THE EMERGENCE OF NEW ORGANIZATIONAL POPULATIONS: MEDIA LEGITIMATION EFFECTS IN THE BROADBAND INTERNET ACCESS INDUSTRY

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ABSTRACT

Building on the tradition of research in organizational ecology and institutional theory, this article extends our understanding of how legitimacy contributes to the creation of new organizational populations. Ecologists have observed that both legitimacy and competition operate through density-dependent processes to affect patterns of organizational foundings. Drawing on Aldrich and Fiol (1994), we argue that new populations form from the influence of cognitive and sociopolitical legitimacy arising around communication and information exchange among industry participants. Using data on the emergent stage of development of the broadband Internet access industry, we develop and test a media coverage model of population entry rates, assessing how the legitimacy effects of various forms of media coverage affect entry rates in the growing population. While the study found significant support for both density-dependent and media-based models of legitimacy effects when treated individually, when taken together density-dependent effects became insignificant, demonstrating the strong influence of the ongoing dialogue occurring among population participants as a factor in population emergence, and strongly suggesting a complex set of interrelationships between different aspects of legitimacy.

"And it ought to be remembered that there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, then to take the lead in the introduction of a new order of things."

—Machiavelli's *The Prince*

The highly dynamic, technologically-driven competitive environment confronting organizations today requires greater interest in and a research focus on the subject of industry creation and entrepreneurship. Aldrich and Fiol (1994) observed that a fundamental problem facing innovators and entrepreneurs in nascent industries is the lack of legitimacy of new technologies, firm strategies, and organizational forms which could be used to obtain needed resources and support. The rise of the personal computer industry in the late 1970s and early 1980s, and the subsequent emergence from the 1990s onward of related technologies involving the Internet fueled waves of new forms of business centered on telecommunications and information systems. Along with this, financial markets and governmental regulators have struggled in evaluating these new industries. Lacking the institutional supports of more established business forms, emerging industries present a variety of challenges to participants that do not appear in more mature areas of activity—new forms of organizational activity do not fit neatly into existing categories of acceptable business practice, patterns of seemingly appropriate behavior have yet to appear, and regulatory structures have not developed. In order to fully understand the creation of new populations of organizations, a clearer understanding of how legitimacy arises during the earliest moments of industry formation must be achieved. The purpose of this study is to examine how different dimensions of legitimacy influence the dynamics of activity in new organizational populations and to propose ways in which these

concepts can be measured and the relationships between them tested, in a way which advances established research in both organizational ecology and institutional theory.

Legitimacy has been of significant interest in two major areas of organizational research: organizational ecology and institutional theory. Organizational ecologists, using the density-dependence model of legitimacy (Hannan, 1991; Hannan and Carroll, 1992; Hannan and Freeman, 1987; Hannan and Freeman, 1988), have inspired a large stream of research on the pattern of founding and failure rates in organizational populations over time, and produced a number of valuable insights and findings. Institutional theory research identifies legitimacy by the degree to which organizations conform in a number of ways to regulatory or legal pressures, a shared sense of value or expectation, or socially constructed categories of meaning (Scott, 1995: 45-47). What is evident from both research traditions is that each shares an interest in how the social environment of organizations affects the character or composition of organizational groups (i.e., industries, populations, or fields).

Despite this shared interest in the legitimacy concept, both institutional theory and organizational ecology differ in their views of the legitimacy concept and how that concept appears in empirical research. The result has been a schism between the two theoretical traditions on a concept that each field shares (Carroll and Hannan, 1989a, 1989b; Zucker, 1989; Hannan, Carroll, Dundon, and Torres, 1995; Baum and Powell, 1995; Hannan and Carroll, 1995). Much of the concern centers on accurately portraying the complexity of the legitimacy concept, and the difficulty in measuring it and its influence on population processes. From the ongoing debate and commentary in the literature, a number of observations can be made about how they approach legitimacy.

First, the true complexity of the legitimacy concept has not been fully explored, particularly its multidimensional character. This has been particularly problematic in the organizational ecology literature, where the density of an organizational form (the number of instances of a particular organizational form in existence at a certain time) is used as an indicator of the legitimacy of that form. In most studies, legitimacy refers simply to "taken-for-grantedness." Baum and Powell (1995) noted that legitimacy is a multidimensional concept, and many factors beyond density can contribute to legitimacy. Delacroix and Rao (1994) claimed that density itself is subject to a number of independent factors, each with their own dynamics and effects on the organizational population.

Second, each field of research has observed that the other has missed a critical step in analyzing the impact of legitimacy: each has not effectively operationalized the legitimacy concept despite its importance. For instance, while population ecology and institutional theory make substantial contributions to the understanding of organizations, the exchange between Carroll and Hannan (1989a, 1989b) and Zucker (1989) resulted in a realization that research in both fields typically do not directly measure legitimacy and instead rely on inferences drawn from other more readily observable phenomena. For ecologists, more direct measurement of the legitimacy concept is avoided because of a belief in its fundamentally unobservable character (Carroll and Hannan, 1989b) and the assumption that it is controlled by easily observed measures of organizational density (Hannan, 1989, 1991). For institutional theorists, legitimacy of organizational practices are explained by the effects of macro-level actors or events on the adoption of activities at lower levels of analysis.

Finally, the concept of legitimacy lacks a strong connection to action and change occurring among industry actors. This occurs because of the highly abstract nature of the

elements involved and the emphasis on explaining stability, conformity, and order (Giddens, 1979 and 1984; Hybels, 1995; Sewell, 1992). It is clear that many organizations are not simply passive actors; they play a role in the maintenance of their own legitimacy within an industry (Ashforth and Gibbs, 1990; Elsbach, 1994; Oliver, 1991 and 1997). What is less clear is how legitimacy develops not just for individual organizations but for new organizational forms—at the creation of an industry, when density is low it may not fully capture that developmental process.

This study contributes to this debate in a number of ways. After a discussion of the organizational ecology perspective, different dimensions of legitimacy identified in the literature will be discussed. Building on the framework initially presented in Aldrich and Fiol (1994) and further developed in Aldrich (1999), the legitimacy concept will be discussed in terms of its cognitive and sociopolitical dimensions. Motivated by suggestions from Baum and Powell (1995), and recent work by Hoffman and Ocasio (2004) and Pollock and Rindova (2003), new ways of operationalizing those attributes of legitimacy will also be identified, by tapping into industry discourse through news media sources rather than organizational density. By separating legitimacy into component dimensions, each can be independently assessed for its effect on organizational populations. Finally, these new measures of legitimacy will be included in a model of new market entry rates in the context of the emergence of the broadband Internet access industry from the years 1993 to 2000. The broadband access industry is ideal for this study for a number of reasons. First, the industry arose at the intersection of a number of different actors and interests, including both broadly diversified telecommunications industry players and broadband industry specialist firms, networking and computing industry companies, regulatory entities, and consumers. The legitimacy of the industry would ultimately be shaped by the interaction of this

diverse set of influences. Second, the legitimacy of the industry would be influenced by a competition over the utility of broadband in a variety of different applications (e.g., high-speed access to Internet, enhanced video services, new telephone functions, or other yet-to-be developed applications).

THEORY AND HYPOTHESES

Density-Dependent Model of Legitimacy and Competition

Organizational ecology has made major contributions to the study of legitimacy and its impact on the historical development of industries and organizational populations. The density-dependence model of legitimation and competition, initially developed by Hannan, Freeman, and Carroll (Hannan and Freeman, 1987 and 1988; Carroll and Hannan, 1989a; Hannan and Carroll, 1992), describes the relationship between the prevalence of a particular organizational form, referred to as the *density* of that organization type, to legitimacy and competition effects occurring within that group of organizations. Initial increases in the number of firms in an emergent population contribute to the legitimacy of a new organizational form by signaling to potential entrepreneurs that opportunities exist and that resources are available for the formation of new firms; as density increases the rate of founding initially increases along with it. At higher levels of organizational density, rivalry increases in intensity as existing firms compete over increasingly scarce resources. High density levels then signal to potential entrants that opportunities are being competed away by the large number of firms already in the environment. As the density of firms increases, competition effects dominate the activity occurring within the population leading to a decrease in the founding rate.

The combination of legitimacy and competition effects produced by the density level of an organizational form create and inverted U-shaped relationship between density and founding rates. Support for this relationship between founding and entry rates and density has been reported in many organizational populations, including labor unions (Hannan and Freeman, 1987), newspapers (Carroll and Hannan, 1989a; Delacroix and Carroll, 1983), breweries (Carroll and Swaminathan, 1991; Carroll and Wade, 1991; Carroll, Preisendoerfer, Swaminathan, and Weidenmayer, 1993), New York life insurance companies (Budros, 1994), Toronto day care centers (Baum and Oliver, 1992; Baum and Singh, 1994), national automobile industries (Rao, 1994; Hannan et al., 1995), savings and loan associations (Haveman, 1993), and trade associations (Aldrich, Zimmer, Staber, and Beggs, 1994), just to name a few.[1]

Carroll and Hannan (2000) broadened the application of the model of density-dependent legitimacy and competition by highlighting the variety of ways the density-dependence model of legitimacy-competition could be applied depending on how population density is operationalized and what is considered the relevant founding events. For instance, founding events typically consist of true *de novo* organizational start-ups, but may also include spin-off firms split from larger parent entities, and *de alio* entries created from diversification strategies or complete migrations of firms from one population to another (Carroll and Hannan, 2000: 41-43). An example of density-dependent processes operating in the context of organizations entering from other organizational populations is seen in Haveman's (1993) study of diversification and market entry in a population of savings and loan associations. She proposed that the dynamics of legitimation and competition described by population ecology also apply to change in existing organizations, such as firm entry into new product markets, and found support for the inverted

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[1] Two recent and comprehensive reviews describing the variety of studies that have been conducted testing the density-dependence model include Baum (1996) and Carroll and Hannan (2000).

U-shaped relationship predicted by the density-dependent legitimacy and competition thesis. The implication is that density contributes to the dynamics of legitimacy and competition regardless whether it is the product of entrepreneurial foundings or entries from neighboring industries.

Carroll and Hannan (2000: 51-54) also note that there exist a wide variety of possible units of analysis of interest, beginning at the establishment level—where entry events and density correspond to operational entities within firms—to the organizational level—in which entry events and density correspond to the number of active organizations present. This allows considerable flexibility and choice in the application of the density-dependent model by organization theorists. Study of the appropriate unit of analysis should provide an accurate depiction of the processes in which legitimacy is generated and competitive rivalry operates occurring in the population.

Therefore, in general the entry rate could include both foundings by completely new organizations and entries by existing ones in other industries, with entry rate and density cast at the establishment or organizational unit of analysis, the specific choice of each depending on the context of a particular study:

Hypothesis 1: The entry rate has an inverted U-shaped relationship with the population density.

Hypothesis 1a: The legitimacy of a population positively affects the rate of entry.

Hypothesis 1b: Competition effects within a population negatively affect the rate of entry.

Cognitive and Sociopolitical Legitimacy Effects of Media Coverage

Cognitive and sociopolitical components of legitimacy. Despite the widespread support for and usefulness of the findings of ecology research, there remain some difficulties in using the

density-dependence model in understanding the works of legitimacy processes in populations. One problem involves the use of one variable—population density—as an indicator for legitimacy. It is common in organizational research to distinguish between legitimacy stemming from taken-for-grantedness versus legitimacy arising from normative approval, relational support, and regulatory or political evaluation (Scott, 1995: 35-47). For instance, the impact of legitimacy has been described as coming from a basic recognition or acceptance of an organizational form or behavior (Berger and Luckmann, 1966; Zucker, 1977; Meyer and Rowan, 1983), the perceived value of the form to organizational members and the community (Selznick, 1949; Selznick, 1957; Zald and Denton, 1963), and the approval and sanction of other social entities (Meyer and Scott, 1983; DiMaggio and Powell, 1983). Recognizing the multitudinous ways in which legitimacy has been conceptualized, Suchman offered an inclusive definition of legitimacy as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (1995: 574).

These images of legitimacy illustrate both *cognitive* and *sociopolitical* dimensions of the legitimation process, each of which act together to influence the creation of new organizational forms and change in existing populations (Aldrich and Fiol, 1994; Aldrich, 1999). The quality of "taken-for-grantedness" is the key description of cognitive legitimacy, and Aldrich noted that at its highest level "a new product, process, or service is accepted as part of the sociocultural and organizational landscape" (1999: 230). Sociopolitical legitimacy reflects the attainment of acceptance by critical environmental entities or conformity to socially constructed standards of behavior or legally established codes of conduct. The cognitive dimension of legitimacy achieves its authority by its unquestioned character in the minds of individuals, while the sociopolitical

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dimension depends largely on the influence of shared values and norms in creating and sustaining stable patterns of organizational activity.

While organizational ecology studies also distinguish between cognitive and sociopolitical legitimacy processes, some have argued that by focusing on density-dependence it tends to emphasize cognitive legitimacy in the development of organizational populations. Sociopolitical factors are largely viewed as driven by density-dependent processes (Hannan and Carroll, 1995). However, institutional theorists typically view each form of legitimacy as complementary and fundamentally inter-related. Baum and Powell (1995) noted that the emphasis on only one part of the legitimation process results in an incomplete picture; aspects of legitimacy other than taken-for-grantedness need to be assessed and combined with density for a more complete understanding of the process.

Similarly, Delacroix and Rao (1994) observed that a variety of different processes affecting industry development are "bundled" together within population density, reflecting its reputation, the information and experience of its participants, and the establishment of supporting structures such as technological standards and industry associations. Rather than focusing on one or the other, the influence of a number of different cognitive and sociopolitical legitimacy processes may be masked by relying only on density. The result is a great deal of difficulty in determining the true role of each element on the emergence and development of organizational populations. While density may serve as a parsimonious indicator of population processes, it also masks a number of social and economic factors that influence the dynamics within an organizational population. Of course, this criticism is not at all limited to ecological research; research in the institutional tradition also suffers from this weakness, and an ongoing challenge within the field of organization studies is to devise measures of cognition and culture that more

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effectively distinguish between different legitimation processes and their effects on organizational density (Baum and Powell, 1995: 530; Schneiberg and Clemens, forthcoming).

Media coverage model of legitimacy effects. Aldrich and Fiol (1994: 648) noted that legitimacy could be assessed "by measuring the level of public knowledge about a new activity" or "by assessing public acceptance of an industry." Public knowledge and understanding of new organizational activities reflects the underlying shared schemas that form the basis of legitimate social action. Baum and Powell called attention to the analysis of information exchange and communication content as an established method which achieves the need for a historical scope and a means for measuring legitimacy separately from density (1995: 530-531). They note that detailed media coverage exists on a wide range of industries, and cite a number of references where content analysis has been used to study the context of social action. In Abrahamson's (1996) study of the dissemination of "management fashions", he observed that the mass media served as a point of diffusion for managerial ideas between both "fashion setters" and "fashion users", and thus played a role in promoting actual managerial practices. For many individuals and organizations, the mass media serves as an important source of information about events and issues going on about them in the environment, a process which then goes beyond being informative to affecting long-term changes in beliefs and attitudes (Alper and Leidy, 1969). Terreberry (1968) claimed that legitimacy is intimately tied to informational exchange regarding rewarding uses for resources and favorable organizational activities.

The mass media is in effect an arena through which various actors express their interests (Hilgartner and Bosk, 1988, McCombs and Shaw, 1972). Actors use the mass media as a tool to advance their own agendas, direct attention to issues, and present and define situations in ways that suit them best. For instance, various groups, both within and outside an industry, can use the

mass media to generate awareness of and promote their own vision of the best organizational forms and practices (Abrahamson, 1991); the media serves as means by which groups can stake out their own claims to legitimacy (Coombs, 1992). In Pollock's and Rindova's study of the effect of mass media-based information exchange on IPO performance, they explained that "in performing its functions of informing, highlighting, and framing, the media presents market participants with information that affects impression formation and the legitimation of firms" (2003: 632). However, this process runs in both directions: individuals and organizations both learn about issues and judge their importance as well as attempt to assert their own interpretations—they both attempt to influence and are themselves influenced by interacting through the conduit of the mass media.

Among content analysis researchers, the mass media and the business press are routinely seen as means in which organizational communities create, share, and perpetuate shared conceptions of facts and meanings regarding social action (Gerbner, 1969: 123), social processes clearly tied to the generation of cognitive and sociopolitical legitimacy. Examining the information exchange occurring within the mass media can be used to simply describe trends in communication content (Holsti, 1968: 610), but can also be used to examine aspects of culture and social change (Berelson, 1954: 503; Franzosi, 1997; Holsti, 1968: 634; Tarrow, 1989), to trace the development of scholarship and research interests in scientific fields (Berelson, 1954: 491; Duncan, 1991; Whaples, 1991), and to assess the focus of attention of various social groups (Hoffman and Ocasio, 2001; Kleinnijenhui, Ridder, and Rietberg, 1997; Weber, 1990: 9). The analysis of public media coverage of an industry should also be an effective way of measuring the legitimacy of organizational forms and strategies since it is central in both disseminating knowledge about new organizational practices and in influencing the behaviors of individual

actors like potential investors or entrepreneurs, and should therefore be critical in the establishment of taken-for-grantedness.

General media coverage. As the intensity of general media coverage of a particular organizational activity increases, information is created and exchanged among interested actors who become more aware of the profit potential or opportunity available, thus contributing to the development of an industry's cognitive legitimacy. As participants increase their exposure to developments in the industry through an increasing volume of media coverage, the industry becomes increasingly taken-for-granted and legitimate in their minds. This should motivate the founding of new organizations or the expansion of existing ones to take advantage of those opportunities; these activities contribute further to the process as they are reported upon and discussed in the news media. The argument here is that as the overall level of public discourse of a particular industry increases, through the arena of the mass media, that industry will gradually become seen as a natural part of the environment and the strategies and organizational forms associated with that industry will become increasingly taken-for-granted, and as a consequence the number of entrants into the population should also increase:

Hypothesis 2: The volume of general media coverage of an industry positively affects the entry rate.

Positive and negative evaluations in media coverage. Beyond emerging from awareness or taken-for-grantedness among entities, legitimacy also integrates the social values of the broader social environment with the actions of those entities (Berger and Luckmann, 1966: 92-92; Parsons, 1960). In organizations, responding to external demands rooted in a social value system results in a change process in which achieving legitimation means taking on value and becoming firmly embedded in the system itself (Selznick, 1949; Selznick, 1957; Zald and

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Denton, 1963). Sociopolitical legitimacy depends on a positive evaluation and approval of an organization or its activities from elements in the environment, and an organization gains legitimacy when it makes a contribution to stakeholders based on criteria rooted in the system of values an beliefs operating in the environment (Meyer and Rowan, 1977; Rowan, 1982; DiMaggio and Powell, 1983; Scott and Meyer, 1983).

Those positive judgments can center on a number of organizational factors. Organizations are evaluated on the social and economic merit of their domain of activity, the consequences of their actions, as well as the methods and procedures used in producing those outcomes (Dowling and Pfeffer, 1975; Suchman, 1995). For instance, organizational activities are legitimate to the extent that they produce results that are consistent with socially constructed notions of worthiness (e.g., high economic or ethical value), and by the degree to which the processes used are considered useful (e.g., scientific or rational). Acceptance and positive evaluation can stem from the degree in which practices conform to expectations regarding organizational activity, which might include the perception that the organization has sound management practices and appropriate business strategies or that it operates in a way that is consistent with ethical standards or legal regulations. It is also necessary in many instances for industries to be seen as having new and untapped opportunities for growth from emerging markets or from the application of a technological breakthrough in its products, services, or operations.

Delacroix and Rao (1994) noted that organizational density was partly reflective of the reputation of the industry among interested entities. Density demonstrates the reputation of the industry to observers, including both awareness and respectability of organizations and strategies in a population. In the case of emergent industries new entrants must establish a positive evaluation and approval of their strategies and product offerings to consumers and investors. The

reputation generated in this process builds familiarity with the industry among interested actors and allows them to generate evaluations of both individual organizations and the industry as a whole. Crucial to this part of the sociopolitical legitimation process is the role of financial news coverage in the exchange of knowledge and information regarding organizational activities. In cases of populations of profit-seeking businesses, financial organizations may be key stakeholders in the evaluation of organizations and the reputation of the industry, and information exchanged within the arena of the business press should play a role in the development of sociopolitical legitimacy through its influence on flows of resources between industry participants.

News coverage regarding investment in the market, particularly in entrepreneurial activity and new product development, should tend to signal to organizations and potential entrepreneurs whether there are opportunities available in the market. Pollock and Rindova noted that "the information the media provide about a firm may affect the processes of impression formation and legitimation not only through the volume of the information, but also through its tenor, or its framing as positive or negative" (2003: 634). Indications of public interest in investing in the area, corporate interest in developing new products or in building relationships with other firms that are already in the market, and the availability of venture capital for investment in the market should have a positive impact on founding and entry rates into the population. On the other hand, media coverage of the possibility or actuality of bankruptcy or other modes of failure in the market, or of a shakeout or overall downturn in the prospects of the industry, should negatively effect founding and entry rates.

Hypothesis 3a. The volume of positive industry evaluations in media coverage of an industry positively affects the population entry rate.

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Hypothesis 3b. The volume of negative industry evaluations in media coverage of an industry negatively affects the population entry rate.

<u>Coverage of governmental and regulatory interests</u>. Governmental or other regulatory interests influence organizations by constraining or releasing resource flows to them, monitoring and licensing their activities, and altering competitive relationships in organizational populations (Baum, 1996: 95-96). Because of their powerful influence on organizational forms and practices, these factors are frequently included in research studies. For instance, Hannan and Freeman's (1987, 1988) work on labor unions examined the effect certain laws had during different historical periods on founding and failure rates. Edelman (1990, 1992) focused on the influence the legal environment of the time had on the diffusion of due process practices and equal employment opportunity structures in organizations. Singh et al. (1991) looked at the influence different laws had on the founding and failure of nonprofit charitable organizations in the city of Toronto. Beyond the effects of laws during particular time periods, researchers have sought other measures to assess the connection between regulatory factors and legitimacy. In the study conducted by Singh et al. (1991), the further effects of organizational certification by regulatory entities were also analyzed. Baum and Oliver (1992) found that the relations between licensed day care facilities and government and community agencies influenced founding rates. The resources available to those agencies through budget allocations also impacted founding rates.

Although the typical strategy in ecological studies is to look at time period or relational effects stemming from regulatory entities, the interest here is in how knowledge of governmental involvement and potential or actual regulation influences legitimacy, and subsequently the entry rate into the market. Media coverage of such events as congressional hearings, executive speeches and statements, and departmental or agency activities or regulations of commercial

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activities all contribute to the sociopolitical legitimacy of the industry. However, government and

regulatory agencies can both support an organizational population as well as limit or restrain it.

For instance, the research cited earlier on Toronto nonprofit organizations reported that during

the early 1970s regulatory activities fostered the emergence of new organizations, but regulatory

actions later that decade reversed those effects (Singh et al., 1991; Tucker, Singh, Meinhard, and

House, 1988). In situations where a new industry or organizational form is emerging or seeking

to become established, governmental attention can positively influence legitimacy and density,

since such actions give approval and stature to the emergent industry as well as signal the

government's willingness to advance or support it (Aldrich, 1999: 230). For instance, Budros

(1992) found that the passage of a crucial piece of legislation provided legitimacy to the

fledgling New York state life insurance industry and positively affected organizational entries. In

the field of Internet commerce, governmental agencies and legislative activity in the United

States have predominately served to facilitate online commercial activity. Laws such as the

National Communications Competition and Information Infrastructure Act and the Internet Tax

Freedom Act serve to promote business on and access to the Internet, and the National

Information Infrastructure initiative brought attention to the potential of information systems and

widespread Internet access (Moschovitis et al, 1999). Thus, the expectation is that:

> **Hypothesis 3c.** The volume of media coverage of governmental interest in a particular
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> industry positively affects the population entry rate.

Combining density-dependent and media-based legitimacy effects. The discussion of

hypotheses 2 and 3 sought to expand the understanding of the concept of legitimacy by

identifying its underlying cognitive and sociopolitical components and the effect of each on

market entry rates. By combining both aspects of legitimacy with density-based indicators of

legitimacy, the population ecology model of density-dependence can be extended with a more complete understanding of the impact of both cognitive and sociopolitical legitimacy on the process.

As stated earlier, the legitimacy-competition model of density dependence claims that density works in two processes affecting the vital rates in a population. The process of legitimation is based on the view that early increases in density reflect the establishment of the viability and appropriateness of organizational activities; thus, density is proposed as positively affecting founding or entry rates. On the other hand, competition is based on the observation that further increases in density contribute to a scarcity of resources allocated among a large number of firms; in this case, density is viewed as negatively affecting founding rates. The need to accommodate density dependence as both a negative and positive function has been accomplished traditionally using curvilinear functions of density; this perspective forms the basis of hypotheses 1a and 1b discussed previously.

However, if density does indeed reflect an underlying multidimensional legitimation process in the industry, and if cognitive and sociopolitical legitimacy can be effectively measured by looking at the discourse and content of media coverage of the industry, then these measures should continue to be significant even when assessed simultaneously with density-based measures. Measures of cognitive and sociopolitical legitimacy should be related to entry rates due to their value in transmitting information about emergent forms of organizations or strategies, while density should remain related to entry rates both as an indicator of actual activities in the population and as a measure of the competition among market participants.

Hypothesis 4: The legitimacy and competition effects of population density, as well as cognitive legitimacy effects of media coverage, are related to the entry rate.

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Hypothesis 5: The legitimacy and competition effects of population density, as well as

sociopolitical legitimacy effects of media coverage, are related to the entry rate.

Table 1 summarizes the hypotheses proposed in this study.

Insert Table 1 About Here

DATA AND RESEARCH METHODS

The rise of e-commerce and Internet business provides a historically convenient and

interesting case in which to study the process of industry emergence and legitimation. While

only a small part of the wide range of activities collectively known as electronic commerce, the

Internet access business is a crucial element in that phenomenon since it provides essential

infrastructure required for electronic transactions to take place (Barua, Pinnell, Shutter, and

Whinston, 1999; Colecchia, 1999; Organization for Economic Co-operation and Development,

1997). While the Internet access industry itself consists of many different elements, some of

which are clearly still emerging in the marketplace, the focus of this study is the introduction and

legitimacy of organizations providing services associated with high speed, broadband Internet

access between 1993 and the first quarter of 2000.

Cable and DSL Broadband Technologies

A preliminary examination of accounts of the industry in the business and trade press, a

review of public utility commission publications on the broadband industry, and informal

discussions with trade association and public utility commission staff members revealed that two

technologies are the dominant competing forms of broadband access to consumers: *cable* and

digital subscriber line (DSL) access. Both cable access and DSL are frequently considered

together in discussions of broadband, both have similar technological roots, both appeal to the

same customer groups by providing essentially identical services, and broadband access

providers often see each other as competitors regardless of any technological differences. More

recent wireless and satellite technologies still have a long way to go to have any impact on the

industry, in terms of technological development, market share growth, or industry attention, and

so are not considered here in this study.

Broadband cable access is a technology that produces a very high-speed Internet

connection over the coaxial and fiber optic cable infrastructure used to deliver cable television.

Internet access is provided through the existing cable television wiring present in most

residences. The technology consists of both the connection service as well as specialized

equipment, such as a cable modem and networking hardware, used to connect the user's personal

computer to the cable company's network. Cable access avoids the use of copper telephone lines

used in dial-up services in order to provide data transfer speeds many times faster than normally

available.

The primary competition for cable access in the broadband market—digital subscriber

line, or DSL—is a high-speed access method that extends the technology in traditional telephone

lines and hardware. Digital signals forming the user's connection to the Internet are transferred

over standard copper telephone lines available in nearly every home and office. Unlike dial-up

modem connections, DSL allows the simultaneous use of both Internet access and normal

telephone services while additionally providing up to fifty times faster data transfer rates. The

technology combines both the network connection service as well as required hardware, such as

a special DSL modem and networking interface cards, used to make the linkage between the user's personal computer and the wall telephone jack.

This research setting is appropriate for a study on the emergence of legitimacy and the creation of new organizational populations for a number of reasons. The rise of the broadband access industry has been characterized by significant support from large, well-funded corporations with significant interests in building telecommunications infrastructure and establishing their dominance in the industry. Since cable access is provided over some of the same infrastructure as cable television, service is typically offered by cable system companies, like AOL Time Warner, AT&T Broadband, Cox Communications, etc. DSL technology is based on extensions of existing telephone communication technology and is thus typically offered by the regional Bell operating companies, such as SBC Communications and Verizon. For companies operating in other industries, moving into broadband significantly redefines their traditional character, potentially allowing expansion into totally new domains of activity but exposing them to new competition in areas where they have little experience. In addition to pre-existing companies, a variety of new forms of organization have emerged—typified by examples such as Covad Communications and Rhythms NetConnections—dedicated solely to developing and taking advantage of new broadband technologies. In addition, the industry receives a tremendous amount of attention from regulatory entities interested in controlling the deployment of new broadband services, and who feel empowered by their authority over older telecommunications forms. Added to this situation is the relative newness of broadband and lack of awareness among businesses and consumers during this period; the overwhelming proportion of Internet users at the time still connected through traditional dial-up modem services[2]

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[2] Boardwatch Magazine (2000) reported that over ninety percent of Internet users connected through dial-up services, while cable and DSL users amounted to just under five percent.

(Boardwatch Magazine, 2000: 13). The industry represents a convergence of a number of competing interests interested in defining the appropriate forms of organization and business, types of services, and codes of conduct among participants. Since the legitimacy of the broadband industry was still being negotiated among business and consumer users, service providers, technologists and industry experts, financial analysts, regulators, and other interested social actors, the broadband Internet access industry provides an ideal setting to study the effects of legitimacy on the emergence and development of new forms of organizational activity.

<u>Sample Selection</u>

The provision of broadband services is based on the development of an organization and infrastructure at the local level; even for firms that are national or global in scope, broadband activities are operated at the city, or even the neighborhood, level (Dempsey, Frisiani, Mehrotra, Rao, and White, 1998). Broadband infrastructure is centered on the linkage between individual customers and nearby local network facilities that aggregate connections to the Internet; it includes investment in cable connections to customers' physical facilities, network upgrades and maintenance, and computer servers that route data between customers in and the Internet. Likewise, broadband competition is also localized; because of the need for close proximity between broadband operations and customers, service providers in one metropolitan area do not compete with service providers in another. Because of these factors, the broadband industry can be characterized by a group of subpopulations whose boundaries are defined at the city level, and that include entries by both new firms as well as existing firms in each city subpopulation. These factors suggest an establishment level of analysis, as described by Carroll and Hannan (2000: 51); density-dependent competitive effects operate locally, in each of the geographic locations that companies operate in.

Furthermore, the localized nature of broadband access creates a situation where economies of scale accrue to firms that can access the most number of customers within the geographic reach of their network facilities. In other words, broadband providers initially start up in urban areas with high residential population density and appear later in less dense metropolitan areas and rural settings. Any research sample chosen must account for effects on founding and entry rates produced by the diffusion of broadband into different residential population levels rather than by legitimacy and competition. Therefore, this study covered the population of broadband providers in the six largest cities in Texas—Austin, El Paso, Dallas, Fort Worth, Houston, and San Antonio—allowing for the observation of industry activities in a typical set of large metropolitan areas, and avoiding extreme differences in urban population density as an important factor. Restricting the choice of cities to one state also has the benefit of controlling for potential differences between state-level regulatory regimes.

With respect to the time frame for the study, the assumption used was that the beginning of the residential-level Internet access industry began in 1993 when the graphical Internet browser Mosaic was developed by the National Center for Supercomputing Applications (Moschovitis et al, 1999). This application resulted in popular interest in the Internet and its information interface known as the World Wide Web, and motivated firms to provide access to those information services. The resulting sample for this study covered all the high-speed broadband provider foundings and entries, measured in monthly time intervals between January 1993 and April 2000, in the six largest cities in the state of Texas, yielding a total of 528 observations (88 monthly periods $\times$ 6 cities). To maintain consistency with organizational ecology research, lagged independent variables were used resulting in the loss of one time period of data.

<u>Population Entry Rate and Density Variables</u>.

The *entry rate* for each city is defined here by the number of new broadband provider entrants (offering either broadband cable or DSL access) that occurred in each city in a particular month. The *population density* of each city is the total number of active industry participants in each city in each month. Following past practices in the literature, first- and second-order forms of population density are used to reflect both legitimacy and competition processes in the population.

Since no single source exists documenting the number of broadband competitors in the population, a number of sources were used to determine the history of entries and exits in the industry, including various regulatory, trade, and news sources. The first task in this data collection effort involved generating a list of broadband service providers in the state of Texas. The *Report to the 77th Texas Legislature on the Availability of Advanced Services in Rural and High Cost Areas* from the Texas Public Utility Commission provided information about the number of broadband service providers and the broadband cable operators active in each city (Public Utility Commission of Texas, 2001). Service providers were also required to file documents with the public utility commission every year on the type of services offered and the areas of service availability. Although these sources do not provide a complete record of the population, this information was used to generate a list of service providers for further investigation. Produced by the U.S. Department of Commerce and the Department of Agriculture, *Advanced Telecommunications in Rural America* provided some information on the broadband cable and DSL providers across the U.S. (National Telecommunications and Information Administration and the Rural Utilities Service, 2000), while *CED Magazine*

provided a much more comprehensive list of broadband cable and national DSL service

providers (CED Magazine, 2001).

After generating a list of broadband service providers for further study, a comprehensive

search of news sources and company information on each provider produced a record of the

entries and exits in each of the six Texas cities studied. The *Lexis-Nexis* database of news articles

was used to identify announcements of new service introductions or withdrawals from service.

Lexis-Nexis was ideal for this purpose because of its coverage of both national and local news

sources and its ability to access the full text of articles. When an article was found which

identified an entry event, it was examined for the date of service inception and the location in

which broadband access was made available; when no specific date was indicated, the article

publication date was used to indicate the month in which the entry occurred. Company

information was also used to identify new market entries; the use of company web sites to

promote products and services to the public and to communicate to external stakeholders about

firm activities facilitated the search for information about foundings and entries. Frequently,

firms published press releases announcing entry events on their web sites; some firms also

released such information in their financial statements. In addition to the web sites of individual

companies, the *Internet Archive* was also used to identify changes in information on company

web sites that occurred over the years, or even to access corporate sites that no longer exist due

to termination of the business.[3] When announcements from company information were found,

the text was examined for the date of entry or exit; when a specific date was not mentioned, the

date of the announcement was used as the date of the entry or exit event.

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[3] The *Wayback Machine* at the *Internet Archive* is a collaborative project, including organizations like the Library of Congress and the Smithsonian Institution, to allow access to web sites that have been published in the past but may no longer be available, either because the information was subsequently updated or because the companies that published them no longer exist. The archive provides a historical record of the information that has appeared on Internet, recording that information for future review. The *Wayback Machine* at the *Internet Archive* can be found at http://web.archive.org/.

The data from each city sub-population are depicted in Figure 1. The procedure employed

in this study identified a total of 55 entries across the six cities, by 17 companies providing

broadband cable or DSL service during the period between January 1993 and April 2000. During

the period of this study, no firms ceased operations in any of the cities studied; subsequent

analysis found market exits began in late 2000, outside the scope of this research project. The

lack of exits from the population during this period is the result of substantial right-censoring in

the data set; organizational exits and failures had simply not occurred within the historical period

of the study. However, this poses few problems for this study since left-censoring is typically

viewed as the most critical concern, and studies are often designed to gather data on the earliest

historical periods possible in organizational populations (Carroll and Hannan, 2000). The focus

on the earliest period in the history of the industry is actually beneficial to the study, since the

objective is to examine the impact of legitimacy on the creation of new organizational

populations. Density effects on founding and entry can be attributed to the emerging legitimacy

of this form of business organization because only the early history of the population is

considered, while studies that include both early and late historical periods can find density

effects that can confuse legitimacy effects with processes of market power or resource

partitioning (Baum, 1996: 89-90).

Insert Figure 1 About Here

While the data is right-censored, it does not exhibit left-censoring because the time period

studied begins years before the first entry activity. The first entrant began service in May 1996 in

Houston. However, much of the entry activity started in late 1998 and continued through early

2000. Despite little entry activity in the early period of the study, industry participants were actively engaged in establishing what would eventually become the broadband access business, including development of the technologies used in providing and using the service, investment in the creation of entirely new organizations and the expansion of existing ones and the construction of technological infrastructure, and the lobbying of both investors and regulators for support in taking advantage of the new opportunities being identified. To get a picture of the extent of industry activity going on before the first market entrant appeared, we must turn to other, non-density-based measures of legitimacy.

Media Coverage Variables

Data sources for media coverage variables. In examining industries involving the Internet a number of news and information sources are available for research purposes, many of which are accessible in electronic form over the network itself as well as other traditional print forms. Online sources of Internet technology news, such as *ZD Net* (www.zdnet.com) and *CNET* (www.cnet.com), are popular sources of online news and information regarding many industries involved in Internet business activities. Many traditional book publishers also publish works on computer and networking topics, although even a casual browsing of the books available will indicate that many are technical in orientation rather than focused on characteristics of the industries themselves. In addition to these sources, there are also many print periodicals that focus on Internet technology and business activity, like *Wired, Red Herring,* and *Fast Company*, while more general interest business journals (e.g., *Business Week*, *Inc*., etc.) also frequently publish articles in this area.

With this wealth of information available, a careful consideration of the needs of the study is necessary in choosing the data sources to be used in a content analysis. The selection of

documents used as the population of interest depends on the hypotheses being tested and the inferences intended by the study as well as the distribution of information among content sources (Krippendorff, 1980: 65; Weber, 1990: 42). The information necessary to test particular hypotheses may not be evenly distributed among different sources; various online information sources, books, and print periodicals may not all supply the needed information equally well for the purposes of the study. In addition, the needed information must be easily accessible and available over the entire history of the industry under study.

In measuring legitimacy, the concern in identifying the appropriate population to draw content from is dependent on the ability to access information about the taken-for-granted character of organizational activities and the evaluation and approval of those activities by interested social actors (such as entrepreneurs, investors, regulators, etc.). The content used should thus be a form of media that extensively reports on industry issues and that interested social actors frequently access and depend on for important information on the industry. Although population events in the broadband industry occur at the local level, the companies that provide access services often operate across many areas, and the technologies they use are not specific to any particular region. Because of this, local information sources (e.g., coverage in local city newspapers) are not as critical to the legitimacy of the entire industry as is content that is applicable across all regions and to the industry as a whole; this is also consistent with the findings of Hannan and his colleagues (1995) who found that legitimacy operates at a level above local activity. The *ABI/Inform* database provided a good source of content for analysis in this study, since it contained an extensive index to articles in all areas of business and management as well as access to their full citations and abstracts. The *ABI/Inform* database covered over 1,800 professional journals and trade publications, effectively covering the

majority of available sources of business knowledge that might be relevant in the legitimation process. Beyond the wide range of publications and subjects covered, *ABI/Inform* also provided access to content going back to 1971, allowing for the collection of data over the entire relevant history of the industry being studied as well as easy to use searching tools which would facilitate access to the information. The disadvantage of using *ABI/Inform* was that it only provided comprehensive access to article abstracts rather than the full text of the articles themselves, although this problem was minimized by the use of the article abstract as the sampling unit and the fact that the information needed by this study is largely contained in the abstracts making the use of full texts unnecessary.

To produce a body of text to use in the content analysis, a search for article abstracts in the *ABI/Inform* database was conducted and a multistage sampling procedure employed, utilizing both stratified and systematic elements. Employing a series of sampling techniques in this manner has been common practice in research using content analysis, and helps capitalize on the characteristics of the content data itself to generate a representative sample. As a starting point in the content analysis, a combination of search terms was chosen to identify published articles on the subject of broadband cable and DSL access technologies. A separate search was then conducted using the chosen keywords for each month in the period from January 1993 to April 2000, generating a list of articles appearing in the database each month on broadband access topics. Finally, in each month every fourth article abstract was systematically selected from the list of articles starting from a randomly chosen point, producing a 25% sample of article abstracts for subsequent analysis. The stratified procedure compensates for variation in the number of articles published in each month, while the systematic procedure facilitates the selection of a random sample drawn from a list of article abstracts when the list does not exhibit periodicity in

its order (Budd, Thorp, and Donohew, 1967; Krippendorff, 1980; Riffe et al., 1998). This procedure produced a total of 1407 article abstracts for further analysis.

General media coverage variables. The volume of *general media coverage* in a particular month is the total number of articles published each month, identified in the content analysis of the *ABI/Inform* database as pertaining to the broadband industry or to broadband cable or DSL technologies. Following the guidelines set out by Riffe et al. (1998), a content analysis procedure was formalized in a content coding protocol. The protocol listed all the categories used in the analysis and specified how the coder was to assess the content in each article abstract. The protocol required the coder to assess each article abstract in each month as to the types of technologies described in the article (broadband cable, DSL, some other technology, or not about broadband), whether the article described the industry and the opportunities for expansion or growth positively or negatively, and if the article described regulatory interest in broadband. If the article described any form of broadband access technology or the firms developing and selling the technology it was viewed as contributing to the taken-for-grantedness of the industry and counted as increasing its cognitive legitimacy.

Figure 2 shows the monthly general media coverage of the broadband industry, including coverage of both broadband cable and DSL technologies, over the 88 month time period of the study. The month-to-month level of discourse on broadband technologies and services starts at a low level and steadily increases over time, indicating how broadband increasingly becomes recognized and taken-for-granted among industry observers and participants. Interestingly, there is some level of discussion about broadband even during the earliest period of the study, albeit at a low level, during a time in which there were no entrants or density in the population.

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Insert Figure 2 About Here

Positive and negative industry coverage and governmental interest coverage variables.

Positive industry coverage represents the current volume of positive evaluations of the

broadband industry in the news media and business press, and encompasses investment activity,

public offerings of equity, industry growth, increasing levels of consumer demand, and venture

capital interest. Positive industry coverage is indicative of the sociopolitical legitimacy conferred

by positive appraisals of the business opportunities present in the industry. The volume of

negative industry coverage is a measure of current negative evaluations of the industry, and is

suggestive of the perceived potential for a downturn in the industry, poor prospects for business

growth, and of potential or actual firm failures. *Governmental interest coverage* is measured by

the current level of media coverage of real or potential governmental regulation of the Internet

access market. This measure should indicate the level of governmental interest in the industry,

and thus is representative of the state's evaluation and approval of the behaviors of firms in the

market.

As in the case of the general media coverage variable, the measurement of the industry

evaluation and regulatory media coverage variables was guided by the content coding protocol.

Each article abstract was examined for descriptions of growth and expansion of the industry or

decline and firm failure, as well as any type of regulatory or governmental activity. Since news

media analyses of the broadband industry frequently distinguished between broadband cable and

DSL technologies, each technology was assessed separately for positive and negative industry

evaluations. For example, a single article might describe future growth and opportunity in the

broadband cable market but negatively portray DSL; such an article would contribute to both a measure of positive industry evaluations as well as the negative industry evaluations measure. The total number of articles describing the development of the industry positively in each time period, covering both DSL and broadband cable technologies, was used as a measure of positive industry evaluations in that month. Conversely, the total number of articles published each month describing the industry negatively, regarding each form of broadband, was taken as an indicator of negative industry evaluations. The total number of articles published each month describing any form of governmental activity or regulatory interest in the broadband business were used as a measure of the level of governmental regulation in the industry.

Figure 3 depicts the volume of both positive and negative evaluations of the broadband business in the news media. Even as early as 1993, articles appeared which described the opportunities available in providing broadband access services or growth in the industry, either in terms of growing demand for the service or from increasing levels of investment by organizations. Positive evaluations grew at a steady pace over the entire time period in the study. Simultaneously, articles negatively describing the industry and its prospects also appeared and steadily grew in number over time, although the magnitude of negative coverage was never as large and that of positive coverage. Figure 4 shows the monthly volume of coverage describing regulatory concerns or governmental interest in the industry. Compared to positive and negative evaluations, regulatory coverage always appeared at a low level; however, the pattern of coverage showed the discourse of the industry focused on the influence of the Telecommunications Act of 1996 and its implications for the broad deployment of telecommunications services.

Insert Figures 3 and 4 About Here

<u>Reliability of content analysis measures</u>. In any study that employs a content analysis

methodology, a major concern for the researcher is the reliability of the analysis procedure.

Employing a highly reliable procedure enhances the objectivity of the study by distinguishing

content analysis as a method of scientific inquiry from other methods used to analyze textual

data, and insures that the data produced by the procedure is consistent regardless of the

researcher performing the analysis or when that analysis is performed (Berelson, 1954;

Kassarjian, 1977). The formulation of content categories and coding rules that different

researchers can consistently apply is a necessary initial step in building a reliable procedure

(Kassarjian, 1977; Riffe et al., 1998), and that process is tied to the identification and

operationalization of the variables discussed previously. After this takes place, the process shifts

to focus on the assessment of how reliably those procedures can be used in acquiring data.

The first step in assessing the reliability of a content analysis procedure is selecting a

sample of the content material to be used. Since content analysis methods are often used to

generate extremely large data sets, using multiple coders to replicate an entire content analysis

study for an evaluation of reliability is usually impractical. Using additional coders to replicate

only subsets of the content used in a study is viewed as sufficient in these circumstances. When

choosing the content for additional coding, Riffe et al. (1998) advocate using a random sampling

approach when performing a reliability test. In this study, one of the authors performed the

primary content analysis, while a second coder was used to code a subset of the sample for the purpose of checking the reliability of the coding procedure.[4]

The second step in determining the reliability of a content analysis study is the quantitative measurement of the degree of consistency between coders. The most common method for determining the reliability of a study is to calculate the percentage agreement between coding judges, which is simply the proportion of agreement between two coders as a percentage of the total number of coding decisions (Kassarjian, 1977: 14; Kolbe and Burnett, 1991; Riffe et al., 1998: 127-128). When the proportion of agreement method is used, a reasonable expectation is that the procedure produces a percentage agreement near 80% or greater between coding judges. If substantially less than 80% agreement is reached, than the reliability of the study has not been established. Often researchers also report a reliability figure for each category coded in addition to an overall measure; such category reliability evaluations are better than an overall measure since aggregating multiple reliability scores may disguise poor performing categories. In this study, none of the categories used had less than 88% agreement between coders, and many categories had over 90% agreement.

Control Variables[5]

Residential population. The *residential population* at the city level (in hundreds of thousands of people) was included to account for demographic factors that might impact the entry rate. In the course of this study, it was found that companies often cited local residential population level as a consideration for entry into a particular city. As stated earlier, the

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[4] For this study the second coder was chosen by selecting an individual with no background in business education or in telecommunications technology. In choosing the second coding judge in this fashion, the focus is on the coding procedure rather than the nature or characteristics of the coder to accurately assess the text being analyzed. The coding protocol, supplemented with additional information on the background of the industry and definitions of the technologies and terminology used in the industry, were collected together and used as a instructional tool or manual to train the second coder in the use of the procedure and the meaning of the categories contained in the protocol.

[5] When particular control variables were not available on a consistent monthly basis, well established linear methods were employed to transform the available data into a format suitable for subsequent statistical analysis.

technologies underlying broadband telecommunications services depend heavily on access to high population density levels within close physical distance to service provider facilities to achieve scale economies. Broadband access is a range-dependent technology; customers can be provided access as long as they reside within a certain service area. Higher resident population levels within potential markets allow for greater use of the communications infrastructure investment, and could potential influence the pattern of entry rates in ways unrelated to legitimacy and competition processes. Annual population data was gathered from the U.S. Bureau of the Census.[6]

GDP growth rate and unemployment rate. Economic variables are frequently used in founding and entry rate studies as control variables; entry rates patterns could result from changes in economic conditions rather than from legitimacy or competition effects. The *GDP growth rate* was used to represent national economic conditions while the city-level *unemployment rate* was used to control for local economic factors. GDP measures were available from the U.S. Bureau of Economic Analysis on a quarterly basis, while the unemployment measures were obtained from the U.S. Bureau of Labor Statistics on a monthly basis.[7]

Internet growth rate. Finally, to account for the growing size of the Internet as a factor in the emergence of the broadband access industry, a measure was included as a control which represented the increase in the number of Internet users and the amount of information available on the Internet. The *Internet growth rate* is the rate of increase in the number of hosts connected to the worldwide information network. The measure is based on data provided by the Internet Software Consortium, and is generated by a methodology that systematically looks for all the

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[6] Data from the U.S. Bureau of the Census are available online at http://www.census.gov/.
[7] Data from the U.S. Bureau of Economic Analysis are available online at http://www.bea.gov/, while data from the U.S. Bureau of Labor Statistics are available online at http://www.bls.gov/.

computing devices connected to and assigned an address on the Internet.[8] While not representing

the number of users of the Internet, it does represent in a reliable way the number of systems on

the network, and thus is a proxy for demand for access to and the amount of information

available on the Internet.

Model Specification and Statistical Analysis

In models where the entry or founding rate is used as the dependent variable,

consideration must be given to the fact that the rate variable is measured using count data. Count

data are characterized by having non-negative, integer values; frequently, count data also have

many instances of zero or very low values, while high values are rare. When the data collected in

a study take this form, linear regression models are not the best choice since the data are not

normally distributed. Instances where data are in the form of counting measures are widespread

in social and economic research and frequently appear in organizational ecology studies, and

statistical models are available that more effectively account for the distribution of counting

process variables.

Typically, count data are modeled using various forms of Poisson regression, where the

dependent variable is drawn from a Poisson probability distribution (Greene, 1997: 931; Hannan

and Freeman, 1989: 193-194; Long, 1997: 217; Neter, Kutner, Wasserman, and Nachtsheim,

1996: 609). In this application, the rate of entry Y is assumed to follow a Poisson process, and the

probability function is given as follows:

$$f(Y \mid \mu) = \frac{\mu^Y}{Y!} \exp(-\mu), \text{ where } Y = 0, 1, 2, \ldots$$

A distinguishing feature of the Poisson distribution is the equality between the mean and the

variance of the outcomes Y:

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[8] The data collected by the Internet Software Consortium are available online at http://www.isc.org/.

$$E(Y) = Var(Y) = \mu.$$

A Poisson regression model can be set up where the mean entry rate of the ith case is a function

of a set of predictor variables; the typical formulation of the Poisson regression model is the log-

linear model:

$$\mu_i = E(Y_i \mid \mathbf{X}_i) = \exp(\mathbf{X}_i \beta), \text{ where } i = 0, 1, 2, \dots n.$$

In this equation, $\mathbf{X}_i$ is a vector of predictor variables for the ith case and β is a vector of

regression coefficients to be determined. By using the log-linear model, the mean response is

constrained to positive values. With this model, the probability distribution of the outcomes Y_i

becomes conditional on the characteristics of each case as indicated by the predictor variables $\mathbf{X}_i$

in the data:

$$f(Y_i \mid \mathbf{X}_i) = \frac{\mu_i^{Y_i}}{Y_i!} \exp(-\mu_i).$$

While some studies in the field of organizational ecology have used the standard form of

the Poisson regression, most have applied more extended models in their analyses which address

some of the restrictions required with its use (Cameron and Trivedi, 1986; Long, 1997).

Frequently, data used in practice by researchers feature dependent variables with variances

which exceed the mean; this is called *overdispersion*, and it results from unobserved

heterogeneity among observations. Unobserved heterogeneity among observations occurs when

different cases are not equally likely to produce occurrences of the counted variable; individual

observations with the same $\mathbf{X}$ may not have the same μ (Long, 1997: 231). The presence of

overdispersion in the data makes the use of the Poisson model problematic; overdispersion

produces variances which are larger than the mean, thus violating a key assumption of the model.

Using a Poisson regression model when there is overdispersion will underestimate the number of

observations at the extremes of the distribution (i.e., it will underestimate the number of zeros and the number of large values) and produce overestimates of the significance of the independent variables.

A more general extension of the Poisson model called the negative binomial model is frequently employed by researchers when it is necessary to relax assumptions in the Poisson model regarding the form of the mean and variance of the underlying probability distribution. The negative binomial regression model adds a random error term δ_i to the mean μ_i; the new mean λ_i is now a random variable that takes the following form:

$$\lambda_i = \exp(\mathbf{X}_i\beta + \varepsilon_i) = \exp(\mathbf{X}_i\beta)\exp(\varepsilon_i) = \mu_i\delta_i.$$

The mean of the error term δ_i is set to 1, so that the expected outcome is equivalent to the Poisson process:

$$E(Y_i) = E(\lambda) = E(\mu_i\delta_i) = \mu_i E(\delta_i) = \mu_i.$$

The distribution of Y_i is now conditional on both $\mathbf{X}_i$ and δ_i:

$$f(Y_i \mid \mathbf{X}_i, \delta_i) = \frac{\lambda_i^{Y_i}}{Y_i!}\exp(-\lambda_i) = \frac{(\mu_i\delta_i)^{Y_i}}{Y_i!}\exp(-\mu_i\delta_i).$$

In order to create a regression model that is a function of only the predictor variables $\mathbf{X}_i$, then the distribution of Y_i must be adjusted by the probability distribution of δ_i (which is typically a gamma distribution):

$$f(Y_i \mid \mathbf{X}_i) = \int_0^\infty f(Y_i \mid \mathbf{X}_i, \delta_i)f(\delta_i)d\delta_i.$$

The probability function of Y_i now follows a negative binomial distribution, and takes the following form:

$$f(Y_i \mid \mathbf{X}_i) = \frac{\Gamma(Y_i + v_i)}{\Gamma(Y_i + 1)\Gamma(v_i)}\left(\frac{\mu_i}{v_i + \mu_i}\right)^{Y_i}\left(\frac{v_i}{v_i + \mu_i}\right)^{v_i}.$$

The mean of the negative binomial distribution is the same as the Poisson:

$$E(Y_i \mid \mathbf{X}_i) = \mu_i = \exp(\mathbf{X}_i \beta).$$

However, the variance is now much different from the Poisson formulation:

$$Var(Y_i \mid \mathbf{X}_i) = \mu_i \left[1 + \left(\frac{1}{v_i} \right) \mu_i \right] = \exp(\mathbf{X}_i \beta)[1 + \alpha \exp(\mathbf{X}_i \beta)]$$

$$\text{where } \alpha = \frac{1}{v_i}.$$

In this specification of the negative binomial model, α is a dispersion parameter indicating the level of overdispersion in the data. When the overdispersion is small, α goes to 0 and the model reduces to the standard Poisson regression model. Tests exist which can indicate the need for the negative binomial regression rather than the Poisson regression procedure (Greene, 1997: 937-939; Long, 1997: 236-237); these tests center on evaluating the hypothesis H_0: $\alpha = 0$. For an extended discussion of the derivation of the Poisson and negative binomial regression models, Cameron and Trivedi (1986) provide an extensive discussion and comparison of regression models of count data while Greene (1997) and Long (1997) provide more recent and easily accessible reviews of the Poisson and negative binomial models. Software to estimate such models, as well as the comparison of different models for differences in fit, is widely available in commercial statistical packages such as SAS and Stata (Allison, 1999; Long and Freese, 2001; StataCorp, 2001).

RESULTS

Table 2 reports the negative binomial regression estimates for models of the entry rate across all six cities between January 1993 and April 2000. Since the likelihood tests of the estimated overdispersion parameter α demonstrated mixed results, it was decided to model the

heterogeneity in the data by using negative binomial regression instead of the Poisson regression model. Doing so produced a more conservative test of the significance of the parameters, since the tendency of the Poisson model to overestimate significance levels in the case of overdispersion was avoided. The pseudo R-squared and the AIC of each model are also provided in Table 2 as indicators of fit with the data.[9]

Insert Table 2 About Here

Testing Hypothesis 1—The Density-Dependent Model of Entry Rates

Hypotheses 1a and 1b test the prediction of an inverted U-shaped relationship between density and entry rates. As shown in Table 2, the parameter estimates of the baseline model of density-dependent legitimacy and competition effects on entry rate are reported under model 1. Both the first-order and second-order forms of population density are significant at the 0.01 level with parameter estimates in the expected directions, providing support for both legitimacy and competition effects of density. Interestingly, even in the earliest phases of industry creation, density-dependent legitimacy effects are still strongly evident, and competition effects are still observed at a significant level, both in an environment with few firms yet in operation. Model 1 thus provides support for the inverted U-shaped relationship between density and entry rates among broadband access providers, as predicted by the population ecology model, even in the formative stages of a population's history.

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[9] Any one measure of fit only provides a "rough" guide to the fit of the model (Long, 1997; Long and Freese, 2001). Focusing on a single fitness measure should not be the only method used to assess the performance of a model; such an approach results in the optimization of only one criterion, possibly at the expense of other equally important considerations. Furthermore, most goodness-of-fit measures have weaknesses which prevent them from being completely representative of the adequacy of a particular model. Therefore, the statistical results reported in this study give both the pseudo R-squared measure as well as an information-based measure, Akaike's information criterion, or AIC. Assessment of the fitness of single model or the comparison of multiple models should balance the results of multiple fit criteria, while also considering the theory being tested as well as past research as additional guides.

<u>Testing Hypotheses 2 and 3—Media-based Model of</u>

<u>Legitimacy Effects and Entry Rates</u>

<u>General media coverage model</u>. The second model from Table 2 reports the estimates for the negative binomial regression model used to test hypothesis 2; hypothesis 2 stated that the cognitive legitimacy evident from the level of general media coverage of the population positively affects the entry rate. The parameter estimate for the general media coverage variable was positive and significant in its influence on entry rates (at the 0.01 significance level), demonstrating the legitimating effect the current volume of communication and information transmission within the industry has on founding and entry rates in the population.

<u>Positive/negative and regulatory media coverage models</u>. Hypothesis 3 stated that the sociopolitical effects of positive and negative industry evaluations and regulatory influences evident through industry discourse affected the entry rate into the population. The third regression model reported in Table 2 reports the significance of both positive and negative evaluations in the news media as well as coverage of governmental and regulatory interest in the industry on the entry rates. The parameter estimates of the model showed both positive industry coverage and the reportage of political and regulatory issues positively affected the entry of broadband providers, supporting hypotheses 3a and 3c with p-values at the 0.01 level, demonstrating the importance of the emergence of these sociopolitical legitimacy dimensions on the creation of the industry. Also found significant, negative industry evaluations were negatively related to the entry rate, supporting hypothesis 3b with a p-value of 0.05 and providing strong evidence for the de-legitimating influence of certain forms of industry discourse.

Comparing density-dependent and media coverage models. Direct comparison of the news media-based measures in models 2 and 3 with the density-dependent measures in model 1 is not possible using a likelihood ratio test since the models are not nested within one another.[10] However, a comparison criterion that has been useful in many limited dependent variable statistical models (including Poisson and negative binomial regression) is Akaike's Information Criterion, or AIC, which allows one to compare two non-nested models that cannot otherwise be compared using the likelihood ratio test (Cameron and Trivedi, 1998; Long, 1997). The AIC also penalizes the model with the larger number of parameters for the degrees of freedom that are lost; because of this, it can be used to supplement the pseudo R-squared in comparing models. All things being equal, the model with the lower AIC is the preferred model.

Comparing models 2 and 3 with the density-dependent effects identified in model 1, using media-based measures of legitimacy to predict the population entry rate compares very favorably with density-based measures. Examining models 1 and 2, the general media coverage model has a higher pseudo R-squared and a lower AIC than the density-dependent model (pseudo R-squared of 0.2269 versus 0.2405; AIC of 292.082 versus 285.220), showing that media-based indicators of cognitive legitimacy may fit the data better than density. In models 1 and 3, the model of sociopolitical legitimacy effects revealed through the volume of news media coverage compares well to the density-dependent model with a higher pseudo R-squared and nearly identical AIC (pseudo R-squared of 0.2302 and AIC of 292.922).

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[10] More correctly, these models overlap only in the control variables, but the theoretical variables of interest do not overlap at all. Models that have no shared independent predictor variables are labeled as "strictly nonnested" models (Cameron and Trivedi, 1998).

<u>Combining News Media-based Legitimacy Effects</u>

<u>In A Single Model of Entry Rates</u>

Model 4 integrates both general media coverage with the current volume of news reports of industry evaluations and regulatory attention into a single model. The purpose of doing this was to build a media-based model of entry rates that simultaneously combines cognitive and sociopolitical legitimacy effects. General industry coverage and regulatory interest variables were shown to have positive and significant effects at the 0.01 level. Negative industry evaluations again affect entry rates negatively, with a significance level of 0.01. However, positive industry coverage is no longer significant when combined with general industry coverage. This may be the result of collinearity between these two measures (the correlation between the two was 0.85), a problem which could result in the insignificance of one measure of legitimacy even though both are separately highly significant. Again the AIC is useful here, because it can be used to assess the improvement in the model combining two sets of variables over models that consider each on their own. The pseudo R-squared of model 4 is higher than that of either model 2 (using only general media coverage) or model 3 (using positive/negative and regulatory media coverage). However, it is well known that these types of fit measures typically increase when the number of predictor variables increase; a higher R-squared alone is not evidence that the combined model is the better one. Comparing the AICs of each model gives additional insight into which more appropriate because it penalizes against a reduction in parsimony in the model. The AIC of model 4 (AIC = 268.133) is lower than either model 2 or 3, indicating that positive industry coverage should be included in the model. Since the statistical fit of the model improves even though this single variable becomes insignificant suggests that it plays an important but indirect role in influencing the population entry rate; in using multiple

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indicators of legitimacy in the model, the possibility that different dimensions of legitimacy interact in complex and interesting ways to affect entry rates becomes evident.

Testing Hypotheses 4 and 5—Combining Density-Dependent and

Media-Based Variables in a Model of Entry Rates

Combined density and general media coverage model. The negative binomial regression models 5, 6, and 7 combine both the density-dependent and the media-based effects considered separately in models 1 through 4, providing a test for hypotheses 4 and 5. Hypothesis 4 stated that both density-dependent effects and general media coverage continue to have the relationships with entry rates described in hypotheses 1 and 2, but that those relationships will remain significant simultaneously; hypothesis 4 is tested in regression model 5 described in Table 2. The statistical analysis showed that both first- and second-order forms of density are significant, with the first-order measure reflecting the positive legitimating effects of increasing density in the population while the second-order variable showed negative competitive effects (although second-order density was only mildly significant at the 0.10 level). The parameter estimate for general industry coverage is positive and strongly significant at the 0.01 level. The significance of density-based legitimacy and competition as well as cognitive legitimacy effects of general news coverage of the industry provide support for their combined effect on entry rates described in hypothesis 4. Furthermore, compared to model 1, the effect sizes for the density variable coefficients are reduced in size, indicating that general media coverage now represents some of the variance in the model previously accounted for by population density.

Table 3 shows the result of the tests comparing the models combining density-dependent and media-based legitimacy effects with the models which treat their influence separately. Comparing model 5 to model 2 tests the significance of adding density variables to a model with

general media coverage. Both the likelihood ratio test and the comparison of AICs show that the density variables significantly add to the explanatory power of the model. Comparing model 5 to model 1 tests the significance of adding the general media coverage variable to a model with density variables. As before, both the likelihood ratio test and the comparison of AICs indicate that both the news media-based measure of the cognitive legitimacy of the broadband industry and the population density variables should be included in the model.

Insert Table 3 About Here

Combined density, and positive/negative and regulatory coverage model. Hypothesis 5 takes both the density-dependent and media-based effects described in hypotheses 1 and 3, and combines their influences in a model of market entry rates. Model 6 from Table 2 tests this hypothesis by including both density-based measures of legitimacy and competition and the three media-based measures of sociopolitical legitimacy as independent variables. Both the density-dependent effects of legitimacy and competition as well as coverage of positive and negative evaluations of the state of the industry and regulatory influence are all highly significant, providing support for hypothesis 5. The coefficients for both positive industry evaluations and regulatory coverage are positive and significant (p-values of 0.05 and 0.01), indicating that both are critical in the creation of the broadband population. The parameter estimates of negative media coverage are also significant but negative in direction (at the 0.05 significance level), indicating that it remains as a de-legitimating influence.

Table 3 shows the results of the likelihood ratio tests and model AICs comparing models 6 and 3. The result shows that adding first- and second-order forms of density produces a

significantly better model of the entry rate into the broadband population then the use of media-based measures alone. In moving from model 3 to model 6, the effect sizes of negative industry evaluations increase while positive and regulatory media coverage slightly decrease. This may suggest that the addition of density variables clarifies a strong and direct influence from negative information on the development of emerging organizational populations, and that some of the effects of the density variables may also represent the influence of regulatory factors and positive industry evaluations. Similarly, comparing models 6 and 1 in Table 3 shows that adding media coverage measures to the density-dependence model produces a more favorable model than using density-based variables alone.

Combined density and media coverage effects model. Model 7 combines the influence of density with all media coverage variables. Most interestingly, both first- and second-order density variables are not significant when included in a model with media coverage variables. In contrast, three of the four media coverage variables are significant in the combined model, suggesting that modeling entry rates at the early stages of population formation benefits considerably from the addition of media coverage variables. General media coverage is highly significant at the 0.01 level, and the direction of the parameter estimate is positive. As was seen in previous models, negative media coverage of the industry is negatively associated with entry into the population at the 0.01 significance level. The volume of regulatory coverage was also significant (at the 0.05 level), with a positive effect on entry rates. As in model 4, the effects of collinearity between general industry coverage and the volume of positive evaluations are seen in model 7, where the combination of the two variables results in the insignificance of the positive industry evaluation as an explanatory factor.

Since the combination of density and all media coverage variables in model 7 results in the lack of significant effects from density variables, the question arises as to whether or not density should be retained in the entry rate model. Again the results in Table 3 displaying the likelihood ratio tests and model AICs comparing full and constained models provide an indication of the appropriate model. Comparing model 7 to model 4 shows the significance of adding density variables to a model with media coverage variables. While the full model has a lower AIC and a higher pseudo R-squared than the constrained model (AICs of 267.455 versus 268.133; pseudo R-squareds of 0.3183 versus 0.3052), thus suggesting that the model containing both density and media coverage variables is appropriate, the likelihood ratio test shows that density variables do not add significantly to the explanatory power of the model with media coverage variables alone. Comparing model 7 to model 1 shows the significance of adding media coverage variables to a model based on density variables; both the comparison of AICs and the likelihood ratio test point to the value of adding media coverage variables to a model with only density variables. By comparing these various models the benefits of going beyond density-dependence in analyzing entry rates becomes apparent.

Control Variable Models

The parameter estimates listed under model 8 in Table 2 depict all the control variables used in the study, and provide a baseline for the rest of the statistical models in the study. Among the control variables, only the local residential population and economic environment variables produced significant results, and only in models without population density-based variables (models 2, 3, 4, and 8), while growth rate of the size of the Internet was never significant in any model. When significant, the signs of the parameter estimates were in the expected directions. Interestingly, the fact that these control variables were only significant in models without first- or

second-order density measures indicate that both forms of density mediate the relationship between demographic and economic conditions and the entry rate.

DISCUSSION AND CONCLUSION

The density-dependence model of legitimacy and competition proposed by the population ecology tradition in organization science has received significant support by many different researchers looking at a variety of organizational populations. Their work has provided a significant contribution to the understanding of the importance of changes in density on the dynamic processes going on within populations of organizations (Hannan and Carroll, 1992; Hannan and Freeman, 1989). The differing views offered by organizational ecology and institutional theory perspectives, highlighted in the introduction to this paper, provided the motivation for this study—to take more detailed look at the operation of legitimacy processes in the formation of new organizational populations. The significant results of this study contribute to this body of work by focusing on the legitimacy side of the model, partially supporting the density-dependence argument while also demonstrating how media coverage variables significantly influence entry rates, extending the understanding of legitimacy and its influence not only on the dynamics within established populations but also on the emergence of new ones.

Implications for Theory Development in Management and Organization Science

The results of this study have several implications for the field of management and organizations, particularly in the development of the density-dependence model of legitimacy and competition. First, this study finds support for the density-dependence model of legitimacy and competition, and extends its application to the nascent broadband Internet service provider industry. Second, the study considerably advances the field by extending the measurement of

legitimacy through the use of media-based measures of taken-for-grantedness and sociopolitical influence in the industry. Finally, the study also highlighted the importance of industry discourse and information exchange as a factor in the development of legitimacy; the sharing of information among industry participants and observers builds greater awareness and understanding of the population, exposes a greater number of people to the opportunities being presented, and underlies the process which establishes or weakens support from critical stakeholders.

  <u>Applying the density-dependence model in emergent populations</u>. While the findings from the analysis of the broadband service providers and their founding and entry activities clearly supports the density-dependence model of legitimacy and competition, what distinguishes this study from others is the focus on the historical period starting long before the start of the population through the beginning stages of its formation; even in initial stages of population creation the density-dependent effects of legitimacy and competition are both highly significant. This is an important finding considering Baum and Powell's (1995: 533) observation that stronger support exists for density-dependence in the literature in studies with populations that had long histories; the support for the inverted U-shaped relationship between density and founding rates may be undermined by the inclusion of populations with low density in both early and late historical periods. The broadband access provider population did not exhibit a late period of low density, but density-dependent effects on entry were still found to be significant. Carroll and Hannan (2000: 23) speculated that in "modern" industries, the historical pattern of organizational density would be similar to that found in older industries but would occur at an accelerated pace; their depiction of the hard disk drive industry showed the same pattern of population density found elsewhere but unfolding over the course of just a few decades,

comparatively short for ecology studies. The population of participants in the broadband access industry developed only over the last few years, demonstrating an even quicker pace of development. However, the lack of significance of density variables in model 7 from Table 2 suggests that the conception of density driven legitimacy processes be reconsidered, especially within the context of nascent organizational populations.

The legitimating effect of media coverage on entry rates. In response to the debate on the measurement of legitimacy and the assessment of its influence (Baum and Powell, 1995; Carroll and Hannan, 1989b; Hannan and Carroll, 1995; Zucker, 1989), this study went beyond the density-dependent model of organizational ecology by extending the measurement of legitimacy with news media-based data sources, and tested the impact of those variables on entry rates. The models used allowed an examination of the legitimating influence of both density-dependent processes and information exchange amongst industry participants, producing a richer picture of the processes underlying population entry rates. When used in place of density variables, models using media-based measures reflecting cognitive and sociopolitical legitimacy effects performed as well as the density-dependent model in predicting entry rates; even when combined together, they retained their significance and produced a much more detailed picture of the processes occurring in the broadband industry. Moreover, in comparing models 4 and 7 in Table 2, the result of the likelihood ratio test indicates that density variables do not add significantly to the model containing only media coverage variables. At least in emerging organizational populations, media-based legitimacy effects appear to exert a stronger influence on founding rates than density-dependent processes; early communications processes and information diffusion among industry participants is more important than density growth patterns. In comparing these two perspectives, the study responds directly to the call by Baum and Powell

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(1995: 530) to examine how different aspects of legitimacy combine to contribute to the legitimacy of organizational populations.

Direct and indirect influences on entry rates. Typical research strategies in the study of organizational populations look at the direct effects of the key density-based variables as well as the independent control variables appropriate for the context of the study; the desired result is a parsimonious model of the density-dependent effects of legitimacy and competition on the entry and exit rates of the population. By combining multiple measures of legitimacy into population entry rate models, it becomes possible to see potential mediating relationships that would not be evident if density-based measures were used alone; a possible new model implied by the results of this study is presented in Figure 5.

Insert Figure 5 About Here

Looking at the parameter estimates across all the statistical models listed in Table 2, it is clear that general, negative, and regulatory media coverage have significant and direct effects on the rate of entry. Increases in the general level of discourse among industry participants increase the taken-for-grantedness of industry activities, and thus positively affect the entry of new market participants. Political and regulatory interests evident in media coverage of the industry also positively impact population entry rates, suggesting that governmental attention lead to greater interest in and support for the developing broadband industry. Increases in negative evaluations of the industry and its prospects have the reverse effect; negative information exchange has a delegitimating effect on the industry, and leads to lower entry rates.

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A mediating relationship is implied between the sociopolitical impact from positive industry coverage and general media coverage. Again comparing the regression estimates from models 3, 4, 6, and 7 listed in Table 2, it can be seen that the addition of general media coverage to the models results in the positive industry media coverage becoming insignificant. Earlier, it was noted that even with this loss of significance it was appropriate to keep the variable in the model. The lack of a significant direct effect when combined with general media coverage suggests that broad coverage of the industry mediates the relationship between positive coverage and entry rates. The implication is that positive interpretations of the potential of the industry lead to more general discourse about the technology, its applications in the market, and organizations created to offer the service; such discussion among industry actors then leads directly to market entry. The complexity of these relationships points out how intertwined cognitive and sociopolitical dimensions of legitimacy are with each other and with growth in the population; further research is clearly needed to more fully specify these relationships.

Most interesting here is not the direct and indirect impact of the media-based measures, but the role density-dependence plays in light of those media coverage effects. Examining models 5, 6, and 7 in Table 2, it is evident that density variables are only significant when general media coverage and evaluative media coverage variables are considered separately. While the initial analysis in model 1 supported the density-dependence model, when general and evaluative media coverage is considered together, as it is in model 7, the legitimacy and competition effects of density disappear entirely. The implication of this finding is that media-based measures of legitimacy may intervene in the relationship between density effects and founding and entry rate patterns. These results recall the competing density-as-process and density-as-proxy arguments regarding the legitimation effects of density on entry rates (Baum

and Powell, 1995; Baum, 1996). The density-as-process argument favored by Hannan and Carroll (1992) views density as controlling legitimacy processes operating in organizational populations; legitimacy is a concept that links density to entry rates rather than a characteristic to be measured itself. Adding nondensity-based measures of legitimacy should enhance the significance of density-based effects. The density-as-proxy explanation portrays density as influencing population rates through legitimacy processes; density is viewed as an indirect indicator of a population's legitimacy. From this perspective, adding additional nondensity-based measures of legitimacy should lead to a reduction in density effects. Since media-based variables lead to a reduction in the significance of density in models 5 and 6, and the lack of significance of density in model 7, these results support the density-as-proxy argument and show that organizational density is a proxy for cognitive and sociopolitical legitimacy effects in new populations.

Furthermore, demographic and economic control variables were significant only in the absence of density-based variables. Demographic and economic variables were intended to account for changes in market conditions that could influence entry beyond the effects of legitimacy and competition. Variables like the local rate of unemployment and the GDP growth rate provide some indication of discretionary income and access to resources that affect the level of market demand or the availability of investment funds, while variables like the resident population of the city provide a measure of the potential size of the market and the capacity of the market to sustain the organizational population. The fact that these control variables lose their significance in models with density-based variables suggests that density mediates the relationship between market conditions and entry; a population's density might represent the legitimacy of the population, but it might also represent other underlying conditions in the

environment. If this is the case, interpreting the significance of density in predicting entry rates becomes difficult since it would no longer simply represent the legitimacy of the population. Using only density may produce a parsimonious model of entry rates in an organizational population, but it may produce an incomplete picture of the impact of legitimacy on the process since density may confound legitimacy with the influence of other economic and social factors.

Legitimacy and information exchange. While density variables are clearly important in predicting entry rates, the media-based measures of legitimacy emphasize information exchange as an important element in the construction of legitimate organizational populations. The implication for research is that the information exchange between different social actors in and around the industry has to be more fully explored. The basic meaningfulness and acceptability of an new organizational form to those in the industry, as evidenced by the rise is discourse regarding that form, is a critical factor in supporting founding events in the population. Discussion among industry actors creates a shared identity and builds a common understanding of new organizational forms, firm strategies, and products and services; it creates awareness of new organizations to those who might support or imitate them.

In broadband, before the industry could be established the technology itself had to be developed, industry standards created, and its usefulness determined; basic facts like who might provide broadband services needed to be resolved (e.g., cable companies, regional Bell companies, competitive telecommunications companies, or some other type of company, just to name a few). Indeed, the very meaning of the term "broadband" had to be settled before new entrants could be started to provide services based on it. The establishment of a routine understanding and identity of new organizational forms through the ongoing conversation among industry participants was a necessary step before new entrants could be founded.

Beyond a fundamental understanding of the organizations in the population, active support and approval by those in the business environment is also a key factor in the development of the organizational population. Organizations and those who might start them exist in a complex social environment, constituted by sets of values of various stakeholders and embedded in networks of relationships with other organizations. The media communication studied in this research project identified the positive and negative interpretations of the broadband industry by various interested parties within that industry. Increasing amounts of information exchanged describing the industry positively lead to an increase in population entries directed toward capitalizing on those opportunities. As people and organizations involved in the telecommunications and networking industries developed broadband technology, a broader recognition of the growth potential of the market for high speed Internet access occurred. Broadband technologies were promoted, business models were created, and investment resources flowed into the industry to capitalize on the technology and satisfy customer demand.

As access providers entered the market, participants and observers of the industry continued their interpretation and evaluation of industry activities. Negative evaluation of the industry also strongly affected the industry, but in this case it played a de-legitimating role, reducing the rate of entry. Even as capital flowed into the industry, some level of concern or caution regarding the true size of consumer demand and the growth in the market appeared in media coverage. Interestingly, this delegitimating influence occurs even in the earliest moments in the history of the industry, even before there is an established population. Regulatory issues were also the subject of much communication in the media, particularly commentary on the meaning and implications of potential and actual legislative actions and regulatory agency rulings, and it should be no surprise that entry rates increased as the meaning of regulatory

activities and the role of the government were developed and the scope of their influence became less ambiguous. All these various facets of the legitimation process are dependent on the information exchange occurring among industry participants. Different dimensions may have different relationships with density, entry rates, and with each other. Furthermore, the pattern of discourse in the industry and its effect on industry activities may be subject to peculiar ways in which managers and entrepreneurs attend to information and its use in generating organizational activities and entrepreneurial efforts. This study takes a cautious first step in the direction of exploring these factors in organizational ecology models.

Terreberry (1968) noted that legitimacy is tied to information exchange and communication regarding the value of organizational practices and the willingness to invest resources. The population density provides industry participants with some knowledge about activities occurring within the population, but changes in density provide information that may seem only distantly linked to many critically important issues in an industry. As a single measure, it may also obscure a number of information exchange processes which have different effects on entry rates (Delacroix and Rao, 1994). Recent work on the formation of new organizational forms has highlighted the importance of developing of a clearly defined and focused identity within a population, which is only partially influenced by patterns of organizational density (McKendrick and Carroll, 2001; McKendrick, Jaffee, Carroll, and Khessina, 2003). Also important in the establishment of a legitimate identity for a new population is the ongoing dialogue and information exchange occurring within the industry. The activities of organizations and entrepreneurs were clearly related to the level and content of industry discourse; as an influence on the activities and practices of organizations, this communication content is evidence of the extent of both the cognitive and sociopolitical

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legitimacy of the population. Examining information exchange provides a window on the social processes in which legitimacy emerges and develops over time. Aldrich and Fiol (1994) noted that legitimacy emerges as an aspect of the social context of industry creation, providing both a restrictive influence on behavior but also an arena in which entrepreneurs work toward establishing the legitimacy of new organizational forms. This study claimed that this social context emerges through information exchange and the sharing of conceptions of what broadband access might provide and who might provide it, and the construction of legitimate status of new organizational forms for the provision of broadband service can be seen in analysis of the business press.

Legitimacy and entrepreneurship. As is evident from Figures 2 through 4, a great deal of communication activity occurred within the broadband industry, about factors ranging from the development of the underlying technologies to how the government should or should not be involved in regulating the industry, even before the first provider entered the market. The examination of communication activity between industry participants before the appearance of the organizational population allows for an assessment of the influence initial organizing activities have on industry creation. This refocuses attention on action and interest in the development of organizational populations; the emergence and growth of populations can be seen as the outcome of many competing interests, with organizations aggressively attempting to innovate and change their strategies and technologies while entrepreneurs build new organizations to exploit emergent opportunities.

As Aldrich and Fiol (Aldrich, 1999; Aldrich and Fiol, 1994) pointed out, the creation of legitimacy is a crucial problem for entrepreneurs engaged in the formation of a new industry. While density-based measures provide key insights into the activity level of established

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populations, the growth of legitimacy evident in the information exchange among industry participants gives important clues about populations still in the formative stage of development, where the opportunity may still be in doubt, the ultimate organizational form is unclear, and the best strategies and technologies may by unknown. Aldrich and Fiol (1994) outlined a number of strategies that organizations and entrepreneurs can take to establish legitimacy. The implication for entrepreneurs and managers is that they take an active role in the communication processes defining new organizational forms and linking pre-population activities to the formation of the new industry. Carefully crafted business models, coherent explanations of technological benefits, the push toward standards and dominant designs, and the creation of industry consortia and trade associations are all activities that can raise the level of legitimacy of the industry; the contribution of information exchange in creating the social context in which this occurs requires that industry actors direct their efforts toward accessing the news media, influencing public opinion and investor concerns, gaining the attention of influential opinion leaders, and lobbying regulatory entities. This work is both an individual and a collective effort; the burden of establishing legitimacy falls disproportionately on those involved in the initial moments of industry creation, and those that follow benefit from the work of those that went before them (Delacroix and Rao, 1994).

Methodological Implications

In order to assess the information exchange and discourse involved in constructing the legitimacy of the population of broadband access providers, this study employed a content analysis technique for data collection. The content in news media coverage has the capacity to both transmit and influence the values in a social group (Alper and Leidy, 1969; Chen and Meindl, 1991; Gerbner, 1969; McCombs and Shaw, 1972; Namenwirth and Weber, 1987).

Furthermore, the prevalence of detailed archives of news media coverage on a number of industries give researchers a valuable resource in the exploration of legitimacy (Baum and Powell, 1995; Hannan et al., 1995). Researchers are just beginning to use content analysis techniques to assess legitimacy (e.g., Coombs, 1991; Deephouse, 1996; Pollock and Rindova, 2003), and greater application in population ecology research has the potential to further develop the understanding on how different dimensions of legitimacy influence population processes.

Limitations and Directions for Future Research

While this study took a critical step in extending the density-dependence model of legitimacy and competition by examining the content of communication and information flows among population participants, much more work in this area needs to done in order to fully understand how the social context in which legitimacy is constructed emerges and develops with the growth of organizational populations. First, while the media-based measures of positive and negative industry evaluations were designed to assess concerns regarding the economic prospects of the industry, differences between the influence of economic factors versus widely held perceptions about those economic factors was not distinguished in this study. Since the subject of this study was an industry in its formative stages, uncertainty and ambiguity about its future prospects and a lack of a past history to provide performance benchmarks caused entrepreneurs and other industry actors to base their decisions on factors other than objective economic information. Socially-constructed beliefs about the industry may be more important in such situations rather than quantitative measures of industry growth. However, future studies could more formally address this issue by adding more objective measures of industry growth to entry rate models.

Second, since this study proposed that information exchange provides the social context in which legitimacy is established and maintained, further development of this research could look at the structure of the mass communication process itself on legitimacy. There may be systematic differences in how organizational activities are covered in the media. For instance, it is reasonable to assume that large firms receive the most news coverage; as a consequence, they may also have greater influence on legitimacy and entry rates even in new industries. If true, the implication would be that the creation of new industries may involve the formation of new firms, but may also require the support of large incumbent firms to ultimately acquire legitimacy. Biases in communication processes may have other consequences for the establishment of legitimacy, such as a focus on highly successful (or unsuccessful), but unrepresentative, entrants in the industry. Furthermore, different sets of publications (e.g., weekly news magazines with a wide audience versus industry trade publications with a focused constituency) may reflect the interests and conceptions of different sets of industry actors which may influence the development of new organizational forms. Future studies should examine further the differences between firms and new media sources in their ability to influence the recognition and reputation of the industry.

Third, the results of this study may not be generalizable to later periods in the history of industries. The scope of this study was the time period leading up to the first entries into the market and through the early phases of population development. However, the patterns of discourse may change as the industry matures. The intent of studying an emergent industry is a focus on the impact of legitimacy over other factors; after the industry becomes established, the influence of density and other variables on the pattern of entries and foundings may reflect other

population processes. However, it may be useful to study how the patterns and content of communication change over time with the maturation of an organizational population.

Finally, this study recognizes the importance of legitimacy on the rates of entry into the population. However, a major thrust of population ecology research is organizational survival. The arguments generated in this study address market entry; a different, albeit complementary, set of arguments should be developed for organizational failures. Applying the approaches developed here for the analysis of entry rates to an analysis of market exit rates would be a substantial contribution to the ecological literature.

Conclusion

This study set out with the objective of expanding our understanding of the effects of legitimacy on entry and founding rates in populations at a formative stage of development. Content analysis methods were devised to evaluate legitimacy effects using news media-based data sources, which were combined with density-based measures in a model of entry rates into the population. By using both density-dependent and media-based measures of legitimacy, a more complex picture of the process of industry creation and development emerged, with both media- and density-based measures significantly related to the rate of founding and entry. Furthermore, it was found that media-based measures of legitimacy produced entry rate models as good as those using density-based legitimacy and competition measures; combining the two types of variables produced substantially better fitting models than those which treated them separately, and in one instance resulted in density becoming insignificant. The use of media-based measures allowed the models to account for pre-population activities, which began to establish the legitimacy of the industry before the first entry appeared and supported the subsequent development of the population, while the use of multiple measures of legitimacy

allowed an examination of the complexity of the relationships between different dimensions of

legitimacy and entry and founding rates.

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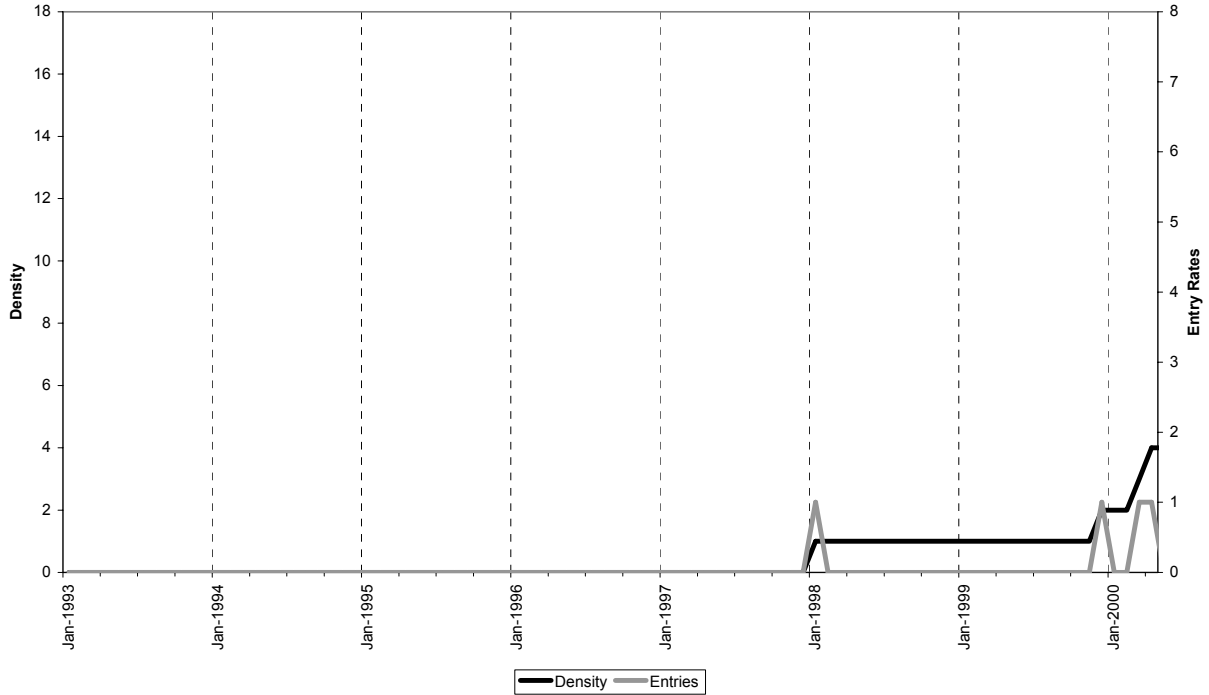
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Figure 1. Entry rate and density in six largest cities in Texas, January 1993 to April 2000 (by month)

(a) Entry rate and density in Austin (by month).

(b) Entry rate and density in Dallas (by month).

(c) Entry rate and density in El Paso.
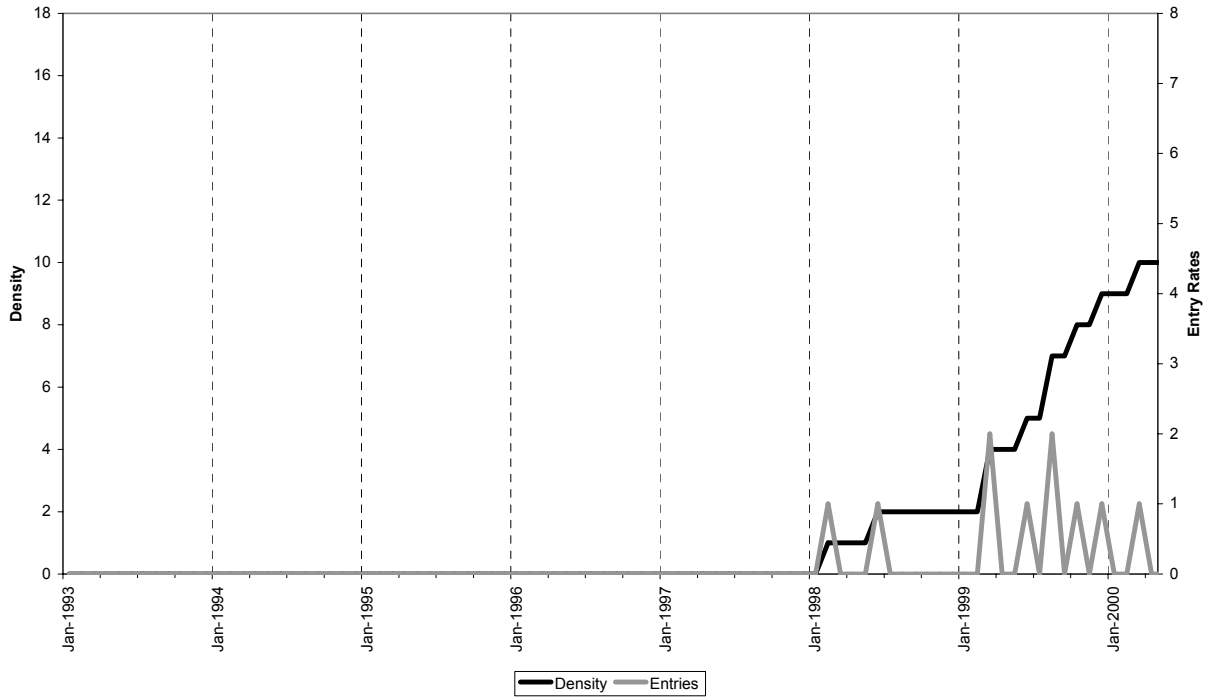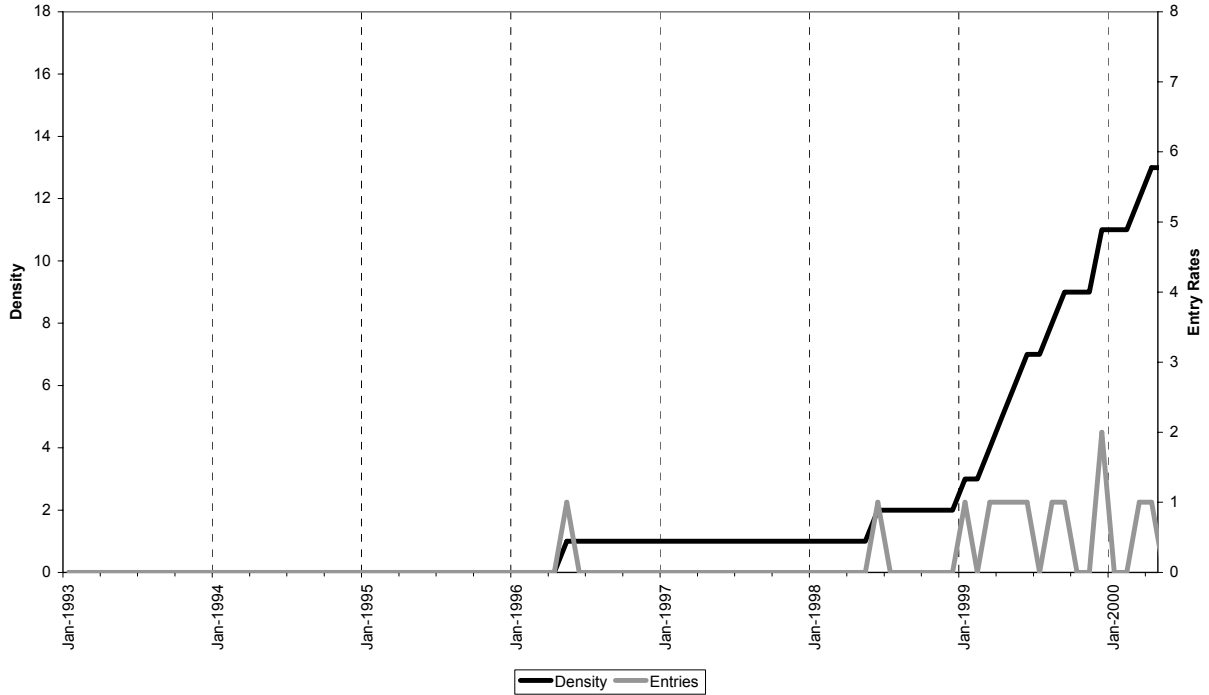

(d) Entry rate and density in Fort Worth.

Figure 1 (continued). Entry rate and density in six largest cities in Texas, January 1993 to April 2000 (by month)

(e) Entry rate and density in Houston.
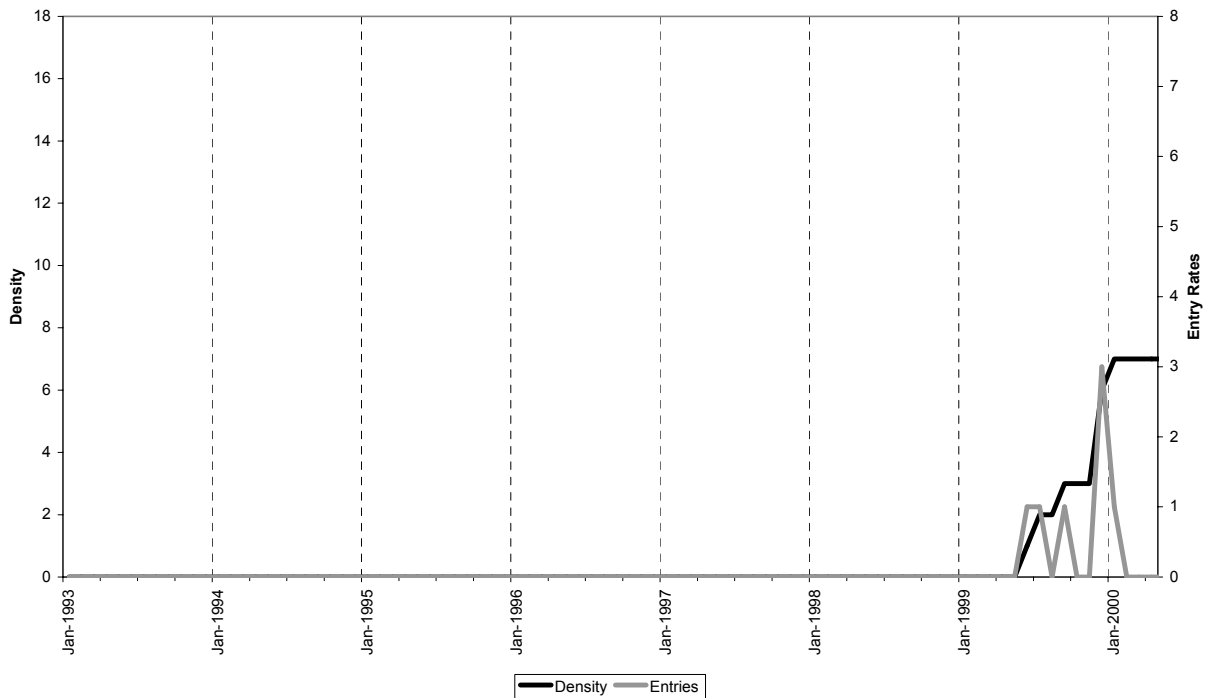

(f) Entry rate and density in San Antonio.

Figure 2. Volume of general media coverage of the industry, January 1993 to April 2000 (by month)
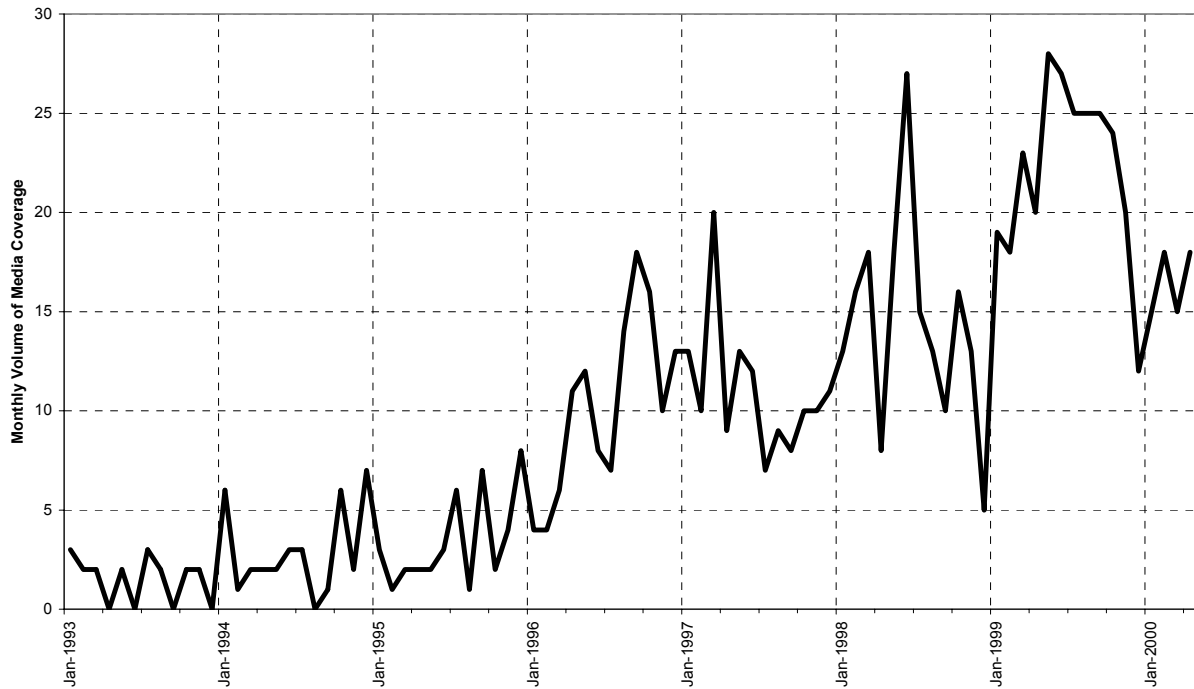

Figure 3. Volume of positive and negative media coverage of the industry, January 1993 to April 2000 (by month)
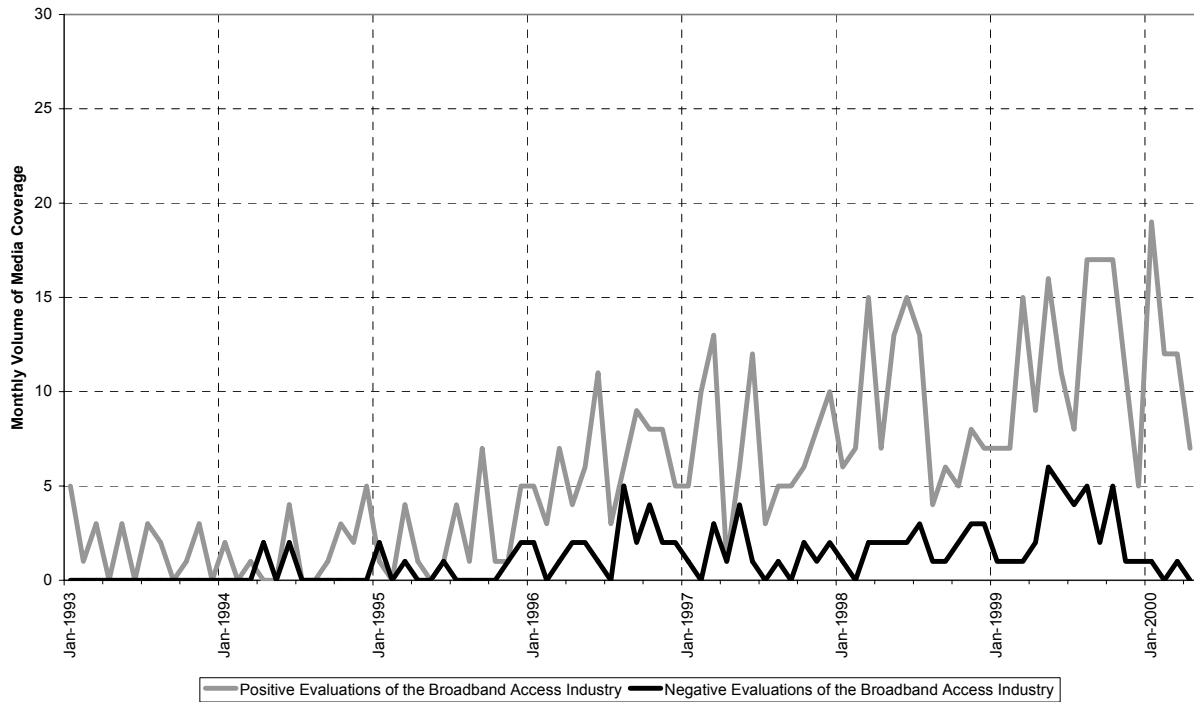
Figure 4. Volume of governmental and regulatory media coverage of the industry, January 1993
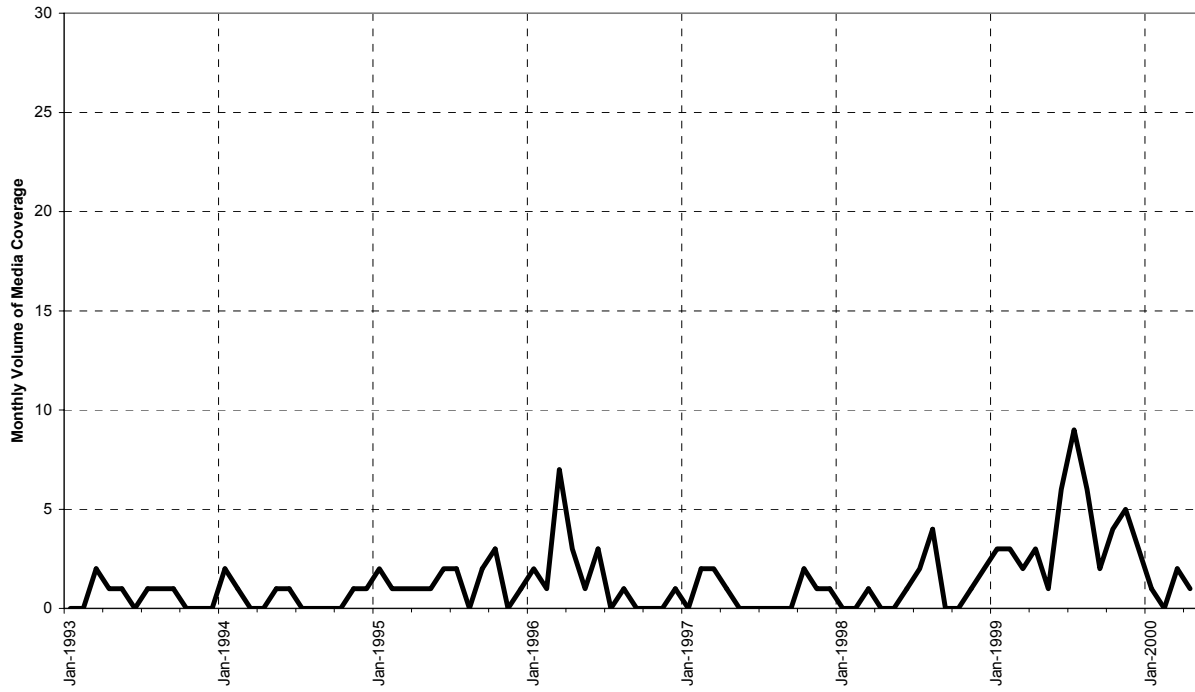to April 2000 (by month)

Figure 5. Revised model of media coverage-based and density-dependent effects on entry rates.
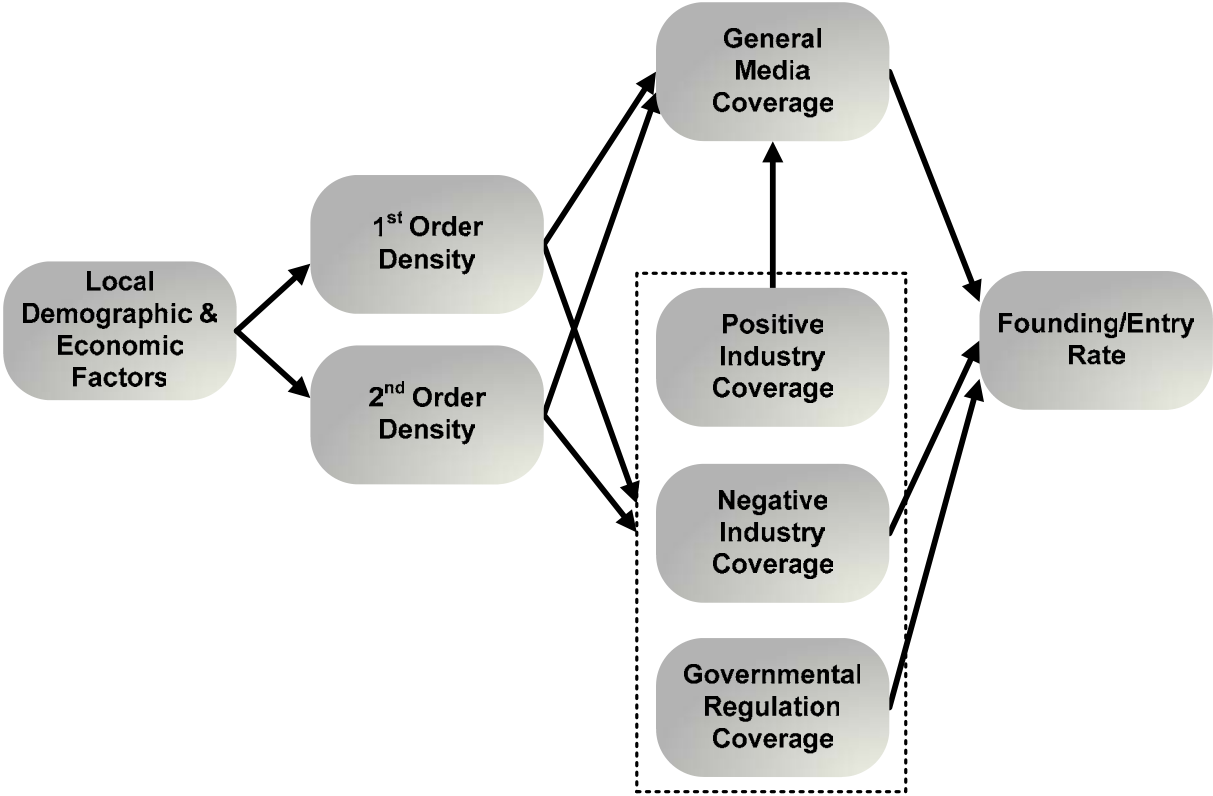
Table 1. Summary of Population Entry Rate Models and Hypotheses

Hypotheses		Independent Variables
Density-Dependent Legitimacy and Competition Effects on Population Entry Rates	**Hypothesis 1a**	First-order form of population density.
	Hypothesis 1b	Second-order form of population density.
Media-based Legitimacy Effects on Population Entry Rates	**Hypothesis 2**	Volume of general media coverage (cognitive legitimacy effects).
	Hypothesis 3	Volume of positive and negative industry media coverage (sociopolitical legitimacy effects), and volume of media coverage of governmental and regulatory interest (sociopolitical legitimacy effects).
Combining Density-Dependent and Media-based Legitimacy Effects on Population Entry Rates	**Hypothesis 4**	Density-dependent legitimacy and competition; volume of general media coverage.
	Hypothesis 5	Density-dependent legitimacy and competition; volume of positive and negative industry media coverage; volume of media coverage of governmental and regulatory interest.

Table 2. Negative Binomial Regression Coefficients for the Relationship Between Entry Rate and Independent Variables: Broadband Access Providers in Six Largest Cities in Texas, January 1993 to April 2000.

Independent Variables				Models				
	1	2	3	4	5	6	7	8
Population density	0.8872 **	—	—	—	0.4355 *	0.6229 **	0.2960	—
(Population density)^2	-0.0668 **	—	—	—	-0.0309 +	-0.0500 **	-0.0198	—
Volume of general media coverage	—	0.1654 **	—	0.1872 **	0.1098 **	—	0.1712 **	—
Volume of positive industry evaluations	—	—	0.1554 **	0.0042	—	0.0836 *	0.0331	—
Volume of negative industry evaluations	—	—	-0.2784 *	-0.4776 **	—	-0.3056 *	-0.4439 **	—
Volume of political and regulatory interest coverage	—	—	0.3929 **	0.2548 **	—	0.2996 **	0.1916 *	—
City population, in hundreds of thousands	0.0273	0.0467	0.0562 +	0.0445	0.0276	0.0389	0.0287	0.0837 *
GDP growth rate	-0.0183	0.2174 *	0.0202	0.1056	0.1100	-0.0226	0.0505	0.0643
City unemployment rate	-0.1642	-0.2080 *	-0.2867 *	-0.1913 *	-0.1434	-0.1695	-0.1446	-0.5220 **
Worldwide Internet host growth rate	-0.1279	0.0329	-0.0342	0.0005	-0.0529	-0.1076	-0.0517	-0.0868
Constant	-2.2875 *	-5.3642 **	-3.2853 ***	-4.8788 **	-4.3632 **	-2.9775 **	-4.3088 **	-0.7846
α	0.4213	0.4960	0.2600	0.0000	0.4171	0.0000	0.0000	1.5379
Likelihood test of α = 0	0.139	0.100	0.269	1.000	0.133	0.500	0.500	0.007
Pseudo R-square	0.2269	0.2405	0.2302	0.3052	0.2657	0.2718	0.3183	0.0843
AIC	292.082	285.220	292.922	268.133	280.234	282.041	267.455	339.006
Log Likelihood	-138.0411	-135.6102	-137.4611	-124.0663	-131.1168	-130.0207	-121.7276	-163.5032
Degrees of freedom	6	5	7	8	7	9	10	4

+ p < 0.10, * p < 0.05, ** p < 0.01

Note: Sample consisted of 522 observations (87 months in 6 cities); one month of data was lost in the statistical analysis through the use of lagged variables.

Note: The parameter α is an estimate of the overdispersion parameter characteristic of the negative binomial regression model. When α = 0, the data exhibits no overdispersion and can be modeled using Poisson regression. The likelihood test is a significance test of overdispersion in the data.

Table 3. Likelihood Ratio Tests and Model AICs Comparing Selected Statistical Models

Model Comparisons:	Likelihood Ratio Test of Full versus Constrained Models[a].			Comparison of Full versus Constrained Model AICs[b].	
	Degrees of freedom	Likelihood Ratio	P-value	AIC of the full model	AIC of the constrained model
Adding density variables to the media coverage variable model:					
Comparing model 5 to model 2	2	8.987	0.011	280.234	285.220
Comparing model 6 to model 3	2	14.881	0.001	282.041	292.922
Comparing model 7 to model 4	2	4.677	0.097	267.455	268.133
Adding media coverage variables to a density variable model:					
Comparing model 5 to model 1	1	13.849	0.000	280.234	292.082
Comparing model 6 to model 1	3	16.041	0.001	282.041	292.082
Comparing model 7 to model 1	4	32.627	0.000	267.455	292.082

[a] A significant p-value in the likelihood ratio test indicates that the full model provides a better fit to the data.
[b] All things being equal, the model with the lower AIC is the preferred model.

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