

Essays on Intellectual Property Rights

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Abstract

Essays in Intellectual Property Rights

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This dissertation examines imperfections in how intellectual property rights are granted to inventions, as well as how a new organizational form, the Patent Assertion Entity, influences patenting and inventive activity. Although patents have been extensively studied for the economic activity they stimulate and have been used as measures of inventive activity and knowledge flow, little research exists on how patents are granted by the patent office. First, I look at patent lawyers' incentives and capabilities as they negotiate with the patent office to obtain patents for their clients. I find that patent lawyers obtain broad patents by concealing prior art on behalf of clients for whom they file the most patents. This effect is stronger when they work as associates in the law firm that employs them, or when they have prior experience as examiners at the patent office. I also find that patent lawyers protect their reputation by obtaining

a broad patent for their client when they service a large number of clients in the focal patent's technology area. Further, these effects are stronger when they are partners at law firms, or when they have prior experience as patent examiners. Second, I look at how examiners are biased when dealing with lawyers of a different gender and ethnicity than themselves. I unpack how stereotypes and occupational status create a multi-dimensional status ranking between the lawyer and examiner. Consistency between these rankings can motivate examiners to discriminate against or favor certain demographic lawyer groups, and also shape lawyer behavior towards examiners. Specifically, I find that White male examiners favor Asian male lawyers, while Asian male examiners discriminate against White male lawyers while allowing intellectual property claims. Contrary to expectations, I also find that Asian men favor white women by granting them more intellectual property. In my final paper, I study a new organizational form, the Patent Assertion Entity (PAE), that have emerged arguably as a consequence of these imperfections in the patenting process. PAE firms like Intellectual Ventures do not create inventions or products, but buy patents from inventors, bundle them into patent portfolios, and license these bundles to product manufacturers. Scholars have extensively debated their impact; some have argued that they incentivize the creation of incremental patents and inventions, while others contend that they create a market for the sale and purchase of incremental patents. I study their impact empirically on small firms that have fewer commercialization assets and likely to rely more on licensing revenues, vis-à-vis large firms that are more likely to create products. I find that they incentivize the creation of more, relatively incremental patents and inventions by small firms lacking commercialization assets. On the other hand, by providing a one-stop shop for such patents, they allow large firms to focus their efforts in the creation of fewer patents that are more novel.

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1 Introduction

Patents and Intellectual Property have long been studied for the important role they play in fostering economic growth. By offering exclusive rights over knowledge to their holders, patents create markets where knowledge can be traded and value from new knowledge can be appropriated (Arora et al. 2004). Due to its granular nature, patent data is also often used to measure innovation, knowledge flows, and the position of inventors and firms within inventive networks (Katila and Ahuja 2002; Sorenson et al. 2006). While these studies rely heavily on the objectivity of the data codified in patents, patents are socially constructed and subject to human biases that can taint the information they contain. For example, studies that use patents that are broader in scope than their underlying inventions can reach erroneous conclusions about those inventions. Further, overly broad patents that overlap with other patents often trigger competitive races between firms that acquire vast portfolios of incremental patents to stave off litigation from competitors, or to sign cross-licensing deals (Hall and Ziedonis 2001b). On the other hand, narrow patents that do not fully cover the underlying invention disincentivize inventors from creating ground-breaking new inventions. Thus, studying the patent grant process is important for both scholarship that relies on patent data, and for firm strategy. It is thus surprising that little work has examined the patent grant process, despite its importance.

First, I unpack the patent lawyer's interaction with the patent office, who is incentivized by clients and law firms, and might also vary in capability in dealing with the patent office. Next, I study the biases that the patent examiner at the patent office might have due to gender and ethnic differences with the patent lawyer. For these two studies, I assemble data for applications and corresponding patents, and create directories of lawyers, examiners and law firms. I

supplement this data with data from other sources, such as the census bureau, and Vault directories of law firms. I also interview patent lawyers and examiners to get first hand insight of how they view the patent grant process. In my final study, I examine the impact of a new organizational form, the Patent Assertion Entity (PAE), that has arguably emerged as a consequence of these imperfections in the patenting process. I examine their impact on inventive and patenting activity between two sectors of inventors-small firms that have relatively limited commercialization assets, and large firms that have substantially more capability to build products and services. Towards this end, I combine patent data from the USPTO with proprietary data on patents held and litigated by Patent Assertion Entities.

2 Client capture, employment revolving doors, and compromised professional judgment: The withholding of known relevant prior art by patent lawyers on behalf of their clients

2.1 Introduction

A distinguishing feature of professionalized occupations, such as law and medicine, is the notion of *trusteeship*; that is, occupational members (e.g., lawyers, physicians, auditors) have a loftier purpose than their own commercial pursuits and a moral responsibility to protect the interests of clients and society more generally (Suddaby and Greenwood 2005; Von Nordenflycht 2010). Client and societal interests frequently conflict, however, and when they do, professionals are expected to be impartial in their judgment and yield to the interests of society (Gunz and Gunz 2008). Indeed, being unduly partial to the interests of one's clients can harm society (Suddaby and Greenwood 2005). For example, although individual patients may benefit from being prescribed antibiotics preemptively by their physicians, the over-prescribing of antibiotics can lead to drug-resistant strains of various diseases that are detrimental to the broader public (Ventola 2015). Enron's high-profile downfall and the loss of billions of dollars in investor funds is commonly attributed to the choices made by a small number of auditors to forego their professional responsibilities to society to advance the immediate interests of their client.

Rarely, however, do the individual choices made by professionals to favor client interests at the expense of their professional obligations deliver societal consequences as calamitous as those that stemmed from Enron's demise. The decision by any one physician to preemptively, and perhaps unnecessarily, prescribe antibiotics to any one patient is unlikely, by itself, to produce harmful drug-resistant strains. Societal damages in these situations are attributable to the

accumulation of relatively routine, yet improper, actions of numerous professionals across multiple interactions with multiple clients. When culpability for the systemic consequences of their judgments is highly dispersed, professionals can easily rationalize favoring the immediate interests of a highly salient constituency, such as paying clients, at the expense of the longer-term interests of a relatively amorphous constituency, such as society (Bazerman et al. 2002). Professionals, in particular, possess high levels of autonomy that allow their self-serving biases to influence the subjective judgments they make when representing their clients. Bazerman and colleagues (2002) go so far as to suggest that, due to their inherent self-serving biases, it is naïve to expect professionals to prioritize consistently the interests of society over those of paying clients; professional improprieties may be as much due to subconscious justification as it is to deliberate deception. Whether deliberate or subconscious, however, the damages that result from the small-scale improprieties of large numbers of professionals may be more detrimental than those from the highly egregious and unambiguous misdeeds of a few. Moreover, professional impropriety can be a slippery slope; minor, undetected misconduct often leads to the acceptance of more severe misconduct (Gino and Bazerman 2009). Unconscious bias may evolve into conscious corruption (Bazerman et al. 2002).

A prime suspect in triggering the self-interest and self-serving biases that compel professionals to shun their professional obligations to society is the extent to which they are “captured” by their clients. *Client capture* refers to the process by which professionals become so beholden to particular clients that their professional judgment and impartiality become compromised (Gunz and Gunz 2008; Leicht and Fennell 2001). The prevalence of client capture has long been questioned, particularly when high-profile cases surface for which professionals have irrefutably disregarded their professional duties to society (Langevoort 2012). Nonetheless,

there has been relatively little theoretical development or systematically derived insight on when professionals are more likely to succumb to client capture, as revealed through their compromised impartiality and judgment. In general, behavior, proper or improper, is a function of incentives and capabilities (Hillman and Dalziel 2003). In this study, we consider the underlying incentives and capabilities of professionals who contract their services to clients and explore when it is that they are more likely to “push the envelope” by making professional judgments that favor client interests at the expense of the professionals’ obligations to society. By doing so, we expand on the notion of client capture and provide context as to when it is that professionals will be particularly beholden to clients and when such indebtedness will lead to compromised judgment.

A significant impediment to methodically investigating such issues is their sensitive nature (Gunz and Gunz 2008). Few professionals are willing to divulge instances in which they have willfully disregarded their professional obligations, let alone have the mindfulness to recognize when their self-serving biases may have subconsciously compromised their judgment. We integrate multiple archival data sources to observe systematic patterns in professional judgment. Specifically, we examine the disclosure of prior art by patent lawyers when representing client patent applications submitted to the US Patent and Trademark Office (USPTO) for review. All else equal, client firms are interested in securing broadly scoped patents (Alcacer et al. 2009b), and such outcomes are more likely when minimal relevant prior art (e.g., previously granted patents) is identified during the examination process at the USPTO (Cotropia 2009). However, to enhance the precision of the examination process, patent lawyers are obligated professionally to disclose all relevant prior art of which they are aware, even if, in doing so, their clients receive narrower intellectual property rights than they would otherwise. In

sum, the patent examination process provides codified granular data that enable us to explore how the propensity for professionals to capitulate to client capture depends on the interplay of incentives and experience.

As a baseline, we suggest that patent lawyers will have stronger incentive to withhold disclosing relevant prior art known to them in patent applications that they develop on behalf of clients with whom they engage repeatedly and have accrued substantial social capital. We also suggest that patent lawyers will be more inclined to withhold known relevant prior art on behalf of a client when they have numerous other clients in the same technological domain. Clients who receive similar services can easily observe how well the contracted professionals they share perform for each other. Due to this transparency, lackluster outcomes for any one client may harm a professional's reputation among all other clients for whom the professional provides similar services (Eisenhardt 1989).

Professionals, however, are agents who work on behalf of not only their clients and society but also of the professional service firms that employ them (Bamber and Iyer 2007; Shapiro 2003). We suggest that the extent to which professionals succumb to client capture will depend on how secure they are in their current employment. Professional service firms are typically partnerships; some staff have equity stakes (i.e., partners), whereas others do not (i.e., associates). We find that, within our sample, associates are more susceptible than are partners to client capture by those with whom they repeatedly engage. Because associates' employment with their professional service firms is relatively insecure, the prospects of employment revolving doors, whereby they exit their firms to join client firms with whom they have built extensive social capital, are particularly valuable. Associates protect and enhance these prospects by, consciously or unconsciously, compromising their professional judgment in the interests of such

clients. Because partners' employment with their firm is highly secure, they are less susceptible to client capture by clients with whom they repeatedly engage.

Although professionals may be susceptible to client capture by particular clients, their prior experience on the other side of the regulatory table bestows them with a degree of savvy that enables them to act on the interests of clients to whom they are beholden. Regulatory employment revolving doors are increasingly common; over the course of their careers, individuals may serve as state regulators of a specific constituency, only to subsequently serve as contracted professionals on behalf of the same constituency by helping them to navigate the regulations that they used to uphold (Salant 1995). Many patent lawyers pursue their legal careers in which they represent client patent applications submitted to the USPTO after having been employed as USPTO examiners responsible for reviewing patent applications and protecting public interests. We find that the effect of repeatedly engaging with clients and having large numbers of similar clients on the withholding of known prior art is significantly greater for lawyers who were former patent examiners.

We contribute to the literature on professions and on patent strategy. Moreover, by exploring public interest violations (i.e., withholding prior art), our study has implications for both organizational theory and public policy (Barley 2016). Others have studied the notion of client capture conceptually and qualitatively (Dinovitzer et al. 2014) and have considered how professional service firm governance (Empson 2007; Greenwood et al. 1990) and employment revolving doors affect the behavior of professionals (Salant 1995). We integrate these disparate lines of research to account for the various relationships that professionals typically contend with, including those with their clients, professional service firms, and regulatory counterparts. In doing so, we develop a more holistic understanding of when the subjective judgments that

professionals make on behalf of their clients are adversely influenced by client capture. The professional partnership governance form has been lauded for being particularly effective for motivating staff (Greenwood et al. 1990), minimizing free-riding and shirking (Alchian and Demsetz 1972), and reassuring clients that their interests are given precedence (Sharma 1997). We find, however, that there is a downside to the inherent employment insecurity concomitant with an “up or out” professional partnership structure; those without the luxury of partnership security are particularly susceptible to abdicating their professional responsibilities in the interest of clients with whom they repeatedly engage. Although regulatory employment revolving doors are often criticized (Neumann 2011), they remain prevalent. Our study provides insight into when such career paths are particularly detrimental to public interests; the experience that professionals derive through regulatory employment revolving doors, combined with their being beholden to specific clients or client segments, can compromise professional judgment.

Patents have been assumed to be objective measures of firm knowledge (Zucker et al. 2002), technological search behavior (Rosenkopf and Nerkar 2001), and knowledge spillover (Almeida 1996). An important aspect of patent strategy is the processes by which patent rights are attained (Somaya 2012). We recognize that intellectual property rights are socially constructed, and we delve into the micro-level processes by which patent lawyers assist their clients in acquiring patent rights. These processes have implications for client firm patent portfolios and the extent to which they can develop the patent thickets and fences essential for proprietary, defensive, and leveraging patent strategies (Somaya 2012). Our analyses suggest how industrial firms can potentially enhance their patent portfolios and thickets by strategically selecting and developing the partiality of the lawyers they use to develop their patent applications.

We begin by providing background on the patenting process, the interests of clients and the USPTO, and the inherent tension that patent lawyers face in prioritizing client and societal interests. We then develop our arguments and describe how we tested our hypotheses.

2.2 Patent Lawyers and the Patent Examination Process

Securing exclusive rights to intellectual property that underlies an invention entails filing a patent application with the USPTO. Patent applicants often enlist the expertise of outside legal counsel to assist them in navigating their applications through the USPTO examination process. They begin a client engagement by consulting with the inventor to gather details on the potentially patentable invention. They then prepare documents that support any claims to intellectual property that they will attempt to secure on behalf of their clients.

On the other side of the table, USPTO examiners assess these patent applications on behalf of the state and public interest to determine which claims are truly novel and worthy of being granted. If inventors are granted excessively broad patent rights inconsistent with the true novelty of their inventions, social benefits are hindered because others will be deterred from developing products in the same technological space, and valuable resources will be diverted toward costly litigation to sort out overlapping claims (Cotropia 2009). To determine the novelty of applicant claims, examiners compare the claims made in patent applications to prior art, including previously granted patents.

Patent examiners, however, have incomplete knowledge of prior art and limited time and resources to uncover prior art that may be relevant to the patent claims that they are assessing (Jaffe and Lerner 2004). To reduce the burden on examiners and to make their assessments more precise, patent lawyers who are involved in the preparation of patent applications are legally bound to disclose all prior art of which they are aware that is relevant to their clients'

inventions.¹ Although there is no obligation for lawyers to search for relevant prior art of which they are unaware, any such art that the representing lawyer is mindful of must be submitted in an Information Disclosure Statement as part of the patent application. This includes prior art to which lawyers have been exposed when representing earlier patent applications (Flores and Warren 1999). Although patent lawyers serve on behalf of their clients by preparing their patent applications, they also are obligated professionally to serve as agents for the state, with a duty to disclose relevant prior art of which they are aware, thereby assisting examiners in protecting public interests.

In consultation with their clients, patent lawyers develop initial patent claims that they believe to be consistent with the prior art that they subsequently disclose in the patent application. In essence, the prior art disclosed in the application demarcates the boundary of the intellectual property that lawyers wish to claim on behalf of their clients. Examiners review these claims and the disclosed prior art as well as conduct their own limited search of prior art, using patent databases. Based on their examination, examiners provide to the lawyer a preliminary report that describes their initial conclusions regarding which claims are patentable. Lawyers can respond by rebutting the examiner's analysis or by amending the claims made within their patent applications. Through this back-and-forth process, an inventory of relevant prior art is developed for those patents that are eventually granted. Some of the prior art will have been disclosed by the lawyer, and the remainder will have been added by the examiner.

Any prior art uncovered by the examiner tends to shrink the scope of the claims granted by the USPTO (Cotropia et al. 2013). Patent owners receive lower economic returns from patents that reference extensive prior art (Merges and Nelson 1990). Because patents are assumed to be

¹ Section 1.56 of Title 37 of the Code of Federal Regulations imposes a *duty of candor* and good faith in dealing with the USPTO during patent examination.

valid and are overturned only by convincing evidence (Sampat 2010), client firms benefit from boosting the number and scope of their patents, even if they are of questionable novelty. Ambiguous patent boundaries have led to a vicious cycle whereby increasingly expansive portfolios of marginally novel patents play an important role in a firm's competitive strategy (Somaya 2012). Whether firms intend to use them to block others from commercializing, secure technology space by establishing countervailing litigation threats, or as bargaining chips for licensing, accumulating a vast trove of patents provides strategic value for firms in their patent wars against others (Hall and Ziedonis 2001b; Somaya 2012). Many critics have argued that these dynamics indicate that the U.S. patenting system is broken and not optimizing public welfare (e.g., (Jaffe and Lerner 2011). Nonetheless, with the assistance of their lawyers, industrial firms optimize their patent strategy within the context of this arguably flawed system. When lawyers withhold known relevant prior art, *and* examiners subsequently fail to uncover such prior art during their examination, client firms may be granted patents of broader scope with greater economic value than they otherwise would. Thus, for lawyers inclined to maximize patent scope on behalf of their clients, there is incentive to withhold relevant prior art ((Wagner and Parchomovsky 2005).

Ultimately, as conveyed by all of the patent lawyers whom we interviewed, patent examination is a negotiation between the examiner and lawyer that is highly subjective and potentially adversarial.² Examiners strive to limit the granting of intellectual property rights to technologies that are truly novel, while lawyers attempt to secure as much intellectual property rights for their clients as reasonably possible. The disclosure of prior art is a sensitive topic for

² We conducted semi-structured interviews with 17 patent lawyers, of whom 16 also were former examiners. These interviews lasted between 20 and 45 minutes and focused on the lawyers' perspective on the patent examination process and how their experience as examiners influenced their behavior as patent lawyers.

patent lawyers, and our interviewees varied in their willingness to discuss the issue. Lawyers can be disbarred when firms accused of infringing on granted patents assert that the lawyers who represented the original patent applications acted inequitably by *intentionally* concealing relevant prior art during the application process (Cotropia 2009).³ Nonetheless, because plaintiffs have to establish a lawyer's intent to deceive in a process where prior art relevancy and invention novelty is highly subjective, findings of inequitable conduct by lawyers is exceedingly rare (Lampe 2012). When questioned, a number of our interviewees immediately insisted that they *always* adhere to their duty to disclose relevant prior art and that to do otherwise would be unethical. Others, however, acknowledged the incentive to serve client interests, and that disclosure likely varied across lawyers and circumstances.

2.3 Hypotheses

2.3.1 *The Prospect of Client Capture*

Some clients are more valuable than others, and fervently attending to their interests is in the self-interest of the professional. As with any buyer-supplier relationship, professionals are more dependent on clients with whom they repeatedly engage. Through repeat engagements, professionals develop personal relationships with individuals within client firms; over time, these relationships can become stronger than the relationships between professionals and their own colleagues in the professional service firms in which they are employed (Alvesson 2000; Granovetter 1985). Although the social capital that professionals' accrue with clients through

³ In many respects, the duty of candor creates perverse incentives for patent lawyers; the more that they know, the greater their exposure to being accused of having acted inequitably Cotropia, C.A. 2009. Modernizing patent law's inequitable conduct doctrine. *Berkeley Tech. Law J.* **24** 723-783. Some law firms even establish "Chinese walls" to limit information flow between lawyers and to reduce their liability with regard to the duty of candor Hricik, D. 2000. Intellectual property litigation in the 21st century: The risks and responsibilities of attorneys and firms prosecuting patents for different clients in related technologies. *Texas Intellectual Property Law Journal* **8** 331-355.

repeat engagements benefits professionals by generating future engagements, it also can increase their dependence on these clients. Due to the extensive investment in developing client relationships that yield valuable repeat engagements, professionals become captive to serving the interests of those with whom they repeatedly engage (Adler and Kwon 2002). At the extreme, those professionals who are reliant on a sole client for their subsistence are completely beholden to that client and ardently internalize their goals (Casciaro and Piskorski 2005). Lawyers who become dependent on specific clients due to extensive repeat engagements are often referred to as “hired guns” due to the intensity with which they protect these clients’ interests (Krauss 2001).

When professionals repeatedly engage with specific clients, we surmise they are more likely to shirk their professional responsibilities to society to serve client interests and to preserve client relationships that are particularly essential to their careers. Such compromised judgment, however, is not attributable solely to conscious deception. Self-interest is a powerful force that can bias how one interprets information. Even when incentivized to be objective and impartial, individuals tend to evaluate information in a manner that advances their own interests (Babcock and Loewenstein 1997). Due to such self-serving biases, when judging the relevancy of information that they process on behalf of repeatedly engaged clients, professionals may be susceptible to subconsciously justifying their favoring the interests of these valuable clients at the expense of their professional obligations to society (Bazerman et al. 2002).

Professionals also may become beholden to entire segments of their clientele. The outcomes that professionals achieve on behalf of particular clients will be especially transparent to their other clients for whom they provide relatively similar services. Because these clients have firsthand experience with the specific services provided by the professionals they share,

each of them can readily decipher how well the respective professional is performing for their counterparts. As a result of this transparency, professionals develop segment-specific (e.g., industry) reputations (Wartick 2002); a professional may have a strong reputation for delivering superior outcomes for one segment of his or her clientele that receive similar services and a significantly weaker reputation for another segment that receives different services. Because reputations can be monetized through pricing (Regan 1997; Weigelt and Camerer 1988), the value of a positive reputation will be greater for segments that include larger numbers of similar clients.

In the case of patent lawyers, some specialize in serving a uniform type of clientele (e.g., biotechnology clients), while others have a broader focus and serve multiple types of clientele (e.g., biotechnology, chemical, semiconductor clients). Clients who apply for semiconductor patents can easily gauge how their lawyer is performing in terms of securing intellectual property rights for other clients in the semiconductor sector but are less capable of deciphering how well their lawyer is performing for clients in the biotechnology sector. Thus, patent lawyers possess distinct reputations for each technological segment represented in their client portfolio. They will be particularly inclined to protect their reputations associated with technological segments for which they have a relatively substantial number of clients, as failing to do so could jeopardize a large portion of their practice (Wolfson 1985).

In sum, patent lawyers will have greater incentive to attend to client interests, at the expense of societal interests, for clients to whom they are more beholden due to repeat engagements and to their having numerous other clients for whom they provide patenting services in the same technological domain. In such cases, relevant prior art will be more likely withheld by the representing lawyer in their preparation of patent applications.

Hypothesis 1a (H1a): Relevant prior art known to patent lawyers is more likely to be withheld on behalf of clients with whom they repeatedly engage.

Hypothesis 1b (H1b): Relevant prior art known to patent lawyers is more likely to be withheld on behalf of clients when there are greater numbers of similar clients for whom they are providing patenting services in the same technological domain.

2.3.2 *Partner vs. Associate*

Although professionals have a responsibility to serve the interests of their clients and society, they also serve on behalf of the professional service firm in which they are employed. The extent to which professionals capitulate to client capture will depend, in part, on their relationship with their professional service firm. Professional service firms, such as those that provide law and auditing services, are typically partnerships; some staff are equity partners and others, typically junior associates, are employees with no equity stake.⁴ In general, owner-employees have a greater stake in the overall performance of their employing firms than do ordinary employees because they have a claim to the profits generated by their firms (Jensen and Meckling 1979). Similarly, partners in professional service firms combine the role of owner, manager, and productive employee and will have a greater stake in the overall performance of their firms than will junior associates whose self-interests may be incongruous with those of the partnership team (Empson and Chapman 2006). Relative to associates, partners assume a collective ethos with a shared responsibility for their firms and enjoy strong employment security (Empson 2007).

Whether professionals are partners or associates will influence the extent to which repeatedly engaging with particular clients incentivizes professionals to pursue client interests at the expense of their professional obligations to society. Associates are especially susceptible

⁴ The legal profession prohibits those outside of the profession from owning law firms.

(relative to partners) to becoming beholden to specific clients with whom they repeatedly engage. Because associates are not equity partners in their professional service firms, their employment status with their firms is relatively tenuous (Phillips 2002). A common career transition for professionals, such as lawyers, who are not invited to become partners of their firms is to take positions with client firms as in-house counsel (Gilson and Mnookin 1989). It is alleged that the prospect of exiting their employing professional service firms through a revolving door that leads to employment with former clients may cloud the impartiality of professionals who provide services to those clients (Bazerman et al. 2002). These prospects are particularly enticing for associates; those clients with whom associates have developed substantial social capital through repeat engagements are prime candidates as future employers. Thus, associates have a potent incentive to protect and burnish their social capital with these clients by serving their interests particularly well, possibly at the expense of their professional obligations to society.

In contrast, because equity partners have a stake in the overall profits of their firms and enjoy considerable employment security, their compensation and future employment depend less on the satisfaction of any individual client, regardless of their level of engagement with that client. In essence, partners are relatively impervious to the effects of client capture by those they repeatedly engage.

Although partners may be less inclined than are associates to being excessively partial to the interests of their repeatedly engaged clients, they will be more inclined to favor the interests of clients who are part of larger segments of similar clients. Partners are expected to be rainmakers by securing new business from existing clients as well as from new clients (Hitt et al. 2001). Not only can existing clients who receive similar services from professionals whom they

share observe how well the respective professionals perform for each other, but potential clients can do so as well. Maintaining a positive reputation among a large segment of existing clients helps professionals to attract other prospective clients with similar needs. Partners directly monetize their efforts in maintaining a reputation for delivering positive outcomes among a large segment of similar clients by sharing in the profits of their firms. In contrast, because they do not have any claim to the overall profits of the professional service firm, and are not typically expected to expand the firm's client base, associates have less incentive to serve the interests of such clients at the expense of their professional obligations to society.

In sum, any incentive for patent lawyers to serve the interests of repeatedly engaged clients by withholding relevant prior art they are aware of will be stronger for associates. In contrast, the incentive to withhold known relevant prior art on behalf of clients for whom there are extensive numbers of similar clients in a lawyer's portfolio will be stronger for equity partners.

Hypothesis 2a (H2a): The relationship between the level of client repeat engagement and the likelihood of known relevant prior art being withheld by a patent lawyer will be more strongly positive for non-equity associates than for equity partners.

Hypothesis 2b (H2b): The relationship between the number of other clients for whom a lawyer is providing patenting services in the same technological domain and the likelihood of known relevant prior art being withheld will be more strongly positive for equity partners than for non-equity associates.

2.3.3 Regulatory Employment Revolving Doors

Although professionals may be predisposed to client capture when serving certain clients, their prior experiences influence their ability to act on such dispositions. Through experience, individuals construct mental models of how things work and the likely outcomes of their behavior (Keren 1987). Within a regulated environment, valuable experience for professionals

comes from having spent time on the other side of the table as regulators. Regulators often can advance their careers by leaving their positions through regulatory employment revolving doors and working on behalf of the constituency that they previously regulated. For example, prosecutors can become defense attorneys, lawmakers transition to being lobbyists, and audit firm employees often go on to become executives within client firms.

There is some belief that the tacit knowledge that professionals gain while being regulators influences their behavior when they switch sides (Mitnick 2011). Such may be the case when audit firm employees become financial executives. Because they are intimately familiar with the audit process from having been on the other side, they may be able to push the envelope during audit engagements and secure better audit outcomes for their current employers. Evidence for such behavior, however, is mixed. Firms that employ executives who previously worked for their firms' external auditors have been found to be more likely to receive clean audit opinions (Lennox 2005). In contrast, Naiker and Sharma (2009) find that former auditors who serve on their firms' audit committees disclose weaknesses in their firms' internal financial controls to the same degree as do committee members who do not have prior auditor experience. Thus, it is unclear when and to what extent professionals who enter their positions through regulatory employment revolving doors exploit the tacit knowledge gained in their previous positions to pursue more aggressively the interests of their new employers or clients.

Many patent lawyers are former USPTO patent examiners. In our interviews with these lawyers, all were adamant that their time spent as examiners made them more effective in representing clients. Each spoke of having a better understanding of the examiner mindset. Some referred to it as knowing "how the sausage is made." Specifically, they grasp the time pressures that examiners are under and their difficulty in searching for prior art. All of them suggested that

having examiner experience allowed them to establish rapport with the examiners whom they engage on behalf of their clients. Many of our interviewees indicated that, in their attempt to create a less adversarial examination process, they inform the examiners whom they engage that they also used to work at the USPTO as an examiner.

A recurring theme in our discussions with the interviewees was how their time spent as patent examiners helped them to recognize more fully the subjectivity of the examination process. In describing the insight that he gained from his years at the USPTO, one patent lawyer remarked, “I could talk to a different examiner on the same matter and get a completely different answer.” Another looked back at his time spent as an examiner, stating, “If five examiners each independently examined an application, you would get five different conclusions on the patentability of the claims.” Still another indicated that his tenure as an examiner made him more cynical as a lawyer of the patent examination process. He described how his former examiner colleagues would make their patent application review quotas through “breeze” searches; i.e., they would flip through prior art so quickly that it created a breeze.

The savvy that professionals acquire from working on the other side of the regulatory fence will accentuate the extent to which they capitulate to client capture when serving clients who are particularly valuable to them. In the case of patent lawyers, their deep understanding of the subjectivity and inner workings of the patent examination process augment their abilities to push the envelope, either deliberately or subconsciously, on behalf of clients whose interests they determinedly wish to serve. When lawyers lack examiner experience, their capacity to fulfill their own self-interests by fulfilling the interests of valuable clients (e.g., those they repeatedly engage) will be somewhat muted. In essence, it is the combination of client incentives and firsthand intelligence regarding the examination process that produces compromised judgment.

Tenure as a patent examiner prior to a career in patent law will enhance the likelihood of patent lawyers' withholding prior art on behalf of particular clients with whom they repeatedly engage and when there are greater numbers of similar clients.

Hypothesis 3a (H3a): The relationship between the level of client repeat engagement and the likelihood of known relevant prior art being withheld by a patent lawyer will be more strongly positive when the lawyer has previous experience as a patent examiner.

Hypothesis 3b (H3b): The relationship between the number of other clients for whom a lawyer is providing patenting services in the same technological domain and the likelihood of known relevant prior art being withheld will be more strongly positive when the lawyer has previous experience as a patent examiner.

2.4 Methods

2.4.1 *Data and Sample*

To test our hypotheses, we examine citations to prior art (i.e., previously granted patents) in patents granted between the years 2001 and 2006. In 2001, the USPTO began to distinguish the prior art citations contributed by lawyers from those added by examiners. Such a distinction is essential for the construction of our dependent variable, the withholding of known prior art. Moreover, we rely on the National Bureau of Economic Research (NBER) patent database for standardized patent applicant firm names; these data are complete through 2006.⁵ We further restricted our sample to prior art citations associated with patents whose applications were represented by a single lawyer as opposed to a team. By doing so, we avoid any problems associated with aggregating individual-level variables (e.g., partner vs. associate) across teams of lawyers.

Although our sample was restricted to prior art cited by patents granted from 2001 to 2006, we relied on all patents granted between 1976 and 2006 to compile inventories of prior art

⁵ <https://sites.google.com/site/patentdatapoint/Home>

to which lawyers in our sample had been exposed, and to construct our variables. The Google patent database was used to obtain the names of lawyers who represented patent applications during this time frame.⁶ Because the spellings of lawyer names are not standardized within USPTO records or by Google, we needed to disambiguate them to accurately compile patent application histories for each sample lawyer. We began the disambiguation process by using the gestalt pattern-matching algorithm to cluster together close spellings; each cluster was assigned a unique identifier (Ratcliff and Metzner 1988). We then checked these computer-generated clusters manually to correct both false and missed matches. Our final directory of lawyer names associated with patents granted between 1976 and 2006 comprised 24,190 unique lawyers based on 45,371 name spellings. We used a similar process to disambiguate law firm names to develop specific control variables.⁷

A total of 13,553 lawyers solely represented patent applications that were eventually granted between 2001 and 2006.⁸ We used the various name permutations for each of these lawyers to search LinkedIn for their profiles, from which we could document yearly law firm and USPTO employment histories. Each profile was examined manually to cull invalid profiles. We identified 5,009 valid LinkedIn profiles of patent lawyers for patent applications that had been granted between 2001 and 2006, including those who served as in-house counsel as well those who served as external counsel.

To assess the withholding of relevant and knowable prior art, we narrowed our sample further. For each lawyer, we identified all patents that they had solely represented and had been

⁶ <https://www.google.com/googlebooks/uspto-patents.html>

⁷ All disambiguation directories are available on request.

⁸ A disproportionately large number of lawyers were active during the time frame used to construct our sample. This is due to a greater level of patenting and greater rates of using legal counsel during the 2001–2006 timeframe. On average, roughly 34,000 patents represented by 700 lawyers were granted per year, 1976–2000. In contrast, 45,000 patents, represented by roughly 2,250 lawyers, were granted per year, 2001–2006.

granted between 2001 and 2006. For each of these focal patents, we determined (1) whether the lawyer served as external counsel based on patent application year and LinkedIn employment history and (2) whether the lawyer had a history of representing patent applications prior to the application year of the focal patent. For each focal patent for which this was the case, we constructed an inventory of prior art known to the lawyer. This inventory included previous patents represented by the lawyer that were granted up to ten years prior to the application year of the focal patent and the prior art associated with these previous patents. Because lawyers are involved in intensive interactions with the patent office during the patent application process, they are aware of the prior art associated with the patent applications that they have represented in the past. As such, they are responsible for disclosing this art if relevant to any future applications they represent (Flores and Warren 1999).

Previous research has shown that citation-level characteristics influence the likelihood of prior art's being cited by patent applicants (Lampe 2012). Thus, to control for citation-level heterogeneity, avoid issues of aggregation, and enhance the precision of our empirical models, we deploy a fine-grained research design, using the prior art citation as the unit of analysis. Our sample is comprised of citations (contributed by either the lawyer or the examiner) to prior art that is also in the lawyer's inventory of known prior art. This is prior art to which the lawyer has clearly been exposed and, thus, is at risk of being withheld by the lawyer.

Research in psychology has shown there to be general differences across individuals in terms of how they value loyalty and fairness (Waytz et al. 2013). Thus, some lawyers may be more mindful than others of their professional responsibility to disclose all relevant prior art that is known to them. To account for this heterogeneity, we deployed a lawyer-level fixed-effects design. Moreover, by doing so, we control for all time-invariant unobserved heterogeneity that

may be related to both our independent variables of interest and the dependent variable, thereby biasing our coefficients. Our design enables us to isolate the influence of our variables of interest (*client repeat engagement, number of similar clients*) within each lawyer, yet still compare these effects across lawyers in terms of *partner vs. associate* and *tenure as patent examiner*. Lawyers with no variance in the dependent variable, however, dropped out of any analysis. Our final sample included 28,406 prior art citations at risk of being withheld by 266 lawyers.

2.4.2 *Dependent Variable*

The dependent variable is *withholding of prior art*. For each prior art citation in the sample, we determined from the Google patents database whether the representing lawyer of the focal patent disclosed the citation or the examiner added the citation. Because this prior art is known to the lawyer, the citation of such art added by the examiner instead of disclosed by the lawyer provides some indication of its relevance (as deemed by the examiner) and of its being withheld by the lawyer. All citations added by the examiner were coded as 1 (indicating withholding of prior art), while those disclosed by lawyers were coded as 0 (indicating disclosure).

One source of error in this measure is the truncation of our sample, occurring on two accounts. First, we consider only the focal lawyer's previously granted patents to identify prior art known to the focal lawyer, from which we derive prior art at risk of being withheld by the focal lawyer in the focal patent application. Patented prior art that is truly known to our sample lawyers but not part of their documented histories is excluded from our sample of prior art at risk of being withheld. Arguably, such prior art is *more likely* to be withheld by the focal lawyer because the risk of being found to have acted inequitably is lower; it is more difficult for the courts to establish that a lawyer's failure to report prior art in such cases is intentional

concealment due to the lack of documentation that indicates that the prior art in question was known to the lawyer.

Second, we do not include rejected applications. The outright rejection of a patent occurs when the novelty of its claims is so limited that even a patent of reduced scope is unwarranted. To craft such claims, patent lawyers would need to either be unaware of or disregard extensive amounts of prior art. Overall, the set of observations that is truncated from our sample, due to considering only a limited portion of prior art known to our sample lawyers and not including rejected patent applications, is likely to include a higher percentage of withholding than does our observed sample. Such truncation biases our coefficients toward zero, rendering our results relatively conservative (Kennedy 2003).

2.4.3 *Independent Variables*

Client Repeat Engagement. For each focal patent, we computed the total number of patent applications represented by the lawyer (and subsequently granted) on that client's behalf in the three years prior to the application year of the focal patent. A greater number of patent applications represented by the lawyer indicates greater repeat engagement.

Number of Similar Clients. We categorized the focal lawyer's clientele using the technological subcategory of the patent applications that were represented by the focal lawyer (Hall et al. 2001). There are 37 unique subcategories, and patents are assigned to only one subcategory. We counted the number of unique clients for whom the lawyer represented patents in the technological subcategory of the focal patent in the three years prior to the application of the focal patent.

Partner vs. Associate. Based on information from the focal lawyer's LinkedIn profile, we coded this variable as 1 when the lawyer was a partner in the employing professional service

firm in the year of filing the focal patent, and 0 if the lawyer was a non-equity-holding associate of the firm.

Tenure as Patent Examiner. From their LinkedIn profiles, we identified those lawyers who had previously worked as examiners at the USPTO and recorded their years of employment. Within our sample prior art citations, 3,426 were at risk of being withheld by lawyers who had prior experience as USPTO patent examiners.

2.4.4 Control Variables

We controlled for additional heterogeneity associated with the focal lawyer, client firm, law firm, examiner, patent, and prior art.

Lawyer Controls. In conjunction with our measure of *client repeat engagement*, we controlled for *lawyer: total patents*, the number of patents that the lawyer represented on behalf of all clients in the three years prior to the focal patent's application year. In conjunction with our measure of the *number of similar clients*, we controlled for *lawyer: total clients*, the number of clients across all technological domains that the lawyer represented patent applications on behalf of in the three years prior to the application year of the focal patent. Lawyers' experience with representing patent applications may influence their risk-taking behavior and propensity to withhold prior art. We controlled for *lawyer experience* by counting the number of granted patents in a lawyer's history prior to the focal patent's application year.

Client Firm Controls. Larger clients may be more valuable to the focal lawyer due to the potential for future business and unduly influence the lawyer's propensity to withhold prior art on their behalf. We thus controlled for *client firm size* by counting the number of patents applied for (and eventually granted) by the focal patent's assignee one year prior to the application year of the focal patent. Client firms may become dependent on the focal lawyer, depending on the

number of alternative external lawyers on which they rely. We controlled for *client firm: external lawyers*, the number of external lawyers who applied for patents (and eventually granted) on behalf of the focal client in the year prior to the focal patent's application year. Similarly, we controlled for *client firm: patents represented by external lawyers*, the number of client firm patents applied for (and subsequently granted) by external lawyers in the year prior to the focal patent's application year.

Law Firm Controls. High-status law firms may protect their status by having norms that influence their staff's propensity for withholding prior art. To control for these effects, we used Vault's law firm rankings to distinguish between high- and low-status law firms. These rankings are based on a yearly survey of thousands of lawyers across the country who rate law firms other than their own on a scale of 1 to 10 and have been used previously to establish which law firms are high status (Rider and Tan 2014). Law firms were deemed to be high status if they were in the top 100 in any of the surveys from 1998 to 2006. *Law firm status* was coded as 1 if the focal lawyer was employed by a high-status law firm in the year prior to the focal patent's application date, and 0 otherwise.

Strong ties between the focal lawyer's law firm and his or her client may influence the focal lawyer's propensity to withhold prior art. To measure the magnitude of these ties, we controlled for *law firm: client patents*, the number of patents represented (and granted) on behalf of the client by any lawyer employed by the focal lawyer's law firm. In conjunction with *law firm: client patents*, we also controlled for *law firm: total patents*, the number of patents prosecuted by the law firm for all clients.

Examiner Controls. Differences across examiners in terms of their experience may influence the prior art that they uncover. Similar to the case with lawyer names, the USPTO does

not rely on standard spellings and identification numbers. We conducted a similar disambiguation process as that for lawyer and law firm names. To account for the influence of the examiner's expertise in examining patents on the extent to which the examiner adds citations to the focal patent, we controlled for *examiner class experience*, the total number of patents in the focal citation's patent class that the examiner had granted prior to the application year of the focal citation's patent. Greater examiner class experience bestows the examiner with superior ability to discover the withholding of prior art.

As a measure of the examiner's diligence in searching for relevant prior art, we controlled for *examiner diligence*, the total number of prior art citations added by the examiner in the focal citation's patent. A more diligent examiner is more likely to detect the withholding of prior art by the focal lawyer. Thus, we anticipate a positive relationship between *examiner diligence* and *withholding of prior art*.

Patent Controls. Lawyers may be more diligent in disclosing prior art for patents of greater value to safeguard them against being invalidated in the future (Lampe 2012). Forward citations of a patent provides some indication of its value (Harhoff et al. 1999; Harhoff et al. 2003). We controlled for *patent value*, the count of forward citations of the focal citation's patent in a five-year window after the grant year of the focal citation's patent. We also controlled for *patent backward citations*, the total number of backward citations associated with the focal patent.

Prior Art Control Variables. Lawyers may be able to recall recently invented prior art more readily than older art. To control for this effect, we computed *prior art age* as the difference between the patent's application year and the citation's grant year. Prior art from outside the focal patent's technological class may be more difficult for lawyers to recall as well.

We compared the patent class of each prior art citation to the patent class of the focal patent. If these classes were the same, we coded the dummy variable *prior art class span* as 1, else, 0. Focal prior art (i.e., patent) that the focal lawyer directly represented during its patent application phase maybe more salient and easier to recall as compared to prior art that was only cited by a patent that the focal lawyer represented during application. If the lawyer had previously represented the focal prior art at risk of being withheld during its patent application phase, we coded the dummy variable *prior art salience* as 1, else, 0.

2.4.5 *Statistical Methods*

Because our dependent variable is binary, we used logistic regression to estimate our models. In addition to lawyer fixed effects, we also controlled for technology sub-category fixed effects. These fixed effects account for the possibility that the strategic benefits from having expansive patent portfolios that include patents of limited novelty may vary across technologies; bullet-proofed patents that are likely to withstand challenges to their validity may be more valuable in some technological sectors than in other sectors in which portfolios of incremental and overlapping patents provide competitive advantages (Hall and Ziedonis 2001b). Such sector differences may influence the propensity for lawyers to withhold prior art. Finally, we control for year fixed effects to account for year-specific shocks that may affect the hypothesized relationships (Hall et al. 2001).⁹

Although we gain empirical precision by using a research design where the prior art citation is the unit of analysis, doing so may lead to dependency among our observations. Within each year of prior art disclosure activity for a given focal lawyer, there are multiple client-prior

⁹ Although the use of fixed effects with logistic regression can lead to biased coefficients when there are few observations per fixed effect (e.g., fewer than 16), such bias is negligible in our sample because we have substantial numbers of observations per fixed effect Katz, E. 2001. Bias in conditional and unconditional fixed effects logit estimation. *Political Anal.* 9(4) 379-384..

art dyads; particular clients and prior art may appear repeatedly across these dyads and create interdependence. We address this issue with lawyer-level fixed effects, an autocorrelation control variable, and multi-way clustering of standard errors. Consistent with recent work that also relies on non-nested dyadic data structures (Kim and Steensma (forthcoming); Rider and Tan 2014), we calculate Lincoln's (1984) autocorrelation control variable for each of our observations. In our application, this control variable is computed as the mean of the dependent variable across all client-prior art dyads within the focal lawyer-year cluster of observations that included either the focal client or focal prior art, excluding the focal observation. This variable controls for additional unobserved heterogeneity associated with within lawyer-year nodal (client, prior art) effects not otherwise accounted for by lawyer and year fixed effects and other control variables. In addition, to account for potentially deflated standard errors, we deployed *multiway* clustering at the client and prior art levels (Cameron et al. 2012; Cameron and Miller 2015). Together, our use of lawyer-level fixed effects, an autocorrelation control variable, and multiway standard error clustering protects against biased parameter estimates and standard errors due to non-independence. We also used conservative two-tailed tests to assess coefficient significance. Summary statistics are presented in Table 2.1 and regression results, in Table 2.2.

Table 2.1. Summary Statistics

Variable	Mean	S.D.	Min	Max
Withholding of Prior Art	0.11	0.32	0	1
Client Repeat Engagement ^a	1.66	1.26	0	6.24
Number of Similar Clients ^a	0.91	0.57	0	2.83
Tenure as Patent Examiner	0.34	1.06	0	9
Partner vs. Associate	0.63	0.48	0	1
Lawyer Total Patents ^a	3.01	0.93	0	6.3
Lawyer Total Clients ^a	1.75	0.77	0	3.97
Lawyer Experience	184.09	415.1	1	3272
Client Size ^a	2.87	2.01	0	8.38
Client External Lawyers ^a	0.82	0.98	0	5.18
Client Patents by External Lawyers ^a	1.99	1.95	0	7.58
Law Firm Status	0.18	0.38	0	1
Client Patents by Law Firm ^a	1	1.35	0	6.23
Law Firm Patents ^a	3.02	2.62	0	7.39
Examiner Class Experience ^a	5.05	1.77	0	8.01
Examiner Diligence ^a	1.46	0.86	0	4.37
Patent Value ^a	1.33	1.01	0	4.75
Patent Backward Citations ^a	3.97	1.12	0.69	6.64
Prior Art Age ^a	2.09	0.64	0.69	3.43
Prior Art Class Span	0.4	0.49	0	1
Prior Art Salience	0.15	0.36	0	1
Autocorrelation Control	0.11	0.2	0	1

^aLog transformed

Table 2.2. The Withholding of Prior Art: Logit Estimates

Variable	(1)	(2)	(3)
Client Repeat Engagement ^a		0.15+	0.20*
		(0.08)	(0.09)
Number of Similar Clients ^a		0.23*	0.06
		(0.10)	(0.15)
Client Repeat Engagement X Partner vs. Associate			-0.19*
			(0.09)
Number of Similar Clients X Partner vs. Associate			0.12
			(0.18)
Client Repeat Engagement X Tenure as Patent Examiner			0.04*
			(0.02)
Number of Similar Clients X Tenure as Patent Examiner			0.13*
			(0.06)
Partner vs. Associate	0.09	0.09	0.37
	(0.22)	(0.22)	(0.33)
Lawyer: Total Patents ^a	0.04	-0.09	-0.07
	(0.11)	(0.12)	(0.12)
Lawyer: Total Clients ^a	-0.15	-0.18	-0.15
	(0.15)	(0.15)	(0.15)
Lawyer Experience	-0.00**	-0.00**	-0.00***
	(0.00)	(0.00)	(0.00)
Client Firm Size ^a	0.07	-0.03	-0.03
	(0.08)	(0.10)	(0.10)
Client Firm: External Lawyers ^a	-0.09	-0.09	-0.08
	(0.09)	(0.09)	(0.10)
Client Firm Patents Represented by External Lawyers ^a	-0.06	0.01	0.02
	(0.09)	(0.10)	(0.09)
Law Firm Status	-0.58*	-0.63**	-0.68**
	(0.23)	(0.23)	(0.24)
Law Firm: Client Patents ^a	0.09	-0.01	0.03
	(0.06)	(0.08)	(0.08)
Law Firm: Total Patents ^a	0.02	0.05	0.04
	(0.04)	(0.05)	(0.05)
Examiner Class Experience ^a	-0.04*	-0.04*	-0.05**
	(0.02)	(0.02)	(0.02)
Examiner Diligence ^a	2.21***	2.23***	2.24***
	(0.10)	(0.10)	(0.10)
Patent Value ^a	0.03	0.03	0.03
	(0.04)	(0.04)	(0.04)
Patent Backward Citations ^a	-1.94***	-1.94***	-1.94***
	(0.12)	(0.12)	(0.12)
Prior Art Age ^a	-0.45***	-0.46***	-0.45***
	(0.08)	(0.08)	(0.08)
Prior Art Class Span	0.62***	0.60***	0.61***
	(0.08)	(0.08)	(0.08)
Prior Art Salience	0.10	0.10	0.12
	(0.12)	(0.12)	(0.12)
Autocorrelation Control	0.82***	0.81***	0.73***
	(0.20)	(0.20)	(0.20)
Constant	0.85	0.97	0.81
	(0.77)	(0.77)	(0.79)
Likelihood ratio test ^b		12.98*	16.16**

N = 28,406; Client, citation multiway clustered standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

^aLog transformed ^b(3) compared to (2), (2) compared to (1)

Model 1 includes the control variables, while Model 2 includes both the control variables and the first-order terms of the variables of interest. A first-order term for *tenure as patent examiner* is not estimated because lawyer fixed effects render this term redundant. Interaction terms that involve such time-invariant variables, however, can be estimated (Wooldridge 2010). Model 3 is the full model with both interaction terms: *partner vs. associate x client repeat engagement*, *partner vs. associate x number of similar clients*, *tenure as patent examiner x client repeat engagement* and *tenure as patent examiner x number of similar clients*. We used Model 2 to assess the main effects of *client repeat engagement* and *number of similar clients* and Model 3 to assess the influence of the interaction terms on the likelihood of *withholding of prior art*.

In Hypothesis 1a, we posited that relevant prior art known to patent lawyers is more likely to be withheld on behalf of clients they repeatedly engage. The coefficient associated with *client repeat engagement* in Model 2 is positive and marginally significant ($\beta = .15, p < 0.10$), providing some support for Hypothesis 1a. The increase in odds of the *withholding of prior art* due to a one standard deviation increase in *client repeat engagement* can be computed as the exponent of the product of the standard deviation of *client repeat engagement* times its coefficient, or $e^{(.15*1.26)}=1.208$, or 21 percent. The coefficient associated with *number of similar clients* is positive and significant ($\beta = 0.23, p < 0.05$), providing support for Hypothesis 1b. The effect of a one-standard-deviation increase in *number of similar clients* on the odds of *withholding of prior art* is 14 percent.

These effects, however, can be delineated further based on whether lawyers are partners or associates within their firms and whether they had prior experience as patent examiners. For Hypothesis 2a, we posited that the relationship between the level of client repeat engagement and the likelihood of known relevant prior art being withheld by a patent lawyer will be more

strongly positive for associates than partners. The coefficient associated with the interaction between *partner vs. associate* and *client repeat engagement* is negative and significant ($\beta = -0.19, p < 0.01$) in Model 3. The effect of a one-standard-deviation increase in *client repeat engagement* for associates who have no examiner experience (i.e., *tenure as patent examiner* = 0) can be computed as the exponent of the sum of three products: (1) the coefficient of *client repeat engagement* multiplied by one standard deviation in *client repeat engagement*, (2) the coefficient of the interaction (*client repeat engagement X partner vs. associate*) multiplied by one standard deviation of *client engagement* multiplied by the value of *partner vs associate* and (3), the coefficient of the interaction (*client repeat engagement X tenure as patent examiner*) multiplied by one standard deviation of client repeat engagement multiplied by the value of *tenure as patent examiner*, or $e^{((0.20*1.26) + (-0.19*1.26*0) + (.04*1.26*0))} = 1.29$. Thus, for associates with no examiner experience, a one-standard-deviation increase in *client repeat engagement* increases the odds of *withholding of prior art* by 29 percent. A similar computation for lawyers who are partners (i.e., *partner vs. associate* = 1) with no examiner experience reveals a relatively negligible one percent increase in the odds of withholding with a one-standard-deviation increase in *client repeat engagement*. Thus, Hypothesis 2a is supported.

For Hypothesis 2b, we suggest that the relationship between the number of other clients for whom a lawyer is providing patenting services in the same technological domain and the likelihood of known relevant prior art being withheld will be more strongly positive for partners. The coefficient associated with the interaction between *partner vs. associate* and *number of similar clients* is insignificant, lending no support for this hypothesis.

Hypothesis 3a proposes that the relationship between *client repeat engagement* and *withholding of prior art* will be more strongly positive when lawyers have had prior experience

as patent examiners. The interaction between *client repeat engagement* and *tenure as patent examiner* is positive and significant in Model 3 ($\beta = 0.04, p < 0.05$). Of those lawyers in our sample who had prior experience in working as USPTO examiners, the average value of *tenure as patent examiner* was 2.9 years. When our sample lawyers are associates and had no examiner experience, the odds of *withholding of prior art* increase by 29 percent with a one-standard-deviation increase in *client repeat engagement*. When associates have an average level of experience as examiners, the odds of *withholding of prior art* increase by $e^{(1.26*0.2 + 1.26*2.9*0.04)}$, or 49 percent with a one-standard-deviation increase in *client repeat engagement*. Although partners with no examiner experience had a negligible increase in the odds of withholding with a one-standard-deviation increase in *client repeat engagement*, when they have an average level of examiner experience, the odds of *withholding of prior art* increases by 17 percent with a one-standard-deviation increase in *client repeat engagement*.

Hypothesis 3b proposes that the relationship between *number of similar clients* and *withholding of prior art* will be more strongly positive when lawyers have had prior experience as patent examiners. The interaction between *number of similar clients* and *tenure as patent examiner* is positive and significant in Model 3 ($\beta = 0.13, p < 0.05$). For associates with no examiner experience, the odds of *withholding of known prior art* increases by 3 percent with a one-standard-deviation increase in *number of similar clients*. In contrast, when associates have an average level of experience as examiners, the odds of *withholding of prior art* increase by 28 percent with a one-standard-deviation increase in *number of similar clients*. For partners with no examiner experience, the odds of *withholding of known prior art* increases by 11 percent with a one-standard-deviation increase in *number of similar clients*. In contrast, when partners have an

average level of experience as examiners, the odds of *withholding of prior art* increase by 37 percent with a one-standard-deviation increase in *number of similar clients*.

2.4.6 *Post-hoc Analyses*

For our analyses, we limited our sample to observations associated with lawyers who have LinkedIn profiles to garner their employment history. One concern regarding our sampling is that the decision whether to create a LinkedIn profile may have generated a sample selection process that biases our results. For selection bias to exist, any unobserved variable that influences the selection process also would need to influence our dependent variable (Certo et al. 2016). To gain further insight into this possibility, we conducted analyses on our entire viable population: 57,723 prior art citations at risk of being withheld by external lawyers (including those that did not have a LinkedIn profile) representing patent applications granted between the years of 2001 and 2006. We coded a dummy variable that indicated whether the focal lawyer had a LinkedIn profile (= 1), or not (= 0). We then reran our model, including lawyer fixed effects and *not* including any variable derived from LinkedIn (e.g., *partner vs. associate, tenure as patent examiner, law firm status*). We also included interactions between the LinkedIn dummy and pertinent variables in the model including *client repeat engagement* and *number of similar clients*. None of the interaction terms was significant, suggesting that the relationships between these variables and the likelihood of withholding prior art does not differ depending on whether the lawyer has a LinkedIn profile. We cannot definitively claim that the effects of our interactions of interest are the same for lawyers with a LinkedIn profile and those without. These

post hoc analyses, however, provide some confidence that bias due to sample selection is limited.¹⁰

For our original analysis, we calculated *client repeat engagement* using a one-year window. We checked the robustness of our findings by using a three-year window to calculate *client repeat engagement*. These results were consistent with our original findings.

2.5 Discussion

Due to the extensive role that professionals play in our society, their dubious impartiality can have substantial social and economic consequences. We explore conditions in which professionals are particularly susceptible to client capture, that is, they become so beholden to certain clients that their professional judgment is compromised. We suggest that the extent to which professionals engage repeatedly with a client and have numerous similar clients provides the foundation for client capture. In such cases, professionals have incentive to push the envelope in terms of favoring the interests of clients at the expense of their professional obligations to society. We surmise, however, that the extent to which professionals are beholden to such clients, and compromise their professional judgment, depends on how secure they are in their employment with their professional service firms and whether they were previously employed on the other side of the regulatory fence.

We find that, as compared to patent lawyers who are partners in their professional service firms, associates are more strongly inclined to withhold their disclosure of known prior art when

¹⁰ One reason that bias due to sampling only observations for which the lawyers have a LinkedIn profile is likely limited is that the decision by these lawyers to create a LinkedIn profile is separated in time from the data that we gathered from LinkedIn. We collected LinkedIn profiles in 2015. The historical data of interest on these lawyers (*partner vs. associate, tenure as patent examiner*) are from 1997 to 2006. LinkedIn did not launch its public profiles until 2006, and, thus, the vast majority of our lawyer population did not decide to create a profile until well after our time period of interest. Any relationship between the decision to create a LinkedIn profile and the data of interest will be muted to some degree.

developing patent applications on behalf of clients with whom they repeatedly engage. We suggest that associates are particularly beholden to such clients due to their employment insecurity. The prospect of an employment revolving door, whereby associates exit their professional service firms to join client firms with whom they have built extensive social capital, is especially alluring. They enhance their employment prospects by compromising their professional judgment to favor the interests of their repeat clients. Because partners have the luxury of strong employment security, such prospects are valued less, and, thus, they are less inclined to compromise their professional judgment in the interests of such clients.

These results provide some support for the view that future employment prospects with client firms cloud the impartiality of professionals who provide services to those clients (Bazerman et al. 2002). Recent research on credit rating analysts also provides empirical evidence that revolving door employment prospects with clients may bias professionals while still employed by their professional service firms. Credit rating analysts who were subsequently employed by client firms were shown to award inflated ratings to these clients while still working for their credit rating agencies (Cornaggia et al. 2016). Our results provide additional nuance to this story; compromised professional judgment attributable to future employment prospects with client firms may be more prevalent among professionals who have relatively weak employment security with their professional service firms (i.e., associates). Such inferences temper a supposed benefit of professional partnerships; the protracted probationary period from initial hire to partnership is designed, in part, to ensure that professionals have unquestioned integrity before they are provided the trappings of partnership (Gilson and Mnookin 1989). Nonetheless, we find that it is during this probationary period that professionals are more likely to succumb to client capture by clients they repeatedly engage.

The effects of employment revolving doors on the judgment of associates are *a priori* in nature; that is, their compromised judgment occurs before any employment move and results from the prospect of moving. We also find evidence for *ex post* revolving door effects due to employment moves from regulatory agencies to professional service firms. The lawyers in our sample who were former patent examiners were more likely to withhold prior art on behalf of clients to whom they were beholden. We suggest that the savvy that these examiner-turned-lawyers gained while serving as patent examiners carries over to their legal careers. From their time as patent examiners, these patent lawyers developed a rich understanding of the inner workings of the examination process and an appreciation for its subjectivity. Such insights strengthen their abilities to push the envelope on behalf of clients to whom they are beholden.

A recent qualitative study conducted by (Dinovitzer et al. 2014), which fleshed out the client capture phenomenon, indicates that the power dynamics between professionals and their clients that lead to client capture are complex and contextual. Dinovitzer and colleagues suggest that professionals' compensation and seniority are likely to come into play. Although their interviews provide initial evidence for differences between associates and partners in their propensity to capitulate to client capture, reasons for these differences, and any underlying conditions supporting these differences, were ambiguous. Our study provides greater specificity and empirical evidence for their assertions.

Our analyses suggest multiple levers that policymakers and professional service firm management can use to alleviate the adverse effects of client capture. One means would be to constrain the root cause of client capture by limiting the extent to which professionals', particularly associates', become beholden to any one client or segment of clients. Some scholars have suggested that, to prevent professionals from disregarding their professional obligations in

pursuit of their clients' interests, there should be a mandatory rotation of professionals across multiple clients (Kiser 1999; Weber 1922). In response to this logic, the Sarbanes-Oxley Act of 2002 mandates the rotation of auditors among multiple firms (Bamber and Iyer 2007).

Nonetheless, as our analysis suggests, professionals may become beholden to entire segments of similar clients. One mechanism for alleviating client capture of associates is greater oversight of their work by partners who are biased less by the prospect of employment with client firms whom they repeatedly engage. Cooling-off periods, whereby professionals are restricted for a certain time from leaving their professional service firms and working for a client firm, also may limit the bias that professionals display in their professional judgment on behalf of clients with whom they repeatedly engage. Such restrictions, however, would not likely be beneficial for alleviating compromised judgment that occurs when professionals enter their field through regulatory employment revolving doors; the lessons learned from working on the other side of the regulatory fence are likely to sustain for longer than any reasonable amount of time set aside for a cooling-off period.

For client firms that are looking to curvy the partiality of the professionals with whom they contract, the implications from our study are clear. Outsourcing their work to a limited number of specialized professionals who are not equity partners in their respective professional service firms may benefit client firms by creating a beholden professional who is willing to push the envelope in their interest. In conjunction with these conditions, tapping the expertise of professionals with prior experience as regulators will be additionally beneficial for client firms.

Due to our patent examination context, our results are particularly pertinent for industrial firms and their patent strategy, and present research opportunities. Prior studies have explored when industrial firms are likely to outsource patent legal services (Mayer et al. 2012), how firms

allocate their outsourcing across multiple law firms (Moeen et al. 2013), and whether such outsourcing influences firms' ability to subsequently enforce their patents (Reitzig and Wagner 2010). Our study looks more closely at the patent lawyer-client relationship. The micro-processes by which lawyers assist their clients in acquiring intellectual property rights have direct implications for proprietary, defensive, and leveraging patent strategies that patent-holding firms use to gain competitive advantage (Somaya 2012). Firms can exploit their patent portfolios by fencing off technological space to ensure that they are free to commercialize products without their being accused of infringing on the patents of others or being held up for rents. Likewise, firms can create dense thickets of patents to block the product development of their competitors or to ensure mutual holdup (Hall and Ziedonis 2001b). Developing extensive portfolios of potentially overlapping patents is essential for these strategies, and client firms may wish to retain lawyers who are particularly beholden and inclined to push the envelope when developing patent applications on their behalf.

Our results, however, suggest that there are countervailing forces that influence prior art disclosure by legal counsel; although greater engagement and specialization may render lawyers beholden and more likely to withhold prior art known to them in the interest of clients gaining broadly scoped patents, it also may make them more knowledgeable of relevant prior art and, thus, liable for disclosing such art. Many clients request that their outside counsel *not* search for prior art beyond their existing knowledge of prior art (Clifford 2013), and law firms are known to establish "Chinese walls" to restrict the flow of information between patent lawyers in their practice as a means to decrease their professional obligations for disclosure (Hricik 2000). Thus, clients may benefit from relying on legal counsel who does not specialize in the client's technological domain or who does not have extensive exposure to the client's technology from

previous engagements. Future research that explores these tradeoffs and the assignment of patent lawyers to client firms would be worthwhile.

Our study has limitations. The lawyers in our sample are restricted to those who have LinkedIn profiles and, thus, constitute a non-random sample. Despite our use of extensive numbers of control variables and fixed effects, as well as our testing for sampling bias, our empirical models are subject to unobserved heterogeneity, potentially leading to traditional and sample-induced endogeneity (Certo et al. 2016). Thus, inferences made from our empirical models are tentative. Future research that replicates and extends our findings, using samples composed of patent lawyers as well other types of professionals, is needed for further validation. Consistent with the phenomenon of client capture, our population of interest also was limited to lawyers employed by law firms. Although in-house professionals do not work under “up or out” employment norms, or are at risk of being “captured” by their various clients, they may experience similar tension between their allegiance to their industrial employers and their professional responsibilities to society. These dynamics open up research opportunities of their own. It would be interesting, for example, to consider how the tenure of in-house lawyers with their employers and how they are compensated (e.g., stock vs. salary) influence their willingness to withhold prior art on behalf of their employers. Lawyers also may vary in the extent to which they identify with their profession and their organization of employment (Hekman et al. 2009). Future research on the behavior of in-house lawyers in terms of withholding prior art and the role of tenure, compensation, and identity could be particularly worthwhile.

3 How stereotypes and occupational status promote discrimination: the role of status consistency, status deprivation and status privilege

3.1 Introduction

Ethnic and gender groups are often subject to bias. The economic inefficiencies of biases in the workplace do little to quell them (Arrow 1998). For example, black employees at Fox News recently filed a racial discrimination lawsuit against their white managers, alleging that these managers forced them to arm-wrestle white co-workers for entertainment (Flint 2017). Bias against women is thought to be particularly severe in male-dominated environments such as high-technology industrial sectors (Williams et al. 2014). A recent and somewhat disputed study found that female engineers employed at Facebook experience substantially greater rejection of their computer code than their male counterparts (Seetharaman 2017).

However, relatively little work has examined how majority groups, such as white males, are sometimes targeted. In this context, two distinct explanations for ethnic and gender bias have emerged. One is the need for certain segments of society, such as white males, to protect their perceived prominent status (Blumer 1958). Perceived status can be based on various dimensions such as race, gender, citizenry, occupation, education, and compensation; any seeming inconsistency in status rankings across dimensions may compel individuals to discriminate against others (Lenski 1954). For example, highly educated citizens who earn less than immigrants may feel status deprived and exhibit prejudice (Runciman and Bagley 1969). Another explanation for prejudice entails stereotyping (Branscombe et al. 1999; Fiske et al. 2002). Stereotypes are beliefs about qualities that an individual possesses due to their membership of a social group. For example, Asian men are viewed as skilled at mathematics (Lin et al. 2005).

Although gender and ethnicity can evoke stereotypes regarding competence, leading to status differences (Ridgeway 2001), little work has examined the role of competence in the backdrop of occupational differences. Further, while context makes a particular stereotype salient, empirical tests that demonstrate its role are scant. For example, males are stereotyped as being aggressive. Legal practice would value this behavior much more than medicine; lawyers are expected to assertively defend their clients' interests, while a doctor's persuasive demeanor matters less than their competence at healing patients. Further, past research has focused largely on the beneficial effects of positive stereotypes on performance (the "Matthew effect"), paying less attention to how such stereotypes can aggravate biases towards others lacking such a stereotype (Merton 1968). Moreover, prior empirical research has typically relied on laboratory settings or perceptual data from surveys rather than actual behavior from large-scale field settings. The few large-scale field studies that have explored bias (e.g., Lin and Lundquist (2013)) lacked a work context and dyadic structure that could account for a rich array of cross gender, cross ethnicity interactions between potential sources and targets of bias, that would allow scholars to integrate status and stereotyping to explain bias. Thus, although the Facebook study suggests that women coders experience discrimination, it does not show whether such bias is due to their ethnicity (e.g., White vs. Asian female coders) or the ethnicity of likely male evaluators of their code.

We attempt to address these gaps by analyzing decisions made by government patent examiners to grant intellectual property rights based on patent applications developed by patent lawyers. The patent granting process provides granular data on the interactions between highly paid patent lawyers working in a coveted profession, and relatively less paid government examiners who endure lower occupational prestige. Similar to high-technology sectors,

intellectual property is male-dominated, and technological expertise plays a critical role; patent lawyers and government examiners often possess advanced science and engineering degrees. Against this backdrop, we consider the roots of possible negative and positive biases of White and Asian male examiners in their assessments of patent applications put forward by patent lawyers varying in gender and ethnicity.

We suggest that government patent examiners are influenced by demographic stereotypes regarding the competency of the lawyers whose patent applications they process, and they evaluate these stereotypes in the context of occupational stereotypes. Specifically, these occupational and demographic stereotypes can be consistent or inconsistent for both patent examiners and lawyers. The perceived competence that the ethnicity and gender of the patent lawyer evoke can be consistent with their high-status occupation as a lawyer. Similarly, examiners can also hold a consistent status position-where they perceive their own competence to be low, but in accordance with their low wage occupation as government bureaucrats. These consistencies can motivate how examiners evaluate patent lawyers' applications, and how lawyers put forth their claims on intellectual property. We posit that examiners consistently low in status on both dimensions will not merely tolerate, but actively support existing status rankings, while consistently high status lawyers will aggressively push for more intellectual property claims (Magee and Galinsky 2008).

Next, we probe inconsistent status individuals, and develop the notion that they can be status deprived or status privileged. In doing so, we show how examiners in low wage occupations who have internalized their own superior competence stereotype (i.e. status deprived) will discriminate against lawyers who they deem as earning more despite possessing lower competence (i.e. status privileged). Using these theoretical mechanisms, our study

explores both positive and negative discrimination in the economically vital domain of Science, Technology, Engineering and Mathematics (STEM). We examine these imperfections from the perspective of socio-psychological biases attributable to gender and ethnic differences between the examiner and the patent lawyer.

By studying gender and ethnic fault lines, we contribute to research on how patents are shaped by socio-psychological biases, an evolving sub-domain of patent research that has largely focused on the knowledge creation and economic value aspects of patents (for an exception, see Steensma et al (2015)). Patents provide incentives for inventive activity, a key pillar of economic growth (Mahoney and Pandian 1992). Granting patents with an accurate assessment of an invention's novelty thus enables the inventor and society to equitably divide the value stemming from rights over the invention. Assigning excessive intellectual property rights can propagate wasteful infringement related court battles and force patent holders with overlapping rights to sign cross licensing deals, increasing transaction costs for all (Ceccagnoli 2009; Hall and Ziedonis 2001b). On the other hand, granting less intellectual property than its underlying technology warrants creates disincentives for inventors to create and profit from ground-breaking new products based on such patents, and denies consumers the use of such products. Thus, any imperfections in the process of granting patent rights merits careful study.

Our analysis reveals that White male examiners, low in status based on both occupation and perceived competence, *favor* Asian male lawyers. On the other hand, we find that Asian male examiners, low on occupational status but high on perceived capability status, discriminate *against* White male lawyers who they believe to be unjustly enjoying a higher status occupation despite possessing lower perceived competence. Surprisingly, we also find that Asian male

examiners favor white female lawyers. We begin by describing the patent prosecution process, develop our hypotheses and describe our data and analysis.

3.2 The Patenting Process

Inventors establish exclusive rights to exploit their inventions by obtaining patents from the United States Patent and Trademark Office (USPTO). On behalf of inventors, lawyers prepare patent applications to be processed by the USPTO that delineate a number of claims to intellectual property requested for protection (Lemley and Shapiro 2005). The USPTO's Office of Initial Patent Examination assigns a technology area (or Art Unit) to the application, and forwards the application to that area's Supervisory Patent Examiner. The Supervisory Examiner then allocates the application randomly to an examiner (Lemley and Sampat 2012). The patent examiner reviews the novelty (and thus the validity) of these claims after assessing related inventions as found in previously granted patents and publications, and assesses whether each claim is indeed novel (Cotropia 2009). Usually over the course of several rounds of clarification and negotiation with the patent lawyer, the examiner allows some claims while rejecting others. The gatekeeper role of patent examiners is analogous to journal editors who ensure the articles they accept for publication will constitute a worthy contribution to the literature. Similarly, patent examiners are responsible for ensuring that lawyers grant claims on each application at a rate consistent with the novelty of the ideas they encompass.

While examiners' assessment of the novelty of a patent application is expected to be objective, they are often highly subjective¹¹. Thus, interactions between the lawyer and the

¹¹ We conducted semi-structured interviews with 16 former patent examiners. These interviews lasted between 20 and 45 minutes, and revealed that outcomes of the examination process could vary widely depending on the examiner. In effect, there are as many patent offices as there are examiners, belying the stated objectivity of the examination process.

examiner can easily be tinged by the examiner's biases towards the lawyer's occupation and perceived competence.

3.3 Status consistency

Occupation and perceived competence are two of many dimensions individuals rank each other on. For example, an electrician might consider a University professor to be highly educated. Often, these differences in education also lead to differences in pay; the professor also likely earns more than the electrician. In such cases, the two status rankings can be said to be *consistent*; the electrician is low in both education and pay, while the professor is high in both. On the other hand, an IT worker might earn more than a university professor despite being less educated. In this instance, both the University professor and the IT worker can be said to be status *inconsistent*. Status consistent individuals are likely satisfied with their standing, and more likely to support existing social hierarchies. This mechanism is likely in play when White male examiners interact with Asian male lawyers.

3.3.1 *White Male Examiner-Asian Male Lawyer*

Asians are often viewed as the “model minority”, with a strong emphasis on their affluence, high education and work ethic (Taylor and Stern 1997). Asian men evoke particularly strong stereotypes; they are believed to have superior intelligence, and are considered “geeky” (Lin et al. 2005; Wong et al. 2012a). White males generally enjoy a perception of superior intelligence on account of their gender, and perform better at quantitative tasks when reminded of this superior perception (Nosek et al. 2002), capability is also presumed to be different across the ethnic divide; specifically, white people view Asians as smart (Lee 2015). Thus, White men are likely to perceive Asian men as intellectually superior (Hurh and Kim 1989). Asian men also

perceive themselves to be intellectually superior, and are more likely to act accordingly when dealing with white men (Wong et al. 2012b).

Such status differences are not driven by ethnic and gender stereotypes alone, but are often viewed in the backdrop of occupational status (Blalock 1967). For example, government bureaucrats are paid less relative to lawyers and scientists and suffer from an occupational status deficit (Ganzeboom et al. 1992). A White male bureaucrat dealing with an Asian male scientist would thus view himself as being low in perceived competence as well as in occupation. Despite occupying a low status position on both dimensions, his status is *consistent* across both. On the other hand, Asians are expected to enjoy greater success in occupations that require superior quantitative skills, such as scientists, mathematicians and engineers (Leong and Hayes 1990). Asians are even perceived to be better leaders when they work as engineers (Sy et al. 2010). A White male bureaucrat would thus also view an Asian male scientist's higher pay as being consistent with his higher perceived competence (Darley and Gross 1983).

These stereotypes and occupational hierarchies tinge the negotiation for intellectual property between a patent lawyer and examiner at the USPTO (Mills 1975). While examiners are expected to be objective when they decide to grant or reject claims in an application, they are susceptible to various biases in their evaluation. Patent examiners are often saddled with a high workload and operate under time pressure (Frakes and Wasserman 2016), and are likely to use cognitive shortcuts to gauge the quality of the applications they process (Simon 1957). One such shortcut is the lawyer's ethnicity and gender that an examiner infers from the lawyer's name (Bertrand and Mullainathan 2004). Examiners likely assess the lawyer's competence based on the lawyer's demographic group with respect to their own demographic group. Examiners perceive lawyers' competence in the backdrop of the higher occupational prestige that lawyers

enjoy, and use the *alignment* between occupational and competence based status of the lawyer to gauge the validity of the claims in the patent application. As lawyers become aware of the examiners' demographics while negotiating with them for intellectual property claims, they also likely change their behavior towards examiners based on this alignment.

White male examiners would thus accord greater respect to the technological knowhow possessed by Asian male lawyers. By virtue of their employment in a higher status occupation, Asian male lawyers fulfill White male examiners' expectations of only highly competent individuals becoming patent lawyers. Moreover, examiners, as government bureaucrats at the USPTO, work in a lower status occupation than the patent lawyers whose applications they evaluate. Government bureaucrats endure lower wages and have lower occupational prestige than lawyers (Hauser and Warren 1997). However, despite being low on both statuses- occupation and perceived competence- white male examiners' status *consistency* will likely motivate them to be positively biased towards Asian male lawyers. Further, Asian male lawyers who are aware of the perception of their own superior competence are also able to better meet lawyers' occupational expectations of aggressively demanding intellectual property on behalf of their clients (Eden 1984; Eden and Ravid 1982). White male examiners are likely to attribute Asian male lawyers' aggressive demands for intellectual property to their higher competence in crafting such claims, and accord greater legitimacy to such claims (Bacharach et al. 1993; Wuggenig 1985). Thus,

Hypothesis 1: Intellectual property claims will be accepted at a higher rate when White male examiners evaluate Asian male lawyers' patent applications.

3.4 Status deprivation and status privilege

Status inconsistent individuals can be further classified as being status *deprived*, or status *privileged*. Continuing the previous example, the University professor who is better educated but earns less than an IT worker is bound to feel status *deprived*. On the other hand, the professor would view the IT worker as status *privileged*, because the IT worker earns more despite being less educated. While status *deprived* individuals are more likely to discriminate against others, we argue that they will most likely target status *privileged* individuals for discrimination. This dynamic is likely at work when Asian male examiners process White male or White female lawyers' patent applications. We describe each of these interactions in turn.

3.4.1 Asian Male Examiner-White Male Lawyer

From an Asian male examiner's perspective, White male lawyers are lower in perceived capability. However, this status is starkly inconsistent with their high-status occupation as lawyers aggressively claiming intellectual property on behalf of their clients (Greenhaus and Beutell 1985). Asian male examiners view themselves as working in a low status occupation despite being more competent, relative to White male lawyers. Examiners, typically processing a heavy workload, are likely to fall prey to the cognitive shortcuts offered by demographics and occupation. Thus, Asian male examiners will likely resent their own status deprived position in contrast to the status privileged position held by White male lawyers, and strike down more claims in their applications (Runciman and Bagley 1969). Further, White male lawyers are likely stressed meeting divergent expectations stemming from their lower perceived capability, but higher status occupation. They are also more likely to yield to Asian men trimming their intellectual property claims (Jackson and Schuler 1985; Stryker and Macke 1978). Thus,

Hypothesis 2: Intellectual property claims will be accepted at a lower rate when Asian Male examiners evaluate White Male lawyers' patent applications.

3.4.2 Asian Male Examiner-White Female Lawyer

A similar dynamic exists between Asian Male examiners and White female lawyers. Confucian philosophy accords superiority to males, and little decision making powers to females (Kibria 1990). For Asian male examiners who have internalized their own superior capability stereotype but work in a lower status occupation, White females have low perceived capability. Status deprived Asian male examiners therefore envy the status privileged position of White female lawyers, and are more likely to reject their claims. Such lawyers are also likely to yield to such trimming of intellectual property claims by Asian male examiners. Thus,

Hypothesis 3: Intellectual property claims will be accepted at a lower rate when Asian Male examiners evaluate White Female lawyers' patent applications.

Figure 3.1 provides a summary of these demographic and occupational status interactions and resulting statuses.

Figure 3.1. Examiner-Lawyer dyads: How demographic and occupational rifts produce status consistency, status deprivation and status privilege.

		Lawyer		
		Asian	White	
		Male	Male	Female
Examiner	Asian Male	NA	Status Deprived Examiner-Status Privileged Lawyer	Status Deprived Examiner-Status Privileged Lawyer
	White Male	Status Consistent (Low) Examiner-Status Consistent (high) lawyer	NA	NA

3.5 Methods

3.5.1 Data and Design

We obtained data on patents and their corresponding applications as published by the patent office, and parsed by Google¹². While the USPTO has published all granted patents, they have only recently begun publishing patent applications (starting in 2001). We excluded any patents that were part of continuations or patent families to maintain a one-to-one correspondence between patent and application, and restricted our sample to only those patents and applications that were represented by a single lawyer. We obtained lawyer and primary examiner names associated with patents granted between 1976 and 2012 from patent bibliographic data published by Google¹³. To resolve ambiguity amongst lawyer names, we first used a computer program to assign unique identifiers to similar names, and checked the program's output manually to correct both false and missed matches. We thus created a directory of lawyer names, and used the same process to create a directory of examiner names¹⁴. We then matched first names from these directories to first names tabulated by gender by the United States Census Bureau as part of the 1990 census¹⁵. Next, we matched surnames in these directories to ethnicity tabulations by surname published by the Bureau in 2000¹⁶. These tabulations reveal the percentage of people with a given name being either White or Asian, and Male or Female.

¹² Patent example: <http://google.com/patents/US8567723>

Application: <http://google.com/patents/US20120153084>

¹³ <https://www.google.com/googlebooks/uspto-patents-grants-biblio.html>

¹⁴ These directories are available on request.

¹⁵ https://www.census.gov/topics/population/genealogy/data/1990_census/1990_census_namefiles.html

¹⁶ https://www.census.gov/topics/population/genealogy/data/2000_surnames.html

Our final sample includes 127,695 patents, applied for between 2001 and 2011, across 8,186 lawyers and 2,312 examiners. Assuming at least an 80 percent probability threshold for demographic characteristics, we computed 5,375 of these lawyers as being White, 313 as Asian and 6,814 as Male¹⁷. 1,027 of the examiners were White, 484 were Asian and 1,633 were Male. A further breakdown of the distribution of patents across examiner-lawyer ethnic/gender combinations are provided in Table 3.1.

¹⁷ Based on a probability score of 80% and above for a name being of a particular ethnicity or gender.

Table 3.1. Observations associated with Examiner Lawyer dyads

		Lawyer					
		Asian		White		Other	
		Male	Female	Male	Female	Male	Female
Examiner	Asian Male	848 patents 184 examiners 96 lawyers	436 patents 107 examiners 37 lawyers	8,900 patents 267 examiners 1,926 lawyers	1,074 patents 218 examiners 242 lawyers	3,862 patents 255 examiners 878 lawyers	387 patents 150 examiners 125 lawyers
	White Male	1,612 patents 425 examiners 142 lawyers	787 patents 244 examiners 63 lawyers	26,397 patents 783 examiners 3372 lawyers	3,257 patents 600 examiners 574 lawyers	11,417 patents 742 examiners 1,535 lawyers	1,269 patents 429 examiners 259 lawyers
	Other Male	1,503 patents 341 examiners 130 lawyers	777 patents 198 examiners 67 lawyers	20,836 patents 561 examiners 3051 lawyers	2,497 patents 448 examiners 486 lawyers	9,278 patents 539 examiners 1,415 lawyers	1,010 patents 318 examiners 244 lawyers

A key feature of our data is quasi-random assignment (random with respect to race and gender of the lawyer and the examiner) of a patent application submitted by a lawyer, to a particular examiner. This randomness obviates the need to statistically control for many of the patent, applicant, or lawyer characteristics that might otherwise impact our hypothesized relationships, and allows us to build a parsimonious econometric model¹⁸. It also allows us to present more generalizable results from the real world, a key limitation of gender and ethnic studies that employ small samples obtained in stringent laboratory settings, or rely on self-reported survey data with its own econometric issues.

Another characteristic of our data is the exclusion of rejected applications from our sample, potentially creating sample selection issues. However, examiners’ decisions regarding even “rejected” patents can be appealed, posing difficulties in assigning such applications to the rejected bucket. Further, although examiner data for such applications is available, lawyer data is at best ambiguous. The extent of endogeneity such exclusion might cause is likely small, given

¹⁸ We need to include only those control variables that influence both the scope of the intellectual property eventually granted, *and* the independent variables of interest. Due to random assignment of a patent application to an examiner, it is highly improbable that any patent, applicant, examiner or lawyer characteristics will be correlated to gender and ethnicity differences between lawyer and examiner.

that approximately 72 percent of all applications are eventually granted (Lemley and Sampat 2012). Further, by excluding applications that did not result in patents, we omit observations where negative bias is likely most severe, thus rendering any related findings more conservative. On the other hand, findings regarding positive bias are rendered less conservative, albeit this effect is tempered by the relatively large sample coverage of the population.

We carefully considered some sources of endogeneity to eliminate any remaining concerns. One potential source of endogeneity is the omitted variable, lawyer competence. Including only granted patents implies our sample likely over-represents the most skilled attorneys who are able to get past examiners' objections and obtain intellectual property. Thus, lawyer competence increases the probability of a patent entering our sample, resulting in positive errors in the sample selection stage. Lawyer competence also increases the scope of granted intellectual property, our final dependent variable, resulting in positive errors in the final stage as well. Thus, lawyer competence causes positive correlation between the error terms in the two stages, depressing coefficients and rendering any obtained estimates conservative (Certo et al. 2016). While a parallel argument applies to examiner competence, we control for extensive examiner heterogeneity by deploying examiner fixed effects.

3.5.2 *Key Variables*

Patent Claims. Consistent with past practice, we measured the scope of intellectual property in a patent by counting its claims (Lanjouw and Schankerman 2001). *Patent Claims* was our dependent variable.

Prob (White Male Lawyer). We controlled for a general bias towards white male lawyers by computing the probability that the last name of the lawyer was white, multiplied by the probability that the first name of the lawyer was male. We similarly computed *Prob (Asian male*

Lawyer) and *Prob (White female Lawyer)*. We included *Prob (White male lawyer)* in models where White male lawyers' applications were assessed, *Prob (Asian male Lawyer)* in models where Asian male lawyers' applications were appraised, and *Prob (White female Lawyer)* where in models where White female lawyers' patent applications were evaluated.

Prob (Male examiner – Female lawyer). We computed this variable as the probability that the first name of the examiner was male, multiplied by the probability that the first name of the lawyer was female. We obtained these probabilities from the Census Bureau, which provided the relative frequency of first names as being male or female in an analysis of the 1990 census data. We similarly computed *Prob (Male examiner – Male lawyer)*. *Prob (Male examiner – Female lawyer)* was included as a control in models which study Male examiners' interactions with Female lawyers, while *Prob (Male examiner – Male lawyer)* was included as a control in models which study Male examiners' interaction with Male lawyers.

Prob (White examiner – Asian lawyer). We computed this variable as the probability that the last name of the examiner belonged to a White individual, multiplied by the probability that the last name of the lawyer belonged to an Asian. These probabilities have been computed by the Census Bureau in the 2000 census for all surnames that occur more than a hundred times. We similarly computed *Prob (Asian examiner – White lawyer)*. We included *Prob (White examiner-Asian lawyer)* in models that study the how White examiners interact with Asian lawyers, and *Prob (White examiner- Asian lawyer)* in models that study the interaction of Asian examiners and White lawyers.

Application Claims. Lawyers tend to start with broad claims on intellectual property, which are whittled down by the patent examiner during the examination process. We controlled for the initial intellectual property claimed by the lawyer by counting the claims in the patent

application. We logged this variable to model a linear relationship between application claims and our dependent variable, *Patent Claims*.

Year Fixed Effects. We also controlled for any yearly shocks that might affect our hypothesized relationships by including fixed effects for the application year of the patent.

3.5.3 Analysis and Results

Our dependent variable, *patent claims*, is a count that can take on only integer values greater than zero. The use of linear regression to model such data may result in inefficient, inconsistent, and biased coefficient estimates (Long 1997). Poisson or negative binomial maximum likelihood estimators are well-suited for modeling outcomes constrained to positive integers. One of the strengths of our data is the ability to control for time invariant unobserved heterogeneity across examiners through fixed effects models. However, given the size of our full sample, and the number of unique examiners (i.e., 2,320), estimating an *unconditional* fixed effect negative binomial model (i.e., dummy variable for each examiner) was computationally intractable. Recent work has shown that, although computationally tractable, *conditional* fixed effects negative binomial estimation (Hausman et al. 1984) is not a true fixed-effects method in terms of controlling for all stable covariates, and does not effectively contend with over-dispersion (Allison and Waterman 2002; Greene 2007).

On the other hand, Poisson Quasi-Maximum Likelihood (PQML) fixed effects estimators have been shown to control for all stable covariates, and effectively contend with both over- and under-dispersion in the dependent variable (Wooldridge 1997, 2010). The method of moments technique is used to specify the estimator:

$$\sum_{i=1}^n [y_i - e^{x_i \tilde{\beta}}] x_i = 0$$

Where the variance assumption is:

$$E[y_i] = e^{(x_i\beta)} = \sigma^2 V[y_i|x_i]; \sigma^2 > 0$$

Because the dispersion parameter is a multiplicative term in the quasi-likelihood function, it is not relevant in the maximization process. Only the standard errors of the coefficients need to be adjusted. Recent simulation studies have shown the PQML estimator to be both consistent and unbiased (Silva and Tenreyro 2006). Thus, we use PQML fixed effects with robust standard errors as our primary means of estimation for all of our models.

Summary statistics are provided in Table 3.2, while regression results are provided in Table 3.3. Models 1-2 in table 3 pertain to White male examiners evaluating Asian male lawyers' applications; models 3-4 test for when Asian male examiners evaluate White male lawyers patent applications, while models 5-6 evaluate how Asian male examiners evaluate White female lawyers' applications. Models 1, 3 and 5 are models that contain only control variables, while 2, 4 and 6 include the full set of variables. In model 2, the coefficient for Prob (White male examiner-Asian male lawyer) is positive and significant ($p < .05$), supporting hypothesis 1. The effect size can be computed as the exponent of the coefficient of Prob (White male examiner-Asian male lawyer), i.e. $e(.05) = 1.05$. Thus, White male examiners grant 5% more claims in patent applications by Asian male lawyers. Similarly, in model 4, the coefficient for Prob (Asian male examiner- White male lawyer) is negative and significant ($p < .05$), providing support for hypothesis 2. The effect size can be similarly computed as 5% lower claims being granted when Asian male examiners process applications by White male lawyers. Interestingly, in model 6, the coefficient for Prob (Asian male examiner- White female lawyer) is positive and significant ($p < .05$), with Asian male examiners granting 5% more claims to White female lawyers. This finding is contrary to hypothesis 3. We graph all effect sizes in Figure 3.2.

Table 3.2. Summary Statistics

Variable	Mean	S.D.	Min	Max
Patent Claims	17.63	13.71	1	478
Application Claims, logged	2.89	0.7	0	8.8
Prob (White male examiner-Asian male lawyer)	0.03	0.12	0	0.97
Prob (Asian male examiner – White male lawyer)	0.1	0.25	0	0.96
Prob (Asian male examiner –White female lawyer)	0.01	0.09	0	0.95
Prob (Asian male lawyer)	0.06	0.2	0	0.98
Prob (White male lawyer)	0.69	0.35	0	0.99
Prob (White Female lawyer)	0.09	0.26	0	1
Prob (White examiner – Asian lawyer)	0.04	0.16	0	0.97
Prob (Asian examiner – White lawyer)	0.17	0.32	0	0.98
Prob (Male examiner – Male lawyer)	0.67	0.45	0	1
Prob (Male examiner – Female lawyer)	0.1	0.29	0	1

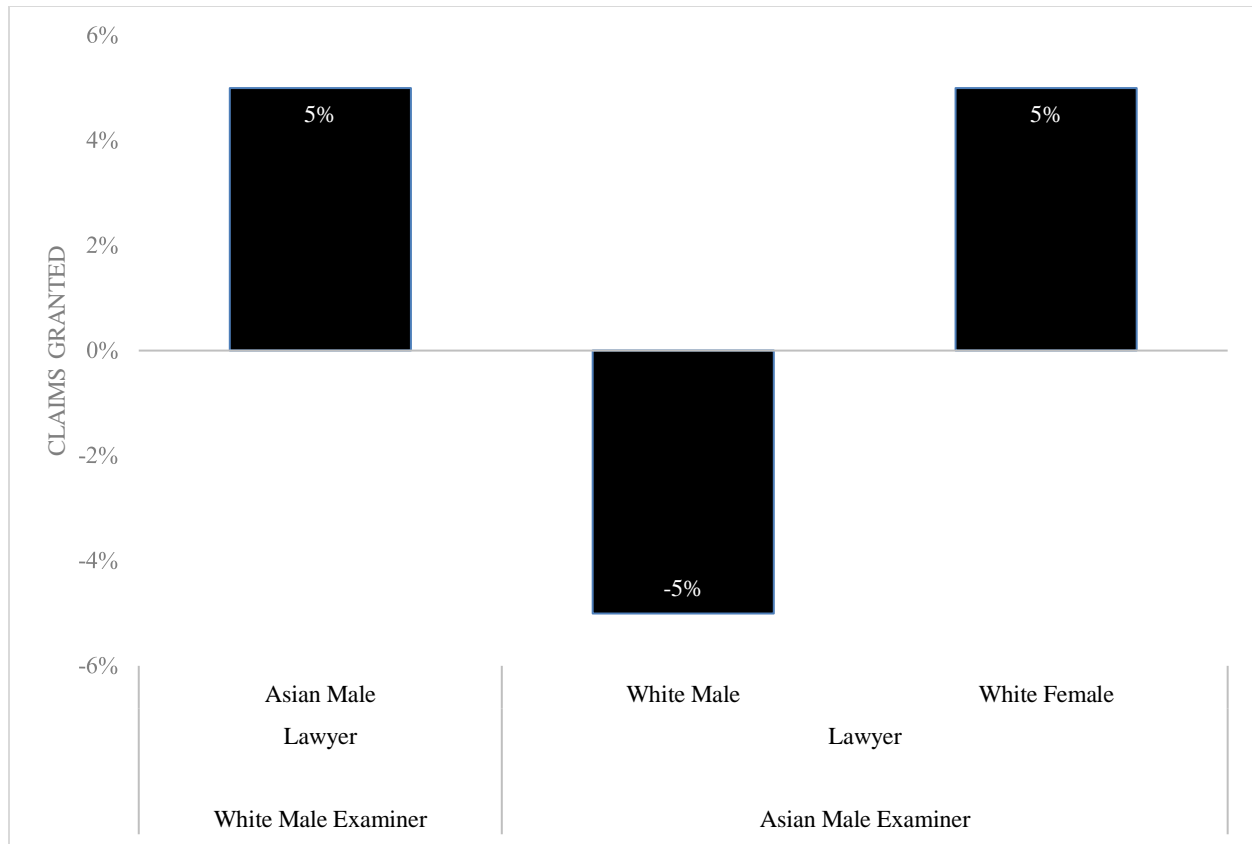
Table 3.3. Patent Claims: Poisson Quasi Maximum Likelihood estimates^{ab}

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Prob (White male examiner-Asian male lawyer)		0.05* (0.03)				
Prob (Asian male examiner-White male lawyer)				-0.05* (0.02)		
Prob (Asian male examiner-White female lawyer)						0.05* (0.02)
Prob (Asian male lawyer)	-0.00 (0.01)	-0.01 (0.01)				
Prob (White male lawyer)			0.01+ (0.01)	0.01+ (0.01)		
Prob (White Female lawyer)					0.05*** (0.01)	0.04*** (0.01)
Prob (Asian examiner-White lawyer)			0.02 (0.02)	0.04* (0.02)	0.02 (0.02)	0.01 (0.02)
Prob (White examiner-Asian lawyer)	-0.07*** (0.02)	-0.09*** (0.02)				
Prob (Male examiner-Male lawyer)	-0.01* (0.01)	-0.01* (0.01)	-0.02* (0.01)	-0.01 (0.01)		
Prob (Male examiner-Female lawyer)					-0.02* (0.01)	-0.03** (0.01)

^aN=127,695; Robust standard errors in parentheses. Examiner and Year fixed effects in all models.

^b*** p < 0.001, **p<0.01, *p<0.05, +p<0.1; one tailed tests.

Figure 3.2. Effect Sizes



3.6 Discussion

Discrimination has deleterious effects on individuals, firms and society. The study of its origins and developing a strong theoretical understanding of why and how it occurs is therefore vital. We explore discrimination by unpacking the role of stereotypes in forming a status hierarchy between individuals based on perceived capability. In doing so, we explore the importance of context (i.e. STEM) in triggering particular skill based stereotypes. We explore these perceived competencies in the backdrop of occupational rankings. We highlight how status *consistent* individuals, even if they are low in status on both occupation and perceived capability, will likely favor individuals who are consistently high status. Next, we build on theory that suggests that status *deprived* individuals, such as individuals that do not work in well-paying

jobs (low occupational status) despite feeling more capable, will be most likely to discriminate. We suggest that such people will discriminate against status *privileged* individuals, i.e. those they view as illegitimately working in a high-status occupation despite possessing lower capability.

We use these insights to predict that White male examiners, with consistently low status on both occupation and perceived capability (relative to Asian male lawyers), will most likely favor Asian male lawyers by granting them more intellectual property claims. Conversely, White male lawyers are grudging their high-status occupation due to their lower perceived capability by Asian male examiners, who grant them fewer intellectual property claims. Our analyses support both predictions. Contrary to theory, however, we find that Asian male examiners favor white female lawyers and grant more intellectual property claims.

Our research efforts align well with patent strategy scholars who highlight the importance of demarcating patent boundaries accurately; granting more patent rights than an invention is due has the potential to spark patent races where competitors accumulate vast troves of low quality patents to deploy in cross-licensing deals and in infringement litigation (Hall and Ziedonis 2001b). These patents, while protecting the short-term interests of firms, eventually cause harm by using up scarce resources that could be deployed in more meaningful ways. For example, Apple and Samsung spent more money on accumulating patents and fighting intellectual property battles than on R&D (Duhigg and Lohr 2012). On the other hand, granting fewer claims than warranted muffles inventors' incentives to create groundbreaking inventions. We also contribute to sociologists' efforts to study discrimination, and their attempts to explain discrimination in terms of multi-dimensional status hierarchies. Specifically, we develop the insight that status deprived individuals are most likely to target status privileged individuals, and

show how privilege and deprivation arise from context activated stereotypes. We find that strong stereotypes can even overcome white males' urge to protect their majoritarian status.

Notably, we find that White female lawyers are treated favorably by Asian male examiners. This finding is somewhat against the prediction offered by status deprivation arguments - Asian male examiners view themselves as high status on perceived capability, but low on occupation, and should discriminate against White female lawyers. However, this discovery reminds us that demographics like ethnicity and gender offers a status hierarchy of its own, shorn of ascribed statuses like occupation and capability. In this research vein, scholars have found that non-white males prefer white females for dates (Lin and Lundquist 2013). Given that examiners operate under targets to process a given number of patent applications within a certain timeframe, and have nothing to lose by granting more or less claims to lawyers, this dynamic arguably comes into play. On a related note, this lack of incentives for examiners to favor or disfavor any particular patent application also highlights how our analysis related to other hypotheses is conservative; examiners fall prey to status linked mechanisms *despite* a lack of economic incentives.

3.7 Implications, limitations, and future research

We make some justifiable assumptions in our data. First, we assume that the census bureau's evaluation of gender and race associated with a particular lawyer name is the same as the examiner's evaluation. To the extent that each examiner consistently deviates from the census bureau's evaluation, we control for these errors by deploying examiner fixed effects. Further, we assign probabilities to the examiner's own gender and ethnicity, assuming that the examiner is drawn randomly from the population. While these assumptions impose some restraints on the generalizability of our findings, the random assignment of patent applications to

examiners and our deployment of examiner fixed effects engender strong confidence in the internal validity of our findings. While the threat of endogeneity always lurks in any regression that does not employ strong instruments, our careful consideration of the sources of endogeneity hopefully limits such concerns.

We are unable to explore other interactions based on status consistency due to limitations imposed by our setting and data- for example, do status privileged individuals discriminate against status deprived individuals, or do they favor them as the “underdogs”? These questions remain unanswered, and perhaps future research can address them. We also assign examiners and lawyers to the rather broad “Asian” bucket, and more research is needed on distinctions between Asian sub-cultures, such as Indian and Chinese. A bigger unanswered question is the cognitive limitation on the number of dimensions of status consistency an individual can process.

4 The Influence of Patent Assertion Entities on the locus of inventive and patenting activity

4.1 Introduction

The Patent Assertion Entity (PAE), pejoratively referred to as a ‘patent troll’, has emerged as an influential organizational form in markets for intellectual property rights. PAEs neither invent nor commercialize, but rather purchase patents from inventors and then license the rights to use this intellectual property to various commercializing entities. The evolution of PAEs is remarkable both in the speed of their ascendance and their influence. In 2011 alone, PAEs generated licensing revenues of over \$29 billion (Bessen and Meurer 2012). From 2000 to 2008, PAEs alleged 17% of all infringement lawsuits, representing 26% of all defendants (Chien 2008). Intellectual Ventures, the largest of these entities, is thought to control over 40,000 patents, testament to the growing influence of PAEs in markets for intellectual property rights (Bishop 2013).

In essence, PAEs disaggregate the intellectual property creation-product commercialization value chain by intermediating relationships between those that patent and those that create products (Steensma et al. 2016a). Some have suggested that their operations, especially the vigorous pursuit of infringement litigation against commercializing entities, is exploitive, destroys value, and incentivizes the creation and patenting of incremental inventions (Aeppel 2004; Blumberg and Sydell 2011; Economist 2005; Nocera 2006; Reitzig et al. 2007). Others claim that they create value by bundling complementary patents, providing one stop shopping to commercializing entities, and assisting small inventors in appropriating value from their inventions and patents that might otherwise be lost to infringement (Cohen et al. 2000; Geradin et al. 2012; Lanjouw and Lerner 1997; McDonough 2006)).

While scholars have studied the types of patents purchased by PAEs (Fischer and Henkel 2012; Shrestha 2010), little is known about how PAEs actually influence patenting pursuits. In this study, we delineate patenting organizations into two sectors based on whether they are likely suppliers or targets/customers of PAEs. The first sector is composed of entities with relatively limited capacity for product commercialization (hereafter referred to as the inhibited commercialization sector). They include independent inventors, small firms, universities, and research labs. Because these entities often lack complementary assets needed for commercialization, they frequently provide their intellectual property to others for commercialization (Gambardella et al. 2007), and are potential suppliers of patents to PAE intermediaries as well. The second sector is composed of relatively large for-profit firms which in addition to inventing and patenting capability, typically have complementary assets for commercializing intellectual property (hereafter referred to as the viable commercialization sector). Entities in this sector are less likely to offer up their intellectual property for others to commercialize (Fosfuri 2006), and more likely to be targets of infringement lawsuits levied by PAEs and potential licensees of PAE-owned patents, as they supplement their own intellectual property in their commercialization efforts.

We examine how PAE intermediation shifts the share of patenting between these two sectors and alters how relatively incremental the patents produced by each of these sectors are. We maintain that by aiding those from the inhibited commercialization sector to appropriate rents from even incremental inventions, PAE intermediation incentivizes their inventive and patenting efforts accordingly. In tandem, by expanding the markets for intellectual property developed by others and diffusing these rights broadly, PAE intermediation enhances parity and competitiveness for those that are inclined to commercializing new products. Unencumbered by

the need to invent around the closely held patents of others due to the intellectual property available through PAEs, firms from the viable commercialization sector are incentivized to develop relatively fewer patents, but these patents are likely to be increasingly novel in nature in order for these firms to distinguish themselves from their competition.

To assess these effects, we constructed a panel of data tracking levels of PAE intermediation, as well as the patent output from these two sectors for each USPTO technology class and each year from 2001-2010. Our analysis suggests that PAE intermediation shifts the distribution and nature of inventive activity between the two sectors. While greater PAE intermediation in a given technology class increases the share of patents produced by the inhibited commercialization sector (i.e., independent inventors, small firms, universities and research labs), the patents that are developed by these entities tend to be increasingly incremental in nature (relative to those from the viable commercialization sector). Analogously, PAE intermediation decreases the share of patents from the sector of firms with greater commercialization capabilities, but the patents they do generate tend to be increasingly novel in terms of building on relatively little prior knowledge.

We seek to contribute to the literature on patent strategy by offering the first empirical test of how PAEs influence firm patenting (Somaya 2012; Steensma et al. 2016a). We show how PAEs influence inventive and patenting activity by offering firms with relatively fewer commercialization capabilities the opportunity to specialize in creating incremental patents. Simultaneously, PAEs also allow firms with commercialization capabilities to focus their efforts on more novel inventions. They do so by reducing the exposure of such firms to litigation by distributing incremental intellectual property bundles across numerous competitors.

4.2 PAEs as intermediaries in intellectual property markets

PAEs are generally structured in a manner similar to venture capital funds, raising money from both corporate and institutional investors to buy assets from those who would have difficulty monetizing them on their own (Myhrvold 2010). To take one example, current funding sources of Intellectual Ventures include Microsoft, Intel, Sony as well as the University of Pennsylvania, Notre Dame, and Charles River Ventures (Feldman and Ewing 2012). PAEs purchase patents from individual inventors, corporations, universities, and government research labs, and employ professionals who specialize in patent valuation, licensing, infringement monitoring, and litigation to eventually license these patents in patent bundles. A typical PAE is structured as a parent organization with multiple specialized shell companies that conduct investment, licensing, and enforcement activities. It is estimated that the operations of a prominent PAE, Intellectual Ventures, are spread across more than 1,000 shell companies (Feldman and Ewing 2012).

PAEs can be viewed as distributors of intellectual property, who intermediate relationships between inventors on one side and those who commercialize inventions on the other (Steensma et al. 2016b). In general, distributors enhance efficiency by matching the supply of varietal goods from multiple suppliers to the demand for this variety from several consumers (Stern et al. 1996). In their absence, suppliers and consumers contracting directly with each other will incur greater transaction costs. For example, a total of twenty-five transactions would occur between five consumers contracting individually with five single-good suppliers; a distributor can reduce this total to ten by buying from five suppliers and selling all goods from each supplied as a bundle to five consumers. Thus, distributors can create transactional efficiencies in exchanges between buyers and sellers (Coughlan 1987).

In a similar vein, PAEs distribute intellectual property rights, reducing the number of transactions for intellectual property licensing which would otherwise occur between inventors and commercializing entities through bilateral licensing agreements. Commercializing entities benefit from one-stop shopping for a portion of their intellectual property needs; inventors benefit from not having to license their intellectual property directly to a vast array of commercializing entities, and not being forced to enforce their intellectual rights against a large number of infringers.

Because PAEs specialize in patent licensing and enforcement, their efficient scale of operations is determined solely by these activities, and they can employ professionals conducting them at an efficient scale (Steensma et al. 2016a). In contrast, when licensing and enforcement is integrated within organizations that also invent, their efficient scale of operations is likely determined by the activity of invention, that is, the dominant activity in terms of capital intensity. In such cases, licensing and enforcement activities are potentially conducted at an inefficient scale. By acting as market makers, and efficiently matching the supply of intellectual property to its demand, PAEs reduce transaction costs between those that invent and those that commercialize. Because of these reduced costs, there is less incentive to integrate invention and commercialization activities in an effort to avoid such costs. The ability of firms to enhance their specialization in either invention or commercialization as a result of PAE intermediation alters the locus and novelty of inventions and associated patents between those that are relatively inhibited in their abilities to commercialize intellectual property due to a lack of complementary assets, and those that are less so.

4.3 PAE intermediation and the shifting share of patenting between inhibited and viable commercialization sectors

Individual inventors, small firms, and research institutions suffer from a liability of smallness (Freeman et al. 1983; Lanjouw and Schankerman 2004). Due to their limited scale and resources, their ability to combat widespread infringement of their intellectual property is constrained (Eisenberg 2011; Lemley 2008; Pisano 1990). Unless their intellectual property is highly valuable and difficult to imitate or substitute for, the opportunity to appropriate value from their ideas is limited for these inventors (Teece 1986). One way to contend with potential infringement and restricted appropriability is to integrate forward by commercializing products based on their intellectual property and compete directly in product markets. However, acquiring the necessary complementary assets for commercialization is often cost prohibitive (Gans et al. 2000). For inventors who lack complementary commercialization assets, securing licensing agreements with larger entities that already have such assets may be the best option (Teece 1986).

PAE intermediation provides those with limited capacities for commercialization (e.g., independent inventors, small firms, research institutions) a means to appropriating greater value from their inventions than they would through either enforcing their patents on their own and licensing directly to commercializing entities, or forward integrating. Patents sold to PAEs can be combined with other complementary patents and licensed as a bundle to a portfolio of commercializing entities wishing to develop products based on this intellectual property. In addition, because PAEs specialize in patent enforcement, they possess the scale economies to more efficiently do so than under-resourced inventors. By efficiently intermediating relationships between inventors and commercializing entities, any value lost to transaction costs is reduced

(Steensma et al. 2016a). The pricing power stemming from the monopolistic nature of patents enables inventors to appropriate a portion of the savings in transaction and enforcement costs resulting from PAE intermediation. By effectively monetizing intellectual property that would not have been otherwise, PAE intermediation provides resources and incentive to inventors that are inhibited in their abilities to commercialize on their own to both invent and patent.

Moreover, by creating markets, PAEs diffuse the rights to commercialize the intellectual property developed by others to a broader array of competing firms. As such, it is less imperative for those who possess the requisite complementary assets for commercialization (i.e., viable commercialization sector) to develop substitute technologies or invent around intellectual property that may be readily sourced from PAE intermediaries. In addition, PAE intermediation renders patent-proliferating defensive strategies often pursued by product market competitors to be ineffective. Competing firms in contested product markets may mutually deter infringement lawsuits levied by each other by threatening to file countervailing infringement suits based on inflated stocks of patents generated from creating and patenting incremental inventions (Hall and Ziedonis 2001a). However, when PAEs control and license substantial portfolios of intellectual property germane to the products of competing firms, developing a trove of patents for defensive purposes becomes less relevant. Because PAEs only distribute intellectual property rights and do not compete in product markets, those who commercialize products based on PAE-controlled intellectual property cannot counter PAEs infringement lawsuits with infringement claims of their own. Creating inventions and patenting them purely for defensive purposes becomes relatively futile.

Overall, the net effect of greater PAE intermediation for a given class of technologies is a shift in the distribution of patenting output such that entities in the inhibited commercialization

sector (i.e., independent inventors, small firms, research institutions) produce a greater share of patents vis-à-vis entities in the viable commercialization sector.

Hypothesis 1: Greater PAE intermediation increases the share of inventions patented by the inhibited commercialization sector of inventors relative to the share of inventions patented by the viable commercialization sector of inventors.

4.4 PAE intermediation and the shifting incremental nature of patenting between inhibited and viable commercialization sectors

PAE intermediation may also shift the extent to which the inhibited and viable commercialization sectors of inventors develop relatively incremental patents.

Without the intermediation services provided by PAEs, entities from the inhibited commercialization sector would be left to monetize intellectual property on their own. Because of the small scale and inefficiencies of these entities, their developing relatively incremental and low value inventions, and monetizing them via patenting is not cost effective. The returns from such inventions and corresponding patents would be incommensurate with the effort required to license them out and enforce them. Without the benefits of PAE intermediation, the survival of small, under-resourced inventors depends on developing novel inventions which will either render the downstream commercialization assets of larger incumbent firms obsolete (Tripsas 1997), or provide them substantial licensing revenue. Patents and their underlying technologies that break from the existing technological paradigm and are more likely to upend established products created by the uninhibited commercialization sector will be worthier for dedicating their limited resources. In the absence of PAEs, entities from this sector face a high bar in terms of needing to create novel inventions.

PAE intermediation, however, changes the cost-benefit dynamics for inventors that are relatively inhibited in their commercialization pursuits. PAEs are able to better monetize patents covering incremental inventions due to their scale and specialization in licensing and enforcement. Some of these gains will be appropriated by the inventors supplying PAEs. Thus, entities from this sector have incentive to produce relatively incremental patents as these patents can subsequently be bundled by intermediaries and licensed to commercializing entities.

Correspondingly, the patents produced by the viable commercialization sector will be relatively more novel as a result of greater PAE intermediation. In effect, the broad availability of PAE-controlled intellectual property rights levels the technological playing field and enhances the competitiveness between firms who commercialize competing products. Commonplace process technologies result in similar cost structures across competitors, and the widespread availability and standardization of input technologies underlying a class of products renders competing products relatively indistinguishable. Unencumbered by the need to invent substitute technologies or contract with individual inventors, and wanting to distinguish their products from the competition, commercializing entities are incentivized to produce more groundbreaking technologies in-house to differentiate themselves from their competition (Aghion et al. 2002).

Overall, the net effect of greater PAE intermediation for a given class of technologies is that the patents produced by the inhibited commercialization sector will become increasingly incremental in nature relative to those produced by the viable commercialization sector.

Hypothesis 2: Greater PAE intermediation increases the incremental nature of inventions patented by the inhibited commercialization sector of inventors relative to inventions patented by the viable commercialization sector.

4.5 Data and Sample

To test our hypotheses, we compiled data from two sources. To ascertain levels of PAE intermediation, we relied on data obtained from PatentFreedom (www.patentfreedom.com), a firm that closely tracks patent holdings and litigation activity of all non-practicing entities; that is, organizations that derive a majority of their revenues from licensing intellectual property. PatentFreedom distinguishes these organizations into five categories: inventors, special purpose vehicles set up by inventors, failed commercial businesses recouping value from their intellectual property, research institutes, and patent assertion entities (i.e. PAEs). PAEs are distinct from the other categories of non-practicing entities in that they are predominantly distributors of intellectual property rights by purchasing the intellectual property from others rather than inventing on their own.

PatentFreedom gathers data from multiple sources including patent assignment records, district court records, state business registries, news articles and annual financial filings to identify PAEs, and individuals associated with these organizations. They track all infringement lawsuits listed in the Public Access to Court Electronic Records (PACER) database provided by the federal judiciary and cover lawsuit information from all district courts across the country. PatentFreedom then removes duplicate lawsuit observations resulting from cases moving across districts. Because of the difficulty in determining whether a lawsuit is filed by a specific PAE (due to their use of shell companies in filing infringement lawsuits), PatentFreedom cross-references the persons of interest listed in each lawsuit against those known to be involved with PAEs. Data on patents acquired, reassigned, expired, and litigated by PAEs and their subsidiaries/affiliates, including the reassignment date of the patent to the PAE and technology class of the patent are retrieved from various patent databases (e.g., Thomson Innovation,

USPTO reassignment information). Through this process, PatentFreedom attains historical patent holdings and litigation activity of PAEs.¹⁹ Others have relied on data from PatentFreedom to describe PAE lawsuit activity, assess the impact of PAE lawsuits on defendant stock prices, and gauge the types of firms targeted in PAE litigation (Bessen et al. 2011; Chien 2013; Cohen et al. 2014).

PAE patent holdings are the stock of patents held by PAEs in any given year, and thus serve as a measure of accumulated patents over the years taking into account patent expirations and sales. PAE Infringement lawsuits are yearly counts. Both patent holdings and infringement lawsuits can be further delineated by the USPTO technology class of each patent held or litigated. Patents are assigned to a primary technology class by the United States Patent and Trademark Office (USPTO) based on a classification scheme of over 400 technology areas.²⁰ If an individual lawsuit includes patents from multiple classes, we credit each class with a lawsuit for that year.

Figure 4.1 and Figure 4.2 provide trends of PAE patent holdings and infringement lawsuits from 2001 to 2010 for a sample of technology classes from the electronics and computer/communications domains. As may be seen, there is substantial variability in these trends across various technology classes within these general technology domains. Thus, our unit of analysis is technology class-year. Our sample begins in 2001 when PAE holdings and litigation was first reliably tracked by PatentFreedom, and ends in 2010.

¹⁹ Informal patent assertions (i.e. letters sent by PAEs demanding payment for supposed infringement) are outside the legal system and thus not included in the data. However, these are in decline due to a rising number of PAEs sending such letters, and their resultant lack of credibility.

²⁰ <http://www.uspto.gov/web/patents/classification/selectnumwithtitle.htm>

Figure 4.1. PAE Holdings

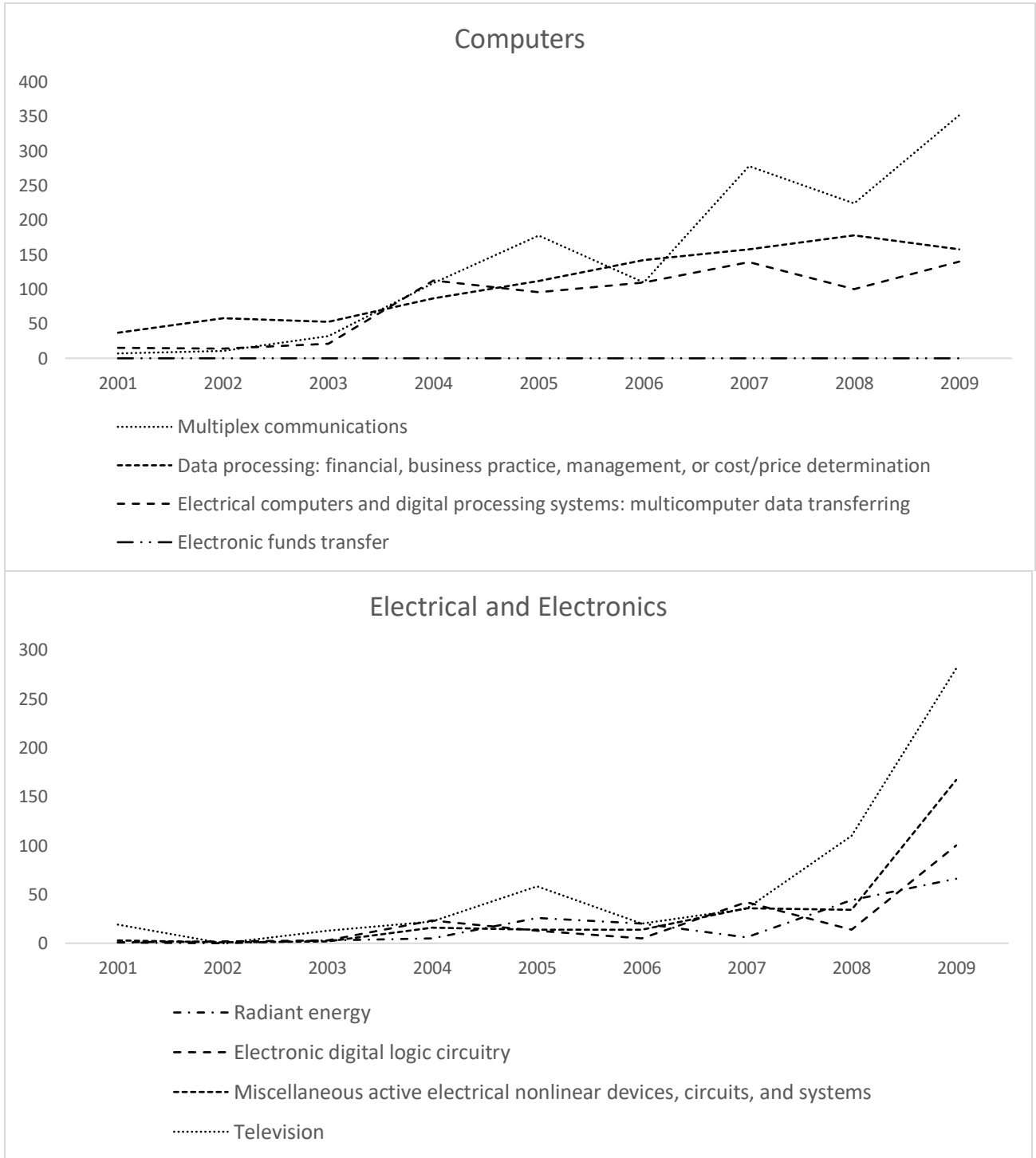
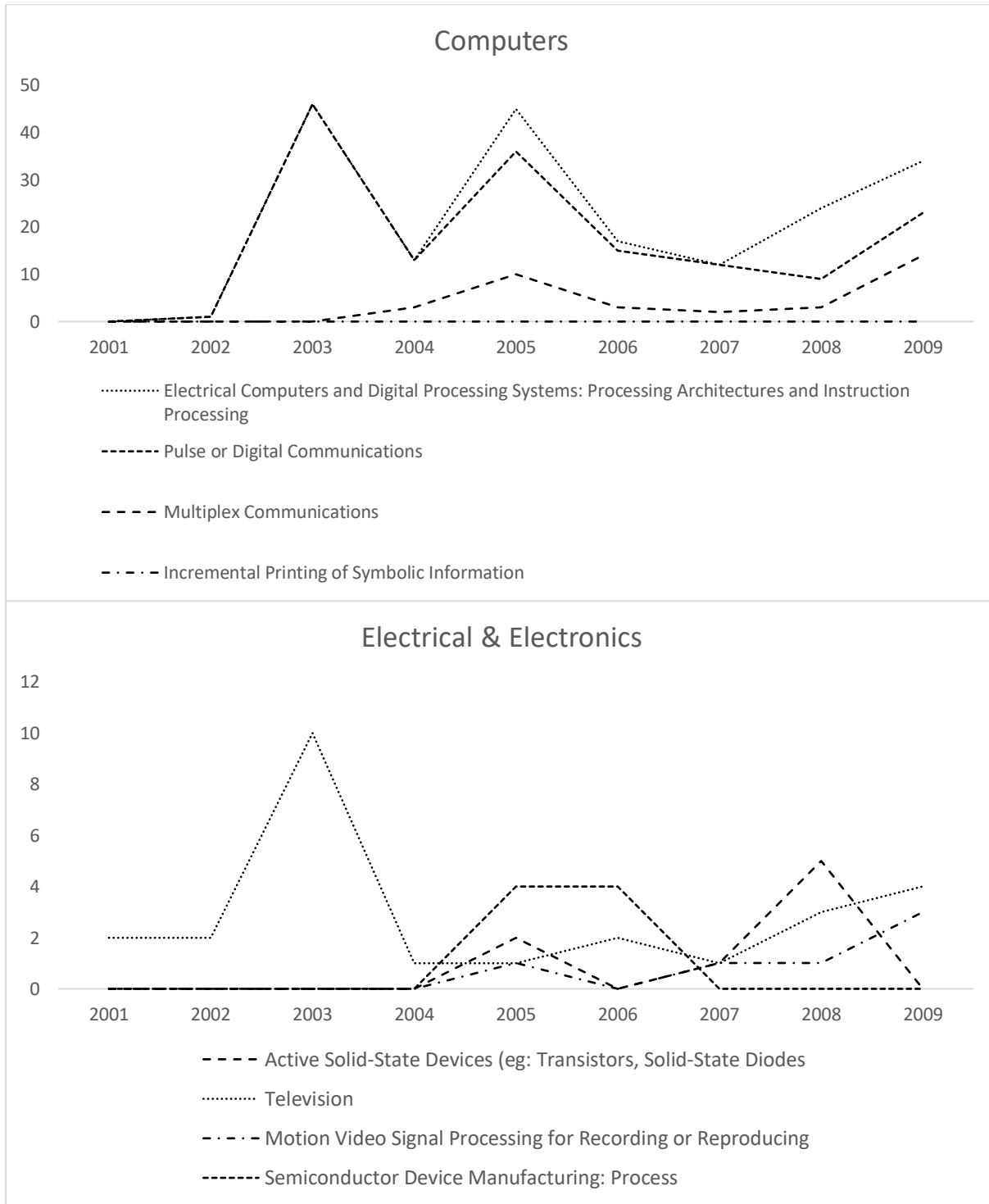


Figure 4.2. Infringement lawsuits



We also attained US utility patent and citation data on patents applied for and subsequently granted from 2002 through 2012 from Google's patent pages.²¹ We relied on the 'small entity flag' provided by Google in its Patent Maintenance Fees file to determine whether a patent was granted to an entity within the inhibited or viable commercialization sector.²² Organizations and individuals are eligible for a reduced patent filing fee if they are independent inventors, small firms, universities, or non-profit scientific or educational organizations.²³ The Small Business Administration provides qualifying standards for small firm status and reduced filing fees that vary by industry taking into account industry differences. For example, firms in the service industry are allowed to have maximum revenues of between \$2.5 million and \$21.5 million, depending on the type of service being provided.²⁴ Others have used the small entity flag to study the pattern of examiner-added citations in patents by small vs. large entities (Alcacer et al. 2009a). The small entity flag was available for 83.2% of all patents applied for (and subsequently granted) within our sample time period.

4.5.1 *Dependent variables*

Patent quantity-inhibited commercialization sector is the count of patents applied for (and granted by 2012) in each year and each technology class for all patents where the small entity flag is set to 1, designating that the applicant is an independent inventor, small firm, university, or non-profit scientific or educational organization.

²¹ Example of a patent webpage: <http://google.com/patents/US7892311>

²² <http://www.google.com/googlebooks/uspto-patents-maintenance-fees.html>

²³ [Manual of Patent Examining Procedure, Section 509](#)
[Code of Federal Regulations](#)

²⁴ <http://www.sba.gov/content/what-sbas-definition-small-business-concern>

Patent incrementality-inhibited commercialization sector is the count of backward cites in all patents where the small entity flag is set to 1, applied for (and granted) in each year and each technology class. Greater numbers of backward citations indicate greater incrementality and higher dependence on existing knowledge and technology.

We added several controls to our empirical model to align our dependent variables with our hypothesized relationships. Because we expect PAE intermediation to influence the *share* of patenting by the inhibited commercialization sector (vis-à-vis the viable commercialization sector), we controlled for *total quantity*, or the total number of patents applied for (and eventually granted) in the same year as the dependent variable *patent quantity- inhibited commercialization sector*. We also controlled for a one-year lagged value of *total quantity*, to account for the *anticipated* increase in overall patenting in the focal technology class.

Our dependent variable, *patent incrementality-inhibited commercialization sector* is a count of backward citations across all patents issued to this sector of entities; we controlled for *patent quantity-inhibited commercialization sector* in order to normalize these backward citations by the number of patents that generated these backward citations.²⁵ Because we expect that PAE intermediation increases the incremental nature of inventions patented by the inhibited commercialization sector relative to inventions patented by the viable commercialization sector, we also controlled for *total backward citations* in the same year as the dependent variable, by counting backward citations to patents granted to both sectors of inventors. Finally, we controlled for the lagged value of *total backward citations* to account for any anticipated overall changes in incremental patenting.

²⁵ While we could compute the *average* patent incrementality in a sector by dividing the total number of forward citations by the total number of patents, it is econometrically not advisable to do so Bradshaw, Y., L. Radbill. 1987. Method and substance in the use of ratio variables. *American Sociological Review* 132-135.. Moreover, it is impossible to assign values to a proportion when the denominator is zero, as is the case with our data.

4.5.2 *Independent and control variables*

Our independent variable of theoretical interest is *PAE intermediation*. We proxied for *PAE intermediation* by normalizing PAE patent holdings and PAE infringement lawsuits levied by PAEs for each year and each class and summing them together ($r = 0.53$).

In addition to the controls associate with our dependent variables described above, we controlled for *class revenues* to account for the overall growth of the technology class. We computed this variable using the Class to Standard Industrial Classification (SIC) concordances developed by the USPTO.²⁶ We obtained total revenues across all firms for each SIC from Compustat. However, multiple SIC codes often mapped to any one class, and several classes often mapped to one SIC code. We first apportioned each SIC's revenue equally to each class it mapped to. We then summed up these contributions from each SIC to arrive at a total revenue ascribed to the focal class. Because concordances were missing for the years 2006, 2009 and 2010, we used 2005's concordance to compute class revenue for the year 2006, and 2008's concordance for computing the revenues for 2009 and 2010.

We use technology class fixed effects to account for heterogeneity across technology classes and possible omitted variables. Similarly, we use year fixed effects to account for any yearly shocks that might affect our hypothesized relationships.

4.6 Analysis and Results

Estimating independent equations for our two dependent variables would not allow the error terms to be correlated, and thus would not account for the inherent relationships between our dependent variables. By estimating the two equations as a single system of equations, a

²⁶ http://www.uspto.gov/web/offices/ac/ido/oeip/taf/data/sic_conc/

seemingly unrelated regression (SUR) analysis allows for correlation across the error terms in multiple equations, and is an appropriate analytical technique for these data (Vorhies et al. 2009; Zellner 1962). To account for heteroskedastic residuals, we estimate our coefficients using Feasible Generalized Least Squares (FGLS) SUR, then adjust standard errors using the White sandwich correction.²⁷

We modeled the data using one, two, and three-year lags in our independent variables. Using a one-year lag in our independent variables, 4,283 technology class-year observations were available for analysis. The number of class-year observations dropped to 3,892 when analyzing a two-year lag model, and 3,501 observations with a three-year lag and specification. Descriptive statistics and correlations are presented in Table 4.1. Table 4.2 provides the results from the SUR models. Equations 1-2 of Table 2 lags *PAE Activity* by one year, 3-4 lags them by two years, while Model 5-6 lags them by three years.

Table 4.1. Summary Statistics

Variables	Mean	SD	Min	Max
PAE Intermediation	7.43	34.06	0	601.01
Total Quantity	235.62	439.55	0	4729
Patent Quantity-Inhibited Commercialization Sector	51.01	98.45	0	1270
Patent Incrementality-Inhibited Commercialization Sector	964.97	2074.99	0	31101
Total Incremental Patenting	4434.90	8788.94	0.00	102490
Class Revenue (Billions)	19.61	26.62	0.20	266.04
Year	2006	2.58	2002	2010

²⁷ Because we hypothesize PAE intermediation as affecting the *share* of patenting activity across both sectors of inventors, we need not include separate equations for the viable commercialization sector dependent variables. The coefficients of interest will have flipped signs for this sector.

Table 4.2. Inhibited Commercialization Sector's Patenting and Inventive Activity (Quantity and Incrementality) ^{ab}

VARIABLES	One-year lag		Two-year lag		Three-year lag	
	(1) Patent Quantity	(2) Patent Incrementality	(3) Patent Quantity	(4) Patent Incrementality	(5) Patent Quantity	(6) Patent Incrementality
PAE Intermediation (lagged)	0.45*** (0.08)	2.07** (0.75)	0.47*** (0.09)	2.69* (1.05)	0.5*** (0.07)	4.55** (1.49)
Total Quantity	0.13*** (0.02)	-2.9*** (0.71)	0.14*** (0.01)	-2.5*** (0.42)	0.14*** (0.01)	-2.57*** (0.40)
Total Quantity (lagged)	0.07*** (0.02)	0.08 (0.61)	0.05*** (0.01)	-0.38 (0.31)	0.05*** (0.01)	-0.12 (0.27)
Patent Quantity- Inhibited Commercialization Sector		15.3*** (0.61)		16.05*** (0.55)		16.81*** (0.62)
Total Incremental Patenting		0.21*** (0.04)		0.19*** (0.03)		0.18*** (0.03)
Total Incremental Patenting (lagged)		-0.02 (0.03)		0 (0.02)		-0.01 (0.02)
Class Revenue (Billions)	0.46** (0.16)	3.86* (1.88)	0.35* (0.16)	3.39 (1.87)	0.28 (0.19)	1.45 (2.72)
Class Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R ²		.92		.92		.90
Number of Obs.	4283	4283	3892	3892	3501	3501

^a ***p < 0.001, **p < 0.01, *p < 0.05, +p < 0.10; two-tailed tests;

^b White's Heteroskedasticity Consistent Robust Standard Errors

Inhibited commercialization sector. *PAE intermediation* significantly and consistently increases *Patent quantity* for the inhibited commercialization sector across all three time lag specifications (Table 2, Equations 1, 3 and 5), providing robust support for hypothesis 1. Based on the one year lag specification, an increase of one standard deviation in *PAE intermediation* increases *Patent quantity* by the coefficient of *PAE Activity*, times one standard deviation of *PAE intermediation*, divided by the mean level of *patent quantity*, or $.45 * 34.06 / 51 = 30\%$. Similarly, it decreases the patent quantity of the viable commercialization sector by $.45 * 34.06 / 184 = 8.3\%$.²⁸

PAE intermediation significantly and consistently increases *patent incrementality* across all three time lag specifications (Models 2, 4 and 6), providing robust support for hypothesis 2. Based on the one year lag analysis, an increase of one standard deviation in *PAE intermediation* increases *patent incrementality* for the inhibited commercialization sector by $2.07 * 34.06 / 964.97$, or 7%. Similarly, *patent incrementality* for the viable commercialization sector decreases by $2.07 * 34.06 / 3469.93$, or 2%.

4.7 Discussion

The evolution of PAEs has stimulated much debate as to their influence on innovation. The scale of their patent holdings, their immunity from countervailing infringement lawsuits, and their enforcement of what some view to be incremental patents have prompted concern (Bessen et al. 2011; Blumberg and Sydell 2011).

²⁸ These percentages reflect an increase relative to the mean level of patenting by each sector. Due to the low overall level of patenting by the inhibited commercialization sector, the *percentage* change is higher for this sector, when compared to the computed percentage change for the uninhibited commercialization sector.

Our analyses indicates that greater PAE intermediation within intellectual property markets may increase patent output from the sector of entities having relatively limited capacity for commercialization (i.e., individual inventors, small firms, research institutions). However, the share of incrementality of such inventions and associated patents in terms of building on past inventions may increase. We suggest that PAEs provide an avenue that did not previously exist for these inventors to monetize relatively incremental inventions. In contrast, we find that greater PAE intermediation may decrease patent output from the sector of larger, for-profit firms typically having substantial complementary assets for commercialization; however, the share of incrementality of inventions and patents that are produced may diminish. We suggest that as market makers, PAEs diffuse intellectual property more broadly than would be otherwise, and reduce the need for commercializing entities to create substitute technologies. Furthermore, because countervailing infringement lawsuits against PAEs are not viable, patent-proliferating defensive strategies pursued by large commercializing entities are rendered less ineffective. By leveling the technological playing field within product markets, PAE intermediation incentivizes commercializing entities to produce a smaller share of inventions and patents, yet their share of novel inventions and patents increases so they can distinguish themselves from the competition.

Our analysis suggests PAE intermediation within intellectual property markets may change the locus and nature of invention by shifting incentives and resources across two sectors of inventors. While small underfunded inventors generally have incentive to innovate in hopes of displacing incumbents, they have often lacked the resources to survive due to the liability of smallness (Freeman et al. 1983). On the other hand, larger established firms generally have the resources to undertake novel inventions, but have often lacked the incentive to do so due to organizational inertia, the possible cannibalization of existing products, and an aversion to risky

exploration beyond known technologies (Ahuja and Morris Lampert 2001; Hannan and Freeman 1984; March 1991; Schumpeter 1942; Schumpeter 1947). However, by providing an avenue for monetizing even incremental patents, PAE intermediation enables small inventors to appropriate rents from such patents, perhaps enabling those to survive who might not have otherwise. By expanding the availability of intellectual property created by others, PAEs promote greater rivalry between established product market competitors by leveling the technological playing field, incentivizing them to focus their inventive pursuits toward fewer, but more novel inventions in order to gain a competitive advantage. Future work linking PAE intermediation to a changing distribution of small and large inventing entities, and further specialization in either invention or commercialization activities would be valuable. Further, while we theorize and assume that both inventive and patenting activity is affected by PAE intermediation, more work is needed to test whether only patenting by these sectors is affected, or whether inventive activity also changes.

Our results support the notion that product developers may reduce their inventive activities to focus on commercialization when they are able to obtain technology from well-functioning markets (Arora and Nandkumar 2012). Greater PAE intermediation may reverse the trend of commercializing entities generating stockpiles of incremental patents as a defense against potential infringement claims of competing commercializing entities (Hall and Ziedonis 2001a). However, we make no claim that PAE intermediation is necessarily beneficial for economic growth or social welfare. Indeed, economizing on transaction costs can generate second-order counterproductive outcomes at the societal level depending on the legal context and other institutional forces (North 1990)²⁹. PAE participation in markets for intellectual property

²⁹ For example, in some legal contexts, bribery or other nefarious activities can be used to minimize transaction costs or enforce contracts. However, such activities may have harmful social costs.

may ultimately increase costs for commercializing entities as they incur licensing fees they would not otherwise; by extracting licensing fees from “frivolous” patents, PAE intermediation may hamper the commercialization of socially beneficial products. Furthermore, by enforcing such patents, PAEs may incentivize some inventors to waste resources by continuing to develop frivolous patents. Indeed, this is the side of the story that one is likely to read in the popular press (Blumberg & Sydell, 2011). Our analysis does indicate that PAE intermediation increases the incrementality of inventions and related patents coming from the inhibited commercialization sector. However, whether a patent or lawsuit is incremental is in the eye of the beholder, and ultimately determined by the courts. Future work assessing how PAE involvement in intellectual property markets influence industry-level productivity and product development may be a logical next step.

5 Conclusion

In this dissertation, I explored the imperfections in the grant of intellectual property rights, unpacking biases held by patent lawyers and examiners. Prior literature has extensively used patents to study knowledge creation and inventive activity, and even acknowledged the severe consequences of improperly scoped patents. However, relatively little literature has examined the *origin* of patents of improper scope. I undertook two studies to address this gap.

The first study explored why patent lawyers attempt to gain more intellectual property than their client's invention is due. Lawyers often contend with competing interests—those of the client, the law firm, and their professional obligations to the public. One key professional obligation that patent lawyers are expected to fulfil is to disclose all relevant patents that the focal patent's invention builds on while applying for intellectual property protection. However, lawyers are incentivized to *not* disclose all such prior art in order to gain more intellectual property for their clients. I argue that these incentives are particularly high when they are applying for a patent on behalf of a client they already have a lot of business with, or when they have a reputation to protect amongst a lot of other clients they also serve in the same technology area as the focal patent. I also argue that the effect of these incentives is further enhanced when the lawyer possesses greater capability to withhold such prior art. One source of increased capability is the revolving door; lawyers often have experience on the other side of the fence as patent examiners. Such lawyers often have added insight into the examination process. My interviews with former patent examiners revealed that they viewed the process of examining patent applications as being highly subjective and largely driven by examiner discretion on what they consider to be relevant prior art. This insight allows them to act on the enhanced incentives stemming from the need to protect

existing business with the focal client, as well as the need to protect their reputation amongst large clientele. I find support for most of these hypotheses using a dataset of 28,406 patent citations.

The second study explores the role of gender and ethnic differences that might influence how examiners and lawyers behave with each other. I use status to explain their behavior; while examiners occupy a lower occupational status relative to lawyers, certain demographic stereotypes (such as Asian men) are viewed as more competent in quantitative skills, and more suited to work in the Science, Technology, Engineering and Mathematics (STEM) domain as patent lawyers. These status hierarchies can define an individual's positions in the following terms: 1) status consistent (like Asian male lawyers, who are high on both perceived competence and occupation, relative to White male examiners), status deprived (like Asian male examiners, who are high on perceived competence, but low on occupation relative to White male lawyers), or status privileged (like White male lawyers, who are low on perceived competence but high on occupation, relative to Asian male examiners). I argue that status consistent examiners, low on both occupation and perceived competence, are likely to favor other status consistent lawyers, who they view as high on both dimensions. Thus, White male examiners are likely to grant more intellectual property rights to Asian male lawyers. On the other hand, status deprived examiners are likely to discriminate against status privileged lawyers. Therefore, Asian male examiners will likely reject intellectual property claims by White male lawyers. I find support for these hypotheses using a dataset of 127,695 patents. Contrary to prediction, however, I find that Asian male examiners favor patent applications by white female lawyers.

My third and final study examines the emergence of a new organizational form, the Patent Assertion Entity (PAE). They arguably clear intellectual property markets of the incremental, low value patents generated in part due to the imperfections that the previous two studies uncover.

However, in doing so, they might encourage the creation of more low value inventions and patents. While scholars have debated whether they add value or detract from it, often labeling them as “trolls”, little empirical research exists on their impact. I explore how their activity influences patenting and inventive activity by two sectors of inventors—small firms that are less likely to create products and more likely to rely on licensing revenues, and large firms that are more likely to create products. Using a novel and proprietary dataset, I find that while their activity increases the share of patents produced by small inventors, such patents also form a more incremental share of patents. Conversely the share of patents produced by large inventors diminishes, but these patents also form a more radical share of patents produced.

VITA

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References

- Adler, P.S., S.-W. Kwon. 2002. Social capital: Prospects for a new concept. *Acad. Management Rev.* **27**(1) 17-40.
- Aepfel, T. 2004. Patent dispute embroils host of industries. Marketwatch, Wall Street Journal, <http://www.marketwatch.com/story/patent-dispute-embroils-host-of-industries-2004-2010-2021>.
- Aghion, P., N. Bloom, R. Blundell, R. Griffith, P. Howitt. 2002. Competition and innovation: An inverted U relationship. *National Bureau of Economic Research Working Paper Series No. 9269*.
- Ahuja, G., C. Morris Lampert. 2001. Entrepreneurship in the large corporation: A longitudinal study of how established firms create breakthrough inventions. *Strategic Management Journal* **22**(6-7) 521-543.
- Alcacer, J., M. Gittelman, B. Sampat. 2009a. Applicant and examiner citations in US patents: An overview and analysis. *Research Policy* **38**(2) 415-427.
- Alcacer, J., M. Gittelman, B. Sampat. 2009b. Applicant and examiner citations in US patents: An overview and analysis. *Res. Policy* **38**(2) 415-427.
- Alchian, A.A., H. Demsetz. 1972. Production, information costs, and economic organization. *Amer. Econom. Rev.* 777-795.
- Allison, P.D., R.P. Waterman. 2002. Fixed-effects negative binomial regression models. *Sociological Methodology* **32**(1) 247-265.
- Almeida, P. 1996. Knowledge sourcing by foreign multinationals: Patent citation analysis in the US semiconductor industry. *Strategic Management J.* **17**(S2) 155-165.
- Alvesson, M. 2000. Social identity and the problem of loyalty in knowledge-intensive companies. *J. Management Stud.* **37**(8) 1101-1124.
- Arora, A., A. Fosfuri, A. Gambardella. 2004. *Markets for Technology: The Economics of Innovation and Corporate Strategy*, Cambridge, MA.
- Arora, A., A. Nandkumar. 2012. Insecure advantage? Markets for technology and the value of resources for entrepreneurial ventures. *Strategic Management Journal* **33**(3) 231-251.
- Arrow, K.J. 1998. What has economics to say about racial discrimination? *The journal of economic perspectives* **12**(2) 91-100.
- Babcock, L., G. Loewenstein. 1997. Explaining bargaining impasse: The role of self-serving biases. *J. Econom. Perspectives* **11**(1) 109-126.
- Bacharach, S.B., P. Bamberger, B. Mundell. 1993. Status inconsistency in organizations: From social hierarchy to stress. *Journal of Organizational Behavior* **14**(1) 21-36.
- Bamber, E.M., V.M. Iyer. 2007. Auditors' identification with their clients and its effect on auditors' objectivity. *Auditing: A Journal of Practice & Theory* **26**(2) 1-24.
- Barley, S.R. 2016. 60th anniversary essay ruminations on how we became a mystery house and how we might get out. *Admin. Sci. Quart.* **61** 1-8.
- Bazerman, M.H., G. Loewenstein, D.A. Moore. 2002. Why good accountants do bad audits. *Harvard Bus. Rev.* (80) 96-102, 134.
- Bertrand, M., S. Mullainathan. 2004. Are Emily and Greg more employable than Lakisha and Jamal? A field experiment on labor market discrimination. *The American Economic Review* **94**(4) 991-1013.
- Bessen, J., J.L. Ford, M.J. Meurer. 2011. The Private and Social Costs of Patent Trolls. *Boston Univ. School of Law, Law and Economics Research Paper No. 11-45*.
- Bessen, J., M. Meurer. 2012. The direct costs from NPE disputes. *Boston Univ. School of Law, Law and Economics Research Paper No. 12-34*.
- Bishop, T. 2013. Intellectual Ventures reveals list of 33,000 patents, in move toward (partial) transparency, <http://www.geekwire.com/2013/intellectual-ventures-reveals-list-33000-patents-move-transparency/>.
- Blalock, H.M. 1967. Toward a theory of minority-group relations.
- Blumberg, Sydel. 2011. When Patents Attack! This American Life, <http://www.thisamericanlife.org/radio-archives/episode/441/when-patents-attack>.
- Blumer, H. 1958. Race prejudice as a sense of group position. *Pacific Sociological Review* **1**(1) 3-7.
- Bradshaw, Y., L. Radbill. 1987. Method and substance in the use of ratio variables. *American Sociological Review* 132-135.
- Branscombe, N.R., M.T. Schmitt, R.D. Harvey. 1999. Perceiving pervasive discrimination among African Americans: Implications for group identification and well-being. *Journal of personality and social psychology* **77**(1) 135.
- Cameron, A.C., J.B. Gelbach, D.L. Miller. 2012. Robust inference with multiway clustering. *Journal of Business & Economic Statistics*.
- Cameron, A.C., D.L. Miller. 2015. A practitioner's guide to cluster-robust inference. *Journal of Human Resources* **50**(2) 317-372.
- Casciaro, T., M.J. Piskorski. 2005. Power imbalance, mutual dependence, and constraint absorption: A closer look at resource dependence theory. *Admin. Sci. Quart.* **50**(2) 167-199.
- Ceccagnoli, M. 2009. Appropriability, preemption, and firm performance. *Strategic Management Journal* **30**(1) 81-98.
- Certo, S.T., J.R. Busenbark, H.s. Woo, M. Semadeni. 2016. Sample selection bias and Heckman models in strategic management research. *Strategic Management Journal*.
- Chien, C.V. 2008. Of Trolls, Davids, Goliaths, and Kings: Narratives and Evidence in the Litigation of High-Tech Patents. *North Carolina Law Review* **87** 1571.
- Chien, C.V. 2013. Patent Trolls by the Numbers. *Santa Clara University Legal Studies Research Paper No. 08-13*.
- Clifford, R.D. 2013. Is It Time for a Rule 11 for the Patent Bar? Available at SSRN 2292195.
- Cohen, L., U. Gurun, S.D. Kominers. 2014. Patent Trolls: Evidence from Targeted Firms. *National Bureau of Economic Research Working Paper Series No. 20322*.
- Cohen, W.M., R.R. Nelson, J.P. Walsh. 2000. Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not). *National Bureau of Economic Research Working Paper No. 7552*.
- Cornaggia, J., K.J. Cornaggia, H. Xia. 2016. Revolving doors on wall street. *J. Financial Econom.* **120**(2) 400-419.
- Cotropia, C.A. 2009. Modernizing patent law's inequitable conduct doctrine. *Berkeley Tech. Law J.* **24** 723-783.
- Cotropia, C.A., M.A. Lemley, B. Sampat. 2013. Do applicant patent citations matter? *Res. Policy* **42**(4) 844-854.
- Coughlan, A.T. 1987. Distribution channel choice in a market with complementary goods. *Internat. J. Res. Marketing* **4**(2) 85-97.
- Darley, J.M., P.H. Gross. 1983. A hypothesis-confirming bias in labeling effects. *Journal of Personality and Social Psychology* **44**(1) 20.
- Dinovitzer, R., H.P. Gunz, S.P. Gunz. 2014. Reconsidering lawyer autonomy: The nexus between firm, lawyer, and client in large commercial practice. *American Business Law Journal* **51**(3) 661-719.
- Duhigg, C., S. Lohr. 2012. The Patent, Used as a Sword *The New York Times*, http://www.nytimes.com/2012/10/08/technology/patent-wars-among-tech-giants-can-stifle-competition.html?_r=0.
- Economist. 2005. Voracious venture, <http://www.economist.com/node/5015073>.
- Eden, D. 1984. Self-fulfilling prophecy as a management tool: Harnessing Pygmalion. *Academy of management Review* **9**(1) 64-73.

Eden, D., G. Ravid. 1982. Pygmalion versus self-expectancy: Effects of instructor-and self-expectancy on trainee performance. *Organizational Behavior and Human Performance* **30**(3) 351-364.

Eisenberg, R.S. 2011. Patent Costs and Unlicensed Use of Patented Inventions. *University of Chicago Law Review* **78**(1) 53-69.

Eisenhardt, K.M. 1989. Agency theory: An assessment and review. *Acad. Management Rev.* **14**(1) 57-74.

Empson, L. 2007. *Managing the modern law firm: New challenges, new perspectives*. Oxford University Press, New York, USA.

Empson, L., C. Chapman. 2006. Partnership versus corporation: Implications of alternative forms of governance in professional service firms *Professional service firms*. Emerald Group Publishing Limited, 139-170.

Feldman, R., T. Ewing. 2012. The Giants Among Us. *Stanford Technology Law Review* **2012** 1, 20–21.

Fischer, T., J. Henkel. 2012. Patent trolls on markets for technology—An empirical analysis of NPEs’ patent acquisitions. *Research Policy* **41**(9) 1519-1533.

Fiske, S.T., A.J. Cuddy, P. Glick, J. Xu. 2002. A model of (often mixed) stereotype content: competence and warmth respectively follow from perceived status and competition. *Journal of personality and social psychology* **82**(6) 878.

Flint, J. 2017. Two Black Women Sue Fox News, Claiming Racial Discrimination *Wall Street Journal*. Dow Jones & Company, <https://www.wsj.com/articles/two-black-women-sue-fox-news-claiming-racial-discrimination-1490810697>.

Flores, E.S., S.E. Warren. 1999. Inequitable conduct, fraud, and your license to practice before the United States Patent and Trademark Office. *Texas Intellectual Property Law Journal* **8** 299-330.

Fosfuri, A. 2006. The licensing dilemma: understanding the determinants of the rate of technology licensing. *Strategic Management J.* **27**(12) 1141-1158.

Frakes, M.D., M.F. Wasserman. 2016. Is the time allocated to review patent applications inducing examiners to grant invalid patents?: Evidence from micro-level application data. *Review of Economics and Statistics*.

Freeman, J., G.R. Carroll, M.T. Hannan. 1983. The liability of newness: Age dependence in organizational death rates. *American Sociological Review* **48**(5) 692-710.

Gambardella, A., P. Giuri, A. Luzzi. 2007. The market for patents in Europe. *Research Policy* **36**(8) 1163-1183.

Gans, J.S., D.H. Hsu, S. Stern. 2000. When does start-up innovation spur the gale of creative destruction? *National Bureau of Economic Research Working Paper No. 7851*.

Ganzeboom, H.B., P.M. De Graaf, D.J. Treiman. 1992. A standard international socio-economic index of occupational status. *Social science research* **21**(1) 1-56.

Geradin, D., A. Layne-Farrar, A.J. Padilla. 2012. Elves or Trolls? The role of nonpracticing patent owners in the innovation economy. *Industrial and Corporate Change* **21**(1) 73-94.

Gilson, R.J., R.H. Mnookin. 1989. Coming of age in a corporate law firm: The economics of associate career patterns. *Stanford Law Review* **41**(3) 567-595.

Gino, F., M.H. Bazerman. 2009. When misconduct goes unnoticed: The acceptability of gradual erosion in others’ unethical behavior. *J. Experiment. Soc. Psych.* **45**(4) 708-719.

Granovetter, M. 1985. Economic action and social structure: The problem of embeddedness. *Amer. J. Sociol.* **91**(3) 481-510.

Greene, W.H. 2007. Fixed and random effects models for count data.

Greenhaus, J.H., N.J. Beutell. 1985. Sources of conflict between work and family roles. *Academy of management review* **10**(1) 76-88.

Greenwood, R., C.R. Hinings, J. Brown. 1990. “P2-form” strategic management: corporate practices in professional partnerships. *Acad. Management J.* **33**(4) 725-755.

Gunz, H.P., S.P. Gunz. 2008. Client capture and the professional service firm. *American Business Law Journal* **45**(4) 685-721.

Hall, B.H., A.B. Jaffe, M. Trajtenberg. 2001. The NBER patent citation data file: Lessons, insights and methodological tools. NBER Working Paper W8498, <http://ssrn.com/abstract=285618>.

Hall, B.H., R.H. Ziedonis. 2001a. The patent paradox revisited: an empirical study of patenting in the US semiconductor industry, 1979-1995. *RAND Journal of Economics* **32**(1) 101-128.

Hall, B.H., R.H. Ziedonis. 2001b. The patent paradox revisited: An empirical study of patenting in the US semiconductor industry, 1979-1995. *RAND J. Econom.* **32**(1) 101-128.

Hannan, M.T., J. Freeman. 1984. Structural inertia and organizational change. *American Sociological Review* **49**(2) 149-164.

Harhoff, D., F. Narin, F.M. Scherer, K. Vopel. 1999. Citation frequency and the value of patented inventions. *Rev. Econom. Statist.* **81**(3) 511-515.

Harhoff, D., F.M. Scherer, K. Vopel. 2003. Citations, family size, opposition and the value of patent rights. *Res. Policy* **32**(8) 1343-1363.

Hauser, R.M., J.R. Warren. 1997. Socioeconomic Indexes for Occupations: A Review, Update, and Critique. *Sociological methodology* **27**(1) 177-298.

Hausman, J.A., B.H. Hall, Z. Griliches. 1984. Econometric models for count data with an application to the patents-R&D relationship. national bureau of economic research Cambridge, Mass., USA.

Hekman, D.R., G.A. Bingley, H.K. Steensma, J.F. Hereford. 2009. Combined effects of organizational and professional identification on the reciprocity dynamic for professional employees. *Acad. Management J.* **52**(3) 506-526.

Hillman, A.J., T. Dalziel. 2003. Boards of directors and firm performance: Integrating agency and resource dependence perspectives. *Acad. Management Rev.* **28**(3) 383-396.

Hitt, M.A., L. Biermant, K. Shimizu, R. Kochhar. 2001. Direct and moderating effects of human capital on strategy and performance in professional service firms: A resource-based perspective. *Acad. Management J.* **44**(1) 13-28.

Hricik, D. 2000. Intellectual property litigation in the 21st century: The risks and responsibilities of attorneys and firms prosecuting patents for different clients in related technologies. *Texas Intellectual Property Law Journal* **8** 331-355.

Hurh, W.M., K.C. Kim. 1989. The ‘success’ image of Asian Americans: Its validity, and its practical and theoretical implications 1. *Ethnic and Racial Studies* **12**(4) 512-538.

Jackson, S.E., R.S. Schuler. 1985. A meta-analysis and conceptual critique of research on role ambiguity and role conflict in work settings. *Organizational behavior and human decision processes* **36**(1) 16-78.

Jaffe, A.B., J. Lerner. 2004. Patent prescription: A radical cure for the ailing [US patent policy]. *Spectrum, IEEE* **41**(12) 38-43.

Jaffe, A.B., J. Lerner. 2011. *Innovation and its discontents: How our broken patent system is endangering innovation and progress, and what to do about it*. Princeton University Press, New Jersey, USA.

Jensen, M.C., W.H. Meckling. 1979. Theory of the firm: Managerial behavior, agency costs, and ownership structure. *J. Financial Econom.* **3** 305–360.

- Katila, R., G. Ahuja. 2002. Something Old, Something New: A Longitudinal Study of Search Behavior and New Product Introduction. *The Academy of Management Journal* **45**(6) 1183-1194.
- Katz, E. 2001. Bias in conditional and unconditional fixed effects logit estimation. *Political Anal.* **9**(4) 379-384.
- Kennedy, P. 2003. *A Guide to Econometrics*. MIT Press, Cambridge, MA.
- Keren, G. 1987. Facing uncertainty in the game of bridge: A calibration study. *Organ. Behav. Human Decision Processes* **39**(1) 98-114.
- Kibria, N. 1990. Power, patriarchy, and gender conflict in the Vietnamese immigrant community. *Gender & Society* **4**(1) 9-24.
- Kim, J.Y.R., K.H. Steensma. (forthcoming). Employee mobility, spin-outs, and knowledge spill-in: how incumbent firms can learn from new ventures. *Strategic Management J.*
- Kiser, E. 1999. Comparing varieties of agency theory in economics, political science, and sociology: An illustration from state policy implementation. *Sociological Theory* **17**(2) 146-170.
- Krauss, M.I. 2001. The lawyer as limo: A brief history of the hired gun. *U. Chi. L. Sch. Roundtable* **8** 325.
- Lampe, R. 2012. Strategic citations. *Rev. Econom. Statist.* **94**(1) 320-333.
- Langevoort, D.C. 2012. Getting (too) comfortable: In-house lawyers, enterprise risk, and the financial crisis. *Wis. L. Rev.* 495.
- Lanjouw, J.O., J. Lerner. 1997. The Enforcement of Intellectual Property Rights: A Survey of the Empirical Literature. *National Bureau of Economic Research Working Paper Series No. 6296*.
- Lanjouw, J.O., M. Schankerman. 2001. Characteristics of patent litigation: a window on competition. *RAND journal of economics* 129-151.
- Lanjouw, J.O., M. Schankerman. 2004. Protecting Intellectual Property Rights: Are Small Firms Handicapped?*. *Journal of Law and Economics* **47**(1) 45-74.
- Lee, S.J. 2015. *Unraveling the "model minority" stereotype: Listening to Asian American youth*. Teachers College Press.
- Leicht, K.T., M.L. Fennell. 2001. *Professional work: A sociological approach*. Wiley-Blackwell.
- Lemley, M.A. 2008. Ignoring Patents. *Michigan State Law Review*(19) 19-34.
- Lemley, M.A., B. Sampat. 2012. Examiner characteristics and patent office outcomes. *Review of Economics and Statistics* **94**(3) 817-827.
- Lemley, M.A., C. Shapiro. 2005. Probabilistic patents. *The Journal of Economic Perspectives* **19**(2) 75-98.
- Lennox, C. 2005. Audit quality and executive officers' affiliations with CPA firms. *Journal of Accounting and Economics* **39**(2) 201-231.
- Lenski, G.E. 1954. Status crystallization: a non-vertical dimension of social status. *American Sociological Review* **19**(4) 405-413.
- Leong, F.T., T.J. Hayes. 1990. Occupational stereotyping of Asian Americans. *The Career Development Quarterly* **39**(2) 143-154.
- Lin, K.-H., J. Lundquist. 2013. Mate Selection in Cyberspace: The Intersection of Race, Gender, and Education 1. *American Journal of Sociology* **119**(1) 183-215.
- Lin, M.H., V.S. Kwan, A. Cheung, S.T. Fiske. 2005. Stereotype content model explains prejudice for an envied outgroup: Scale of anti-Asian American stereotypes. *Personality and Social Psychology Bulletin* **31**(1) 34-47.
- Lincoln, J.R. 1984. Analyzing relations in dyads problems, models, and an application to interorganizational research. *Sociological Methods and Research* **13**(1) 45-76.
- Long, S.J. 1997. *Regression models for categorical and limited dependent variables*. SAGE Publications, Thousand Oaks.
- Magee, J.C., A.D. Galinsky. 2008. 8 Social Hierarchy: The Self-Reinforcing Nature of Power and Status. *The Academy of Management Annals* **2**(1) 351-398.
- Mahoney, J.T., J.R. Pandian. 1992. The resource-based view within the conversation of strategic management. *Strategic management journal* **13**(5) 363-380.
- March, J.G. 1991. Exploration and exploitation in organizational learning. *Organization Science* **2**(1) 71-87.
- Mayer, K.J., D. Somaya, I.O. Williamson. 2012. Firm-specific, industry-specific, and occupational human capital and the sourcing of knowledge work. *Organization Science* **23**(5) 1311-1329.
- McDonough. 2006. Myth of the Patent Troll: An Alternative View of the Function of Patent Dealers in an Idea Economy. *Emory Law Journal* **56** 189-228.
- Merges, R.P., R.R. Nelson. 1990. On the complex economics of patent scope. *Columbia Law Rev.* **90**(4) 839-916.
- Merton, R.K. 1968. The Matthew effect in science. *Science* **159**(3810) 56-63.
- Mills, E. 1975. Conceptual problems in status inconsistency theories of stress *Annual Meeting of the American Sociological Association, San Francisco, August*.
- Mitnick, B.M. 2011. Capturing "capture": developing a normative theory of fiducial regulation. Jerusalem.
- Moeen, M., D. Somaya, J.T. Mahoney. 2013. Supply portfolio concentration in outsourced knowledge-based services. *Organ. Sci.* **24**(1) 262-279.
- Myhrvold, N. 2010. Funding Eureka! *Harvard Business Review* **88**(3) 40-50.
- Naiker, V., D.S. Sharma. 2009. Former audit partners on the audit committee and internal control deficiencies. *The Accounting Review* **84**(2) 559-587.
- Neumann, J. 2011. Credit raters join the rated *Wall Street Journal*.
- Nocera, J. 2006. Tired of Trolls, a Feisty Chief Fights Back. New York Times, http://www.nytimes.com/2006/09/16/business/16nocera.html?pagewanted=all&_r=0.
- North, D.C. 1990. *Institutions, institutional change and economic performance*. Cambridge University Press, New York.
- Nosek, B.A., M.R. Banaji, A.G. Greenwald. 2002. Math= male, me= female, therefore math≠ me. *Journal of personality and social psychology* **83**(1) 44.
- Phillips, D.J. 2002. A genealogical approach to organizational life chances: The parent-progeny transfer among Silicon Valley law firms, 1946–1996. *Admin. Sci. Quart.* **47**(3) 474-506.
- Pisano, G.P. 1990. The R&D Boundaries of the Firm: An Empirical Analysis. *Admin. Sci. Quart.* **35**(1) 153-176.
- Ratcliff, J.W., D.E. Metzener. 1988. Pattern-matching-the gestalt approach. *Dr Dobbs Journal* **13**(7) 46-&.
- Regan, M.C. 1997. Professional reputation: Looking for the good lawyer. *S. Tex. L. Rev.* **39** 549.
- Reitzig, M., J. Henkel, C. Heath. 2007. On sharks, trolls, and their patent prey--Unrealistic damage awards and firms' strategies of "being infringed". *Res. Policy* **36**(1) 134-154.
- Reitzig, M., S. Wagner. 2010. The hidden costs of outsourcing: Evidence from patent data. *Strategic Management J.* **31**(11) 1183-1201.
- Rider, C.I., D. Tan. 2014. Labor market advantages of organizational status: A study of lateral partner hiring by large US law firms. *Organ. Sci.* **26**(2) 356-372.
- Ridgeway, C.L. 2001. Gender, status, and leadership. *Journal of Social issues* **57**(4) 637-655.
- Rosenkopf, L., A. Nerkar. 2001. Beyond local search: boundary-spanning, exploration, and impact in the optical disk industry. *Strategic Management J.* **22**(4) 287-306.

- Runciman, W.G., C. Bagley. 1969. Status consistency, relative deprivation, and attitudes to immigrants. *Sociology* **3**(3) 359-375.
- Salant, D.J. 1995. Behind the revolving door: a new view of public utility regulation. *RAND J. Econom.* **26**(3) 362-377.
- Sampat, B.N. 2010. When do applicants search for prior art? *J. Law Econom.* **53**(2) 399-416.
- Schumpeter, J.A. 1942. *Socialism, capitalism and democracy*. Harper and Brothers.
- Schumpeter, J.A. 1947. The creative response in economic history. *The Journal of Economic History* **7**(02) 149-159.
- Seetharaman, D. 2017. Facebook's Female Engineers Claim Gender Bias *Wall Street Journal*.
- Shapiro, S.P. 2003. Bushwhacking the ethical high road: Conflict of interest in the practice of law and real life. *Law & Social Inquiry* **28**(1) 87-268.
- Sharma. 1997. Professional as agent: Knowledge asymmetry in agency exchange. *Acad. Management Rev.* **22**(3) 758-798.
- Shrestha, S.K. 2010. Trolls or Market-makers? An empirical analysis of nonpracticing entities. *Columbia Law Review* **110** 114.
- Silva, J.S., S. Tenreiro. 2006. The log of gravity. *The Review of Economics and statistics* **88**(4) 641-658.
- Simon, H.A. 1957. Models of man; social and rational.
- Somaya, D. 2012. Patent strategy and management An integrative review and research agenda. *J. Management* **38**(4) 1084-1114.
- Sorenson, O., J.W. Rivkin, L. Fleming. 2006. Complexity, networks and knowledge flow. *Research Policy* **35**(7) 994-1017.
- Steensma, H.K., M. Chari, R. Heidl. 2015. The quest for expansive intellectual property rights and the failure to disclose known relevant prior art. *Strategic Management J.* **36**(8) 1186-1204.
- Steensma, H.K., M. Chari, R. Heidl. 2016a. A Comparative Analysis of Patent Assertion Entities in Markets for Intellectual Property Rights. *Organ. Sci.* **27**(1) 2-17.
- Steensma, H.K., M. Chari, R. Heidl. 2016b. A Comparative Analysis of Patent Assertion Entities in Markets for Intellectual Property Rights. *Organization Science* **27**(1) 2-17.
- Stern, L.W., A.I. El-Ansary, A.T. Coughlan. 1996. *Marketing Channels*. Prentice Hall, Inc., New Jersey.
- Stryker, S., A.S. Macke. 1978. Status inconsistency and role conflict. *Annual Review of Sociology* **4**(1) 57-90.
- Suddaby, R., R. Greenwood. 2005. Rhetorical strategies of legitimacy. *Admin. Sci. Quart.* **50**(1) 35-67.
- Sy, T., L.M. Shore, J. Strauss, T.H. Shore, S. Tram, P. Whiteley, K. Ikeda-Muromachi. 2010. Leadership perceptions as a function of race-occupation fit: The case of Asian Americans. *Journal of Applied Psychology* **95**(5) 902.
- Taylor, C.R., B.B. Stern. 1997. Asian-Americans: Television advertising and the "model minority" stereotype. *Journal of advertising* **26**(2) 47-61.
- Teece, D.J. 1986. Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Res. Policy* **15**(6) 285-305.
- Tripsas, M. 1997. Unraveling the process of creative destruction: Complementary assets and incumbent survival in the typesetter industry. *Strategic Management Journal* **18**(s 1) 119-142.
- Ventola, C.L. 2015. The antibiotic resistance crisis: Part 1: Causes and threats. *Pharmacy and Therapeutics* **40**(4) 277.
- Von Nordenflycht, A. 2010. What is a professional service firm? Toward a theory and taxonomy of knowledge-intensive firms. *Acad. Management Rev.* **35**(1) 155-174.
- Vorhies, D.W., R.E. Morgan, C.W. Autry. 2009. Product-market strategy and the marketing capabilities of the firm: impact on market effectiveness and cash flow performance. *Strategic Management Journal* **30**(12) 1310-1334.
- Wagner, R.P., G. Parchomovsky. 2005. Patent portfolios. *University of Pennsylvania Law Review* **154**(1) 06-15.
- Wartick, S.L. 2002. Measuring corporate reputation definition and data. *Business & Society* **41**(4) 371-392.
- Waytz, A., J. Dungan, L. Young. 2013. The whistleblower's dilemma and the fairness-loyalty tradeoff. *J. Experiment. Soc. Psych.* **49**(6) 1027-1033.
- Weber, M. 1922. *Economy and Society* (reprinted 1978). University of California Press, Berkeley, CA.
- Weigelt, K., C. Camerer. 1988. Reputation and corporate strategy: A review of recent theory and applications. *Strategic Management J.* **9**(5) 443-454.
- Williams, J., K.W. Phillips, E.V. Hall. 2014. *Double Jeopardy?: Gender Bias Against Women of Color in Science*.
- Wolfson, M. 1985. *Empirical evidence of incentive problems and their mitigation in oil and gas tax shelter programs*. HBS Press, Boston.
- Wong, Y.J., J. Owen, K.K. Tran, D.L. Collins, C.E. Higgins. 2012a. Asian American male college students' perceptions of people's stereotypes about Asian American men. *Psychology of Men & Masculinity* **13**(1) 75.
- Wong, Y.J., J. Owen, K.K. Tran, D.L. Collins, C.E. Higgins. 2012b. Asian American male college students' perceptions of people's stereotypes about Asian American men. *Psychology of Men & Masculinity* **13**(1) 75.
- Wooldridge, J.M. 1997. Quasi-likelihood methods for count data. *Handbook of applied econometrics* **2** 352-406.
- Wooldridge, J.M. 2010. *Econometric Analysis of Cross Section and Panel Data*. MIT press, Cambridge, MA.
- Wuggenig, U. 1985. *A Dying Theory?: A Critical Assessment of Some Aspects of Status Inconsistency Research 1950-1983*. International Sociological Association.
- Zellner, A. 1962. An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. *Journal of the American statistical Association* **57**(298) 348-368.
- Zucker, L.G., M.R. Darby, J.S. Armstrong. 2002. Commercializing knowledge: University science, knowledge capture, and firm performance in biotechnology. *Management Sci.* **48**(1) 138-153.