The Assignment of Intellectual Property Rights and Innovation

Christopher Armstrong
carmstro@stanford.edu
Stanford Graduate School of Business

Stephen Glaeser[ϕ]
Stephen_Glaeser@kenan-flagler.unc.edu
The University of North Carolina at Chapel Hill

Stella Park
yeayeunpark@sogang.ac.kr
Sogang University

Oscar Timmermans
o.timmermans@lse.ac.uk
London School of Economics

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Abstract: We study how the assignment of intellectual property rights between inventors and their employers affects innovation. Incomplete contracting theories predict that stronger employer property rights reduce the threat that employee inventors hold up their employers, thereby affecting inventor and invention outcomes. We test these predictions using a U.S. appellate court ruling that shifted the assignment of property rights from inventors to their employers. Within-employer-year analyses demonstrate that affected inventors are less likely to retain patent rights, assign patents to new employers, or leave their current employer, all consistent with reduced inventor ability to hold up their employers. Due to the reduced possibility of hold-up, affected inventors' innovations are revealed more promptly when disclosed, draw from a broader set of prior patents, and spread more to subsequent patents. If affected inventors do leave their employer, they are more likely to relocate to unaffected states. Furthermore, employers affected by the ruling are more likely to locate their inventors in agglomeration economies and alter their innovation strategy by reallocating activity across states and expanding their innovation portfolios. Our collective evidence suggests that shifting intellectual property rights to employers affects inventor and invention outcomes by reducing the threat of employee hold-up from the employer's perspective.

Keywords: corporate innovation, disclosure, employee mobility, hold-up, incomplete contracts, employer-specific investment

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[ϕ] Corresponding author.
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1. Introduction

We study how the assignment of intellectual property rights for successful innovations between inventors and their employers affects inventors' behavior and outcomes of the invention process. Innovation is the dominant engine of modern economic growth, accounting for a large share of productivity gains, competitive advantage, and, ultimately, societal welfare (e.g., Romer, 1990; Jones, 2021; Glaeser and Lang, 2024). Yet translating inventive effort into realized value is fraught with contractual frictions because most of the know-how that underlies a breakthrough is embedded in people, especially inventors, rather than in tangible assets. As soon as an employee inventor develops a valuable innovation, they can part ways with their employer and appropriate the *ex post* rents by joining—or even founding—a rival firm (Anton and Yao, 1994, 1995; Kang and Lee, 2022). From the employer's perspective, this threat of "hold-up" reduces the expected payoff to their research and development and can potentially distort the allocation of resources.

Incomplete contracting theory formalizes the core problem: because innovation outcomes are novel and uncertain, it is inherently impossible to draft an exhaustive contract *ex ante* that specifies who will own what in every possible scenario.[1] In the context of intellectual property, residual control rights therefore default to whichever party is granted legal ownership *ex post*. If those rights reside with the employee, they can threaten to hold up their employer.

Anticipating this potential hold-up problem, employers may prefer to employ inventors in locations where talent poaching is more difficult, or they may direct their inventors towards employer-specific projects that are less transferable to competitors. If intellectual property rights instead reside with employers, employee inventors' outside options are curtailed, shifting the bargaining power back to employers. In principle, stronger employer property rights should: (i)

[1] See, e.g., Coase (1937), Klein et al. (1978), Holmström (1989), Aghion and Tirole (1994), Hart (1995), Manso (2011), Christensen et al. (2016), and Glaeser and Yoo (2025).

reduce the threat of employee hold-up; (ii) encourage employers to invest in broader and further spreading—rather than employer-specific—technologies; and (iii) reduce the need to delay disclosure of successful innovations. However, employee inventors may also resist such regimes—either by bargaining for exemptions or by relocating to jurisdictions that protect employee intellectual property—so the net effects on where and how innovation occurs are ultimately empirical questions.

To speak to these questions, we examine the 2004 Texas appellate decision in *Alcatel USA, Inc. v. Brown* (*Alcatel v. Brown*). In *Alcatel v. Brown*, the court held that Evan Brown's "abstract idea" for a software program constituted company property under a pre-invention assignment clause, even though Brown alleged that he had developed the idea "off the clock" and without using company resources. Legal scholars and the media quickly recognized that *Alcatel v. Brown* set a persuasive nationwide precedent that enhanced employers' ability to claim inventions that arise during employment—even without establishing that the inventor used company resources to develop the innovation (Lai, 2003; Lobel, 2014).[2]

An important feature of the research setting is that nine states previously enacted statutes that explicitly protect employees' inventions that are conceived without the use of their employer's resources. Consequently, inventors who reside in those states were unaffected by *Alcatel v. Brown*, creating a cross-section of "treated" and "control" inventors once *Alcatel v. Brown* took effect. By focusing on 2003–2006 inventor-patent data and excluding inventors located in Texas (the forum state), we reduce concerns that lobbying or local politics drive inferences. The differential assignment of property rights across inventors—combined with rich fixed effects structures (e.g., employer-year, inventor, inventor-city, assignee-state-year, and technology-year)—allows us to

[2] For instance, legal arguments stemming from *Alcatel v. Brown* were subsequently invoked in cases such as *Preston v. Marathon Oil Co.* and *Mattel, Inc. v. MGA Entertainment, Inc*.

develop a credible quasi-natural experiment design.

We examine four interrelated research questions. The first relates to talent retention and appropriation: do stronger employer ownership rights reduce: (i) the frequency with which inventors retain their patent rights; (ii) employee inventors' movement to rival firms; and (iii) the outward transfer of knowledge?[3] Second, does reduced threat of employee hold-up lead employers to redeploy their employee inventors to knowledge-dense clusters, where there tend to be more beneficial knowledge "spill ins," but also a heightened risk of talent poaching? Third, does reduced threat of employee hold-up make employers more willing to signal innovation success—as demanded by capital markets and required by the "grand bargain" of the patent system? Fourth, do stronger employer rights encourage projects that build on a wider knowledge base and generate spillovers for a broader set of future innovators?

We examine these questions using a panel dataset consisting of 389,451 inventor-patent observations, 183,343 unique inventors, and 171,009 unique first-in-family patents filed with the USPTO between 2003 and 2006. Our baseline specification is a within-employer-year difference-in-differences design at the inventor-patent level. All time-varying employer shocks, competitive dynamics, capital-market pressures, and technology area-specific trends are absorbed by fixed effects, thereby isolating within-employer-year contrasts between inventors who were and were not subject to the court's decision (i.e., "treated" and "control," respectively).

Using this difference-in-differences design, we first document that *Alcatel v. Brown* reduced inventors' ability to hold up their employers and their labor market mobility. Following *Alcatel v. Brown*, treated inventors became: (i) 0.23 percent less likely to retain patent rights; (ii) 21 percent less likely to assign an idea to a new employer in the following year; and (iii) 16 percent

[3] Inventors are the default owners of patent rights unless they assign these rights to another (e.g., their employer). We therefore refer to such cases as "inventor-retained patents."

less likely to switch employers within the subsequent five years. Moreover, those employees that did switch became 193 percent more likely to relocate to one of the nine protective states, highlighting how local intellectual property law influences the location and movement of talent throughout the country.

Second, we find that *Alcatel v. Brown* causes employers to increase their hiring in inventor-dense, high-spillover regions (i.e., agglomeration economies). This increased hiring is consistent with Anand and Galetovic's (2000) prediction that stronger employer property rights reduce the net cost of employing inventors in agglomeration economies. Third, we find that when protected by *Alcatel v. Brown*, employers tend to reveal their disclosed innovations earlier. Specifically, we find that affected employers are no more likely to request early publication from the USPTO than their unaffected counterparts, but when they do request early publication, they do so more promptly (i.e., conditional on requesting early publication they do so sooner after the initial filing).

Fourth, we find that patents affected by *Alcatel v. Brown* tend to have a broader scope: they cite prior art from a wider array of entities—a 3 percent increase in their breadth—and are themselves subsequently cited by a more diverse set of entities—a 5 percent increase in their spread.[4] These patterns are consistent with a shift towards the pursuit of less employer-specific, higher spillover research and development, which implies greater employer investment in their employee inventors' human capital.

Finally, we examine the geographic dispersion and nature of corporate innovation. In employer-level analyses, we find that employers that employed more inventors in 2003 in states

[4] We define "breadth" as the extent to which a patent cites prior work from a broader set of entities, indicating greater technological diversity. We define "spread" as the extent to which a patent is subsequently cited by a broader set of entities, indicating wider downstream applicability. These measures are similar to those of Trajtenberg et al. (1997) and Hall et al. (2001), which examine technological diversity across patent classes, but focus on diversity across entities to capture whether employee inventors generate innovations that are more widely applicable to other employers.

later affected by *Alcatel v. Brown* (i.e., those with greater *ex ante* exposure to *Alcatel v. Brown*) tend to: (i) reallocate their patenting to affected states; (ii) disclose their patents more rapidly; and (iii) pursue broader portfolios across technology classes. These results highlight more aggregate effects of potential inventor hold-up of employers.

Collectively, our evidence suggests that *Alcatel v. Brown* shifted intellectual property rights from employee inventors to their employers, reducing the threat of inventor hold-up as evidenced by reduced inventor mobility, patent rights retention, and competitor patent assignment. After the reduced threat of hold-up, employers are more likely to locate their inventors in agglomeration economies and grant them more autonomy as reflected in less employer-specific investment, as well as broader and further spreading innovation portfolios. This combined evidence highlights the organizational and economic consequences of the assignment of intellectual property rights between inventors and employers.

Our findings contribute to several literatures at the intersection of innovation, labor economics, and accounting. First, we advance the incomplete contracting literature by providing large-sample evidence that shifting the assignment of intellectual property rights from employee inventors to employers reduces the threat of employee hold-up and alters both inventor and employer behavior (e.g., Armstrong et al., 2010; Christensen et al., 2016; Dou et al., 2016; Bena et al., 2023). In line with the theoretical predictions of Hart (1995) and Anton and Yao (1994, 1995), we show that stronger employer rights reduce inventor appropriation and mobility, and that employers respond by shifting their innovation strategies in ways consistent with reduced appropriability concerns. These employer responses include relocating inventors to knowledge-dense regions and pursuing less employer-specific technologies.

Second, we contribute to the accounting literature on labor-related contracting (e.g., Bowen

et al., 1995; Armstrong et al., 2010; Bloomfield et al., 2017; Barrios and Gallemore, 2024; Böke et al., 2025) by documenting how shifts in intellectual property rights affect implicit contracts between employers and employees. In contrast to prior research that examines how legal restrictions on employee mobility influence disclosure incentives (e.g., Gao et al., 2018; Ali et al., 2019), we examine a setting where legal changes reduce employees' outside options directly through shifting property rights.[5] This allows us to observe not only labor market outcomes, but also how employers reconfigure their innovation portfolios and internal human capital strategies in response.

Third, we contribute to the innovation and disclosure literatures by demonstrating how the assignment of intellectual property rights affects the breadth, spread, and timing of disclosed innovation. Prior work in this literature emphasizes the role of product market competition, analyst coverage, and other institutional settings in shaping innovation, whereas we focus on the role of intra-employer contracting frictions.[6] We show that employers affected by *Alcatel v. Brown* accelerate disclosure not by increasing the likelihood of early publication per se, but by reducing delays conditional on choosing to disclose. Moreover, we find that affected employers produce less employer-specific innovations. These findings highlight that internal frictions shape private contracting outcomes, as well as the public availability and diffusion of knowledge.

2. Predictions, related literature, and background

[5] See also Bova et al. (2015), who find that firms with unionized employees are more likely to miss analyst forecasts to reduce the bargaining power of the union, and Lin et al. (2022), who find that noncompete enforceability reduces the incidence of executive turnover and weakens the relation between turnover and performance.

[6] See, e.g., Hedge et al. (2018), Glaeser et al. (2020), Glaeser and Landsman (2021), Kim and Valentine (2021), Griffin et al. (2022), Hedge et al. (2023), Martens (2023), Dyer et al. (2024), Kim and Valentine (2025), Kim et al. (2025b), Hou et al. (2025), and Kim et al. (2025a). A related literature also examines how firm disclosures and information intermediaries affect patenting outcomes (e.g., Martens and Sextroh, 2021; Kim and Valentine, 2023; Chang et al., 2024; Breuer et al., 2025; Chawla, 2025).

2.1. Predictions and related literature

We examine how shifts in intellectual property rights affect employers' innovation disclosure decisions (e.g., Glaeser, 2018; Hedge et al., 2018; Glaeser et al., 2020; Glaeser and Landsman, 2021; Hedge et al., 2023; Kim and Valentine, 2023; Boot and Vladimirov, 2025) and innovation strategies (e.g., Marx et al., 2009; Samila and Sorenson, 2011; Brown and Martinsson, 2018; Kim and Valentine, 2021; Glaeser et al., 2022; Kim et al., 2025b). Understanding how employers respond to shifts in intellectual property rights provides insights into several areas of accounting research, including disclosure theory, proprietary costs of transparency, and the valuation of innovation-related intangibles (Glaeser and Lang, 2024). More broadly, the question of appropriability—who controls and benefits from innovation—is fundamental to the economics of innovation and thus also has implications outside of accounting.[7] These effects are especially salient in today's economy, where human capital is among the most scarce and strategically important resources that employers must attract, retain, and protect.

We analyze these effects through the lens of incomplete contracting theory (e.g., Coase, 1937; Hart, 1988; Tirole, 1999), a common framework in the accounting and finance literature. Prior literature uses this framework to study related phenomena in the context of, for example, corporate governance (Roberts and Sufi, 2009a, 2009b; Armstrong et al., 2010), debt contracting (e.g., Sridhar and Magee, 1996; Gârleanu and Zwiebel, 2009; Li, 2013; Christensen et al., 2016), and incentive-compensation (e.g., Holmström and Milgrom, 1991; Aghion and Tirole, 1994; Baker et al., 2002).

Incomplete contracts govern relationships—such as those between employers and

[7] For instance, in finance, intellectual property rights affect firm valuation, investment, and risk taking. In strategy and management, they shape organizational boundaries, research and development structure, and employee mobility. In labor economics, they influence wage bargaining, inventor incentives, and talent allocation. And in law, intellectual property rights determine the structure and enforcement of innovation incentives.

employees—where many future contingencies are left unspecified *ex ante* because they are difficult to define or enforce. Because innovations are novel they are impossible to describe *ex ante* and hence contracts governing innovation activities are necessarily incomplete.[8] Incomplete contracts create incentives for opportunistic behavior, leading to a principal-agent problem commonly referred to as the "hold-up problem" (Klein et al., 1978; Williamson, 1979). The hold-up problem arises when two parties could maximize efficiency by cooperating but are limited in doing so due to concerns about shifts in bargaining power that could subsequently reduce their expected returns. Applying this problem to the innovation setting, an employer's primary concern is that employee inventors will take their knowledge elsewhere—either to a competitor or to start a rival firm—leaving the employer to bear the costs of innovation while receiving little benefit or even facing increased competition (Anton and Yao, 1994, 1995; Kang and Lee, 2022).

As Christensen et al. (2016) highlight, a core insight from the incomplete contracting literature is that assigning property rights can generate economic benefits in settings where complete contracts cannot be written or enforced. The primary mechanism for mitigating hold-up problems is the *ex ante* allocation of decision rights, particularly through the assignment of intellectual property rights. Thus, incomplete contracting theories predict that stronger employer property rights mitigate hold-up risks by altering how inventors and employers appropriate innovation returns, thereby influencing inventor behavior, employer behavior, and innovation outcomes. For instance, stronger employer intellectual property rights diminish the ability of employee inventors to capture innovation value. Absent strong intellectual property rights, employers can also take deliberate actions to increase their ability to capture returns to innovation *ex post*. For example, employers can encourage or force inventors to work on projects that are

[8] See, e.g., Klein et al. (1978), Holmström (1989), Aghion and Tirole (1994), and Manso (2011).

more likely to yield employer-specific innovations that are difficult to appropriate outside the firm (Hart, 1995). Employers can also withhold or delay disclosure about successful innovation that might otherwise enhance their employee inventors' labor market value and mobility.

Kim and Marschke (2005) find that one way in which employers respond to the appropriability problem and threat of hold-up is to reduce their investment in innovation and substitute secrecy with patenting.[9] Acharya et al. (2013, 2014) examine hold-up from the perspective of rank-and-file employees, and Alok and Subramanian (2023) investigate the impact of strengthening the property rights of inventors on the level of firm innovation. We add to this line of research by demonstrating that the threat of hold-up may also alter where firms employ inventors and the type of projects they direct or encourage inventors to work on.

Employers concerned about potential inventor hold-up may prefer to employ inventors in locations where talent poaching by competitors is more difficult. However, inventors may prefer mobility, and whether their preferences or their employer's preferences dominate is an open empirical question. Another open empirical question is whether changes in the threat of hold-up affects employers' willingness to employ inventors in agglomeration economies, such as California's Silicon Valley. Glaeser et al. (2022) find that public firms avoid locating their inventors in agglomeration economies, suggesting that the cost of knowledge spill-outs are greater than the benefit of knowledge spill-ins. However, when employers' innovation property rights are strong, they may benefit more from agglomeration economies (Anand and Galetovic, 2000). Consequently, employers may be more willing to employ or hire inventors in agglomeration economies when their innovation property rights are stronger. Understanding how employers manage the trade-off between knowledge spill-outs and spill-ins is critical for policymakers tasked

[9] Bradley et al. (2017) and Mann (2018) also examine how shifts in bargaining power between unions and creditors affects firms' propensity to patent. Dasgupta et al. (2021) study hold up and innovation in supply chain relationships.

with creating environments that promote both innovation and economic growth while safeguarding the interests of employers and inventors.

The strength of employers' innovation property rights may also affect the type of innovations they direct or encourage their inventors to work on and whether they accelerate the disclosure of these innovations conditional on patenting (Boot and Vladimirov, 2025). When employers' innovation property rights are weaker, they may direct their inventors towards employer-specific projects that are less likely to benefit competitors due to the threat of subsequent inventor hold-up. However, when employers' innovation property rights are stronger, they may be more willing to allow their inventors to work on generalizable innovations because they are less concerned about potential hold-up (Hart, 1995). Similarly, employers may be more willing to accelerate the disclosure of innovation when their intellectual property rights are stronger, as they are less concerned about signaling their employee inventors' innovation successes to competitors and inviting talent poaching (Arrow, 1972; Verrecchia and Weber, 2006; Zhao, 2022; Oh et al., 2024; Glaeser et al., 2025).

2.2. Background on the legal framework and the case of Alcatel USA, Inc. v. Brown

State courts generally follow common law rules and federal precedents regarding the property rights over employee inventors' inventions. Briefly put, the common law states that employers can claim ownership of employee inventors' inventions if employment contracts include intellectual property agreements or, in the absence of intellectual property agreements, if inventors are specifically employed to work on the invention. Employers also have an implied nonexclusive license to develop and use employee inventors' ideas if the inventors used their employer's resources to create the ideas. Nine states in the U.S. have enacted employee invention legislation that protects employee inventors' inventions if the inventions are unrelated to their

employers' businesses. In the other states, *Alcatel v. Brown* set a persuasive precedent that would inform employer-inventor litigation over innovation property rights.

The Brown in *Alcatel v. Brown* refers to Evan Brown, a software developer from Texas. He claimed to have conceived the idea for a software program in 1976, long before he joined DSC Communications Inc. ("DSC")—a company that was later acquired by Alcatel USA, Inc. In 1996, Brown asked DSC to release him from his invention disclosure agreement so that he could pursue the development of his idea without DSC's interference. Both Brown and DSC recognized the value of this program and after a year of unsuccessful negotiation, DSC fired Brown and brought a breach of contract action against him. DSC claimed that Brown violated his employment agreement when he failed to disclose the idea. DSC sought a declaratory judgment granting ownership of the idea to DSC and requiring Brown to disclose the idea in full. The 219th Judicial District Court of Texas found in July 2002 that the idea was an invention falling under the terms of the employment agreement between Brown and Alcatel, which entitled Alcatel to "full legal right, title and interests" of the invention. In 2004, the Texas Appeals Court turned down Brown's appeal of the 2002 decision.

The Appeals Court decision generated significant interest from both the public (e.g., Michalski, 2001; Nachtigal, 2004) and academics (e.g., Lai, 2003; Lobel, 2014; Sample, 2018). Many articles discussed Brown's bankruptcy and difficulty complying with the court's demand that he disclose his invention in full and pay Alcatel's $332,000 attorneys' fees. Moreover, although the Appeals Court decision did not set a formal legal precedent outside of Texas, it arguably established a persuasive precedent that would inform any subsequent decisions by other state and federal courts in similar cases (Lai, 2003; Lobel, 2014; Sample, 2018). Consequently, the final decision in *Alcatel v. Brown* shifted innovation property rights from inventors to their

employers.

However, and importantly for the research design, the *Alcatel v. Brown* shift in property rights did not extend to nine states with legislation that explicitly limits the enforceability of intellectual property assignment agreements (California, Delaware, Illinois, Kansas, Minnesota, North Carolina, Nevada, Utah, and Washington). For example, as the California Codes Labor Code Section 2870–2872 (California Legislative Information, 1979) states:

> "*Any provision in an employment agreement which provides that an employee shall assign, or offer to assign, any of his or her rights in an invention to his or her employer shall not apply to an invention that the employee developed entirely on his or her own time without using the employer's equipment, supplies, facilities, or trade secret information […].*"

Similarly, the Revised Code of Washington (RCW) 49.44.140 (Washington State Legislative, 1979) states:

> "*A provision in an employment agreement which provides that an employee shall assign or offer to assign any of the employee's rights in an invention to the employer does not apply to an invention for which no equipment, supplies, facilities, or trade secret information of the employer was used and which was developed entirely on the employee's own time […].*"

Inventors in the nine states that place clear restrictions on the enforceability of employee agreements were likely aware that the final decision in *Alcatel v. Brown* did not affect them. Although the following passage was written more than a decade later, it demonstrates that practitioners in innovation-intensive fields continue to reference the case when discussing employee ownership of intellectual property, suggesting awareness of its implications (Elizabeth, 2017):

> "*The famous case of Alcatel vs. Evan Brown is something of an object lesson for employees everywhere to keep their mouths closed if they have a brilliant idea... When he went to his company to negotiate an agreement to share the profits, they refused and demanded the code. Brown said no, so they fired him and sued him in short order for his 'invention'. A Texas appeals court agreed with the employer; Brown was eventually forced to pay the legal costs and share the code*."
>
> "*However, Alcatel vs. Evan Brown was tried in Texas. According to GitHub, California's*

> *notoriously lax enforcement of these kinds of employment agreements has helped Silicon Valley prosper. The state laws allow 'employees to own the work they produce on personal equipment and time'. That means, if you have a brilliant idea, it stays your brilliant idea*."

2.3. Background on patent disclosure

The patent system is built on the grand bargain: in exchange for the right to exclude others from the production or use of a novel device, process, apparatus, formula, or algorithm for a specified period, inventors provide detailed disclosure of how to independently recreate their innovation. This disclosure creates positive externalities by preventing the costly duplication of research efforts and by creating knowledge spillovers that allow others to build upon their innovations, which drive technological and economic growth (Romer, 1990).

Recognizing the value of prompt disclosure, the USPTO requires the publication of patent disclosures on the USPTO website by a deadline.[10] Specifically, the USPTO (2025b) notes that:

> "*Applications will be published after the expiration of a period of eighteen months from the earliest of: (1) the U.S. filing date; (2) the international filing date; or (3) the filing date of an earlier application for which a benefit is sought under 35 U.S.C. 119, 120, 121, 365, or 386.*"

This policy means that for applications also filed in foreign jurisdictions, the 18-month publication deadline is determined by the earlier of the foreign or U.S. filing date. If the applicant seeks international protection under the Patent Cooperation Treaty—which allows filing within 12 months after the domestic application while maintaining the domestic application's "priority date"—the USPTO will publish the application 18 months after the earliest filing date (World Intellectual Property Organization, 2025). However, domestic-only applicants can opt out of this default timeline and remain confidential by submitting a non-publication request under 35 U.S.C. 122 (USPTO, 2025c). All applicants can request at any time that the USPTO publishes their in-process application for an additional $300 fee (during the sample period) (USPTO, 2025d).

[10] Consistent with the notion that these disclosures are an important source of information, the USPTO website receives millions of visits each month (Semrush, 2025).

3. Sample and summary statistics

3.1. Sample

Table 1 Panel A details the sample selection procedure. The final sample comprises 389,451 inventor-patent observations, including 183,343 unique inventors and 171,009 unique patents. The sample begins with all successful patent applications filed with the USPTO between January 1, 2003, and December 31, 2006.[11] We identify assignees, inventors, locations, and successful patent applications—including patent assignments, disclosure timing, and citations—using data from patentsview.org, the USPTO patent database, and Stoffman et al. (2022). We consider patents of domestic public and private firms, individuals, and nonprofits. We remove inventors living in Texas—whose judiciary decided *Alcatel v. Brown* and Brown's appeal—from the analysis to avoid any potential endogeneity concerns.[12]

We begin the sample in 2003 to ensure the initial 2002 ruling does not contaminate results. We set the post period after the 2004 rejection because the rejection set the most persuasive precedent, was the focus of national news articles, and was not immediately followed by an appeal (see Section 2.2 for details). Because the *Alcatel v. Brown* case remained open for a possible rehearing motion between October 8, 2004 and November 30, 2004 (Supreme Court of Texas Blog, 2004), we classify both 2003 and 2004 as the "pre-event" period and treat 2005 and 2006 as the

[11] We focus on patent filing dates, as this date reflects the point at which inventors choose to protect their intellectual property. Furthermore, because the sample period ends in 2006, we have extensive data on inventor and patent characteristics (e.g., inventor switches, patent issue dates, citations, etc.) for much more recent years. This means we can construct all necessary inventor- and patent-level variables with high accuracy. Consequently, the inferences are unlikely to suffer from any truncation bias, as discussed by Lerner and Seru (2022).

[12] This exclusion helps mitigate potential concerns that the judiciary's composition or ruling may have been endogenously influenced by firms' and inventors' decisions through indirect channels, such as lobbying or local legal influence (Klasa et al., 2018). As a robustness check, we include inventors living in Texas and find that the inferences remain consistent—and slightly stronger in some cases.

"post-event" period.[13]

Alternatively, we could select 2000 and 2001 as the pre period (i.e., prior to the initial ruling). However, adding additional distance between the pre- and post-period reduces the power of our empirical tests as inventors are more likely to retire or switch jobs between 2001 and 2005, which would result in fewer inventors observed working for the same employer in both the pre and post periods. Moreover, Evan Brown immediately appealed the 2002 decision, creating significant legal uncertainty about the outcome of the case. Consistent with this uncertainty, we find limited evidence of anticipation effects in 2003 and 2004 (see Section 4.6 for more details).

We end the sample in 2006 so that we create a balanced sample before and after the final decision in *Alcatel v. Brown*. Consequently, we end the sample several years prior to the 2008 Federal Circuit ruling in *DDB Technologies, LLC v. MLB Advanced Media, LP*, which also affected the assignment of intellectual property rights (Suh, 2023).

A potential concern is that inventor teams may complicate the assignment of patent rights and the measurement of appropriability. This is particularly the case for employer-sponsored technologies, which are often created by teams of inventors. When multiple inventors are on the patent, each is considered a co-owner of the innovation. Under U.S. patent law, any one owner can transfer their ownership right or license the technology without the consent of the other owners (USPTO, 2025a). To account for this complexity, we use an inventor-patent unit of analysis that repeats the patent observation for each inventor listed on the patent.

Finally, because a single invention is often protected by a series of related patent documents filed with potentially multiple patent offices—the patent family—we restrict the sample to one

[13] In unreported analyses, we re-estimate our main tests using the Texas Supreme Court's October 8th, 2004 denial of Evan Brown's petition for review to identify treatment within the calendar year. The results remain largely consistent with our main findings, except for those reported in Table 2 Panel B and Table 7 Panel B, which lose statistical significance—potentially due to limited dissemination of the final decision.

patent per patent family by excluding all continuation, continuation-in-part, and provisional applications.[14] This restriction avoids multiple counting of the same invention. Specifically, we retain the first patent filing in the patent family, defined as the patent document whose filing date matches its priority date. Because our focus is on inventions originating from U.S.-based public and private firms, individuals, and nonprofits, we exclude patents with a foreign priority date—that is, those whose first filing occurred outside the U.S. We also implicitly limit the sample to successful applications because unsuccessful applications may never be disclosed. As such, the results may not generalize to abandoned patent applications or unpatented innovations (Glaeser and Guay, 2017). However, we believe that the theoretical foundations should help mitigate these concerns.

3.2. Summary statistics

Table 1 Panel B presents summary statistics. The final decision in *Alcatel v. Brown* affects approximately 27 percent of inventor-patent observations (recall that none are affected prior to 2005). The average patent lists 2.5 inventors, whereas the average inventor files 1.4 patents. Consistent with prior work, more than half of inventors reside in the same state as their employer (Glaeser et al., 2022). At the employer-year level, the average firm has about 12 active inventors and files about 8 patents per year in the sample.

We also descriptively explore the importance of the appropriability tradeoff affected by *Alcatel v. Brown*. At its core, this tradeoff relates to whether inventive activity conducted by employees on their own time should belong to the employee or their employer (see Section 2.2 for details). We find that among 183,343 inventors in the sample, 23,540 (12.84 percent) retain at least

[14] A continuation is a patent document that adds new claims to an existing patent document (the parent) and retains the priority date of the original parent application (i.e., the earliest filing date for any document in the patent family). A provisional application is a temporary patent filing that allows an inventor to establish an early priority date without initiating the formal examination process.

one patent; similarly, 21,924 out of 171,009 patents (12.82 percent) are retained by their inventors. In unreported analyses, we find evidence of widespread individual patenting that would likely be affected by the final decision in *Alcatel v. Brown*. For instance, 17.10 percent of inventor-retained patents are filed during uninterrupted spells in which the inventor also files patents assigned to a single employer.[15] Relaxing the requirement to observe at least two employer-assigned patents, we find that 20.15 percent of inventor-retained patents are filed within a [–1, +1] year window of a patent assigned to the inventor's current employer.[16] In total, these patterns indicate that inventors frequently retain patent rights during periods of ongoing corporate employment—a practice significantly curtailed by *Alcatel v. Brown*.

4. Empirical analysis

4.1. Shifts in inventor-employer property rights and patent assignment

We begin the empirical analysis by examining whether the final decision in *Alcatel v. Brown* strengthened employment relationships. Identifying side project ideas developed by employee inventors while working at corporate employers is highly challenging. Many widely used technology products—and even entire firms—originated as side projects but were ultimately patented under newly founded companies.[17] We therefore focus on two types of patent

[15] For example, if an inventor files patents in 2002 and 2005 assigned to Intel Corporation, and files for a patent in 2004 that they assign to themselves, we assume that the inventor was employed at Intel Corporation during the development of the 2004 patent.

[16] We also find that individual patents draw from prior work outside the firm and receive more forward citations, even as they are used less often in future work by other employers.

[17] For instance, the popular workplace communication tool Slack came from an internal messaging system built during the development of the multiplayer game Glitch. When Glitch failed to gain traction and was shut down, the team recognized the broader potential of their messaging tool. They refined it and launched Slack Technologies, Inc. as a standalone company—and U.S. Patent No. 9,940,394 was assigned to Slack Technologies, Inc., not an individual. The same holds for Twitter, which began as a side project within the podcasting company Odeo. The platform was later granted U.S. Patent No. 8,401,009, which was assigned to Twitter, Inc. Likewise, YouTube began as a side project by employees of PayPal Holdings, Inc. in 2005, with the original idea for YouTube being a video version of an online dating service. The YouTube idea was incorporated as a company and subsequently acquired by Alphabet Inc.

assignments that serve as indicators of reduced hold-up. First, we examine whether inventors are less likely to retain patent rights . A decline in inventor-retained patents would be consistent with the ruling reducing employee inventors' appropriation of innovations. *Patent Retained by Inventor* is an indicator equal to one if the patent is retained by an individual, rather than assigned to a company, government, hospital, or research institute. Second, we examine whether employee inventors are less likely to take their ideas to another employer, which would similarly suggest that *Alcatel v. Brown* reduced employee appropriation. *Patent Assigned to New Employer* is an indicator equal to one if an inventor on the patent files a different patent with a different employer within the following year.

We estimate the following specification using *Patent Assigned to Inventor* and *Patent Assigned to New Employer* as the dependent variables:

$$\begin{aligned}[Outcome_{ipt}] = {} & \beta_1 \cdot Affected\ by\ Alcatel\ v.\ Brown_{it} \\ & + \beta_2 \cdot \text{ihs}(Total\ Patents\ by\ Inventor_{it}) \\ & + \beta_3 \cdot \text{ihs}(Total\ Inventors\ on\ Patent_{ipt}) \\ & + \beta_4 \cdot Inventor\ and\ Employer\ in\ Same\ State_{iet} \\ & + \mathbf{\Omega} \cdot \xi_{et} + \mathbf{\Lambda} \cdot \theta_i + \mathbf{T} \cdot \varphi_l + \mathbf{\Phi} \cdot \tau_{at} + \mathbf{\Gamma} \cdot \nu_{ct} + \varepsilon_{ipt}, \end{aligned} \quad (1)$$

where i indexes inventors, p indexes patent applications, t indexes application years, e indexes employers, l indexes inventor location city, a indexes assignee state, c indexes patent technology classes, and ihs(·) indicates an inverse hyperbolic sine transformation. Throughout, we multiply dependent variables by 100 to ease interpretation and interpret results in terms of percentage changes relative to the sample baseline. In this case, multiplying by 100 means that the coefficient estimates reflect percentage-point changes in patent assignment. We cluster standard errors by employer, inventor, and technology class to account for serial dependence within each.

Our main variable of interest is *Affected by Alcatel v. Brown*, which is an indicator that equal to one if an inventor is affected by the final decision in *Alcatel v. Brown* after Evan Brown's

appeal was rejected in 2004. We measure the effect of *Alcatel v. Brown* based on the inventor's home state, assuming that is the state in which the inventor works. The inventor's work state is the strongest connection between employer and inventor, and hence by far the most likely law applied by courts that hear contract disputes (e.g., *Alcatel v. Brown* was heard based on Texas law, as that is where Brown worked for Alcatel USA, Inc., and not California law, where Alcatel USA, Inc. was headquartered).[18]

We include a variety of controls and fixed effects in Eq. (1) to address potential alternative explanations and to increase the precision of the estimates. *Total Patents by Inventor* is the total number of patents filed by the inventor within a given year, and controls for differences in individual inventive activity. *Total Inventors on Patent* is the total number of inventors listed on the patent, and controls for differences in co-invention of different patents. *Inventor and Employer in Same State* is an indicator equal to one if the inventor is located in the same state as the employer's headquarters and controls for the degree of separation between the inventor and their employer (e.g., Glaeser et al., 2022).

Eq. (1) includes a variety of fixed effects. ξ_{et} are employer-year fixed effects that control for all time-varying features of the firm, including those that are difficult to measure or observe such as competition and manager preferences (Glaeser and Landsman, 2021; Glaeser et al., 2022). Consequently, Eq. (1) compares inventor and innovation outcomes for innovations created by inventors who work for the same firm, at the same point in time, but are differently affected by the final decision in *Alcatel v. Brown*. θ_i are inventor fixed effects, which control for time-invariant

[18] Contracts can include a choice of law provision but courts often decline to enforce these provisions for a variety of reasons, including when the provisions are used to avoid the legal system that has the most substantial connection with the contract (e.g., the inventor's work state), another state has a more substantial connection to the contract (e.g., the inventor's work state), the forum state's public policy would be thwarted by applying the chosen law, etc. (Transnational Litgation Blog, 2022).

inventor attributes (e.g., the inventor's innate ability). φ_l are inventor city fixed effects that control for time-invariant aspects of the inventor's location (e.g., the inventor's personal tax rate). τ_{at} are employer assignee-location state-by-year fixed effects, which control for time-varying assignee factors such as state corporate tax rates, which affect employers' risk taking and inventor location decisions due to wage tax-deductibility (Ljungqvist et al., 2017; Langenmayr and Lester, 2018; Glaeser et al., 2022). ν_{ct} are technology class-by-year fixed effects, which control for differential technology-specific effects (e.g., differential citation rates; Lerner and Seru, 2022). We cluster standard errors by employer, inventor, and technology class to address potential time-series dependence within employers and inventors and cross-sectional dependence within technology classes.

Table 2 presents the results. Panel A shows that inventors affected by the ruling are 0.23 percent (coefficient = –0.016; mean dependent variable is 6.788) less likely to retain patent rights , relative to the baseline rate of inventor-retained patents in the sample.[19] Panel B shows that affected inventors are 21 percent (coefficient = –1.878; mean dependent variable is 8.842) less likely to assign a patent to a new employer in the following year, relative to the baseline. Combined, this evidence suggests that the court's decision made inventors less likely to hold up their current employers by appropriating successful innovations for themselves or for other employers.

4.2. Shifts in inventor-employer property rights and inventor mobility

Next, we examine whether inventors affected by the final decision in *Alcatel v. Brown* are less mobile. To do so, we examine whether inventors switch employers or relocate to unaffected states within the next five years. *Inventor Switches Employer* is an indicator equal to one if the

[19] Throughout the paper, we report effect sizes as a percentage of the mean of the dependent variable in the relevant sample. For example, an estimated coefficient of –0.016 is interpreted as a –0.23 percent effect when the sample mean of the dependent variable is 6.788. We report the relevant means in the text, as they may differ from those in Table 1 due to variation in units of observation (e.g., patent-level summary statistics versus inventor-patent-level regression).

inventor switches employer within the next five years as evidenced by assigning a patent to a different employer over that period. *Inventor Relocates to Unaffected State* is an indicator equal to one if the inventor relocates to an unaffected state within the next five years as evidenced by patenting filing made while residing in an unaffected state over that period.

Although we focus on a five-year window to account for the time required for inventor-employer matching, innovation development, and subsequent patenting, this also introduces the potential for overlap between the pre- and post-periods. For example, an inventor observed in 2002 could switch to a different employer by 2007, which crosses into the post-treatment period. We therefore estimate an adjusted version of Eq. (1) that restricts the sample to 2004, ensuring that any moves within the next five years fall entirely within the post-treatment period:

$$\begin{aligned}[Outcome_i] = {} & \beta_1 \cdot Affected\ by\ Alcatel\ v.\ Brown_i \\ & + \beta_2 \cdot \text{ihs}(Total\ Patents\ by\ Inventor_i) \\ & + \beta_3 \cdot \text{ihs}(Total\ Inventors\ on\ Patent_{ip}) \\ & + \beta_4 \cdot Inventor\ and\ Employer\ in\ Same\ State_{ie} \\ & + \boldsymbol{\Theta} \cdot \mu_e + \boldsymbol{\Phi} \cdot \tau_a + \boldsymbol{\Gamma} \cdot \nu_c + \varepsilon_i, \end{aligned} \tag{2}$$

where [*Outcome*] is either *Inventor Switches Employer* or *Inventor Relocates to Unaffected State*.

In Eq. (2), we include employer fixed effects (μ_e) and employer assignee state fixed effects (τ_a), allowing us to compare whether inventors affected by *Alcatel v. Brown* within the same firm are more or less likely to switch employers or move to unaffected states. We also include technology class fixed effects (ν_c) to control for cross-sectional variation across patent technology areas. We exclude time-based fixed effects because we examine a single year. We cluster standard errors by employer to address potential dependence within employers.

Table 3 presents the results using *Inventor Switches Employer* as the dependent variable for observations in 2004. The results indicate that inventors affected by the final decision in *Alcatel v. Brown* are 16 percent (coefficient = –3.714; mean dependent variable is 22.807) less likely to

switch employers within the next five years, relative to the baseline rate of inventor mobility in 2004. This evidence further corroborates the earlier findings that *Alcatel v. Brown* made inventors less likely to hold up their current employers by appropriating successful innovations for other employers. Furthermore, Table 4 presents the results using *Inventor Relocates to Unaffected State* as the dependent variable for observations in 2004. The results indicate that conditional on moving, inventors affected by *Alcatel v. Brown* are 193 percent (coefficient = 4.450; mean dependent variable is 2.308) more likely to move to a state that is unaffected by *Alcatel v. Brown*.

4.3. Shifts in inventor-employer property rights and access to agglomeration economies

We also examine whether employers hire new inventors in agglomeration economies. We define agglomeration economies based on the annual change in the total number of inventors conducting patenting activity or employers engaged in patenting activity in a given state compared to the previous year (*Inventor Agglomeration* and *Employer Agglomeration*, respectively). We then create forty-nine observations for each new inventor hire-year—one for each state, excluding Texas—and examine as the dependent variable an indicator equal to one if the state is where the new hire is located (*Hired in State*):

$$\begin{aligned} \textit{Hired in State}_{ipt} = {} & \beta_1 \cdot \textit{Affected by Alcatel v. Brown}_{it} \times [\textit{Agglomeration}_{lt}] \\ & + \beta_2 \cdot \textit{Affected by Alcatel v. Brown}_{it} \\ & + \beta_3 [\textit{Agglomeration}_{lt}] \\ & + \beta_4 \cdot \textit{Inventor and Employer in Same State}_{iet} \\ & + \mathbf{\Omega} \cdot \xi_{et} + \mathbf{T} \cdot \varphi_l + \mathbf{\Phi} \cdot \tau_{at} + \varepsilon_{ipt}, \end{aligned} \tag{3}$$

where [*Agglomeration*] is *Inventor Agglomeration* or *Employer Agglomeration*. We include employer-year fixed effects (ξ_{et}), inventor's location city fixed effects (φ_l), and employer assignee-location state-by-year fixed effects (τ_{at}). We cluster standard errors by employer and inventor to address potential time-series dependence within employers and inventors.

We present the results in Table 5. The results indicate that employers are more likely to

locate their inventors in agglomeration economies when affected by *Alcatel v. Brown*, as indicated by positive coefficients on the interaction between *Affected by Alcatel v. Brown* and both [*Agglomeration*] variables. These results indicate that by reducing the threat of inventor hold-up *Alcatel v. Brown* made employers more likely to locate inventors in agglomeration economies, as predicted by Anand and Galetovic (2000).

4.4. Shifts in inventor-employer property rights and disclosure timeliness

Next, we turn to patent disclosure timing analyses by examining early publication requests within the subsample of patents that are published before the 18-month publication deadline. Data on early publication requests come from the patent's transaction history, which becomes publicly available when a patent is published. *Request for Early Patent Publication* is an indicator equal to one if the patent is published early due to an early publication request. To examine the intensive margins of early publication requests, we measure the days between the patent's first priority date and the date of the early publication request, conditional on such a request (*Early Publication Request Timing*). The strength of these request-based measures is that they capture the explicit decision to solicit early publication.

Table 6 presents the results using *Request for Early Patent Publication* and *Early Publication Request Timing* as the dependent variables in Eq. (1). Panel A shows that filers are more likely to request early publication when affected by *Alcatel v. Brown*, although this result is only statistically significant when excluding inventor fixed effects. Panel B shows that conditional on an early publication request, protected applicants submit these requests earlier for patents with inventors affected by *Alcatel v. Brown*. Without inventor fixed effects, protected applicants are 39 percent (coefficient = 1.228; mean dependent variable is 3.180) more likely to request early publication, and conditional on doing so the timing of their requests is 13 percent shorter than

those of unprotected applicants (coefficient = –0.208; mean dependent variable is 1.581). With inventor fixed effects, protected applicants are no more likely to request early publication, but conditional on doing so the timing of their requests is 4 percent shorter than those of unprotected applicants (coefficient = –0.060; mean dependent variable is 1.581). Combined, this evidence suggests that reducing the threat of inventor hold-up made the inventor's employer more likely to accelerate patent disclosures, conditional on making an early publication request.

4.5. Shifts in inventor-employer property rights and the nature of innovation

Next, we examine how shifting property rights affects the nature of innovation. Specifically, we examine the "breadth" and "spread" of patents by measuring citations across employers, following the intuition of Trajtenberg et al. (1997) and Hall et al. (2001). Although they focus on technology classes, we focus on citations across entities to test the prediction that employee inventors are more likely to develop broader and further spreading innovations that are widely applicable to other employers. Breadth captures the extent to which a focal patent builds upon diverse prior innovations by measuring the citations the focal patent makes to other entities' prior patents (i.e., backward citations; *Patent Breadth*). Spread reflects a focal patent's breadth of influence on subsequent innovations by measuring the diversity of citations the focal patent receives from other entities' future patents (i.e., forward citations; *Patent Spread*). Both measures are constructed in a Herfindahl-Hirschman concentration-like fashion:

$$1 - \sum_{f=1}^{N_p} s_{pe}^2, \tag{4}$$

where s_{pf} denotes the share of citations made (for *Patent Breadth*) or received (for *Patent Spread*) by patent p belonging to entity e, out of all N citations made or received by patent p. A higher breadth score indicates that a patent cites prior work from a broader set of entities, suggesting

greater diversity. A higher spread score indicates that a patent is cited by subsequent work from a broader set of entities, suggesting broader downstream applicability.

Table 7 presents the results using *Patent Breadth* and *Patent Spread* as the dependent variables in Eq. (1). Panel A shows that *Alcatel v. Brown* caused inventors to develop innovations that cite a 3 percent (coefficient = 1.433; mean dependent variable is 51.118) broader set of other entities' future patents relative to the baseline (i.e., broader innovations). Panel B shows that *Alcatel v. Brown* caused inventors to develop innovations cited by a 5 percent (coefficient = 1.666; mean dependent variable is 32.747) broader set of other entities' future patents relative to the baseline (i.e., more further spreading innovations). Combined, these results suggest that shifts in intellectual property rights from inventors to employers lead to broader and further spreading—and hence less employer-specific—innovations, implying greater employer investment in the employee's human capital (Hart, 1995).

4.6. Anticipation effects

An important consideration regarding the sample period is the possibility of anticipation effects (e.g., that the initial 2002 ruling may have led to meaningful anticipatory reactions). We therefore examine differential trends in outcomes between treated and control using 2002–2003 as a pre-treatment period, 2004 as the baseline, and 2005–2006 as the treatment period. Figure 1 presents trend plots for patent-level outcome variables across treated and control groups over these three periods. Across all five outcome variables, we find no significant evidence of differential pre-trends. In most cases, the treatment and control groups appear to follow similar trajectories prior to 2004, and any slight deviations around 2002–2003 are not statistically or visually pronounced; the only exception is for *Patent Spread*. We find some evidence that *Patent Spread* trended differentially downwards prior to the appeals decision, in the opposite direction of the

ultimate treatment effect (i.e., the differential trend could not explain the ultimate treatment effect).[20]

4.7. Shifts in inventor-employer property rights and aggregate employer-level effects

Finally, we examine employer-level responses of the final decision in *Alcatel v. Brown* to shed light on the study's broader motivation of how the assignment of intellectual property rights for successful innovations between inventors and their employers affects innovation. We first examine changes in the allocation of innovative activity across states within employers.[21] Specifically, we examine whether employers adopt collaborative and geographically disperse innovation models (Anand and Galetovic, 2000). *%Affected-State Patents* is the fraction of an employer's patents that list at least one inventor located in a state affected by *Alcatel v. Brown* (this variable is identified for 2003 and 2004). *%Mixed-State Patents* is the fraction of an employer's patents that list at least: (i) one inventor located in a state ultimately affected by *Alcatel v. Brown*; and (ii) one inventor located in a state ultimately unaffected by *Alcatel v. Brown*. We use these variables to test whether employers prefer to concentrate their innovation activity in states where they have stronger property rights, reflecting a strategic response to reduced hold-up concerns.

Second, we examine whether employers adjust their overall innovation strategy in response to the ruling. Specifically, we test whether employers accelerate patent disclosures and expand their technological scope. To measure these shifts, we construct two variables. *Firm Early Publication Requests* is the average value of *Request for Early Patent Publication* for a given firm-

[20] The general lack of pre-trends is arguably unsurprising because the 2004 appeals court decision was much more significant than the 2002 ruling (see Sections 2.2 and 3.1). Regardless, we believe these results are reassuring, as they support the identifying assumption that, in the absence of the 2004 ruling, treated and control observations would have continued to evolve similarly. Moreover, even if some minor anticipatory behavior occurred, it would still be attributable to the broader legal shift in the assignment of intellectual property rights that this study aims to quantify.
[21] For all the variables described here, we ensure that each patent is counted only once per firm-year observation.

year observation. *Firm Innovation Diversity* is a firm-year-level innovation diversity index calculated similarly to Eq. (4): one minus the firm's technology class concentration, reflecting the breadth of innovation across different technological fields. A high innovation diversity score indicates that a firm is active in a broad range of technology classes, whereas a lower score indicates a smaller set of technology classes.

We examine these aggregate employer-level responses as dependent variables in the following specification:

$$\begin{aligned}[Outcome_{et}] = {} & \beta_1 \cdot Exposure\ to\ Alcatel\ v.\ Brown_{et} \\ & + \beta_2 \cdot \text{ihs}(Total\ Patents\ by\ Firm_{et}) \\ & + \beta_3 \cdot \text{ihs}(Total\ Inventors\ in\ Firm_{et}) \\ & + \beta_4 \cdot Inventors\ in\ Same\ State\ as\ Firm_{et} \\ & + \mathbf{\Psi} \cdot \omega_t + \varepsilon_{et}, \end{aligned} \tag{5}$$

where *Exposure to Alcatel v. Brown* measures the firm's *ex ante* exposure to *Alcatel v. Brown*, as measured based on their 2003 distribution of operations across states. Specifically, this variable measures the fraction of the firm's inventors that live in a state ultimately affected by *Alcatel v. Brown*. We use this value for 2005 and 2006 and set it to zero for 2003 and 2004. Thus, *Exposure to Alcatel v. Brown* captures employers innovation strategies in the post period as continuous function of their upcoming exposure to *Alcatel v. Brown*, as measured in 2003.[22] We also aggregate and use as dependent variables the total number of unique patents, total number of unique inventors, and the ratio of inventors that share the same state as the employer's headquarters at the firm-year level (i.e., *Total Patents by Firm*, *Total Inventors in Firm*, and *Inventors in Same State as Firm*, respectively). We cluster standard errors by employer to address dependence within employers.

[22] In unreported analyses, we assess whether employers may have altered the geographic distribution of their inventors following the initial 2002 *Alcatel v. Brown* ruling by examining pre-trends in the *Exposure to Alcatel v. Brown* measure. Although we find no evidence of anticipatory effects in 2002, there is some evidence of anticipation effects during the 2003–2004 period for outcomes other than early publication requests, suggesting potential adjustments in response to the initial decision.

Table 8 presents the results. Panel A shows that employers with greater exposure to *Alcatel v. Brown* are more likely to patent in affected states compared to employers with less exposure. Panel B shows that greater exposure is also associated with employers' overall innovation strategies; more exposed employers are more likely to request early publication and patent in multiple technology classes. The finding that more exposed employers are more likely to request early publication on average, whereas the result for individual inventors is statistically insignificant, suggests that the decision to request early publication may be more employer-level than inventor-level. Combined, the results in Table 8 suggest that shifts in intellectual property rights from inventors to employers not only affect inventor-level outcomes, but also employer-level outcomes, providing insight into the overall effects of the inventor-employer appropriability trade-off and the threat of inventor hold-up.

5. Conclusion

We document that *Alcatel v. Brown*—which shifted innovation property rights from inventors to their employers—reduced the threat of inventor hold-up of employers as evidenced by reduced inventor patent retention, inventor mobility, and outside employer assignment. Consistent with predictions from incomplete contracting theory, affected inventors' innovations are revealed more promptly when disclosed, draw from a broader set of prior patents, and spread more to subsequent patents. Further consistent with incomplete contracting theory predictions, affected employers are more likely to locate their inventors in agglomeration economies, reallocate activity across states, and broaden their innovation portfolios.

Overall, we contribute to the literature by documenting how the allocation of intellectual property rights between inventors and their employers affects a broad range of inventor and invention outcomes by reducing the threat of inventor hold-up of employers. The findings

highlight the role of intellectual property rights and the threat of inventor hold-up in shaping talent retention, disclosure, knowledge diffusion, and employers' responses to innovation risks.

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Appendix A. Variable definitions

This appendix defines the variables used in the empirical tests and details their data sources. Variables are categorized into patent-level, inventor-level, and employer-level.

Panel A. Patent-level variables

Variable	Description	Data source(s)
Patent Retained by Inventor	An indicator equal to one if the patent is retained by an individual, rather than assigned to a company, government, hospital, or research institute.	Assignee table on patentsview.org
Patent Assigned to New Employer	An indicator equal to one if an inventor on the patent files for patent within the following year under the name of an employer that is different from the inventor's current employer.	Assignee and inventor tables on patentsview.org
Request for Early Patent Publication	An indicator equal to one if the patent is published early due to an early publication request.	USPTO Transactions History Data
Early Publication Request Timing	The number of days between the patent's first priority date and the date of the early publication request, conditional on a request.	USPTO Transactions History Data
Patent Breadth	The breadth index of the patent, following the intuition of Trajtenberg et al. (1997) and Hall et al. (2001), based on the diversity of employers cited by the patent (i.e., backward citations). One minus the Herfindahl-Hirschman concentration index of cited employers in the patent's backward citations.	Citations table on patentsview.org, and Stoffman et al. (2022)
Patent Spread	The spread index of the patent, following the intuition of Trajtenberg et al. (1997) and Hall et al. (2001), based on the diversity of employers that cite the patent in the future (i.e., forward citations). One minus the Herfindahl-Hirschman concentration index of citing employers in the patent's forward citations.	Citations table on patentsview.org, and Stoffman et al. (2022)
Total Inventors on Patent	The total number of inventors listed on the patent.	Inventor table on patentsview.org

(continued on next page)

Panel B. Inventor-level variables

Variable	Description	Data source(s)
Affected by Alcatel v. Brown	An indicator equal to one if the inventor is affected by the final decision in *Alcatel v. Brown*. This indicator equals one after 2004 if the inventor resides outside the nine states that limit the enforceability of intellectual property assignment agreements through employee invention legislation. The nine states are California, Delaware, Illinois, Kansas, Minnesota, North Carolina, Nevada, Utah, and Washington.	Assignee and inventor tables on patentsview.org, and Stoffman et al. (2022)
Inventor Switches Employer	An indicator equal to one if the inventor switches employer within the next five years.	Assignee and inventor tables on patentsview.org, and Stoffman et al. (2022)
Inventor Relocates to Unaffected State	An indicator equal to one if the inventor relocates to an unaffected state within the next five years. The nine unaffected states are California, Delaware, Illinois, Kansas, Minnesota, North Carolina, Nevada, Utah, and Washington.	Inventor table on patentsview.org
Inventor Agglomeration	The annual change in the total number of inventors conducting patenting activity in a given state compared to the previous year (in thousands).	Inventor table on patentsview.org
Employer Agglomeration	The annual change in the total number of employers engaged in patenting activity in a given state compared to the previous year (in thousands).	Assignee and inventor tables on patentsview.org
Total Patents by Inventor	The total number of patents filed by the inventor within a given year.	Inventor table on patentsview.org
Inventor and Employer in Same State	An indicator equal to one if the inventor is located in the same state as the employer's headquarters. For inventors who are not associated with an employer, we code this variable as 1, treating the inventor as their own employer.	Assignee and inventor tables on patentsview.org

(continued on next page)

Panel C. Employer-level variables

Variable	Description	Data source(s)
Exposure to Alcatel v. Brown	The firm's *ex ante* exposure to *Alcatel v. Brown*, based on their 2003 distribution of operations across states. We use this value for 2005 and 2006 and set it to zero for 2003 and 2004.	Assignee and inventor tables on patentsview.org
Total Patents by Firm	The total number of patents filed by the firm within a given year.	Assignee and inventor tables on patentsview.org, and Stoffman et al. (2022)
Total Inventors in Firm	The total number of inventors that file a patent for the firm within a given year.	Assignee and inventor tables on patentsview.org, and Stoffman et al. (2022)
Inventors in Same State as Firm	The average value of *Inventor and Employer in Same State* for a given firm-year observation.	Assignee and inventor tables on patentsview.org, and Stoffman et al. (2022)
%Affected-State Patents	The fraction of a firm's patents that list at least one inventor located in a state ultimately affected by *Alcatel v. Brown*.	Assignee and inventor tables on patentsview.org
%Mixed-State Patents	The fraction of a firm's patents that list at least: (i) one inventor located in a state ultimately affected by *Alcatel v. Brown*; and (ii) one inventor located in a state ultimately unaffected by *Alcatel v. Brown*.	Assignee and inventor tables on patentsview.org
Employer Early Publication Requests	The average value of *Request for Early Patent Publication* for a given firm-year observation.	Assignee table on patentsview.org, combined with USPTO Transactions History Data
Firm Innovation Diversity	One minus the technology class concentration, for a given firm-year observation.	Assignee and application tables on patentsview.org

Figure 1. Anticipation effects

This figure presents trend plots for patent-level outcome variables across treated and control groups over three periods: (i) 2002–2003 ("after initial ruling"); (ii) 2004 ("final ruling"); and (iii) 2005–2006 ("after final ruling"). Moving clockwise from the top-left panel, the figure displays results for the following outcomes: (i) *Patent Retained by Inventor*; (ii) *Patent Assigned to New Employer*; (iii) *Request for Early Patent Publication*; (iv) *Patent Spread*; and (v) *Patent Breadth*. For each outcome, we estimate the following specification:

$$[Outcome_{ipt}] = \beta_1 \cdot Treated_i \cdot 2005\text{–}2006_t + \beta_2 \cdot Treated_i \cdot 2002\text{–}2003_t + \mathbf{\Omega} \cdot \xi_{et} + \mathbf{\Lambda} \cdot \theta_i + \mathbf{T} \cdot \varphi_l + \mathbf{\Phi} \cdot \tau_{at} + \mathbf{\Gamma} \cdot \nu_{ct} + \varepsilon_{ipt},$$

where i indexes inventors, p indexes patent applications, t indexes application years, e indexes employers, l indexes inventor location city, a indexes assignee state, and c indexes patent technology classes. *Treated* is an indicator equal to one if the inventor resides outside the nine states that limit the enforceability of intellectual property assignment agreements through employee invention legislation. The variables *2002–2003* and *2005–2006* are time-period indicators, with 2004 serving as the reference period. For each specification, the figure plots the coefficients on the treatment-by-period interactions along with bars indicating 90% confidence intervals, capturing dynamic differences between treated and control inventors relative to the 2004 reference period.

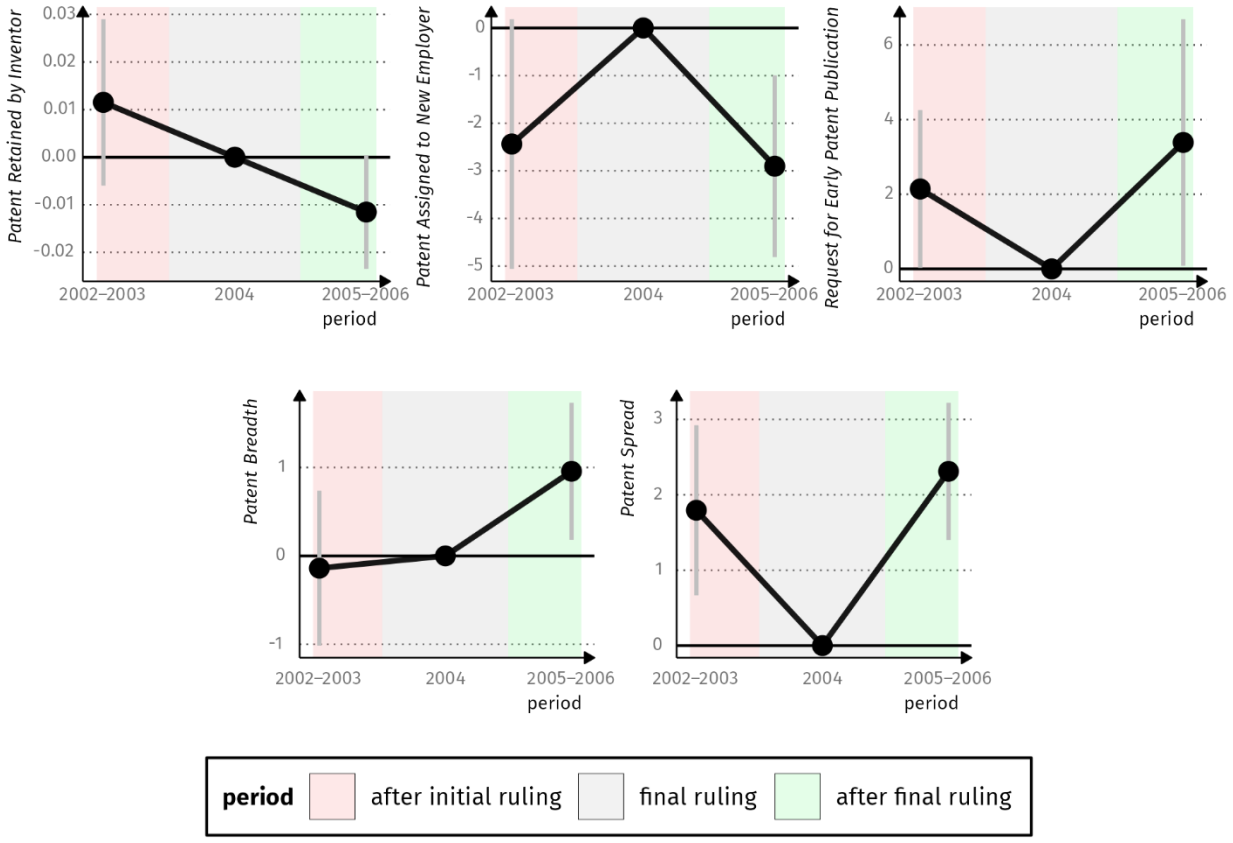

Table 1. Sample

This table provides an overview of the sample. Panels A and B detail, respectively, the sample selection and summary statistics. The final sample comprises 389,451 inventor-patent observations, including 183,343 unique inventors and 171,009 unique patents filed in the U.S.—outside Texas—with the United States Patent and Trademark Office between January 1, 2003, and December 31, 2006. We consider patents of both public and private firms as well as individuals, governments, hospitals, and research institutes, as long as they are located in the U.S. We limit the sample to a single patent within a given patent family by excluding continuation and provisional patents. Appendix A defines all variables.

Panel A. Sample selection

Step	Selection criteria	Unit of observation	Change in observations	Total observations
(1)	Initial set of patents with USPTO after 1989	Patent	+3,870,043	3,870,043
(2)	Remove all patents not filed during 2003–2006	Patent	–3,064,933	805,110
(3)	Remove all continuation patents	Patent	–358,127	446,983
(4)	Remove all patents with an earlier foreign filing	Patent	–208,070	238,913
(5)	Add all U.S. inventors listed on a given patent	Inventor-patent	+182,716	421,629
(6)	Remove all inventors living in Texas	Inventor-patent	–32,178	389,451

Panel B. Summary statistics (continued)

Patent-level variables	*N*	Mean	Std. Dev.	25th	50th	75th
Patent Retained by Inventor	171,009	0.128	0.334	0.000	0.000	0.000
Patent Assigned to New Employer	171,009	0.143	0.351	0.000	0.000	0.000
Request for Early Patent Publication	171,009	0.003	0.055	0.000	0.000	0.000
Early Publication Request Timing	511	47.225	101.527	0.000	0.000	37.000
Patent Breadth	144,077	0.494	0.278	0.398	0.590	0.713
Patent Spread	120,126	0.316	0.272	0.000	0.384	0.562
Total Inventors on Patent	171,009	2.472	1.654	1.000	2.000	3.000

Inventor-level variables	*N*	Mean	Std. Dev.	25th	50th	75th
Affected by Alcatel v. Brown	183,343	0.269	0.416	0.000	0.000	0.500
Inventor Switches Employer	183,343	0.186	0.376	0.000	0.000	0.000
Inventor Relocates to Unaffected State	183,343	0.020	0.133	0.000	0.000	0.000
Inventor Agglomeration	183,343	–0.759	1.405	–0.858	–0.317	0.060
Employer Agglomeration	183,343	–0.320	0.556	–0.434	–0.118	–0.011
Total Patents by Inventor	183,343	1.386	1.042	1.000	1.000	1.333
Inventor and Employer in Same State	183,343	0.636	0.471	0.000	1.000	1.000

Table 1. Sample (continued)

Panel B. Summary statistics (continued)

Employer-year-level variables	*N*	Mean	Std. Dev.	25th	50th	75th
Exposure to Alcatel v. Brown	17,978	0.126	0.318	0.000	0.000	0.000
Total Patents by Firm	17,978	7.716	60.724	1.000	1.000	2.000
Total Inventors in Firm	17,978	11.992	89.194	1.000	2.000	5.000
Inventors in Same State as Firm	17,978	0.747	0.377	0.500	1.000	1.000
%Affected-State Patents	17,978	0.635	0.462	0.000	1.000	1.000
%Mixed-State Patents	17,978	0.058	0.207	0.000	0.000	0.000
Employer Early Publication Requests	17,978	0.004	0.059	0.000	0.000	0.000
Firm Innovation Diversity	17,978	0.238	0.322	0.000	0.000	0.481

Table 2. Shifts in inventor-employer property rights and patent assignment

This table presents OLS regressions of patent assignment as a function of a shift in the property rights around successful innovation from inventors to their corporate employers. Panels A and B present, respectively, results for inventor retention of patent rights and future assignments to other employers. Appendix A defines all variables and sample summary statistics are in Table 1. Standard errors appear in parentheses and are clustered by employer, inventor, and technology class. *, **, and *** denote statistical significance at two-tailed probability levels of 10%, 5%, and 1%, respectively. We multiply dependent variables by 100 so that the coefficient estimates reflect percentage-point changes and to ease interpretation.

Panel A. Patents retained by individuals

	(1)	(2)
	Dependent variable:	
Variable:	*Patent Retained by Inventor*	
Affected by Alcatel v. Brown	–0.017*	–0.016*
	(0.010)	(0.009)
ihs(*Total Patents by Inventor*)		–0.004
		(0.003)
ihs(*Total Inventors on Patent*)		–0.002
		(0.001)
Inventor and Employer in Same State		0.069
		(0.049)
Fixed effects:		
Employer × year	yes	yes
Inventor	yes	yes
Inventor city	yes	yes
Assignee state × year	yes	yes
Technology class × year	yes	yes
Inventor-patent observations	389,451	389,451
Adjusted within-R^2	0.004%	0.048%

Table 2. Shifts in inventor-employer property rights and patent assignment (continued)

Panel B. Patents assigned to new employers

	(1)	(2)
	Dependent variable:	
Variable:	*Patent Assigned to New Employer*	
Affected by Alcatel v. Brown	–1.831**	–1.878**
	(0.902)	(0.906)
ihs(*Total Patents by Inventor*)		–0.680*
		(0.352)
ihs(*Total Inventors on Patent*)		0.245*
		(0.144)
Inventor and Employer in Same State		–2.772***
		(0.974)
Fixed effects:		
Employer × year	yes	yes
Inventor	yes	yes
Inventor city	yes	yes
Assignee state × year	yes	yes
Technology class × year	yes	yes
Inventor-patent observations	389,451	389,451
Adjusted within-R^2	0.017%	0.060%

Table 3. Shifts in inventor-employer property rights and inventor mobility

This table presents OLS regressions of future inventor mobility as a function of a shift in the property rights around successful innovation from inventors to their corporate employers. The sample includes all observations in 2004 and examines whether the inventor switches employer within the next five years. Appendix A defines all variables and sample summary statistics are in Table 1. Standard errors appear in parentheses and are clustered by employer. *, **, and *** denote statistical significance at two-tailed probability levels of 10%, 5%, and 1%, respectively. We multiply dependent variables by 100 so that the coefficient estimates reflect percentage-point changes and to ease interpretation.

	(1)	(2)
	Dependent variable:	
Variable:	*Inventor Switches Employer*	
Affected by Alcatel v. Brown	–3.731***	–3.714***
	(0.751)	(0.808)
ihs(*Total Patents by Inventor*)		12.144***
		(1.087)
ihs(*Total Inventors on Patent*)		–2.544***
		(0.445)
Inventor and Employer in Same State		–0.215
		(1.214)
Fixed effects:		
Employer	yes	yes
Inventor	no	no
Inventor city	no	no
Assignee state	yes	yes
Technology class	yes	yes
Inventor-patent observations	63,555	63,555
Adjusted within-R^2	0.099%	2.008%

Table 4. Shifts in inventor-employer property rights and inventor mobility—moves to unaffected states

This table presents OLS regressions of future moves to unaffected states as a function of a shift in the property rights around successful innovation from inventors to their corporate employers. The sample includes all observations in 2004 and examines whether the inventor relocates to an unaffected state within the next five years. Appendix A defines all variables and sample summary statistics are in Table 1. Standard errors appear in parentheses and are clustered by employer. *, **, and *** denote statistical significance at two-tailed probability levels of 10%, 5%, and 1%, respectively. We multiply dependent variables by 100 so that the coefficient estimates reflect percentage-point changes and to ease interpretation.

	(1)	(2)
	Dependent variable:	
Variable:	*Inventor Relocates to Unaffected State*	
Affected by Alcatel v. Brown	4.582***	4.450***
	(0.449)	(0.403)
ihs(*Total Patents by Inventor*)		1.683***
		(0.213)
ihs(*Total Inventors on Patent*)		–0.066
		(0.140)
Inventor and Employer in Same State		–0.942***
		(0.328)
Fixed effects:		
Employer	yes	yes
Inventor	no	no
Inventor city	no	no
Assignee state	yes	yes
Technology class	yes	yes
Inventor-patent observations	63,555	63,555
Adjusted within-R^2	0.939%	1.200%

Table 5. Shifts in inventor-employer property rights and access to agglomeration economies

This table presents OLS regressions of employment location decisions as a function of a shift in the property rights around successful innovation from inventors to their corporate employers. The sample includes forty-nine states observations for each new hire-year (i.e., excluding Texas). *Hired in State* is an indicator equal to one if the state is where the new hire is located (i.e., where the employer employs the new inventor). All other variables are as defined in Appendix A and sample summary statistics are in Table 1. Standard errors appear in parentheses and are clustered by employer and inventor. *, **, and *** denote statistical significance at two-tailed probability levels of 10%, 5%, and 1%, respectively. We multiply dependent variables by 100 so that the coefficient estimates reflect percentage-point changes and to ease interpretation.

	(1)	(2)
	Dependent variable:	
Variable:	*Hired in State*	
Affected by Alcatel v. Brown × Inventor Agglomeration	2.949***	
	(0.614)	
Affected by Alcatel v. Brown × Employer Agglomeration		9.101***
		(1.319)
Affected by Alcatel v. Brown	0.731***	0.656***
	(0.154)	(0.097)
Inventor Agglomeration	–3.773***	
	(0.601)	
Employer Agglomeration		–11.570***
		(1.159)
Inventor and Employer in Same State	0.001	0.001
	(0.002)	(0.002)
Fixed effects:		
Employer	yes	yes
Inventor	no	no
Inventor city	no	no
Assignee state × year	yes	yes
Technology class × year	no	no
Inventor hire-year-state observations	7,430,950	7,430,950
Adjusted within-R^2	1.163%	1.617%

Table 6. Shifts in inventor-employer property rights and early publication requests

This table presents OLS regressions of early publication requests and early publication requests timing as a function of a shift in the property rights around successful innovation from inventors to their corporate employers. Panels A and B present, respectively, results for early publication requests and early publication requests timing. In Panel A, the sample includes all patents before the 18-month deadline. In Panel B, the sample includes all patents published early due to an early publication request. Appendix A defines all variables and sample summary statistics are in Table 1. Standard errors appear in parentheses and are clustered by employer, inventor, and technology class. *, **, and *** denote statistical significance at two-tailed probability levels of 10%, 5%, and 1%, respectively. We multiply dependent variables in Panel A by 100 so that the coefficient estimates reflect percentage-point changes and to ease interpretation.

Panel A. Early publication requests

	(1)	(2)	(3)	(4)
	Dependent variable:			
Variable:	*Request for Early Patent Publication*			
Affected by Alcatel v. Brown	1.214**	1.228**	2.575	2.345
	(0.600)	(0.600)	(1.918)	(1.731)
ihs(*Total Patents by Inventor*)		–0.056		–0.678
		(0.159)		(0.585)
ihs(*Total Inventors on Patent*)		–0.201		–0.216
		(0.281)		(0.223)
Inventor and Employer in Same State		–0.270		3.753
		(0.372)		(3.335)
Fixed effects:				
Employer × year	yes	yes	yes	yes
Inventor	no	no	yes	yes
Inventor city	yes	yes	yes	yes
Assignee state × year	yes	yes	yes	yes
Technology class × year	yes	yes	yes	yes
Inventor-patent observations	24,992	24,992	24,992	24,992
Adjusted within-R^2	0.078%	0.105%	0.113%	0.248%

Table 6. Shifts in inventor-employer property rights and early publication requests (continued)

Panel B. Early publication requests timing

	(1)	(2)	(3)	(4)
	Dependent variable:			
Variable:	ihs(*Early Publication Request Timing*)			
Affected by Alcatel v. Brown	–0.149	–0.208*	–0.048***	–0.060***
	(0.160)	(0.107)	(0.000)	(0.003)
ihs(*Total Patents by Inventor*)		–0.114*		–0.057***
		(0.063)		(0.002)
ihs(*Total Inventors on Patent*)		–0.212***		–0.238***
		(0.047)		(0.071)
Inventor and Employer in Same State		1.111		0.648***
		(0.674)		(0.005)
Fixed effects:				
Employer × year	yes	yes	yes	yes
Inventor	no	no	yes	yes
Inventor city	yes	yes	yes	yes
Assignee state × year	yes	yes	yes	yes
Technology class × year	yes	yes	yes	yes
Inventor-patent observations	941	941	941	941
Adjusted within-R^2	0.073%	1.648%	0.008%	0.599%

Table 7. Shifts in inventor-employer property rights and the nature of innovation

This table presents OLS regressions of patent breadth and spread as a function of a shift in the property rights around successful innovation from inventors to their corporate employers. Panels A and B present, respectively, results for patent breadth and spread. Appendix A defines all variables and sample summary statistics are in Table 1. Standard errors appear in parentheses and are clustered by employer, inventor, and technology class. *, **, and *** denote statistical significance at two-tailed probability levels of 10%, 5%, and 1%, respectively. We multiply dependent variables by 100 to ease interpretation.

Panel A. Backward-citation breadth

	(1)	(2)
	Dependent variable:	
Variable:	*Patent Breadth*	
Affected by Alcatel v. Brown	1.362***	1.433***
	(0.483)	(0.472)
ihs(*Total Patents by Inventor*)		1.303***
		(0.175)
ihs(*Total Inventors on Patent*)		1.873***
		(0.219)
Inventor and Employer in Same State		0.597
		(0.689)
Fixed effects:		
Employer × year	yes	yes
Inventor	yes	yes
Inventor city	yes	yes
Assignee state × year	yes	yes
Technology class × year	yes	yes
Inventor-patent observations	342,254	342,254
Adjusted within-R^2	0.007%	0.162%

Table 7. Shifts in inventor-employer property rights and the nature of innovation (continued)

Panel B. Forward-citation spread

Variable:	(1) Dependent variable: *Patent Spread*	(2)
Affected by Alcatel v. Brown	1.616***	1.666***
	(0.580)	(0.578)
ihs(*Total Patents by Inventor*)		–0.281*
		(0.160)
ihs(*Total Inventors on Patent*)		2.444***
		(0.353)
Inventor and Employer in Same State		0.820
		(0.776)
Fixed effects:		
Employer × year	yes	yes
Inventor	yes	yes
Inventor city	yes	yes
Assignee state × year	yes	yes
Technology class × year	yes	yes
Inventor-patent observations	289,703	289,703
Adjusted within-R^2	0.008%	0.177%

Table 8. Shifts in inventor-employer property rights and aggregate employer-level effects

This table presents OLS regressions of the innovation strategy at the employer level as a function of employers' exposure to a shift in the property rights around successful innovation from inventors to their corporate employers. Panels A and B present, respectively, results for innovation strategies across states within a given employer and innovation strategies at the employer level. Appendix A defines all variables and sample summary statistics are in Table 1. Standard errors appear in parentheses and are clustered by employer. *, **, and *** denote statistical significance at two-tailed probability levels of 10%, 5%, and 1%, respectively. We multiply dependent variables by 100 to ease interpretation.

Panel A. Innovation strategies across states within an employer

	(1)	(2)
	Dependent variable:	
Variable:	*%Affected-State Patents*	*%Mixed-State Patents*
Exposure to Alcatel v. Brown	81.118***	–4.752***
	(1.011)	(0.691)
ihs(*Total Patents by Firm*)	–6.306***	–10.262***
	(0.749)	(0.459)
ihs(*Total Inventors in Firm*)	4.598***	10.137***
	(0.692)	(0.396)
Inventors in Same State as Firm	–18.832***	–9.693***
	(0.925)	(0.444)
Fixed effects:		
Year	yes	yes
Firm-year observations	17,978	17,978
Adjusted within-R^2	16.240%	9.741%

Panel B. Innovation strategies at the employer level

	(1)	(2)
	Dependent variable:	
Variable:	*Firm Early Publication Requests*	*Firm Innovation Diversity*
Exposure to Alcatel v. Brown	0.432*	1.621*
	(0.227)	(0.846)
ihs(*Total Patents by Firm*)	–0.011	28.972***
	(0.134)	(0.731)
ihs(*Total Inventors in Firm*)	–0.046	–1.765***
	(0.113)	(0.290)
Inventors in Same State as Firm	0.209**	–0.316
	(0.104)	(0.427)
Fixed effects:		
Year	yes	yes
Firm-year observations	17,978	17,978
Adjusted within-R^2	0.051%	69.736%