nine industries, although it was statistically significant in only seven. For mortality, the predictions were upheld in seven of the nine industries, but statistical significance for both relevant coefficients was found only in three. Comparison of these findings across the two types of processes suggests that nonmonotonicity in density dependence characterizes founding processes more consistently than mortality processes. The pattern of effects suggests that legitimation affects both founding rates and mortality rates strongly, but that competition has more powerful effects on founding than on mortality.

While we think that these findings are strong enough to stand on their own, we also believe that it is possible to account for the non-significant estimates in some of the industries. We offer several plausible explanations. First, note that the estimates for the largest industries are always significant and that the non-significant estimates usually are found for all industries below some certain size level. This pattern suggests that density dependence might operate only in populations which become large and crowded. Second, the smaller industries are all relatively small metropolitan areas of the U.S. Since these areas are the

most likely to be penetrated by outside media and newspapers, it could be that these industries are not as autonomous as the others. In other words, local density may not be the proper specification of the model for these industries. Third, several of the smaller industries began later than the others. This suggests that the population's development may be truncated by the research design and that the competition process has yet to dominate. The late starting date of the San Francisco industry indicates that this is a partial explanation at best. Fourth, the lack of significance is most prevalent for the U.S. localities in the mortality models where the predicted initial effect of density is to lower closure rates via increased legitimacy. Undoubtedly, some--and perhaps the most important--legitimacy battles were fought at the national rather than the local level. If so, this would suggest that many local American industries began with substantial although varying (depending on date of initiation) levels of legitimacy. Fifth, while American metropolitan areas seem to bound newspaper markets for advertising and circulation fairly well, the high levels of human migration suggest that there may have been considerable diffusion of labor and culture across markets. Such transfers likely affected indigenous processes of legitimation and competition.

Finally, we address the question of why does the number of organizations matter? A general answer has been put forth by Hannan and Freeman (forthcoming), who argue that density implies diversity and that modern societies facing uncertain futures are better off when they retain diverse organizational solutions to problems. Here we focus on the roles of density and diversity in newspapers. As is well known, the primary

policy concern of social critics of the press is about ownership concentration (see Compaine 1979). The usual argument is that concentration is unhealthy, especially for democratic societies, because information is controlled by only a few persons or institutions. From this perspective, the crucial policy variable is the number of independent editorial voices in a market--in other words, density.

Yet density and diversity are two separate issues. While density in the American press has declined throughout much of the twentieth century, it also appears that this has occurred hand-in-hand with a process of diversification involving smaller, specialized newspapers (see Carroll 1987). The relevance of these developments to the policy debate depends in part on one's predisposition towards different forms of editorial diversity. If one supports a type of diversity where a range of general opinions each reaches a large audience, then recent developments are probably distressing. If, however, one supports diversity of a kind where strong, closely-held opinions each reach separate small interested audiences, then the current situation seems better. So although our models speak to the issues which concern policy analysts, we do not think they address directly the most relevant factors. For this, additional research on diversity and the specialized press is needed.

NOTES

1. In a similar line of argument, Scott (1987) has recently suggested that it is more useful to think of variations in the strength of institutional and competitive sectors across organizational settings rather than thinking of discrete sectors.

2. This assumption requires that the capacity of the social system to sustain organizations of the type under study have been taken into account.

3. Hannan and Freeman (1987, forthcoming) report that models in the form of (4a) fit better than those in the form of (5) for founding rates of American national labor unions and for rates of entry of firms in the semiconductor industry. As should be obvious by now, the two models differ little in terms of substantive conclusions. For the most part, they are simply alternative ways to develop parametric specifications of the argument.

4. In order to focus on the central issues of the paper, we drop here the notation for the functions summarizing environmental conditions. In the empirical analysis below, however, we will not ignore or omit environmental factors.

5. By these views, it is remarkable that so many of the findings from these limited research designs show estimates consistent with predictions from the model. It is partly because of this robustness that we do not believe the model should be discarded for particular organizational forms at this time.

6. The sources usually give dates based on the life histories of newspapers rather than publishing firms. Most of the time there is a strong correspondence between the two although occasionally there may not be. For Argentina and Ireland, we had no additional information and thus were forced to use the dates as given. For the American cities, we often had additional information which allowed for construction of some dates at the firm level.

7. Our use of two different but conceptually similar models and estimators may strike some readers as odd, especially since the Cox model is apparently a more general formulation of the Gompertz. The decision rests on technical complications created by the need to measure time-varying covariates on a regular annual basis. More specifically, the major complication is that by breaking the mortality observations into one-year spells, most events have "tied" waiting times of one year. Under such conditions, age is automatically factored out of the nuisance function and the model with age as a covariate reduces to a Gompertz-like specification. The "tie breaking" procedure of the partial likelihood algorithm we use does not seem to be the best way to estimate such a model. Nor does it seem advisable to use such an algorithm with data containing so many ties. Consequently, for the mortality models we use maximum likelihood procedures which are not based on order statistics and which are therefore much less sensitive to the number of tied waiting times. For assurance, we have taken the precaution of estimating the founding models with maximum likelihood procedures (assuming both a constant rate and a Gompertz specification) and the mortality models with partial likelihood procedures. In general, the estimates obtained for

density using these different procedures do not alter the substantive conclusions discussed below, although the specific point estimates of coefficients do change.

Figure 1. Predicted Relationships Between Density and Legitimacy and Competition

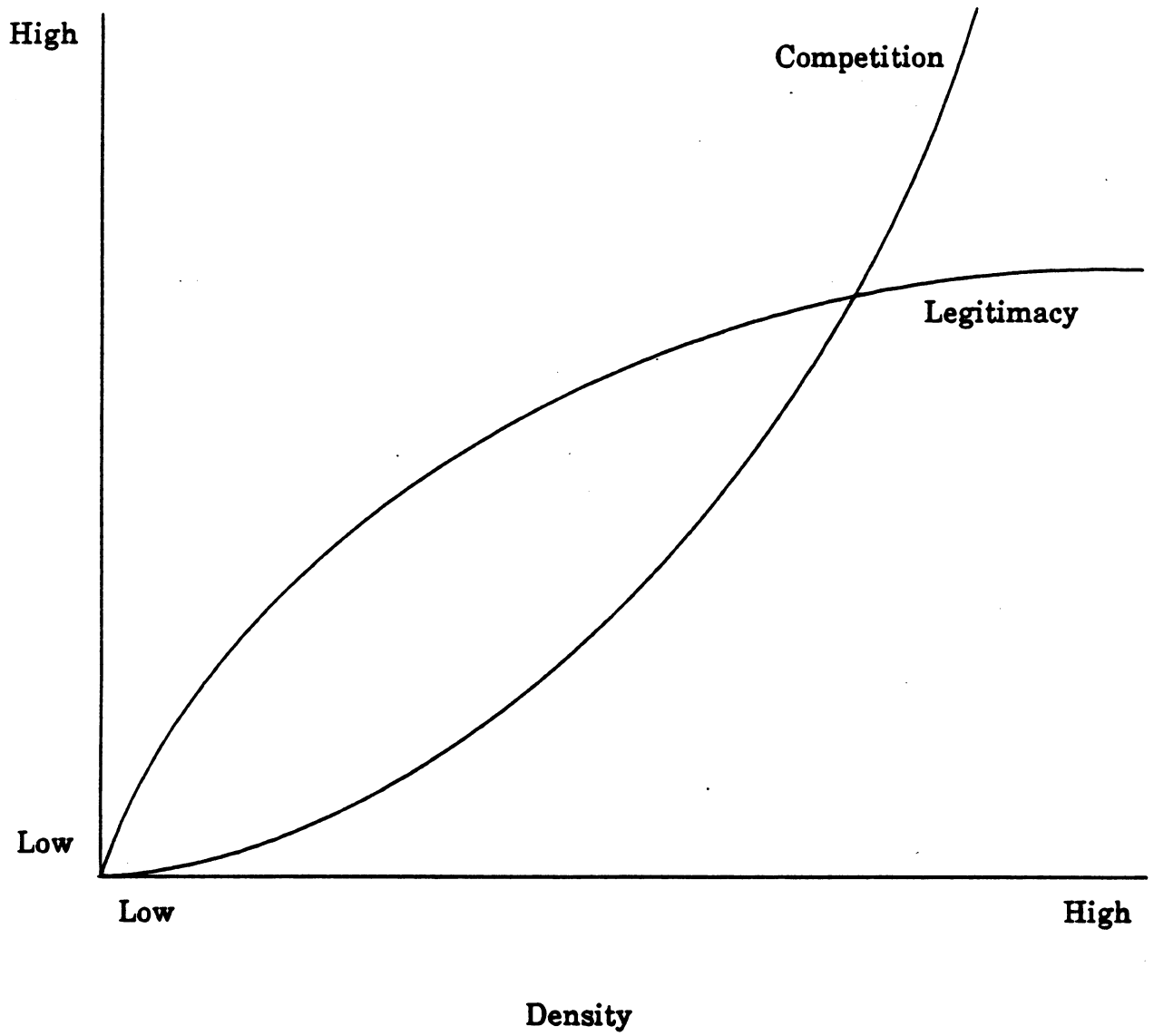


Figure 2. Simplified Diagram of Relationships Implied by the Density Model

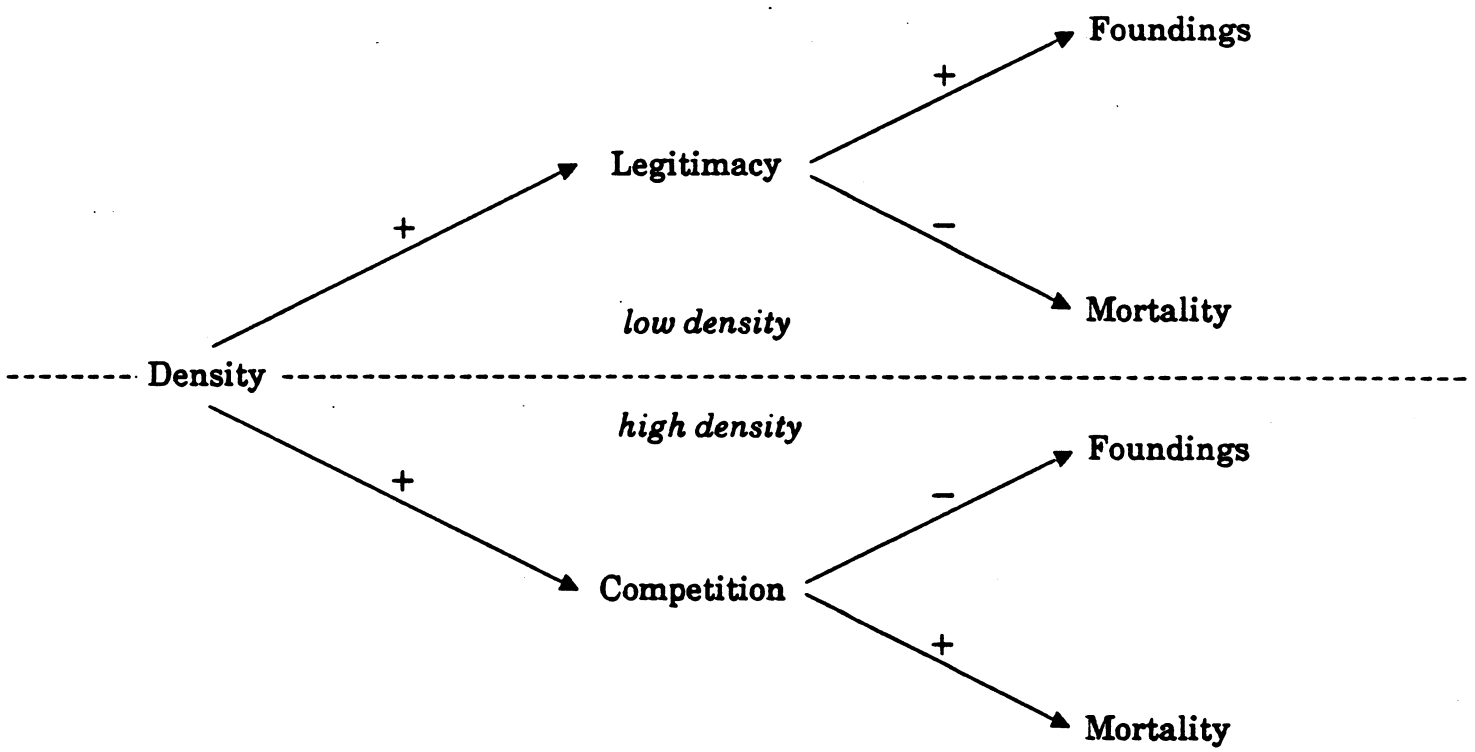
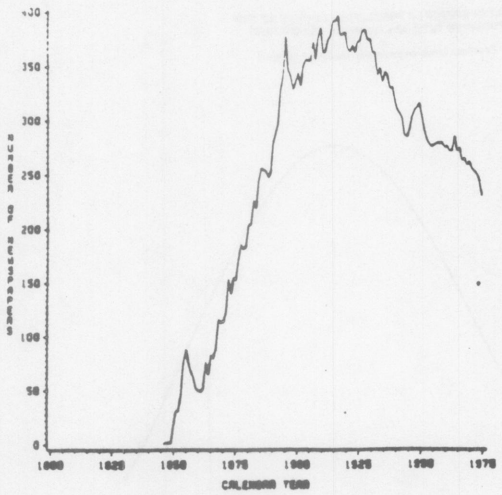
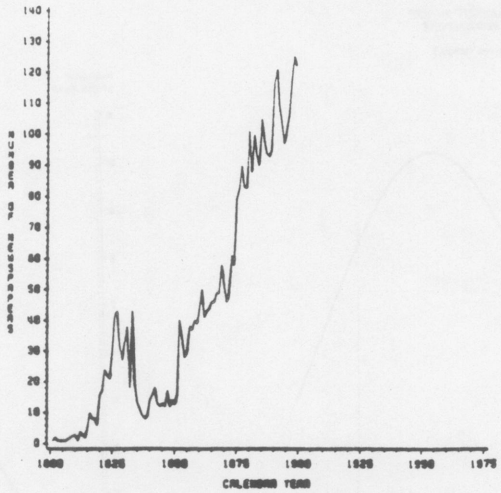


Figure 3. Newspaper Density From 1800 to 1975 in Nine Industries

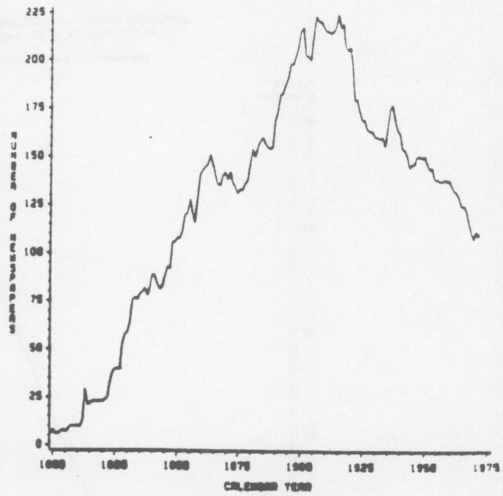
San Francisco Area



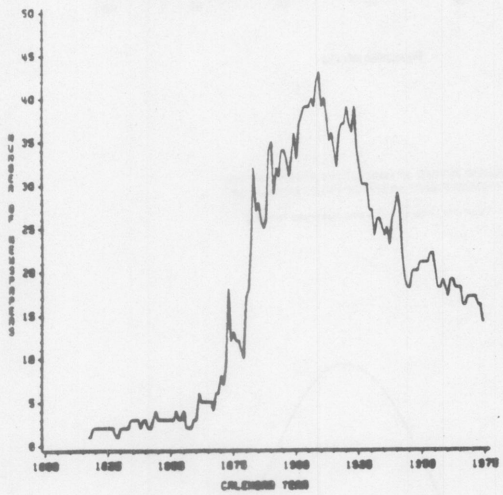
Argentina



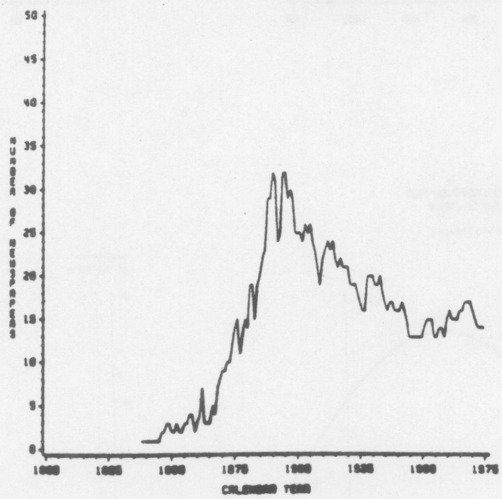
Ireland



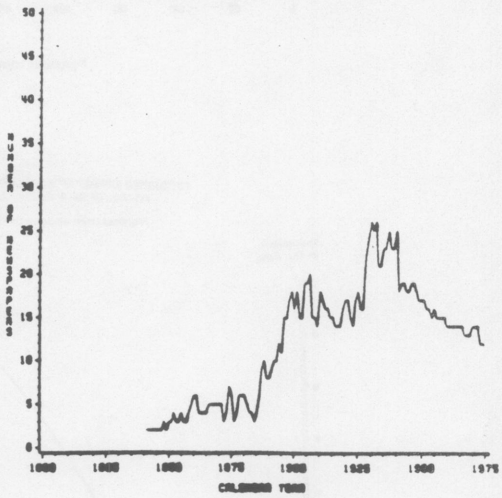
Little Rock



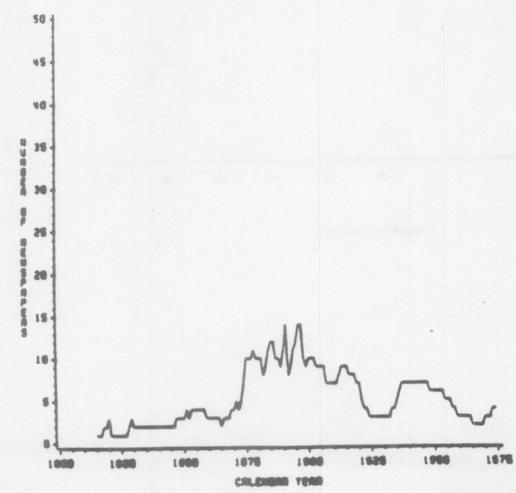
Springfield



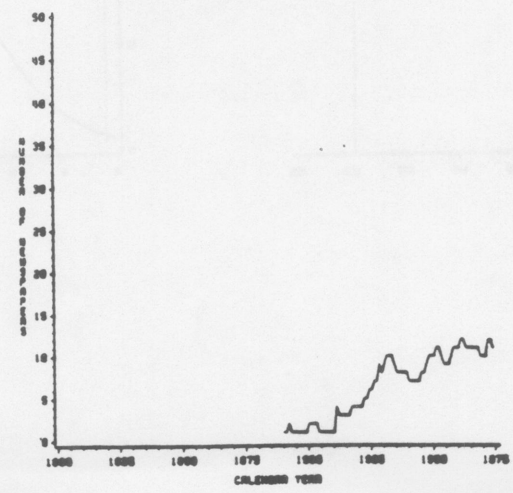
Shreveport



Elmira



Lubbock



Lafayette

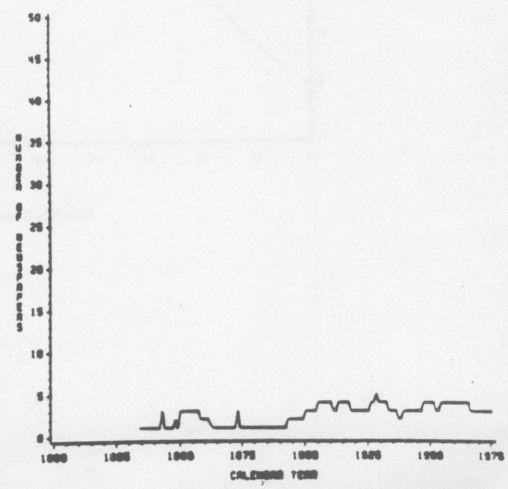
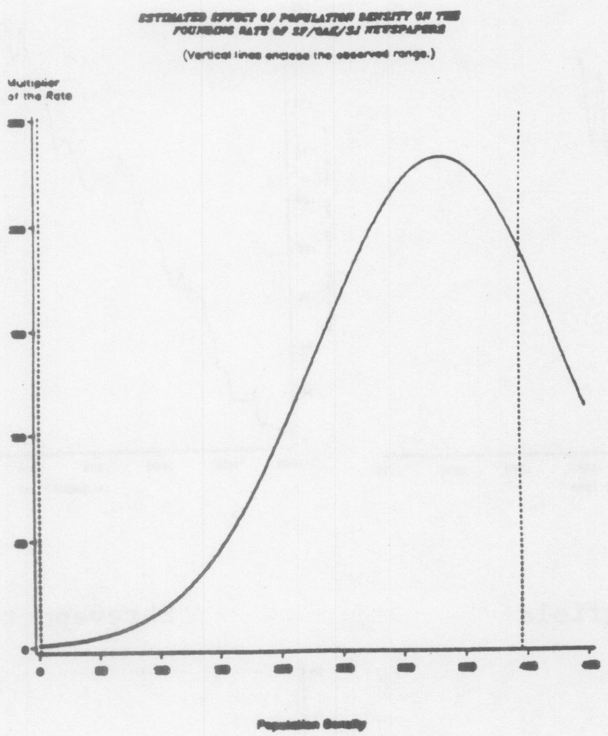
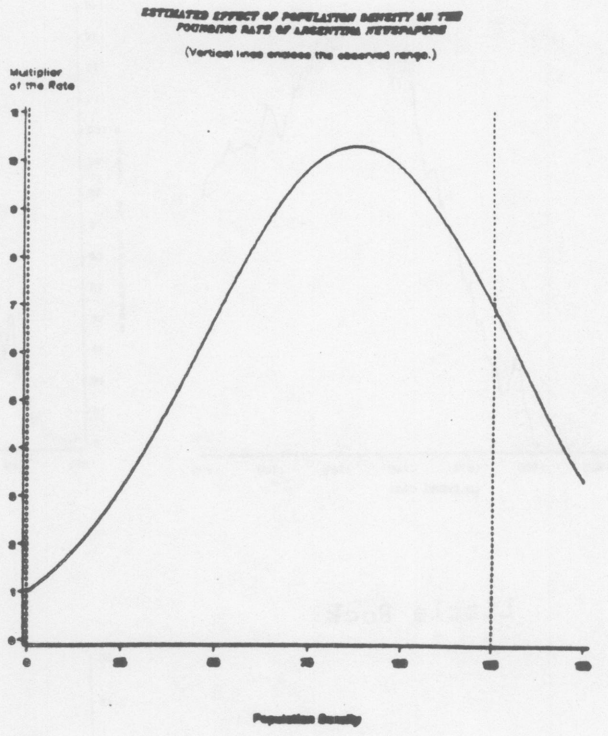
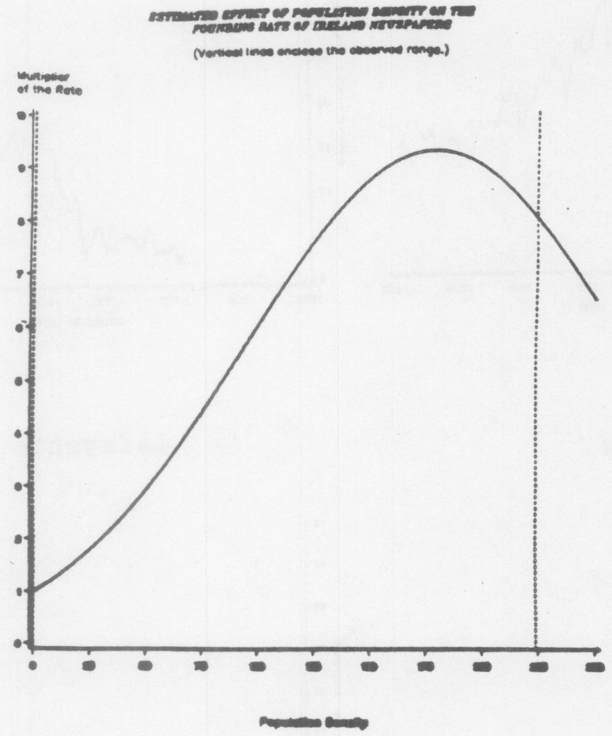


Figure 4. Estimated Effects of Density on Founding Rates







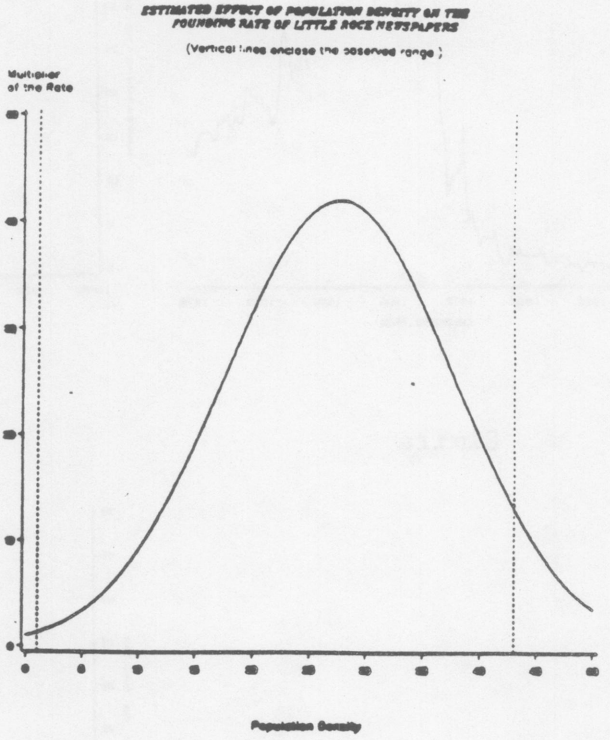
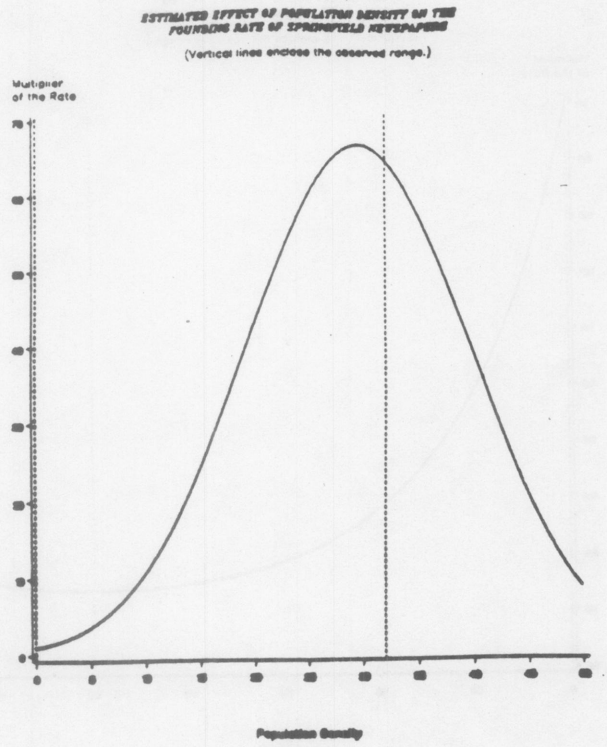
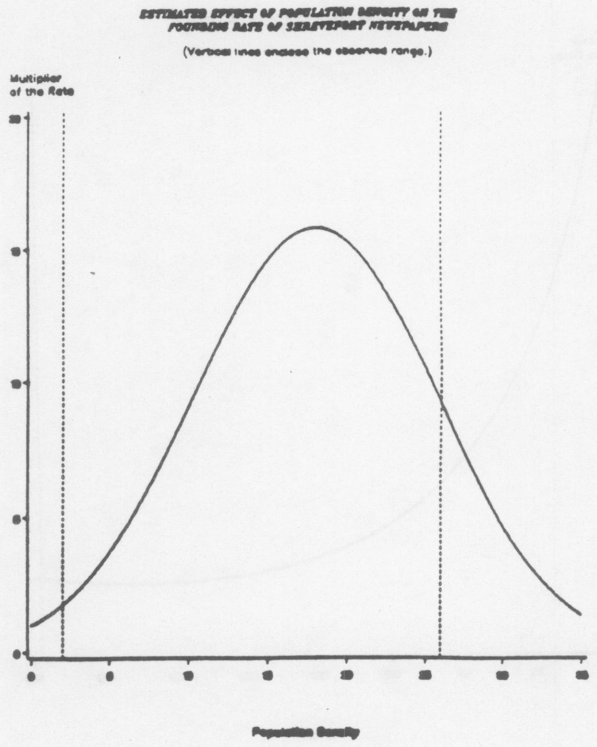


Figure 4. (continued)





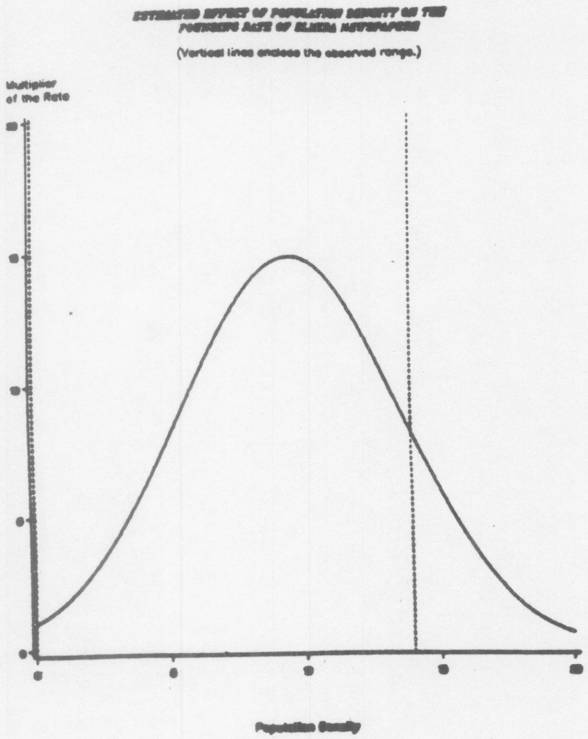
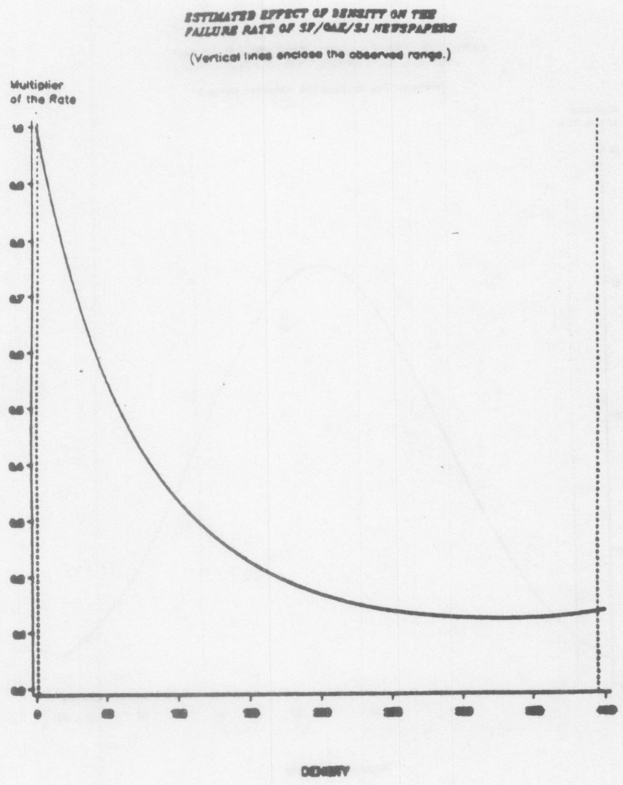
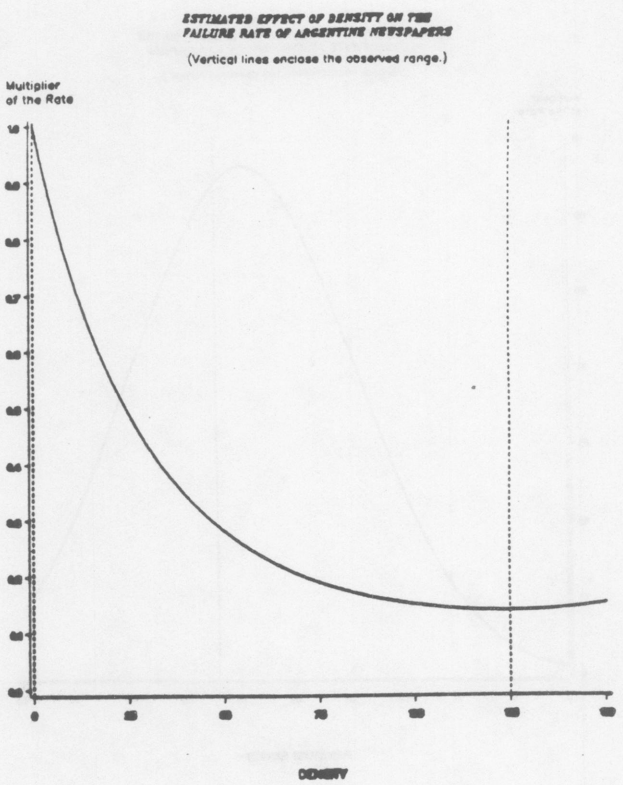


Figure 5. Estimated Effects of Density on Death Rates





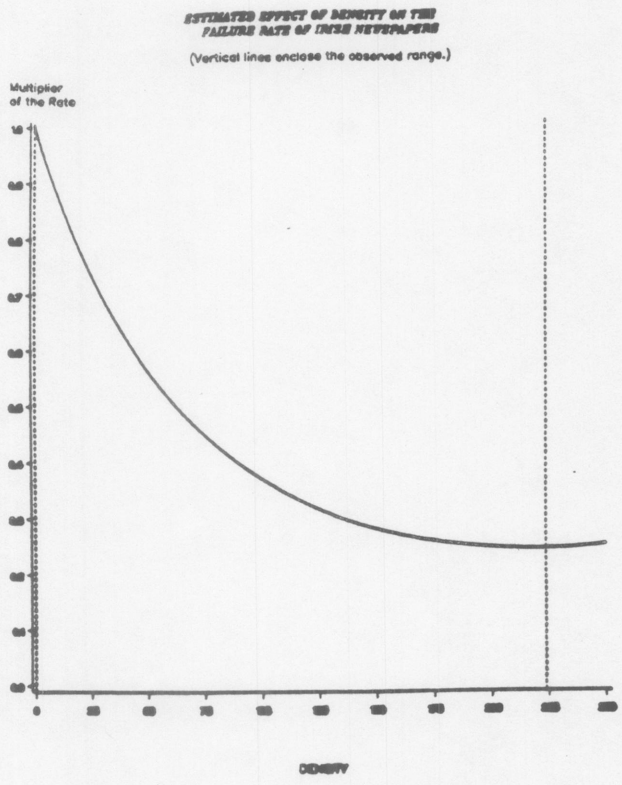


Table 1. Summary of Nine Organizational Populations of Newspapers

Location	*Approximate Beginning Date*	*End of Observation*	*Total No. of Newspapers*	*Peak Number*	*Date of Peak*	*Curvilinear Temporal Trend*
San Francisco-Oakland-San Jose	1845	1975	2169	395	1916	Yes
Argentina	1800	1900	1453	125	1898	No
Ireland	1800	1975	996	224	1914	Yes
Little Rock	1815	1975	220	43	1909	Yes
Springfield	1835	1975	161	32	1894; 1895	Yes
Shreveport	1840	1975	108	26	1932	Yes
Elmira	1815	1975	55	14	1891	Yes
Lubbock	1890	1975	26	12	1961; 1962; 1972; 1973	No
Lafayette	1835	1975	19	5	1928	No

Table 2. Partial Likelihood Estimates of Effects of Density on Rate of Newspaper Founding (Standard errors shown in parentheses.)

Location	*Density*	*Density²/100*	*Industry Age*	*Political Turmoil*	X^2	*D. F.*
San Francisco-Oakland-San Jose	.031* (.001)	−.0047* (.0002)	−.045* (.001)	.117* (.053)	1219.	4
Argentina	.090* (.005)	−.047* (.003)	−.017* (.003)	1.10* (.064)	651.	4
Ireland	.040* (.003)	−.011* (.001)	−.011* (.001)	.658* (.068)	431.	4
Little Rock	.280* (.032)	−.484* (.067)	−.026* (.003)		124.	3
Springfield	.215* (.047)	−.277* (.122)	−.032* (.005)		124.	3
Shreveport	.346* (.078)	−.917* (.266)	−.023* (.005)		27.8	3
Elmira	.604* (.212)	−2.90* (1.44)	−.018* (.005)		24.8	3
Lubbock	.438 (.291)	−3.78 (2.06)	.003 (.025)		3.46	3
Lafayette	.334 (.965)	−18.5 (21.6)	.000 (.009)		5.74	3

*$p < .05$ (two-tailed test)

Table 3. Partial Likelihood Estimates of Effects of Density and Population Dynamics on the Rate of Newspaper Founding (Standard errors shown in parentheses.)

Location	*Density*	*Density²/100*	*Industry Age*	*Political Turmoil*	*Prior Foundings*	*Prior Foundings²*	*Prior Closures*	*Prior Closures²*	X^2	*D.F.*
San Francisco-Oakland-San Jose	.033* (.002)	−.005* (.0003)	−.047* (.002)	.138* (.055)	.012 (.010)	−.0001 (.0002)	−.050* (.010)	.001* (.000)	1272.	8
Argentina	.053* (.009)	−.030* (.005)	.001 (.004)	1.03* (.070)	−.157* (.024)	.003* (.001)	.170* (.025)	−.003* (.001)	870.	8
Ireland	.025* (.003)	−.007* (.001)	−.006* (.001)	.567* (.070)	.227* (.029)	−.008* (.002)	.003 (.030)	−.002 (.002)	557.	8
Little Rock	.271* (.040)	−.491* (.080)	−.024* (.004)		.142 (.109)	−.024 (.013)	−.166 (.089)	.050* (.013)	342.	7
Springfield	.285* (.055)	−.484* (.144)	−.035* (.006)		−.162 (.133)	.036* (.017)	−.197 (.112)	.029* (.010)	179.	7
Shreveport	.306* (.088)	−.848* (.284)	−.019* (.006)		.184 (.175)	−.007 (.032)	−.011 (.205)	−.004 (.046)	32.3	7
Elmira	.566* (.234)	−2.97 (1.66)	−.015* (.006)		1.08* (.457)	−.326 (.198)	−.376 (.458)	.137 (.170)	35.0	7
Lubbock	.483 (.302)	−3.76 (2.06)	−.004 (.029)		−.546 (1.09)	.301 (.702)	−.220 (.619)		3.83	6
Lafayette	.295 (.982)	−19.1 (21.7)	.002 (.009)				.872 (.648)		7.54	4

*$p < .05$ (two-tailed test)

Table 4. Maximum Likelihood Estimates of Effects of Density on Rate of Organizational Mortality (Standard errors shown in parentheses.)

Location	*Age*	*Constant*	*Density*	*Density²/100*	*Industry Age*	*Born in Political Turmoil*	X^2	*D. F.*
San Francisco-Oakland-San Jose	−.063* (.002)	−3.19* (.127)	−.015* (.001)	.0025* (.0002)		.022 (.053)	2023.	4
San Francisco-Oakland-San Jose	−.062* (.002)	−3.70* (.140)	−.004* (.001)	.0006* (.0003)	−.013* (.001)	−.135* (.055)	2171.	5
Argentina	−.235* (.012)	.174 (.112)	−.003 (.004)	−.0028 (.003)		.262* (.061)	1236.	4
Argentina	−.226* (.012)	.410* (.119)	.011* (.005)	−.0072* (.003)	−.014* (.003)	.151* (.065)	1263.	5
Ireland	−.029* (.002)	−2.40* (.176)	−.001 (.003)	.0001 (.0009)		.053 (.070)	357.	4
Ireland	−.030* (.002)	−2.50* (.187)	−.003 (.003)	.0007 (.001)	.002 (.001)	.052 (.070)	359.	5
Little Rock	−.077* (.008)	−3.98* (.315)	.092* (.037)	−.1804* (.0753)	−.023* (.003)		284.	4
Springfield	−.090* (.009)	−3.43* (.410)	−.030 (.055)	.2047 (.1386)	−.023* (.004)		335.	4
Shreveport	−.097* (.013)	−4.98* (.509)	.245* (.086)	−.5780* (.2692)	−.029* (.006)		166.	4
Elmira	−.063* (.012)	−4.41* (.644)	−.141 (.194)	1.640 (1.190)	−.012* (.006)		90.3	4
Lubbock	−.114* (.033)	−2.59* (.883)	−.485 (.337)	6.573* (2.721)	−.082* (.028)		40.3	4
Lafayette	−.072* (.027)	−7.85* (3.03)	1.56 (2.01)	−10.53 (33.09)	−.016 (.010)		22.5	4

*$p < .05$ (two-tailed test)

Table 5. Maximum Likelihood Estimates of Effects of Density and Population Dynamics on the Rate of Organizational Mortality (Standard errors shown in parentheses.)

Location	*Age*	*Constant*	*Density*	*Density²/100*	*Industry Age*	*Born in Political Turmoil*	*Prior Foundings*	*Prior Foundings²*	*Prior Closures*	*Prior Closures²*	X^2	*D.F.*
San Francisco-Oakland-San Jose	-.062* (.002)	-3.85* (.165)	-.013* (.002)	.0020* (.0003)	-.003 (.002)	-.140* (.055)	.013 (.010)	.0002 (.0002)	.047* (.011)	-.001* (.000)	2239.	9
Argentina	-.214* (.012)	.037* (.157)	-.032* (.008)	.0130* (.0045)	.002 (.003)	.013 (.067)	-.011 (.024)	.0003 (.0005)	.076* (.023)	-.0009 (.0005)	1336.	9
Ireland	-.029* (.002)	-3.07* (.233)	-.013* (.004)	.0028* (.0012)	.005* (.001)	.027 (.070)	.025 (.028)	.0003 (.0015)	.152* (.029)	-.0055* (.0016)	422.	9
Little Rock	-.076* (.008)	-4.26 (.339)	.003 (.043)	-.0454 (.0828)	-.013* (.004)		.428* (.124)	-.0405* (.0147)	.048 (.082)	.0031 (.0075)	304.	8
Springfield	-.090* (.009)	-3.35* (.423)	-.073 (.060)	.3514* (.1642)	-.021* (.005)		.145 (.144)	-.0173 (.0177)	-.095 (.119)	-.0008 (.0118)	339.	8
Shreveport	-.097* (.013)	-5.17* (.531)	.177 (.095)	-.4387 (.2776)	-.022* (.007)		.543* (.246)	-.0997 (.0570)	.058 (.221)	-.0259 (.0511)	173.	8
Elmira	-.063* (.015)	-4.40* (.679)	-.248 (.221)	2.214 (1.440)	-.010 (.006)		1.20* (.557)	-.4352 (.2406)	-.613 (.550)	.1494 (.1724)	98.4	8
Lubbock	-.114* (.033)	-2.63* (.930)	-.539 (.360)	6.622* (2.743)	-.076* (.037)		-.233 (1.28)	.3719 (.660)	.006 (.660		41.6	7
Lafayette	-.072* (.027)	-7.97 (3.11)	1.81 (2.08)	-20.01 (34.72)	-.018 (.010)		2.56 (3.16)	-3.098 (31.52)	.780 (.833)		24.3	7

*$p < .05$ (two-tailed test)

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