THE ORGANIZATION OF PROFESSIONAL SPORTS LEAGUES: MORTALITY AND FOUNDING RATES, 1871-1997

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by

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In this dissertation, I examine explanations from organizational ecology for organizational mortality and founding rates. I review the literature regarding age dependence, including the liabilities of newness, adolescence, obsolescence, and senescence; size dependence; density dependence, including disaggregated measures; and possible effects of founding conditions due to imprinting or a trial by fire. I develop hypotheses about each of these based on previous research. In addition, I develop a new concept in organizational mortality that I call growth dependence. For the mortality analysis, two types of models are used – a piecewise constant exponential model and a basic exponential model. For the foundings analysis, Poisson regression models are used. The data used to test the hypotheses are organizational and environmental data about the entire population and history of professional sports leagues in North America. This data set includes measures of size, age, density, and other variables covering a period of 127 years from 1871 to 1997. Additional

variables measuring different environmental conditions (e.g. GNP growth) are also included in tests of hypotheses. Results can be summarized as follows. First, underspecified models can lead to erroneous conclusions about age dependence. Second, there is no evidence of a significant interaction between organizational age and size in this population. Third, disaggregated density effects may be stronger than total density effects. Fourth, competitive forces present at the time of founding have a lasting effect on organizations in this population. Fifth, there is little support for the trial by fire hypothesis in this analysis. And sixth, there is no support for the newly developed concept of growth dependence in this population.

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VITA

Michael E. Dobbs was born in Houston, Texas, on August 25, 1966, the son of Curtis E. Dobbs and Sue Castleberry Dobbs. He graduated from Skyline High School, Dallas, Texas in 1984 and then entered Baylor University at Waco, Texas where he completed one year of college education before returning to the Dallas area. There, from the fall of 1985 through the end of 1986 he worked for the Garland Independent School District as a computer hardware technician. In January 1987, he resumed his college education at the University of North Texas in Denton, Texas. In December 1988, he received the Bachelor of Arts degree, cum laude, majoring in Communication/Public Address and minoring in History. For the next year and a half he held several jobs in retail before entering graduate school. He enrolled in the Hankamer School of Business at Baylor University in the summer of 1990 and received his Master of Business Administration degree in August of 1991 majoring in Management and Marketing. From 1991 through 1994, he worked as a wholesale sales representative for Slaughter Distributing, Incorporated of Dallas, Texas. In the fall of 1994 he returned to graduate school, this time to the School of Management at the University of Texas at Dallas as a student in the Organizations, Strategy, and International Management program.

CHAPTER 1

INTRODUCTION

> "…most of the players are in the game for the money that's in it – not for the love of it, the excitement of it, the thrill of it." (Helyar, 1994)

Who said that? Was it Rupert Murdoch who recently purchased the Los Angeles Dodgers for $350 million? Maybe it was Tom Hicks who just signed Mike Modano to a $43.5 million National Hockey League contract. Perhaps it was Gene Upshaw, President of the National Football League Player's Association (NFLPA), reminiscing about the good old days and feeling bad that he was not paid much relative to today's salaries. Was it David Stern, Commissioner of the National Basketball Association (NBA) which recently decided to scrap the labor agreement between owners and players and locked out the players? Or just maybe it was Ralph Backstrom, the Commissioner of Roller Hockey International (RHI), longing for the good old salary days in the early 1990's before the Anaheim franchise drew more fans than some NBA teams. Although many of the people above may very well have uttered something similar, the quote is from Baseball Hall of Famer Ty Cobb . . . in 1925.

Many in the media today lament that "sports aren't what they used to be." They point to escalating salaries and the seemingly nightly police blotter segment during the local television sports report. However, these and other aspects of sports have been around for a hundred years or more. Certainly, treatment of sports by media has changed some – there was no ESPN 100 years ago – but it is dangerous to assume that things were better in the past.

Likewise, it is dangerous to assume things were the same in the past. This is especially true for those interested in examining sports leagues as organizations. It would be unwise, for instance, to assume that the “Big Four” sports of today (baseball, basketball, football, and hockey) have always enjoyed such a preeminent position. Prior to World War I it was not so. Believe it or not, roller hockey was more popular than either basketball or ice hockey at that time (Pollak, 1998). How do we know such things? Professional sports is one of those industries about which we have a great deal of historical information. Of course there is not as much as we would like (there never is, it seems), but there is enough to perform certain tests about the dynamics of the industry throughout its history.

Organizational ecology has provided a unique perspective regarding the dynamics of populations of organizations. The environment is seen as the predominant factor affecting the founding, development, and mortality of organizations (Hannan & Freeman, 1984). A variety of environmental factors have been tested for the effects they may or may not have on organizations with varying degrees of success. Only one of these tests, however, has been performed with professional sports leagues as the industry of focus. I endeavor to change that with this study.

Professional sports leagues are rather unique in their organizational form. While there is strong competition with other leagues, there is even stronger competition between teams within the league. But this competition must be tempered by some degree of cooperation between teams in the same league. And leagues sometimes even cooperate with each other. In addition, as leagues are established in different sports, the legitimacy of sports leagues is further entrenched. Add to all this the value of sports to society, both economically and sociologically, and it becomes apparent that these aspects of professional sports leagues make them intriguing subjects for study. All of these topics will be discussed in more detail in Chapter 2, a description of professional sports leagues and a listing of the leagues used for empirical research herein.

Chapter 3 moves us into the realm of organizational ecology. In this chapter, I explore previous research concerning organizational mortality rates. Of particular interest are age and size dependence, density dependence, possible effects of founding conditions, and growth dependence. This last concept is a new one developed here for the first time. I generate hypotheses about each of these areas and test them using a piecewise constant exponential modeling technique and then test for size/age interactions using a basic exponential model.

Chapter 4 reviews the organizational ecology literature concerning organizational foundings. This body of literature is much smaller than that dedicated to mortality rates. Nevertheless, hypotheses are developed concerning density and same sport density effects on founding rates. I test these using Poisson regression analysis.

Chapter 5 serves as the conclusion to this study. Results of tests of mortality and foundings are summarized and discussed, and extensions and revisions are recommended. So once again, here are the chapters in this work and their subject matter:

Chapter 1 – Introduction

Chapter 2 – Professional Sports Leagues

Chapter 3 – Organizational Mortality Rates

Chapter 4 – Organizational Founding Rates

Chapter 5 – Conclusions

CHAPTER 2

PROFESSIONAL SPORTS LEAGUES

In 1871 the first American professional sports league was formed. It was called the National Association of Professional Base Ball Players (NA). The NA existed for only five years, but that was long enough for some of the issues that face today's professional sports leagues to surface. The best players left their teams in search of better financial deals. Existing teams folded or relocated while new teams were born. And there was infighting among team owners. All this was happening before Sitting Bull defeated Custer at Little Big Horn (Helyar, 1994)

Sports in North America have a long and sometimes well documented history. But this alone is not reason enough to make sports organizations the subject of inquiry. Why, then, may professional sports leagues be of interest to organizational sociologists and particularly organizational ecologists? There are two primary reasons. First, professional sports leagues are unlike most other organizational populations studied by organizational scholars. They are subject to strong forces of competition in addition to requiring a great deal of cooperation both between leagues and between teams within the same leagues. And second, sports have social and economic value in North American society. In this chapter, I explore the reasons why sports leagues are interesting organizations to study and describe the sports leagues used in the empirical work that follows in Chapters 3 and 4.

Cooperation, Competition, and Legitimation

Although today's professional sports leagues vary in the amount of cooperation required or offered by member teams, there is no doubt that cooperation exists and is necessary for both team and league survival. Land, Davis, and Blau (1994) point out that teams cannot be successful without other teams to play. There is symbiosis between competing teams. They can draw more fans, share expenses (e.g. officiating, advertising, etc.), and create a broader interest in the game. It benefits teams to cooperate to some degree. The National Football League (NFL), for example, has an extensive revenue sharing agreement between its teams. Each member team receives an equal share of national television revenue (95% of all television revenue) and an equal share of the merchandising revenue. In addition, home teams keep 60% of the gate while visiting teams take home 40% (Sheehan, 1996). The NFL has developed a structure of cooperation that has helped it vault to the top of league market values (Sheehan, 1996). But while teams certainly cooperate with one another, they also compete with other teams in the league. They compete both on the playing field and for scarce resources.

One area in which this combination of cooperation and competition is readily apparent is the market for player services. Cooperation means that player costs become self-regulated (Scully, 1989). This was the case as early as 1879 when baseball's National League (NL) recognized that franchises would be less stable if players were allowed to jump from team to team in search of the best pay. Therefore, the NL created the "reserve clause" which permanently reserved the playing rights of players for individual teams. In other words, players belonged to teams. If a player did not like his salary, his choice was to play anyway, or not play in that league at all. By 1883 the rosters of all teams in the NL were locked. Any attempts to recruit players from other teams or otherwise tamper with the rosters of other teams was met with the threat of blackballing. This in effect allowed team owners to control player costs – a crucial component of teams' financial viability.

This was recognized early on as a monopoly. But in the case of *Federal Baseball Club of Baltimore v. National League et. al.* in 1922, the Supreme Court of the United States decided that the NL should exist as an exception. Otherwise, in the court's opinion, the most skillful players would migrate to the wealthiest clubs reducing the competitiveness of the league and ultimately destroying it (Scully, 1989). Thus, baseball enjoyed its monopoly status for decades until labor negotiations forced owners to allow restricted free agency. This meant that owners once again competed with each other financially for the services of the top players – not only in baseball, but also in almost all major professional sports. So with regard to player services, teams in professional sports leagues have attempted cooperation in the past to varying degrees of success, but are today relegated to a competitive structure. They face competition from within their league for valuable resources. A balance between team and league concerns – a balance between competition and cooperation – must be struck to ensure survival.

Table 2.1 shows many of the industries that have been examined in previous ecological studies. Of the 22 categories of populations, 20 are made up of individual organizations competing against each other at various levels. Only two populations are made up of collections of individual organizations that must cooperate to survive – trade associations and baseball's minor leagues. And of these two population categories, only sports leagues also have a high degree of competition between organizations within the population. Professional sports leagues, then, are rather unique because they are characterized

Table 2.1
Industries Included in Ecological Studies

Industry	**Author(s) & Published Date**
Newspapers	Carroll & Delacroix, 1982 Freeman, Carroll, & Hannan, 1983 Delacroix & Carroll, 1983 Carroll & Hannan, 1989a Carroll & Hannan, 1989b Levinthal, 1991 Amburgey, Kelly, & Barnett, 1993 Swaminathan, 1996
Labor Unions	Freeman, Carroll, & Hannan, 1983 Carroll & Hannan, 1989b
High Technology	Freeman, Carroll, & Hannan, 1983 Boeker, 1988 Brittain & Wholey, 1988 Freeman, 1990 Brittain, 1994 Anderson, 1995 Mitchell, 1995 Ryan, Freeman, & Hybels, 1995 Hannan, Burton, & Baron, 1996 Podolny, Stuart, & Hannan, 1996 Henderson, 1997
Telephone Companies	Barnett & Carroll, 1987 Barnett, 1994 Barnett, 1997
Wine Making	Delacroix & Solt, 1988 Delacroix, Swaminathan, & Solt, 1989
Volunteer Organizations	McCarthy, Wolfson, Baker, & Mosakowski, 1988 Tucker, Singh, Meinhard, & House, 1988 Tucker, Singh, & Meinhard, 1990
Trade Associations	Aldrich & Staber, 1988 Aldrich, Staber, Zimmer, & Beggs, 1990 Aldrich, Zimmer, Staber, & Beggs, 1994
Breweries	Carroll & Hannan, 1989b Carroll & Swaminathan, 1992 Swaminathan, 1996 Barnett, 1997
Small Businesses	Brüderl & Schüssler, 1990 Gimeno, Folta, Cooper, & Woo, 1997
Financial Institutions	Ranger-Moore, Banaszak-Hall, & Hannan, 1991 Haveman, 1992 Rao & Neilsen, 1992 Amburgey, Dacin, & Kelly, 1994 Freeman & Lomi, 1994 Barron, West, & Hannan, 1994 Podolny, 1995 Barron, 1995

Table 2.1 (Continued)

Industry	**Author(s) & Published Date**
Life Insurance	Ranger-Moore, Banaszak-Hall, & Hannan, 1991 Ranger-Moore, 1997
Day Care Services	Baum & Oliver, 1991 Baum & Oliver, 1992 Baum & Oliver, 1996
Hotels	Baum & Mezias, 1992 Ingram & Baum, 1997 Baum & Haveman, 1997
HMO's	Wholey, Christianson, & Sanchez, 1992 Strang, 1995
Minor Leagues & Teams	Land, Davis, & Blau, 1994
Railroads	Dobbin, 1995
Art Museums	Blau, 1995
Automobile Manufacturing	Hannan, Carroll, Dundon, & Torres, 1995 Carroll & Teo, 1996 Hannan, Carroll, Dobrev, & Han, 1998 Hannan, Carroll, Dobrev, Han, & Torres, 1998
Radio Stations	Leblebici, 1995
Retailers	Usher & Evans, 1997
State-Owned Enterprises	Spenner, Suhomlinova, Thore, Land, & Jones, 1998
Accounting Firms	Pennings, Lee, & Witteloostuijn, 1998

by strong competition *and* the need for cooperation. By using professional sports leagues to examine and extend the tenets of organizational ecology, we gain further insight into this seldom studied type of population.

But it should be noted that these intraorganizational dynamics of professional sports leagues do not serve to eliminate the pressures of competition between leagues. Like so many of the other organization types listed in table 2.1, the population of professional sports leagues is one in which competition is a strong force. And this force is strongest between leagues that participate in the same sport because these leagues pursue many of the same resources including players, fans, media coverage, playing venues, and sometimes even whole teams. In roller hockey, for example, the Central Polo League stole players and teams from the

Western Polo League and caused the latter's demise in 1905. Intense competition between leagues playing the same sport is the rule rather than the exception.

Competition also exists between leagues that play different sports. Although the competition for some resources such as players may be less direct between leagues playing different sports, there is certainly competition that exists. For example, leagues that play during the same time of year compete for media exposure. The NBA and NHL compete with one another for almost their entire seasons to see who can lead "Sports Center" on ESPN. Leagues playing during the same time can also compete for facility time in stadiums and arenas. Again, NBA and NHL franchises in the same city oftentimes compete for playing time in the same arena. So although competition is usually strongest between leagues playing the same sport, there can be competition between leagues and teams playing different sports as well.

In addition to the cooperation and competition forces at work between professional sports leagues, there are legitimation processes at work as well. The NA baseball league, as mentioned before, was the first professional league to ever be created. Before 1871 there were professional athletes, but they did not compete in leagues as we know them today. They either competed in tournaments or as members of barnstorming teams that would travel throughout a region playing the best teams communities could put together (Reichler, 1985). So the NA was the first organization to take on this new form – a group of teams from different cities made up of athletes who are paid to play.

Would this new form grow and thrive in its environment, or would it wither and die? Although we know today what happened, at the time this was a very valid question. In fact, according to Reichler (1985), the NA was hounded by accusations of gambling by players and fan distrust lead to its demise. The establishment of the NL the following season and its owners' commitment to keep things above board may have had a considerable impact on the perception of this organizational form as legitimate. Although there were and still are barnstorming teams (e.g. the Harlem Globetrotters), the team league form did grow and thrive from the 1870's to the present day. It has been the form of choice for most team sports in North America and some have even tried to use it for traditionally individual sports such as bowling, rodeo, and boxing. So the form was legitimized first for baseball and then for other team sports. As more and more leagues succeeded in more and more sports, the form became cemented in society's mind as one that was legitimate.

Societal Value

The existence of leagues is very much taken for granted by society today. Sales of local teams make the front pages of local newspapers. Relocations of franchises sometimes lead the national news. And stadium referendums bring sports related issues to the local forefront on a nearly daily basis in cities where votes are pending. One state, Washington, has even authorized its state lottery to issue special "Sports Bonanza" lotto scratch tickets to raise an estimated $127 million of the $300 million commitment to a new sports arena the state has made. Professional sports have both economic and social impacts on North American society.

The sports industry is very large. With franchise values of hundreds of millions of dollars and multi-billion dollar network television contracts, professional sports is a large portion of the U.S. economy. In fact, it is the eleventh largest industry in the country estimated at $152 billion a year according to researchers at Georgia Tech (Alm, 1998). The industry has grown so large that sports management is now offered as a major at more than 200 North American colleges and universities (Daniel Webster College, 1998).

Not only are sports management degrees being offered at the university level, but degrees in the sociology of sports are also being offered. In fact, Ph.D.s in sports sociology are offered by some of the most prestigious state schools in the U.S., including The Ohio State University, the University of Illinois, and the University of North Carolina. This underscores the prominent position taken by sports in society.

The value of sports is often debated, but not the fact that it impacts society. While some sociologists question the wisdom of training youth sports participants to be competitive rather than cooperative, others point out that professional sports has led the way, albeit late, with regard to race integration in the U.S. (Rosentraub, 1997). Whether one thinks of sports as a positive influence or not, one cannot deny that it is an influence. Nine of the top ten television shows in U.S. history have been coverage of sporting events (Nelson, 1996). Professional sports leagues are, then, an important thread in the tapestry of American culture and society.

Add up all these aspects of professional sports leagues and one has a somewhat unique organization type and one that is important to society. But it is also true that professional sports leagues have not been the subject of much empirical inquiry as to their organizational structure. There has been a significant amount of work concerned with the economics of sports (e.g. Scully, 1989; Zimbalist, 1992; Quirk & Fort, 1992) and the sociology of sports – what sports mean to society, sports as a means of personal achievement, etc. – the but not much as to the *organizational* nature of sports and their leagues (Slack, 1997). Only Land, Davis, & Blau (1994) have examined it from an ecological point of view. This work endeavors to change this by examining a broader range of professional sports leagues over the entire history of the population.

Professional Sports Leagues Studied

The primary source of data on professional sports leagues used herein is Sports Leagues and Teams: An Encyclopedia, 1871 through 1996 (Pollak, 1998). The following characteristics and criteria describe the leagues included in the study. (1) Only *team* sports leagues in which competition takes place between teams rather than individuals are included. Organizations such as the Professional Golf Association (PGA) and the World Tennis Association (WTA) are not included. (2) Only *professional* leagues are included. Amateur and collegiate leagues are not. Collegiate leagues in particular have substantially different organizational forms than professional leagues and therefore seem inappropriate for inclusion in this study. (3) Only *North American* leagues are included, and the vast majority of these are based in the United States. There are, however, a few Canadian based leagues included in addition to Canadian teams that are part of U.S. based leagues. (4) Only *major* leagues are included. No "feeder" or minor leagues are included; that is, no leagues are included that have formalized ties with a major league through which players are provided to the major league level. (5) *Multiple* sports are used including baseball, basketball, football, hockey, soccer, roller hockey, softball, volleyball, and lacrosse. Not only do these sports provide a richer picture of the history of professional sports leagues, but some of these sports were more popular at times than some of the "Big Four" sports of baseball, football, basketball, and hockey that are most familiar to us today (e.g. roller hockey in the late 19th century). (6) The *complete history* of professional sports leagues is used. The time frame is 1871-1997 – data covering 127 years. The first recognizable professional sports league in North America was the National Association (NA) and was the precursor to the present day National League (NL). The NA was founded in 1871.

The data set includes all 206 professional leagues that meet the criteria listed above. This means that rather than *sampling* the population, the entire population is captured and its entire history can be studied. Of course, the data are right-censored because leagues still existed in 1997. But this can be handled appropriately by the models chosen for hypothesis testing.

So, in reality, the leagues used in this study are major North American professional team sports leagues. But since that seems a bit cumbersome, the shorter "professional sports leagues" description is used throughout this paper. A couple of these leagues merit special consideration. First, the Negro baseball leagues are included. They were subject to most of the same pressures as other leagues and had on their rosters some of the best baseball players in North America into the late 1940's when the American and National leagues began to recruit their players in earnest, leading to their collapse in the 1950's. To omit the Negro leagues from the study would inappropriately omit a significant group of observations. And because women's leagues are likewise subject to many of the same pressures, they too are included. Table 2.2 lists all leagues used in the study.

Table 2.2
Professional Sports Leagues Included in Study

Baseball	
National Association (NA)	Negro Southern League (NSL1)
National League (NL)	Eastern Colored League (ECL)
International Association (IA)	Negro Southern League (NSL2)
League Alliance (LA)	American Negro League (ANL)
Northwest League (NWL)	Negro Southern League (NSL3)
Eastern Championship Association (ECA)	East-West League (EWL)
American Association (AA)	Negro Southern League (NSL4)
Union Association (UA)	Negro National League (NNL2)
Players League (PL)	Negro Southern League (NSL5)
Western League (WL)	Negro American League (NAL)
American League (AL)	United States Baseball League (USBL)
United States League (USL)	Negro Southern League (NSL6)
Federal League (FL)	All-American Girl's Baseball League (AAGBL)
Pacific Coast League (PCL)	National Girls Baseball League (NGBL)
Senior Professional Baseball Association (SPBA)	Women's Baseball League (WBaseL)
National Professional Indoor Baseball League (NPIBL)	US Women's Professional Baseball League (USWPBL)
Southern League of Colored Base Ballists (SLCB)	Women's Baseball Association (WBaseA)
National Colored Baseball League (NCBL)	Ladies League Baseball (LLB)
Negro National League (NNL1)	

Football	
National Football League (NFL)	World Football League (WFL)
American Football League (AFL1)	United States Football League (USFL)
American Football League (AFL2)	World League of American Football (WLAF1)
American Football League (AFLX)	Interprovincial Rugby Football Union (IRFU)
American Football League (AFL3)	Western Inter-Provincial Football Union (WIFU)
All American Football Conference (AAFC)	Canadian Football League (CFL)
American Football League (AFL 4)	Arena Football League (ArFL)

Hockey	
International Professional Hockey League (IHL)	Pacific Coast Hockey Association (PCHA)
Eastern Canada Hockey Association (ECHA)	National Hockey League (NHL)
Ontario Professional Hockey League (OPHL)	Western Canada Hockey League (WHL)
National Hockey Association (NHA)	World Hockey Association (WHA)

Table 2.2 (Continued)

Basketball	
National Basketball League (NBL1)	Eastern League (EBL2)
Interstate League (IBL1)	National Basketball League (NBL2)
American Basket Ball Association (ABBA)	Central Basketball League (CBL2)
Massachusetts Basketball League (MABL)	Eastern League (EBL3)
Central Massachusetts Basketball League (CMBL1)	National Basketball League (NBL3)
American Basketball League (ABL1)	Tri-State League (TSL)
Central Massachusetts Basketball League (CMBL2)	Metropolitan Basketball League (MBL2)
New England Basketball League (NEBL1)	National Basketball League (NBL4)
Philadelphia Basketball League (PBL)	American Basketball League (ABL4)
American Basketball League (ABL2)	Midwest Basketball Conference (MBC)
Connecticut American Basketball League (CABL)	National Basketball League (NBL5)
New England Basketball League (NEBL2)	Basketball Association of America (BAA)
Western Massachusetts Basketball League (WMBL)	Professional Basketball League of America (PBLA)
Western Pennsylvania Basketball League (WPBL1)	All America Basketball Conference (AABC)
New England Basketball League (NEBA)	National Basketball Association (NBA)
Central Basketball League (CBL1)	National Professional Basketball League (NPBL)
Eastern League (EBL1)	American Basketball League (ABL5)
Hudson River League (HRL)	American Basketball Association (ABA)
New York State League (NYSL)	All-American Basketball Alliance (AABA)
Western Pennsylvania Basketball League (WPBL2)	World Basketball League (WrBL)
Connecticut State Basketball League (CSBL)	Women's Professional Basketball League (WBL)
Western Pennsylvania Basketball League (WPBL3)	Ladies Professional Basketball Association (LPBA)
Pennsylvania State League (PSL)	Women's American Basketball Association (WABA)
Interstate League (IBL2)	Women's Basketball Association (WBA)
Connecticut State League (CSL)	American Basketball League (WABL)
Metropolitan Basketball League (MBL1)	Women's National Basketball Association (WNBA)
American Basketball League (ABL3)	

Soccer	
American League of Pro. Football Clubs (ALPF)	National Professional Soccer League (NPSL1)
National Association Foot Ball League (NAFBL)	United Soccer Association (USA)
St. Louis Soccer League (SLSL)	North American Soccer League (NASL)
Eastern Professional League (EPSL1)	Canadian Professional Soccer League (CPSL)
Interprovincial Soccer League (IPSL)	United Soccer League (UnSL)
Southern New England Soccer League (SNESL)	Western Soccer League (WSL)
American Soccer League (ASL1)	Canadian Soccer League (CaSL)
International League (ISL1)	A-League (ASL3)
Eastern Professional League (EPSL2)	American Professional Soccer League (APSL)
American Soccer League (ASL2)	Major League Soccer (MLS)
New England Division-American Soc. League (NED1)	Major Soccer League (MSL)
North American Soccer Football League (NASFL)	North American Soccer League (NASL-I)
New England Division-American Soc. League (NED2)	National Professional Soccer League (NPSL2)
Eastern Canada Professional Soccer League (ECPSL)	Continental Indoor Soccer League (CISL)
Eastern Professional Soccer Conference (EPSC)	W League (USWISL)

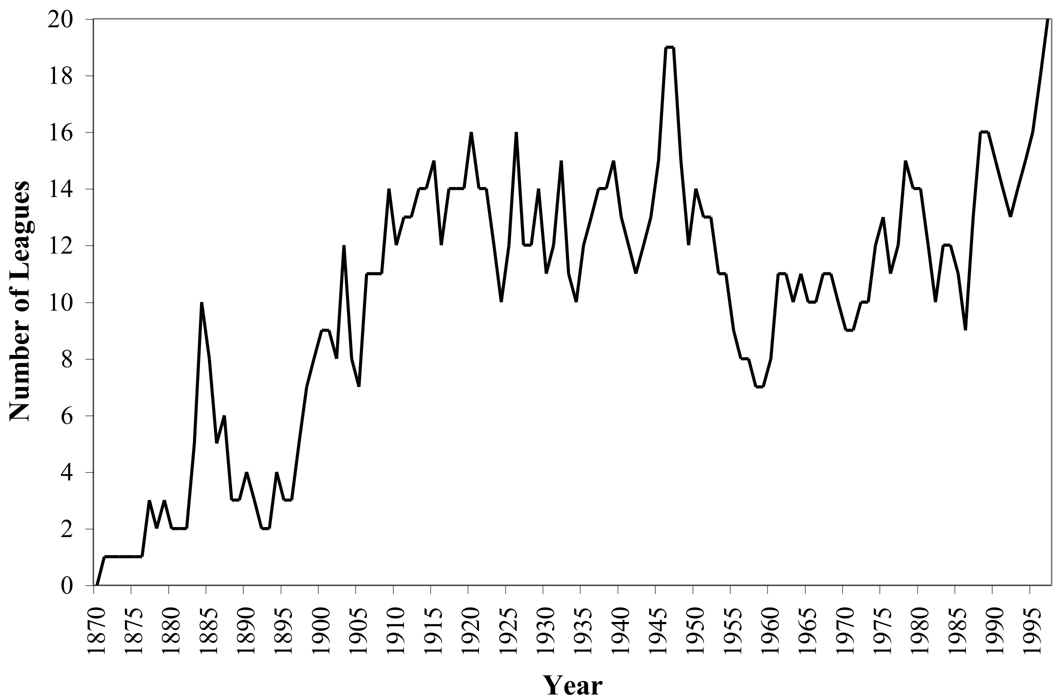
Table 2.2 (Continued)

Roller Hockey	
New England Polo League (NEPL1)	Maine Roller Polo League (MAIN4)
National Polo League (NPL1)	American Roller Polo League (ARPL1)
Maine Polo League (MAIN1)	National Polo League (NPL2)
Massachusetts Polo League (MASSL)	Western Polo League (WPL2)
New England Polo League (NEPL2)	Cental Polo League (CPL)
Old Colony Polo League (OCPL)	Interstate Polo League (ISPL1)
Southern New England Polo League (SNEL1)	Western Ohio Polo League (WOPL)
Union Polo League (UPL)	American Roller Polo League (ARPL2)
Western New England Polo League (WNEL)	Connecticut Roller Polo League (CRPL)
Central New England Polo League (CNEL)	National Roller Polo League (NRPL3)
Eastern New England Polo League (ENEL)	Empire State Roller Polo League (ESRPL)
Independent Polo League (IPL)	American Roller Polo League (ARPL3)
Connecticut State Polo League (CSPL2)	Interstate Roller Polo League (ISPL2)
Metropolitan Polo League (METL)	National Roller Polo League (NRPL4)
National Roller Polo League (NRPL1)	American Roller Polo League (ARPL4)
Maine Polo League (MAIN2)	American Roller Polo League (ARPL5)
Southern New England Polo League (SNEL2)	National Roller Polo League (NRPL5)
American Polo Association (APA)	American Roller Hockey League (ARHL1)
Eastern Massachusetts Roller Polo League (EMRPL)	American Roller Hockey League (ARHL2)
National Roller Polo League (NRPL2)	National Roller Hockey League (NRHL)
Southeastern Mass. Roller Polo League (SEML)	American Roller Hockey League (ARPL6)
Maine Polo League (MAIN3)	Roller Hockey International (RHI)
New England Roller Polo League (NERPL)	
Lacrosse, Softball, and Volleyball	
American Lacrosse League (ALL)	American Professional Slo-Pitch League (APSPL)
International Professional Lacrosse League (IPLL)	North American Softball League (NAPSL)
American Box Lacrosse League (ABLL)	United Professional Softball League (UPSL)
National Lacrosse Association (NLA)	International Volleyball Association (IVA)
National Lacrosse League (NLL1)	Major League Volleyball (MLV)
Major Indoor Lacrosse League (MILL)	Women's Western Volleyball League (WVL)
Internat'l Women's Pro. Softball Association (WPS)	National Volleyball Association (NVA)
Women's Professional Fastpitch (WPF)	Professional Volleyball League (PVL)

A snapshot of this population is presented in Figure 2.1 as the number of professional sports leagues over time. For the first 50 years there is a gradual increase in the number of leagues with the exception of the spike in the 1880's. This was due to the great number of roller hockey teams that were battling for preeminence at that time. From 1920 to World War II, the number of leagues was relatively stable at between 10 and 16 leagues. Then, shortly after the end of the war, the number of leagues reached its second biggest peak at 19 leagues.

But this was followed by a massive drop from 19 to 7 leagues, a reduction of more than 50 percent. And from 1960 until 1997 there was a rebound in the number of leagues such that at the end of the observed period, there were more leagues in existence than at any time in the industry's history.

Figure 2.1
Number of Professional Sports Leagues Over Time



So we see that professional sports leagues are rather unique organizations that should prove rather interesting to study. They incorporate interesting combinations of competition and cooperation in their internal relationships while holding a valued place in the society in which they exist. They will hopefully prove useful in our attempt to better understand organizational dynamics when they are used to empirically study the major tenets of organizational ecology.

CHAPTER 3

ORGANIZATIONAL MORTALITY RATES

This chapter discusses my examination of issues related to organizational mortality. Specifically, four broad issues are addressed. The first is age and size dependence. The second is density dependence. The third is the lasting effects of founding conditions. And the fourth is a new concept developed in this dissertation – growth dependence.

The first of the four areas I address is the oldest and most discussed issue in organizational ecology – the effects of age and size on mortality rates. Negative age dependence has been a cornerstone of ecological theory and research for over 15 years. Beginning with Freeman, Carroll, and Hannan's seminal article in 1983, study after study has seemed to lend support to Stinchcombe's (1965) concept of a liability of newness. But recently, researchers have begun to use more complete data sets that include measures of organizational size over the organization's full life span. These studies have begun to question the validity of a universal liability of newness while supporting the concept of a liability of aging. It now seems that any examination of age dependence should be conducted with controls for size in the analysis. Therefore, I examine the effects of age and size together in the first section of this chapter.

The second area covered in this chapter is that of density dependence. Six years after the liability of newness received its initial support, Carroll and Hannan (1989a) proffered their view of density dependence. They hypothesize that two processes – legitimacy and competition – are bound up in the measure of density and explain density's effect on mortality. Specifically, they argue that as the number of organizations increases, the resulting competition boosts mortality rates. However, they say this does not apply when there are relatively few organizations in the population. When density is low, competition effects are superceded by legitimacy effects. When modeled, the relationship between density and mortality rates takes on an inverted U-shape. Since 1989, though, several researchers have questioned this view of density dependence. Their objections range from the idea that forces other than just competition and legitimation may be present in the density measure (Zucker, 1989) to the idea that competition and legitimation differ depending on how subgroups of the population are defined (e.g. Baum & Oliver, 1991). I take the second approach in this paper by looking at same sport density effects in addition to composite density effects. This will be explained in detail in the density dependence section.

The third group of issues I address is how founding conditions may affect organizational mortality. At about the same time density dependence began receiving attention, others began looking at possible effects that founding conditions may have on mortality rates. Two concepts emerged as important in this research. The first related to another idea developed by Stinchcombe (1965) – organizational imprinting. That is, certain conditions at founding have lasting effects on the organization's future. Stinchcombe's concept was developed with societal conditions in mind, but others added organizational and environmental conditions as well (e.g. Boeker, 1988). The second idea to emerge was related to the observation that some organizations are founded during times of great environmental stress and these typically have higher failure rates than organizations founded in "better" times. But if the organizations founded in times of trouble survive the initial onslaught of difficulties, the thinking is they are better able to survive in the long run. This "trial by fire" hypothesis was first proposed by a reviewer of Carroll and Hannan's (1989b) initial examination of founding density's effect on mortality rates. Both of these ideas are addressed using several measures of founding conditions.

The fourth area discussed in this chapter is a new hypothesis regarding growth dependence. I hypothesize that growing organizations have lower mortality rates for three reasons. First, growing organizations signal their viability to outside actors by growing and thus gain advantages in relations with them. Second, growing organizations are better able to take advantage of the benefits that come from increased organizational size. And third, organizational growth may be a residual effect of slack resources available to the organization. This concept of organizational growth dependence is more fully explained and tested in the growth dependence subsection.

Following the sections that review the literature and generate hypotheses, there is a section describing the data, measures, and methods used to test them. That is followed by a presentation of empirical results and a discussion of them. Then, conclusions are drawn concerning the hypotheses and limitations are discussed.

Literature Review and Hypothesis Development

Organizational Age and Size

Since the inception of organizational ecology, the relationship between organizational age and organizational mortality has been of particular interest to population ecologists. In 1965, Stinchcombe argued that new organizations generally require the establishment of new roles for members of the new organization. While these new roles are being worked out, there are negative effects on the organization including inefficiency, conflict, and financial costs. In addition, new external relationships must be forged as well. And while bonds of trust are being developed, the new organization may suffer. Stinchcombe argues, therefore, that new organizations fail more often than older organizations because of what he called a "liability of newness."

Numerous ecological studies have tested Stinchcombe's arguments about the liability of newness. Carroll (1983) summarized the results of 32 empirical studies published from 1927 through 1983. The studies reviewed ranged in sample size from 20 to over a million, and included mostly businesses in the U.S. but also included some nonprofit organizations. Carroll concluded that the most consistent finding among these studies was that organizational mortality is related to organizational age. Specifically, organizations are more likely to die in the first few years of their existence.

Subsequent to the review by Carroll, more studies have been published that purport to show evidence of a liability of newness. The empirical results of these and other studies examining the relationship between organizational mortality and organizational age are displayed in table 3.1. A negative relationship (indicated with a minus sign in the table) between age and mortality rates indicates support for a liability of newness. A positive relationship (indicated with a plus sign in the table) between age and mortality rates indicates support for a contrary construct – a liability of aging. That is, as an organization grows older, its likelihood of mortality increases. The type of model specification and whether or not a study also included measures of size that varied with time are indicated as well.

Table 3.1
Age and Mortality Rates

Author(s)	Year	Relationship Between Age & Mortality Rates	Size	Model Type
Carroll & Delacroix	1982	–	No	Makeham
Freeman, Carroll, & Hannan	1983	–	No	Makeham
Carroll	1985	–	No	Makeham
Barnett & Carroll	1987	not significant	Yes	Gompertz
Tucker, Singh, Meinhard, & House	1988	+ / –	No	Gompertz
Carroll & Hannan	1989a	–	No	Gompertz
Carroll & Hannan	1989b	–	No	Gompertz/Weibull
Delacroix, Swaminathan, & Solt	1989	not significant	Yes	Gompertz
Brüderl & Schüssler	1990	+	Yes	Log-logistic
Aldrich, Staber, Zimmer, & Beggs	1990	+	No	Logit
Freeman	1990	–	Yes	Cox proportional hazards
Baum & Oliver	1991	– / not significant	Yes	Exponential
Hannan & Carroll	1992	–	No	Log-quadratic
Haveman	1992	not significant	Yes	Gompertz
Baum & Oliver	1992	+	Yes	Exponential
Baum &, Mezias	1992	+	Yes	Exponential
Rao & Neilsen	1992	+	Yes	Logit
Wholey, Christianson, & Sanchez	1992	not significant	Yes	Exponential
Amburgey, Kelly, & Barnett	1993	–	No	Exponential
Barron, West, & Hannan	1994	+	Yes	Piecewise exponential
Barnett	1994	+	Yes	Exponential
Land, Davis, & Blau	1994	not significant	No	Weibull
Carroll & Teo	1996	–	Yes	Gompertz
Swaminathan	1996	–	No	Makeham
Ingram & Baum	1997	not significant	Yes	Piecewise exponential
Ranger-Moore	1997	+	Yes	Piecewise exponential
Pennings, Lee, & van Witteloostuijn	1998	not significant	Yes	Log-log

Looking at this table, it is reasonable to ask why the results of these studies are so contradictory. I see at least two possibilities: (1) methodological differences regarding variables, model types, and time frames; and/or (2) the existence of both a liability of newness *and* a liability of aging (Henderson, 1997).

One difference in methodologies that jumps out at us from table 3.1 is that studies supporting the liability of newness generally do not include a time varying measure of organizational size. Of the ten studies that report a negative relationship between age and mortality (liability of newness), only two also include a measure of size in the same model.

Conversely, of the eight studies reporting a positive relationship between age and mortality (liability of aging), only one does not include a measure of size in the same model.

In their study of New York City credit unions, Barron, West, and Hannan (1994) found that without a size measure in the model, a liability of newness was supported. But with a measure of size included in the model, the sign of the age coefficients changed and mortality rates appeared to increase with organizational age. Ranger-Moore (1997) found a similar pattern in his study of New York life insurance companies. Without measures of organizational size or population density included in the model, age appeared negatively related to mortality rates. But when these two variables were added to the model, age was significantly and positively related to mortality rates indicating a liability of aging. So is this always the case when size is added to models which indicate a liability of newness? Apparently there are exceptions, since Carroll and Teo's (1996) study included a measure of size and they found that age was negatively related to mortality.

In addition to size being included in some studies while excluded in others, the researchers cited above did not use uniform modeling techniques. For example, Carroll and Teo (1996) use a Gompertz model to test their ideas, while Barron, et al. (1994) and Ranger-Moore (1997) use a piecewise exponential model. As is evident from table 3.1, other modeling techniques have been used as well. The use of parametric statistical methods such as the Gompertz model may impose restrictions on the functional form of the relationship between age and mortality. Specifically, because the relationship is restricted to a particular form, the true relationship may not be discovered. It may be significant that no study incorporating a Gompertz model finds consistent evidence for a liability of aging. Thus, differences in findings may be due to what models are chosen for analysis and what variables besides age are included in those models.

The second possible reason for the disparate results presented in table 3.1 is the possibility that both a liability of newness *and* a liability of aging exist. There are sound theoretical grounds for both. In addition to Stinchcombe's (1965) ideas about the liability of newness, new organizations are less likely to be in powerful positions with regard to key environmental actors. Thus, critical resources needed by new organizations may not be available at suitable prices or even at all. This aspect of resource dependency (Pfeffer & Salancik, 1978) would support the liability of newness hypothesis. Also, key institutional linkages may not be fully developed yet, decreasing the likelihood that the new organization is perceived as legitimate (Meyer & Rowan, 1977). So, in addition to Stinchcombe's arguments, certain aspects of resource dependency and institutional theory support the liability of newness hypothesis as well.

There is a theoretical argument, however, that older organizations, too, face challenges that may affect their survivability. Organizational age contributes to organizational inertia (Hannan & Freeman, 1977). An older organization has an established worldview. The way in which it has seen its environment has led to its survival and presumed success. Thus, the organization has little reason to change the way it sees the world. This perceptual shortcoming dampens the organization's ability to make needed organizational changes and reduces the chances of success and survival when faced with environmental changes (Brittain & Freeman, 1980). Tushman and Anderson (1986) also refer to "liabilities of age and tradition" when organizations face competence-destroying discontinuities. Barron, West, and Hannan (1994) refer to this as a "liability of obsolescence." That is, when older organizations are set in their ways and are unable or unwilling to adapt to environmental change, their survival chances are diminished.

Another possible reason older organizations may have higher mortality rates is that the longer an organization exists the more likely it is to have tenured employees with vested interests in maintaining the status quo. These organization members may be more likely to put up barriers to change when faced with environmental changes. Also, they may misrepresent information to their superiors if they believe that such information may lead to undesirable changes. Organizations are not immune from individual employees pursuing their own goals at the expense of the organization, with motivations to provide incomplete or even untruthful information (Fligstein, 1985). So older organizations may be more susceptible to the negative effects of organizational politics that may increase their failure chances.

Also, since organizations accumulate more and more rules, routines, and structures as they age, they may have higher overhead costs than their younger counterparts and may be less able to act in response to environmental changes (Carroll & Hannan, 2000). Barron, West, and Hannan (1994) refer to this as a "liability of senescence," which just means growing old.

Each of these concepts – the liability of obsolescence and the liability of senescence – is associated with older organizations. Add to these the effects of accumulated organizational politics, and it is apparent there is a theoretical basis for believing that older organizations may be more likely to fail than their younger counterparts. Since all of these processes are associated with aging organizations, I prefer to use the more general moniker of a liability of aging to refer to the collective effects of these processes.

There is one other concept that describes a liability of aging, but it is significantly different from those discussed above. Brüderl and Schüssler (1990) developed the concept of a "liability of adolescence," which is sometimes referred to as the honeymoon effect. They argue that the initial stock of resources used to start an organization is sufficient to sustain it in its very early life. An organization that does fail when it is young had to reach some age before it died. It did not die at age zero. So an organization's mortality chances are low for a short period of time after founding, and then increase abruptly. In studies examining and testing this idea, the data are structured so that very small increments of time can be observed. In the Brüderl and Schüssler study, they analyzed organization failures to the month and found that mortality rates for their population peaked at six months and then declined with age monotonically. Because this study's observations are limited to yearly data, the liability of adolescence will likely not be visible and is not, therefore, an idea that is developed further as a hypothesis.

So if it is possible that both a liability of newness and a liability of aging do exist, what determines when one takes precedence over the other? One factor that may be partially responsible is the level of environmental turbulence (Baron, West, & Hannan, 1994; Ranger-Moore, 1997). The argument for a liability of aging is heavily dependent on the effects of organizational inertia, and these are most detrimental to organizations in environments that experience frequent discontinuous changes. Such environments require the organization to be flexible, and in these environments we might expect to see older organizations failing at higher rates than younger organizations. If environmental turbulence is a relevant factor though, there are significant challenges ahead for organizational ecology studies. Since many of the studies incorporate entire industry histories into their models, the industries under study are often relatively stable over the life of the population with only brief periods of abrupt change. Capturing these periods and measuring their effects may prove too difficult leading to false inferences from model results.

With the varied conclusions of both the theoretical and empirical literatures in mind then, what pattern will emerge in the population of professional sports leagues? While early findings supporting a liability of newness may seem compelling, the latter findings supporting a liability of aging cast serious doubt on the accurateness of early representations of age dependence. Therefore, because this study is similar to those of Barron, West, and Hannan (1994) and Ranger-Moore (1997) having a full complement of control variables and using the piecewise constant exponential model to test hypotheses, I expect to find results similar to theirs. I expect that without a measure of size in the model, a liability of newness will be apparent. But when size is added to the model, the apparent liability of newness will give way to a liability of aging. The following two hypotheses express these ideas.

> *Hypothesis 3.1a: A liability of newness will be present when no measure of size is included in models of mortality rates.*

> *Hypothesis 3.1b: A liability of aging will be present when a measure of size is included in models of mortality rates.*

One of the interesting questions raised by the apparent disappearance of the liability of newness when measures of size are introduced into some models is whether or not there is some interaction going on between size and age. This is an idea that has yet to be explored in the literature. Is the relationship between age and mortality rates the same regardless of the size of the organization? Is the relationship between size and mortality rates the same regardless of the age of the organization? The answer to these questions is unclear at this point, but exploring these questions using interaction terms may help answer these questions. I propose using an interaction term between age and size. I expect the interaction term itself will be statistically significant, but I have no prediction as to its expected sign. Interpretation of the sign, if the interaction term is significant, will be left for the discussion section. Therefore, Hypothesis 3.1c is generated as follows.

Hypothesis 3.1c: The interaction of organizational age and size will be statistically significant in models of mortality rates.

Density Dependence

A second area that has received a great deal of attention in the organizational ecology literature is that of density dependence. Although there are still discrepancies in the empirical results of the research, the weight of the evidence does tip the scale in favor of the traditional prediction of a U-shaped relationship. That is, as population density (i.e. the number of organizations in the population) increases the mortality rate decreases until the density reaches some point (supposedly the carrying capacity) at which time the mortality rate increases as the density also increases. The interpretation of what is going on, however, is still in question.

The view put forth by Carroll and Hannan (1989a) and Hannan and Carroll (1992) is that social processes of legitimation and competition are responsible for the density/mortality rate relationship found in many empirical studies. Specifically they argue that at low levels of population density, the organizational form is not yet perceived as legitimate. As density increases, legitimation of the organizational form occurs prompting the founding of many similar organizations. But as the population density reaches some higher level, competition processes take over from legitimation processes as the primary driver of the population size. As organizations battle for critical resources, this competition causes many organizations to fail, thus increasing the mortality rate as population density continues to increase. This is asserted to explain the nonmonotonic relationship between population density and mortality rates characterized by U-shaped relational forms found in much of the literature.

Several studies have supported this traditional viewpoint. The results reported in these and other studies are summarized in table 3.2. But as is evident in the table, support for this view is not unanimous. Five of the studies found a positive relationship between density and mortality and eight found the relationship to be non-significant.

So once again, there are contradictions in the empirical results describing the relationship between organizational mortality and a key construct. However, it is interesting to note that seven of the studies cited above which contradict or fail to support the predictions of Carroll and Hannan regarding density dependence are studies that are short term in nature. That is, while the studies of Carroll and Hannan and others often encompass 100 or more years, those which contradict or fail to support the density dependence argument more often than not cover a time period of less than 50 years. These short-term studies may fail to cover the entire life history of the populations examined and may fail to allow the processes of legitimation and competition to run a more complete course.

Table 3.2
Density and Mortality Rates [a]

Author(s)	Year	Relationship With Density	Relationship With Density²	Time Frame	Disaggregated Density Also: Yes	Disaggregated Density Also: No
Barnett & Carroll	1987	ns	–	1900-17	✓	
Tucker, Singh, Meinhard, & House	1988	+	–	1970-82		✓
Carroll & Hannan	1989a	–/ ns	+/ ns	1800-1975		✓
Carroll & Hannan	1989b	–	+	1633-1988		✓
Delacroix, Swaminathan, & Solt	1989	ns	ns	1940-85		✓
Aldrich, Staber, Zimmer, & Beggs	1990	+	+	1900-80		✓
Freeman	1990	–	+	1946-84	✓	
Baum & Oliver	1991	–/ ns	+/na	1971-87	✓	
Haveman	1992	+	n/a	1977-86	✓	
Baum &, Oliver	1992	–	+	1971-89	✓	
Baum &, Mezias	1992	ns	ns	1898-1990	✓	
Rao & Neilsen	1992	+	n/a	1960-87	✓	
Wholey, Christianson, & Sanchez	1992	ns	ns	1976-91	✓	
Amburgey, Kelly, & Barnett	1993	+	n/a	1771-1963	✓	
Barron, West, & Hannan	1994	–	+	1914-90	✓	
Land, Davis, & Blau	1994	–	+	1883-1990	✓	
Carroll &, Teo	1996	–	+	1885-1981		✓
Ranger-Moore	1997	ns	ns	1813-1985		✓
Pennings, Lee, & van Witteloostuijn	1998	ns	+	1880-1990		✓

[a] ns – not significant, n/a – not included

Another issue to be considered in studies of density dependence is whether or not total density should be disaggregated – that is, broken up into smaller components. Table 3.2 indicates studies that included disaggregated density measures in addition to aggregate measures of density. Researchers have separated out density measures based on organizational type or form (Freeman, 1990; Haveman, 1992; Baum & Oliver, 1992; Wholey, Christianson, & Sanchez, 1992), market or location (Barnett & Carroll, 1987; Baum & Mezias, 1992; Rao & Neilson, 1992), and product or service (Baum & Oliver, 1991; Amburgey, Kelly, & Barnett, 1993). The results of these attempts at breaking down density are inconclusive. In some instances, the inclusion of a disaggregated measure of density drives the effects of overall density to non-significance. In other cases, overall density is the only density measure that proves significant. In addition, the signs of the variable coefficients show no consistent pattern.

So what will be the relationship between density and mortality in this study? Hannan and Carroll posit that when density is low, legitimation of the organizational form is the dominant process at work in the population. As density increases, competition becomes the dominant process. But in the case of professional sports leagues, the traditional view of the underlying processes of density dependence may require some adjustments. Professional sports leagues are in the greatest competition with other leagues engaged in playing the *same sport*. Specifically, they very often try to create or maintain a monopoly in their own sport. For example, baseball leagues compete much more fiercely with each other than they do with hockey leagues. Therefore, I expect the effects of *competition* to dominate in same sport populations, but to have little impact in the total population. That is not to say that legitimation processes are left out of the equation. Rather *legitimation* will be more likely to dominate processes within the *total* population. As the number of total professional sports leagues increases, the professional sports league is more and more legitimated as an organizational form. Therefore, I expect the effects of legitimation to dominate in the total population, but to have little impact in same sport populations.

Specifically, because the legitimation process is expected to be the dominant force for *total* density, I hypothesize that only the first order effect of total density will be significant and it will be negative. The second order positive effect argued by Carroll and Hannan should not be found. This yields the following hypothesis:

Hypothesis 3.2a. Total density will be negatively associated with mortality rates.

Conversely, I hypothesize that the competition process will be the dominant force for *same sport* density. Only the first order effect should be significant, and it should be positive. I do not expect to find the second order negative effect proposed by Carroll and Hannan. This yields the following hypothesis:

Hypothesis 3.2b. Same sport density will be positively associated with mortality rates.

The combined effect of these two hypotheses is that the relationship between density and mortality observed in previous research is broken up into its component parts. Instead of observing a U-shaped relationship in which the initial downward slope represents legitimation and the subsequent upward slope represents competition, only one slope should be apparent when density is measured as total and same sport. That is, total density more adequately represents legitimation and *negatively* impacts mortality rates, while same sport density more adequately represents competition and *positively* impacts mortality rates.

Founding Condition Effects

Organizational scholars have also theorized about the possible effects of founding conditions on organizational mortality. Some believe that founding conditions can have a strong effect on organizations throughout their lifetimes. The research is mixed about the effects of environmental conditions at founding on mortality rates, but it is an interesting subject to address in this study of professional sports leagues.

Stinchcombe (1965) not only developed the concept of a liability of newness, but also of organizational imprinting. That is, organizations take on qualities from the larger societal structure at the time of the organization's establishment, and these qualities remain part of the organization for the duration of its existence. The concept of imprinting has been widened to include not only societal factors, but other characteristics as well (Boeker, 1988; Tucker, Singh, and Meinhard, 1990), and has been supported by some empirical research (e.g. Hannan, Burton, and Baron, 1996).

Population density has been by far the founding condition variable most studied. Carroll and Hannan (1989b) found density at founding to be positive and significant in four of their five samples which included American labor unions, Argentine newspapers, Irish newspapers, San Francisco newspapers, and American brewers. These results, along with those of similar studies, can be found in table 3.3. In their study of U.S. trade associations, Aldrich, Staber, Zimmer, and Beggs (1990) also included founding density in their models, but found no statistical significance. Wholey, Christianson, and Sanchez (1992) likewise found no statistical significance. Barron, West, and Hannan (1994), however, found founding density to be positive and significant in a simpler Weibull model, but not in a piecewise exponential model. Carroll and Teo (1996) also found a positive and significant relationship between founding density and mortality in their study of U.S. automobile manufacturers. Ranger-Moore (1997) studied founding density as well, and in his fully specified models, the relationship between founding density and mortality rates was positive and significant.

Two other founding conditions have been tested. Freeman, Carroll and Hannan (1983) tested organizational size at founding and found significant results. However, in one sample the relationship was positive while in the other it was negative. In addition, they were

Table 3.3
Founding Conditions and Mortality Rates

Author(s)	Year	Founding Conditions Tested (Results)
Freeman, Carroll, Hannan	1983	Size (+/–)
Carroll, Hannan	1989	Political turmoil (ns)
Carroll, Hannan	1989	Density (+)
Aldrich, Staber, Zimmer, Beggs	1990	Density (ns)
Wholey, Christianson, Sanchez	1992	Density (ns)
Barron, West, Hannan	1994	Density (ns)
Carroll, Teo	1996	Density (+)
Swaminathan	1996	Density (+ then not significant)
		Cumulative age of competitors (+ then –)
		Political turmoil (+ & still +)
Ranger-Moore	1997	Density (+)

using the measure as a proxy for size throughout the life of the organization. It was a very early test of age dependence to see whether or not the liability of newness would stand up to size controls. The other founding condition tested was political turmoil. It was used in models of newspaper population mortality (Carroll and Hannan 1989).

The argument behind testing for effects of founding conditions, and density at founding in particular, is based primarily on the idea that resource scarcity in the early part of an organization's life can have detrimental effects throughout the life of the organization (Carroll & Hannan, 1989b). High levels of competition early in an organization's life may prevent the organization from ever really getting established. Thus, the organization's life chances are reduced if it is founded during a period of high competition (i.e. density is high).

An interesting twist on this idea was proposed by a reviewer of Carroll and Hannan's paper. Specifically, organizations founded during periods of environmental adversity initially experience higher mortality rates, but if organizations can survive this initial "trial by fire" their survival chances are improved later in life. One way to understand this is to think of a new organization as having some measure of fit with the environment that will either allow it to survive for a long period of time or that will cause it to fail. If the organization is to die, it is just a matter of time. But due to the accumulation of resources that allowed the organization to come into being in the first place, death will not occur immediately. It takes some time to exhaust the supply of initial resources to the point that death occurs. However, this resource use is accelerated in the case of great competition and death occurs sooner. If this process really does take place, the process of death is accelerated under conditions of high competition at founding and instead of mortality rates being evenly distributed, we would expect them to be higher around periods of adverse conditions. And those organizations surviving this early onslaught of competition are those that are truly suited to the environment. We would expect them to have very good survival chances.

Swaminathan (1996) proposed testing this extension by examining the second order term of founding density. The first order term should be positive if high founding density is related to higher mortality rates. But the second order term should be negative if the trial by fire hypothesis is supported. Therefore, I expect the following hypotheses to be supported:

Hypothesis 3.3a: Founding density will be positively related to the mortality rate while founding density squared will be negatively related to the mortality rate.

And like the density measures developed in the density dependence section earlier, I will also test same sport measures of founding density. The argument hinges on the observation that the effects of competition for scarce resources and competition is likely to be more fierce between leagues competing in the same sport. In fact, I expect these effects to be stronger than those for the founding density of the population as a whole.

Hypothesis 3.3b: Same sport founding density will be positively related to the mortality rate while same sport founding density squared will be negatively related to the mortality rate.

Swaminathan (1996) proposed another measure of founding adversity – what he termed competitive intensity. This measure is constructed by summing the ages of all organizations in the population at the time of founding. It is presumed that the higher the number, the higher the adversity. For example, a sports league founded when the only other sports leagues in existence are 2, 4, and 8 years old (competitive intensity = 14) would experience less adversity than one founded when the only other sports leagues in existence are 2, 8, and 32 years old (competitive intensity = 42). The assumption is that older leagues present more of a challenge to competitors due to their established roles with suppliers of critical resources. I will test this measure as well. And once again, because competition is likely to be greater between leagues competing in the same sport, I will test a measure of same sport competitive intensity. Hypotheses 3.3c and 3.3d formalize these arguments.

Hypothesis 3.3c: Competitive intensity will be positively related to the mortality rate while competitive intensity squared will be negatively related to the mortality rate.

Hypothesis 3.3d: Same sport competitive intensity will be positively related to the mortality rate while same sport competitive intensity squared will be negatively related to the mortality rate.

Growth Dependence

Organizational growth may also affect organizational mortality rates. I propose that growing organizations obtain three benefits that I discuss in detail below. First, because organizational *size* has many benefits, the growing organization is better able to take advantage of those benefits as it grows larger. Second, growth signals the environment that the organization is viable and strong. And third, observed growth may indicate the presence of excess resources available to specific organizations. Therefore, I propose that shrinking organizations face an increased risk of failure and the survival chances of growing organizations are enhanced.

Aldrich and Pfeffer (1978, p. 131) claim that "growth, regardless of how it is achieved, provides organizations with additional control over their environments and enhances their likelihood of survival." The primary focus of Aldrich and Pfeffer's argument is that there are benefits to being large with regard to the control of resource dependent relationships. While this is true, there are other advantages to being large. Economies of scale and scope (Chandler, 1990) allow larger organizations to lower input costs, take advantage of product or service synergies, and typically have more slack resources. Thus, they may be able to endure periods of environmental hardship longer than their smaller counterparts. Additionally, larger organizations may have an increased ability to effectively enact their environment (Weick, 1979). That is, a large organization can affect the structure of its own environment, presumably in its own favor, enhancing its chances of survival.

As organizations grow they are more and more able to take advantage of these benefits of larger size. Empirical research has borne out the benefits to size by establishing a link between larger size and lower mortality rates (Barnett & Carroll, 1987; Delacroix, Swaminathan, & Solt, 1989; Freeman, 1990; Baum & Oliver, 1991; Baum & Mezias, 1992; Barron, West, & Hannan, 1994; Carroll & Teo, 1996; Ranger-Moore, 1997; Pennings, Lee, & van Witteloostuijn, 1998). So then, because when an organization grows the advantages of size are increased, its survival chances are enhanced.

But growth also serves as a signaling mechanism. It signals to individuals and organizations in the environment that the organization is thriving. Suppliers anticipate who will be their customers in the future based on growth. Customers anticipate who will reliably supply goods and services for them in the future based on growth. The media jump on stories of growing, thriving organizations, increasing visibility in the community and perhaps enhancing legitimacy. One example of this in the case of professional sports leagues is when a league increases its size by adding teams (league expansion) and there is much media coverage. The league increases its visibility in a positive way, perhaps allowing the league to better its position in its environmental relations.

Conversely, the shrinking organization sends a signal that its future is in doubt. Hambrick and D'Aveni (1988) suggest that organizational failure is better seen as a protracted, downward spiral than as a discrete event. The environment is likely to perceive a shrinking organization as a dying organization and distance itself from it. The organization's relations with environmental actors are likely to deteriorate, and its relative power is likely to decrease. In the case of professional sports leagues, when a league has teams drop out, it looks very bad for the league. The league's future is in question, fans worry about emotional investment in hometown teams, attendance can drop, and relations with other environmental entities can suffer as well. An organization that shrinks in size can be at higher risk of mortality, indeed. So when an organization grows, it signals its strength to environmental actors giving the organization enhanced bargaining power and increasing its survival chances; and when it shrinks, it signals that its environmental viability is in question, increasing its mortality chances.

A third reason organizational growth may be associated with lower mortality rates is that the growth could be an indicator that there are excess resources available to the organization. These could be very specific resources not captured by other measures included in models. For instance, a growth in a roller hockey league could mean that fan interest (a resource, customer demand in this case) in roller hockey has increased and the survivability of the league is enhanced. So the growth or shrinkage of an organization could be an indicator of the availability of organization specific resources. Growth indicates excess resources and a positive future outlook. Shrinkage indicates scarce resources and a dim future outlook.

Two ecological studies have included measures of growth in addition to size in their models. Barnett (1994) included a measure of market share variance that proved to be non-significant. Ranger-Moore (1997) included a measure of asset growth that was negatively associated with the mortality rates of New York life insurance companies. How this measure was constructed, however, was not detailed in the publication. So there is some empirical evidence, if scant, that preliminarily supports this idea of growth dependence.

Therefore, because growth allows organizations to benefit more from increased size, from enhanced relations with environmental actors due to signaling, and may be an indicator of organization specific excess resources, I expect organizational growth rates to be negatively associated with mortality rates.

Hypothesis 3.4: Organizational growth rates will be negatively associated with mortality rates.

Data, Measures, And Methods

Chapter 2 described the population used here to test the hypotheses developed above. Now I turn to describing how the dependent, independent, and control variables were operationalized and the models used to test the hypotheses.

Organizational Mortality

For the purposes of this study, a league is said to have failed in a particular year if there were active teams operating that year that ceased to operate in the following year. For example, the NA operated from 1871 through 1875. In 1875 thirteen teams were members of the NA. In 1876 there were no teams in the NA – the league had ceased operations. Thus, I count the NA as a failure in 1875 even though the failure probably occurred late in the year, but could have actually occurred in early 1876 before another season began. This method allows for the inclusion of organizational level variables in all observations. The variable mortality is constructed as a dummy variable with a value of 0 indicating the observation is right-censored or with a value of 1 indicating the league failed.

Also treated as right-censored are leagues that ceased to operate because they merged with another league. The processes leading to merger and those leading to failure can be quite different (Barron, West, & Hannan, 1994). In fact, while leagues ceasing operations due to lack of interest or other reasons are commonly viewed negatively, a league that merges with another is often seen as a success. For example, the American Football League (AFL4) was considered by many to be successful when it ceased operations and all ten of its teams merged with the NFL in 1969 (Sheehan, 1996; Pollak, 1998). Because my primary goal in this work is to examine the process of failure, I chose to not count mergers as failures but to treat them as right-censored following the example of other empirical work (e.g. Barron, West, & Hannan, 1994; Ranger-Moore, 1997). I consider a league to have merged with another if more than half its teams join the other league. Using this definition, twelve leagues are treated as merged rather than failed. Two of these joined existing leagues that kept their identity. The remaining ten joined forces with another league to create a brand new league. Table 3.4 summarizes league mergers in this population.

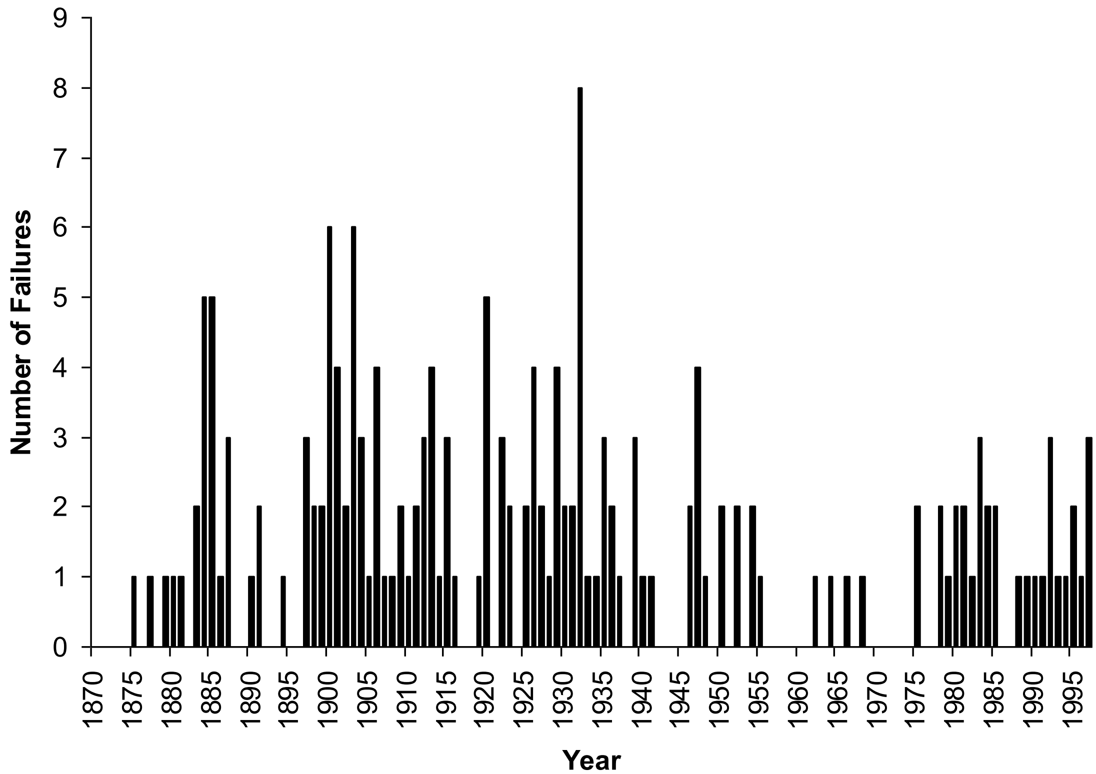
Table 3.4
Professional Sports League Mergers

Leagues joining larger, existing leagues			
Merged League	Expanded League	Sport	Year
ABA	NBA	Men's Basketball	1975
AFL4	NFL	Football	1969

Leagues joining with another league to form new league			
Merged Leagues	New League	Sport	Year
NBL5 & BAA	NBA	Men's Basketball	1948
IRFU & WIFU	CFL	Football	1957
NPSL & USA	NASL	Soccer	1967
WSL & ASL3	APSL	Soccer	1990
APSPL & NAPSL	UPSL	Men's Softball	1992

Total failures among professional sports leagues as defined above (i.e. not including mergers) from 1871 through 1997 number 176 of 206 total leagues. Thus, over 85% of professional sports leagues have failed, nearly 6% have continued to exist through merger, and almost 9% have never ceased operations at all. The variation in yearly professional sports league failures is shown in Figure 3.1.

Figure 3.1
Professional Sports League Failures Over Time



Theoretical Variables

I measure organizational age by counting the number of years a league was in existence. Leagues in their first season are considered to be one year old. Leagues in their 100^{th} season are considered to be 100 years old. Leagues born out of mergers are regarded to be as old as the older of the two leagues merged. For example, when the NBA was formed by the merger of the NBL5 and the BAA, instead of being regarded as 1 year old in its first season, the NBA is treated as being 13 years old since the NBL5 had existed the previous 12 years.

As a measure of league size, I use the number of teams in each league. However, many researchers (Baum and Oliver, 1992; Barron, et al., 1994) use the natural log of their measure of size with the rationale being that the effects of size on mortality rates are not linear in nature. Therefore, when models with size are constructed, both size and the natural log of size are used and results shown.

Total population density (sometimes referred to as contemporaneous density) is measured as the number of existing leagues in the population in a given year. Once again, some researchers use a log transformation of density (Hannan and Freeman, 1989). But because the number of leagues in existence at any given time is not large in this population (a maximum of 20), a log transformation seems inappropriate. The measure of same sport density is the number of leagues in a particular sport in existence in a given year. For each observation there is a measure of total density and a measure of same sport density. For example, in 1950 there were 14 professional sports leagues in operation and 3 of these were basketball leagues. So for the observation covering the fourth incarnation of the American Basketball League (ABL4) in 1950, total density is 14 and same sport density is 3.

Independent variables designed to test the hypotheses about founding conditions all use values from the founding year of the league in question. Thus, founding density is the number of all other leagues in existence in the year of founding; competitive intensity is the sum of the ages of all other existing leagues in the year of founding; and founding size is the size of the league in question in the year of founding. And like the measure of same sport density described in the previous paragraph, same sport measures are limited to only other leagues that participate in the same sport as the league in question.

Organizational growth is measured as the difference between an organization's size in time *t*, minus the organization's size in time *t* – 1, all divided by the organization's size in time *t* - 1. This is actually just a growth rate calculation. Again, size is measured as the number of teams in the league. This measure of organizational growth can take on positive or negative values. For example, a league growing from 8 leagues in 1975 to 10 leagues in 1976 has a growth rate value of 25% for 1976. And if a league shrinks from 10 leagues in 1976 to 8 leagues in 1977, it has a growth rate value of –20% for 1977.

Control Variables

The organization ecology literature provides good information about what control variables should be included in models of organizational mortality. One of the most common control variables used is an approximation of market size (Carroll, 1985; Baum & Oliver, 1992, Wholey, et. al., 1992). I measure market size as the population of metropolitan areas of all teams in a league in a given year. Definitions of metropolitan areas (i.e. what counties were considered to be part of a particular metropolitan area) were taken from the 1990 U.S. census and the 1991 Canadian census. Then, county population levels were obtained from decennial census data to arrive at a population level for each metropolitan area in question. For years in between census years, a linear growth trend was assumed. Data for Canadian cities were obtained directly and by special order from Ian Moore at Statistics Canada since no publications included data like that needed. Market size is measured in millions of people. Data for the five metropolitan areas outside the U.S. and Canada were obtained from the Information Please web site (1999).

As an example, let us look at the market size variable for a small league – the Professional Volleyball League (PVL). In 1997, this league was comprised of teams in four metropolitan areas: Honolulu, Hawaii; San Francisco, CA; Sacramento, CA; and Salt Lake City, Utah. The populations of each of the counties included in each of these metropolitan areas were summed to arrive at the market size of the league. Table 3.5 should clarify this somewhat. This process was repeated for every league and in each year of its existence. In essence, there were 1,299 similar sets of calculations made to create this market size control variable.

Table 3.5
Market Size Calculation for the PVL in 1997.

Counties		Metropolitan Areas		PV League Total
Name	Population	Name	Population	
Honolulu	887,797	Honolulu	887,797	10,735,894
Alameda	1,443,623	San Francisco	6,914,263	
Contra Costa	906,913			
Marin	235,349			
Napa	118,861			
San Francisco	755,449			
San Mateo	693,229			
Santa Clara	1,639,331			
Santa Cruz	258,849			
Solano	412,459			
Sonoma	450,201			
El Dorado	154,123	Sacramento	1,748,204	
Placer	211,680			
Sacramento	1,221,706			
Yolo	160,695			
Davis	216,922	Salt Lake City	1,185,631	
Salt Lake	800,779			
Weber	167,930			

In addition to market size, I also control for market penetration – that is, the market size of the league as just described, divided by the population of the U.S. and Canada. This yields the percentage of the North American population within a reasonable distance of league games. For the PVL, the market penetration figure is 3.6%, meaning that 3.6% of the population of the U.S. and Canada are in the league's immediate market. This variable is included to help alleviate difficulties arising from variations in market size over the history of the population. For instance, a league with a 25% market penetration in 1900 would only have a market size of 20 compared to a market size of 75 for that same market penetration of 25% today.

Another factor that may indicate market size is the discretionary income of fans and potential fans. Because data on discretionary income does not exist for much of the 20th century, much less the 19th century, I use the U.S. GNP growth rate as a proxy (Brüderl & Schüssler, 1990; Carroll & Teo, 1996; Ingram & Baum, 1997). In addition to serving as a proxy for discretionary income of customers, the GNP growth rate can also serve as a proxy for the general level of resources available to league and team owners. GNP figures were obtained from the U.S. Department of Commerce back to 1890 and prior to that, estimates of GNP are from Berry (1988).

Following the example of some of the studies reviewed earlier (e.g. Baum & Mezias, 1992; Aldrich, et. al., 1994; Land, et al., 1994), I also include dummy variables to control for possible period effects, specifically periods of war and recession. I use dates from The World Book Encyclopedia to construct the war dummy variable (with the exception of the Gulf War occurring in 1991). And I use the National Bureau of Economic Research definition of economic contraction to determine periods of recession (U.S. Department of Commerce, 1994). The war dummy variable is coded as 1 during periods of war, and the recession dummy variable is coded as 1 during periods of recession.

Because attendance and general interest in sports can be considered "optional" additions to life, the likelihood of fans spending time involved with sports may be contingent on the number of discretionary hours in their week. So, as the average number of hours worked in a week decreases, sports demand may increase as well. Thus, the average U.S. working week in hours is included as a control variable. Data were obtained from various editions of The Statistical Abstract of the United States and Historical Statistics of the United States: Colonial times to 1970.

Another possible effect on mortality rates is the media (Leifer, 1995). Media coverage has been argued to both increase and decrease attendance in sporting events. While media coverage may heighten fan interest in a particular sport and/or team, having the option to watch a game on television at no cost may encourage fans to stop attending games. I control for possible effects of newspapers, radio, and television by including estimates of U.S. daily newspaper circulation, the percentage of U.S. households with radios, the percentage of U.S. households with televisions, and the percentage of U.S. households with cable television. I collected data from various editions of The Statistical Abstract of the United States and Historical Statistics of the United States: Colonial times to 1970 to construct each of these measures.

I realize that using these U.S. measures is less than ideal because the study encompasses Canadian leagues and teams, too; but, unfortunately, because the data do not exist or are not compatible with U.S. data, Canadian measures cannot be included.

Carroll and Delacroix (1982) encountered similar problems in their study of Argentinean and Irish newspapers, but they argue that those economies closely mirrored that of the United Kingdom – and that data was available. So they included a measure of British GNP in their models of Argentinean and Irish newspaper failure rates. Considering that Canadian data are likely to be highly correlated to U.S. data, using the more comprehensive U.S. data seems to be the appropriate control strategy.

Still other control variables are included in the models. I control for any linear trend over time by including the age of the total population (Carroll & Hannan, 1989a; Ingram & Baum, 1997). I also attempt to control for some of the diversity in the organizational population. As pointed out in Chapter 2, women's leagues, the Negro leagues, and leagues based in Canada are all included in the population studied. Dummy variables for each of these categories of leagues were constructed. I also include dummy variables for each sport. I do not know if individual sports have unique characteristics that affect their mortality rates differently. The inclusion of these dummy variables helps control for any possible unknown effects.

Descriptive statistics and a correlation matrix of all of these variables are presented in table 3.6. Four variables have high correlations with other variables: population age, work week duration, market penetration, and market population. Population age is essentially a clock, and so high correlations with other variables that generally move in one direction over time is to be expected. Work week duration is one such variable – it generally decreases over time. Market penetration and population are highly correlated with each other and with size so I construct models with and without these variables in the same models.

Table 3.6
Means, Standard Deviations, Minimums, Maximums, and Bivariate Correlations for all Mortality Study Variables*

Variable	Mean	S.D.	Min.	Max.	1	2	3	4	5
1. Mortality	.14	.35	.00	1.00	--				
2. Age	22.65	27.81	1.00	122.00	-.27	--			
3. Size	8.96	5.18	3.00	32.00	-.17	.43	--		
4. Density	12.22	3.41	1.00	20.00	-.05	.03	.08	--	
5. Same sport density	2.86	1.50	1.00	9.00	.13	-.11	-.16	.28	--
6. Founding density	10.82	4.37	1.00	20.00	.06	-.38	.13	.48	.04
7. Same sport founding density	2.40	1.30	1.00	9.00	.27	-.38	-.11	.14	.65
8. Competitive intensity	162.62	137.51	1.00	535.00	.02	-.27	.18	.38	.01
9. Same sport competitive intensity	23.24	33.07	1.00	220.00	.06	-.17	-.05	.23	.47
10. Founding size	7.82	3.51	3.00	19.00	-.11	.18	.60	-.04	-.06
11. League growth	1.83	18.81	-70.59	242.86	-.07	-.02	.17	.05	-.01
12. Market penetration	13.34	10.37	.01	39.52	-.20	.54	.74	.03	-.16
13. Market population	25.69	26.63	.01	117.78	-.18	.59	.83	.15	-.18
14. US GNP growth rate	3.18	5.85	-14.83	17.62	-.01	-.01	-.04	-.19	-.05
15. Period of war, 1=yes	.25	.44	.00	1.00	-.13	.06	-.09	-.01	.05
16. Period of recession, 1=yes	.26	.44	.00	1.00	.09	-.16	-.11	-.11	.02
17. Work week	44.86	7.94	34.60	60.00	.19	-.40	-.32	-.40	.03
18. Newspaper	43.33	17.62	2.60	63.15	-.22	.47	.39	.37	-.07
19. Radio	56.29	43.44	.00	99.00	-.19	.47	.40	.24	-.05
20. Television	38.14	45.83	.00	98.30	-.14	.47	.51	.08	-.22
21. Cable television	11.16	20.64	.00	67.38	-.06	.29	.45	.37	-.06
22. Population age	73.50	32.15	.00	126.00	-.19	.47	.47	.43	-.08
23. Women’s league	.04	.20	.00	1.00	.06	-.15	-.06	.19	.13
24. Negro league	.06	.23	.00	1.00	.05	-.15	-.09	.08	.34
25. Canadian league	.13	.34	.00	1.00	-.08	.06	-.27	.05	-.06
26. Baseball league	.28	.45	.00	1.00	-.07	.30	-.08	-.14	.29
27. Basketball league	.17	.38	.00	1.00	.10	-.18	.04	.07	.00
28. Football league	.18	.38	.00	1.00	-.14	.18	.13	.05	-.01
29. Ice Hockey league	.10	.30	.00	1.00	-.08	.06	.03	.02	-.28
30. Soccer league	.16	.37	.00	1.00	-.03	-.19	.03	.10	-.00
31. Roller hockey league	.08	.27	.00	1.00	.26	-.13	-.13	-.20	-.03
32. Softball league	.01	.10	.00	1.00	.01	-.07	-.01	.04	-.08
33. Volleyball league	.01	.11	.00	1.00	.04	-.08	-.06	.09	-.12
34. Lacrosse league	.01	.12	.00	1.00	.07	-.08	-.07	.09	-.13

Table 3.6 (Continued)

Variable	6	7	8	9	10	11	12	13	14
6. Founding density	--								
7. Same sport founding density	.36	--							
8. Competitive intensity	.54	.23	--						
9. Same sport competitive intensity	.28	.59	.41	--					
10. Founding size	.05	-.13	.23	-.04	--				
11. League growth	.03	-.00	.07	-.02	-.03	--			
12. Market penetration	-.05	-.28	.00	-.12	.54	.07	--		
13. Market population	.08	-.21	.19	-.07	.50	.09	.92	--	
14. US GNP growth rate	-.09	-.03	-.07	-.04	.01	-.08	-.01	-.03	--
15. Period of war, 1=yes	.04	.02	-.02	.06	.02	-.02	.01	-.01	.21
16. Period of recession, 1=yes	-.06	.02	-.23	-.10	-.07	-.00	-.13	-.20	-.36
17. Work week	-.31	.08	-.56	-.27	-.24	-.02	-.37	-.50	.09
18. Newspaper	.29	-.08	.62	.25	-.28	.04	.41	.59	-.06
19. Radio	.19	-.06	.60	.26	-.29	.04	.41	.58	-.03
20. Television	.08	-.12	.58	.09	.30	.06	.42	.64	-.03
21. Cable television	.15	-.02	.58	.13	.12	.07	.27	.51	-.07
22. Population age	.28	-.08	.68	.23	.26	.06	.41	.64	-.06
23. Women's league	.15	.18	.34	.39	-.09	.01	-.10	-.03	-.02
24. Negro league	.15	.37	.02	.51	-.04	-.05	-.10	-.12	-.00
25. Canadian league	.00	-.08	-.02	-.04	-.29	-.01	-.45	-.34	.03
26. Baseball league	-.52	.03	-.39	.34	-.05	-.05	.22	.05	.01
27. Basketball league	.17	.09	.10	-.13	.22	-.01	-.02	-.00	-.01
28. Football league	.17	-.08	.09	.08	.12	-.00	-.02	.03	.01
29. Ice Hockey league	.18	-.08	-.08	-.13	-.31	.01	.03	.06	.02
30. Soccer league	.14	.03	.29	-.08	.10	.06	-.08	-.01	-.02
31. Roller hockey league	-.07	.09	-.17	-.17	-.13	.00	-.21	-.19	.01
32. Softball league	.02	-.07	.18	-.06	.06	-.04	.00	.03	-.01
33. Volleyball league	.09	-.11	.22	-.07	-.08	.01	-.05	-.01	-.01
34. Lacrosse league	.06	-.12	.19	-.08	-.11	.01	-.02	.02	-.07

Variable	15	16	17	18	19	20	21	22	23
15. Period of war, 1=yes	--								
16. Period of recession, 1=yes	.19	--							
17. Work week	.07	.29	--						
18. Newspaper	.13	-.33	-.90	--					
19. Radio	.14	-.36	-.88	.95	--				
20. Television	.02	-.29	-.60	.81	.81	--			
21. Cable television	.20	-.25	-.41	.53	.53	.71	--		
22. Population age	.05	-.34	-.85	.96	.92	.87	.74	--	
23. Women's league	.01	-.08	-.14	.15	.18	.12	.20	.19	--
24. Negro league	.01	.04	-.06	-.04	-.05	-.19	-.13	-.07	-.05
25. Canadian league	.05	.00	.01	.01	-.03	-.03	-.06	-.01	-.08
26. Baseball league	.00	.04	.08	-.13	-.08	-.16	-.13	-.15	.10
27. Basketball league	.03	.03	.07	-.05	-.09	-.07	-.06	-.06	.01
28. Football league	.06	-.08	-.22	.20	.20	.12	.04	.17	-.10
29. Ice Hockey league	.01	.01	.00	.02	-.02	.00	-.03	.00	-.07
30. Soccer league	.01	-.07	-.13	.17	.14	.18	.17	.19	-.06
31. Roller hockey league	.11	.12	.36	-.37	-.31	-.21	-.11	-.32	-.06
32. Softball league	.06	-.00	-.08	.10	.09	.13	.06	.11	.18
33. Volleyball league	.06	-.05	-.08	.10	.11	.14	.16	.14	.30
34. Lacrosse league	.04	-.01	-.09	.09	.09	.11	.17	.13	-.03

Table 3.6 (Continued)

Variable	24	25	26	27	28	29	30	31	32	33
24. Negro league	--									
25. Canadian league	-.10	--								
26. Baseball league	.40	-.24	--							
27. Basketball league	-.11	-.18	-.29	--						
28. Football league	-.11	.49	-.29	-.21	--					
29. Ice Hockey league	-.08	.21	-.20	-.15	-.15	--				
30. Soccer league	-.11	-.08	-.27	-.20	-.20	-.14	--			
31. Roller hockey league	-.07	-.11	-.18	-.13	-.13	-.09	.13	--		
32. Softball league	-.02	-.04	-.06	-.04	-.04	-.03	.04	-.03	--	
33. Volleyball league	-.03	-.04	-.07	-.05	-.05	-.04	.05	-.03	-.01	--
34. Lacrosse league	-.03	-.03	-.07	-.05	-.06	-.04	.05	-.03	-.01	-.01

*Note: Coefficients >.05 are significant at $p<.05$. The sample contained 1,299 yearly spell observations.

Models

I use discrete-time event history analysis to test the hypotheses. The data are split into year-long episodes, or spells, so that covariates can be updated on an annual basis. This yields 1,299 league-year observations for which the dependent variable is the 0,1 dummy variable for mortality.

A variety of models have been used to examine mortality rates. Some of the conflicting results with regard to age dependence may, in fact, be due to differences in the parametric assumptions of some of these models. For example, a liability of newness is generally supported when a Gompertz or Makeham model is employed. On the other hand, a liability of aging is evident when other modeling techniques are used. I do not wish to use a parametric model that limits the reported relationship between age and mortality. Therefore I employ a piecewise constant exponential model to test all but one of my hypotheses.

The piecewise constant exponential model estimates the transition rate from origin state j to destination state k as

$$r_{jk}(t) = \exp \{ \bar{\alpha}_l^{(jk)} + A^{(jk)} \alpha^{(jk)} \} \quad \text{if } t \in I_l ,$$

where for each transition (j,k), $\bar{\alpha}_l^{(jk)}$ is a constant coefficient associated with the lth time period. $A^{(jk)}$ is a vector of covariates, and $\alpha^{(jk)}$ is an associated vector of coefficients assumed not to vary across time periods. This yields baseline rates with no constraints for each pre-selected time segment so the rate can rise or fall from one segment to the other. This model, then, provides the ability to update covariates annually while remaining flexible in its treatment of the relationship between organizational age and the mortality rate.

In all models the same age segment divisions are used: 1 year, 2 years, 3 years, 4-5 years, 6-10 years, and 11 and greater years. Shorter segments at early ages and longer segments at later ages is a pattern consistent with prior research (Barron, West, & Hannan, 1994; Hannan, et. al., 1998). It would be ideal if each year could be its own segment. But because there are not enough events (deaths) at later ages, some years must be collapsed into larger segments. For the segments listed above there are 78 deaths of 1 year old leagues, 28 deaths of 2 year old leagues, and between 15 and 20 for the rest of the segments.

One other word of caution is in order here. Interpreting the coefficients of the various age segments is not like interpreting typical coefficients. The sign does not indicate the relationship between the age segment and the mortality rate. It is the change in constant from segment to segment that indicates the relationship. This will become apparent in the discussion of the findings below.

The one hypothesis that is not tested using the piecewise constant exponential model is Hypothesis 3.1c. This hypothesis relates to the interaction between age and size. The piecewise constant exponential model does not allow for interactions with the alpha bar terms. As an alternative, the pattern of the age segment constants in the piecewise constant exponential models can be observed and an appropriate functional form for age in a basic exponential model can then be determined. This model estimates the mortality rate as:

$$r_{jk} = \exp\ \{A^{(jk)}\,\alpha^{(jk)}\}$$

where r_{jk} is the constant mortality rate, $A^{(jk)}$ is a vector of covariates, and $\alpha^{(jk)}$ is a vector of associated coefficients to be estimated. Like the piecewise constant exponential model, this model also allows for annual updating of covariates, but the age dependence is constricted by the choice of the age function. This choice will be explained in the findings section because it is based on the models designed to test earlier hypotheses.

Models were estimated using the statistical program Transition Data Analysis (TDA) developed by Blossfeld & Rohwer (1995). Descriptive statistics and correlation coefficients were obtained using STATA.

Findings

In order to test the hypotheses developed above, I use the following model building strategy. First, I develop a base model with all control variables, the age segments, and size if it proves significant. Then I add to the base model each group of theoretical variables separately. So I add the density variables to just the base model, then I add the founding condition variables to just the base model, and so on. For each of these sets of theoretical variables, I find which variables are significant and in what combinations. Then, using that information, I attempt to build the best model possible of all the theoretical variables that proved significant. And from this final model, I draw conclusions about the hypotheses.

The lone exception from this strategy is the special case of testing for possible age/size interaction. As mentioned previously, rather than using a piecewise constant exponential model, I use a basic exponential model to test this hypothesis. All variables included in the best piecewise constant exponential model developed in earlier sections are used in the basic exponential model examining age/size interaction effects. I explain this more fully in the section discussing age and size interaction near the end of the "Findings" section of this chapter.

Age and Size

Table 3.7 shows the estimates of three models. The first model does not include any measure of size, while the second and third models do include size. From the first model we see that the coefficients of age have a general downward trend. This trend is only violated once when the 6-10 year segment is slightly higher than the 4-5 year segment. But this is a very slight upturn in the mortality rate. In general, a negative relationship is indicated in which the slope approximates a negative logarithmic curve.

But what happens when size is added in the second and third models? First of all, we see that neither measure of size is significant. Two measures are used in the models because previous researchers have used both a non-transformed measure of size and the log of size in their research. This is a somewhat surprising result. Measures of size have consistently been negatively and significantly related to mortality rates in other studies (e.g. Freeman, 1990;

Table 3.7
Piecewise Constant Exponential Models with Age and Size Variables [a]

Variable	1	2	3
Age, 1 year	9.394*** (2.399)	9.574*** (2.418)	10.071*** (2.462)
Age, 2 years	8.889*** (2.416)	9.066*** (2.434)	9.562*** (2.477)
Age, 3 years	8.637*** (2.431)	8.814*** (2.449)	9.310*** (2.492)
Age, 4-5 years	8.606*** (2.436)	8.784*** (2.454)	9.280*** (2.497)
Age, 6-10 years	8.658*** (2.452)	8.834*** (2.470)	9.328*** (2.512)
Age, 11+ years	8.120*** (2.467)	8.289*** (2.484)	8.778*** (2.525)
Size		-.025 (.043)	
Size (log)			-.384 (.314)
Market penetration	-.068† (.037)	-.069† (.037)	-.064† (.037)
Market population	-.033† (.020)	-.030 (.021)	-.031 (.020)
US GNP growth	.022 (.014)	.022 (.014)	.021 (.014)
Period of war	-.555* (.277)	-.558* (.277)	-.559* (.277)
Period of recession	.132 (.191)	.136 (.190)	.144 (.192)
Work week	-.149*** (.035)	-.149*** (.035)	-.148*** (.035)
Newspapers	.054 (.045)	.054 (.045)	.055 (.045)
Radio	-.005 (.007)	-.005 (.007)	-.005 (.007)
Television	.018** (.007)	.018** (.007)	.018** (.007)
Cable television	.060** (.019)	.061** (.019)	.062** (.020)
Population age	-.112** (.036)	-.113** (.036)	-.114** (.036)
Women's league	1.727*** (.455)	1.705*** (.458)	1.668*** (.459)
Negro league	1.643*** (.437)	1.647*** (.437)	1.653*** (.436)
Canadian league	-.967 (.608)	-.998 (.614)	-1.056† (.618)
Baseball league	-1.296** (.409)	-1.301** (.410)	-1.300** (.411)
Basketball league	.710** (.270)	.708** (.270)	.722** (.271)
Football league	-1.858** (.676)	-1.819** (.683)	-1.781** (.685)
Ice hockey league	-.509 (.510)	-.523 (.513)	-.542 (.515)
Roller hockey league	.882** (.331)	.852* (.335)	.841* (.333)
Softball league	1.046 (.828)	.998 (.833)	.966 (.833)
Volleyball league	.617 (.648)	.565 (.655)	.526 (.655)
Lacrosse league	2.006*** (.498)	1.907*** (.526)	1.819*** (.521)
Log-likelihood	-649.922	-649.747	-649.172

****p*<.001, ***p*<.01, **p*<.05, †*p*<.10
[a] The sample included 1,299 yearly spells and 176 league failures. Standard errors are in parentheses.

Baum & Oliver, 1992; Carroll & Teo, 1996). Two possible explanations for this are the high correlations of .74 and .83 between size and the control variables for market penetration and market population, respectively. So I ran models 2 and 3 again without the market penetration variable and size was still not significant in either model. I tried again holding out the market population variable with the same result. Only when both market penetration and market population were dropped from the model were both measures of size significant. But removing both of these controls from the model is not an option.

Regardless of what size measures are included or excluded from models, the trend of the time segment coefficients remains the same. The trend is always downward with the same slight increase in the 6-10 year segment. It appears that a liability of newness may exist in this population of organizations. But we have yet to see if this situation will hold when additional variables are added.

Model 1 from table 3.7 will be used as the baseline model for further model development. Each set of theoretical variables will build on this model. In order to test whether or not these new models improve on the baseline model, the following technique is used based on Knoke & Burke (1980) and Menard (1995). Twice the absolute value of the difference between log-likelihoods of the two models in question is calculated. This value is tested using a chi-square test with degrees of freedom equal to the number of variables added to the baseline model. So, in the case of a model with only one additional variable, the absolute difference between log-likelihoods would have to exceed 3.841 for the model to be a statistical improvement over the baseline model at the .05 level of significance. This testing methodology is used extensively in the subsections that follow.

Testing for age/size interactions will be performed later. That test requires a basic exponential model with an "appropriate" functional form for age. If the test was performed at this point, the log of age would probably be the most appropriate transformation. But this could change as other theoretical variables are added to the baseline model. Therefore, I will wait until a "best" piecewise constant exponential model is finalized. At that point I will have a better idea as to the most appropriate age transformation and all the variables to be included in the basic exponential model that will test for age/size interaction significance.

Density Dependence

Table 3.8 shows models with density dependence variables added to the baseline model (model 1 from table 3.7). All models presented are statistically significant improvements over the baseline model. The first model in table 3.8 adds only a linear measure of density to the base model. This measure is significant at the .01 level of significance. But when density squared is added in model 2, neither density term is significant and model 2 is not an improvement over model 1.

The third model includes only the linear measure of same sport density. Again, this measure alone is statistically significant. Model 4 adds the quadratic term for same sport density and this measure is marginally significant (at the .10 level) with a negative sign. But model 4 is not a statistically significant improvement over model 3 using the log-likelihood method of testing nested models described earlier. Models 5, 6, and 7 attempt to improve on model 3, but each falls short. None of them statistically improve upon model 3. It appears that either density or same sport density can be added to the baseline model to improve it, but not both at the same time.

Table 3.8
Piecewise Constant Exponential Models with Density Dependence Variables [a]

Variable	1	2	3	4	5	6	7
Age, 1 year	10.465*** (2.447)	10.442*** (2.590)	9.087*** (2.411)	8.535*** (2.458)	9.650*** (2.468)	9.171*** (2.517)	9.867*** (2.626)
Age, 2 years	9.998*** (2.467)	9.975*** (2.606)	8.630*** (2.429)	8.077** (2.475)	9.199*** (2.486)	8.719*** (2.535)	9.411*** (2.642)
Age, 3 years	9.765*** (2.483)	9.742*** (2.618)	8.395*** (2.444)	7.848** (2.489)	8.969*** (2.502)	8.495*** (2.550)	9.180*** (2.654)
Age, 4-5 years	9.725*** (2.486)	9.702*** (2.622)	8.332*** (2.447)	7.785** (2.493)	8.909*** (2.505)	8.437*** (2.554)	9.121*** (2.658)
Age, 6-10 years	9.732*** (2.499)	9.709*** (2.635)	8.336*** (2.461)	7.774** (2.508)	8.902*** (2.517)	8.413** (2.568)	9.096*** (2.671)
Age, 11+ years	9.192*** (2.513)	9.169*** (2.652)	7.748** (2.473)	7.180** (2.520)	8.327*** (2.532)	7.832** (2.581)	8.525** (2.687)
Density	.115** (.038)	.118 (.105)			.059 (.047)	.067 (.048)	-.037 (.126)
Density ^{2} (/1000)		-.127 (4.621)					4.499 (5.019)
Same sport density			.180*** (.051)	.545* (.219)	.133* (.064)	.522* (.222)	.560* (.224)
Same sport density ^{2} (/100)				-4.564† (2.678)		-4.946† (2.729)	-5.179† (2.692)
Market penetration	-.056 (.037)	-.056 (.037)	-.039 (.039)	-.034 (.039)	-.040 (.039)	-.035 (.039)	-.035 (.039)
Market population	-.039† (.020)	-.039† (.020)	-.045* (.021)	-.045* (.021)	-.046* (.021)	-.045* (.021)	-.045* (.021)
US GNP growth	.027† (.014)	.027† (.014)	.025† (.014)	.023 (.014)	.027† (.014)	.025† (.014)	.028† (.015)
Period of war	-.540* (.273)	-.541† (.276)	-.597* (.274)	-.620* (.275)	-.579* (.273)	-.598* (.274)	-.561* (.276)
Period of recession	.099 (.193)	.098 (.198)	.104 (.189)	.102 (.190)	.096 (.191)	.094 (.191)	.134 (.198)
Work week	-.173*** (.037)	-.173*** (.038)	-.159*** (.036)	-.158*** (.036)	-.168*** (.037)	-.169*** (.037)	-.176*** (.038)
Newspapers	.055 (.045)	.055 (.045)	.050 (.045)	.057 (.045)	.051 (.045)	.059 (.045)	.066 (.046)
Radio	-.001 (.007)	-.001 (.008)	-.009 (.007)	-.006 (.007)	-.006 (.008)	-.003 (.008)	-.006 (.008)
Television	.031*** (.008)	.031*** (.009)	.020** (.007)	.020** (.007)	.027** (.008)	.027** (.009)	.028** (.009)
Cable television	.061** (.019)	.061** (.019)	.054** (.020)	.057** (.020)	.056** (.020)	.059** (.020)	.058** (.020)
Population age	-.143*** (.037)	-.143*** (.037)	-.105** (.036)	-.114** (.037)	-.122** (.039)	-.133*** (.039)	-.135*** (.039)
Women's league	1.635*** (.459)	1.634*** (.459)	1.631*** (.464)	1.680*** (.470)	1.604*** (.463)	1.651*** (.470)	1.666*** (.473)
Negro league	1.608*** (.438)	1.607*** (.439)	1.414** (.445)	1.449** (.446)	1.446** (.446)	1.483*** (.447)	1.493*** (.447)
Canadian league	-.977 (.606)	-.977 (.606)	-1.009† (.592)	-1.038† (.587)	-1.005† (.595)	-1.041† (.589)	-1.056† (.589)
Baseball league	-1.181** (.410)	-1.181** (.412)	-1.397*** (.423)	-1.485*** (.432)	-1.306** (.425)	-1.384** (.433)	-1.437** (.439)
Basketball league	.725** (.269)	.725** (.267)	.682* (.279)	.680* (.282)	.694* (.276)	.691* (.278)	.690* (.280)
Football league	-1.815** (.675)	-1.815** (.675)	-1.777** (.654)	-1.767** (.645)	-1.776** (.659)	-1.762** (.650)	-1.757** (.649)

Table 3.8 (Continued)

Variable	1	2	3	4	5	6	7
Ice hockey league	-.467	-.467	-.300	-.151	-.332	-.174	-.144
	(.507)	(.507)	(.516)	(.529)	(.514)	(.527)	(.529)
Roller hockey league	.969**	.968**	.950**	1.018**	.973**	1.059**	1.093**
	(.332)	(.333)	(.352)	(.360)	(.347)	(.356)	(.360)
Softball league	.867	.869	1.226	1.332	1.088	1.184	1.146
	(.834)	(.839)	(.839)	(.849)	(.846)	(.855)	(.857)
Volleyball league	.415	.419	.916	1.103	.725	.890	.810
	(.654)	(.666)	(.660)	(.679)	(.676)	(.694)	(.706)
Lacrosse league	1.958***	1.958***	2.340***	2.518***	2.226***	2.400***	2.429***
	(.499)	(.499)	(.509)	(.518)	(.516)	(.524)	(.525)
Log-likelihood	-645.355	-645.354	-643.993	-642.409	-643.224	-641.419	-641.024

***p<.001, **p<.01, *p<.05, †p<.10

[a] The sample included 1,299 yearly spells and 176 league failures. Standard errors are in parentheses.

Founding Conditions

Table 3.9 presents results of models that include measures of founding density and same sport founding density. I use the same baseline model as before, with all the control variables and the age segments. All models in this table are statistically significant improvements over the baseline model using the nested model testing technique described earlier.

Model 1 includes only the linear founding density term and it is very significant in the model. Model 2 adds the squared term. Neither founding density variable is significant and the model is not an improvement over model 1. The linear term for same sport founding density is added to the baseline model in model 3 and it is significant. However, attempts to include the squared term into this model proved unsuccessful. TDA reports an error in "function evaluation." The descriptions of error codes, unfortunately, are rather vague for TDA so I cannot be sure what the problem is. My best guess is that this error is one of two kinds, either an error in how the variable is constructed or an error in finding a maximum value for the iterative algorithm to begin. I have checked the construction of the

Table 3.9
Piecewise Constant Exponential Models with Founding Density Variables [a]

Variable	1	2	3	4	5
Age, 1 year	5.667* (2.527)	5.953* (2.541)	7.133** (2.506)	5.293* (2.566)	6.236* (2.609)
Age, 2 years	5.256* (2.537)	5.546* (2.551)	6.707** (2.520)	4.902† (2.577)	5.868* (2.621)
Age, 3 years	5.046* (2.547)	5.334* (2.561)	6.484* (2.533)	4.695† (2.587)	5.663* (2.632)
Age, 4-5 years	5.011* (2.550)	5.301* (2.563)	6.432* (2.535)	4.643† (2.588)	5.612* (2.632)
Age, 6-10 years	5.024* (2.561)	5.323* (2.575)	6.418* (2.546)	4.623† (2.598)	5.598* (2.641)
Age, 11+ years	4.836† (2.568)	5.147* (2.585)	5.979* (2.556)	4.412† (2.604)	5.387* (2.648)
Founding density	.259*** (.040)	.155 (.105)		.190*** (.046)	-.078 (.119)
Founding density ^{2}		.005 (.005)			.013* (.005)
Same sport founding density			.342*** (.057)	.199** (.067)	.260*** (.070)
Same sport founding density ^{2}	not statistically possible				
Market penetration	-.045 (.038)	-.054 (.039)	-.007 (.040)	-.014 (.040)	-.027 (.041)
Market population	-.041† (.021)	-.036† (.021)	-.058** (.022)	-.054* (.022)	-.048* (.022)
US GNP growth	.031* (.014)	.032* (.014)	.028* (.014)	.033* (.014)	.036* (.014)
Period of war	-.803** (.279)	-.808** (.278)	-.642* (.276)	-.790** (.279)	-.783** (.276)
Period of recession	.150 (.190)	.158 (.191)	.155 (.187)	.164 (.190)	.191 (.189)
Work week	-.112** (.037)	-.109** (.037)	-.144*** (.037)	-.120** (.037)	-.120** (.038)
Newspapers	-.021 (.047)	-.022 (.047)	.044 (.046)	-.002 (.047)	-.002 (.047)
Radio	.015† (.008)	.016* (.008)	-.010 (.007)	.006 (.008)	.005 (.008)
Television	.023** (.007)	.022** (.007)	.015* (.007)	.019** (.007)	.019** (.007)
Cable television	.047* (.020)	.043* (.020)	.049* (.020)	.045* (.020)	.038† (.020)
Population age	-.099** (.036)	-.098** (.036)	-.086* (.037)	-.088* (.037)	-.085* (.037)
Women's league	.930† (.478)	.990* (.483)	1.210* (.483)	.759 (.492)	.902† (.502)
Negro league	.300 (.482)	.363 (.491)	.950* (.467)	.185 (.495)	.338 (.514)
Canadian league	-.302 (.557)	-.251 (.556)	-.853 (.572)	-.439 (.550)	-.360 (.543)
Baseball league	-.358 (.427)	-.522 (.461)	-1.290** (.434)	-.521 (.448)	-1.001† (.514)
Basketball league	.554* (.270)	.521† (.272)	.554† (.290)	.501† (.280)	.394 (.286)
Football league	-2.064*** (.596)	-2.143*** (.596)	-1.806** (.629)	-1.933*** (.588)	-2.085*** (.579)

Table 3.9 (Continued)

Variable	1	2	3	4	5
Ice hockey league	-1.246*	-1.326*	-.537	-1.050*	-1.177*
	(.524)	(.530)	(.507)	(.523)	(.526)
Roller hockey league	.698*	.679*	.784*	.700*	.656†
	(.332)	(.330)	(.372)	(.354)	(.354)
Softball league	1.856*	1.842*	1.788*	2.067*	2.067*
	(.816)	(.816)	(.838)	(.820)	(.819)
Volleyball league	.403	.229	1.429*	.961	.664
	(.666)	(.693)	(.668)	(.688)	(.721)
Lacrosse league	2.095***	2.120***	2.598***	2.388***	2.520***
	(.502)	(.502)	(.509)	(.511)	(.511)
Log-likelihood	-627.235	-626.692	-631.921	-622.764	-619.987

****p*<.001, ***p*<.01, **p*<.05, †*p*<.10

[a] The sample included 1,299 yearly spells and 176 league failures. Standard errors are in parentheses.

variable and everything appears normal. Descriptive statistics show the mean and range values are exactly what they should be. This leads me to conclude that for some reason, this variable throws off TDA somehow and prevents it from calculating an initial maximum likelihood value. As a result, same sport founding density squared cannot and is not included in any model.

Returning to the models in table 3.9, model 4 includes linear terms for founding density and same sport founding density. Both terms are significant and model 4 is a statistical improvement over both model 1 and model 3. Model 5 includes all the founding density variables that are testable, but the linear term for founding density is not significant and the model is not an improvement over model 4. Model 4 is the best of the models presented in table 3.9.

Table 3.10 presents estimates for models that include competitive intensity measures. Again, the baseline model includes all control variables and the age segments. Each of the models reported in table 3.10 statistically improves on the baseline model.

Table 3.10
Piecewise Constant Exponential Models with Competitive Intensity Variables [a]

Variable	1	2	3	4	5	6
Age, 1 year	6.640** (2.472)	7.645** (2.570)	11.492*** (2.458)	10.712*** (2.497)	8.595*** (2.532)	9.552*** (2.642)
Age, 2 years	6.256* (2.485)	7.279** (2.586)	11.057*** (2.476)	10.255*** (2.514)	8.244** (2.547)	9.208*** (2.659)
Age, 3 years	6.094* (2.496)	7.121** (2.598)	10.855*** (2.490)	10.036*** (2.528)	8.113** (2.559)	9.070*** (2.671)
Age, 4-5 years	6.162* (2.497)	7.183** (2.597)	10.830*** (2.492)	10.006*** (2.530)	8.178** (2.557)	9.128*** (2.668)
Age, 6-10 years	6.480** (2.505)	7.493** (2.603)	10.993*** (2.505)	10.171*** (2.539)	8.523*** (2.564)	9.470*** (2.673)
Age, 11+ years	7.135** (2.531)	8.132** (2.624)	10.882*** (2.528)	10.200*** (2.554)	9.210*** (2.587)	10.192*** (2.690)
Competitive intensity	.029*** (.003)	.022** (.006)			.027*** (.003)	.018** (.006)
Comp. intensity ^{2} (/1000)		.016 (.011)				.018 (.012)
Same sport comp. intensity			.035*** (.004)	.059*** (.009)	.023*** (.005)	.033*** (.010)
Same sport comp. intensity ^{2} (/1000)				-.118** (.041)		-.063 (.042)
Market penetration	-.091* (.040)	-.096* (.040)	-.019 (.039)	.002 (.040)	-.055 (.042)	-.047 (.043)
Market population	-.021 (.023)	-.020 (.023)	-.032 (.020)	-.043* (.021)	-.025 (.024)	-.031 (.024)
US GNP growth	.022 (.014)	.022 (.014)	.028* (.014)	.028* (.014)	.028* (.014)	.029* (.014)
Period of war	-.630* (.277)	-.567* (.281)	-.538† (.276)	-.601* (.275)	-.594* (.277)	-.532† (.281)
Period of recession	.143 (.189)	.138 (.189)	.157 (.190)	.166 (.190)	.157 (.188)	.157 (.188)
Work week	-.094* (.037)	-.111** (.039)	-.173*** (.036)	-.165*** (.037)	-.120** (.038)	-.139*** (.040)
Newspapers	.001 (.046)	.018 (.048)	.060 (.045)	.033 (.046)	.006 (.046)	.018 (.049)
Radio	-.015* (.007)	-.019* (.008)	-.007 (.007)	-.007 (.008)	-.017* (.007)	-.021** (.008)
Television	.001 (.007)	.000 (.007)	.018* (.007)	.016* (.007)	.003 (.007)	.001 (.007)
Cable television	.008 (.019)	-.004 (.021)	.069*** (.020)	.063** (.019)	.020 (.020)	.008 (.021)
Population age	-.137*** (.035)	-.141*** (.035)	-.144*** (.036)	-.124*** (.037)	-.155*** (.036)	-.152*** (.037)
Women's league	.634 (.433)	.568 (.431)	.147 (.485)	-.125 (.501)	.068 (.488)	-.198 (.486)
Negro league	.560 (.482)	.680 (.487)	.609 (.464)	-.216 (.537)	.324 (.492)	.066 (.561)
Canadian league	-.839 (.532)	-.862 (.530)	-.197 (.580)	-.184 (.559)	-.412 (.538)	-.421 (.521)
Baseball league	-1.075* (.461)	-1.085* (.456)	-3.217*** (.530)	-3.286*** (.532)	-2.299*** (.560)	-2.309*** (.558)
Basketball league	.306 (.277)	.329 (.277)	.483† (.271)	.438 (.276)	.243 (.276)	.309 (.281)
Football league	-1.304* (.538)	-1.221* (.547)	-2.892*** (.646)	-3.260*** (.636)	-1.890*** (.542)	-1.896*** (.546)

Table 3.10 (Continued)

Variable	1	2	3	4	5	6
Ice hockey league	-.623	-.580	-1.207*	-1.179*	-1.020†	-.941†
	(.559)	(.554)	(.516)	(.508)	(.562)	(.543)
Roller hockey league	.659†	.717*	.418†	.443	.365	.502
	(.345)	(.346)	(.363)	(.375)	(.368)	(.382)
Softball league	.009	-.248	3.143***	3.620***	1.094	1.133
	(.802)	(.816)	(.837)	(.854)	(.839)	(.884)
Volleyball league	-.178	-.340	3.128***	3.556***	1.233†	1.340†
	(.623)	(.627)	(.692)	(.712)	(.707)	(.742)
Lacrosse league	1.563**	1.665***	2.747***	3.049***	2.108***	2.469***
	(.486)	(.491)	(.515)	(.531)	(.510)	(.554)
Log-likelihood	-587.535	-586.604	-619.854	-615.517	-577.601	-575.872

***p<.001, **p<.01, *p<.05, †p<.10

[a] The sample included 1,299 yearly spells and 176 league failures. Standard errors are in parentheses.

In the first model, competitive intensity is added to the baseline model and is statistically significant. The second order term is added in model 2, but it is not significant and the model is not an improvement over model 1. Models 3 and 4 add same sport competitive intensity measures to the baseline model. In this case, however, the second order term is significant and model 4 is a statistical improvement over model 3.

In model 5 both linear terms are included and both are significant. Model 6 adds both squared terms to model 5, but neither squared term is significant. I also estimated models with both linear terms and only one squared term in them (not shown). In neither of these models was the squared term significant and neither was a statistical improvement over model 5. Given that both linear terms are significant in whatever combination of variables I try, it appears that model 5 is the superior model of those presented in table 3.10.

Growth Dependence

Table 3.11 presents a model with the league growth variable added to the baseline model. As is apparent, the league growth rate is not significant and additionally, the model is not an improvement over the baseline model. Since the idea of growth dependence was an original one developed here, I wanted to spend some time investigating why these results were obtained. So I tried two other approaches.

First, I thought that perhaps the inclusion of the market penetration and market population variables may have had an impact on the league growth variable because their correlations with size are so high and size is the variable with the highest correlation to league growth. But leaving those variables out of the model only pushes the significance of the league growth variable to .11, and that is not high enough to be considered significant.

Second, I employed a function of TDA that shows whether or not effects of covariates are constant over the time periods. In order to use this function, the number of variables was reduced. The resulting model did show variations in the effects of the league growth rate over time. But there was no consistent pattern and statistical significance was only rarely apparent.

I have one other idea about why I get these results. Because growth is closely linked to size, and because size is uncharacteristically non-significant in earlier models, whatever is responsible for the size effect being absent may also be affecting the significance level of growth. At the outset, I talked about how unusual the population of professional sports leagues is compared to other populations studied. This certainly proved to be so with regard to the effects of size on mortality rates. In almost every other study, size is negatively related to mortality rates. And because in this study organizational growth is based on the change in league size from one year to the next, maybe we should not be surprised to find non-significant results for growth. So perhaps in other populations in which size is a factor, growth dependence will prove to be a valid concept. But for now, we cannot draw such a conclusion.

Table 3.11
Piecewise Constant Exponential Model with Organizational Growth Variable [a]

Variable	
Age, 1 year	9.173*** (2.409)
Age, 2 years	8.664*** (2.427)
Age, 3 years	8.410*** (2.442)
Age, 4-5 years	8.377*** (2.447)
Age, 6-10 years	8.422*** (2.463)
Age, 11+ years	7.883** (2.478)
League growth rate	-.004 (.004)
Market penetration	-.066† (.037)
Market population	-.034† (.020)
US GNP growth	.020 (.014)
Period of war	-.556* (.276)
Period of recession	.123 (.191)
Work week	-.146*** (.036)
Newspapers	.056 (.045)
Radio	-.005 (.007)
Television	.017* (.007)
Cable television	.060** (.019)
Population age	-.112** (.036)
Women's league	1.730*** (.456)
Negro league	1.642*** (.437)
Canadian league	-.949 (.607)
Baseball league	-1.302** (.409)
Basketball league	.710** (.271)
Football league	-1.854** (.673)

Table 3.11 (Continued)

Variable	
Ice hockey league	-.504 (.509)
Roller hockey league	.883** (.332)
Softball league	1.042 (.828)
Volleyball league	.641 (.649)
Lacrosse league	2.002*** (.498)
Log-likelihood	-649.525

***p<.001, **p<.01, *p<.05, †p<.10

[a] The sample included 1,299 yearly spells and 176 league failures. Standard errors are in parentheses.

Best Model

As is evident with the previous subsections, the baseline model presented in table 3.7 can be improved. The question remains as to how this should be accomplished. Table 3.12 presents my best attempts to do so. In model 1 I attempt to include all the theoretical variables that were in best models in each subsection above. However, once again I encounter the same error with TDA as when I tried to test same sport density squared. Again the problem is with same sport founding density, but the linear term this time. I tried to include this variable in all possible combinations not previously run, but to no avail. So this variable is left out of all models because TDA cannot handle it for some reason.

Model 1 is not a statistical improvement over model 5 of table 3.10 (which is included here as model 7) that adds competitive intensity and same sport competitive intensity to the baseline model. It appears from model 1 as if these two variables are the strongest, so in models 2 through 6 I try various combinations of the other variables to see if any are significant in combination with the competitive intensity measures. None of these models is a statistical improvement over model 7 of table 3.12.

Table 3.12
Piecewise Constant Exponential Models with Best Variables [a]

Variable	1	2	3	4	5	6	7
Age, 1 year	8.226** (2.748)	8.669** (2.714)	7.746** (2.639)	9.163*** (2.561)	8.266** (2.546)	7.747** (2.629)	8.595*** (2.532)
Age, 2 years	7.916** (2.760)	8.354** (2.726)	7.430** (2.649)	8.843*** (2.578)	7.942** (2.559)	7.414** (2.638)	8.244** (2.547)
Age, 3 years	7.799** (2.772)	8.240** (2.738)	7.309** (2.659)	8.729*** (2.591)	7.818** (2.571)	7.291** (2.648)	8.113** (2.559)
Age, 4-5 years	7.852** (2.771)	8.302** (2.736)	7.359** (2.657)	8.792*** (2.588)	7.868** (2.569)	7.353** (2.647)	8.178** (2.557)
Age, 6-10 years	8.151** (2.781)	8.607** (2.745)	7.661** (2.669)	9.107*** (2.593)	8.186** (2.576)	7.669** (2.658)	8.523*** (2.564)
Age, 11+ years	8.830** (2.799)	9.274*** (2.766)	8.348** (2.691)	9.776*** (2.614)	8.879*** (2.598)	8.345** (2.680)	9.210*** (2.587)
Density	.032 (.051)	.060 (.043)		.070† (.039)			
Same sport density	.069 (.068)		.092 (.058)		.105† (.055)		
Founding density	.026 (.049)	.028 (.050)	.036 (.047)			.057 (.045)	
Same sport founding density	not statistically possible						
Competitive intensity	.025*** (.003)	.025*** (.003)	.025*** (.003)	.026*** (.003)	.026*** (.003)	.025*** (.003)	.027*** (.003)
Same sport competitive intensity	.018*** (.005)	.019*** (.005)	.017*** (.005)	.019*** (.005)	.018*** (.005)	.019*** (.005)	.023*** (.005)
Market penetration	-.034 (.044)	-.044 (.043)	-.032 (.044)	-.045 (.042)	-.033 (.044)	-.050 (.042)	-.055 (.042)
Market population	-.036 (.025)	-.031 (.024)	-.037 (.025)	-.030 (.024)	-.036 (.025)	-.028 (.024)	-.025 (.024)
US GNP growth	.033* (.014)	.033* (.014)	.032* (.014)	.032* (.014)	.031* (.014)	.030* (.014)	.028* (.014)
Period of war	-.626* (.279)	-.606* (.278)	-.646* (.278)	-.582* (.275)	-.618* (.276)	-.640* (.279)	-.594* (.277)
Period of recession	.156 (.188)	.156 (.189)	.158 (.187)	.153 (.189)	.154 (.187)	.163 (.188)	.157 (.188)
Work week	-.127** (.040)	-.129** (.040)	-.120** (.039)	-.135*** (.039)	-.126*** (.038)	-.112** (.038)	-.120** (.038)
Newspapers	-.003 (.047)	-.002 (.047)	-.007 (.047)	.008 (.046)	.000 (.046)	-.006 (.047)	.006 (.046)
Radio	-.015 (.009)	-.012 (.009)	-.015† (.009)	-.014† (.007)	-.019** (.007)	-.011 (.009)	-.017* (.007)
Television	.010 (.009)	.012 (.008)	.007 (.007)	.012 (.008)	.005 (.007)	.006 (.007)	.003 (.007)
Cable television	.017 (.020)	.020 (.020)	.015 (.020)	.021 (.020)	.015 (.020)	.019 (.020)	.020 (.020)
Population age	-.154*** (.040)	-.167*** (.038)	-.143*** (.037)	-.172*** (.037)	-.145*** (.036)	-.150*** (.036)	-.155*** (.036)
Women’s league	-.109 (.490)	-.102 (.486)	-.117 (.493)	-.078 (.483)	-.085 (.492)	-.120 (.491)	.068 (.488)
Negro league	.125 (.518)	.240 (.504)	.067 (.511)	.308 (.489)	.141 (.503)	.180 (.503)	.324 (.492)
Canadian league	-.403 (.537)	-.368 (.541)	-.405 (.537)	-.398 (.537)	-.457 (.531)	-.337 (.542)	-.412 (.538)
Baseball league	-2.011*** (.594)	-2.056*** (.589)	-2.004*** (.595)	-2.153*** (.562)	-2.140*** (.570)	-2.065*** (.587)	-2.299*** (.560)
Basketball league	.254 (.280)	.255 (.276)	.244 (.281)	.266 (.276)	.259 (.282)	.225 (.276)	.243 (.276)
Football league	-1.867*** (.543)	-1.879*** (.545)	-1.878*** (.541)	-1.866*** (.545)	-1.855*** (.540)	-1.918*** (.541)	-1.890*** (.542)

Table 3.12 (continued)

Variable	1	2	3	4	5	6	7
Ice hockey league	-.957†	-1.030†	-.957†	-.992†	-.894	-1.098†	-1.020†
	(.568)	(.564)	(.571)	(.557)	(.562)	(.569)	(.562)
Roller hockey league	.469	.423	.460	.439	.482	.355	.365
	(.377)	(.367)	(.380)	(.367)	(.383)	(.365)	(.368)
Softball league	1.108	1.101	1.139	1.062	1.100	1.166	1.094
	(.844)	(.844)	(.842)	(.841)	(.840)	(.841)	(.839)
Volleyball league	1.111	1.044	1.172	1.070	1.242†	1.134	1.233†
	(.721)	(.717)	(.715)	(.712)	(.707)	(.716)	(.707)
Lacrosse league	2.211***	2.098***	2.269***	2.077***	2.269***	2.146***	2.108***
	(.525)	(.512)	(.517)	(.510)	(.518)	(.510)	(.510)
Log-likelihood	-575.305	-575.815	-575.505	-575.972	-575.807	-576.779	-577.601

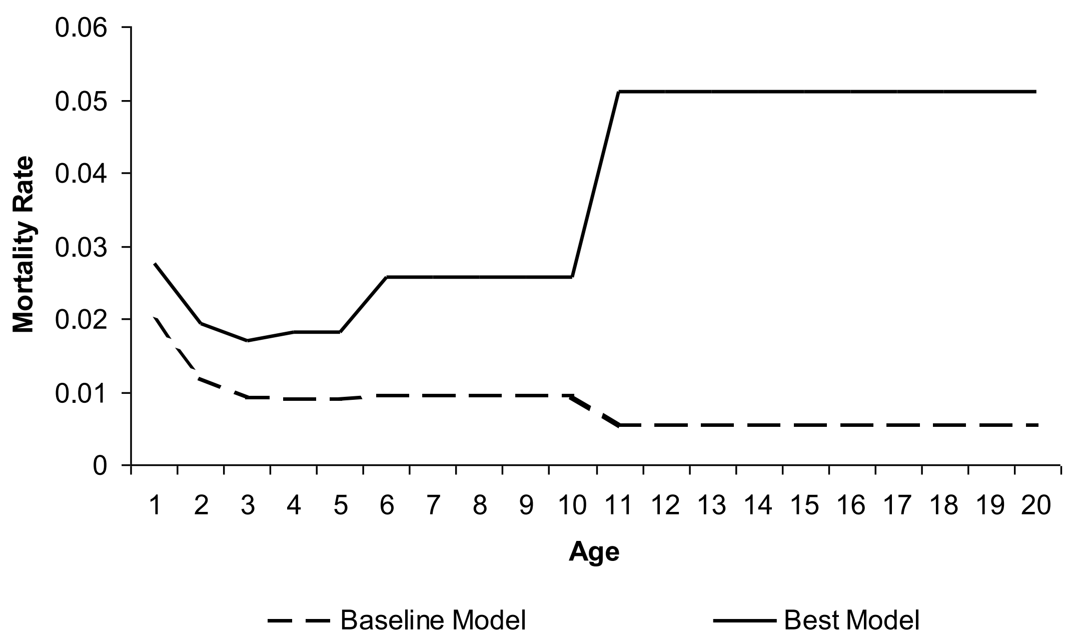
***p<.001, **p<.01, *p<.05, $^{\dagger}p$<.10

[a] The sample included 1,299 yearly spells and 176 league failures. Standard errors are in parentheses.

I tried several other combinations of variables that are not shown in table 3.12. Because the effects of the competitive intensity variables are so strong, I tried models without measures of competitive intensity but with various combinations of density, same sport density, and founding density. But none of these models was statistically superior to model 7 in table 3.12. It appears that this is the best model of mortality rates from this data set.

From this best model, the relationship between age and the mortality rate can be graphed. To do this, I obtain mortality rates by using the mean values of continuous variables (with the exception of age, of course) and omitting all dummy variables to estimate the model. So figure 3.2 below depicts the estimated relationship between age and the mortality rate for a U.S. men's soccer league in 1945 with a market penetration of 13 percent, a market population of 26 million people, a GNP growth rate of 3 percent, an average work week of 45 hours, a U.S. newspaper circulation of 43 million, 56 percent of homes with radios, 38 percent with televisions, and 11 percent with cable television. The competitive intensity level is 163, which means that all other sports league ages add up to 163 years. And the same sport competitive intensity level is 23, which means that all other soccer leagues in existence at the time are a combined 23 years old. In order to see the effects of the competitive intensity measures on the effects of age, I estimate the baseline model used earlier and the best model. The dashed line represents the estimates generated from the baseline model, while the solid line represents estimates generated from the best model. They are very different indeed. The baseline model would lead someone to believe a liability of newness is present. Age is negatively related to the mortality rate and follows a near logarithmic path. The best model presents a very different picture. Although mortality rates decrease with age at early ages, the mortality rate increases as leagues age 3 years and older. Rather than following a logarithmic path, the solid line follows a more quadratic path in the lower age range.

Figure 3.2
Age-Specific Baseline Mortality Rates.



Age and Size Interaction

In order to test the hypothesis concerning the age and size interaction, a basic exponential model is used as described earlier. All variables in the best model just described are included in all the models here. Because age is included as an independent variable in this model rather than a series of constants as in the piecewise constant exponential model, an appropriate functional form must be selected for age. The age dependence depicted in table 3.2 indicates that a quadratic transformation of age may be the most appropriate form to use, so that is what I use. But I also use a log transformation just in case there might be some unforeseen differences between the piecewise constant exponential model and the basic exponential model.

Table 3.8 shows the results of four basic exponential models. The first two use a quadratic expression of age while the last two use a log transformation. Model 1 includes only the age and size variables. Log of size is used here because it was considerably more significant in the models of table 3.7 than ordinary size (I tried a non-logged measure of size, too, but the results were no better). Model 2 adds the appropriate interaction terms for an interaction between a quadratic term and another variable (Jaccard, Turrisi, & Wan, 1990), which are age times the log of size and age squared times the log of size. Neither term is significant and the model is not a statistical improvement on model 1 at the .05 level of significance.

Model 4 adds the interaction term for the log of age and log of size. And unlike model 2, the interaction term is significant, but the model is not a statistical improvement over model 3. So we must conclude that there is not a significant interaction between age and size in this population as modeled here.

Table 3.13
Basic Exponential Models with Age and Size Variables [a]

Variable	1	2	3	4
Age	-.322*** (.036)	-.191 (.191)		
Age ^{2}	2.642*** (.310)	8.043* (4.002)		
Age (log)			-1.586*** (.118)	-.383 (.524)
Size (log)	-.531† (.309)	-.150 (.437)	-.475 (.301)	.053 (.371)
Age * Size (log)		-.096 (.100)		
Age ^{2} * Size (log)		-1.984 (1.995)		
Age (log) * Size (log)				-.641* (.274)
Competitive intensity	.006 (.004)	.006 (.004)	.004 (.003)	.004 (.003)
Same sport competitive intensity	.013** (.004)	.013** (.004)	.011** (.004)	.011** (.004)
Market penetration	.003 (.040)	.004 (.040)	.001 (.039)	.007 (.040)
Market population	-.023 (.022)	-.021 (.022)	-.021 (.022)	-.022 (.022)
US GNP growth	.010 (.014)	.010 (.014)	.010 (.014)	.009 (.014)
Period of war	-.603* (.274)	-.576* (.274)	-.507† (.271)	-.526† (.272)
Period of recession	.085 (.185)	.084 (.185)	.051 (.187)	.056 (.187)
Work week	-.073* (.036)	-.071* (.036)	-.061† (.035)	-.060† (.035)
Newspapers	.003 (.044)	.004 (.044)	.003 (.044)	.005 (.044)
Radio	-.000 (.008)	-.001 (.008)	-.003 (.007)	-.003 (.007)
Television	.015* (.007)	.014* (.007)	.011 (.007)	.011† (.007)
Cable television	.004 (.019)	.005 (.019)	.004 (.019)	.004 (.019)
Population age	-.068† (.038)	-.066† (.038)	-.046 (.037)	-.047 (.037)
Women's league	-.023 (.435)	-.076 (.430)	-.148 (.427)	-.149 (.421)
Negro league	.280 (.462)	.206 (.454)	.195 (.433)	.149 (.430)
Canadian league	-.365 (.451)	-.530 (.471)	-.430 (.444)	-.601 (.461)
Baseball league	-1.183* (.538)	-1.164* (.535)	-.931† (.507)	-.940† (.512)
Basketball league	.412 (.280)	.363 (.278)	.293 (.275)	.281 (.275)
Football league	-.720 (.461)	-.866† (.479)	-.809† (.462)	-.855† (.473)

Table 3.13 (Continued)

Variable	1	2	3	4
Ice hockey league	-.558 (.508)	-.473 (.515)	-.460 (.502)	-.410 (.507)
Roller hockey league	.391 (.337)	.344 (.333)	.298 (.326)	.316 (.325)
Softball league	.045 (.823)	.007 (.819)	.268 (.815)	.130 (.815)
Volleyball league	.414 (.646)	.413 (.644)	.526 (.644)	.505 (.641)
Lacrosse league	1.097* (.515)	1.043* (.513)	.828 (.506)	.847† (.505)
Constant	5.984* (2.526)	5.219* (2.581)	5.139* (2.504)	4.079 (2.544)
Log-likelihood	-523.822	-517.970	-490.660	-487.790

***p<.001, **p<.01, *p<.05, †p<.10

[a] The sample included 1,299 yearly spells and 176 league failures. Standard errors are in parentheses.

Discussion

I use the relationships estimated in the best model to draw conclusions about the hypotheses generated in the previous sections. The first hypothesis, 3.1a, predicted that without a measure of size in a model of organizational mortality, a liability of newness would be evident. This was indeed the case. With no measure of size in a model with just the control variables and the time segments, there was a general downward trend in the mortality rate as age increased. Hypothesis 3.1b predicted that when a size measure was added to this baseline model the liability of newness apparent in the baseline model estimates would be replaced by evidence for a liability of aging. But this was not the case. Size was not a significant addition to the baseline model and the relationship between age and the mortality rates remained the same.

However, the idea behind hypothesis 3.1b was that a liability of newness may be evident in underspecified models. Previous research indicates that the omission of size variables in models of mortality can lead to false conclusions about age dependence (Barron, West, & Hannan, 1994; Ranger-Moore, 1997). That is why size was hypothesized to be the variable that could transform a model that showed evidence for a liability of newness into a model supporting a liability of aging. But the more general concept is that an underspecified model is the real culprit in producing misleading results regarding age dependence. So even though, technically, hypothesis 3.1b is not supported, the idea behind it certainly is. Underspecified models can lead to faulty conclusions regarding age dependence.

The third hypothesis developed was 3.1c that predicted that an age/size interaction term would be significant in mortality models. Although two different transformations of age were made, no model with interaction terms was statistically superior to models without interaction terms. Thus, it appears that no significant age/size interaction is taking place in this population and hypothesis 3.1c is not supported.

Hypotheses 3.2a and 3.2b dealt with the predicted effects of density and same sport density on mortality rates. It was predicted that density would be negatively related to mortality rates while same sport density would be positively related to mortality rates. When these variables were added to the baseline model, it appeared that the same sport density hypothesis might be supported. Same sport density was significantly and positively related to the mortality rate. The same was true of total density. However, neither variable retained its significance when added to the best model so I must conclude that neither hypothesis 3.2a nor 3.2b is supported.

Hypotheses 3.3a and 3.3b dealt with the effects of linear and squared terms of founding density and same sport founding density, respectively. The squared terms were not significant in any models. But the linear terms were significant when added to the baseline model. And they were significant in the direction predicted. However, the significance levels of founding density and same sport founding density were significantly reduced when competitive intensity variables were introduced into the model. So because none of the founding density variables can be included in the best model, hypotheses 3.3a and 3.3b are not supported.

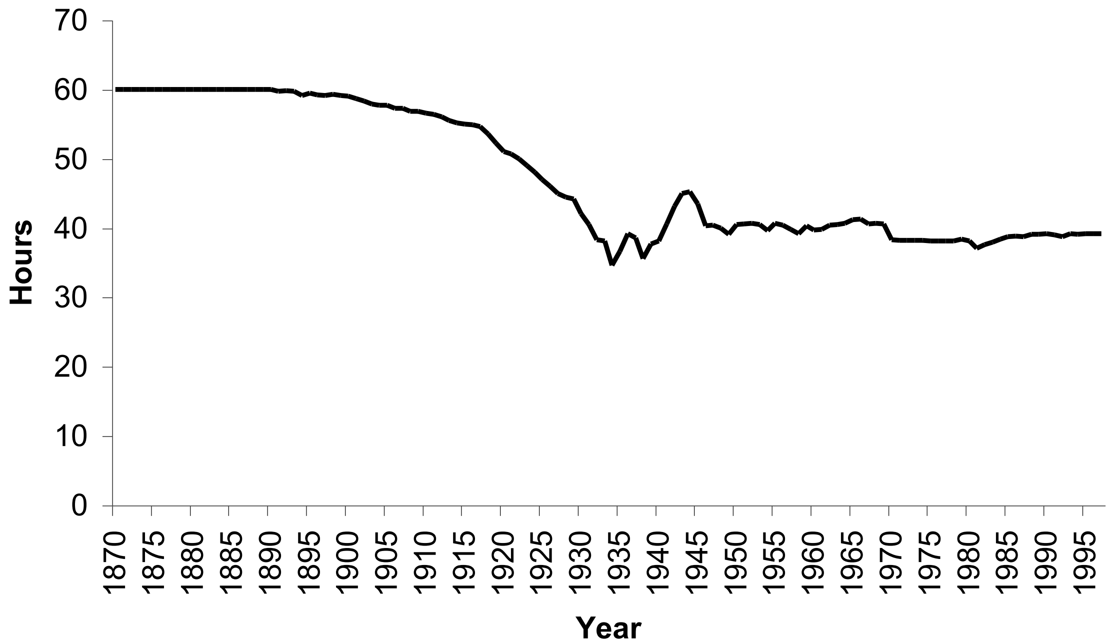
The second group of founding condition variables I hypothesized about related to competitive intensity. Hypothesis 3.3c predicted that competitive intensity would be positively related to mortality rates while its squared term would be negatively related. Hypothesis 3.3d predicted that same sport competitive intensity would follow the same pattern. The primary reason behind the hypotheses was to test the idea of a trial by fire. In order for this idea to be supported, it was essential that the second order terms be significant and in the direction predicted. In the best model, the competitive intensity measures were the only ones that added significance to the baseline model. However, the second order terms were not part of that model. The second order terms were not significant in combination with the variables in the best model, so the trial by fire hypothesis is not supported. However, because the first order terms were significant in the final model, there is evidence that organizations founded when there are many established organizations already in existence in the population face a higher mortality rate than those founded in times when the other organizations in the population are younger.

The final hypothesis generated was hypothesis 3.4, which dealt with growth dependence. As stated previously, there is no support for this hypothesis. However, because this population is rather unique as evidenced by the lack of significant effects of size on mortality rates, further testing of this concept may prove fruitful. If a measure of growth could be used in a model of a population with significant size effects, support for the idea of growth dependence might be found. I do not believe the construct should be tossed out because it failed to be supported in a single study. More studies are necessary in order to rule out growth dependence as a significant determinant of organizational mortality rates.

As for the control variables, some of them also show significance in the best model. The GNP growth rate, for instance, is positively related to the mortality rate. Leagues are more likely to fail in years when the economy is expanding. One of the more interesting observations from the best model is that during periods of war, mortality rates are lower. Some of this could be due to the actions of some leagues during World War I and World War II. Figure 3.1 shows that no leagues folded during either World War. All Canadian leagues suspended operations during the World Wars only to continue operations later. But several of these leagues folded shortly after the wars. They probably would have folded earlier (i.e. during a war) had not play been suspended. So the wars only delayed the inevitable. Another possible explanation for the observed effect is that because sports were important to society, leagues in trouble were either encouraged to continue anyway or were otherwise supported to keep morale high among the U.S. public.

Another apparent oddity in these models is the negative relationship between the length of the work week and the mortality rate. This relationship seems to imply that leagues in existence during times when work weeks are longer (and there is presumably less leisure time) have lower mortality rates. This seems counterintuitive. But if we look at a graph of work week length over time (Figure 3.3), a reasonable explanation becomes evident. During the Great Depression, there were many league failures (see Figure 3.1) while the number of hours in the average work week reached its lowest point during the time frame analyzed. In addition, when work week hours were increasing a great deal during World War II, there were no league failures. So it seems that rather than being a function of work week durations, league failures were affected by the same processes that affected the length of the work week, namely war and depression. And both of these are controlled for in the models so direct effects on mortality rates can be observed.

Figure 3.3
Average Number of Hours in U.S. Laborer's Work Week



Other control variables that are significant in the best model are radio penetration and population age. The variables that measure radio, television, and cable television penetration in the U.S. market have a disappointing characteristic in that for much of the time period covered their values are zero. Thus, the relationships apparent in this model may be nothing more than an association between time and mortality rates. If this were the case, because higher radio penetration (which occurred later in the population history) is associated with lower mortality rates, we would expect population age to be positively related to the mortality rate. And this is exactly what we find. Population age is negatively related to the mortality rate meaning that the mortality rate dropped in later years of the population.

With regard to the dummy variables, there are some mild surprises, as well as some expected significance levels. First, there appears to be no difference between the mortality rates of women's versus men's leagues, the Negro leagues and other leagues, or between Canadian and U.S. leagues. But there are differences between some of the sports. The omitted sport to which all the sport dummy variables are comparable is soccer. There are some differences, but what is at the root of these differences is unknown. There are too many possibilities to know for sure. It could be seasonal competition, general sport popularity, differences in costs, or any number of other factors. By including these controls in the model, though, perhaps some unobserved heterogeneity is reduced.

Conclusions

It appears that recent work in population ecology is headed in the right direction as more fully specified models are used in research. This study demonstrates that looking at effects of age on mortality without considering other variables is a precarious undertaking that can lead to mistaken conclusions. With a large number of control variables but some other variables omitted from models, there appeared to be a liability of newness in the population. Even when size, density, and founding density were added to the model, this finding persisted contradicting recent empirical work (Barron, West, & Hannan, 1994; Ranger-Moore, 1997). But when competitive intensity as defined by Swaminathan (1996) was added to the model, age dependence took on a modified U-shape with regard to mortality rates. So perhaps there is a liability of aging in this population after all. Perhaps inertial pressures associated with aging decrease the survival chances of organizations in their later years. This issue is surely far from being resolved. What is a surety, however, is that underspecified models can be misleading.

It also seems that the continuing work regarding density dependence is warranted. Like other researchers, I disaggregated total density to try to understand some of the inner workings of the density dependence relationship with mortality. Although neither density nor same sport density is included in the best model, there is some limited evidence that examining density in subpopulations could be beneficial in the future. Added to the baseline model by itself, same sport density was significantly and positively related to mortality. This would seem to indicate that the more leagues there are in a particular sport, the more difficult it is to survive as a league in that sport. There was no evidence however, not even marginal evidence, to support the legitimation arguments of Carroll and Hannan. This study produced some rather unusual results regarding density dependence, then.

This study also examined founding condition effects on mortality rates. First order effects of competitive intensity and same sport competitive intensity were both found to be statistically significant and positive. This indicates that great competitive pressures at the time of the organization's founding can have lasting detrimental effects on the organization's survival chances. And the lack of statistical significance for second order terms of these variables indicates that this effect persists. The trial by fire hypothesis that states that organizations that can survive an early competitive onslaught are better suited to the environment is not supported.

I also introduced the concept of growth dependence. I predicted that growing organizations have lower mortality rates because they are better able to utilize the advantages of size, signal their environments they are and will be viable, and because growth may indicate the presence of excess organization-specific resources. Empirical testing, however, did not support this hypothesis. And further examination revealed that growth rates exhibited no consistent patterns of effects on mortality rates over time.

Overall then, this study has made use of the population of professional sports leagues to extend our understanding of the factors that contribute to organizational mortality. Because this population is rather unique, however, the results presented herein may be somewhat atypical, but in general I think I have shown that:

- Underspecified models can lead to erroneous conclusions about age dependence.
- There appears to be no significant interaction between age and size in this population.
- Competitive forces at founding have a lasting effect on organizations in this population.
- There seems to be little support for the trial by fire hypothesis in this population.
- There is no support for the concept of growth dependence in this population.

CHAPTER 4

ORGANIZATIONAL FOUNDING RATES

The process of organizational foundings has also been of interest to organization scholars. Unlike the study of mortality rates, however, the study of foundings has been limited to primarily one issue, that of density dependence. This is due in large part to the fact that a different data structure is required for an analysis of founding rates. When studying mortality rates, the risk set is all the organizations in the population. But with founding rates, the risk set is all the organizations that could be established. So rather than operating on both a population and organizational level of analysis, we are limited to a population level of analysis only when studying organizational founding rates. This severely limits the type of variables we can use in our analysis. No longer can organizational level variables be used such as organization age, size, and growth. Only population level variables can be examined.

Density is one such variable and has been examined extensively in the foundings literature. Below, I review the treatment of density in organizational founding studies and present hypotheses about how total density and same sport density will affect foundings in the population of professional sports leagues. I discover that much like density measures in mortality studies, density measures in foundings studies can be disaggregated to uncover more information than total density by itself provides.

Literature Review And Hypothesis Development

Carroll and Hannan (1989a) explained the effects of density on organizational mortality by citing legitimation and competition processes. They use the same explanations of density in their treatment of founding processes. That is, as a population density increases initially, the organization form becomes legitimate. This prompts the formation of new and similar organizations thereby further increasing the population density. However, the number of organizations in the population cannot increase infinitely due to resource scarcity. Competition processes take over at some point and drive the number of organizations in the population downward. When competition is the dominant process, new organizations are less likely to form. Therefore, it is expected that founding rates increase with density and decrease with density squared. This type of relationship is expressed as an inverted U-shaped relationship between density and founding rates.

Table 4.1 reviews empirical studies that have examined measures of density and density squared and their effects on founding rates. The results are remarkably consistent. In only two studies are there significant relationships found between density and the founding rate in the opposite direction of that predicted. The McCarthy, et. al. (1988) study may owe its results to two factors. First, it covers only the very early history of the anti-drunk driving movement. And second, it covers only a very short time frame of less than ten years. Maybe if the study is re-administered 50 years from now, a more complete picture of the population history will reveal results consistent with analyses of other populations.

Table 4.1
Density Dependence and Founding Rates [a]

Author(s)	Year	Sample	Density	Density^2
Delacroix, Solt	1988	California Wineries, 1941-1984	ns	n/a
McCarthy, Wolfson, Baker, Mosakowski	1988	Drunk Driving Orgs, 1978-1985	–	n/a
Hannan, Freeman	1989	US Labor Unions, 1836-1985	+	–
		US Semiconductor Firms, 1947-1984	+	+
		San Francisco Newspapers, 1840-1980	+	–
Carroll, Hannan	1989a	San Francisco Newspapers, 1845-1975	+	–
		Argentina Newspapers, 1800-1900	+	–
		Ireland Newspapers, 1800-1975	+	–
		Little Rock Newspapers, 1815-1975	+	–
		Springfield Newspapers, 1835-1975	+	–
		Shreveport Newspapers, 1840-1975	+	–
		Elmira Newspapers, 1815-1975	+	ns
		Lubbock Newspapers, 1890-1975	ns	ns
		Lafayette Newspapers, 1835-1975	ns	ns
Ranger-Moore, Banaszak-Holl, Hannan	1991	Manhattan Banks, 1791-1980	+	–
		US Insurance Cos., 1759-1937	+	–
Baum, Oliver	1992	Toronto Day Care Centers, 1979-1989	+	–
Hannan, Carroll	1992	Manhattan Banks, 1792-1980	+	–
		US Brewers, 1634-1988	+	ns/–
		US Labor Unions, 1837-1984	+	–
		US Life Insurance Cos., 1760-1937	+	–
		Argentine Newspapers, 1801-1900	+	ns/–
		Irish Newspapers, 1801-1974	+	ns/–
		San Francisco Newspapers, 1841-1974	+	ns/–
Freeman, Lomi	1994	Italian Banking Cooperatives, 1948-1988	+	–
Land, Davis, Blau	1994	US Minor-League Baseball Teams, 1883-1990	+	–
Aldrich, Zimmer, Staber, Beggs	1994	US Trade Associations, 1901-1982	+	–
Hannan, Carroll, Dundon, Torres	1995	Belgium Auto, 1886-1981	+	–
		Britain Auto	+	–
		France Auto	+	–
		Germany Auto	+	–
		Italy Auto	+	–

[a] ns – non-significant results, n/a – not included in models

The only other study with results inconsistent with the rest is Hannan & Freeman's (1989a) study of the semiconductor industry. But once again, although the time frame is longer – 37 years versus 10 for the anti-drunk driving study – the study only incorporates the early years of the industry. In this particular case, founding rates are higher the more firms there are in the industry. It is not unreasonable to think that competitive forces failed to dominate this industry during its early years. Carroll and Hannan's proposition would allow for increasing founding rates with no downturn due to competition in the early years of an industry. And this is what we see in the semiconductor industry study.

The studies listed in table 4.1 cover a wide range of industries leading me to conclude that density dependent founding rates could be a pervasive outcome. In addition, many of the studies incorporate extremely long periods of time covering most if not all of industries' histories, only adding to this conclusion. The data available for this study also cover a long period of time (127 years) in a rather mature industry. So given that the empirical work examining founding rates is so consistent and that it covers many different population types over long periods of time, I find no reason to believe the same relationships will not be found in this examination of the founding rates of professional sports leagues. I fully expect to find that density is positively related to founding rates, while density squared is negatively related to founding rates.

Hypothesis 4.1: Density will be positively related to the founding rate while density squared will be negatively related to the founding rate.

In addition to the effects of total density on founding rates, I wish to examine the effects of same sport density on founding rates. In order to do this, the data must be reorganized, and I explain how this is done later in the methods section. I expect to find the same relationship present between same sport density and same sport density squared as I do for total density and its second order term. But because the forces affecting founding rates are greater between leagues competing in the same sport, the same sport measures may supercede the total density measures. So I hypothesize the following:

> *Hypothesis 4.2: Same sport density will be positively related to the founding rate while same sport density squared will be negatively related to the founding rate.*

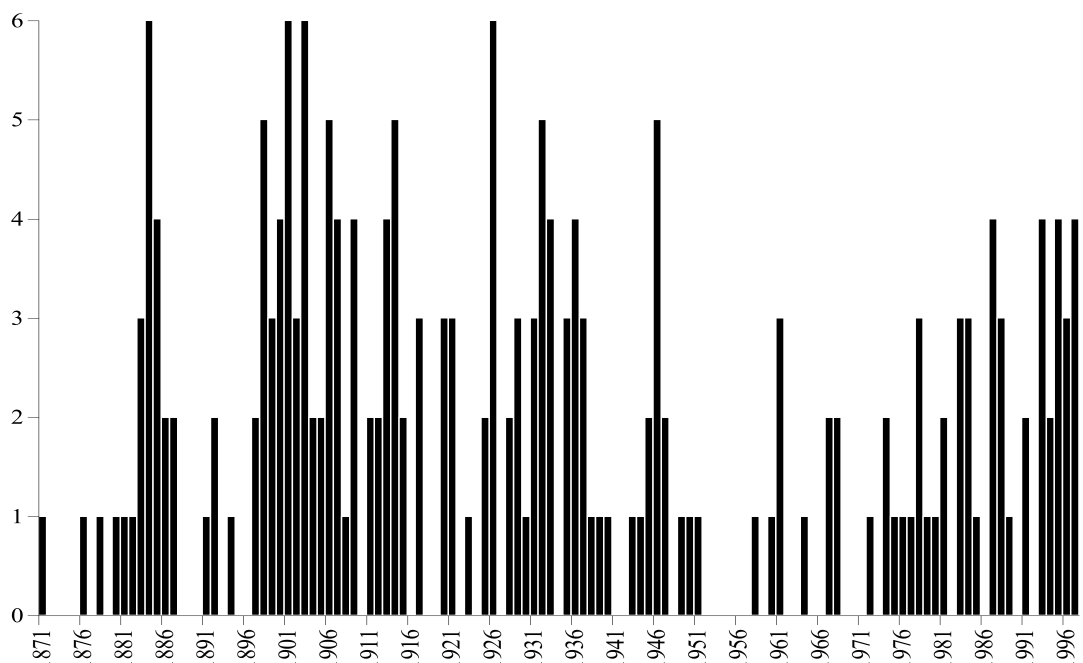
Data, Measures, And Methods

Chapter 2 described the population used to test the hypotheses developed above. Please refer back to that chapter if you have any questions regarding the data set. In this section I turn to describing the dependent, independent, and control variables used to test the hypotheses. Then I describe the type of analysis used to perform the tests – Poisson regression.

Organizational Foundings

The data structure for analyzing founding rates is radically different from that required to analyze mortality rates. Rather than organizing the data based on league-years, the data are organized just by year. The number of foundings in a given year serves as the dependent variable. So in the first year of this population's history, 1871, there was one founding. In 1884, however, there were 6 leagues founded. Total foundings among professional sports leagues from 1871 through 1997 number 206 total leagues. The variation in yearly professional sports league failures is shown in Figure 4.1.

Figure 4.1
Professional Sports League Foundings Over Time



Theoretical Variables

The primary theoretical variables in this study are total density and same sport density. Because the data are organized as yearly observations, construction of the total density measure is fairly straightforward as the number of leagues in the population in a given year. The measure of same sport density, however, is not so easily constructed. This is because same sport density cannot be tabulated if the data set is an aggregate of all sports. The data must be reorganized so that each sport has its own yearly observations. So instead of having one observation per year for the entire history of the population (127 observations), there is one observation per year for each sport (743 observations). Observations for each sport begin the year the first league is founded and continue until 1997. That is why there are 743 observations rather than 1,143 (nine sports times 127 years). Table 4.2 shows the historical time frames for each of the nine sports included in the data set. I should also note that when same sport density measures are used in a model, following the example of Hannan et. al. (1995) measures of total density are not used. Rather, measures of other sport density are used instead.

Table 4.2
Historical Time Frames of All Nine Sports

Sport	Historical Time Frame	Total Years
Baseball	1871-1997	127
Basketball	1898-1997	100
Football	1907-1997	91
Ice Hockey	1904-1997	94
Soccer	1895-1997	104
Roller Hockey	1883-1997	115
Volleyball	1975-1997	23
Softball	1976-1997	22
Lacrosse	1931-1997	67

Control Variables

As already stated, variables included in models must be at the population level of analysis. Therefore, no organization level variables are included as controls. However, there are several control variables that can still be included in models of foundings. One such variable is the general population. Increases or decreases in the general population can mean increases or decreases in market potential for leagues. The populations of the U.S. and Canada are combined to serve as this variable. U.S. data were collected from various editions of The Statistical Abstract of the United States and Historical Statistics of the United States: Colonial times to 1970, while Canadian data were collected from Urquhart (1965) and Statistics Canada (1997).

Another possible influence on potential market size may be the number of leisure hours people have in their weeks. Because attendance and general interest in sports can be considered “optional” additions to life, the likelihood of fans spending time involved with sports may be contingent on the number of discretionary hours in their week. So, as the average number of hours worked in a week decreases, sports demand may increase as well, creating a more inviting atmosphere for potential leagues. Thus, the average U.S. working week in hours is included as a control variable. Data were obtained from various editions of The Statistical Abstract of the United States and Historical Statistics of the United States: Colonial times to 1970.

Another possible effect on founding rates is the media. Positive media coverage of sporting events in general can create a greater interest in fans and the public. Thus, heightened public interest may entice potential league owners to commit to establishing a new league. I control for possible effects of newspapers, radio, and television by including estimates of U.S. daily newspaper circulation, the percentage of U.S. households with radios, the percentage of U.S. households with televisions, and the percentage of U.S. households with cable television. I collected data from various editions of The Statistical Abstract of the United States and Historical Statistics of the United States: Colonial times to 1970 to construct each of these measures.

I realize that using these U.S. measures is less than ideal because the study encompasses Canadian leagues and teams, too; but, unfortunately, because the data do not exist or are not compatible with U.S. data, Canadian measures cannot be included. Carroll and Delacroix (1982) encountered similar problems in their study of Argentinean and Irish newspapers, but they argue that those economies closely mirrored that of the United Kingdom – and that data was available. So they included a measure of British GNP in their models. Considering that Canadian data are likely to be highly correlated to U.S. data, using the more comprehensive U.S. data seems to be the more appropriate control strategy.

Another control variable included in the models is the U.S. GNP growth rate. This measure serves as a proxy for two ideas. First, a rising GNP can be associated with increased discretionary money available to fans and potential fans. A high GNP growth rate would indicate to potential league owners that market conditions are favorable for the establishment of new leagues. Second, the GNP growth rate may also indicate the general level of resources available to potential league and team owners. A high GNP growth rate would indicate that potential league owners might be in a better economic position to launch a new league. GNP figures were obtained from the U.S. Department of Commerce back to 1890 and prior to that, estimates of GNP are from Berry (1988).

I also include dummy variables to control for possible period effects, specifically periods of war and recession (Ranger-Moore, Banaszak-Holl, & Hannan, 1991; Land, Davis, & Blau, 1994; Aldrich, et. al., 1994; Hannan, et. al., 1995). I use dates from The World Book Encyclopedia to construct the war dummy variable (with the exception of the Gulf War occurring in 1991). And I use the National Bureau of Economic Research definition of economic contraction to determine periods of recession (U.S. Department of Commerce, 1994). The war dummy variable is coded as 1 during periods of war, and the recession dummy variable is coded as 1 during periods of recession.

Still other control variables are included in the models. I control for any trend over time by including the age of the total population (Carroll & Hannan, 1989a; Land, Davis, & Blau, 1994). However, when measures of same sport density are included in models, the age of the sport population in question is used. In addition, following the lead of previous research (Ranger-Moore, Banaszak-Holl, & Hannan, 1991; Baum & Oliver, 1992; Land, Davis, & Blau, 1994; Aldrich et. al., 1994), I include measures of prior foundings and prior deaths (lagged one year). Descriptive statistics and a correlation matrix of all of these variables for the total population in aggregate are presented in table 4.3.

Table 4.3
Means, Standard Deviations, Minimums, Maximums, and Bivariate Correlations for all Aggregate Founding Study Variables*

Variable	Mean	S.D.	Min.	Max.	1	2	3	4	5
1. Founding count	1.62	1.64	.00	7.00	--				
2. Density	10.28	4.53	1.00	20.00	.34	--			
3. Population	150.51	74.75	44.63	298.01	-.06	.60	--		
4. Work week	47.40	9.22	34.6	60.00	.10	-.64	-.86	--	
5. Newspapers	37.34	21.47	2.60	63.15	-.11	.65	.94	-.94	--
6. Radio	47.35	45.30	.00	99.00	-.19	.46	.91	-.90	.94
7. Television	33.08	44.43	.00	98.30	-.15	.28	.90	-.67	.81
8. Cable television	8.19	17.83	.00	67.38	.10	.38	.75	-.43	.51
9. GNP growth rate	.04	.06	-.15	.18	-.12	-.15	-.10	.11	-.09
10. Population age	63.00	36.81	.00	126.00	-.06	.66	.99	-.91	.97
11. War	.22	.42	.00	1.00	-.18	.19	.16	-.21	.27
12. Recession	.28	.45	.00	1.00	.12	-.14	-.31	.28	-.30
13. Prior foundings	1.59	1.63	.00	7.00	.32	.27	-.08	.09	-.11
14. Prior failures	1.46	1.55	.00	8.00	.36	.13	-.08	.05	-.09

	6	7	8	9	10	11	12	13
7. Television	.84							
8. Cable television	.53	.67						
9. GNP growth rate	-.05	-.07	-.09					
10. Population age	.93	.85	.67	-.10				
11. War	.26	.10	-.12	.17	.21			
12. Recession	-.33	-.28	-.22	-.36	-.31	-.21		
13. Prior foundings	-.19	-.17	.06	-.14	-.07	-.18	.12	
14. Prior failures	-.17	-.18	.01	-.15	-.06	-.14	.13	.55

*Note: Coefficients with absolute value >.17 are significant at $p<.05$. The sample contains 127 years of observations.

Models

Because the dependent variable is a count, the same model form used in Chapter 3 cannot be used here. Instead, following the work of others (Baum & Oliver, 1992; Freeman & Lomi, 1994; Aldrich, et. al., 1994) I use Poisson maximum likelihood regression to test my hypotheses. In this model the founding rate for the jth observation is given by

$$r_j = e^{\beta_0 + \beta_1 x_{1,j} + \ldots + \beta_k x_{k,j}},$$

where β_0 is a constant, $\beta_1 \ldots \beta_k$ are covariate coefficients, and $x_1 \ldots x_k$ are values of covariates.

Some researchers have opted for a negative binomial model instead of a Poisson (Ranger-Moore, Banaszak-Holl, & Hannan, 1991; Land, Davis, & Blau). However, goodness-of-fit diagnostics available through STATA verify that Poisson regression is preferable to a negative binomial model given this data set. I did try the models described below in a negative binomial model anyway, but not all the variables were estimatable. It should be noted that Aldrich et. al. (1994) also tried both models and came up with very similar estimates.

Descriptive statistics, correlation coefficients, and regression model estimates were all obtained using STATA.

Findings

Results

Table 4.4 presents the results of Poisson regression models designed to test the effects of density and density squared on founding rates. As mentioned in the methods section above, for total density no special treatment is needed for the population. So the models in table 4.4 contain 127 observations and do not make a distinction between sports in any way. In model 1, density is statistically significant and has the predicted sign. And in model 2, density squared is significant with the predicted negative sign, but the model is a statistical improvement over model 1 at only the .10 level of significance. I use the same log-likelihood method of testing nested models described earlier in chapter 3. This partially supports hypothesis 4.1, but does this support hold up when combined with measures of same sport density?

Table 4.4
Poisson Regression Estimates for Combined Population [a]

Variable	1	2	3
Density		.271*** (.039)	.491*** (.099)
Density ^{2}			-.010* (.004)
North American population	.007 (.034)	-.039 (.034)	-.007 (.037)
Work week	.030 (.032)	-.055 (.036)	-.039 (.036)
Newspapers	-.036 (.036)	-.018 (.036)	-.030 (.037)
Radio	-.007 (.006)	.004 (.007)	.011 (.007)
Television	-.012 (.013)	.035* (.014)	.020 (.016)
Cable television	-.007 (.023)	.033 (.024)	.024 (.024)
GNP growth rate	-.537 (1.352)	.673 (1.343)	-.251 (1.396)
Population age	.035 (.056)	.004 (.056)	-.044 (.061)
Period of war	-.322 (.229)	-.231 (.220)	-.337 (.226)
Period of recession	.063 (.178)	.062 (.181)	-.053 (.186)
Prior foundings	.041 (.049)	-.093† (.055)	-.108* (.054)
Prior failures	.105* (.049)	.217*** (.053)	.177*** (.055)
Constant	-2.264 (2.869)	4.661 (3.022)	1.828 (3.191)
Log-likelihood	-204.482	-179.978	-176.991

***p<.001, **p<.01, *p<.05, †p<.10
[a] Standard errors are in parentheses. N=127

Table 4.5 presents models designed to answer this question. These models have 743 observations because sports are broken out from each other so that same sport density can be calculated. As pointed out earlier, instead of using total density in conjunction with same sport density, I use other sport density following the example of Hannan, et. al. (1995) in their study of European automobile manufacturer foundings. Measures of population age, prior foundings, and prior failures are calculated on a within sport basis. For example, rather than using the population age for the entire population for a given observation, the age of the particular sport in question is used instead.

Table 4.5
Poisson Regression Estimates for Disaggregated Populations [a]

Variable	1	2	3	4	5	6	7
Other sport density	-.088*	.056			.036	.064	-.016
	(.037)	(.119)			(.042)	(.042)	(.117)
Other sport density ^{2}		-.008					.004
		(.006)					(.006)
Same sport density			.634***	1.458***	.646***	1.516***	1.529***
			(.052)	(.181)	(.054)	(.187)	(.188)
Same sport density ^{2}				-.111***		-.116***	-.116***
				(.023)		(.024)	(.024)
Population	.068†	.083*	.038	.035	.032	.026	.019
	(.036)	(.038)	(.036)	(.037)	(.037)	(.037)	(.038)
Work week	.015	.017	-.071*	-.069*	-.079*	-.084*	-.086*
	(.033)	(.033)	(.034)	(.034)	(.035)	(.036)	(.036)
Newspapers	-.026	-.036	-.002	.018	-.000	.022	.029
	(.037)	(.038)	(.038)	(.038)	(.038)	(.038)	(.039)
Radio	-.001	.004	-.004	.003	-.002	.006	.003
	(.007)	(.008)	(.007)	(.007)	(.007)	(.007)	(.008)
Television	-.034*	-.038*	-.001	-.003	.005	.007	.009
	(.014)	(.015)	(.014)	(.014)	(.015)	(.015)	(.015)
Cable television	-.019	-.021	.009	.018	.014	.026	.027
	(.024)	(.024)	(.023)	(.024)	(.024)	(.024)	(.024)
GNP growth rate	-.626	-.776	-.056	-.197	.064	.072	.284
	(1.388)	(1.397)	(1.365)	(1.392)	(1.368)	(1.391)	(1.421)
Population age	-.082	-.113†	-.105†	-.119†	-.107†	-.126*	-.113†
	(.059)	(.064)	(.063)	(.063)	(.063)	(.064)	(.066)
Period of war	-.261	-.277	-.250	-.301	-.230	-.264	-.250
	(.231)	(.231)	(.219)	(.219)	(.220)	(.220)	(.221)
Period of recession	.047	.024	.023	.064	.032	.057	.091
	(.180)	(.181)	(.180)	(.183)	(.182)	(.184)	(.190)
Prior foundings	.060	.052	-.584***	-.490***	-.591***	-.502***	-.508***
	(.094)	(.095)	(.111)	(.105)	(.112)	(.106)	(.106)
Prior failures	.289***	.282***	.498***	.449***	.509***	.474***	.482***
	(.088)	(.087)	(.091)	(.091)	(.092)	(.092)	(.093)
Basketball league	-1.406	-2.280	-1.627	-1.982	-1.711	-2.242	-1.877
	(1.569)	(1.717)	(1.645)	(1.674)	(1.647)	(1.690)	(1.750)
Football league	-3.004	-4.159†	-3.533	-4.172†	-3.634	-4.495*	-4.015†
	(2.116)	(2.309)	(2.224)	(2.251)	(2.226)	(2.270)	(2.346)
Ice hockey league	-3.291†	-4.337*	-3.188	-3.369	-3.310	-3.700†	-3.256
	(1.957)	(2.129)	(2.063)	(2.085)	(2.067)	(2.105)	(2.175)
Soccer league	-1.388	-2.159	-1.439	-1.731	-1.512	-1.949	-1.621
	(1.339)	(1.471)	(1.420)	(1.448)	(1.421)	(1.460)	(1.518)
Roller hockey league	-.579	-.959	-.175	-.108	-.246	-.254	-.076
	(.712)	(.775)	(.755)	(.759)	(.760)	(.767)	(.799)
Volleyball league	-8.114	-11.352†	-9.103	-9.796	-9.398	-10.724	-9.403
	(6.207)	(6.734)	(6.504)	(6.570)	(6.511)	(6.622)	(6.815)
Softball league	-8.063	-11.286†	-9.166	-9.945	-9.451	-10.840	-9.479
	(6.144)	(6.669)	(6.583)	(6.671)	(6.589)	(6.722)	(6.925)
Lacrosse league	-5.133	-6.992†	-5.035	-5.050	-5.237	-5.616	-4.832
	(3.532)	(3.835)	(3.730)	(3.768)	(3.736)	(3.801)	(3.921)
Constant	-4.301	-5.058†	1.149	-.038	1.928	1.233	1.685
	(2.994)	(3.045)	(2.928)	(2.931)	(3.063)	(3.055)	(3.124)
Log-likelihood	-425.243	-424.290	-352.902	-339.420	-352.527	-338.288	-338.023

***p<.001, **p<.01, *p<.05, †p<.10

[a] Standard errors are in parentheses. N=743

Model 1 includes only the other sport density measure, which is significant at the .05 level but in the opposite direction predicted. And when other sport density squared is added in model 2, neither term retains significance. Models 3 and 4 include same sport density and same sport density squared. In both models, these variables are significant and in the predicted direction. In addition, model 4 is a statistical improvement over model 3. Models 5, 6, and 7 attempt to improve on model 4 by adding one or both other sport density measures. But no model exceeds model 4 in quality.

As far as the control variables are concerned, only a few are statistically significant. Prior foundings and prior failures are both significant and with the sign we would expect. Prior foundings has a negative sign indicating that if a league or leagues were founded in the previous year, a league founding in the year in question is less likely. Prior failures has a positive sign meaning that when leagues failed, the following year there was an increased chance of a new league being formed. This could very well be because in many cases of league failure not all the teams failed with the league. They would oftentimes band together with the other members of the defunct league, try to entice other teams to join them, and then start their own new league.

One of the sport dummy variables, for football leagues, was marginally significant at the .10 level. But no other dummy variables were significant. The only other control variable significant in model 4 of table 4.5 at the .05 level is work week duration. But unlike in the case of the best mortality model discussed in chapter 3, work week duration has the expected sign in this model. When work weeks are shorter, more leagues are founded. This makes sense if league organizers are watching their potential markets and see public leisure time on the increase.

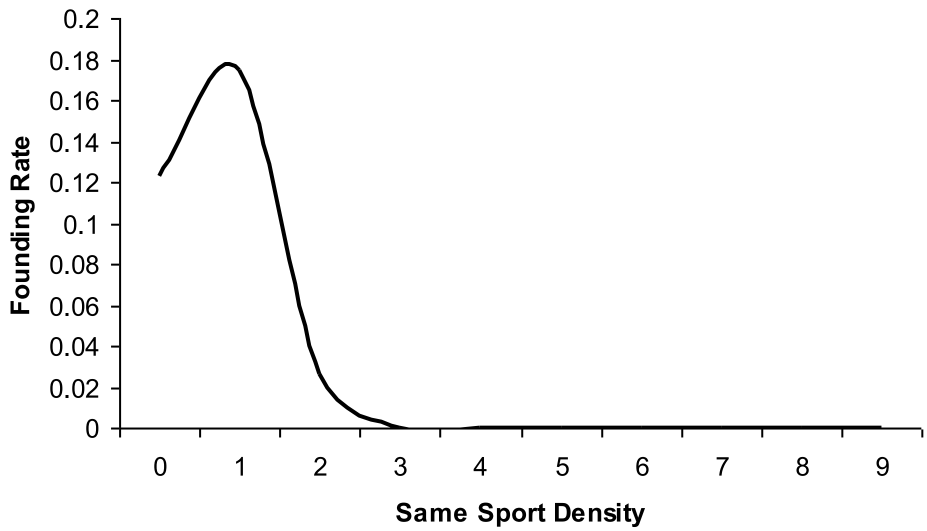
Conclusions

Hypothesis 4.1 predicted that the inverted U-shaped density dependent relationship developed by Carroll and Hannan would be evident in this population. And it is (weakly) when the population is anlyzed as a whole. But hypothesis 4.2 predicted that a much stronger inverted U-shaped relationship would exist between density and founding rates among leauges playing the same sports. This hypothesis is strongly supported by model 4 of table 4.5 in which both the linear and squared terms of same sport density are significant. Attempts to add the more general other sport density measures failed to improve upon this model leading to the conclusion that same sport density effects are, indeed, much stronger than total density effects.

In any event, the traditional view of how density reflects the forces of competition and legitimation forces and their effects on founding rates is supported here. As density within a subpopulation of leagues in a given sport increases and the legitimation of the form supposedly rises, the founding rate also increases, but only to a certain point. Then, as density continues to increase and presumably competition is greater, founding rates decrease.

Figure 4.2 is a graphical depiction of this and is based on the estimates of model 4 in table 4.5. Although the range of same sport density is zero to nine, most values fall in the zero to three range and that is why most of the change in the slope of the curve is in the zero to three range. Founding rates are higher when only one or two other leagues exist in a given sport, but once there are more leagues than that, the founding rate drops dramatically and is nearly zero when there are more than three leagues already playing a particular sport.

Figure 4.2
Relationship Between Same Sport Density and Founding Rates



So in this chapter we see that unlike the results of the mortality analysis in chapter 3, the results here are very much in line with existing research concerning founding rates. Density effects have the significance levels we expect and are in the directions we expect. Even the control variables do not present us with any unusual relationships to explain. All in all then, founding rates of professional sports leagues seem to be very similar to those of other industries that have been studied by organizational ecologists.

CHAPTER 5

CONCLUSIONS

I began this undertaking with the goal of making use of the population of North American professional sports leagues to test ecological ideas about the processes of organizational founding and mortality. In Chapter 3 we examined the history of empirical research into mortality rates. I developed hypotheses that extended to some degree some of the existing constructs (i.e. age/size interaction and density) and created a new one – growth dependence. In Chapter 4 the same pattern was followed with regard to organizational foundings. Table 5.1 presents all the hypotheses developed in this dissertation and indicates whether or not each hypothesis is supported.

The first two hypotheses must be examined together. The first really deals with an underspecified model. Without size and other key variables in a model of mortality, a liability of newness is very likely to be present. But as important theoretical variables are added to the equation, sometimes a liability of aging appears. Although this was not the case when size was added to the model by itself, it certainly was the case when competitive intensity was added. So while the second hypothesis was not explicitly supported, the idea behind it that an underspecified model can lead to precarious conclusions about age dependence certainly was supported. The same cannot be said, however, for the third hypothesis dealing with age and size dependence. There is no evidence that there is a significant interaction between age and size in this population.

Table 5.1
Review of Hypotheses and Support

Hypothesis #	Hypothesis Statement	Supported?
3.1a	A liability of newness will be present when no measure of size is included in models of mortality rates of the population of professional sports leagues.	Yes
3.1b	A liability of aging will be present when a measure of size is included in models of mortality rates of the population of professional sports leagues.	No
3.1c	The interaction of organizational age and size will be statistically significant in models of mortality rates.	No
3.2a	Total density will be negatively associated with mortality rates.	No
3.2b	Same sport density will be positively associated with mortality rates.	No
3.3a	Founding density will be positively related to the mortality rate of professional sports leagues while founding density squared will be negatively related to the mortality rate of professional sports leagues.	No
3.3b	Same sport founding density will be positively related to the mortality rate of professional sports leagues while same sport founding density squared will be negatively related to the mortality rate of professional sports leagues.	No
3.3c	Competitive intensity will be positively related to the mortality rate of professional sports leagues while competitive intensity squared will be negatively related to the mortality rate of professional sports leagues.	Yes/No
3.3d	Same sport competitive intensity will be positively related to the mortality rate of professional sports leagues while same sport competitive intensity squared will be negatively related to the mortality rate of professional sports leagues.	Yes/No
3.4	Organizational growth rates will be negatively associated with mortality rates in the population of professional sports leagues.	No
4.1	Density will be positively related to the founding rate of professional sports leagues while density squared will be negatively related to the founding rate of professional sports leagues.	No
4.2	Same sport density will be positively related to the founding rate of professional sports leagues while same sport density squared will be negatively related to the founding rate of professional sports leagues.	Yes

Hypotheses 3.2a and 3.2b dealt with the continuing exploration of density dependence by organizational scholars. Like others before me, I wanted to see if I could unbundle density and discover some underlying forces. This effort was somewhat successful even if the

hypotheses were not completely supported. When total density was broken up into sub-population density, total density effects lost their significance. Thus, hypothesis 3.2a was not supported. But the sub-population density effects were significant when added to the baseline model and in the direction predicted indicating they were more substantial than their total density counterparts. However, since same sport density effects did not retain significance in the best model, hypothesis 3.2b is not supported.

Hypotheses 3.3a through 3.3d dealt with the effects of founding conditions on mortality rates. In general, no second order terms were found to be significant among the variables tested for these hypotheses. Thus, the trial by fire hypothesis is not supported here. However, positive first order effects of competitive intensity were evident in the best model. So, while the trial by fire hypothesis failed to receive support, the lasting effects of competition were quite apparent, consistent, and pervasive.

Hypothesis 3.4 presented a completely new idea in ecological research. It was hypothesized that growing organizations have lower mortality rates than organizations that are not growing or are shrinking. However, this idea was not support by empirical tests. And, in fact, further investigation into whether or not organizational growth was perhaps significant but not constant over time failed as well. Perhaps this idea can be tested again in the future. But for now, it appears that in this population of organizations, organizational growth is not associated with lower mortality rates.

And finally, hypotheses 4.1 and 4.2 were developed to test ideas about density's effects on founding rates. Hypothesis 4.1 reflected the traditional thinking about density dependence and founding rates. Namely that there is an inverted U-shaped relationship between the two. And at first glance Hypothesis 4.1 is supported. But when sub-population density is entered into the equation, aggregate measures of density become insignificant. This was expected. Same sport density effects were expected to be stronger than total density effects, perhaps even overpowering them in models, and this is exactly what happened. Same sport density variables were strongly significant in the direction predicted in the best model developed here for founding rates lending strong support to hypothesis 4.2.

What shall we say then? Based on this analysis of professional sports leagues, I believe we can come to several conclusions. First, underspecified models can lead researchers to mistakenly conclude that a liability of newness exists in populations of organizations. Second, total or aggregate measures of density should be broken down into sub-population measures to gain a better understanding of what they represent and how they affect both organizational mortality and foundings. And third, competition is a strong force that can leave lasting imprints on organizations. Hopefully, through refinement of this analysis and the conclusions drawn from it and the undertaking of new research, we can significantly add to our understanding of the dynamics of organizational foundings and failures.

However, these conclusions must be tempered by an acknowledgement of the limitations of this study. First, the population studied, as described at the outset, is fairly unique. The combination of competitive and cooperative actions within and between leagues is unusual among industries studied in the organizational ecology literature. And this may in fact be one of the reasons for the unusual results found in chapter 3, especially concerning a lack of significance with size measures. So the uniqueness of the population could be viewed as a two edged sword. On the one hand, generalizing the conclusions found here to other populations may be a bit tenuous; but on the other hand, we have added to our understanding of organizations by studying this rather unique form.

Two other limitations are worth considering at this point as well. First, not all the variables I would like to have included in models were available. Scully (1989), for instance, talks about the quality of leagues in terms of winning percentage distributions. Leagues that have a certain distribution of winning percentages among their teams are thought to be regarded as of higher quality than other leagues. Unfortunately, team winning percentages by year are only available for a very few leagues. Other variables I wish I had include media revenue, stadium revenues, league organization structures, and revenue sharing agreements. These variables would have made the study so much richer, but trade-offs are part of research. In order to study the entire history of this entire population, I had to give up some variables, increasing the potential effects of unobserved heterogeneity.

And finally, there are concerns about some of the problems I encountered with the TDA statistical program. The program's inability to handle the same sport founding density variables was disappointing. And the program's ambiguous error messages did not help matters as the problem cannot be fully understood based on the error messages provided.

But regardless of this study's limitations, we can still learn from it and use it as a springboard to further analyze organizational dynamics which will never be a dull undertaking. For organizations are made up of people, and people's actions are not always as predictable as some like to think they are. As Calvin Griffith, the former owner of the Washington Senators once said, "I can't tell you what I intend to do. But I can tell you one thing. It won't be anything rational." Everyone has his or her own version of rationality that makes this world and organizational dynamics hard to predict. But it also makes organizational studies forever interesting and ever so challenging.

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