THE SOCIAL STRUCTURE OF STIGMATIZED CAREERS

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ABSTRACT:

In this dissertation, two large and seemingly unrelated digital footprints of social behavior are analyzed. The first is an extensive record of fighting interactions in North American Ice Hockey at both the professional and developmental levels. The second is a dataset containing records of performances in the adult film industry. While the contexts of these two phenomena are seemingly distinct, in both cases we see how individuals can remain in their professions through embracing more stigmatized or potentially deviant roles or acts. In the case of ice hockey, the emergence of a semi-designated fighting role is empirically demonstrated. While the act of fighting is somewhat controversial within the game, it is an established way for individual players who are less talented at other aspects of the sport to secure a position on the roster of a professional team. Within the case of adult film, it is well known that careers are short and there is a constant demand for new talent. However, the data demonstrates that a performer's willingness to perform in perhaps more deviant behavior on camera may enhance the amount of time they can stay in the adult film industry. In either case, it is shown that individuals who are willing to embrace less conventional and desirable roles or behaviors can enhance their longevity within competitive occupations that offer little job security.

BIOGRAPHICAL SKETCH

Antonio Diego Sirianni was born in Albany, NY on April 7th, 1988, to Eileen Marie (Parks) Sirianni and Diego Antonio Sirianni. He also has one younger sister (Rita Marietta Sirianni). After a number of moves around Upstate New York, his family eventually moved to West Seneca, NY, a suburb of his parents' hometown of Buffalo, NY. Sirianni later attended the Canisius High School of Buffalo, New York, a Jesuit all-boys college preparatory school, on a partial academic scholarship, graduating in 2006. He also completed the six-year "Gifted Math Program" at the State University of New York at Buffalo. Sirianni then attended Yale University with the intention of studying biology before pivoting to the social sciences and eventually receiving a Bachelor of Science with Distinction in Psychology in 2010.

As a high school and college student, Sirianni dedicated a large portion of his time to the sport of rowing. After learning the sport at the West Side Rowing Club, he rowed for four years and eventually served as a captain of the Canisius High School Team, and in 2006 rowed on Canisius' National Youth Champion Lightweight Eight-man Boat. At Yale University, he spent his Freshman year on the Varsity Lightweight Rowing team, and his remaining three years on the Varsity Heavyweight Rowing Team. In 2010 he received the George Pew Award, which is awarded to "the team member who distinguishes himself through hard work, dedication, and loyalty to Yale Crew."

In 2010, Sirianni moved to the Boston area and began working at CSN Stores, a set of online retail sites that rebranded as Wayfair.com in 2011. After three years of work as a business analyst and data scientist, and several night courses in Mathematics and Statistics at the Harvard Extension School, he began graduate study in Sociology in the Fall of 2013 at Cornell University. In January 2017, he received his Master of Arts Degree in Sociology, and in August 2019, he received his Doctor of Philosophy

Degree in Sociology. While in graduate school, Sirianni supplemented his study of sociology with coursework in computer science, mathematics, and statistics, and attended workshops in computational social science at the Santa Fe Institute.

Outside of his academic and professional career, Sirianni has continued to be involved with the sport of rowing as a youth coach and masters sculler. He also plays ice hockey, skis (downhill and Nordic), and is a lifelong supporter of the Buffalo Bills.

This work is dedicated to my parents, Eileen and Diego, who have taught me to value education and learning, encouraged me to pursue my curiosities and interests in a bold and balanced manner, and unconditionally supported me in every step of my life and career.

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I also consider myself very fortunate to have been a teaching assistant Vida Maralani, who not only helped me develop as a teacher, but also ended up being an invaluable source of advice and wisdom during the final half of my graduate studies.

Outside of Cornell, I was lucky enough to have the opportunity to twice attend the Graduate Workshop in Social Science and Complexity Science at the Santa Fe Institute, which is led by John Miller and Scott Page. (I am also very grateful for the continued mentorship of John Miller.) The interactions I have had with economists, psychologists, anthropologists, and other social scientists at these workshops were

intellectually invigorating. I left these workshops with a much better sense of how sociology fits into the larger enterprise of social science.

The support of my family, especially my parents Diego and Eileen, and my sister Rita, and my friends outside of the academy has also been paramount to my success. I would fail in trying to list everyone, but to everyone who visited me in Ithaca, hosted me during an escape from Ithaca, asked me about how things were going in graduate school, and sensed when they should not ask me about how things were going, you have my sincerest thanks.

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INTRODUCTION

My dissertation is centered on the analysis of two seemingly unrelated social phenomena that have large but unstructured "digital footprints": fist-fighting in North American ice hockey, and career performance and co-performance in the adult film industry.

The decisions to engage in either violent or sexual behavior in a public sphere share several distinct characteristics of interest. First, they both involve the performance of activity that is largely stigmatized, yet success in either vocation is both rare and presumably desirable by participants. These are unique examples of what has been referred to by sociologists and organizational scholars as "dirty work" (work that is physically, socially, or morally tainted) (Hughes 1962; Ashforth et al 2007), where culturally desired ends (fame, fortune) are systematically pursued by what might be thought of as culturally undesirable means.

Second, while literature on career success in other fields is largely characterized by rich-get-richer or 'Matthew' effects and hot-streaks (Merton 1968; Liu et al 2018) there are dynamics in both industries that should undermine these effects. Hockey players can only take so many punches before negative health effects accumulate, and adult film stars must avoid the traps of "overexposure" and a retrogressive career dynamic that has been documented by Paul Cressey in his study of "taxi-dance halls" (Cressey 1932) and sociological examinations of the adult film industry (Escoffier 2003; 2007), as well as by journalists who currently study the business.

Third, both datasets have a large public health component. The interactions that define these two vocational paths can be directly harmful to participants – in the case of hockey there is the threat of CTE and other negative consequences of repeated head-trauma, and in the case of adult film there have been documented STI outbreaks in the industry, an inherently network-based issue. In addition, to the extent that these phenomena are both highly visible, the attitudes and norms displayed towards sex and violence spillover to their consumers. While many scholars have examined the detrimental effects of both violence in sports (Bloom and Smith 2006) and pornography (Brown & L'Engle 2009; Lo and Wei 2005) on the general public, few have given the source of these alleged negative effects adequate empirical attention.

Finally, each case is also defined by the co-evolution between individual careers and professional interactions. Success as either a specialized fighter in ice hockey or an adult film performer arguably depends on the choice of "collaborators". Each individual career can plausibly be advanced following a publicly visible interaction with the right person, either via the transferal of status (Podolny 2010; Benjamin and Podolny 1999), the collective formation of skills, or, in the case of adult film, brokerage and the formation of a large but sparse social network (Burt 1992; Podolny and Baron 1997). Furthermore, each individual actor's choice of interaction partners is potentially determined by their status and identity within the industry of interest.

My dissertation will also by necessity make a series of methodological contributions: 1) Both sets of analysis involve uniting and dissecting multiple sets of highly detailed online data from various sources. 2) the datasets constructed are both

longitudinal and relational, as such data analysis must deal with the challenges of temporal and network autocorrelation. 3) Conclusions must be robust against the possibility that incompleteness is highly correlated with variables of interest: mainly, it is reasonable to expect that data completeness is strongly associated with recency and the fame of success of the individuals being tracked.

Part I: Fist-Fighting in North American Ice Hockey

Data:

My analysis of fighting in North American Ice Hockey comes largely from two sources. The first source is a fan-compiled web-archive of fights from a wide array of ice hockey leagues that stretch across North America and the world. I focus my attention on the hierarchy of leagues in Canada and North America. Primarily, I use data from the National Hockey League (the highest level of ice hockey in North America) and the Western Hockey League, one of three leagues in Canada and North America that serves as a final pre-professional stepping-stone for 16-21 year-old players who do not play collegiate hockey. I also supplement this with data from minor professional leagues that exist between these two levels. My analysis of NHL data also draws on a large 5-year subset of play-by-play data from games, which allows me to look at the specific in-game situations that lead to violence and how they co-vary with the types of players who are participating in violence.

Chapter 1: The Specialization of Informal Social Control: Fighting in the National Hockey League from 1960-2012

In this paper, I track the changes in both the network structure of fighting interactions in the NHL, and an emerging differentiation between players who score

and players who fight. The study shows how fighting as an element of an honor-based system of decentralized social control that depends on individual self-help evolved into a signaling component of a semi-specialized system of social control that depends on a small number of enforcers.

Chapter 2: The Specialization of Violence Over the Career Course in Professional Ice Hockey

This chapter analyzes how individuals in the Canadian Junior Hockey Leagues come to accept the responsibility on behalf of their teammates, and how their play at earlier ages both helps the advance through the hierarchy of North American Ice Hockey and funnels them into specialized roles as fighters or skill players. Drawing on a longitudinal dataset from three major hockey leagues, this paper shows how players are fed into the specialized system of social control discussed in the first chapter, and also adds to our understanding of why certain people come to take on unfavorable tasks and roles in groups.

Part II: Co-performance in Adult Films

Data:

The analysis in this chapter focuses on data drawn primarily from two main sources of data. The first is an analysis of all films posted on a large internet aggregator of adult film content from 2008-2018. This dataset contains over 500,000 films that have at least one performer associated with the film, with just over 20,000 performers appearing in the dataset in total. This is supplemented by a large archival dataset maintained by fans of the adult film industry. This site has information which predates the industry's online shift and contains data on both film appearances and

performer demographics going back to the late 1960s on over 160,000 performers. There is a substantial overlap between these two data sets, with roughly 15,000 performers appearing in both.

Chapter 3: A Study of the Career Trajectories of Adult Film Performers

In this chapter, the focus is on the career longevity and performance sequencing strategies of adult film performers. While there is an allegedly a large demand for new talent in the adult film industry, particularly in the case of female performers, there are still many women who manage to maintain long successful careers despite this dynamic. This chapter addresses this empirical anomaly by analyzing the individual demographic features and strategies that predict success in the industry, and more generally, how women in the industry preserve their appeal in an industry that constantly demands "fresh faces."

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CHAPTER 1:

THE SPECIALIZATION OF INFORMAL SOCIAL CONTROL: FIGHTING IN THE NATIONAL HOCKEY LEAGUE FROM 1960-2012

***Abstract*:**

Much theoretical and empirical work has examined how systems of social control can emerge from a group of self-interested actors who either have shared collective interests or co-exist under the same sovereign authority. Conversely, while many types of social control have been found to exist in decentralized areas where institutions are weak and collective interests are limited, little is known about how these systems emerge. This article offers a rare empirical analysis of the evolution and formalization of a system of social control by drawing upon a 52-year record of nearly 30,000 fist-fights in the National Hockey League. Fighting is commonly understood to be both an instrument of retaliatory "self-help" exercised by all players, but also the semi-exclusive domain of "enforcers" or "goons" who are employed by teams to physically retaliate on behalf of their opponents and deter violent play in others. An analysis of the player distribution, network structure, and in-game contexts of these fights demonstrates a gradual shift from a system of self-help to a system of specialized enforcement.

***Introduction*:**

Social scientists and legal scholars have both noted the wide variety of systems that exercise control over a population. Systems of governance and social control vary from formal to informal, from centralized to decentralized, and from cultural to institutional. In many contexts, these systems exist side-by-side. Of particular interest

is how systems of social control emerge and evolve. One puzzling question in this area of research centers broadly around a "chicken-or-the-egg" question of social control and collective action: how are individuals compelled to contribute to a collective pool of resources, when collective investment is required to provide a system that can compel contributions (i.e., punish those who do not contribute and reward those who do)? At the micro-level, this has been studied with simulations (Heckathorn 1988; 1989; 1990, Macy 1993) and experiments (Fehr and Gächter 2000; 2002; Sefton, Shupp, and Walker 2007) where individuals decide whether or not to invest in a public resource pool and then whether or not to punish or reward others for their investment decisions. At a macro-level, work has been more empirical and focused on the process of "state-making" (Tilly et al. 1985), or conversely how systems of order and control change after the disintegration of the state (Varese 1994). At both the micro or macro level, an initial spark can generate a virtuous-cycle between the growth of social control and the growth of public contributions to the state (collective action).

Yet, not all systems of social control are predicated entirely on the existence of a strong and centralized state, or even on a substantial common interest between the actors. Areas that lack strong state control, or states that remain intentionally weak, often develop systems of control that are not dependent on a collectively constructed "leviathan". These systems of lawless order vary in their levels of sophistication. Some systems of decentralized social control are based on restorative justice, gossip, and retaliation (Black 1983; Ellickson 1987), whereas other more complex and specialized systems of decentralized social control might involve private security forces (Shearing and Stenning 1981; 1982), organized criminal activity (Gambetta

1996), or even institutions that lack resources but coordinate markets for enforcement and sanctioning (Friedman 1979). Examples of how these systems can shift from simple to complex in the absence of a strong collective interest, however, remain elusive.

This article empirically demonstrates how an informal and decentralized system of social control can evolve by drawing upon a context that has many characteristics of a deliberately weak state and is remarkably transparent and well-documented: North American Ice Hockey. While players are often punished for deviant play with penalties by on-ice officials, and in rare cases financial sanctions by off-ice officials, the modern National Hockey League (NHL) has rules that effectively permit fist-fighting as a means of letting players police the sport alongside the officials and the league. The role of fighting in the game is commonly depicted through the lens of two distinct systems of informal social control: an unspecialized "culture of honor" where individuals retaliate and pick fights with players who violated a norm or rule in a way that was not adequately addressed by formal systems of control, and a specialized system that relies on the existence of a small number of players called "enforcers" (or, less generously, "goons") who have the unofficial job of both retaliating for teammates and intimidating opponents by signaling their capacity to produce violence.

An empirical analysis of both the records of individual players and the fights that have occurred between them resolves the tension between unspecialized and specialized explanations of fighting in ice hockey. More interestingly, it provides a rare empirical and quantitative glimpse of the evolution of social control in the

absence of a strong state. Furthermore, tracing the network structure of fighting interactions and temporally aligning them with play-by-play data demonstrates how the nature of fighting has shifted with the specialization of control, and illustrates a potential side-effect of the specialization of social control: enforcers (and the teams who employ them) may have an incentive to display their ability and willingness to sanction and produce violence even when there is no obvious pretext for retaliation.

This article will first briefly discuss the problem of social control in collective and decentralized contexts, and then distinguish between second-party and third-party systems of social control in the absence of a strong state. Then, the problem of governance and the history of violence within the sport of North American Ice Hockey, along with the use of fighting as an informal means of social control, is reviewed. To examine this context more thoroughly, two novel data sets are introduced: a 52-year record of player statistics and fight occurrences in the National Hockey League (NHL) stretching from 1960-2012 and a five-year segment of this data from 2007-12 that has been augmented with time-stamped play-by-play data from the NHL, which allows "calculated" and "impulsive" fights to be distinguished from one another. By analyzing temporal changes and situational differences in both fighting distributions across players and the network structure of fights, this article demonstrates how an unspecialized system of retaliatory violence and "self-help" gradually shifted towards a specialized enforcer-based system of social control and vicarious third-party sanctioning. The more general implications of this shift, and a deeper discussion of its potential causes, are then discussed.

Social Control and Collective Action

Social control is frequently examined as a potential solution to the problem of collective action: why do individuals behave altruistically when it is in their individual best interest to behave selfishly (Olson 1965)? Social control in this context involves the provision of a system of rewards and punishments that fundamentally alter the calculus of would-be selfish actors. The effective use of selective incentives is largely dependent on the nature of the collective action problem at hand: when public utility is contingent on pro-social behavior from only a few individuals are best suited by social rewards, but when the collective well-being is harmed by only a handful of defectors, defection requires targeted punishment (Oliver 1980).

The implementation of punishment, however, becomes a collective action problem in and of itself. In order to guarantee that all individuals choose to behave altruistically, individuals must be willing to either punish individuals who behave anti-socially at a cost to themselves or invest in a larger social structure that will punish on their behalf. This has been billed as the "second-order free-rider problem" (Heckathorn 1989). Dynamic rational choice and agent-based models have shown that individuals may be able to optimize investment in social control via mathematical calculation or social learning and adaptation (Heckathorn 1988; 1990; Macy 1993). One potential solution of interest is "hypocritical cooperation," where individuals who altruistically sanction anti-social behavior in others do not behave pro-socially otherwise (Heckathorn 1989).

Countless laboratory experiments have also focused on the role of sanctioning, either directly by giving individuals the opportunity to impose punishments on others at a cost to themselves (Fehr and Gachter 2000), or indirectly by giving participants

the opportunity to contribute to a system that punishes anti-social participants (Yamagishi 1986). The desire to sanction, whether the proximate cause is rational calculation or an evolved impulse to punish, is effective in compelling individuals to behave pro-socially in the laboratory setting (Fehr and Gachter 2002; Sigmund 2007). It has been experimentally shown that individuals are more responsive to designated sanctioners, especially when those sanctioners appear legitimate due to their higher positions in an established social hierarchy (Baldassarri and Grossman 2011). Furthermore, individuals prefer experimental scenarios where institutions are in place to enforce pro-social behavior to those where such institutions are absent (Gürerk, Irlenbusch and Rockenbach 2006).

More politically-minded social scientists have examined the parallel macro-level phenomena of state-making. Whereas literature on emergent social order requires collective action to proceed the capacity for social control, state-making literature has emphasized the necessity of violence and plundering as pre-requisites for establishing systems of social control. The origins of the European nation-states in the 16th and 17th centuries are argued to be rooted in the ability of political groups to use physical power to usurp resources, and then use those resources to maintain domination and a tax base (i.e., compel collective action) and expand (Cohen, Brown, and Organski 1981; Rasler and Thompson 1985; Tilly et. al 1985).

The micro-emergence of social order and the macro-emergence of the nation-state seem to provide different answers to the 'chicken-or-the-egg' problem of social control and collective action. Simulations and experiments suggest that individual decisions to behave collectively must come first, and historical analyses suggest that

acquiring the resources necessary to establish an apparatus of social control must proceed compulsory collective action. However, these two models are actually quite similar. Both presume the existence of a self-reinforcing dynamic. Social control compels more effective collective action, and collective action provides the resources necessary for more extensive social control. Whether this cycle is sparked by a group stumbling upon altruistic punishment via adaptation or calculation, or a handful of individuals plundering a surplus of power and resources, the process after the spark is lit is largely the same.

Social Control Without the Collective

Most studies that examine the importance of social sanctioning and altruistic punishment tend to focus on issues of public wealth. The 2-person model of the Prisoner's Dilemma is used to motivate larger *n*-person public goods games, where all individuals must choose between hoarding their wealth or investing in a larger public project that generates non-excludable goods, or the 'Tragedy of the Commons', where individuals decide how much to extract from a finite public pool of resources. These scenarios are both predicated upon the existence of shared wealth. However, anti-social behavior is often predatory and directed at other individuals, not collectives. Furthermore, certain contexts are less amenable to the development of a sovereign state or public investment than others. (Stated mathematically, in certain cases the dilemma between altruistic and selfish behavior may be better reflected by $n*(n-1)/2$ pairwise games than a single *n*-person game.) How does governance emerge when the potential for both collective action and the development of a strong state is limited?

Negative Reciprocity as Social Control

Retaliatory punishment, or negative reciprocity, is still prevalent when there is no collective entity coordinating sanctions or compelling altruism. Negative reciprocity is a common feature in many animal societies and is thought to have the effect of warding of parasitic or predatory behavior (Clutton-Brock and Parker 1995). Retaliation may be irrational in the short-term, but signaling a willingness to impose costly sanctions on others can be rational in the long-term (Schelling 1960; Elster 1990; Gambetta 2009). While the impulse to punish may have been naturally selected via evolutionary processes for the value of forward-looking deterrence, the proximate mechanisms may be driven by backwards-looking vengeance. Punishment in laboratory trust games persists even when punishers know that recipients will not necessarily realize they are being punished, suggesting that punishment is driven by a sense of vengeance as opposed to explicitly forward-looking motives (Crockett, Ozmedir, and Fehr 2004). A universal "taste for vengeance" has also been mathematically shown to alter the 2-person prisoner's dilemma into a coordination game that rewards cooperative behavior (Friedman and Sing 1999), and negative reciprocity is also at the heart of the most well-known solution to the repeated prisoner's dilemma game, "Tit-for-Tat" (Axelrod 1981).

Beyond biologically evolved impulses to retaliate, certain contexts may promote cultures or norms that encourage retaliation. Legal scholars have emphasized the importance and prevalence of negative reciprocity, or "self-help", as an alternative to centralized sanctioning (Black 1983; Ellickson 1991). Criminologists, sociologists, and anthropologists have noted that vengeance and reciprocal violence are present in a variety of areas that have an ineffective, weak, or absent central-authority, from the

Pacific to the Mediterranean (Colson 1953; Boehm 1987; Gould 2000). Honor cultures, which are characterized by retaliatory norms, hyper-sensitivity to insult, and high rates of risk-taking (as a means of signaling) are found in both rural parts of the U.S. South (Nisbett 1993) and portions of certain U.S. cities. In the U.S. South this culture is thought to have been brought over from Scots-Irish herders, whose wealth came from a source that was especially vulnerable to predation (Cohen and Nisbett 1994). This culture was enforced by weaker state institutions in the U.S. south. Murder rates in the South are correlated with weaker institutions (Grossjean 2014), and experiments have shown that people from this part of the country are more sensitive to insult (Cohen et. al 1996; Cohen and Nisbett 1997) and willing to take dangerous risks to signal fearlessness (Barnes, Brown and Tamborski, 2012). In under-policed inner-city areas in the United States, honorific violence is perpetuated by the belief that the state is weak and unresponsive to acts of crime (Kirk and Papchristos 2011). Individuals, particularly men, in these areas live by a code of unspoken rules and norms (Anderson 2000), and adherence to these norms is strongly correlated with violent behavior (Stewart and Simons 2010). Street gangs in Chicago with overlapping "turf" frequently engage in conflict (Papachristos, Hureau and Brage 2013), and feel obliged to reciprocate an act of murder with one of their own (Papchristos 2009). Simulation-based studies have supported the idea that honor cultures could be evolved cultural responses to stateless contexts. (Nowak et. al 2016).

Third Party Systems of Control

More sophisticated decentralized systems of social order may involve third parties. Ellickson, in his typology of social control, identifies three potential sources of

third-person social control. Two rely on formal governments or organizations that have a degree of sovereignty over the parties involved, but the third relies on informal social forces and "vicarious self-help" (1991). Experiments have shown that individuals are willing to sanction on the behalf of one another, although at lower rates than they sanction on behalf of themselves. (Fehr & Fischbacher 2004). Direct retaliation is an effective deterrent because a retaliating individual develops a reputation as someone who is ultimately not profitable to victimize. However, if an individual regularly has someone else sanction on their behalf, then deterrence can be achieved without self-help. Through a combination of social exchange and sophisticated legal design, the willingness to buy or sell third-party control can crystalize into more institutionalized systems of decentralized order.

Like cultures of honor, systems of private protection thrive in areas where the state has not seized an effective monopoly of physical force, or in areas such as post-Soviet Russia where the state has been dramatically weakened. (Gambetta 1996; Varese 1994; Frye and Shleifer 1996). These systems also emerge to govern transactions in industries that are outlawed and thereby not-regulated by the state (i.e., narcotics) or in areas where public trust is weak (Gambetta 2000). In the case of protection rackets, where people buy "protection" from private suppliers of force, the line between centralized and decentralized social control becomes blurry, as a private protection service may be effectively acting as a sovereign entity that governs a limited number of people.

More organized systems of third-party social control have also emerged in areas where there are established states, but states deliberately limit their power. A

complex and institutionalized, but still ultimately decentralized, solution to the problem of social control was found in medieval Iceland: judicial bodies determined guilt and had all guilty parties pay a fine directly to their victim, even for instances of killing or murder, but individuals had to privately enforce these laws (which was often done by paying enforcers of the law a share of the fine). This system of restorative justice was so peculiar that it arguably set a market price on murder, yet it still flourished in Iceland for hundreds of years (Friedman 1979).

More recently, The United States has been painted as an example of a "deliberately weak state" that reluctantly developed complex systems of administrative law in order to prevent the aggregation of power in the hands of a few or the creation of a state that has sovereign authority over individuals (Hamilton & Sutton 1989). Perhaps because of its nature as an intentionally weak state, the use of private security in modern times has been most extensive in the United States (Shearing and Stenning 1983). The rise of private security has been linked to "modern development of mass private property controlled by vast corporate conglomerates" (Shearing and Stenning 1981). Private parties have a profitable interest in establishing higher levels of social control and maintaining order, especially in private areas that are open to the public (stores, malls, etc.).

Ultimately, we might expect private security to arise in any situation where the private demand for security exceeds what the public could be expected to supply, or, as in the case of protection rackets, where private supply is strong enough to generate demand from other parties. What is less clear is if second-party systems of private

social control, which are thought to emerge in similar environments, can evolve into more specialized and sophisticated third-party systems.

It is at this point that we turn to the realm of Professional North American Ice Hockey, particularly its highest level, the National Hockey League (NHL). While the NHL to a certain extent governs constituent players and teams directly, it does not adequately police all infractions. The gap in governance is filled by players and teams whose interests are largely at odds with one another due to the competitive context of the league: players must compete with one another for spots on teams with limited numbers of roster spots and salary cap space; teams must compete for a fixed number of wins, playoff appearances, and championships. Fighting is a common ritual within the sport and understood by many as a means of maintaining social control. Puzzlingly, fighting seems to function as an instrument of both second-party self-help and a third-party system of private protection. In some cases, fighting is described as part of a decentralized and unspecialized "culture of honor" that governs the game: victimized players primarily initiate fights with offending players in response to dangerous physical contact initiated by the offending players. However, fighting is also understood as the primary job of "enforcers" or "goons", specialized players who are largely valued for their ability to fight and intimidate on behalf of their teammates.

Fighting and The Problem of Social Order in North American Ice Hockey

Problems of social order in ice hockey, especially early in its history, are well documented. In late 19th and early 20th century Canada, the elite level amateur hockey played between clubs around Montreal and across Canada transitioned from a 'gentleman's game', to a game where the rational pursuit of winning became the norm

and expectation (Barlow 2009). Violent and 'strenuous' play became common. Canadian journalist Lawrence Scanlan writes in his study of hockey violence: "My overwhelming impression from reading the literature, from hearing the testimony of players from the early to mid-1900's and from poring over the news clippings, is that early hockey was very much like war, the blood flowed freely." (2002: 30)

Although there is debate on just how much the media sensationalized and approved of violence in hockey around the turn of the 20th century (McKee, 2015), there is no doubt that violent incidents occurred, even if they were not a fundamental part of the game itself. There are documented incidents of players swinging sticks at their then helmetless opponents in the 1900s, some of which ended in death, while other incidents ended in criminal charges of assault (Lorenz and Osborne 2009). In 1904 alone, four players died playing hockey in the Province of Ontario (Metcalfe 1997).

Fighting is perceived by some as a ritual outlet to curb the more extreme incidents of violence that occurred more frequently during the early days of the sport. In this view, fighting is a relatively safe way of retaliating against play that is dangerous or aggressive and may deter many of these incidents from occurring in the first place. In his examination of fighting in ice hockey, Colburn writes: "Here we come to the problem of why fist-fights occur in ice hockey…it is due partly to the contingent features of the sport such as speed which make detection difficult, and it is due partly to the cultural value placed on honor, the

right of the individual to take matters of violation of the law into his own hands." (1986: 169)

In this view, fighting is one part of a larger unspoken 'code' that all players are supposed to adhere to, which allegedly keeps the game honorable and safe (Roubidox 2001; Bernstein 2006; Atkinson and Young, 2008). Fighting is also largely approved by younger players, their coaches, and their parents as both an appropriate reaction to violence and as a means of improving their teams' success (Smith 1979a; Smith 1979b; Loughead and Leith 2001). Ironically, two of the more dangerous incidents in recent NHL history occurred when players' who *refused* to fight were assaulted.[1] When fighting does occur, it also comes at a cost to players and perhaps society at large. In addition to the obvious immediate and long-term medical risks players put themselves in by fighting, some work has shown that approval of violence on the ice translates into more violent behaviors off the ice (Bloom and Smith 1996; Pappas et. al 2004).

Explanations and Interpretations of Fighting

Most academic research on hockey violence does not focus on fighting as a possible means of social control, but instead as a cultural anachronism that perpetuates outdated norms of masculinity, a marketing ploy, or a strategy employed by teams for winning.

[1] In both incidents, a player attempted to provoke a player into a fight to address a prior infraction, and the targeted player repeatedly refused instigation into a fight. These incidents occurred between players Martin McSorely and Donald Brashear in 2000, and players Todd Bertuzzi and Steve Moore in 2004.

A great deal of literature has focused on how hockey perpetuates a violent and aggressive form of masculinity in a society with shifting gender roles (Gruneau & Whitson 1993; Allain 2008). Violent behavior is accepted and celebrated (Smith 1974) and violent play is judged as competent play even amongst younger players (Weinstein, Smith and Wiesenthal 1995). In particular, much academic attention has been paid to Don Cherry, a former NHL coach and Canadian Broadcasting Corporation television personality, who defends fighting and violence within the game as both a means of deterrence and as a moral virtue in its own right, while simultaneously championing his own vision of Canadian nationalism during nationwide Saturday-night hockey broadcasts (Knowles 1995; Gillet, White, & Young, 1996; Elcombe 2010; Allain 2015).

Fighting is also seen as a means of generating popularity and revenue. It can be as much of a product as the game itself. The notion that violence is explicitly used by teams to fill seats is widely held. In the 1977 hockey film, *Slap Shot*, a fictional minor league team in financial disarray tries to capitalize on the violent antics of their newly hired players, the infamous Hanson Brothers, to reverse their fortunes. While fighting has in-fact been found in some cases to boost ratings and ticket sales (Stewart, Ferguson, and Jones 1992), others have found that it is not a profit-maximizing strategy in the NHL (Rockerbie 2015). There is considerable variation from hockey league to hockey league in terms of rates of fighting, as some leagues choose to curb fighting by excessively penalizing those who participate in it, including those in Europe and collegiate hockey leagues in North America. The NHL, and its feeder leagues, however, have rules that not only establish a standardized penalty for fighting

(both players are excluded for five minutes, therefore, unless one player is labeled an 'instigator' and given an additional penalty, neither team is put at a disadvantage), and also forbidding fights from having a 'third-man in': this keeps the fight fair, and thus may encourage more fights to proceed (Collins 2008).

Considering the strategic importance of fighting requires separate consideration of short-term (winning the game at hand) and long-term interests (winning games in the future). While it is plausible that an individual fight can change the outcome of a game as a means of generating momentum or restoring "emotional energy" (Collins 2008), research on whether the result of a fight leads to winning the game at hand is mixed (Widmeyer and Birch, 1979; 1984; Englhardt 1995). Furthermore, it is mathematically impossible for both teams to simultaneously improve their odds of winning a game. (If all players acted purely in a way that maximized their team's probability of winning the game at hand, and all players had a shared estimate of how any given fight would influence the game, then no consensual fights would ever start.) However, there may be a long-term deterrence value for one or both teams if they signal their willingness to retaliate to other teams in the league. Fighting may also be a successful strategy if it is incorporated into a larger strategy of physical intimidation. Paradoxically, while the problem of social control within the game is allegedly amplified by the difficulty of monitoring by on-ice officials, the games and the fights that do and do not occur within games are televised and highly visible to all other teams and players, enhancing the forward-looking value and strategic importance of retaliatory violence. A team that does not or cannot retaliate against predatory and dangerous play by other teams will be quickly found out. The

fact that fighting rates currently drop in the post-season, when teams focus on one opponent at a time, but are highest in the pre-season, when the results of the games do not matter at all, underscores this point. Fighting cannot help both participating players' teams win the battle (game), but it may improve their collective odds of winning "the war" (finishing with a better record at the end of the year, advancing to the post-season, winning the Stanley Cup).

While fighting may in fact be a vessel of masculinity, a form of entertainment, or a means of rallying the troops and intimidating opponents, this does not change the fact that fighting is largely experienced by players and coaches as an element of a larger system of social control. There is little question that the NHL and other leagues with high rates of fighting could drastically reduce fighting by punishing it more severely, as is the case in American collegiate hockey and prominent European leagues. It is unclear that they could prevent the type of violent incidents that fights allegedly deter. Furthermore, even if the league could adequately identify and punish all dangerous hits without diminishing the quality of the game, the fact is that they do not, and accordingly players and teams perceive the need to police the game themselves. Fights occur, ultimately, because players find fights appropriate in certain situations, the culture of hockey permits and encourages fighting, and it is tacitly permitted by the bodies governing the game (Colburn 1985).

The Enforcer:

"But our game is improved tremendously by players' ability to police the game. It makes it more exciting and honorable. It allows skill players to focus

on the skilled aspects of the game because someone else can watch their back. And it fundamentally makes our game safer." (Burke 2013)

The "someone else" of this quote refers to an informal group of players known as "enforcers". These players participate in a disproportionate amount of fighting and are typically not as skilled at the sport of hockey as their teammates are in terms of directly scoring goals or preventing other teams from doing so. The plight of the enforcer has been highlighted in light-hearted comedic films (such as the 2011 feature, *Goon*, named for a common moniker for enforcers), and heartbreaking journalism. One such work tracks the rise and fall of former professional enforcer Derek Boogaard, an otherwise unskilled hockey player who rose from the junior leagues of Canada to the NHL solely by fighting, and ultimately died of an overdose of alcohol and painkillers that was likely mediated by brain damage from repeated head-trauma (Branch 2011a; 2011b; 2014).

Within ice hockey, the system of employing designated fighters acts as a third layer of social control: one is formal, specialized, and centralized (penalties imposed by the referees/league officials), one is informal, unspecialized, and decentralized (self-help via fighting), and one semi-formal, semi-specialized, and semi-centralized (hiring enforcers to fight for other players and act as broader deterrents). While the dangers of repeated head-trauma pose serious issues with the practice of hiring people to fight repeatedly, employing a small number of players to act as retaliators and deterrents may provide competitive advantages.

Records of the performance of players within the National Hockey League are very well documented and available, and extensive archives of fighting incidents

between players have been assembled and archived by dedicated communities of hockey enthusiasts. An examination of which players fight (and how much), who fights whom, and how these patterns have changed illuminates how the multi-tiered system of social control within the NHL has evolved over time. More generally, this data can inform our understanding of how specialized systems of social order can emerge in the absence of a strong and centralized state.

Data and Analytical Approach

The data used is drawn from two online sources.[2] The first source is a website where fans of hockey, particularly fans of fighting within hockey, have compiled extensive records of fights that have occurred between players: *DropYourGloves.com*. On this website, individuals post details about who participated in fights with whom, post videos when available, and share opinions about the quality of fighting that occurred. Contributors to the website have also painstakingly archived vast amounts of fighting data by reviewing newspaper articles and television broadcasts from before the internet era, although there is no guarantee that this record is completely comprehensive. Fighting dyads from 51 seasons of a 52-year period (the 2004-2005 season was called off due to a labor dispute) of National Hockey League play from 1960-2012, as well as traditional performance statistics (goals, assists, points, and games played) for all players from each of these 51 seasons are used. This time

[2] The final list of fighting dyads from the 1960-2012 NHL seasons was obtained from the website *DropYourGloves.com* from February 12th-February 19th, 2017. The final list of scoring and fighting statistics for individual players was obtained from *DropYourGloves.com* on February 21st, 2017. Play-by-play data for games from the 2007-2012 seasons was obtained from *NHL.com* on September 11th, 2014.

period is used largely due to data availability: 1960 is the earliest season available where fighting data is marked as "complete", and the 2011-12 season was the last complete season that occurred before the NHL's last major labor dispute in 2012 (which resulted in a shortened 2012-2013 season with no regular season games occurring between teams in the Eastern and Western conferences, thus preventing the existence of a connected network of fights emerging for analysis).

The second source is a 5-season record (2007-2012) of play-by-play data from *NHL.com*, the official website of the National Hockey League. While the NHL does not include detailed information about fighting in its play-by-play data, it does provide very extensive and well-documented information about every other event that occurs during each game. These two online data sources can be used in tandem: time-stamped data allows for the determination of what events co-occurred with or immediately preceded each fighting incident during that period. Earlier research has tried to determine whether fighting in hockey generally is 'calculated' or 'impulsive' (Goldschmeid and Espindola 2013); in this analysis it is assumed that the motives of individual fights vary. Fights that co-occur with another on ice incident (the time of the fight on droopyourgloves.com corresponds to a non-fighting penalty on NHL.com) are more likely to be retaliatory incidents, where players immediate fight on their own behalf or on behalf of another. Fights that occur immediately after a stoppage in play (the fight timestamp on droyourgloves.com occurs within five-seconds of a "face-off" timestamp on NHL.com; face-offs occur whenever play is being initiated or resumed after a stoppage) are more likely to reflect a mutual consensual decision of two players to fight with one another and are more likely to reflect a third-party system of social

control where specialized enforcers know when and with whom a fight must occur. These fight types are respectively referred to as “impulsive” and “calculated”. (Any remaining fights are categorized as “other.”)

In both datasets, information is available about each player’s number of games played, fights, goals, assists, penalty minutes, and position for each season. In the second dataset from 2007-12, the total number of fights are decomposed into the three aforementioned categories and tallied for each player, and information is also included on the “plus/minus” rating of each player, a metric that is commonly used to measure the defensive value of a player. (These statistics are summarized in Table 1).

The first portion of the analysis examines the distribution and rates of fighting across individual players. Correlation and GINI coefficients are used to illustrate changing rates of fighting concentration and specialization, and a series of negative binomial regression models estimate player fighting rates based on normalized player statistics per game and position (while using games played as an exposure variable). One negative binomial model is estimated for each season in the 1960-2012 data set, and three additional models are estimated for each fight type in the five seasons of the 2007-2012 dataset.

Dataset	1960-2012	2007-2012
Observations		
Seasons	51	5
Distinct Players	5011	1438
Player-Seasons	29713	4401
Fights (Per Player-Season)		
Total Fights	2.00 (3.94)	1.64 (3.51)
-Impulsive	---	0.53 (1.13)
-Other	---	0.62 (1.59)
-Calculated	---	0.49 (1.40)
Performance Metrics		
Games Played/Season	48.99 (28.29)	50.29 (28.82)
Goals/Game	0.14 (0.15)	0.12 (0.12)
Assists/Game	0.25 (0.20)	0.21 (0.18)
Plus/Minus/Game	---	-0.04 (0.26)
Adjusted Penalty Minutes /Game	0.69 (0.68)	0.51 (0.48)
Position Distributions		
Pos. = Defense	0.34	0.34
Pos. = Center	0.22	0.28
Pos. = Right Wing	0.17	0.18
Pos. = Left Wing	0.18	0.19
Pos. = Forward	0.09	0.01

Table 1 – Summary of statistics for both the 1960-2012 dataset, and the 2007-2012 dataset.

The second portion of analysis examines the social geometry of fighting, or the question of who is fighting whom. Fighting interactions for each season from 1960-2012 are constructed into a social network, along with three additional networks for each fight type and season from 2007-2012. Using a simulation-based analysis that adjusts for degree distribution, the extent to which each fighting network has a core-periphery structure is evaluated. Core-periphery networks are characterized by a small number of nodes that share a large portion of edges with one another (Borgatti and Everett 2000). The presence of this network structure in different seasons and for

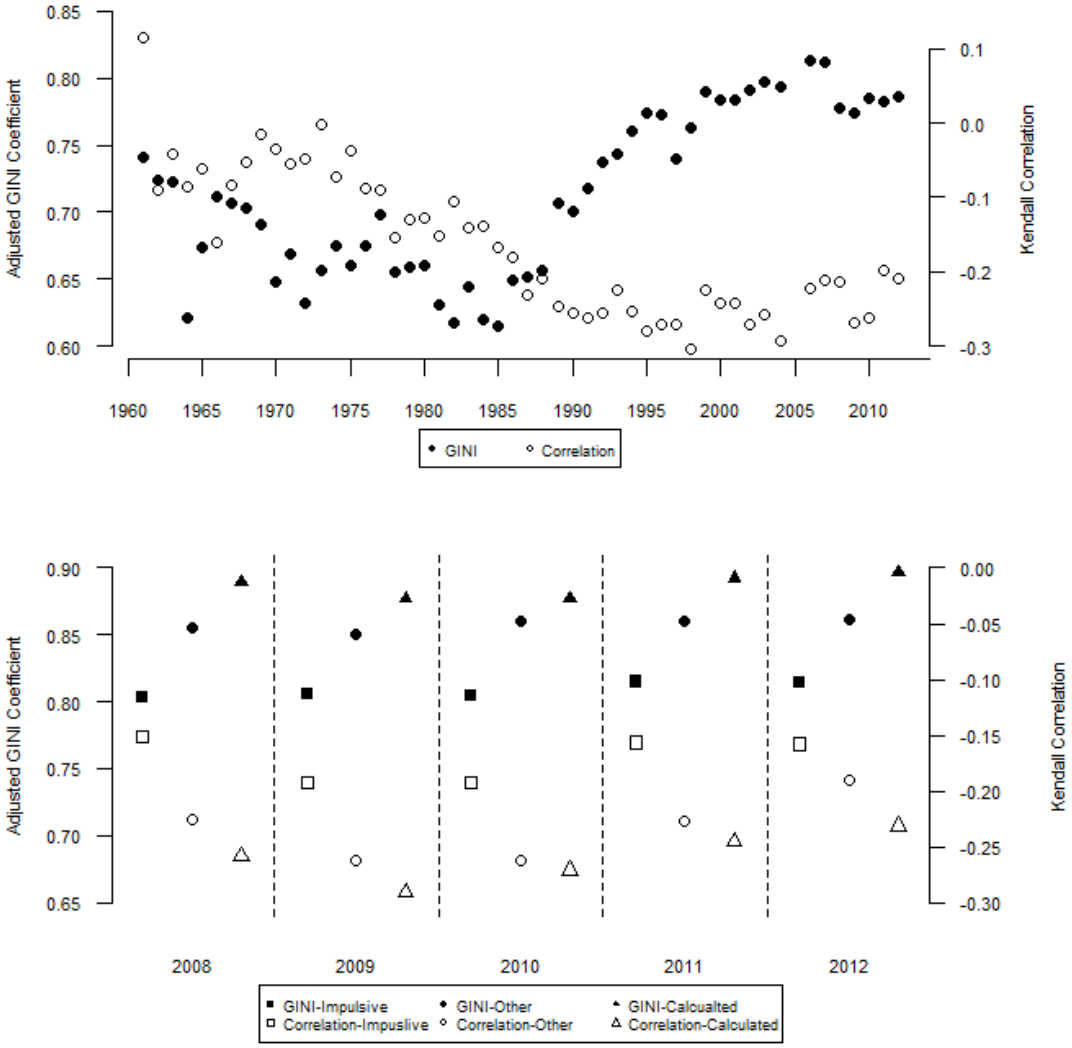
certain fight types suggests that the emergent third-person system of social order has a level of complexity that goes beyond simply "sticking up" for teammates.

Distributions, Correlates, and Predictors of Fighting Incidents

The stereotype of the enforcer who fights but does not directly contribute to his team's success through scoring points is well-known among fans of the game. However, evidence indicates that specialized enforcement has been far from a stable feature of the game. Figure 1a highlights two main changes that have occurred with regards to how fighting has been distributed across players over time. First, the correlation of fighting rates and the rate of scoring points (goals and assists) has reversed over time, shifting from positive to negative. (Kendall correlations, which only reflect the ordering of individual data points along each dimension, are used to control for changes in the overall distribution of fighting.) Second, the concentration of fighting within a relatively small number of players has increased, which is reflected in the increasing GINI coefficient for the distribution of fights across players. (This coefficient is weighted and adjusted to account for the fact that the distribution of games played (and thus opportunities to fight) across players may have also shifted from 1960-2012.)

The overall temporal shift to higher levels of concentration and specialization in fighting is mirrored in differences between the distributions of "impulsive" and "calculated" fights across players. Figure 1b shows these differences. For each season in the 2007-2012 dataset, fights that occur immediately after a stoppage in play are more highly concentrated within a small number of players, and the rate of fighting has a more pronounced negative correlation with the number of points a player scores

per game. While fighting is still concentrated and negatively correlated with point scoring in the impulsive case, the effects are not as pronounced.



Figures 1a & 1b - Overall concentration of fighting activity and the (Kendall) correlation of fighting rates with point-scoring rates per player in each season from 1960-2012 (1a - top), and by each fight type for the 5 seasons in the 2007-12 dataset (1b - bottom). Figure 1a shows an increasing concentration of fighting activity along with an increasing negative correlation between fighting rates and scoring rates. Figure 1b shows that this temporal trend is mirrored as fights go from impulsive to calculated. Taken together, this suggests that overall trends in the NHL mirror a larger shift from impulsive to calculated fighting.

A series of negative binomial regression models are estimated for the total number of fights participated in by each player for each season of play from 1960 through 2012. A second series of negative binomial regression models are fit separately for each fight type ("calculated", "impulsive", and "other") in the 2007-12 dataset. Players who have not played in at least 20 games per year (out of 70-82 total games depending on the season, except for 1994-95 where an abbreviated season was played) and recorded at least one goal or assist are omitted from the analysis. Players with a very small number of games naturally have higher variance in their rates of scoring and fighting, and the heteroskedasticity introduced by this could allow the metrics of players who are less embedded in the system to have high levels of influence on the relationships between point scoring and violence. Goaltenders, a small and highly specialized group of players that are almost never involved in fighting and have a separate battery of metrics measuring their in-game performance, are also omitted from the analysis.

In both sets of analyses, point scoring rates are split into rates of goals per game and assists per game and are log-transformed to induce normality. A metric calculating the number of penalty minutes per game, less the 5 penalty minutes expected from each fight, is also included as a predictor variable to measure any changes in how the level of formal sanctioning a player receives relates to their participation in informal sanctioning. The total number of games played is included as an exposure variable to eliminate any spurious correlation between fighting and scoring that would occur from some players participating in more games than others. Minutes player per season would be a more precise exposure variable but is largely

unavailable.[3] Each player position is included as a factor variable to account for any differences in fighting rates that may be due to player position, with the position of defender being used as a reference group. Most offensive players have been labeled as either Left Wings, Right Wings, or Centers in the data used, with some players who vary in their role being labeled simply as 'Forward' (this is more common earlier in the dataset). Finally, in the 2007-12 dataset "plus-minus" (the number of goals scored by one's team while on the ice minus the number of goals scored against one's team while on the ice) per game is also included, as it is a frequently used measure of a player's defensive abilities. Not all models are included in the paper in their entirety, but a selection of three years (1964,1984, and 2004) from the first data set, and each of the three models from 2012 in the second dataset, are included in Tables 2a and 2b.

Figures 2 and 3 show how each coefficient varies by year and fight type for each set of models, and figure 4 translates coefficients from these models into predicted rates of fighting per game. The patterns found are largely consistent with the analysis of specialization and fighting-concentration highlighted in Figure 1. Over time, fighting in the NHL has become negatively associated with offensive performance metrics (goals and assists per game), and increasingly concentrated in a small number of players. Parallel differences are found as fighting varies from impulsive to concentrated within each of the past five-years: low-scoring players are

[3]In recent years (after the onset of the specialization) the number of fights a player is in per game has been inversely correlated with their average playing time per game. Players who fight frequently, but score infrequently, tend to spend less time on the ice. Therefore, it is fair to suspect that the availability of minutes played per season would exaggerate the findings that are shown.

predicted to have higher rates of fighting across the board, but especially for fights that are labeled as calculated. Furthermore, calculated fights demonstrate overdispersion (the variance exceeds what would be predicted by a Poisson distribution) whereas impulsive fights demonstrate underdispersion (the variance is less than what would be predicted by a Poisson distribution).

	Total Fights		
	1964	1984	2004
Constant	-5.415***	-4.861***	-7.538***
	(0.49)	(0.20)	(0.27)
Player Metrics			
Log(Goals/GP)	-0.097	-0.004	-0.189*
	(0.20)	(0.10)	(0.11)
Log(Asst/GP)	-0.1	-0.413***	-1.079***
	(0.21)	(0.10)	(0.11)
Adj. PIM/GP	1.461***	1.299***	2.157***
	(0.20)	(0.07)	(0.16)
Plus-Minus/GP			
Player Position			
Position: "C"	0.56	0.173	-0.194
	(0.34)	(0.18)	(0.19)
Position: "LW"	0.436	0.324	0.189
	(0.33)	(0.20)	(0.19)
Position: "RW"	0.036	0.522***	0.788***
	(0.35)	(0.17)	(0.18)
Position: "F"	0.225	0.272*	-0.646
	(0.45)	(0.14)	(0.83)
Overdispersion			
Theta	4.724	2.305***	0.830*
	(2.59)	(0.30)	(0.09)
N	*106*	*459*	*665*

Table 2a – Coefficients for selected Negative Binomial Regression models for all fights from the years 1964, 1984, and 2004.

Taken together, the increasing specialization and concentration of fighting over time from 1960-2012, and the more pronounced association between these

characteristics and calculated fighting activity from 2007-2012, suggest a shift in the organization of informal social control in the NHL from a decentralized system based on norms of immediate vengeance, to a more centralized system that involves a small number of violent specialists sanctioning and deterring on behalf of their team when an opportunity becomes available.

	2012 Fights		
	Impulsive	Other	Calculated
Constant	-7.313***	-8.383***	-10.561***
	(0.31)	(0.38)	(0.50)
Player Metrics			
Log(Goals/GP)	-0.118	-0.505***	-0.769***
	(0.12)	(0.15)	(0.18)
Log(Asst/GP)	-0.672***	-0.701***	-1.053***
	(0.13)	(0.15)	(0.19)
Adj. PIM/GP	1.859***	1.325***	2.052***
	(0.16)	(0.22)	(0.26)
Plus-Minus/GP	0.563	0.026	1.243*
	(0.44)	(0.53)	(0.67)
Player Position			
Position: "C"	0.048	0.473*	0.787**
	(0.21)	(0.25)	(0.32)
Position: "LW"	0.297	0.937***	1.375***
	(0.21)	(0.26)	(0.32)
Position: "RW"	0.461**	1.001***	1.465***
	(0.21)	(0.25)	(0.31)
Position: "F"	0.963	-26.501	-33.764
	(1.18)	(592468.60)	(32081581.00)
Overdispersion			
Theta	1.891*	0.783*	0.510***
	(0.49)	(0.15)	(0.10)
N	*674*	*674*	*674*

Table 3b – Coefficients for Negative Binomial Regression models for total number of fights per type from the year 2012.

Network Analysis of Fighting Interactions

The shifting trends in fighting rates are echoed by a shift in the patterns of who fights whom. High levels of overdispersion may reflect not only a small group of players awareness of their position as “enforcers”, but also their awareness of one another as fellow enforcers and appropriate sparring partners.

To assess differences in patterns of fighting interactions by year and type, a separate network of fighting for each year in the 1960-2012 data set, and for each year and fight type in the 2007-2012 set is constructed. A core-periphery network, where a small number of nodes (players) share a high number of edges (fights) with one another, should be more pronounced in more recent or more calculated fighting networks. This can be operationalized by measuring the level of centralization in each graph, which is conceptualized as the variance of the eigenvector centrality across all nodes. Eigenvector centrality for any given node is a function of not only the degree count of each node, but also the degree count of each neighboring node, and to a lesser extent, the degree count of each neighbors’ neighboring nodes, and so on in an infinite regress.

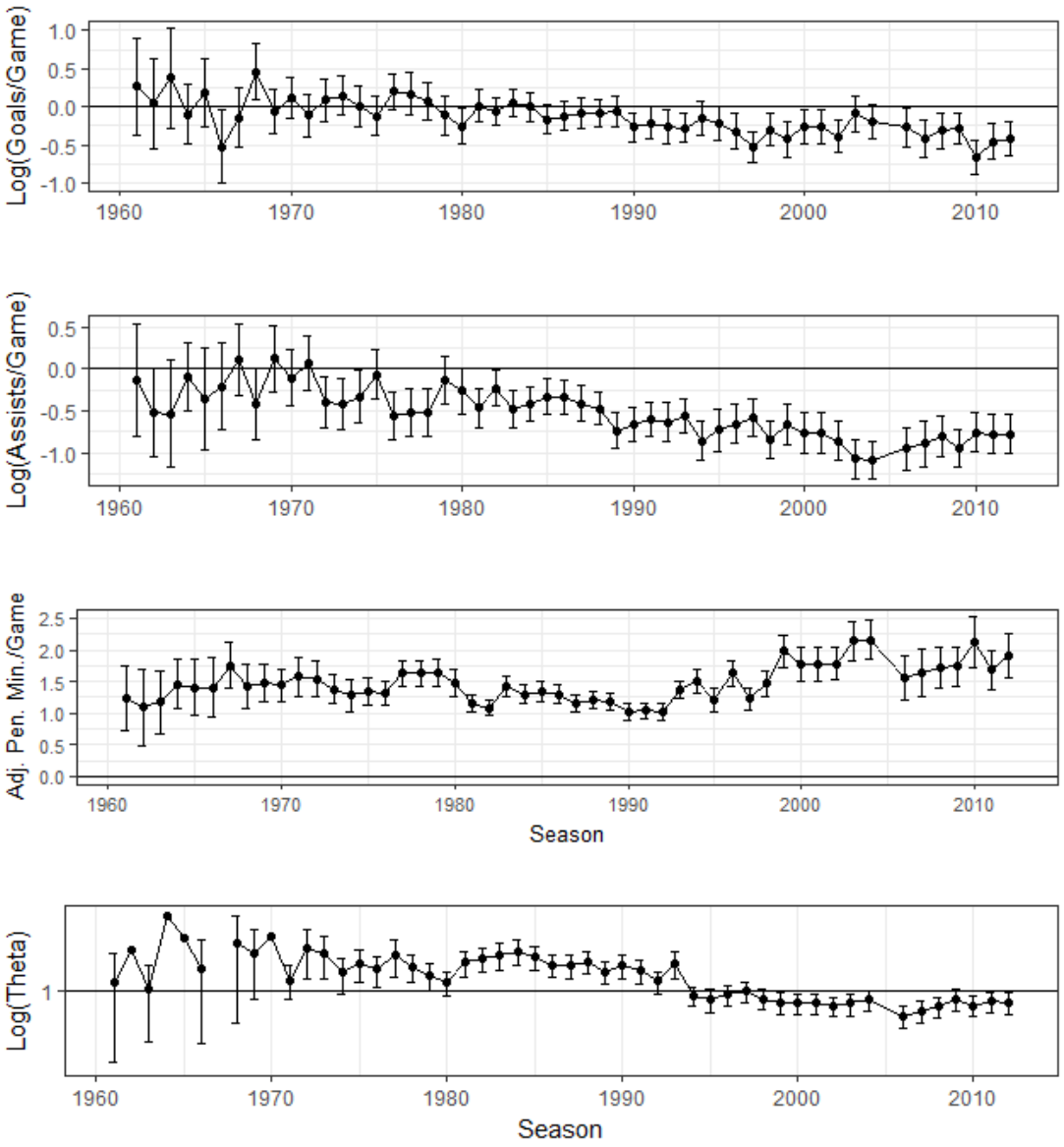


Figure 2 – Coefficients of interest are plotted for each negative binomial model of regular season fight totals from 1960-2012. From top to bottom, this shows values for fights per game, assists per game, penalty minutes per game, and the over dispersion coefficient, theta. Fights become significantly negatively associated with rates of scoring assists and goals over time. There is a consistent positive association with fighting and penalty minutes (adjusted for fighting) per game over time. The overdispersion coefficient shifts from above 1 (corresponding to less overdispersion), to below 1 (corresponding to over dispersion) in the mid-1990s.

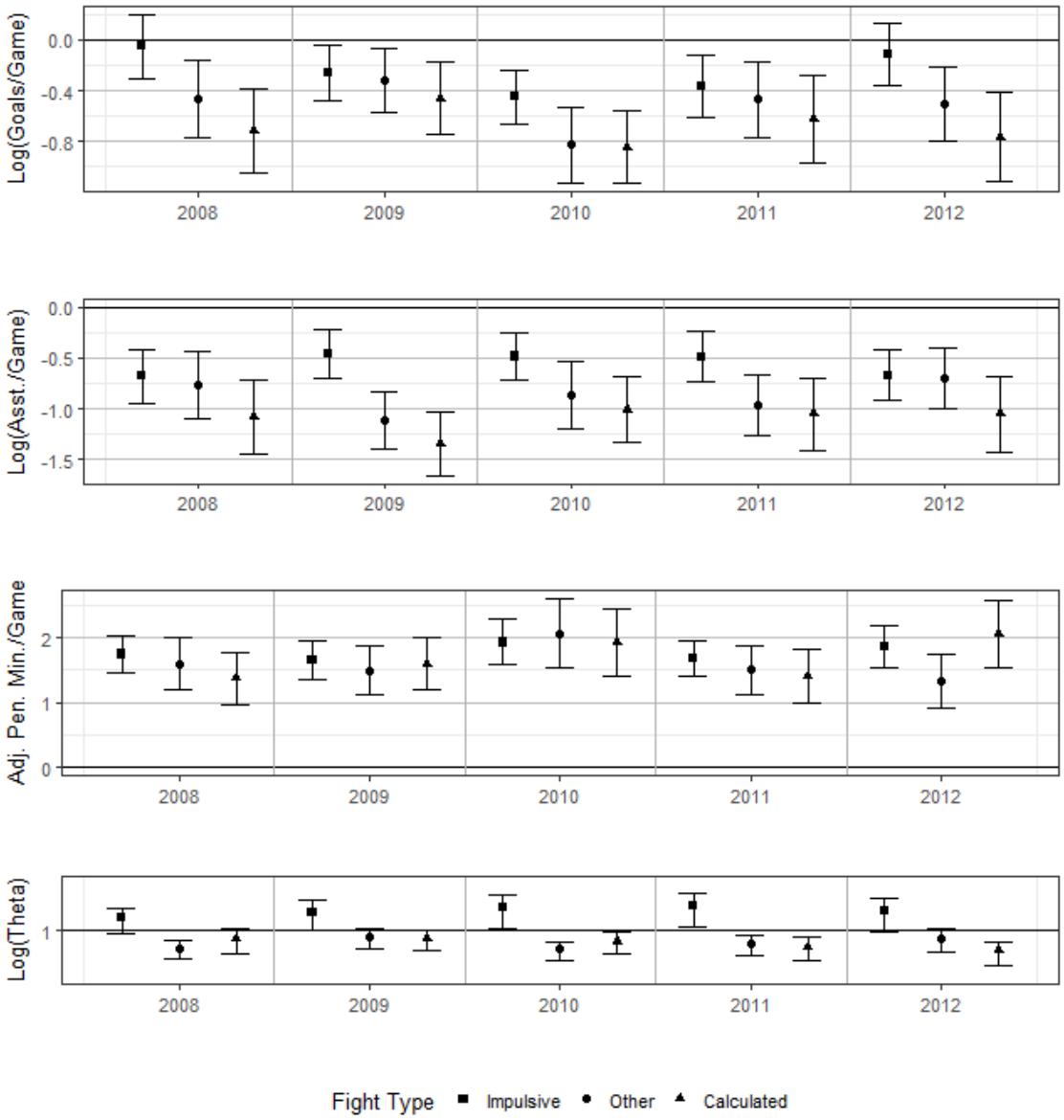


Figure 3 – Coefficients of interest for separate negative binomial models for each of the three separate fight types for seasons ending in 2008-2012. The coefficients for goals per game and assists per game decreases as fights shift from impulsive to calculated. More strikingly, the overdispersion coefficients are much higher for impulsive fights, implying that these fights are more evenly distributed even after accounting for player metrics and covariates.

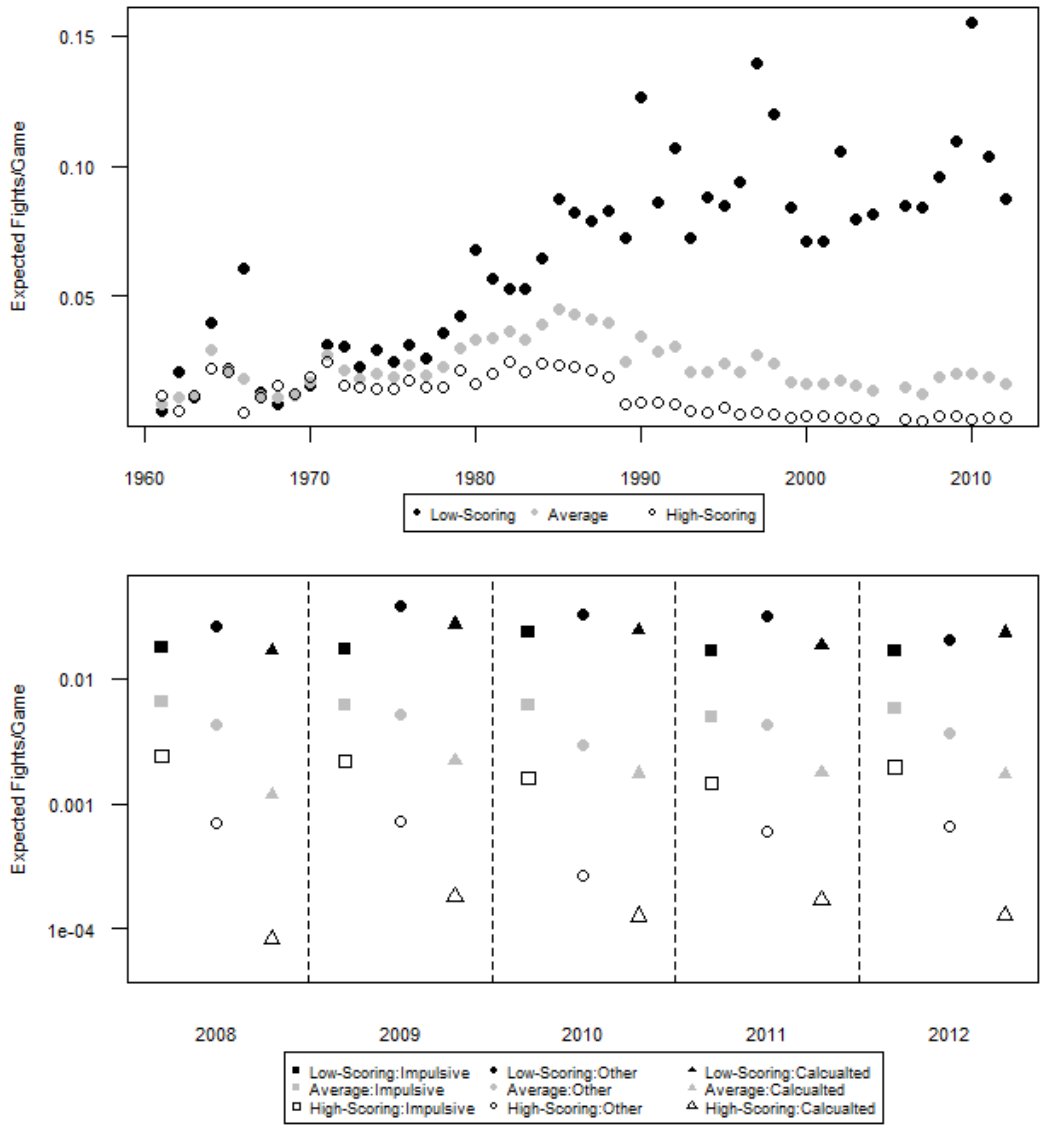


Figure 4 - Predicted rates fighting per game from the 1960-2012 dataset (top) and the 2007-2012 dataset (bottom), for a hypothetical player at the 'center' position who is either low-scoring (two-standard deviations below the mean for goals per game and assists per game, average on other stats), average (mean levels of each player metric, or high-scoring (two-SDs above average for fighting and scoring rates, mean levels of other player metrics). The top figure indicates that fighting has shifted largely towards lower performing players. The bottom figure demonstrates how difference between low-skill and high-skill players vary by type of fight. Low-scoring players are about 10-times as likely as high-scoring players to participate in an impulsive fight, but nearly 1000-times as likely to participate in a calculated fight.

Network centralization values will be higher when more central players in the fighting graph disproportionately target one another. Measures of centralization covary intensely with degree distribution and network density, and these change over time in the dataset. Accordingly, measurements of centralization are adjusted to account for differences in degree distribution. This is accomplished by comparing the centralization level of observed networks to the centralization of simulated networks with an identical degree distribution, but entirely random patterns of connection. Graphs that feature more connections between high-degree nodes than would be expected from chance alone will also have a higher overall level of centralization than expected by chance alone, given a certain degree distribution. In the observed graphs, multiple ties between players are counted only once. This omits roughly 5-10% of fights in any given year, prevents any one dyad for having a disproportionate influence on the overall level of centralization of the graph, and thus controls for the effect of rivalries that may exist between established enforcers.[4] In the simulated graphs, only one tie is permitted for any pair of individuals as well. For each observed graph, 1000 simulated graphs of identical degree distribution are constructed. Simulated and observed centralization measures for each network are normalized using the mean and standard deviation of the centralization scores from the simulated networks.

Figure 5 shows the observed levels of (normalized) centralization in each fighting network, compared to the distribution of centralization levels in each of the

[4] Of the 29,937 analyzed regular season fights, 27,743 (93.0%) are the first between two players in a given season, and 24,029 (80.5%) are the first between two players in the entire dataset.

1000 simulated networks. As expected, there is a large increase in the level of centralization that occurs over time from 1960-2012. From 1985-2012, only one season occurred where the observed normalized centralization measure failed to exceed 2.5. In the vast majority of these seasons, the observed level of centralization exceeded the simulated centralization observed in all 1000 simulations, effectively rejecting the null hypothesis of random association with a p-value of less than 0.001. Echoing this shift, the observed levels of centralization in graphs of "calculated" fights systematically exceeds the levels of centralization in graphs of "impulsive" fights.

A visual inspection of fighting networks also highlights this change. Figures 6a and 6b compare the largest connected components of the last season with an average level of centralization, 1984, with the season that exhibits the highest level of normalized centralization, 2004. Nodes are sized proportional to the number of games the player participated in during the season and are colored proportional to the number of points they scored per game (darker nodes scored fewer points per game). The 2004 graph clearly shows a more defined core with much darker colored nodes, as the centralization analysis suggests.

For more recent fighting activity, "calculated" fights and low-scoring players are both more likely to be found towards the center of the overall fighting structure. This is demonstrated visually in Figures 7a-7c, which highlight 3 different aspects of the largest connected component of the fighting network constructed from the entire 2007-2012 dataset. This finding visually supports the notion that the emergence of centralization in the fighting networks from 1960-2012 reflects an overall shift of the nature of informal social control within the NHL.

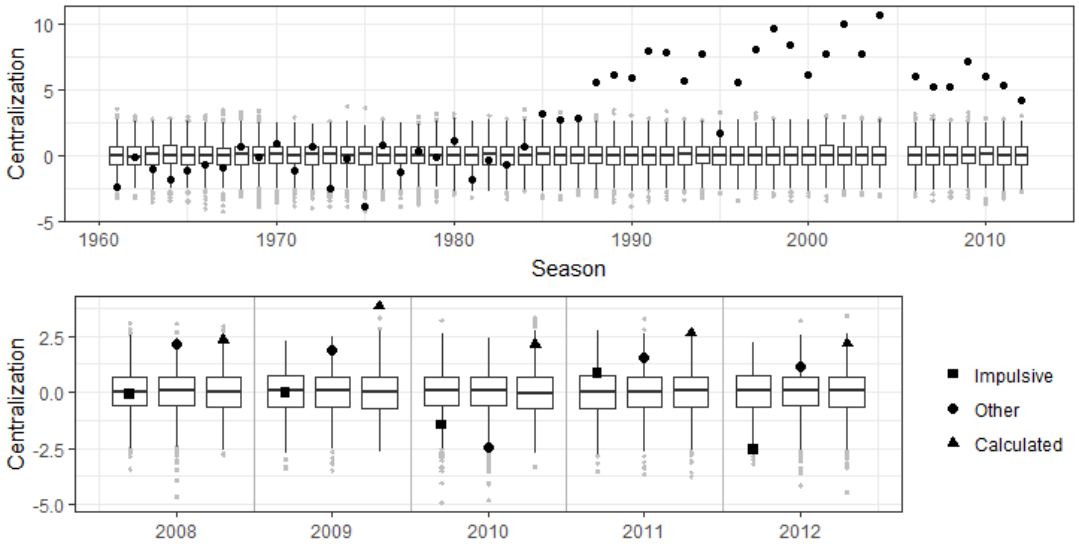
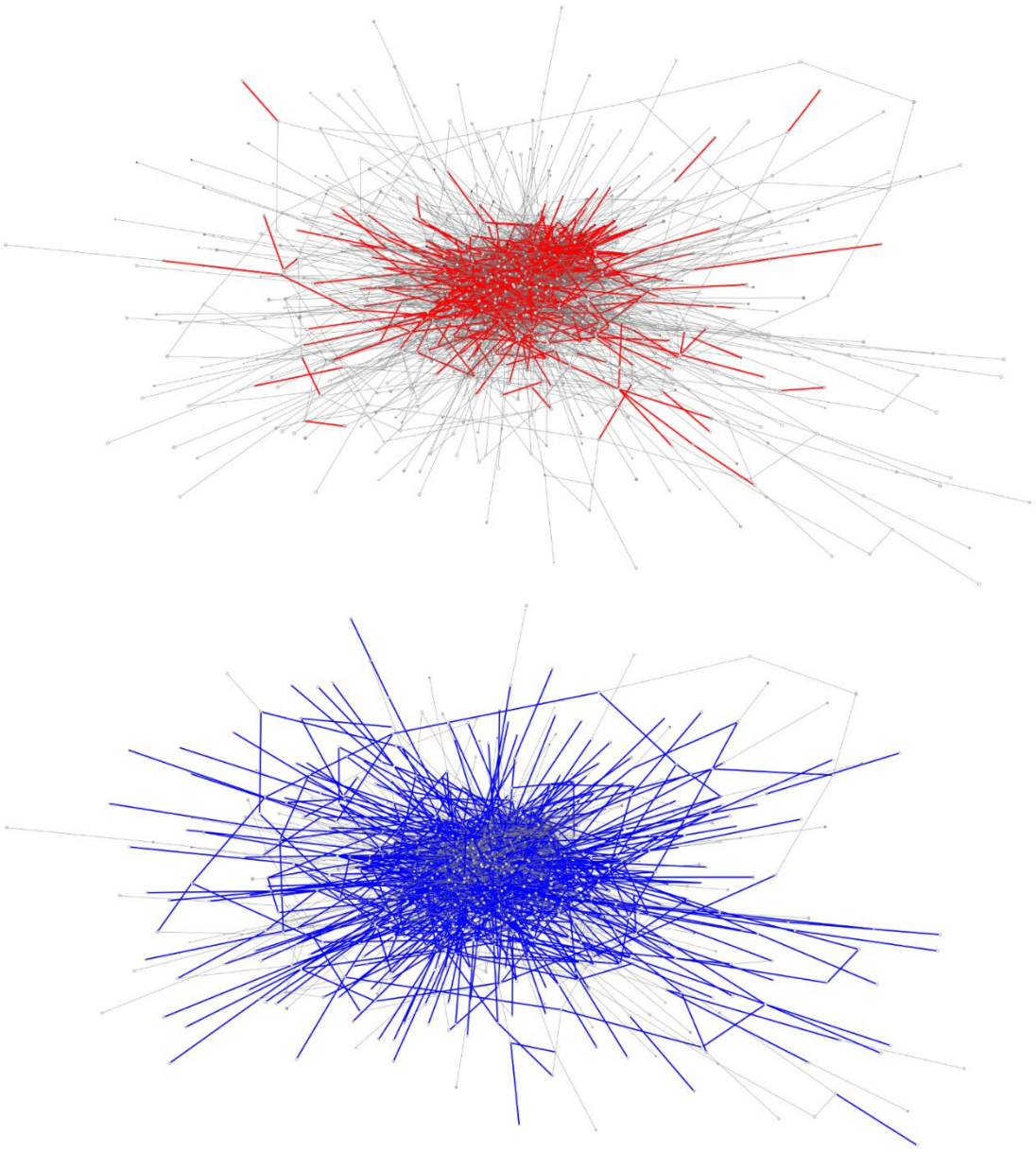
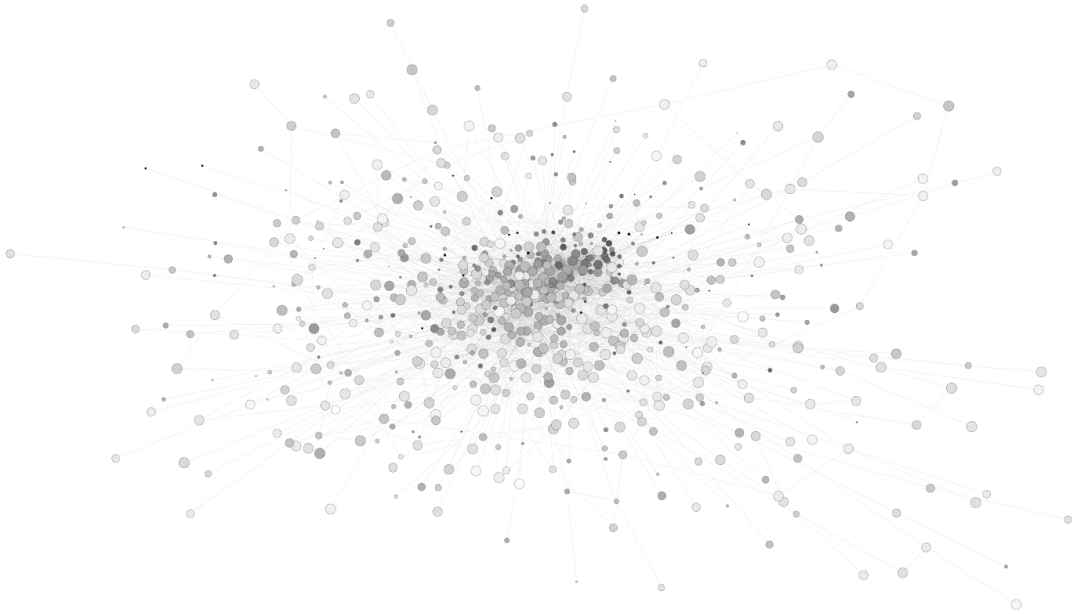


Figure 5 – The standardized centralization of each observed network, as compared to simulated networks with the same degree distribution, for each year (top) for the 1960-2012 dataset, and each year and fight type in the 2007-12 dataset. Once again, there are parallels between the progression over time in network structure, and the impulsive to calculated network structures within each year of the 2007-dataset. Networks from recent years and networks of "calculated" fights consistently show higher levels of centralization compared to what would be expected by chance from these networks.

Figures 6a and 6b – Graphs showing the largest components of the fighting networks for the 1984 (top) and 2004 (bottom) regular seasons. Darker nodes indicate players with fewer points per game, and larger nodes indicate players who participated in more games. The graph from the 2004 season features a more concentrated core of darker colored nodes towards the top right corner of the graph, reflecting a more concentrated group of specialized fighters who target one another.





Figures 7a, 7b, and 7c – These three images show the largest component of the entire fighting network observed between players in the NHL from 2007-2012. Each player in this network appears in the same coordinate across all three figures. Figure 7a (previous page, top) highlights fights that have been coded as "calculated" in red. Figure 7b (previous page, bottom) highlights fights that have been coded as "impulsive" in blue. Figure 7c (this page, top), makes the nodes more visible. Calculated fights are more concentrated in the center of the graph, and impulsive fights are more frequent on the periphery in the network. Furthermore, darker nodes (which indicate lower rates of point scoring/game) are more common towards the center of the graph.

Discussion

On January 9th, 2007, Eric Godard of the Calgary Flames and Derek Boogaard of the Minnesota Wild lined up across from one another during a face-off at the Calgary Saddledome, one minute and twenty-six seconds into the second period. Immediately after the puck is dropped by the referee and play resumes, both players drop their sticks, fling off their gloves, and begin to exchange punches. On the television broadcast, one announcer declares:

> "And now we got a fight at center ice, the guys we've waited all night for, Boogaard and Godard, two former Western Hockey Leaguers that can be tough …. Eric Godard coming up from Omaha, there's not a lot of reasons he's here but to kinda watch over what the big guy from Minnesota is (doing) is one of them."

The other announcer notes that the two players spoke during the pre-game warm-up, and a slow-motion replay of the face-off then shows the two players discussing something, presumably the upcoming fight, right before the puck was dropped. After the fight concludes, a visibly dazed Boogaard skates to the wrong penalty box at first, and then eventually skates off to the locker room. Eric Godard played 17 games for the Calgary Flames and 29 games for their AHL affiliate, the Omaha Knights that year. He participated in 8 fights for each team, scored only 2 points for Calgary, and 9 for Omaha. Boogaard played 48 of 82 possible regular season games for Minnesota, in which he earned 1 assist, no goals, and participated in 13 fights.

This is an archetype of the "calculated" fights that become more prevalent across the time period considered and are characteristic of a more complex and formalized system of informal social control that has emerged in the National Hockey League. A puzzle unresolved by this paper is the exact proximal cause for fights like this. It may be the "job" of these players to fight in this specific circumstance, but why is a fight that appears totally unnecessary occurring? It is sometimes the case that an "enforcer" is picking a fight with a player to address an inadequately punished

infraction that occurred previously that game, or even in an earlier game that season. But the data suggests that enforcers are fighting each other, implying that either enforcers themselves are more likely to be deviant, as predicted by the emergence of "hypocritical enforcers" in other work on governance (Heckathorn 1989), or enforcers are additionally tasked with answering for the infractions of their own deviant teammates (or both).

Alternatively, enforcers may be performing an act of deterrence on behalf of their team, perhaps after being instructed by a coach to do so. By fighting, the enforcers on each team indicate to other players that on-ice infractions will have consequences. Furthermore, in demonstrating the strength of their enforcers against one another, both teams also demonstrate their ability to sanction to other teams they may play in the future. Intermittent fights by such players across the league might also help sustain a generalized league-wide deterrence that reduces deviance by highlighting punishment.

While the benefits of forward-looking deterrence and backwards-looking retaliation may be enjoyed by the teams that employ enforcers, the enforcers themselves also stand to benefit from participating in these fights, especially if these fights occur with one another. In the modern NHL, enforcers are hired almost explicitly to fight and intimidate, and have a violent reputation from the minor or junior leagues that follows them into the NHL. Like *mafiosi* who must continuously perform violent actions in order to maintain their reputation (Alastair and Varese 2001), enforcers may be concerned with their continued status as producers of violence. Status is especially important when the underlying quality is difficult to

ascertain (Podolny 2001), and it is difficult to measure the exact influence an enforcer or a fight has on the outcome of a game or season. Furthermore, status is thought to "leak" across relationships (Benjamin and Podolny 1999; Podolny 2005). To the extent that fighting is a relationship, two players with strong reputations as fighters may have an incentive to fight one another. For similar reasons, players with reputations as enforcers may wish to avoid fighting with players who do not share their fighting abilities, as this may harm their reputation. It has also been found generally that violence is often more likely to occur between individuals of similar status (Gould 2003) and that conflict exists to resolve status ambiguities between individuals. Those who seek to be employed as enforcers may have an added incentive to target other enforcers. On the occasions where typically non-violent high-skilled players find themselves in a situation where fighting is appropriate, they may still avoid them if their potential sparring partner is an experienced enforcer, knowing they are outmatched.

The disproportionate prevalence of "calculated" fighting among specialized enforcers has broader implications for policing and security work more generally. Those who are employed as agents of social control may have an added incentive to sanction explicitly, even in systems that are less decentralized in origin. While in the case of ice hockey agents of control advertise this ability by sanctioning one another, other professional agents of social control will likely not pick one another as targets. Scholars of policing may be wise to build upon prior studies of how organization structure effects officer discretion (Chappel, MacDonald, and Manz 2006) and examine how rates of employee turnover and promotion criteria influence rates of

officer activity enforcement. Just as rates of primary behavior (deviance or compliance) are influenced by secondary behavior (sanctions and rewards), rates of secondary behavior are influenced by tertiary behavior, which in this case is the rewarding of those who sanction. Erikson's study of deviance in Puritan society noted the close relationship between the criminal population and the availability of jail beds (1966); pre-determined rewards for sanctioners may be another mechanism that ties rates of enforcement to the size of the social control apparatus in place.

A question that remains is why this shift from unspecialized to specialized informal control happened when it did. The increase in the size of the NHL from the late 1960s to the early 1990s may have temporarily introduced opportunities for players with less conventional skillsets to establish themselves in the league, and also inherently increased the number of different strategies that could have been experimented with by teams in any given year. The diffusion of enforcer norms may have occurred via the repeated interaction of exchange of coaches, managers, and players between teams, or via increased visibility due to the rise of televised sport. Furthermore, as the number of teams increased. so did the number of opportunities for teams to trade with one another, creating a larger incentive for enforcers to signal their own capability to teams across the league. Levels of informal control exercised may have also co-evolved with the norms and rules of formal officiating. Curiously, however, the rates of both informal and formal sanctioning increase and decrease nearly simultaneously, with a peak in both forms of behavior seen in the late 1980s. (Per game rates of both are graphed in an appendix.) A challenge in observing this directly is the inability to distinguish between levels of deviance and formal control, as

instances of deviance without punishment are not recorded. Ultimately, while the gradual nature of the concentration and specialization of fighting strongly suggests an adaptive and diffusive process, future work on the external mechanisms that might have facilitated this process are also worth identifying and understanding.

Conclusion

Studies of social control have focused largely on how individuals and states can compel individuals to behave in a pro-social manner. The question of who bares the responsibility of compelling pro-social behavior is framed as a "second-order" problem of collective action. Most solutions are predicated on the existence of a central authority that can collect or usurp the resources necessary to establish social order. The puzzle of how social order can emerge without a pre-existing state or collective entity remains less well examined. The analysis presented suggests that a more complex version of stateless social control emerged in the NHL through a gradually emergent process that has designated the responsibility of sanctioning to a subset of individuals. Individuals who perform sanctioning duties are rewarded with a place on an NHL roster, even while lacking the performance metrics to maintain a place otherwise. The implication of this finding is that in the absence of an adequate and pre-existing centralized enforcement mechanism, simple "self-help" driven systems of control evolve into more complex systems by designating and rewarding sanctioners. A consequence is that under such a system sanctioning may become more proactive and less reactive. When punishment is rewarded, it can potentially become decoupled from the deviant behavior it was originally intended to curb.

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Appendix: Rates of Formal and Informal Sanctioning Per Game Over Time

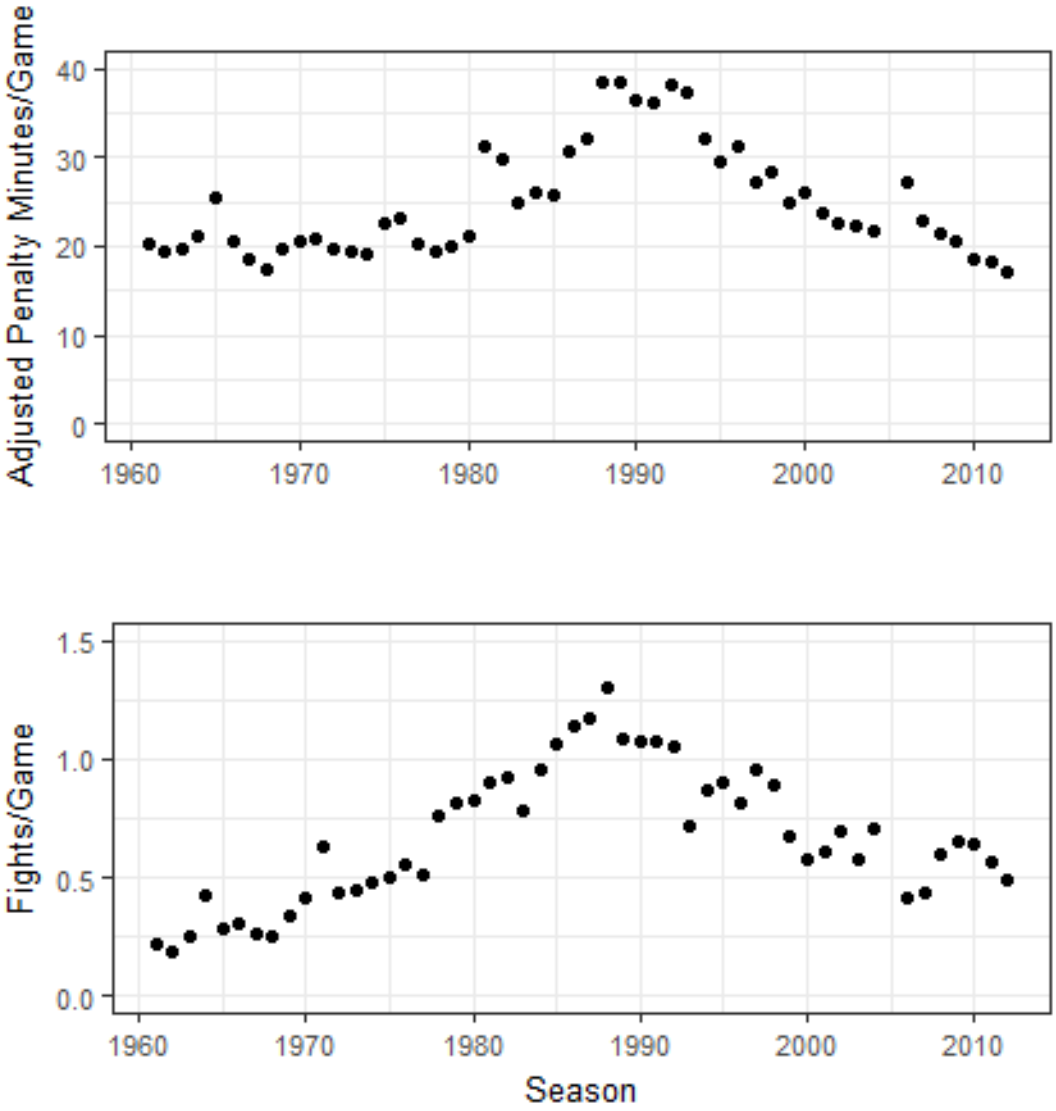


Figure A1 – The top panel demonstrates the number of penalty minutes assigned per game (less what would be expected due to fighting) for each season. The bottom panel displays the number of fights per game for each season. These can be thought of as rates of formal and informal sanctioning respectively. Both increase drastically in the 1980s and taper off in the 1990s.

CHAPTER 2: THE SPECIALIZATION OF VIOLENCE OVER THE CAREER COURSE IN PROFESSIONAL ICE HOCKEY

Abstract

Prior sociological examinations of violence have focused on the cultures and social situations that lead to violent activity. Other work has focused on individual attributes that correlates with violent behavior. Less attention has been paid to how individual and structural determinants of violence interact with each other. A highly structured and regularly occurring social situation is used to examine individual differences in violent behavior within a shared social context: fist-fighting in North American ice hockey. My analysis shows that labor division and specialization are necessary for understanding individual rates of violence. I demonstrate the importance of two sets of skills in ice hockey ("fighting" and "scoring"), their inverse correlation, and the tendency of individuals to focus on one or the other over time. The analysis corroborates journalistic evidence of an informal group of players, "enforcers," who participate in a disproportionate amount of fighting. Enforcers fight to compensate for deficiencies in other skills and advance their career, and organizations funnel people into specialized roles. While theories of masculinity, intergroup violence, and honor cultures can explain why these fights occur in the first place, theories of labor specialization and division are needed to understand the distribution of violence across individuals.

Introduction

Sociologists frequently examine the conditions that lead to both the production of violent individuals, and the occurrence of violent acts. The most parsimonious

sociological explanations suggest that violence comes from individuals that are generally not well integrated into society at large. Communities that are poor in social capital will experience higher rates of violent behavior, because social control compels individuals to behave in a way that conforms to societal expectations, inhibiting deviant behavior (Sampson and Groves 1989; Sampson 1997). If a community or larger social structure is not preventing violent behavior, it follows that individuals who have the most to gain from violent behavior (either because they find pleasure in the act of violence, or are able to leverage violence into some sort of profit) will do as they please without consequence. A converse social explanation of violence has also been presented. If violence is something that people naturally try to avoid, and that only exceptional situational circumstances will cause a level of emotional arousal that is sufficient to compel individuals into an act of violence (Collins 2009; Collins 2013).

Other literature focuses on the individual determinants of violence. Sociologists have attributed deviant behavior to individual attributes, but these socio-economic and demographic attributes typically serve as a proxy for some larger structural phenomenon (Sampson and Groves 1989). Scholars interested in gender and violence, for example, suggest that boys are more likely acquire a violent conception of masculinity, and are accordingly more violent (Kaufman 1987; Miedzian 2002). Psychological and biological explanations of violence have also been put forward, suggesting that the levels of certain hormones (such as testosterone) or the presence of some individual level cognitive trait (such as self-esteem) is correlated with violent behavior (Mazur and Booth 1998; Baumeister, Boden, and Smart 1996).

This article focuses on how contexts that permit violence can interact with individual characteristics to create large discrepancies in levels of violent behavior. Most social environments repress rather than exacerbate violence; violence is exceedingly rare in contemporary human society (Collins 2009). This means there is typically little observable variance in the violence of individuals, since most individuals commit no violent acts, and those who do are more likely to be removed from society via the consequences of violence (incarceration or death). There are, however, specific environments that are more permissive of violent actions.

In this paper, I first outline the different types of social situations that can give rise to violence, and then focus my attention on violence in the world of sport. Sports teams, like gangs, criminal organizations, and the military, are generally more accepting of acts of violence (Bredemier and Shields 1986). I then propose that when violence is considered an important part of attaining a group goal, certain group members may specialize in violence. I propose that the perceived value of violence and processes of labor specialization can exacerbate individual differences in violent behavior. I then turn my attention to the sport of Ice Hockey North America, where fist fighting is both frequent and acceptable. While it is against the rules of the sport, it is only lightly punished by officials and organizations that supervise the sport, and players on the ice are not later held accountable for their violent actions by the legal system.

This focus on specialization differs from previous approaches to the study of violence in two important ways. First, as I show below, existing theories of violence do not explain the concentration of violent behavior among a very small fraction of

group members. Second, theories of the division of labor point to ability as an explanation, whereas I will show how the ability is also a consequence of a path dependent "tipping" mechanism, such that very small initial differences in fighting ability can track young players into a career as a specialized enforcer.

I use data from ice hockey leagues at the developmental, semi-professional, and professional levels and a series of statistical tests to examine the processes that lead to larger individual variations of violence in this violence-approving context. I find evidence that fighting is a skill that is valued by teams, that it is disproportionately concentrated in a small number of players, and that fighting roles differentiate themselves from other roles over the career course. Specifically, my analysis shows how young ice hockey players are funneled into a violent career. More generally, I document an important feedback loop that is missing in theories of violent behavior by demonstrating how the role of "enforcer" as a career path shapes the evolution of players to fill that role, which reinforces processes of self-selection at the individual level. In more general terms, I show how social structures and processes can amplify individual variation in behavior that would be regarded as deviant in most social contexts.

Socially Permitted Violence

In many cases, broader cultures and subcultures endorse violent rituals and practices. Functional explanations have been proposed for such violent behavior in many cases. So called "honor cultures" have been found historically in areas where stronger central institutions that prevent violence and protect property rights are weak (Cohen and Nisbett 1997). In these cases, an individual must show a willingness to use

physical force, since the state cannot stop others from taking advantage. One such honor culture is thought to exist in the Southern United States. These residents emigrated from areas where government institutions were weak and private property was vulnerable. Individuals who did not threaten violence to defend their property were easy targets (Cohen and Nisbett 1994). and empirically the perception of low authority in an area has been found to positively predict rates of homicide (Kirk and Papachristos 2011).

Many cultures not only recognize the use of violence as a way for individuals to signal their toughness, but also as a tool for groups to protect their reputation and resources. Murder patterns between gangs in the south side of Chicago, an area with crime rates high enough to suggest a state of semi-lawlessness, has been found to be a function of gang proximity and violence (Papachristos 2009; Papachristos, Hureau, and Braga 2013). Gangs target each other's members to avenge the loss of one of their own and to protect their territory, which both serve as mechanisms for honor and reputation preservation. An analysis of Corsican mobs suggested that a successful revenge killing is also a signal of coherence, as compelling an individual to commit an act of murder for the sake of the group require a group to solve the collective action problem of who takes on the risks and responsibilities of violence (Gould 1999).

The Sociological Meaning of Violence in Sport

While the majority of contemporary nation states in the industrialized world do not permit the use of individual violence to solve problems and solidify reputations, there are still subdomains of modern society where forms of violence are permitted and even rewarded. It has been noted that violent and unruly behavior often occurs in

a “moral holiday” situation where individuals encourage and approve of what would otherwise be considered antisocial behavior (Weenink 2013). A somewhat similar situation occurs in the world of sports. Sports are thought to offer a “contextual morality” where the set of acceptable behaviors becomes quite different: aggression that is frowned upon elsewhere is embraced (Bredemier and Shields 1986). The somewhat paradoxical idea that a highly structured subculture is needed to undermine society’s general aversion to violence has been addressed largely with a gendered perspective.

One angle has suggested that sports in general facilitate masculine hegemony, which was fundamentally challenged as industrialization minimized the importance of physical strength in society in the late 19th and 20th centuries (Bryson 1987; Messner 1990). This perspective suggests that sports are used as a way to socialize young boys into their role as the physically dominant gender; to borrow from West and Zimmerman, it is a way to teach young male children to “do gender” and become boys (1987). Careers in sports later served as a way for men in marginalized communities to assert themselves as more legitimate in society (Messner 1989). This perspective has also suggested that sports are a means of encouraging violence in young males and teaching them to use their bodies as weapons, as achievement in contact sports is typically linked to the successful use of violence (Messner 1990). This feminist perspective on violence in sport may very well explain society’s differing attitudes towards aggression in male sports and female sports. However, the gendered perspective on violence in sport does not account for the variance in violent behavior among males, especially its concentration in a very small fraction.

Violence and Specialization

While the adherence to violent and aggressive masculine norms may be a symptom or even motivation of the larger existence of televised contact sports, the individuals who play (or coach) for a living are attempting to achieve prestige and wealth by succeeding at the sport. They presumably do not have an explicit interest in preaching a philosophy of violence for its own sake. Individuals and teams have their own short term and long term rational motives, independently of whether or not they seek to perpetuate masculine hegemony.

Just as some of the aforementioned violent subcultures are characterized by violence between different pairings of gangs, most contact sports (outside of "combat" sports such as boxing or wrestling) consist of two groups being brought together to compete with one another. Any intentional aggression or violence during games between two teams should occur between players of opposing teams. The team is the social unit that is thought to be motivating the violence, yet players on a team show different levels of physical aggression How can within group variations in violence be explained? Some members may be more socialized into the violent norms of their cultures than others. However, if violence serves a specific functional purpose for a gang or team, then it follows that certain individuals may specialize in violent roles. Furthermore, these specializations may persist even if individuals change membership from one group to another group. It has been argued that athletes are encouraged even as children to focus their efforts on a specific sport, or even a specific position within a sport (Coakley 2010). The argument of this paper is that these theories of labor specialization can explain individual variations in violent behavior.

I will frame and test my specific hypotheses with respect to the sphere of professional sports. Professional sport provides a clear set of measurable material and symbolic motives for players (ex: maximizing salaries and wins), as well as a detailed and publicly available body of statistics describing both the in-game behaviors of players and their rates of success. Contact sports in North America are also ubiquitous, both in terms of visibility and participation.

I start with the assumptions that sports teams attempt to maximize their number of wins, there are violent as well as non-violent duties required for a team to win a game, and individuals are concerned with the number of times their team wins and their employment within sports organizations. From this, I hypothesize that theories of labor division and specialization suggest the following:

1. Only some individuals will perform violent roles.
2. These individuals will be specialized (that is, the roles are not rotated among team members).
3. These individuals will not contribute to non-violent roles, particularly scoring. Hence success in violent and non-violent roles will be inversely correlated.
4. Individuals who excel in violent roles will be valued by their team in much the same way that those who excel in non-violent roles.
5. Individuals will be tracked into violent roles as a career specialization.

To test these hypotheses, I turn my attention to the sport of Ice Hockey in North America.

The Case of North American Ice Hockey

My analysis focuses on a curious phenomenon: the fights that regularly occur between members of opposing ice hockey teams in North America. Although it is largely absent from women's hockey, and American Collegiate hockey, fighting occurs fairly frequently in professional, minor, and junior hockey leagues. For example, the Western Hockey League, a junior league in Western Canada comprised of 16 to 20-year-old boys that sends a large portion of its players to the National Hockey League (NHL), averaged more than one fight per game until the 2011-12 season. The National Hockey League is the highest level of professional ice hockey in North America. In the modern NHL fights tend to occur about once every two games. These fights can end in injury, but do not end in death. They are technically illegal within the rules of the game, but are usually not stopped by game officials or punished severely enough to deter them out of existence. As a result, fights are frequent and recurrent.

Fighting and aggression in ice hockey has been investigated from several different angles. Some have sought to understand the cultural norms surrounding fighting (Colburn 1985; Colburn 1986; Bloom and Smith 1996; Weinstein, Smith, and Wisenthal 1995). These accounts all seem to foreshadow or compliment the study of the aforementioned honor cultures in the Southern U.S. and elsewhere. From these perspectives, players feel compelled to fight when they or a teammate are physically endangered by the play of a member of the opposing team. Not all illegal actions are detected by on ice officials, some are detected but not punished adequately, and some acts of play are not necessarily illegal but violate the unspoken norms of

sportsmanship that govern the game. The inadequacy of the rules compels players to take enforcement into their own hands, and the National Hockey Leagues punishes players who do said enforcing very lightly. Other research has focused on the specific situations that lead to more violent play in hockey (Widmeyer and Birch 1984; Sheldon and Aimar 2004). Players are more likely to fight in some game situations compared to others. The tolerance of fighting means that players may also use fighting disproportionately in situations where they are playing against a hated rival. Or a team may fight in a situation where they can no longer win the game, but they can salvage the symbolic resource of honor and minimize self-esteem damage by picking a fight. Another strand of the literature interprets violence as rational behavior leading to profit, crowd size or win maximization (Stewart, Ferguson, and Jones 1992; Paul 2003). The recent proliferation of analytics in professional sports organizations, largely popularized by the book, *Moneyball (*Lewis 2004), has led to many questions about the worth of fighting (with respect to winning games) and the players who fight (Willis 2013). Fighting has also been explored in a more multi-dimensional manner by sports journalists, some of whom have published extensive works that provide compelling narratives and portraits of fighting and those who participate in it (Branch 2014; Bernstein 2006).

Fights in hockey are a source of much controversy, especially given the recent focus of the media on injuries and long-term health consequence of athletes that repeatedly experience head trauma. The National Hockey League punishes players who participate in a fight with a five-minute penalty for each player. However, when each team sustains a penalty, neither gains a competitive advantage or disadvantage,

as the penalties offset each other. The officials do not attempt to break up the fight immediately, rather, they tend to let it "play itself out". This effectively results in the existence of fighting in a legal grey area, where it is against the rules, but it is still permitted. It has been observed that in some inner city areas that law enforcement turns a blind eye to some acts of criminal violence, which effectively gives people free reign to exercise violence wherever they see fit (Leovy 2015). The referees of the NHL are witnessed by fans, so they cannot stand by completely. Instead, the rules are written in a way so that officials are required to exercise only a limited amount of deterrence whenever a fight does break out. The National Hockey League rulebook for the 2014-15 season states the following:

> "The Referees are provided very wide latitude in the penalties with which they may impose under this rule. This is done intentionally to enable them to differentiate between the obvious degrees of responsibility of the participants either for starting the fighting or persisting in continuing the fighting. The discretion provided should be exercised realistically." (p. 69)

Following this quote, there are five pages of rules dictating how players should fight, if they are to fight, in order to avoid harsher penalization. So while fighting is technically against the rules, the correct manner in which to fight is also written into the rules. Fighting can be "more illegal" if these rules are not followed, in which case players are ejected from the game. Among other things, players are not

permitted to remove their own helmets or jerseys, they are not permitted to begin a fight while the game is stopped, and they are not permitted to enter a fight already in progress between two other players.

Outside of fighting, ice hockey involves two teams of players (six from each team are on the ice at any point barring situations where one has been excluded due to a penalty) who use long sticks to attempt to advance the "puck" (a small disc of vulcanized rubber) across an ice rink into the "goal" or "net" of the opposing team. The nets are placed on opposite ends of an ice rink. A team scores a "goal" when the puck is successfully advanced into the opposing team's net. The game is won by the team who accumulates the most goals. One player on each team (the "goalie") stays by their own net to block the other team's attempts at scoring goals, this is called "goaltending". Outside of goaltending, ice hockey tends to value two broad families of skills. The first set of skills involves speed, agility, and the ability to handle and shoot the puck with precision. These abilities allow a player to move the hockey puck around opponents easily and quickly, and ultimately lead to scoring goals. The game is won by the team who accumulates the most goals. The second set of skills are more defensive and based on impedance. They involve how physical and aggressive a player is; an individual can limit the success of his opponent by delivering hits or "checks" on the ice. These actions can also lead to the intimidation of the opponent.

Fights typically break out as a direct or indirect result of this second method of play. Fights allegedly happen for many different reasons, one (non-academic) work cited ten different reasons: "retaliation and retribution", "swinging the momentum", "intimidation", "sending a message", "trying to draw a reaction penalty",

"deterrence", "job security", "prison justice" (trying to make oneself look tough by defeating a tough opponent), and "bad blood" (pre-existing animosity between players or teams) (Bernstein 2006). Most of these reasons can fall under the umbrella of the following explanation: Fights occur because one or both players wishes to seek vengeance for himself or a teammate, or because one or both players wish to intimidate others with an act of physical aggression. The fact that some fights occur for "job security" suggests that at times fights occur for performative reasons, it is a violent face-to-face interaction that follows the patterns outlined by Goffman (1959). The stage is the rink, and the audience is not only the crowd of fans watching the game, but also the teammates and coaches (and potential teammates and coaches) of the players. Players may fight to maintain a masculine and violent image, in part because this image is monetizable. Fights between members of rival teams may occur because a player wants to signal his group loyalty to his teammates. Any fight could be more meaningful than two people in an isolated contest for temporary physical dominance; a fight could be considered a presentation, a signal, or a deterrent.

Regardless of their cause, the frequent occurrence of fighting, the precedent set for using this phenomenon to explore other aspects of the social sciences, and the existence of multiple archives of data kept on the internet by fans of hockey fighting, all make it an ideal phenomenon to use for the examination of how violence varies between members of groups. There are clearly demarcated groups (teams), clearly structured opportunities for interaction between members of groups (games), and a sizeable number of violent actions that are taken on by certain members of groups during scheduled interactions. If there are people who assume a disproportionate

amount of violent responsibilities for a group, it will be completely transparent. this example of violence gives us an opportunity to address the question of who embraces the responsibility and risk of violence for the group with a rich and detailed data set.

An Unofficial Role: Deterrence and "The Enforcer"

The aggressive skills that are necessary in ice hockey are practiced in the extreme by an unofficial class of players that are referred to by players and fans of hockey as "enforcers". Coaches and managers allegedly add them to their roster typically to bring an ineffable sense of toughness to a team. The position of enforcer is different from the officially recognized positions on a hockey team: goaltenders, defenders, centers, and wingers. Some teams employ no enforcers, while others employ several. In theory, a very good enforcer could do his job without ever fighting, the threat would be enough. The Philadelphia Flyers, a franchise in the National Hockey League, strategically employed many enforcers during the 1970s when fighting was more frequent than it is today. The willingness of every player to fight and play in a physically aggressive manner allegedly led to opposing teams playing more passively (Bernstein 2006). The team, nicknamed the "Broad Street Bullies," won two consecutive championships. Those victories are largely attributed to their physical aggression. It is harder to draw a correlation between fighting and winning in the modern NHL, since more rules are in place to prevent teams from winning purely by physical aggression and intimidation. However, if the idea that having aggressive players leads to winning is present among different organizations, there is no reason to think that the practice of teams employing players to fight will not persist. If purely violent players no longer provide an edge, organizational theory

suggests that the existence of teams that had won via violent tactics may create an "institutional myth" of sorts that keep the hiring of enforcers in common practice (Meyer and Rowan 1977).

Individual players are also still largely in favor of keeping fighting in the game. The NHL Players Association has found in polls of its players that roughly 98% of players favor the inclusion of fighting in the game, and many believe that the presence of fighting keeps the game safer, by deterring dangerous plays that are not adequately penalized or seen by the officials (Burke 2013). This strongly supports the idea that fighting is an instrument of a larger honor culture that pervades the game. It is also an endorsement of the idea of deterrence. Just as the "MAD" hypothesis argues that states armed with nuclear weaponry will not go to war with one another, players believe that the presence of fighting will keep teams in a state of relative peace. A player is theoretically less likely to play aggressively or deliver "cheap shots" (hits delivered to opponents that are unnecessary and typically out of sight of the in game officials that might penalize them) to their opponent if a 250-pound member of the opposing team on the bench will come onto the ice and begin a fight with them. Deterrents, however, do not work if they are not known. The nuclear war analogy is compromised when the frequency of fighting is considered compared to the frequency of nuclear weapon deployment. Enforcers must make themselves known. A team with a known enforcer has something similar to "second strike" capability (Rauchhaus 2009). A player who delivers a "dirty" (illegal or unsportsmanlike) hit against and opposing player will be fairly certain that he will soon have to answer for his crimes

by fighting a more aggressive player on the opposing team. One former NHL 'enforcer', Marty McSorely, offered the following quote:

> "The mere presence of a tough guy in many games, will in itself deter any scrums, cheap shots, unnecessary obstruction, or little intimidation tactics, and keeps the game flowing freely. That veiled threat of knowing a fight could happen at any moment really cleans up the game." (Bernstein 2006, p. 49).

While such deterrence could theoretically be instilled by everyone throughout the league, the responsibility is anecdotally handed to only a few people. Only a small number of visible and intimidating actors are needed to create a generalized threat towards the remainder of actors (Boulding 1963). The aggression of a handful of enforcers can be directed towards anyone. This implies that a small number of people are doing the vast majority of fighting. This idea is further supported by anecdotes about "enforcers" and "goons" in the sport of hockey. There is no official cutoff or positional definition that labels a player as an enforcer or not. Therefore, I hypothesize that fights will be disproportionately participated in by a small number of players. While this is something that is known by most fans of the sport of hockey, confirming it for the reader unfamiliar with the sport will be a useful exercise.

Enforcers: Specialists or Enthusiasts?

The existence of a group of players that do the majority of the fighting is not sufficient to say that the "enforcer" is a unique position with Professional Ice Hockey. A group

of people may just find themselves especially prone to random bursts of violence, or they may find the embracement of violent masculinity more compelling than others. Fighting could be an example of autoetelic violence; it may simply be enjoyed for its own sake more by certain individuals than for others (Schinkel 2004). If this is the case, there is no reason to believe their performance in other aspects of the game should differ from the performance of their less violently-inclined teammates.

Journalistic accounts suggest that this is not the case. While some players may be successful on the ice and have an inclination to fight often, anecdotally enforcers are not as talented as their teammates. John Branch recently published a series of articles and book on the life of one such player, Derek Boogaard, whose life tragically ended in his late twenties after an overdose of painkillers mixed with alcohol (2011; 2011; 2014). It is more than likely that his problems with painkillers and alcohol were made worse by the effects of chronic traumatic encephalopathy, a consequence of repeated head trauma (from fighting) that is characterized by poor executive functioning and personality changes, among other symptoms (Gavett, Stern, and McKee 2011). Even at the junior levels of play, Boogaard was never sought for his ability to play hockey; he was only kept on teams because of his aggression, size, and willingness to fight for his teammates. While he wished to be a player valued for his skill and his strength, he rarely saw more than a few minutes on the ice in any given match, but still managed to tally some of the highest fight totals in the league. His NHL career ended with 62 fights, and only 3 goals.

This specialization is not always cast in such a negative light. In an editorial for the USA Today, Brian Burke, a Harvard Law School graduate, former minor

league player, and President of Hockey Operations for the Calgary Flames (another NHL Franchise) defended fighting and the role of the enforcer, writing:

> "But our game is improved tremendously by players' ability to police the game. It makes it more exciting and honorable. It allows skill players to focus on the skilled aspects of the game because someone else can watch their back. And it fundamentally makes our game safer." (2013)

The quote reveals how both normative and utilitarian arguments can become intertwined with one another: fighting is okay because it is honorable, but restricting that "honor" to a few individuals makes fighting more effective. The concentration of fighting abilities in a handful of players, and other hockey skills more directly tied to obtaining a favorable balance of goals scored for one's team as opposed to against one's team, is the natural result that would be expected from ideas on labor division. Firms are thought to profit more off of individuals when individuals are concentrated in specialized roles (Rosen 1983). If teams are firms that seek to maximize winning, then it is strategic for only certain players to focus on fighting at the expense of other skills.

What makes this specific division more interesting is its fluidity in general. While there is certainly a relationship between a player's tendency to fight and his tendency to successfully perform other hockey tasks, there is no concrete separation of roles and responsibilities. A star goal-scorer can pick a fight if he wants. The player

may take some criticism from coaches, but teammates and opponents may respect the player more. Connor McDavid, a top NHL prospect and leading point-scorer in another Canadian Junior League, injured his hand after starting a fight with someone in a game in 2014 as a 17-year-old. His coach said of the incident:

> "We don't want Connor doing it…Connor is a competitive person whose emotions are going to get to him sometimes. I'm not saying he acted badly, but he gets upset sometimes and sometimes that leads to a fight." (Peters 2014)

The coach seems more concerned with Connor risking his comparative advantage in goal scoring by sustaining and injury through fighting; but does not believe he "acted badly". Furthermore, if an enforcer scores a goal, it is also celebrated. In "Boy On Ice", the biography of ex-NHL enforcer Derek Boogaard, the author writes of the wild celebration that followed a playoff goal Boogaard Scored in a game for his WHL junior team (Branch, 2014). The roles of players are tendencies and strengths, not concrete positions. When considering fighting, it is very much a secondary skill compared to the importance of achieving a favorable scoring balance. Scoring goals (and preventing opposing goals) directly leads to wins. A team can win without an enforcer, but cannot win without goal-scorers. Players that mainly contribute by fighting make a commensurate salary if they reach the top levels of the game, but rarely do they receive the multi-million dollar contracts that their goal-producing teammates receive. Fighting is dangerous and painful work, Risking the

talent of a highly skilled goal scorer on a violent and injury-prone role would be ill-advised. The tendency of firms to specialize labor, and the presumed financial and positional superiority of a non-fighting role, suggests that there is an inverse correlation between rates of scoring and rates of fighting among players in the National Hockey League. Those who fight rarely score, and those who score rarely fight.

Specialization Over the Career Course

Assigning specialized roles to individuals and concentrating their training in a specific area is sufficient to outperform a firm where individuals all perform and learn multiple roles. Families in societies with pre-defined gender roles have been modeled as superior at producing offspring to societies without specialization (Becker 2009). But a firm or society using specialization based on ascribed categorical differences would outperform one where specialization is purely random. Even better would be a specialization based on actual differences between individuals in relevant abilities.

Players do not arrive at the National Hockey League franchise unspecialized. They have already spent years playing the sport at its lower levels, developing a custom skill set that is strong enough to earn them a roster spot in an NHL organization. Furthermore, it can be expected that as the level of play increases from league to league, the specialization must become more pronounced. If a hockey team is thought of as a firm, then a team at a higher level can be expected to produce more output on average than a team at a lower level, and the need for increased output should result in a need for increased specialization. Conversely, for a player to earn a spot on a more competitive team, he must demonstrate an ability to contribute to the

overall output in one way or another. The aforementioned study of NHL enforcer Derek Boogaard describes how at the age of 15 he was instructed by a junior league coach to enroll in boxing lessons to further augment his fighting skills (Branch 2014). This anecdote is corroborated in the academic literature: workers are theorized to make human capital investments based on depth of skill rather than breadth of skill in a large enough labor market (Kim 1989). This suggests there should therefore be a positive feedback loop that manifests itself over the course of a player's career. A younger player that is taken from a lower league to a higher league likely excels in at least one key area, and as that player moves from one level to the next, he can expect to focus even more on the area in which he excels. Thus, specialization should increase as leagues become more competitive, and players who excel in an area of specialization should be more likely to earn spots on teams in more competitive leagues.

Data and Methods

The four hypotheses originally proposed to verify a specialization of labor will be tested with a highly detailed set of player data from three separate North American Hockey Leagues over a number of years. The data source used for the remainder of this paper is provided by the website dropyourgloves.com. For each player in each season, data is available on the number of assists, goals, and fights accumulated by each individual player, as well as the total number of games in which he played. Goals are recorded when a player successfully shoots the puck into the net defended by the opposing team. Assists are awarded to the player who passes the puck to a player who subsequently scores a goal (a 'first assist'), and the player who passes to this player (a

'second assist'). Each goal may co-occur with 0,1, or 2 assists. Points are the combined total of assists and goals that a player records. Fights are recorded when one player pairs off with another player and begins exchanging punches until the referees separate them. Other superfluous physical contact between players (such as pushing and shoving) is not recorded as a fight. Goaltenders, players whose success is purely measured in terms of blocking shots and preventing goals, are omitted from all levels of analysis. These data are collected over 17 National Hockey League (NHL) seasons from 1997 to 2015, 18 American Hockey League (AHL) seasons from 1997 to 2015, and 15 Western Hockey League (WHL) seasons from the years 1997 to 2012. (The NHL 2004-05 season was not played due to a bargaining dispute between the players' association and the league owners.)

The WHL is one of three "major junior" hockey leagues in Canada, with 22 teams located in British Columbia, Alberta, Saskatchewan, Manitoba, as well as teams in the U.S. states of Washington and Alberta. Teams play 72 regular season games each year. Players are aged from 15-20 years old. Of the 2826 players in the dataset being used, over 10% had played at least one game in the NHL during the period from 1997-2015. Many others have played on lower tier professional hockey teams, or leagues in other countries. The NHL is typically considered to be the highest level of professional hockey in the world. It currently has 30 teams across the United States and Canada. The regular season is 82 games long. Its players are as young as 18, and some play into their early 40s. The AHL is the league directly below the NHL, where many players who are just on the outside of an NHL roster are kept to develop their skills and get more in game experience.

I will first verify the degree to which fighting is disproportionately concentrated in the hands of a small number of specialists using a variety of regression methods for count data. Since fighting is seemingly a random event that occurs between pairs of individuals, and it occurs somewhat rarely, I will model the actual distribution of fights per player against a Poisson model assuming that all players will randomly enter into fights at an equal rate, and a zero-inflated Poisson model assuming that a fraction of all players will randomly enter into fights at an equal rate, and that the remaining fraction will avoid fighting. Poisson distributions are used to model the occurrence of rare events, one of the earliest works describing the Poisson distribution modeled rates of soldier deaths from horse kicks, and child suicides (Quine and Seneta 1987). Since there is roughly only one fight for every two games of ice hockey in the National Hockey League, this distribution seems reasonable. The zero-inflated Poisson model (ZIP model) is used to model frequency data with a larger than expected number of zeros, which throws off the mean-equals-variance characteristic of the Poisson distribution (Bohning et al. 1999). Negative binomial models are similar to Poisson models, however, they allow for a greater dispersion of the data. In Poisson models, the variance is equal to the mean, whereas the variance is a quadratic function of the mean in negative binomial models (Greene 1994). Negative binomial models will be used with and without a zero-inflation parameter. The independent variable will be rates of scoring per game, which serves as a measure of hockey success outside of fighting. These models will simultaneously test whether or not violence is concentrated in a small number of players, and whether or not the occurrence of fighting is inversely correlated with a player's ability to score goals and

assists. The models are estimated from the statistics of 9,124 player-season pairings where players recorded at least one point and played in at least one quarter of the season (more than 20 games). These pairings stretch across 14 seasons and feature 1,858 different players. As a robustness check I will estimate the same models for career fighting totals in the NHL from 1997-2012 for the 1,952 players who played more than 20 NHL games total and recorded at least one point. Table 1 presents descriptive statistics for this portion of the analysis.

Next, I will test whether or not the broadly defined skills of "fighting" and "scoring" are independently valued by ice hockey teams at higher levels, and test whether or not fighting may serve a rational purpose for the career advancement of younger hockey players. I will look at the statistics for 15 years of the Western Hockey League, a junior league in Canada, and see how rates of scoring and fighting predict whether or not the players will reach the AHL or NHL. I will perform an ordinal logistic regression with these three levels of player success (not reaching either league, reaching the AHL but not the NHL, and reaching the NHL) as my dependent variable. I will also verify that the "parallel lines" assumption is met for each of the dependent variables using a procedure similar to the Wald test outlined by Brant (1990); I will compare the likelihood of the ordinal logit models to each of the partial proportional odds models containing either a partial effect for one of the predictors or partial effects for all of the predictors. Of the 2826 WHL Players in the data set, 2158 that recorded at least one point and played in more than 18 games (one quarter of a 72-game WHL season) are used in this analysis. Summary statistics for the 2158 players I will use for this analysis are presented in Table 2.

	Player-Season Pairs			
Variables	Mean	SD	Min	Max
Dependent Variables				
Fights	10.33	22.02	0	199
Not in Any Fights	.336			
Predictors				
Games Played	308.3	259.5	21	1117
Points Per Game	.323	.212	.015	1.403
Observations	9124			

	Across Career of Each Player			
Variables	Mean	SD	Min	Max
Dependent Variables				
Fights	2.075	4.058	0	40
Not in Any Fights	.533			
Predictors				
Games Played	63.87	17.42	21	85
Points Per Game	.395	.263	.012	1.767
Observations	1952			

Table 1 Descriptive Statistics for Players in the NHL from 1997-2012 Used in Estimation of Count Models of Fighting

Variables	Mean	SD	Min.	Max.
Dependent Variables				
Advanced to AHL, not NHL	.143			
Advanced to NHL	.126			
Predictors				
Points Per Game in WHL	.427	.318	.017	2.135
Fights Per Game in WHL	.079	.090	.003	.717
Games Played in WHL	166.327	88.098	18	520
Total Players		2826		

Table 2. Descriptive Statistics of Players in the WHL from 1997-2012 Used in Ordinal Logit Models of Career Advancement

Finally, I will look at players who have played a large number of games at multiple levels of ice hockey to see if they specialize or generalize as they advance to higher levels of play. I will regress a player's rate of either scoring or fighting at a certain level on their rates of both scoring and fighting at a lower level of play. I will perform four sets of two regressions. One set will be on 199 players who played in both the WHL and the NHL, a second set will be on 466 players who played in the WHL and the AHL, a third set will be on 776 players who played in the AHL and NHL, and a final set will be on 157 players who played in the WHL, AHL and NHL. To be included in an analysis, a player must have recorded at least one point and one fight in each league of interest, and played more than one quarter of a season in each league (more than 18 games in the WHL and more than 20 games in the AHL or NHL) across the span of their careers. Descriptive statistics for the sets of players featured in the four cross-league analyses are shown in Table 3.

League Transition	WHL to NHL				WHL to AHL			
Variables	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
Dependent Variables								
NHL Fights Per Game	.071	.080	.002	.353				
NHL Points Per Game	.260	.185	.023	.955				
AHL Fights Per Game					.086	.101	.002	.544
AHL Points Per Game					.347	.208	.019	.106
Predictors								
AHL Fights Per Game								
AHL Points Per Game								
WHL Fights Per Game	.093	.092	.003	.594	.093	.098	.003	.594
WHL Points Per Game	.743	.372	.033	2.135	.635	.327	.021	.768
Number of Players	199				466			

League Transition	AHL to NHL				WHL and AHL to NHL			
Variables	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
Dependent Variables								
NHL Fights Per Game	.080	.097	.001	.641	.082	.082	.002	.353
NHL Points Per Game	.231	.151	.017	.975	.216	.143	.023	.608
AHL Fights Per Game								
AHL Points Per Game								
Predictors								
AHL Fights Per Game	.085	.093	.002	.554	.098	.094	.003	.453
AHL Points Per Game	.492	.257	.034	1.474	.429	.223	.044	1.106
WHL Fights Per Game					.103	.094	.003	.594
WHL Points Per Game					.700	.336	.033	1.742
Number of Players	776				157			

Table 3 Descriptive Statistics for Players Spanning Multiple Leagues of Play

Results

Concentration and Specialization

First, I will confirm the typology of "the enforcer" by verifying that there is indeed a small number of players who end up responsible for a disproportionate amount of fighting in the National Hockey League, and that they tend to record fewer goals and assists (points). Two sets of four models are estimated. The first set considers each player's statistics over the course of one season as a single data point. I include only cases where players participated in more than one quarter of the games (more than 20) in a given season, and where they registered at least one point during the season. Respectively, I do the former to ensure that no artificially extreme levels of scoring rates or fighting rates are recorded for players who may have only played in a handful of games, and the latter to simplify the process of log transforming players' scoring rates. The second set of models considers all games that each player played over the 14 NHL seasons as one data point, after applying the same restrictive criteria (over 20 games and at least one point across 14 years). For both sets of models, I include the natural log of the number of games played as an exposure variable. This ensures that the rate of fighting is being analyzed after accounting for the fact that players participate in different numbers of games. I log transform the rate of scoring for the purpose of normalization. For the regression models considering each player's data by season, I include factor variables for the season of play. The levels of fighting in the league vary from season to season, which could be based on a number of factors that I am not explicitly concerned with in this paper (changes in stringency of officiating, league wide shifts in strategy, etc). These coefficients are omitted from the

model. For both sets of data, I estimate a Poisson regression model, a zero-inflated Poisson regression model, a negative binomial regression model, and a zero-inflated negative binomial regression model. The results are shown in Table 4.

In the first sets of models, the lowest log likelihoods correspond to the negative binomial model as opposed to the Poisson models. Adding the overdispersion parameter to the Poisson model drastically improves the likelihood (= 16793, *d.f.* = 1, $p < .001$), and adding the overdispersion parameter to the negative binomial model also improves the likelihood by a large amount (= 7371.7, *d.f.* = 1, $p < .001$). When comparing the zero-inflated negative binomial model to the standard negative-binomial model, the zero-inflation parameter also adds a statistically significant amount of explanatory power (= 32.65, *d.f.* = 15, $p < .01$), although the increase is far more modest than the increase from adding the overdispersion parameter.

In the second set of models, which look at all games for each player across the career course, the negative binomial models once again have far higher log-likelihoods for the models without zero-inflation (= 21843, *d.f.* = 1, $p < .001$) and with zero-inflation (= 17649, *d.f.* = 1, $p < .001$). However, when comparing the two negative binomial models, the zero-inflation term leaves the log likelihood virtually unchanged (= .001, *d.f.* = 2, $p = .999$). The logit coefficients are not significant, and the count coefficients of the two models are virtually the same. Therefore, the negative binomial model is accepted as the best fit when aggregating data across all 14 seasons.

	Player-season pairings			
Regression Model Type	Poisson	Zero-Inflated	Negative Binomial	Zero-Inflated NB
Count Coefficients				
Intercept	**-4.455*** **	**-3.569** **	**-4.595*** **	**-4.447*** **
	(.028)	**(.092)**	**(.180)**	**(.254)**
Log(Points Per Game)	**-.936*** **	**-.671*** **	**-1.016*** **	**-.949*** **
	(.008)	**(.009)**	**(.024)**	**(.027)**
Logit Coefficients				
Intercept		**-3.805**		**-5.858*** **
		(.101)		**(.759)**
Log(Points Per Game)		**.495*** **		**1.093*** **
		(.122)		**(.211)**
Overdispersion: θ			.432	.481
N	9,124	9,124	9,124	9,124
df	15	30	16	31
Log Likelihood	-23,693.76	-18,946.92	-15,277.30	-15,260.97

Note: Dummy variables controlling for seasons are Included in Models of Player-Season Pairings; the coefficients are omitted from the results. The natural log of games played is used as an 'offset' or 'exposure' variable to account for differing numbers of games for each player in all models.
*p<.05; **p<.01; ***p<.001

Table 4. Poisson, Zero Inflated Poisson, Negative Binomial, and Zero Inflated Negative Binomial Models for Number of Fights in Each Individual Season for Each Player, and for Each Player Across All Seasons

	Players across all seasons			
Regression Model Type	Poisson	Zero-Inflated	Negative Binomial	Zero-Inflated NB
Count Coefficients				
Intercept	**-5.024*** **	**-4.714*** **	**-5.180*** **	**-5.180*** **
	(.016)	**(.017)**	**(.074)**	**(.073)**
Log(Points Per Game)	**-1.186*** **	**-1.098*** **	**-1.172*** **	**-1.172*** **
	(.009)	**(.009)**	**(.047)**	**(.047)**
Logit Coefficients				
Intercept		**-7.222*** **		-16.840
		(.122)		(39.840)
Log(Points Per Game)		**-.404*** **		4.187
		(.082)		(103.885)
Overdispersion: θ			.473	.473
N	1952	1952	1952	1952
df	2	4	3	5
Log Likelihood	-16227.55	-14130.97	-5306.27	-5306.27

Note: Dummy variables controlling for seasons are Included in Models of Player-Season Pairings; the coefficients are omitted from the results. The natural log of games played is used as an 'offset' or 'exposure' variable to account for differing numbers of games for each player in all models.

*p<.05; **p<.01; ***p<.001

Table 4 (Continued). Poisson, Zero Inflated Poisson, Negative Binomial, and Zero Inflated Negative Binomial Models for Number of Fights in Each Individual Season for Each Player, and for Each Player Across All Seasons

The superiority of the negative binomial models to the Poisson models suggests that before player ability in rates of scoring is even considered, there is evidence that fighting disproportionately falls in the hands of a small number of

individuals. A Poisson distribution of fights would suggest that fighting randomly falls across players, but the increased likelihood from adding the overdispersion parameter suggests that there is a small number of players doing a great deal of fighting. Adding coefficients to predict whether or not a player avoids fighting altogether slightly improves models of data by player-season pairing, but it does not improve the model of fight counts for players across the 14 seasons in the data set. This suggests that the statistical significance of the zero inflation term disappears when players who are reluctant to fight are given enough opportunities to do so.

The natural log of points per game is a highly significant negative predictor of fighting in the two superior models. In the zero-inflated model for player-season pairings it is a positive predictor of never entering a fight during the season. In these two models, each one-unit increase in the natural log of points per game over the course of a season or of all seasons changes the rate of player fighting by the exponential of the coefficient. One intuitive way to interpret this is to show the expected number of games a player will go without a fight as a function of the number of points a player scores per game. This function is shown in Table 1 using the negative binomial model of fighting (without zero inflation) for fights for each player across all 14 years. A player who scores an average of one point per game is expected to fight only once every 175 games (over 2 seasons of play), while a player who scores a point an average of once every 20 games is expected to fight about once every 5 games.

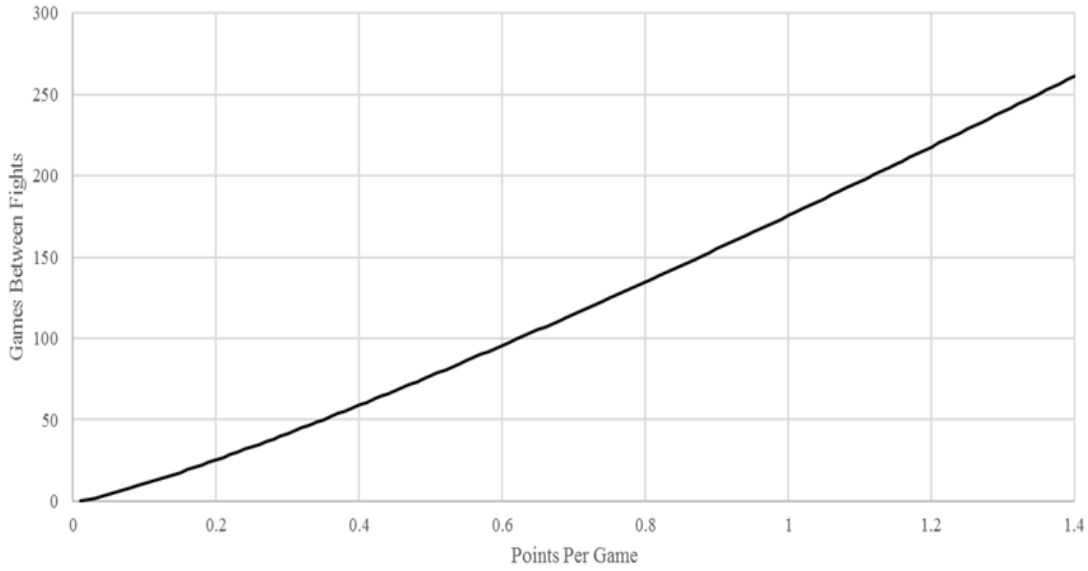


Figure 1. Expected Number of Games Between Each Fight in the NHL as a Function of a Player's Scoring Rate

The models all show that the number of fights are negatively associated with the log of the average number of points (goals and assists) each player scores per game, holding games played constant. The results of these models confirm the hypothesis that a large number of fights are concentrated in a small number of players, and that these players are more likely than not going to be less productive in terms of points scored than other players. As mentioned before, these results should not be surprising to followers of professional ice hockey, who are familiar with the archetype of the enforcer. It is apparent that there is specialization in the form of an inverse correlation between two skill sets, now I will turn to the question of whether or not fighting skills are sought after by hockey organizations independently of scoring ability.

Predicting Advancement to the NHL and AHL

It is important to verify that fighting and scoring are valued skills in the higher levels of ice hockey, as an alternative explanation of this inverse correlation is that violent behavior is simply a reaction to poor results in other areas of the game. I will use an ordinal logit model to predict how rates of scoring and fighting in the Western Hockey League, a junior league in Western Canada comprised of younger players with professional aspirations, predicts advancement into the higher levels of ice hockey. Specifically, I have coded the instances where players have advanced from the Western Hockey League into either the National Hockey League, or the league that is typically reserved for professional players who are on the cusp of reaching the NHL, the American Hockey League. I will examine the 2,158 players that have played more than a quarter of a season's worth of games (19 or more) in the Western Hockey League from the years 1997-2012, and have registered at least one point and one fight during those games. As predictors in the model I will use the total number of games played, the square root of points per game, and the natural log of fights per game. The transformations of the fights per game and points per game variables are to create normality in these variables. The interaction of these two terms will also be included in the model. While the data for the predictors extends from 1997-2012, a player's highest level of advancement before the end of the 2014-2015 season is used for the dependent variable. Figure 2 graphically shows the outcomes of each player as a function of the transformed fighting and scoring variables.

Three ordinal logit models are estimated for the three levels of the dependent variable. The first model regresses professional attainment on the total number of

games played in the WHL (measured in hundreds) and the square root of the number of points each player scored per game during their career in the WHL. The second model includes the log transformed number of fights per game. The third model includes the interaction of the variables for fights per game and points per game. The results of the three models are shown in Table 5

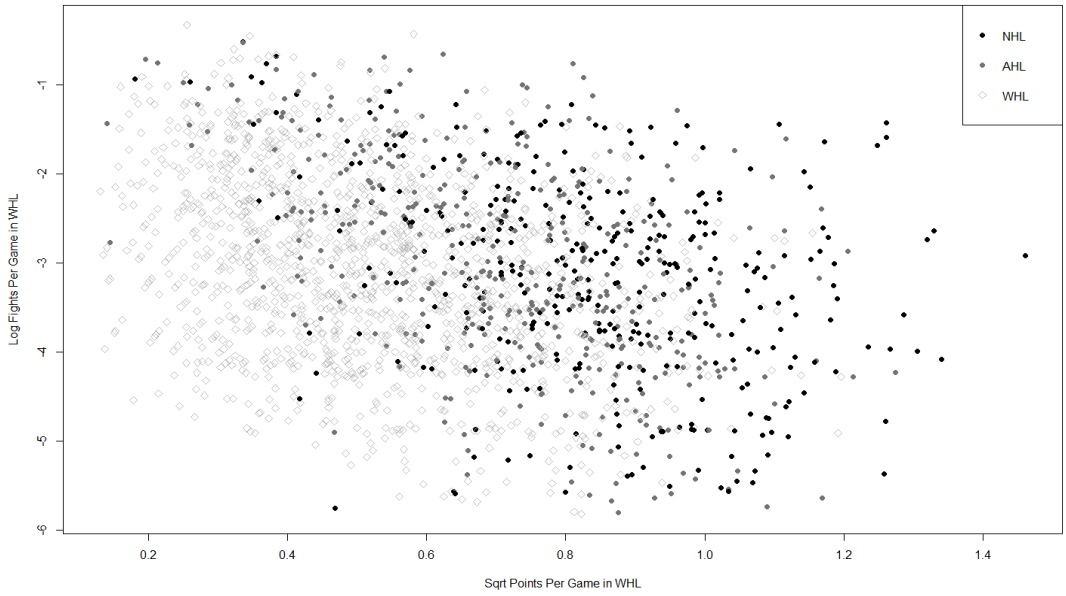


Figure 2. Highest League Achieved by Fights Per Game and Points Per Game in the WHL

	Model 1	Model 2	Model 3
Predictors			
100*Games Played in WHL	**.209*** **	**.284*** **	**.290*** **
	(.058)	**(.060)**	**(.060)**
Sqrt(Points Per Game)	**5.412*** **	**6.384*** **	**3.561*** **
	(.247)	**(.278)**	**(.655)**
Log(Fights Per Game)		**.515*** **	**1.212*** **
		(.052)	**(.161)**
Sqrt(PPG)*Log(FPG)			**-.976*** **
			(.213)
Threshold Coefficients			
WHL vs AHL	4.468	3.652	1.746
	(.194)	(.209)	(.447)
AHL vs NHL	5.412	5.046	3.151
	(.247)	(.224)	(.213)
Observations	2158	2158	2158
Log Likelihood	-1571.87	-1519.44	-1508.93
Akaike Inf. Crit.	3151.73	3048.87	3029.85
*p<.05; **p<.01; ***p<.001			

Table 5. Ordinal Logit Models Predicting Advancement to Semi-Professional (AHL) or Professional (NHL) Levels of Play from the Western Hockey League

The first model shows that both the total number of games played and the transformed number of points per game both positively predict an individual's likelihood of advancing to a higher level of the league. Each additional 100 games in

the WHL is associated with a 20% increase in the probability of advancing to the next level (holding scoring rates constant), and each squared unit increase in points per game is associated with a 540% increase in advancing to the next level (holding games played constant). (A player with 2.25 (1.52) points per game is 540% more likely to advance to a higher level of play than a player with 0.25 (0.52) points per game.) Both coefficients are statistically significant at $p < .001$. The second model adds a term for the natural log of fights per game. Each unit increase in the log of fights per game is associated with an increase in the probability of advancement by around 52% holding games played and scoring constant. (A player who averages 0.368 (e-1) fights per game is 52% more likely to advance to a higher level of play than a player who averages 0.135 (e-2) fights per game.) The coefficients for points per game and total games remain positive and significant. The third ordinal logit model estimated adds an interaction term for the rates of fighting and scoring, which has a statistically significant ($p < .001$) coefficient of -.976. Holding all else constant, each unit increase in the rate of scoring diminishes the effect of a unit increase in fighting by around 98%, and vice versa. Stated another way, players who fight frequently early in their careers appear to experience less of a career benefit from scoring, and players who score frequently experience less of a career benefit from fighting. The other coefficients in the model remain positive and statistically significant, and the fighting and scoring terms become larger (offsetting their negative interaction effect).

The third model estimated shows the highest log-likelihood, and appears to be the most complete model. The proportional odds assumption is tested by comparing the likelihood of this model against the likelihood of each model that estimates a

partial effect for one of the four predictor variables, and the likelihood of a model that estimates a partial effect for all of the predictor variables. These partial effects allow the effect of a predictor variable to vary between levels. For example, if a partial effect for fighting is estimated, then one coefficient will be estimated for the effect of fighting on advancing from the WHL to a career that goes no higher than the AHL, and one will be estimated for the effect of fighting on reaching the NHL instead of only the AHL. Table 6 shows likelihood ratio tests comparing the fit of the final ordinal logit model to the fit of the five partial proportional odds models of interest. None are significant at the level of $p < .05$, therefore the proportional odds assumption is not rejected, and the generalized ordinal logit model is accepted as the best fit for the data. (It should be noted that the omnibus test is close to significance with a p-value of just over .0503, which is rounded to .050 in Table 6.)

Variables	d.f.	$\chi 2$	p-value
Omnibus	4	9.473	.050
Games Played	1	2.801	.094
Sqrt(Points Per Game)	1	.137	.711
Log(Fights Per Game)	1	.685	.408
Sqrt(PPG) * Log(FPG)	1	.000	.994

Table 6. Results of Likelihood Tests Checking the Proportional Odds Assumption for Ordinal Logistic Regression Models Predicting Level of Career Advancement

The coefficients in the models presented here suggest the statistical significance of both scoring points and picking fights in terms of producing future outcomes, but the practical significance is difficult to discern. The marginal effects of

fighting and scoring are presented in a more interpretable fashion in Figures 3 and 4. These figures show the expected effect of fighting on career advancement for players who have played 100 games in the WHL for different rates of scoring per game. For example, according to Figure 3 a player who participated in 5 fights and scored 50 points during his 100 games in the WHL has around a 39% chance of eventually playing in either the AHL or NHL. However, if that player participated in 20 fights, his estimated probability of reaching the AHL or NHL is around 56%. During his first 99 games in the WHL, the aforementioned enforcer Derek Boogaard accumulated 9 points and 31 fights, which would give him a roughly 20% chance at making it to the AHL or NHL according to the models estimated. Had he only been in 1 fight during this time, the projected probability of him making it to the higher levels of ice hockey would have been only 1%.

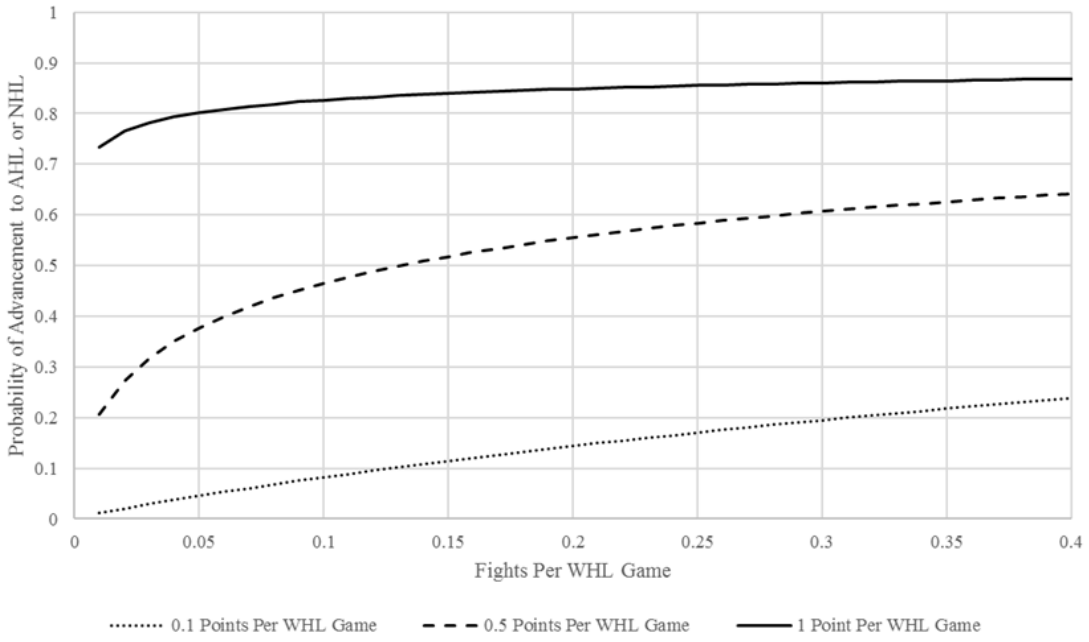


Figure 3. Marginal Effects Plot Showing Estimated Probability of Reaching the AHL or NHL Based on WHL Performance Over a 100 Game WHL Career

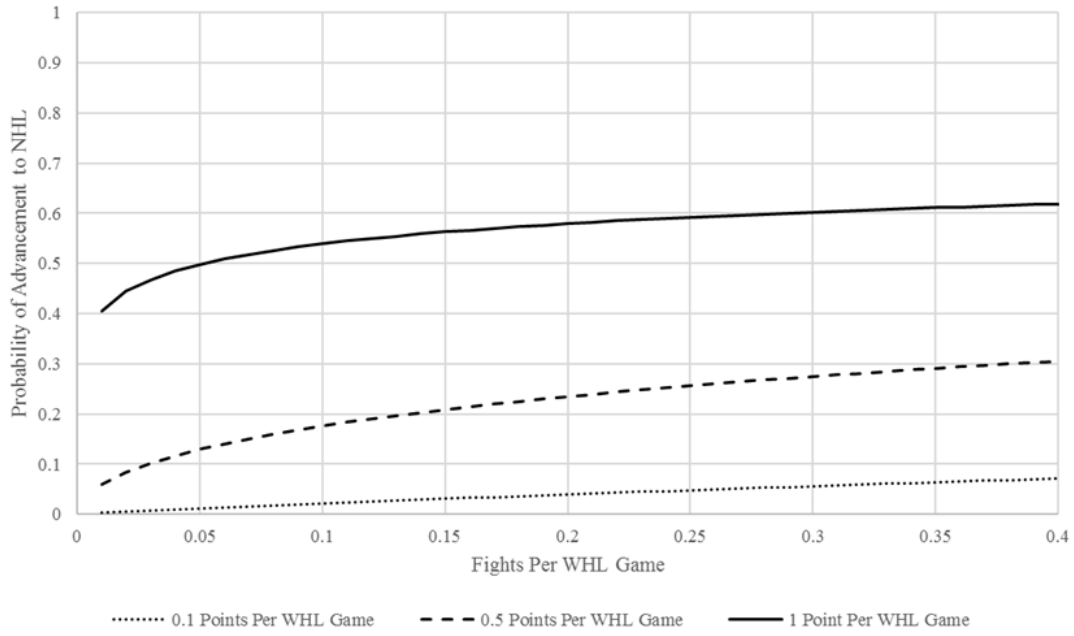
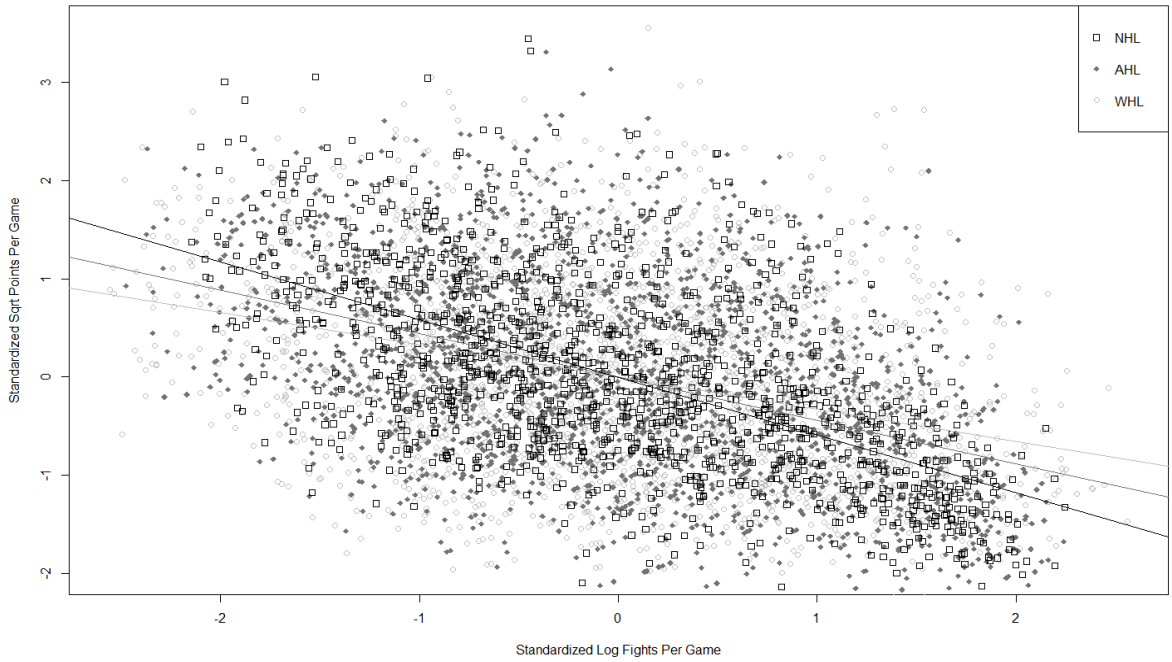


Figure 4. Marginal Effects Plot Showing Estimated Probability of Reaching the NHL Based on WHL Performance Over a 100 Game WHL Career

Player Transitions in the NHL

Fighting and scoring tend to be inversely correlated in a way that would be predicted by any hypothesis grounded in a specialization of labor argument. We also know that fighting and scoring are both valued, ruling out the explanation that violence is simply a "reaction to failure". The question now turns to whether or not specialization remains consistent as players progress through the ranks of ice hockey in North America. A quick inspection of the relationship between fighting and scoring at the three levels discussed in this paper, the WHL, AHL, and NHL, show that the inverse correlation increases as the quality of the level of play increases. A comparison of the standardized z-scores of the square root of points per game and the log of fights per game is shown in Figure 5. Values are only taken for players with at least one point, one fight, and a quarter season's worth of games played. The NHL is shown in Figure

5 with hollow black squares, the AHL is shown with grey diamonds and the WHL is shown with hollow grey circles. Dots represent players and lines represent the OLS regression of points on fights, with black, dark grey, and light grey used for the NHL, AHL and WHL respectively. The slope increases as the level of the league increases.



Note: Diagram includes all players who participated in any of these leagues between 1997 and 2012

Figure 5. Standardized Fights Per Game and Points Per Game for Players During Their Careers in the WHL, AHL, and NHL.

To statistically test for patterns of specialization, a series of models will be run for players who have sufficient data at multiple levels of play. In these analyses we will include an additional three years of AHL and NHL data, so that more WHL players who have advanced to higher levels in recent years can be included in the analysis. Two sets of four models will be run. One set will predict the natural log of fights per game, the other will predict the square root of points per game. In each set

of models, performance at a higher level will be predicted by performance one or more lower levels. One model will contain WHL outcomes predicting NHL outcomes, another will contain WHL outcomes predicting AHL outcomes, another will contain AHL outcomes predicting NHL outcomes, and the final will contain WHL and AHL outcomes predicting NHL outcomes. The models are presented in the table below.

For each model where there is only one 'predictor league' and one 'outcome league', the points term positively predicts scoring outcomes and negatively predicts fighting outcomes at the higher level of play, while the fights term positively predicts fighting outcomes and negatively predicts scoring outcomes at the higher level of play. For the models where the WHL and AHL statistics are used to predict NHL statistics, scoring rates in the NHL are predicted at a statistically significant level only by scoring rates in the AHL. Fighting, however is negatively predicted by AHL scoring, and positively predicted by AHL and WHL fighting rates at a statistically significant level. Overall these results suggest that a skill at a higher league is positive predicted by the same skill at a given lower league and negatively predicted by the other skill at the lower league. This suggests that in ice hockey specialization is longitudinal over the career course.This finding is parallel to the pattern of intensifying negative correlations in Figure 5.

Model	1	2	3	4
Dependent Variable	Sqrt(Points Per Game)			
Predicting League(s)	WHL	WHL	AHL	WHL, AHL
Predicted League	NHL	AHL	NHL	NHL
Constant	.036	**.061****	**.076*****	.065
	(.041)	**(.023)**	**(.016)**	(.038)
WHL Sqrt(Points Per Game)	**.424*****	**.559*****		-.034
	(.047)	**(.029)**		(.064)
AHL Sqrt(Points Per Game)			**.484*****	**.615*****
			(.024)	**(.081)**
WHL Log(Fights Per Game)	**-.032****	**-.025*****		-.007
	(.010)	**(.006)**		(.014)
AHL Log(Fights Per Game)			**-.018*****	.001
			(.004)	(.013)
Observations	199	466	776	157
R2	.390	.533	.457	.495
Adjusted R2	.384	.531	.455	.481

*p<.05; **p<.01; ***p<.001

Table 7. Multivariate Regressions Predicting Rates of Scoring and Fighting in Higher Leagues by Rates of Scoring and Fighting in Lower Leagues

Model	5	6	7	8
Dependent Variable	Log(Fights Per Game)			
Predicting League(s)	WHL	WHL	AHL	WHL, AHL
Predicted League	NHL	AHL	NHL	NHL
Constant	.005	-.120	-.004	.014
	(.231)	(.141)	(.104)	(.234)
WHL Sqrt(Points Per Game)	**-1.003*** **	**-.858*** **		.015
	(.266)	**(.179)**		(.387)
AHL Sqrt(Points Per Game)			**-1.179*** **	**-1.051***
			(.162)	**(.494)**
WHL Log(Fights Per Game)	**.881*** **	**.808*** **		**.368*** **
	(.058)	**(.035)**		**(.083)**
AHL Log(Fights Per Game)			**.807*** **	**.516*** **
			(.026)	**(.078)**
Observations	199	466	776	157
R2	.623	.615	.673	.682
Adjusted R2	.619	.613	.672	.673

*p<.05; **p<.01; ***p<.001

Table 7 (continued)**.** Multivariate Regressions Predicting Rates of Scoring and Fighting in Higher Leagues by Rates of Scoring and Fighting in Lower Leagues

Discussion

The analysis in this article aims to add another layer of understanding to how individuals respond to violent social contexts. Even if violence is universally accepted by a group of people, the majority of violent activity may fall into the hands of only a handful of individuals. Theories of social influence and control, the emergence of honor cultures, and gendered patterns of physical domination can help explain the phenomenon of fighting professional ice hockey, but theories of labor division and specialization are necessary to help explain how violence is distributed across individuals.

The characteristics of individuals within a group matter when analyzing acts of violence between groups. The analysis I have conducted suggests that those who fight on behalf of a group are the most expendable when it comes to performing other roles for the group. While fighting may win a player the approval of his peers, regardless of the status of the fighter, it is most necessary for those whose membership in the group may otherwise be in question. Gould wrote about the tension between individual and collective action when it came to acts of gang violence. The individual who fights for the group is suffering a net loss for the sake of the rest of the members of the group (1999). For all but the fighter, the reputation of the group (that benefits everyone) stays intact for no cost. It would make sense that those who fight have the most to prove to a group. Furthermore, studies of violent gangs have suggested that violence is used as an initiation procedure, and that the experience of participating in an act of gang violence is an experience that builds collective solidarity (Decker 1996). While my analysis does test whether or not younger players will fight on teams, it does

support the idea that violence is part of a cost of group membership. And in the NHL this cost varies from individual to individual.

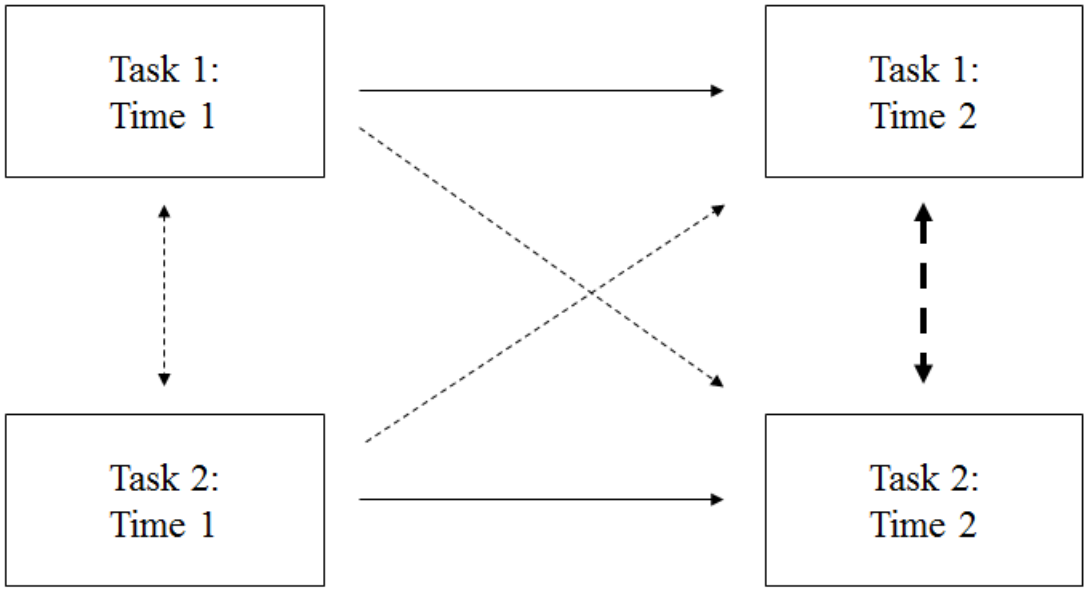
This cost may also vary depending on the quality of the group one seeks to enter. Players at the level of the junior leagues (the WHL in my dataset) are already somewhat separated into the roles of 'scorer' and 'enforcer', and this is likely based largely on natural differences in ability and size. In higher leagues, the minimum contribution a player must make to remain on a team is theoretically higher, and this requires more players to capitalize on their pre-existing skill sets. While teams in higher leagues do not have a larger number of players on their roster, a higher aggregate productivity is expected from the same number of people. The analysis in this article supports the broader hypothesis that there is an association between specialization and output. If the family is considered a type of firm, then my analysis is consistent with the finding that heterosexual couples specialize more after they have a child (Sanchez and Thomson,1997). If the firm is a hockey team that seeks to maximize wins, fighters must fight, goal scorers must score, and those who find themselves with both abilities must focus on where their comparative advantage lies.

From the perspective of the career of the individual, as opposed to the productivity of the firm, fighting can become a way for players who do some scoring and some fighting at the junior level to earn their keep at a higher level. The comparative analysis of player statistics across leagues demonstrates how specialization can accumulate over time. Many sociological analyses of labor division emphasize the inequality generated through ascriptive hiring practices (Gorman 2005; Baron 1994; Pager and Shepherd 2008). While my analysis focused exclusively on

males, the vast majority of whom are white, an implication of the analysis in this paper is that even minor incidences of occupational differentiation by sex, race, or another characteristic early in the career course can lead to vast occupational differences later in the career course. Just as small amounts of in-group preference can pull individuals into racially segregated neighborhoods (Schelling 1971), small amounts of specialization compounded over time can pull individuals into effectively separate careers.

Methodologically, my analysis provides an outline for how a division and specialization of labor can be quantitatively discerned in a group without clearly demarcated and formalized positions. Many sociological studies focus on how labor divisions correlate with another variable as opposed to focusing on the labor itself (Strauss 1985). A common example is using gender as a categorical dependent variable and household labor share or income as outcomes (Becker 1985; Brines 1994). My approach does not rely on *a priori* divisions of individuals, but focuses instead on how a division of labor can be quantitatively inferred by the distribution of work itself. At a minimum for a division of labor to be present, there must be more than one task that is valued by a group or firm. The performance of one task should negatively predict the performance of other tasks. If specialization is present, then the inverse correlations should also increase when examining in a longitudinal data set. Additionally, the performance of one task at time 1 should positively predict performance of the same task at time 2, and negatively predict the performance of other tasks at time 2. Figure 6 presents this model in the form of a causal diagram. The negative relationship between the tasks of fighting and scoring is shown in the count

models from the first portion of the results section. The causal relationships between time 1 and time 2, and the increase of the negative correlation between tasks from time 1 to time 2 are demonstrated with the interleague models in the third portion of the results section. (The ordinal logit models in the second portion of the results section validates the selection of fighting and scoring as the two tasks of interest.) Etymologists claim that an insect society characterized by a division of labor performs several different tasks simultaneously by specialized groups of individuals (Robinson 1992). The model I propose builds on this and incorporates a longitudinal+ specialization of labor as well.



Note: Arrow points show direction of causality. Solid lines indicate positive causal relationships, dotted lines indicate negative or inhibitive causal relationships. The thicker line between the tasks at Time 2 indicates a stronger negative correlation than the negative correlation at Time 1.

Figure 6. Causal Diagram for Model of Labor Division and Specialization

As a final point of discussion, it is worth noting again that head trauma in sports is a public health concern in North America that is becoming a topic of frequent

media discussion. Sincere and unbiased sociological examinations of why and when fights in hockey occur, who is participating in them, and if they have a larger impact in terms of either encouraging or deterring other violent events can help guide strategies that minimize injury risk, and perhaps more importantly prevent well-intentioned reduction strategies that could actually make the problem worse. While my analysis focuses on only a few thousand hockey players, there are over 1.2 million registered hockey players across all levels in the United States and Canada (USA Hockey 2015; Hockey Canada 2015). On any given day dozens of fights from different leagues are posted on 'dropyourgloves.com', the site that I drew most heavily upon for the data in this article. A sociological understanding of the causes of these events is an important compliment to a medical understanding of their consequences.

Conclusion

While many studies of violence focus on the social environments that inhibit or encourage violent behavior or individual correlates of violent behavior, less work has been done on how these two sources of variation might interact with one another. The variance in individual levels of aggression among hockey players can largely be explained by the structural ideas of labor division and specialization. I propose this explanation by citing journalistic and ethnographic research suggesting the existence of a fighting role within hockey (as opposed to a role that is focused on goal scoring or goal prevention), and verify it by quantitatively replicating the patterns predicted by theories of labor division and specialization. In the sport of hockey, job responsibilities are fluid between individuals. Anyone can fight and anyone can score. This fluidity allows me to demonstrate that "generalists" are slowly ironed out into

"specialists" as players' careers progress and the demands of the organizations that they belong to increase. Furthermore, the data suggest that individuals who take on less desirable tasks may do so out of necessity. It is where their comparative advantage lies and a way for them to gain and maintain group membership. Interpreted more broadly, my analysis suggests that the occurrence of interpersonal violence or other rare forms of social behavior is a function of individual attributes, social environments, and the processes that sort individuals into different positions in a larger social structure.

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CHAPTER 3:

A STUDY OF THE CAREER TRAJECTORIES OF ADULT FILM PERFORMERS

Abstract

In this chapter, the adult film industry is used to study how people attain and maintain success in "boundaryless" and project-based careers. While the film industry in general has long been used to explore the contours of the boundaryless career, there are particular dynamics of the adult film industry that make it particularly well-suited for studying the attainment of a success in such a career. There is a constant demand for "fresh faces" in the adult film industry, and female performers tend to only be in high demand for a finite range of ages. While these effects should undermine the attainment of cumulative success, "stars" still emerge within the industry. These dynamics are further moderated by performer's gender, race, and the repertoire of sexual acts they are willing to engage in. Using a vast dataset constructed from two different online sources, we use event-history models to examine how certain performers benefit from strategic career planning and network effects in an industry where there are strong prevailing headwinds against sustained career success.

Introduction

Research on the sociology and psychology of careers is shifting focus towards a deeper understanding "boundaryless" careers, and reflects a broader societal shift away from "organizational" careers that are contained within a single firm or organization (Inkson 2008). A large number of these careers are positioned within project-based industries, where groups of people form and re-form teams and groups to complete specific tasks. Unlike organizational careers, success in a boundaryless

career cannot be based on steady progression through a single organizational hierarchy. Success in boundaryless careers has been described as a function of three forms of knowledge: "knowing why", "knowing whom" and "knowing how" (Eby, Butts, and Lockwood 2003), although clear definitions of how to define success in boundaryless careers have remained theoretically elusive (Arthur, Khapova, and Wilderom 2005). Other work on careers where success and reputation largely follows individuals instead of organizations (i.e., artistic, scientific, and athletic careers) has also demonstrated patterns of cumulative advantage. (Merton 1968; Allison, Long, and Krauze 1982; Petersen et al. 2011; Liu et al. 2018). The logical result of such non-linear dynamics are very skewed distributions of objective career success within a given industry.

In particular, the contemporary film industry has been used to analyze and evaluate success in project-based networks: including the influence of collaborators, past success, and the importance of network position and gender (Faulkner and Anderson 1987; Rossman, Esparza, and Bonacich 2010; Lutter 2015). The film industry is also characterized by the dynamics of cumulative advantage, the common aphorism of aspiring celebrities waiting for their "big break" reflects this: aspiring performers are cognizant of the fact that an initial appearance in a performance can generate a cascade of success that could rapidly transform their career and lead to a high level of success.

In this article, we evaluate the dynamics of career trajectories in the adult film industry: which has unique dynamics that should work *against* rather than for the success of established individuals. There is generally thought to be a "retrogressive

dynamic" in sex work (Cressey [1932]2008; Escoffier 2007), and a demand for "fresh faces" in the contemporary adult film industry that should undermine the effects of cumulative advantage that are typically seen. Yet there is still a highly positively skewed distribution of objective success within the industry. We seek to resolve this tension by evaluating the effectiveness of known career strategies used by performers in adult film, and the importance of different network effects in determining success.

After a brief review of the literature on boundaryless careers, we discuss the history of the adult film industry, as well as the particular challenges it presents to performers over the course of their career and the strategies that are used to confront these challenges. We then introduce two data sets, one from an online site that aggregates pornographic films, and another from a site where adult film enthusiasts compile information about the film appearances and biographical information of performers in the adult film industry. Employing discrete-time event history models, we evaluate the importance of career strategies (acting in the right film at the right time), network position, and demographic characteristics (race, gender, age) for the longevity of pornographic careers. Our contribution is three-fold. Theoretically, we contribute to the broader literature on the sociology of careers by analyzing a unique and informative example of a boundaryless career. Substantively, we provide the first large scale quantitative analysis of the careers of performers in the contemporary porn industry. Methodologically, we demonstrate how multiple large "readymade" datasets can be used in tandem to develop a deeper understanding of social phenomena (Salganik 2017).

Achieving Success in a Project-Based Career

Individual careers are constituted by a sequence of jobs, and those sequences tend to follow regular patterns depending upon the structure of a given labor market (Spilerman 1977). These patterns are often characterized by inequality along the lines of gender, race, socioeconomic status, educational attainment, and a host of other factors (Rosenfeld 1980). They are also shaped by the structure and composition of one's social network, which can provide access to information about job opportunities (Granovetter 1973, 1974), access to valuable resources (Lin, Ensel, and Vaughn 1981), and may produce brokerage opportunities (Burt 1995), and these dynamics in turn are mediated by demographic characteristics such as gender (Ibarra 1992, 1993; McPherson, Popielarz, and Drobnic 1992).

Career patterns have changed profoundly in the United States and elsewhere in the latter part of the 20th century, with fewer people experiencing typical "organizational" or "occupational" careers that became the norm in the post-World War II period, where people gradually progress through a hierarchy of positions within a single firm (Slocum 1967; Kalleberg 2009). As people are shifting jobs more frequently, (Haveman and Cohen 1994) it has become increasingly common for career paths be "boundaryless", involving "sequences of job opportunities that go beyond the boundaries of single employment settings" (DeFillippi and Arthur 1994: 307). Work has also become more precarious, as employment has become "uncertain, unpredictable, and risky" across many different sectors of the labor market (Kalleberg

2009). To be successful under these conditions,[5] scholars emphasize the importance of individual "competencies" such as motivation, the acquisition of relevant skills and knowledge, and the ability to cultivate diffuse, extra-organizational professional networks to gain information about opportunities and to learn from their peers (Arthur 1994; DeFillippi and Arthur 1994, 1994; Arthur, Khapova, and Wilderom 2005; Eby, Butts, and Lockwood 2003; Jones and DeFillippi 1996). Contemporary careers are also increasingly "protean", driven by individuals rather than organizations, with the goal of psychological success (Hall 1996).[6] While success can be measured subjectively and objectively, for our purposes and in the analysis below we are primarily interested in objective career success, which at the most basic level is the ability to sustain oneself in a given industry over time.

Hollywood as Prototype of Project-based Industry

The Hollywood motion picture industry experienced major structural changes since the breakup of the oligopolistic major studio system in the 1950s and has often been studied as the archetypal sphere for the development of boundaryless careers (Jones 1996). Work in Hollywood is typically organized around short-term projects, where different individuals come together to work on each film. To sustain their careers, individuals must continually seek new opportunities (Jones 1996). Each new project

[5] Discuss distinction between objective and subjective success. Emphasize how we focus on objective success. Arthur, Kapova, and Wilderom discuss this in detail (see notes)

[6] While the theory of the "protean" career emphasizes the importance of strong internal motives as opposed to weak external restrictions (Briscoe and Hall 2006), it shares the emphasis with the boundaryless perspective on how "the individual must develop new competencies related to the management of self and career" in order to be successful (Hall 1996: 11).

requires an individual to be re-hired, so to be successful in Hollywood individuals must establish and maintain their reputation, expand their skill base (depending upon their role), and develop and maintain a network of contacts, tasks which all require a great deal of time and energy (Jones 1996). There is extensive evidence demonstrating that most individuals are unable to sustain their careers in the industry: 64% of producers and 50% of directors over a 15-year period received only a single credit (Faulkner and Anderson 1987), 69% of contractors studied over a two-year period only appear in a single film (Jones 1996), 70% of actors credited in films between 1992 and 1994 were not credited again in the following two years (Zuckerman et al. 2003).For performers, sustained success is not only uncommon, it is also not purely a function of individual competencies. The opportunities afforded to individual performers are often determined by sociodemographic attributes, and an individual's previous roles. This process is broadly known as "typecasting". In common with other industries, opportunities can be circumscribed based upon social attributes like gender (D. D. Bielby and Bielby 1996), age (Reif and Anselm 1965; Faulkner 1974; Spilerman 1977; D. D. Bielby and Bielby 1993; W. T. Bielby and Bielby 1999; Rachel A. Rosenfeld 1992) and race and ethnicity (Rosenfeld 1980).

While typecasting may restrict the opportunities available to performers, it can be advantageous for actors to be typecast in certain types of roles early on in their careers, as it allows them to assume a simple, focused identity (e.g. as a person who acts in Action movies) that can enable them to get a foothold in the industry, although in the long-term it is beneficial to diversify (Zuckerman et. Al 2003). In contrast, actors who try to be generalists by taking any opportunities that come their way tend

not to last long, as they do not develop a reliable signal that can lead employers to select them. Similarly, films which attempt to span too many genres are less appealing to audiences than more focused ones (Hsu 2006).

The structure and composition of project-based networks can also influence actors' career success. The global network position of one's collaborators predicts one's likelihood of being nominated for an award; individuals situated *between* the networks core and periphery or teams composed of members from both components have the optimal balance of ties to the elite core and novel ideas from the lower-status periphery (Cattani and Ferriani 2008). This mirrors Uzzi and Spiro's (2005) finding that too much cohesion in Broadway productions can stifle creativity, diminishing the prospects of its success. Collaborating with prestigious, high-status peers, such as Academy Award winners, also increases an actor's probability of achieving recognition (Rossman, Esparza, and Bonacich 2010) as status "leaks" between participants (Podolny 2010). These network effects are, however, mediated by social attributes. For example, female actors tend to have shorter careers than men if they are embedded in cohesive teams than more diverse ones, which provide access to more social capital and job opportunities, whereas male success is relatively independent of their network structure (Lutter 2015). One's career path is therefore not simply the result of their own personal competencies but of the interplay between their attributes, abilities, the social structure of the labor market.

In addition to the non-linearity and unpredictability of success in the film industry, creative and project-based industries do not easily lend themselves to standardized credentials or measures of success. The market for employment in a

project-based industry is typically fits the definition of an inscrutable market (Gambetta 1994): both employees and employers may be unaware of their own true quality. When credentials are generally absent and skills are difficult to measure, it is often unclear whether the success of an individual is at all related to their ability (Bielby and Bielby 1992; Salganik, Dodds, and Watts 2006; Rossman, Esparza, and Bonacich 2010). Given the uncertainty and volatility of the market, individuals are selected for new projects based upon a combination of their reputation, prestige, and prior experiences with their collaborators. However those doing the selecting, such as producers or studios, often only have a partial perception of a given individual and their fit for a particular job, leading them to be over reliant on cues like prior experience when making decisions (Zuckerman et al. 2003; Hsu, Hannan, and Pólos 2011). To help to resolve some of this uncertainty, employers and prospective employees also turn to talent agencies, organizations that act as brokers between the two parties (Hirsch 1972). This brokerage can make career success within a project-based industry more durable, as being represented by an elite agency can confer reputation and opportunities, leading to more stable employment and higher incomes (Bielby and Bielby 1999).

The self-reinforcing relationship between past success and future opportunity makes project-based industries prone to patterns of cumulative advantage (W. T. Bielby and Bielby 1992). Evidence from Hollywood suggests that the project-based labor market can result in the emergence of a small, influential elite, who tend to hoard opportunities and consequentially dominate the industry (Faulkner and Anderson 1987; Jones 1996; G. Rossman, Esparza, and Bonacich 2010). While it is true in a

sense that "the work organization is constantly created and recreated with each new project" (Jones 1996: 67), it is recreated in a consistent, industry-specific pattern (Spilerman 1977), reproducing structural inequalities. The uncertainty of the creative industry tends to result in artistic labor markets characterized by "an extremely skewed distribution of fame and success, in the long term" (Menger 1999, 570). Many project-based industries are thus characterized by "Matthew effect", as initial success in one's career begets further and further success down the road (Merton 1968; Allison, Long, and Krauze 1982; Petersen et al. 2011).

Taken together, in Hollywood and many other creative industries we expect the success of individuals to be largely a function of demographic covariates, network position, awards and nominations, and strategic selection of projects. The adult film industry, while sharing the project-based nature of contemporary Hollywood, has different determinates for success. Mainly, the industry has a demand for new talent that can undermine the effects of "cumulative advantage", and is thought to award individuals who broaden their repertoire as opposed to "typecasting" themselves. The broader sociodemographic dimensions of race, ethnicity, gender, and age also influence success in the adult film industry in ways that both mirror and differ from Hollywood. Understanding how these dynamics and dimensions influence individual careers in the adult film industry can broaden our understanding of attaining success more generally in project-based industries and boundaryless careers. It can also illuminate an industry that has both a wide reach and a huge digital footprint.

The Adult Film Industry

There are many similarities between the development and organization of Hollywood and the contemporary porn industry (Simpson 2004). Motion pictures depicting sexual acts began to be produced around ten years after the invention of the motion picture (Simpson 2004). In the United States so-called "stag" films were screened to all-male audiences in brothels and underground theatres from the beginning of the 20th century until the 1970s (Miller-Young 2014; Tarrant 2016). By the 1970s, over 750 adult movie theatres opened across the United States, allowing these films to be viewed by larger audiences, despite a negative legal climate. This heralded the "golden age of porn" and the emergence of "porn chic", with higher production values, a more mainstream audience, and significant commercial success; the 1972 film *Deep Throat* made over $3.2 million within seven months of its release (Tarrant 2016).

Technological and legal changes also had an influence on the adult film industry. The industry rapidly expanded with the invention of video-cassettes, which could be cheaply rented from video stores, and later pay-per-view cable television, enabling consumers to discreetly watch pornography within their own homes (Miller-Young 2014; Tarrant 2016). In 1986 the California Supreme Court ruled that having sex on camera was not prostitution, effectively removing legal prohibitions in the state. By the early 1990s the San Fernando Valley in northern Los Angeles had become the de facto home of the porn industry and a number of large studios emerged, a process similar to the emergence of the Hollywood studio system (Simpson 2004; Tarrant 2016). Aspects of the industry became professionalized and bureaucratized,

with tens of thousands of people employed by production, distribution, and marketing companies (Voss 2012). It is difficult to estimate the size of the porn industry, the *Adult Video Network*, a leading industry organization, estimated 2007 rental sales at $6 billion, most recent estimates have put the 2015 annual revenue at between $5 and $12 billion (Tarrant 2016, 42–44).

The emergence of the World Wide Web fundamentally changed the pornography industry, increasing access, and opportunities for specialized niche porn, catering to the peculiarities of people's sexual tastes (Miller-Young 2014). It is generally believed that revenues have fallen as much as 50% since the mid-2000s, as people have turned away from pay-per-view and video rental, instead consuming free pornography online (Tarrant 2016, 43–45). It has also become cheaper to produce porn, both due to the widespread availability of user-friendly video recording equipment and editing software and because the industry has moved towards more "gonzo" porn, which requires only a small production team—one industry executive estimates that 95% of current productions fall into this category (Tarrant 2016). This has weakened the control of the major studios, which emerged during the 1990s and had dominated the industry (Simpson 2004). On the other hand, these sites have allowed the consumption of pornography to grow. In the past decade, a number of "tube" sites like "RedTube", "YouPorn", and "Pornhub" have emerged that aggregate promotional clips of professional films released by porn production companies, alongside videos uploaded by amateurs. Pornhub, which was founded in 2007, has become the most popular of these sites: it was visited 33.5 billion times in 2018, making it one of the most frequently visited websites in the world; in 2018 around 1

million hours of video (or 115 years of video) were uploaded to the website.(Pornhub 2018).

Determinants of Success in the Contemporary Porn Industry

We are interested specifically in the careers of the adult film performers, the people who are paid to perform sexual acts on camera, rather than the directors, producers, agents, videographers, editors, and others involved in production and distribution (Voss 2012). For some pornography is seen as a short-term "job" to make ends meet and to provide temporary enjoyment, while for others it is a longer-term career (Abbott 2009; Escoffier 2007; see Abbott 2009 and Griffith et al. 2012 for discussion of why people decide to enter the industry). The porn industry has a flat job hierarchy, with little distance between the positions occupied by new entrants and high-status performers, fostering the illusion that "anyone can make it big" in the industry (Mears and Connell 2016). Closer inspection, however, reveals a "winner-takes-all" structure where only a small group of performers can become famous and make large amounts of money, while the majority do not achieve any success. Careers in the industry are precarious and often short, as workers are faced with "all-or-nothing career advancement patterns."[7] Many new entrants only make a single movie.

This characterization of the industry thus bears many similarities to the descriptions of Hollywood presented above. Moreover, careers are circumscribed by a

[7] Although our focus here is careers in pornography, it is worth noting that sex workers often cycle through multiple complementary types of work, such as from porn star to stripper to escort, each of which lasts from days to years and potentially overlaps with the others, rather than a linear progression in one sector (Escoffier 2007; Griffith et al. 2012; Berg and Penley 2016; Berg 2016; Schieber 2018).

performers age, gender, and race, and career success is thought to be moderated by how and when a performer performs in different categories of pornographic films and different types of sexual acts. The trajectories of careers within the contemporary adult film industry are subject to many of the same dynamics and processes that determine success in Hollywood. However, there are several complications that are unique to the adult film industry and the nature of sex work in general, which make the careers of adult film performers a unique case that can illuminate otherwise unseen nuances. A multi-part quantitative analysis of two highly detailed sets of data from the adult film industry will evaluate the presence and influence of the following sets of mechanisms and dimensions.

Sociodemographic Career Determinants: Gender, Age, and Race

Once in the industry there are stark differences in men's and women's career patterns. In "straight" porn,[8] prior work has observed that men tend to have much longer careers than women. To maintain a stable career, a male performer must be able to consistently perform on camera, meaning that they must be able to produce and maintain erections as necessary (Abbott 2009). While it can still be difficult to break into the industry, successful men often have careers that last over a decade. For women, on the other hand, careers are often very short. One of Abbott's respondents claimed, "girls have a shelf life of 9 months to 2 years" (2009: 56). These differences are reflected in the concentration of awards at the Adult Video Network (AVN)

[8] Consistent with industry practice, we refer to "straight" porn as to all porn that does not include homosexual sex acts directly between males, which is generally separated online as "gay" porn. Straight porn thus also includes sex acts between women and scenes where multiple men perform with women.

awards (the "Oscars of porn"), where a smaller number of men receive a naturally higher share of nominations and wins year after year: from 2000-2018 only 8 men have won "Male Performer of the Year", while 18 different women have won "Female Performer of the Year." While men can benefit from longer, more stable careers, there are many more women than men in the industry, and unlike many other sectors, women are typically paid substantially more than men (Mears and Connell 2016).[9]

Female adult performers and other sex workers are also often limited by their age, as their clientele—mostly heterosexual males—demand young bodies (Abbott 2009; Hoang 2015; Mears and Connell 2016).[10] "Teen" and other age-based subgenres are popular in the adult film industry, although some of these genres are also focused on older women (Vannier, Currie, and O'Sullivan 2014). This also results in a large gender and age imbalance: the demand for "fresh faces" means that many of the women entering the industry are very young, often between 18 and 22, whereas the men can be considerably older (Abbott 2009). This causes the industry to exhibit "age-vulnerable career structures" (Spilerman 1977: 574-5), which are particularly acute in professions like dancing or pornography (Menger 1999).

Race has always been a highly salient factor in the porn industry, and in American views about sexuality more generally. Black men have historically been stereotyped as hypermasculine and aggressive (Collins 2004; Dines 1998, n.d.; Hodes

[9] Men working in gay porn can also earn higher salaries than those working in straight porn, resulting in actors commonly switching between the genres in what is known as "gay-for-pay", although the resulting stigma can effectively prevent them from returning to "straight" porn (Escoffier 2003).
[10] While this pattern in gendered in porn in a particular way, we also see similar tendencies in other areas of sex work: Logan (2010) finds that male escorts experience an age-based wage-penalty of approximately $2 to their asking price each year.

2014; Williams 2004; Logan 2010), black women as hypersexual and available (Collins 2004; Williams 2004; Miller-Young 2014, 2010; Brooks 2010). Latina (Brooks 2010) and Asian (Mayall and Russell 1993; Shimizu 2010; Hoang 2015) women also experience racialized sexualities, while white women have been represented as epitome of feminine beauty (Mayall and Russell 1993). Pornography often plays upon these racial stereotypes and taboos, resulting in performers being typecast by their (assumed) ethnic and racial background.

"Interracial" porn (or "IR", to use the industry abbreviation) specifically consists of scenes where white women have sex with black men (although the term is sometimes used more loosely).[11] This genre is particularly popular in the United States, where the term was searched for on Pornhub 36% more frequently than in other countries (Pornhub 2018). These films have also been criticized for exploiting and reifying racial stereotypes about the sexual aggressiveness of black men (Cowan and Campbell 1994; Dines, n.d.; Williams 2004; Neal 2013). For white women these scenes can be lucrative, as they tend to pay more than other scenes. But they may also be stigmatizing, as performers are discriminated against by fans or agents and producers. A number of white women, including high-profile "stars" like Jenna Jameson and Tera Patrick, have refused to work with black men; some have cited threats or fear of reprisals from others as explanations for this (Landes and Nielsen 2018).

[11] The uniquely racialized and gendered dynamic of IR may reflect deep-seated beliefs about sex between black men and white women that crystallized in the Reconstruction period as a way to police black male sexuality in the absence of the institution of slavery (Hodes 1997: 6).

The racial and ethnic categorization of women in pornography is also important. Non-white women may more readily find themselves typecasts into specific or marginalized roles, but their ethnicity may also help them secure more stable employment. Porn featuring black women is known as "ebony" in the industry,[12] however black women tend to be paid half to three-quarters as much as white women for the same scenes and appear in fewer scenes over the course of their careers (Miller-Young 2010). They are often cast into racialized roles in low-end, niche "ghetto porn", depicting stereotypical roles associated with black poverty. Asian and Hispanic women are also typecast into roles that draw upon sexualized racial stereotypes (Mayall and Russell 1993; Shimizu 2010).[13] On the other hand, it is plausible that racialized typecasting may allow them to assume more focused, specialist identities that make it easier for them to initially find work and to subsequently gain a foothold in the industry Multi-ethnic or multi-racial performers may also be able to span multiple categories (Brooks 2010)..

Overall there is strong evidence indicating the presence of intersectional patterns of racial and gender dynamics in the porn industry (Crenshaw 1989; Collins 2015). White women are paid more than black women and have many different roles open to them, although choosing certain higher paying scenes like IR can potentially result in discrimination. Black men and women are often cast into racialized roles and niches within the industry, potentially limiting their opportunities for career

[12] Unlike IR, this term is used to describe an array of different types of scenes, including black women performing alone, or with other men or women of any race.
[13] A study of Latina representation on the internet found that pornography was the most common type of content featuring Latinas, with sites promoting them as sexualized, "exotic objects" (Salinas 2006).

advancement. Asians and Hispanics are also often typecast into racialized roles. Multi-racial/ethnic performers may, on the other hand, have advantages, if they are able to "pass" between different racial and ethnic categories.

Taken together, the effects of race, gender, and age lead us to the following demographic-based hypotheses:

Hypothesis 1a: Upon entering the adult film industry, the career success and length of performers will be highly associated with gender.

Hypothesis 1b: Upon entering the adult film industry, the career success and length of performers will be highly associated with race.

Hypothesis 1c: The pacing of female performers through different types of films will be determined by race.

Hypothesis 1d: Younger female performers will face a lower risk of career exit and enjoy a higher rate of performance than older performers.

The Effects of Cumulative Advantage and Overexposure

As noted, success in the mainstream (non-pornographic) film industry is largely path-dependent, perhaps this is best underscored by the commonplace notion of the "big-break". This phrase indicates an aware ness of the non-linear dynamics

that govern success in certain creative industries, where the story of rampant inequality in levels of success may be partially explained by the presence of a "Matthew Effect".

The rich-get-richer effects present in adult film may occur via the same mechanisms that we see in the mainstream film industry. Performing in films may inherently lead to more success by helping a performer develop a larger audience, by introducing the performer to new potential collaborators and broadening their network, or by leading to awards or other forms of recognition that may increase their marketability. These are mechanisms that we would also expect to be present in the mainstream film industry. Therefore, we suggest the following hypotheses:

Hypothesis 2a: Performing in more films (and having a larger audience) will lead to future career success (decreased risk of exit).

Hypothesis 2b: Having more co-performers will decrease the risk of career exit.

Hypothesis 2c: Having more awards (or nominations) will decrease the risk of career exit.

In adult film however, there are mechanisms that are in place that may undermine the career advantages bestowed by prior success. The careers of female performers decline if they "become too familiar" with their audiences (Abbott 2000).

There is exacerbated by the constant demand for "fresh" faces to enter the industry, putting pressure on performers. Males performing in gay porn face a similar dynamic, a performer's "fantasy potential" diminishes over time, as their clients become bored with them (Escoffier 2007). Performers must therefore carefully manage their image. If a performer becomes overexposed, he will tend to work in lower budget productions, be paid less money for the same scenes, engage in sex acts he had previously refused, and will ultimately lose status in the industry (Escoffier 2003, 2007). This process is particularly acute for workers engaging in what Mears and Connell (2016: 335) call "display work" such as pornography and stripping, where "the primary exchange of bodily capital is for the purpose of visual consumption, either in image, video, or in direct contact for a wage." The longer a performer remains in the industry, the greater their risk of "overexposure" (Abbott 2000; Escoffier 2007). At the most basic level, we expect that performers who appear too frequently will, *ceteris paribus*, be at higher risk for career exit than those who perform less frequently.

> *Hypothesis 2d: A female performer will face increased risk of career end if she performs too frequently.*

Specializing, Sequencing, and the "Fundamentally Retrogressive" Dynamic

Work on mainstream film has noted that one strategy for succeeding in film comes from associating oneself very strongly with one type of early in one's career as a means of establishing a foothold in an industry. Performing too widely, too early may

also make it difficult for producers to typecast a performer, limiting their career opportunities (Zuckerman et al. 2003). Mainstream film performers will slowly expand their niche width over the course of their careers, starting off with more specialized identities before developing more generalized ones (Hsu 2006).

Hypothesis 3a: Appearing in new types of adult films will decrease the number of films a performer appears in.

In adult film, however, the demand for novelty and the risks of overexposure may drive performers in the opposite direction. An alternative strategy for sex workers managing the risks of "overexposure" was first noted in Paul Cressey's 1930's examination of taxi-dance halls in Chicago. In these dance halls, young girls would sell dances to male patrons. The "life cycle" of these dancers, had a dynamic that was described as "fundamentally retrogressive." After a short period of time, a dancer would find that the relatively high-status clientele had tired of her and moved on to newer dancers. Dancers would thus either move to lower-status racial groups within the dance hall or move onto new dance halls that primarily catered to lower-status groups. Alternatively, dancers might modify their appearance (hair-coloring), or dance in a more sexually explicit fashion in order to maintain their novelty and appeal while competing with newer dancers. Progressing through these stages and working harder and/or accepting a lower status role was "almost inevitable."

Other examinations of more contemporary forms of sex work and sexualized display work has found similar retrogressive trajectories. In straight porn, prior work

suggests that women must carefully manage their progression through the industry in order to minimize their risk of overexposure. This typically means slowly progressing from lower paying scenes, like solo masturbation or "girl/girl" (lesbian) scenes, to "boy/girl", and then higher-paying scenes that involve anal sex, sex with multiple men simultaneously, or "interracial" sex with a black male co-performer (Abbott 2009: 50). While jumping into these higher paying scenes immediately may offer greater rewards in the short-term, it is widely believed that in the long-term performers can earn more for these scenes after they have built up a reputation. For example, male performer Lexington Steele argues that a woman can earn the most if she moves in sequence from "girl-girl to boy-girl to anal to DP [double-penetration]" and then can "charge her most when she finally does interracial."

This type of career trajectory is not only contrary to what we might expect to see in mainstream film, where performers become more instead of less desirable after developing a respectable CV, but also goes against the finding in mainstream film that establishing oneself in a "niche" can be beneficial to one's career. In mainstream film, the goal of performers is to establish themselves as a reliable type of performer in one niche, and then broaden. In adult film, female performers must maintain their novelty and manage over exposure, and their career longevity may be threatened by remaining in a particular niche.

Hypothesis 3b: Appearing in new types of adult film will increase the number of films a performer appears in.

Technological Changes in the Adult Film Industry Over Time

Finally, we suspect that these dynamics will have changed over time as the industry has adapted to technological changes. By the 1990s the industry was largely dominated by a few major studios in California and films were distributed by VHS cassette and on cable television. The availability of home video cameras and the adoption of internet has driven down the cost of both production and distribution, radically altering the nature of the industry. These changes have been further exacerbated as free video-streaming websites have become one of the primary means through which people consume pornography and have taken revenues away from production and distribution companies. There has been little work, however, on how these changes have affected performers. There is not much reliable data available on salaries but Tarrant (2016: 51) contends that pay has declined since the industry peak in the late 1990s and early 2000s. On the other hand, the internet and social media has created new opportunities for performers to market themselves (many are on Twitter in particular, since it allows pornography) and to supplement their income via alternative revenue streams, for example performing live sex acts for clients on webcam ("camming") or creating and selling their own content (Berg 2016; Berg and Penley 2016; Schieber 2018). This may give performers more control over their careers and allow them to stay in the industry for longer. As these technological changes have altered the structure of the industry they may have also affected the dynamics of individuals' careers within it.

Furthermore, as we have discussed in the previous section, a number of industry insiders have suggested that the threat of overexposure and the need to delay or avoid certain types of scenes may be waning. It may be the case that norms within the field about the conventional patterns of typecasting and category affiliation have shifted (Rao, Monin, and Durand 2003). We expect to see differences in career patterns over time, which may also interact with the other mechanisms of interest. Thus,

> *Hypothesis 4: Compared to the period before the World Wide Web, performers have a higher (lower) risk of career failure (a) when the World Wide Web became a popular way to access pornography (1991-2006), (b) when the tube websites began to be the primary means through which pornography is consumed (2007-present).*

Data and Methodology

Data

We draw upon multiple sources of online data to conduct our analyses. We have obtained two distinct sets of information from which we can reconstruct the careers of individual performers and have augmented this with other information available online. In addition, we have collected information on major industry awards, which we can then match to performers in either dataset. We begin by briefly describing each of the three datasets before discussing how we have transformed them to address our hypotheses.

The Tube data consists of data on all videos uploaded to one of the largest pornography streaming services from 2007 until 2018. The data consist of over 4.2 million videos. We discarded videos where no performers were listed, resulting in 357,492 videos featuring one or more named performer. We filtered out videos with duplicate titles, choosing the first occurrence, although as we discuss below we expect that duplicates will be present. Each of these videos includes information about the types of sex acts performed in a set of categories and tags assigned to the video. For each performer in the dataset we also collected information on their profile pages including their ethnicity, data of birth, birthplace, and measurements, and other characteristics like eye-color, hair-color, and tattoos, although a large proportion of this data was missing. For our analysis we only consider ethnicity and data of birth as it was included considerably more often.

The Wiki data consists of data collected from an online wiki devoted to pornography. Unlike Wikipedia, where only the website administrators are able to edit the archive, an established group of people maintain and update records, but interested parties can send information or request changes. Each performer has a profile page containing similar information to the previous website, as well as information about the films they performed in, including what sex acts they participated in.

Each of these data sources can be used alone to reconstruct the career trajectories of individual performers. Each has its own benefits and drawbacks. The Tube data constitutes a relatively uncurated record of pornographic performances, allowing us to track a smaller number of performers in fine-grained detail over time. There are two main drawbacks to this data. First, the data cover a shorter period, so

more careers are “right-censored” (we do not observe them ending). It also means we are unable to observe the industry prior to the internet and the widespread adoption of these websites. Second, we have no way to verify that each video uploaded is unique, indeed it is common for many clips from the same scenes will be repeatedly uploaded. This makes these data an unreliable way to measure career duration, since videos can continue to be uploaded well after a performer has stopped performing. This may be particularly acute for more successful performers, leading us to overestimate their success. That said, we can leverage the fine-grained nature of these data to study sequences of *debuts*, since we are only interested in the first event we can safely ignore any repeat uploads. We thus use these data to model the effects of differences in sequences of debuts on performers’ popularity, measured by rate their videos are uploaded and the amount these videos are viewed, which we model using negative binomial regression.

The Wiki data is more carefully curated, so should be free from duplicates, and the person-level data appear to be more complete. The data also cover a much longer period, so we can see more complete careers and observe performers who entered the industry prior to the invention of online pornography. On the other hand, for around 80% of the films listed on the website we were only able to obtain the year the film was released (and not the date), we are unable to observe within-year sequences of events for most performers. We use these data for discrete time event history models to model the duration of performers’ careers.

While such “ready-made” datasets contain problems that are generally less severe in the “custom-made” datasets typically used by sociologists (Salganik 2017),

triangulating between these two separate sources of ground truth we should be able to make up for the limitations of either dataset. Both datasets likely suffer from some selection bias with respect to who is included and what information we have about them. We expect that more information will be available for more successful performers, making them more likely to enter our dataset. We are thus less likely to observe people who have extremely short careers than extremely long ones. Our findings about career success should therefore be considered conservative estimates, since many failures will be unobserved. We are more likely to observe those to enter the industry as a long-term career rather than treat it as a short-term job (Abbott 2010). We supplement these two data sources with data on awards and from the websites of agencies. For the awards data focus on the Adult Video Network Awards—considered to be the Oscars of pornography—and the XBiz Awards, which are also prestigious.

Variables

The dependent variable in our analysis is when a performer's career in pornography ended. We must reconstruct each performer's career from the available data and identify this point. After inspecting the data we found that the final year a performance was observed was not necessarily a reliable measure, particularly in the Tube data, since some of the later values could be old videos re-uploaded. We thus decided to define the end as the last year in the first contiguous sequence of years with observed performances. For example, if someone performed in 2004, 2005, 2006, and 2008 we would define 2006 as the last year of their career. Since employment in the pornography industry is generally unstable, we do not expect that such breaks in

employment are the consequence of maternity leave, as may be common in other occupations. For the event history analysis, we have transformed our dataset to person-year format and construct a variable *career end*, equal to 1 if the observed year was the final year in a performer's career.

We use information on the types of sex acts performed to model their effects on career length and success. For the Tube data, many different categories are available. We choose several categories that reflect the general sequence of sex acts performed in film articulated in the quotes presented above and that are present in both datasets: solo female/mastrubation, lesbian, anal, double penetration, and interracial. (The interracial category currently aligns with the relatively narrow industry definition, white women performing with black men). Three of these categories represent types of sex acts that would be expected to come later in a performers career, while two of these categories represent types of sec acts that would be expected to come earlier. To model the effects of performing particular sex acts, we construct dummy variables to denote whether a performer debuted in a category in a given year and whether a performer has previously debuted in a category. For models predicting when a performer will perform in a particular category we use the debut as the outcome variable of interest while controling for previous debuts in other categories.

From both datasets we were able to obtain basic demographic information on a subset of performers. Gender was available for most performers, although for the bulk of our analyses we focus only on females, due to the vast differences in career dynamics by gender. Ethnicity was available in both datasets, although was coded slightly differently. The Tube data contains the following categories: Asian, Black,

Latin, White, Indian, Middle Eastern, and Other. Due to their rarity we collapsed Indian and Middle Eastern into Other. The Wiki data contained these categories and more, as well as several very specific categories like “Caucasian/Black/Middle Eastern/Multi-ethnic”. We recoded these to follow the same schema as the Tube dataset, classing all new categories as Mixed/Other. We use dates of birth from each site to determine the age of each performer at the end of each year and we include age-squared terms to account for the accelerating or diminishing effects of age.

In addition to these demographic variables we can construct dynamic variables that capture information about performances. Career-year, where first year observed has a value equal to 1, is used to demarcate each time period in the EHA. We construct dummy variables for each cohort, which we use to account for cohort effects. The number of films performed each year allows us to model how prolific a performer is, its squared term is also added to capture whether performing many films can result in overexposure, or at the very least diminishing returns. We construct co-performance networks, where an edge exists if two actors performed in the same film, and calculate the PageRank statistic to model the centrality of an actor in the overall network for each given year. This is included to help account for status effects. Using the AVN data we construct dummy variables indicating whether a performer has previously won an award or been nominated for one.

Analysis

The analysis will procced in three parts. First, we will use negative binomial models to test the influence of gender, race, calendar year of career beginning, age, and

appearing in certain film types to on the total number of films the performers appear in on both the Tube and Wiki datasets (testing hypotheses 1a, 1b, 3a, 3b, and 4). Second, we will use discrete time event history models on the Wiki dataset to test the influence of age, awards, prior appearances, debut status, and longevity on the likelihood of a performer seeing the end of their career. Finally, we will use discrete time event history analysis again with the Wiki dataset, to test both how the debut status of an individual both influences their likelihood of appearing in other debuts, and how debuts may in new categories may be accelerated or delayed by other covariates.

Negative Binomial Models of Total Film Appearances

For the first part of all analysis, we perform a series of negative binomial regressions in order to estimate the total number of films that each performer has appeared in over the course of their career. Some of these totals, particularly for more recent entrants into the adult film industry, are right censored. However, given the typical brevity of careers in the adult film, we suspect this will only have a highly significant effect on all but the newest of entrants into the adult film industry.

For each of the two sets of data in our dataset, we use three different sets of models. The first model extends to all performers from whom we have information on age, gender, and ethnicity. We exclude performers in the Wiki dataset whose career began before the year 1989, and in both data sets we limit our analyses to performers who began their career between and including the ages of 18 and 39. In this way, we are focusing our analyses on performers about whom some information is documented, and are disproportionately selecting performers who have had more

success in the industry. Given the high volume of participants who appear in only a small number of films, we believe the analysis will still contain a fair number of participants whose total career success is quite limited. For the second model, we exclude male performers who have appeared in films targeted at the male homosexual audience, thus limiting our analysis to those who are predominantly performing for heterosexual men. For the third set of models, we analyze only those who are tagged as female, and add binary terms for whether they appeared in certain types of sex acts or films over the course of their careers. We include three categories that women are believed to "work up" to: scenes featuring anal sex, interracial sex, or sex with two male partners simultaneously ("double penetration"), and two "softer" categories that female performers are thought to perform in towards the beginning of their careers: lesbian scenes and solo/masturbation scenes.

In each of the three sets of models, the age of the performer at the beginning of their career, the ethnicity of the performer, and the gender of the performer are included as predictors, as well as two-way interaction terms between each pair of these three key demographic variables. We also include factor variables for the calendar year in which each performer began: this simultaneously accounts for changes in the industry over time, and the possibility of right censoring towards later years. Unfortunately, in this analysis distinguishing between these two factors is challenging given the nature of the data.

In Table 1, descriptive statistics for these two datasets (and their subsets) are shown. In Table 2, results for models using the Wiki dataset are shown (less factor variables for calendar year). In Table 3, results for models using the Tube dataset are

shown (less factor variables for calendar year). In Figures 1a and 1b, the coefficients for each calendar year are shown for Wiki and Tube models respectively.

	Wiki			Tube		
	All	Heterosexual	Women	All	Heterosexual	Women
Performers	13207	11576	10240	5075	4932	4847
Proportion Female	0.775	0.885	1	0.955	0.983	1
Age on 12/31 of First Year	23.6	23.5	23.1	26.7	26.5	26.4
(Std. Dev.)	(4.6)	(4.6)	(4.3)	(5.3)	(5.2)	(5.2)
Proportion Asian	0.049	0.055	0.061	0.046	0.051	0.051
Proportion Black	0.070	0.066	0.055	0.059	0.054	0.052
Proportion Hispanic	0.082	0.083	0.089	0.084	0.084	0.084
Proportion Other	0.078	0.082	0.084	0.006	0.006	0.006
Total Films	75.0	75.9	60.8	80.7	77.4	76.8
(Std. Dev.)	(175.0)	(174.6)	(112.9)	(153.5)	(149.1)	(149.5)
Proprortion Appearing in:						
Anal			0.487			0.698
Interracial			0.463			0.513
Double Penetration			0.192			0.376
Lesbian			0.621			0.669
Masturbation			0.535			0.680

Table 4 - Descriptive statistics for data used to fit the negative binomial regression models of total number of films.

Table 1 indicates that the data sets overall tend to be skewed towards women. This may partially because they are the main focus of most of the industry and are therefore more likely to have data available on them, and this may partially be because more women are cycled through the industry, while men tend to have longer tenures upon entering the profession. In both the Tube and the Wiki dataset, we also see that the standard deviation of the total films far exceeds the mean of the total films, indicating that the dataset is overdispersed. The ethnicity of the performers tends to be

predominantly white, with non-white performer totals in the 15-30% range for each different subset of the two datasets.

The models themselves (Tables 2 and 3) reveal that being male, in each dataset is positively and significantly associated with appearing in more films. Once again, there are issues of selection here, as only the men who are very prolific may have details about themselves available in the data, but this result does go along with what has been reported in more detailed descriptions of the adult film industry. Results on race and ethnicity vary somewhat, but in each dataset being a black woman is significantly associated with a lower film total. Entry age coefficients tend to be negative and significant, as expected, but positive squared terms also suggest the effects may be more complicated than initially hypothesized.

While the coefficients for each calendar year are not listed in the tables, they are displayed visually in Figure 1a and 1b. In both data sets, there is a downward trend over time. The more recently a performer began their career, the lower we expect their total number of performances to be when holding other demographic variables constant. While this would be expected if we suspect that more recent entrants have not yet seen their full careers "play out", it seems insufficient to explain the overall negative trend in the Wiki models from 1989 to 2018 (although it does likely explain the more rapid descents in the last few years of both models.) In general, this finding supports the idea that the advent of internet pornography and the world wide web has led to more precarious positions for all performers.

In each of the models for the film totals of women only, at least one appearance in each of the 5 types of films identified was positively associated with a

higher overall film total. If we assume that performers will happen to be a wide variety of films given a longer career in the industry, this result both seems logical and uninteresting. However, if we consider the decision to perform in a more distinct type of pornographic scene to be a deliberate career choice with either positive or negative career consequences, there is mild support for the hypothesis that acting in an additional film type is beneficial for overall career length, as opposed to specializing in only one type of film. The next sets of models will examine the effect of this further.

	All Performers	Hetero W/M	Women
Male	0.510***	0.900***	
	(0.03)	(0.05)	
Asian	-0.630***	-0.620***	-0.340***
	(0.05)	(0.05)	(0.04)
Black	-0.470***	-0.460***	-0.430***
	(0.06)	(0.06)	(0.04)
Hispanic	-0.090*	-0.093*	0.210***
	(0.04)	(0.05)	(0.03)
Mixed/Other	0.410***	0.410***	0.390***
	(0.05)	(0.05)	(0.03)
Age - 18	-14.000***	-13.000***	1.00
	(1.60)	(1.50)	(0.97)
(Age - 18)^2	6.800***	6.200***	5.400***
	(1.50)	(1.40)	(0.96)
Male * (Age - 18)	23.000***	9.000*	
	(2.90)	(4.00)	
Male * (Age - 18)^2	-28.000***	-25.000***	
	(2.80)	(3.50)	
Male * Asian	0.14	-0.840*	
	(0.29)	(0.34)	
Male * Black	0.240**	0.320**	
	(0.09)	(0.11)	
Male * Hispanic	-0.18	-0.18	
	(0.11)	(0.18)	
Male * Mixed/Other	-0.61***	-0.630***	
	(0.11)	(0.15)	
Female Performer Appears In:			
Anal			0.100***
			(0.03)
Interracial			0.640***
			(0.02)
Double Penetration			0.210***
			(0.03)
Lesbian			0.940***
			(0.02)
Masturbation			0.840***
			(0.02)
Constant	4.800***	4.800***	3.100***
	(0.13)	(0.15)	(0.13)
Observations	13,207	11,576	10,240
Theta	0.650*** (0.007)	0.640*** (0.007)	1.200*** (0.015)

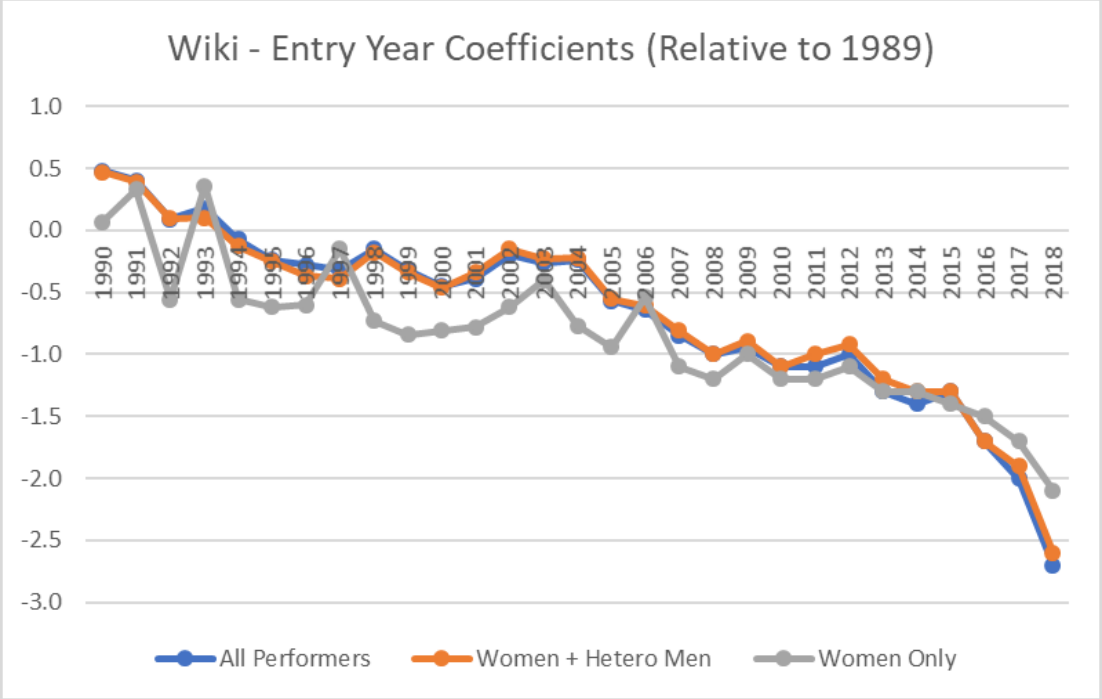
*p<0.05; **p<0.01; ***p<0.001

Table 5 - Negative Binomial regression models for appearances using Wiki Dataset

	All Performers	Hetero W/M	Women Only
Male	0.860***	0.710*	
	(0.13)	(0.27)	
Asian	-0.210**	-0.210**	0.076
	(0.07)	(0.07)	(0.05)
Black	-0.160*	-0.160*	-0.150**
	(0.07)	(0.07)	(0.05)
Hispanic	-0.160**	-0.160**	-0.066
	(0.06)	(0.06)	(0.04)
Mixed/Other	1.000***	1.000***	0.630***
	(0.20)	(0.20)	(0.15)
Age - 18	-22.000***	-21.000***	-11.000***
	(1.20)	(1.20)	(0.83)
(Age - 18)^2	10.000***	9.600***	5.000***
	(1.20)	(1.20)	(0.82)
Male * (Age - 18)	-4.00	-6.00	
	-9.20	-20.00	
Male * (Age - 18)^2	0.99	3.50	
	-6.40	-12.00	
Male * Asian	-0.49	-2.500**	
	(0.57)	(0.90)	
Male * Black	0.16	-0.12	
	(0.20)	(0.36)	
Male * Hispanic	-0.29		
	(0.35)		
Male * Mixed/Other	-0.46	0.31	
	(0.81)	(1.10)	
Female Performer Appears In:			
Anal			0.520***
			(0.03)
Interracial			0.530***
			(0.03)
Double Penetration			0.460***
			(0.03)
Lesbian			0.660***
			(0.03)
Masturbation			0.930***
			(0.03)
Constant	5.900***	5.900***	2.900***
	(0.33)	(0.33)	(0.24)
Observations	5,075	4,932	4,804
Theta	0.840*** (0.015)	0.830*** (0.015)	1.700*** (0.034)

*p<0.05; **p<0.01; ***p<0.001

Table 3 - Negative Binomial regression models for number of film appearances using the Tube Dataset



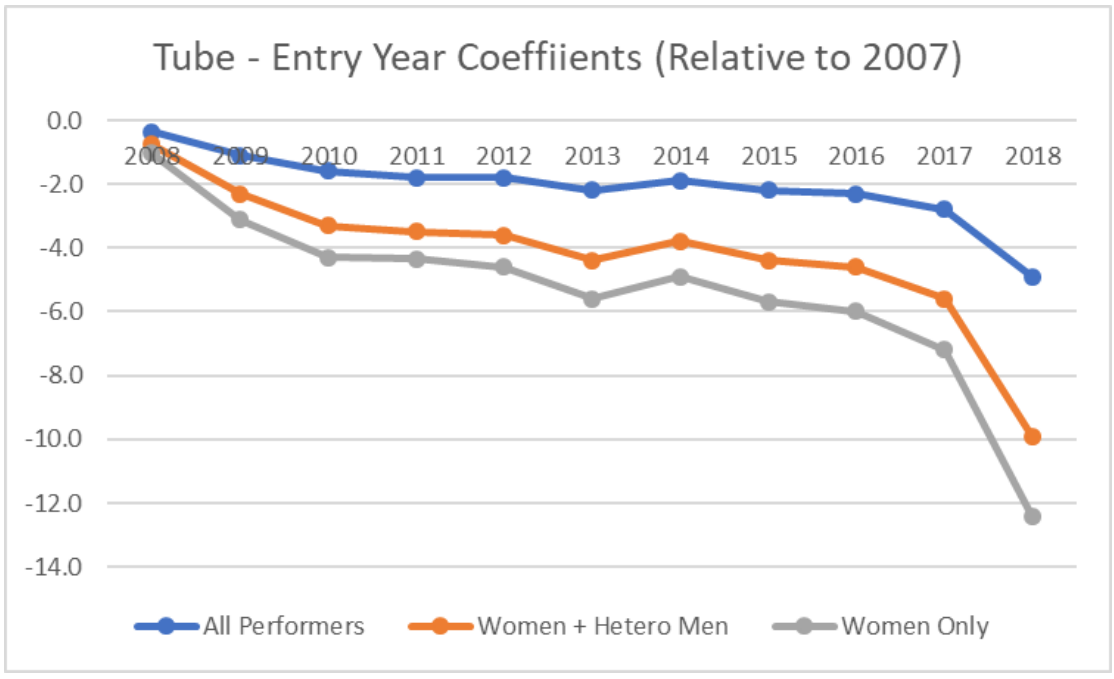


Figure 8a (top) and 1b (bottom) - coefficients for entry years for Negative Binomial models of film totals from Wiki (top) and Tube (bottom) datasets.

Discrete Time Event History Analysis Models of Career Exit

The likelihood of an individual performer's career ending can also be modelled in order to understand not only the effect of how an individual's demographic characteristics influence their likelihood of continuing their career, but also their prior levels of success, the amount of time that they have spent in the industry, and the types of films in which they have performed. The models in this portion of the paper focus specifically on women, as their careers are likely to be the sight of potentially counteracting "cumulative advantage" and "overexposure" dynamics. The analysis also draws on data from the Wiki dataset, rather than the Tube, as it appears to be a more accurate one-to-one record of each film. Tube, on the other hand, may have the same film uploaded more than once, and does not have a body of industry enthusiasts attempting to archive each individual performance.

The data used for this set of modes and the next portion of the analysis focuses on women appearing in adult films performing between the years of 1989 and 2017 (2018 is excluded, but is used to determine whether or not a performer exited the industry after 2017). Once again, performers must have data available on race and ethnicity and age in order to be included in the analysis. Furthermore, we also exclude women who are 40 or older, due to sparsity of data availability and the potentially high influence of outliers on variables modeling career length or age. Summary statistics for this set of 44,457 performer-years are shown in Table 4.

Variable	Mean	SD
Age	26.00	4.74
Asian	0.043	
Black	0.005	
Hispanic	0.085	
Mixed/Other	0.081	
Films This Year	11.42	17.05
Normalized Page Rank	0.00	1.00
Co-performers	75.61	96.45
Log(Old Co-performers)	2.09	1.66
Log(New Co-performers)	3.16	1.34
Won Award	0.005	
Nominated, Did Not Win	0.038	
Anal Debut	0.096	
Post Anal Debut	0.443	
IR Debut	0.185	
Post IR Debut	0.425	
DP Debut	0.059	
Post DP Debut	0.292	
Lesbian Debut	0.122	
Post Lesbian Debut	0.572	
Solo/Mast Debut	0.101	
Post Solo/Mast Debut	0.451	
Observations		
Performer-Years	44,457	

Table 4 - Descriptive Statistics for female performer-years included in the dataset for event history models of career exit and debut types.

The number of performers in the industry within our dataset does not stay constant over time, and generally increases. While an increasingly competitive landscape in the adult film industry may account for this, it also may be the case that we simply have more data available on performers who have entered the adult film industry more recently. Figure 2 shows how the number of female performers have increased over time, split into performers who remain in the industry for the next year

and those who exit. The secondary axis and dark black line show the percentage of female career performers who exit at the end of any given year. As we can see this rate increases over the second half of the time period examined and increases drastically in the last 5 years. While the potential of data not missing at random from our dataset limits the conclusions that can be drawn about the changing nature of the adult film industry, the pattern is still worth noting. Furthermore, it is sufficient justification to control for calendar year when modelling the probability of career exit.

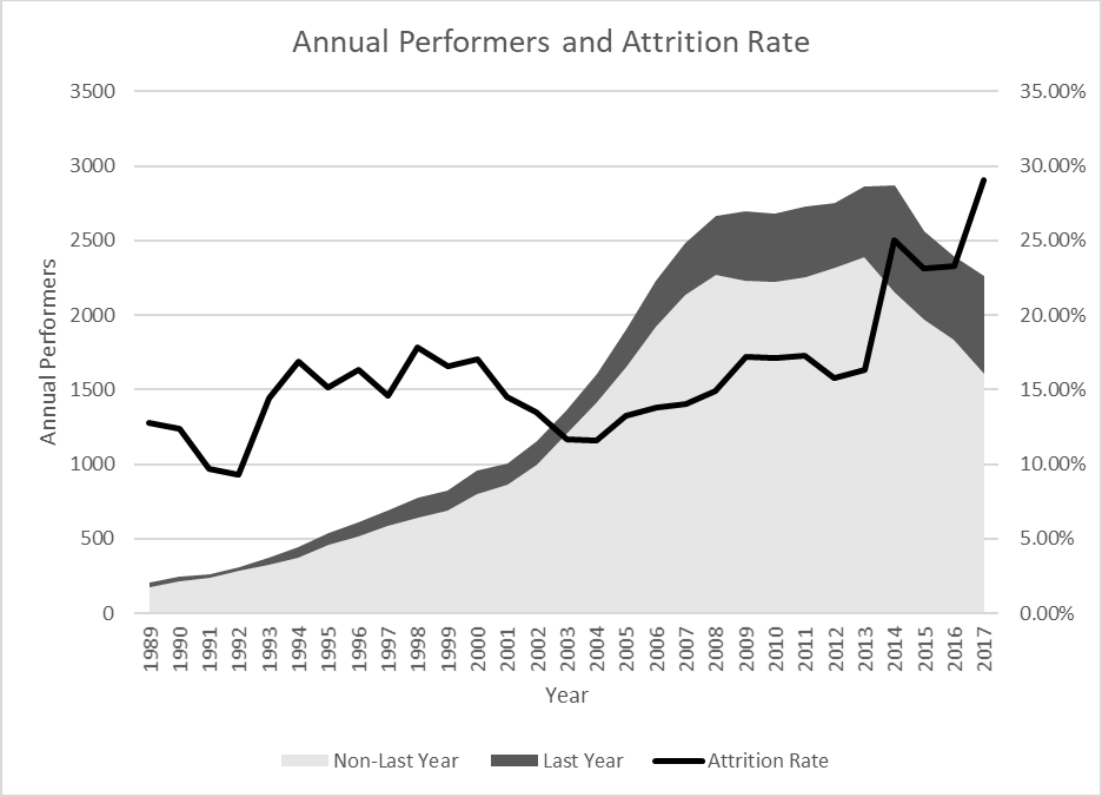


Figure 2 - Total number of female performers by year, with the shaded area and left-axis indicating the number of performers who continue in the next year versus those who do not, and the line and right-axis indicating the "attrition rate" (percentage of performers exiting) in any given year.

To model the risk of a performer's career ending, we use a discrete time event history model. This allows us to incorporate the time data available for each film

performance in the Wiki dataset in a survival analysis framework, even though we lack specific dates for each film. This type of analysis resembles a logistic regression, where we are attempting to predict which performer-years within the dataset correspond to the final year of a performer's career.

The overall results are shown in Table 5. Career years are modelled in a way that allows us to simultaneously account for the accelerating or decelerating effects of career length on a performer career, but also allows us to account for unique findings in the first year of the dataset (which may be "left-censored" and thus shorter for many performers). This is accomplished by including a binary variable for whether or not a performer is in their first calendar year in the adult film industry, and otherwise modelling the number of years (and years-squared) performers are beyond their second calendar year in the industry. The risk of exit tends to increase, and accelerate, for each year beyond a performers second calendar year in the business. Lending credibility to the idea that there is a demand for "fresh faces" in the industry. Similarly, age is also associated with an increased risk of exit, and this effect also has a positive and significant squared term, suggesting it too, accelerates (for performers aged 18-39, at the very least.)

Ethnicity also plays an important part in predicting career exit, as the odds of career exit in any given year are significantly higher for Asian or Black female performers compared to their White counterparts. However, there is a decreased risk for those with ethnic classifications that do not neatly fit into the 4 other ethnic categories, supporting the idea that ethnic ambiguity can be an asset for performers in the industry.

The number of films a performer appears in during any given year is also a strong predictor of whether a performer will stay in the industry. After accounting for the number of calendar years a performer has already spent in the industry, performing in a higher number of films is negatively associated with the risk career exit. However, the squared term is negative – suggesting not surprisingly that there are diminishing returns to performing in additional films as far as career longevity is concerned, or that there is indeed a penalty for "overexposure."

The effect of the number of co-performers a performer has on the probability of career exit is negative and significant for new co-performers, but this is not so for old co-performers. Furthermore, individuals that have a more central position within the network of performers, all else being equal, actually have a significantly higher probability of leaving the industry. Performers who have received an award do not show a significantly different risk of leaving the industry compared to performers who have neither won nor been nominated, but performers who have been nominated have a decreased risk of career exit compared to those who have not been nominated, and curiously seem to face more favorable long term career prospects than those who have won.

For four of the five sex act debut types that we are interested in examining, we see that debuting in two of the three allegedly later career sex acts (Anal, IR, not DP), and one of the two earlier career acts (Lesbian, not Solo/Masturbation), are negatively associated with career exits. However, performers who continue to perform in these areas after they have already debuted in them do not have a lower risk of career exit. However, "post-debut" status is only negatively associated with career exit in each of

the early career acts. There do not appear to be sustained career benefits from performing in Anal and IR films, the decreased risk of career exit is only enjoyed by performers who are new to these categories. This, taken together, suggests that performers may only temporarily be improving their career prospects by debuting in anal or interracial films. Predicting when these debuts occur may shed more light on these dynamics.

	Career Exit
(Intercept)	-4.14***
	(0.524)
Longevity	
Career Year = 1	-0.541***
	(0.0533)
(Career Year - 2)	66.6***
	(6.69)
(Career_year - 2)^2	22***
	(3.91)
Age	0.119***
	(0.0328)
Age^2	-0.00201***
	(0.000584)
Ethncity	
Asian	0.443***
	(0.0625)
Black	0.271***
	(0.061)
Hispanic	-0.071
	(0.0512)
Mixed/Other	-0.195**
	(0.0602)
Cumulative Advantage	
Films This Year	-713***
	(22.2)
Films This Year^2	177***
	(8.36)
Cumulative Films	-109***
	(7.59)

Cumulative Films^2	82.4***
	(5.41)
Social Networks and Awards	
Normalized PageRank	0.155***
	(0.0394)
Log(Old Coperformers)	-0.0077
	(0.0209)
Log(New Coperformers)	-0.168***
	(0.0234)
Won Award Last Year	0.248
	(0.515)
Nominated, Did Not Win Award Last Year	-0.771***
	(0.162)
Debuts	
Anal Debut	-0.239***
	(0.0698)
Post Anal Debut	0.0552
	(0.0437)
IR Debut	-0.195*
	(0.076)
Post IR Debut	0.0169
	(0.0381)
DP Debut	-0.129
	(0.0963)
Post DP Debut	-0.019
	(0.0462)
Lesbian Debut	-0.155**
	(0.0585)
Post Lesbian Debut	-0.223***
	(0.0411)
Solo/Masturbation Debut	0.182**
	(0.0584)
Post Solo/Masturbation Debut	-0.147***
	(0.0389)
N	44457

Table 5 - Discrete Time Event History Analysis of Career Exit

Discrete Time Event History Analysis of Sex Act Type Debuts

Using a similar approach to the models of career exits, we can also estimate whether a performer will debut in a certain type of sex act in any given calendar year.

The modelling approach changes slightly, as we are now modelling whethersomething occurs during a year, as opposed to the career exit model when we were modelling whether or not the absence of any events in the following year. The terms that are used to model the dynamics of cumulative success, over exposure, and social capital are thus lagged by one year (the number of films performed in, PageRank, and the cumulative co-performers as of the prior year.) In each dataset, we also filter out performers who are "post-debut" in the sex act of interest, and in the case of interracial, we limit our model to White and Asian performers (given the narrow definition of interracial performance and the unique attention paid by the industry and its customers to White and Asian females co-performing with black males). The results of these models are shown in Table 6.

Several directional patterns appear across the coefficients for all five models. In general, most dummy variables for ethnicity are negative and statistically significant, suggesting that non-white performers may be able to rely on their own racial identity for a sense of novelty (and in turn, may only be valued for this aspect), but that white performers may be more likely to perform to unique sex acts to maintain their appeal.

Another interesting finding is that debuting in one category is often positively or negatively associated with debuting in another. Debut and Post-Debut status in each of the three allegedly later career sex acts (Anal, IR, DP) are each positively and significantly associated with debuting in one of the other later career sex acts. However, debuting in one of the two earlier career sex acts is a negative significant predictor of debuting in each of the allegedly later career sex acts. This, and the fact

that the number of films appeared in is controlled for in this set of models, suggests that whether or not a performer is appearing in a certain type of film is not purely a function of how frequently they are performing in a given year. Performers may either have varying degrees of willingness to perform in more stigmatized sex acts, or may consciously prolong their entry into these categories in order to maintain their appeal.

Debut Model	Anal	IR	DP	Lesbian	Solo/Mast.
(Intercept)	-2.14**	-0.265	-6.87***	-1.84**	-3.36***
	(0.732)	(0.742)	(0.921)	(0.644)	(0.675)
Longevity					
Career Year = 1	0.186	-0.568***	-0.0331	0.403**	-0.214*
	(0.136)	(0.132)	(0.149)	(0.142)	(0.105)
(Career Year - 2)	-119***	-53.5***	-117***	-53.4***	-57.6***
	(14.2)	(10.4)	(16)	(11.4)	(8.44)
(Career_year - 2)^2	37.3***	24.2***	47.1***	-8.51	24***
	(8.55)	(6.49)	(8.92)	(11.5)	(4.83)
Age	-0.0629	-0.105*	0.0373	0.102*	0.0469
	(0.0489)	(0.0505)	(0.0578)	(0.0438)	(0.0427)
Age^2	0.0011	0.00214*	-0.000781	-0.00215**	-0.00122
	(0.00091)	(0.000934)	(0.00108)	(0.00082)	(0.000796)
Ethnicity					
Asian	-0.757***	-0.421***	0.308*	-0.455***	-0.658***
	(0.117)	(0.112)	(0.131)	(0.0918)	(0.1)
Black	-0.339***		-0.666***	-0.353***	0.111
	(0.101)		(0.129)	(0.0871)	(0.0775)
Hispanic	-0.42***		-0.595***	-0.964***	0.11.
	(0.0842)		(0.113)	(0.0758)	(0.0646)
Mixed/Other	-0.177*		-0.42***	-0.262***	-0.0956
	(0.0823)		(0.0989)	(0.0769)	(0.0703)
Film Controls					
Films	61.1***	103***	94.4***	109***	99.9***
	(6.88)	(5.78)	(7.08)	(10.6)	(5.86)
Films^Squared	-88.9***	-128***	-82.7***	-215***	-90.8***
	(7.91)	(7.24)	(8.28)	(12.3)	(5.89)
Cumulative Advantage					
Films Last Year	-9.88	-29.4***	-46.9***	-129***	-4.98
	(7.52)	(6.08)	(8.68)	(29.8)	(5.45)
Films Last Year^2	46.4***	54***	57***	-101**	26.1**
	(7.99)	(10.6)	(8.03)	(34.7)	(9.95)
All Prior Films	-13	-24.6*	-44.8**	-226.	-57***
	(12.9)	(9.61)	(14.6)	(127)	(16.7)

All Prior Films^2	-9.01	-2.96	213.9	-128	-81***
	(12.4)	(9.73)	(8.66)	(111)	(24.4)
Social Networks and Awards					
Normalized PageRank	-0.111.	0.215***	0.00664	-0.217***	0.103*
	(0.0635)	(0.0614)	(0.069)	(0.0578)	(0.0494)
Log(Coperformers as of prior year)	0.0709.	-0.0955*	0.207***	0.0194	-0.0371
	(0.0425)	(0.0389)	(0.0441)	(0.0371)	(0.0309)
Won Award Last Year	0.348	0.0857	-0.991	0.925	-0.0814
	(0.663)	(0.584)	(1.05)	(1.14)	(0.666)
Nominated, Did Not Win Award Last Year	0.635**	0.353.	0.605**	-0.679	0.246
	(0.208)	(0.21)	(0.2)	(0.46)	(0.221)
Other Debuts					
Anal Debut		0.684***	4.11***	-0.0682	-0.617***
		(0.0648)	(0.107)	(0.0576)	(0.0612)
Post Anal Debut		0.53***	3.89***	0.179*	-0.367***
		(0.0799)	(0.117)	(0.0775)	(0.0661)
IR Debut	0.652***		0.762***	-0.239***	-0.331***
	(0.0591)		(0.0636)	(0.0564)	(0.056)
Post IR Debut	0.279***		0.207**	0.217**	-0.184**
	(0.081)		(0.0779)	(0.0702)	(0.0582)
DP Debut	4.21***	0.886***		-0.453***	-0.269***
	(0.109)	(0.0698)		(0.0735)	(0.0758)
Post DP Debut	0.915***	0.584***		-0.0931	-0.183*
	(0.209)	(0.0896)		(0.0916)	(0.0754)
Lesbian Debut	-0.156**	-0.174**	-0.445***		0.143**
	(0.0587)	(0.0624)	(0.0722)		(0.0498)
Post Lesbian Debut	-0.0228	-0.21**	-0.655***		0.487***
	(0.0788)	(0.0752)	(0.088)		(0.0578)
Solo/Masturbation Debut	-0.714***	-0.253***	-0.466***	0.0903.	
	(0.0662)	(0.0662)	(0.0802)	(0.0534)	
Post Solo/Masturbation Debut	-0.69***	-0.493***	-0.241**	-0.122	
	(0.0831)	(0.0791)	(0.0882)	(0.075)	
N	24761	20632	31480	19028	24387

Table 6 – Models of female performer debuts across five different sexual acts or performance types.

Discussion

The effects detectable from the negative binomial and event history models estimated suggest that succeeding in the adult film industry is sensitive to many different

dynamics. Time in the industry seems to negatively predict succeeding, but the number of films one appears in predicts continuing in the industry. Female performers who are members of ethnic minority groups tend to have shorter overall totals of film appearances and are less likely to cycle through a variety of sexual acts, suggesting that their ethnic status may give them unique inherent appeal. Appearing in one type of sex act may positively predict appearing in another type, suggesting that the "typecasting" strategy employed in the mainstream film industry may not be as successful in the adult film industry. The findings in the models presented here suggest that while there are some similarities, there also may be inherent differences between successful careers in the adult film and the mainstream film industries. In mainstream film, projects combine talented actors in different ways and success may be based on successful interactions between actors who have mastered their specific type of role or genre. While in adult film, success may be about individuals showcasing the entirety of their sexual repertoire and novelty. More generally, we might say that there are differences between what makes people succeed in a project-based industry based on projects (mainstream film), as opposed to project-based industries that use projects to highlight and showcase individual skills and attributes (adult film).

Furthermore, the challenges of succeeding in the "boundaryless" or "project-based" career largely revolve around the informal work one has to do to maintain opportunities for future employment, a burden that is absent from the traditional "organizational" career. While many industries defined by project-based work may favor those who have already proven themselves and "gotten their foot in the door",

the particular case of the adult film industry illuminates how this effect works when one's employability is both exhaustible within an industry and inversely correlated with age. As the employment-model in the United States continues to shift toward a more project-based model, these effects will become more important to understand. The importance of networking strategies and knowing what types of work to accept or reject may be generally important in industries where "success-begets-success" dynamics can easily be overpowered by "retrogressive" effects where employees, for whatever reason, lose their ability to either perform or obtain employment over time. Novelty in an adult film career may be exhausted over time, and perhaps so can the ability of a consultant to work a 70-hour week. Younger performers may have an advantage in the adult film industry, and younger computer programmers may have a cognitive advantage over their older counterparts. Further study is needed to understand not only which career strategies are effective in different employment scenarios, but the broader dynamics that characterize the industries and markets that require sophisticated career strategies in the first place.

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CONCLUSION

At first glance, there are several differences between the worlds of fighting in ice hockey and performing in adult film. The differences between the contexts and data sources of the two scenarios prohibit any sort of crisp comparison. Yet through the careful assembly and analysis of datasets on these two contexts, interesting conclusions can be drawn that can inform future work on how and why individuals pursue different roles within networks, organizations, and societies in general. These cases were selected as potentially similar examples of "dirty work", but the findings presented have implications that extend beyond this realm.

The career of an ice hockey enforcer or an adult film star, or indeed athletes and entertainers more generally, is based on obtaining a sequence of contracts to play or perform in a finite number of games or films. As careers in general become more "boundaryless", and industries become more "project-based", it can be expected that more individuals will be expected to navigate their own project-based careers. The sociology and management literature are both flush with examples of the importance of cumulative advantage. Obtaining the right "gig" can lead to new social connections leading to more opportunities, the accumulation of skills, and the absorption of prestige from high-status co-workers, projects, or firms. The everyday emphasis importance of "getting a foot in the door" or getting a "big break" suggest that there is also a colloquial awareness of cumulative advantage dynamics.

In the case of both fighting within ice hockey, and performance in adult film, there are limits to the number of performances one can presumably endure before their career comes to a halt. Within ice hockey, repeatedly suffering blows to the head can have serious health consequences that can bring one's career, or worse, one's life, to an untimely end. Fighting in ice hockey may be a way of keeping oneself in the game,

but it can lead players into a role that may be unsustainable, and the short-term careers they experience in hockey may prevent them from receiving training in other industries that may be more fruitful in the long run. Each fight an individual player involves himself in may lead to paychecks in the short-term, but ultimately diminish his long-term financial prospects.

There are parallelisms in the world of adult film, particularly for female performers in "straight" porn. Setting aside the potential physical and psychological consequences of sustained performance in the sex industry, there is a well-known "overexposure" effect both within adult film and sex work more generally. The more performances one participates in, the less appealing they become to consumers of pornography. An adult film performer may establish valuable ties in the industry with each additional performance, but the demand for her performances is known to diminish with each additional performance. Some gigs, indeed, may not be worth taking in the long run if they exhaust her appeal as a performer more than they enhance her opportunities for more work, but the short-term need for employment may often dictate how these decisions are made.

The dynamics in these specific cases are interesting because they go against the typical patterns of cumulative advantage that are ubiquitous in longitudinal sociological studies of success: increasing fights or performances simultaneously endows people with career connections, experiences, and symbolic capital, but can also decrease either the ability one may have to perform in the future or the demand for their work more generally.

While the two cases selected for this project were ultimately chosen as parallel examples of work that was both stigmatized, dangerous, undesirable, and gendered, the shared implications of the two cases may be most relevant to more mundane occupations and careers that are slowly becoming more "project-based." As the gig-

based economy grows, it is likely that both academic and popular literature will continue to emphasize the dynamics of cumulative advantage. The implicit or explicit practical conclusions drawn from these studies will encourage people to take jobs to build resumes, to network with other individuals, and to generally engage in behavior that is potentially costly in the short term in order to generate a cascade of cumulative advantage that they can capitalize on in the long term. The two cases studied in this dissertation demonstrate the limits of this career strategy. In certain project-based industries and boundaryless careers cumulative advantage will have its limits, and employees may need to strategically balance their finite ability to perform a task with their long-term interest in maintaining demand for their services.