Non-Compete Agreements: A Review of the Literature

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December 31, 2019

Abstract

Non-compete agreements (NCAs) are employment contracts that limit the post-employment options of workers. On the one hand, they potentially solve an investment hold-up problem, allowing firms to make mutually beneficial investments in workers. On the other hand, the agreements potentially erode workers' future bargaining position by limiting their outside options. In this paper, we review the economic literature on non-compete agreements in the U.S.

Keywords: Non-compete agreements, worker mobility, training, investment holdup

JEL codes: J2, J6, K3, L4, M5

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Electronic copy available at: https://ssrn.com/abstract=3513639

I. Introduction

Non-compete agreements (NCAs) are employment contracts that limit the ability of an employee to join or start a competing firm after a job separation. The past decade has seen burgeoning interest from academics, policymakers, and the media over non-compete agreements—partly due to concern over whether labor markets have been becoming less competitive, and partly due to several high-profile examples of non-competes involving low-skilled occupations such as sandwich makers, dog walkers, and warehouse workers.[2]

This interest has spurred several state enforcement actions and legislative proposals to limit the perceived harm that non-competes cause.[3] For example, Oregon, Massachusetts, and Washington have passed laws in recent years rendering non-competes unenforceable against low-wage workers. As their very name might suggest, non-compete agreements have also drawn the attention of competition authorities. For instance, the Chairman of the Federal Trade Commission has stated the agency is considering issuing a rule to limit the use of non-compete agreements.[4] This is part of a broader push by the U.S. competition agencies to address competition issues in labor markets.[5] Alongside the increased attention from policymakers and legislators has been a flurry of economic research into non-compete agreements and their effects on labor and product markets. Reviewing this economic literature is the purpose of this paper.

States vary considerably in their legal enforcement of non-compete agreements between employers and workers.[6] Several states do not enforce non-competes at all, or do not enforce them for certain classes of workers.[7] Most states, though, will enforce non-compete agreements to a certain extent. The relative strictness of a state's enforceability regime depends on a number of dimensions. This includes whether the agreements can be enforced for both voluntary and involuntary separations, or only voluntary ones; whether employers must provide additional consideration beyond the job itself to the employee for signing the agreement; whether the firm has a sufficient "protectable interest" to motivate the use of a non-compete; and how the state courts treat agreements that contain provisions which are invalid according to state law.[8] For

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[2] On the latter point, see Jamieson, Dave, "Jimmy John's Makes Low-Wage Workers Sign `Oppressive' Noncompete Agreements," *Huffington Post* (Oct. 13, 2014); Jamieson, Dave, "Doggy Day Care Chain Makes Pet Sitters Sign Noncompetes To Protect 'Trade Secrets'," *Huffington Post* (Nov. 24, 2014); and Woodman, Spencer, "Amazon makes even temporary warehouse workers sign 18-month non-competes," *The Verge* (Mar. 26, 2015).

[3] See Johnson and Lipsitz (2018) for a discussion of some recent legislative proposals. President Obama, in 2016, also issued a "State Call to Action on Non-Compete Agreements" making several proposals.

[4] Parts, Spencer, "Simons: Non-Compete Rulemaking May Come Soon," *Global Competition Review* (May 8, 2019).

[5] Remaly, Ben, and Kaela Coote-Stemmermann, "FTC Considers Workers in Deal Reviews," *Global Competition Review* (Oct. 4, 2018).

[6] States themselves do not "enforce" non-compete agreements directly; it is private employers who do. We follow the economic literature in using the terms "enforce" and "enforceability" to reflect whether a state would uphold a non-compete if an employer attempted to enforce one through the courts.

[7] California and North Dakota do not enforce non-competes at all. Other states do not enforce them for specific groups such as technology workers (Hawaii), low-wage workers (Oregon and Washington), and health care workers (various states). Within the legal sector, non-competes are generally not enforceable in any state.

[8] A non-compete agreement which contains an invalid provision can be nullified completely ("red-pencil doctrine"), the invalid provision can be deleted while keeping the rest of the agreement intact ("blue-pencil doctrine"), or the

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convenience, researchers often combine the various dimensions of enforceability into a single index. California and North Dakota, two states that do not enforce NCAs, show the lowest levels of enforceability, while Florida and Connecticut display the highest.[9]

Data on non-compete use in the U.S. are sparse. The government surveys that are standard in the study of U.S. labor markets do not ask about non-compete use. Researchers have conducted four surveys of non-compete use in the U.S., one of which is national in scope and covers a broad range of occupations, and three of which cover specific occupations. These surveys are the basis of many studies within the literature. The national survey finds that 18% of workers in the U.S. were bound by an NCA as of 2014, and 38% had signed one at some point during their career (Starr, Prescott, and Bishara ["SPB"] 2019b). Moreover, the incidence of non-competes is generally higher in technical and high-skilled occupations and industries. The other three surveys find a sizeable incidence of non-compete agreements among specific occupations, as discussed below.

Curiously, the existing research consistently finds that non-compete use is common across states regardless of how enforceable the agreements are. In fact, non-competes are only somewhat less common in states where they are completely unenforceable as compared to states with stricter enforceability. The previously mentioned national survey finds that 18% of workers across the U.S. are bound by non-competes, compared to 19% in California and North Dakota—two states where NCAs are unenforceable (SPB 2019b). Two surveys of individual occupations show a similar pattern.[10]

There are several potential explanations for why firms offer non-competes, and why workers accept them. Non-competes potentially solve a "holdup" problem for certain types of investment (e.g., training, information sharing), allowing firms to make mutually beneficial investments in their workforce. Non-competes also allow firms to reduce recruitment and training costs by lowering turnover, and firms may offer a wage premium to compensate signers. Nevertheless, non-competes restrict workers' employment options *ex post*. Thus, workers may experience lower mobility, less competition for their services, and a worse bargaining position vis-à-vis their current employer.

The presence of non-compete agreements also has implications for innovation and entrepreneurship. By limiting the flow of workers to competitors, non-compete agreements simultaneously increase the returns to research and development (R&D) at incumbents while reducing knowledge transfer to new or existing competitors, with the net effect on innovation being ambiguous. The trade-off is analogous to that of patent protection, with stricter protections encouraging investment but temporarily limiting competition. NCAs may also tend to diminish entrepreneurship, as they limit the ability of workers to start competing firms. In theory, this

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invalid provisions can be rewritten so as to render them valid ("equitable reform" or "reformation"). Bishara (2011) is a thorough summary of state statutes and case law on the various dimensions of enforceability.

[9] See, for example, Figure 1 in Balasubramanian et al. (2018).

[10] Johnson and Lipsitz (2018) report that 31% of physicians in California have signed an NCA (vs. 45% nationally). Garmaise (2011) finds that 58% of firms in California have their executives sign NCAs (vs. 70% nationally).

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reduction in firm entry could reduce competition in product markets and further reduce competition over wages, though direct evidence does not exist.

There is relatively little research into why non-compete agreements appear in markets for low-skilled workers. Its incidence among low-wage and low-skill workers tends to be lower than among the more affluent or skilled, but still non-trivial: SPB (2019b) report that 12% of individuals earning less than $20,000 per year were covered by a non-compete, compared to 21% of those earning $60-80,000. There are several possible theories. First, turnover tends to be higher in low-wage occupations,[11] and non-competes will tend to limit turnover either by inducing longer tenure or by screening out more mobile individuals. Second, if poorer households tend to be credit constrained, they may have difficulty funding certain types of training themselves that would otherwise be profitable to undertake. Non-competes potentially offer a mechanism through which firms can fund the cost. Third, low-wage workers are more likely than average to be bound by the minimum wage, and firms can extract additional surplus from workers when the minimum wage limits the ability of wages to do so.[12] Further research is necessary to understand why firms offer low-skilled workers non-competes and why those workers sign them.

Although the literature has made important strides in studying non-competes and their effects on workers, firms, and end consumers, further work is needed. Due to the limited availability of data and a paucity of natural experiments (e.g., law changes) to assess the impact of non-competes, much of the literature relies on cross-sectional comparisons of signers and non-signers, or high-enforceability states and low-enforceability ones. The more credible empirical studies tend to be narrow in scope, focusing on a limited number of specific occupations (e.g., executives) or potentially idiosyncratic policy changes with uncertain and hard-to-quantify generalizability (e.g., banning non-competes for technology workers in Hawaii). There is little evidence on the likely effects of broad prohibitions of non-compete agreements. Further research, perhaps exploiting more recent law changes or new sources of data, is necessary to establish the causal impact such agreements have on market participants.

The remainder of the paper is organized as follows. Section II outlines the theory behind non-compete use and Section III reviews the data and evidence. Section IV concludes.

II. Theory

This section discusses several channels through which non-compete agreements affect labor and product markets, many of which are not necessarily mutually exclusive. The focus is on highlighting the potential mechanisms through which the agreements operate rather than offering a detailed exposition or critique of the theories. Section III reviews the empirical evidence and suggests which channels receive more support from the data.

[11] Farber (1999), Choi and Fernández-Blanco (2017).
[12] Johnson and Lipsitz (2018).

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A. Effects in the Labor Market

Non-compete agreements potentially offer a solution to a key problem that would otherwise limit investments in the employer-employee relationship, but at the same time may introduce frictions in the labor market, change the bargaining positions of workers and employers, and reduce (ex post) competition over wages. Before discussing the theory specific to non-compete agreements, we briefly overview the theory of worker-firm bargaining in order to frame the discussion.

In the simple, benchmark model of the labor market with perfect competition and no frictions, firms pay workers a wage equal to the full value they contribute to the firm, known as their value of marginal product (Borjas 2013).[13] A worker's value of marginal product incorporates their education, skills, training, and other attributes that contribute to productivity.

Deviating from perfect competition yields the possibility that a given worker-firm pair yields positive rents that the two can bargain over in a Nash-type bargaining game (Cahuc, Postel-Vinay, and Robin 2006). In a Nash bargaining model, equilibrium wages will be determined by the bargaining power and outside options of each party to the negotiation. A worker's outside options could include outside wage offers generated from on-the-job search, expected wage offers from job search during unemployment, or non-market activities. A worker with generous outside wage offers, for example, will have greater negotiating leverage and hence will tend to receive higher wages than a worker with less generous offers.[14] Similarly, a firm's outside options could include recruiting and training a replacement employee, leaving a job opening vacant, or filling a vacancy using an employee from elsewhere in the firm. A firm facing high recruiting and training costs will have less leverage and hence will have to pay higher wages in equilibrium.

1. Lock-in

One potential effect of non-compete agreements is to alter the bargaining positions of workers and firms. Balasubramanian et al. (2018) model how non-competes narrow the outside options and reduce the bargaining power of workers who sign them. The consequence will be lower worker mobility and longer tenure, as well as a flat or declining wage profile over the life of a job, all else equal. Balasubramanian et al. (2018) refer to this effect as "lock in".

The possibility of lock-in raises the question as to why a worker would sign a non-compete to begin with if the firm was expected to use it during future negotiations to extract a higher share of the match surplus. It is possible that workers either heavily discount the future (myopia), do not understand the implications of the clauses to begin with, or are offered sufficient additional compensation so that they are willing to accept the non-compete.

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[13] Our discussion throughout generally focuses on wages, but a similar logic applies to non-wage compensation or workplace amenities.

[14] In a structural model estimated using French data, Cahuc, Postel-Vinay, and Robin (2006) find that inter-firm wage competition is a much more important determinant of the worker's share than the worker's bargaining power, especially for lower skilled workers.

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2. *Mitigating holdup*

Employees are free to leave their employer at any time. Cognizant of this mobility, firms may forgo making certain investments in their workforce knowing that employees would be able to subsequently quit and appropriate the value of the investment. This is an example of a "hold-up" problem (Rubin and Shedd 1981; Grossman and Hart 1986). Common examples of investments likely to be subject to hold-up in the present context include non-tangible assets such as training, information (trade secrets or production processes), and client lists.[15]

Non-compete agreements are one arrangement that can mitigate the hold-up problem.[16] They do this by discouraging worker attrition before the firm has had time to recoup the cost of its upfront investment, and thus permit firms to make investments in its workers that are mutually beneficial and that it otherwise may not decide to do (Rubin and Shedd 1981). As the employee-employer relationship becomes more valuable, firms will tend to pass on some portion of the higher profits in the form of higher wages, assuming firms do not possess all the bargaining power in the relationship.[17] Thus, to the extent that non-compete agreements mitigate holdup, we should expect to see wages rise over a worker's tenure, all else equal.

The lock-in and holdup mitigation channels are not mutually exclusive. If the data suggest that wages are flat or fall over a worker's tenure, though, that suggests that the lock-in channel tends to dominate. Similarly, if wages tend to rise, that suggests that holdup mitigation tends to be the dominant mechanism.

While mitigating holdup will tend to increase wages, it generates ambiguous implications for worker tenure and mobility, depending on the relative increase in worker productivity at the incumbent firm as compared to at firms that are outside the scope of the non-compete (Balasubramanian et al. 2018). To the extent that mobility does decline as a result of increases in investment facilitated by non-competes, it is because the worker's current job has become *more* attractive relative to alternatives, unlike with lock-in. Thus, unlike declines in wages, declines in worker mobility are not necessarily informative about whether non-compete clauses are harmful.

Garmaise (2011) argues that non-competes have potentially offsetting effects on investments in training. Reducing holdup tends to increase the incentive for firm-sponsored training. But limiting an employee's outside options of employment will tend to decrease their incentive to

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[15] In Becker's (1962) seminal model, firms may find it profitable to make investments in human capital that increases worker productivity at their specific firm ("firm-specific" training), but will generally not sponsor training that raises productivity at other firms. Firm-specific training is unlikely to be subject to a hold-up problem because it is by definition not valuable at other firms.

[16] Alternatively, workers could pay firms *ex ante* a portion of the value of the investment, or could post a bond that would be forfeited if the worker were to leave.

[17] Existing studies are consistent with firms sharing rents to some extent with employees in both union and non-union settings (Blanchflower, Oswald, and Sanfey 1996; Van Reenen 1996). Cahuc, Postel-Vinay, and Robin (2006), however, find that low-wage workers have little to no bargaining power in their study of the French labor market. Evidence on the returns to firm-specific human capital (tenure)—a market with one buyer and one seller—is also consistent with firms and workers splitting rents (Topel 1991; Altonji and Williams 2005). Outside of a bargaining framework, it is common to see compensation schemes designed around splitting rents (e.g., profit sharing, performance bonuses).

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invest in portable (general) skills. Thus, the net impact on human capital accumulation is theoretically ambiguous.

3. *Labor market frictions*

Both mechanisms above (increased returns to tenure and lock-in) are consistent with a decline in worker mobility among individuals who have signed non-compete agreements. A reduction in worker mobility will tend to increase recruitment costs for all firms as the pool of potential applicants for a given posting will shrink. This type of friction can have important implications for wages and productivity. Worker mobility is an important source of wage growth for younger workers, with job changes accounting for approximately a third of early career wage growth (Topel and Ward 1992). In matching models of labor markets, increases in frictions such as recruitment costs will lead to a reduction in average match quality and hence lower aggregate productivity (Jovanovic 1979, 2015).

The presence of non-compete agreements in labor markets may also increase recruitment costs if there is uncertainty regarding whether a potential hire has signed one. Many workers are unsure whether or not they have signed a non-compete. One national survey reports that 30% of respondents did not know whether they had signed one (SPB 2019b). Firms, fearing litigation over hiring a worker bound by a non-compete, may need to expend resources to learn whether potential hires had signed a non-compete with their prior employer.
At the same time, by reducing worker mobility, non-compete agreements reduce turnover costs for the firms that use them. They may also reduce turnover through a screening mechanism: workers who are more likely to leave a job after a short stay will tend to select out of applying for jobs where non-competes are a requirement.

Provided that the firm's benefit from reducing turnover exceeds the cost imposed on the worker, the cost savings will be passed on to workers via higher wages. In perfectly competitive labor markets, workers will capture the entirety of the savings (Johnson and Lipsitz 2017). The premium paid to workers to accept workplace disamenties such as a non-compete agreement is commonly referred to as a compensating differential (Rosen 1974).

Non-compete agreements offer an option for firms to capture a greater portion of the surplus generated from their match with workers in the presence of downward rigidity in wages, such as in the presence of a minimum wage (Johnson and Lipsitz 2017).[18] When a firm cannot adjust total compensation through wages, they may instead adjust along non-wage dimensions such as firm-sponsored training (Schumann 2017), employer-provided health insurance (Marks 2011), or pension coverage (Simon and Kaestner 2004). Johnson and Lipsitz (2017) argue that offering or requiring non-compete agreements is yet another way for firms to adjust compensation (downward, as they impose costs on workers) and capture a larger share of the match surplus.

[18] Minimum wage laws are one example of downward rigidity, but firms may have a number of rationales for not reducing wages below a certain threshold: incentive provision in an efficiency wage model (Shapiro and Stiglitz 1984), concern over fairness (Akerlof and Yellen 1990), or to encourage employee cooperation (Fehr and Falk 1999).

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Non-compete agreements can be seen as a non-wage attribute of a job that provide a benefit to firms (in the form of lower turnover costs) while imposing a cost on workers (reduced mobility), with the result being a transfer in the match surplus from workers to firms. In the context of minimum wage laws, firms are able to pay what are effectively sub-minimum wages. While this reduces the utility of inframarginal workers, it also expands the set of workers for which it is profitable for firms to hire. This expansion in employment will attenuate the disemployment effects of minimum wage laws. Johnson and Lipsitz (2017) propose this as one rationale for why non-compete agreements are observed in low-skilled labor markets, where minimum wage laws are more likely to be binding.

4. Reduced firm entry and competition for workers

Not only can non-compete agreements prevent workers from joining competing firms, but they can also prevent workers from founding new firms. If fewer new firms are formed, or if startups are hobbled by a dearth of qualified employees, then demand for workers in industries with a high incidence of non-compete agreements will be lower than otherwise. This mechanism will tend to reduce the wage competition for workers by reducing the frequency and attractiveness of outside offers.

B. Effects in Product Markets

By limiting mobility, non-compete agreements potentially tie up potential entrepreneurs, increase expected litigation costs over non-competes, and raise hiring costs for employed talent. These factors suggest that non-competes have the potential to reduce firm entry. Lower firm entry could dampen competition and product variety in product markets.

The implications of non-competes for innovation are ambiguous. On the one hand, greater worker mobility may lead to knowledge spillovers that spread information to other firms, enhancing their productivity. Gilson (1999) attributes the success of Silicon Valley, with its large concentration of innovative technology firms, to the unenforceability of non-competes in California and concomitant cross-pollination of ideas from a mobile workforce. On the other hand, firms may be reluctant to invest in risky R&D when departing workers can transfer proprietary information to competitors. By restricting the outflow of workers with non-competes, incumbent firms are in a better position to capture the returns to risky R&D investments. When it comes to innovation, the trade-offs involved are analogous to those in patent protection, with stricter protections encouraging investment but temporarily limiting competition.

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III. Evidence

We first outline the data used in the literature, as well as some general features and limitations of the empirical models used to assess the effects of non-competes. Then, we turn to the empirical findings of the literature.

A. Data

The standard surveys used in studying U.S. labor markets (e.g., Current Population Survey, American Community Survey, and National Longitudinal Surveys) do not ask about non-compete agreements. Thus, the literature on non-competes relies on four surveys administered by academics to quantify their incidence, as well as to study their impact. One survey is national in scope and covers multiple industries and occupations, and the other three focus on individual industries or occupations. Separately, several papers combine state-level measures of non-compete enforceability with data on various worker and firm outcomes from more traditional government surveys.

The 2014 National Noncompete Survey Project surveyed 11,505 individuals on the use of non-compete agreements and other information using an online survey administered by the survey firm Qualtrics (Prescott et al. 2016; SPB 2019b). The survey collected data from individuals employed in the private sector or for a public healthcare organization, and covered all states, occupations, and (private) industries. Of those in the target sample who began taking the survey, 29% completed it and survived a number of quality checks implemented by the authors. The authors discuss several potential concerns over the validity of their survey instrument—to be included, an individual must participate in online surveys, have responded to the offer to take the survey, and have completed it. If the decision to respond to the survey is somehow correlated with non-compete use, then that could introduce bias into empirical work based on the survey.

The National Noncompete Survey finds that 18% of workers in the U.S. were bound by an NCA as of 2014, and 38% had signed one at some point during their career (SPB 2019b). Moreover, NCAs are prevalent across a number of industries, occupations, and skill levels, though they are more common among technical and high-skill occupations and industries. For example, non-competes are most prevalent in architecture and engineering (36%), computer and math-related jobs (35%), and management (30%). Nevertheless, they also appear with some frequency in grounds maintenance (11%), food preparation and service (11%), and construction and extraction (12%).[19] Non-compete incidence tends to be increasing with educational attainment as well, with holders of professional (39%) and master's degrees (29%) having the highest incidence, while high school graduates (13%) and those with some college (12-14%) have the lowest.[20]

Other surveys focus on specific occupations or industries. Garmaise (2011) and Kini, Williams, and Yin (2019) collect information on non-compete use among executives at public companies from public filings with the Securities and Exchange Commission (SEC) (e.g., 10-Ks and 10-

[19] SPB (2019b), Figure 5.
[20] SPB (2019b), Figure 3.

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Qs). Many firms disclose whether their top executives have signed a non-compete in their SEC filings. This information is then combined with data on executive compensation from Standard & Poor's ExecuComp database. ExecuComp is a frequently studied database that tracks details on the compensation for the five highest paid executives of large public companies. Garmaise (2011) finds that about 70% of large, publically traded firms have their top executives sign non-compete agreements over the 1992 to 2004 period. Since some firms may require a non-compete but not disclose that fact publically, this figure is likely a lower bound. Kini, Williams, and Yin (2019) find that 26% of CEOs in their data covering 1992 to 2014 have executed non-compete clauses.[21]

Johnson and Lipsitz (2017) survey non-compete use among hair salons using an e-mail survey conducted in 2015 through a national hair stylist professional trade group, the Professional Beauty Association. A total of 218 salon owners responded with information on non-compete use, training, hiring practices, compensation, and other characteristics of the business. The authors estimate that the response rate to the survey was 31%, conditional on an individual having opened the e-mail survey. Among respondents, 30% of salon owners said they had their most recent hire sign a non-compete, and 39% said they had at least one hire in the past sign one.

Lavetti, Simon, and White (2018) implemented a survey on non-compete use among primary care physicians using web-based and mailed surveys. A total of 1,976 physicians across five states (California, Texas, Illinois, Georgia, and Pennsylvania) responded to the 2007 survey, which had a response rate of 70%. Beyond non-compete use, the survey elicited information on compensation and physician and firm characteristics. They estimate that about 45% of primary care physicians in group practices are bound by a non-compete agreement.

A number of other papers combine a state-level measure of enforceability with worker and firm outcomes from government surveys or data sources in order to compare high vs. low enforceability regimes. For example, Balasubramanian et al. (2018) derive data on worker mobility and wages from the Longitudinal Employer-Household Dynamics survey and the Current Population Survey. Several studies (e.g., Marx, Strumsky, and Fleming 2009; Conti 2014) use public data on patent filings in order to measure R&D and the mobility of inventors. These papers do not observe whether or not a given worker has signed an NCA, or whether a given firm offers NCAs to its workers. As such, they do not offer estimates of the incidence of non-compete use.

B. Empirical Approaches Used in the Literature

There are three general approaches in the literature to assess the effects of non-compete agreements. Some papers follow multiple approaches.

The first is to use state policy changes in enforceability, such as changes in state statutes or changes in judicial interpretations of state statutes. Papers following this approach include Marx,

[21] 42% of CEOs in their sample have reported signing an employment contract, of which 62% have an NCA. This latter figure grew from 46% in 1992-93 to 63% in 2013-14, which demonstrates the growing use of NCAs among executives.

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Strumsky, and Fleming (2009), Garmaise (2011), Carlino (2017), Balasubramanian et al. (2018), and Johnson, Lavetti, and Lipsitz (2019), among others. Exploiting policy changes can be a credible way of assessing the impact of state laws and regulations.

In the literature on non-competes, though, there is a paucity of changes in enforceability, with papers often relying on one or a handful of policy changes, such as Hawaii's ban on non-competes for tech workers or Michigan's reversal of its prohibition.[22] The dearth of policy changes raises two problems: assessing external validity and quantifying the uncertainty regarding estimated effects. While the studies exploiting state policy changes are well executed, it is far from clear whether the estimated effects are likely to extend to other states (with, e.g., a different composition of firms for workers to switch to), industries (with, e.g., different opportunities for training), or occupations. Non-compete incidence varies markedly across industry and occupation, which suggests that the underlying determinants of use do as well. Although research directly examining heterogeneity in effects across different groups is sparse, Fallick, Fleischman, and Rebitzer (2006) do find that non-competes matter only for tech workers and not other occupations. Regarding quantifying the uncertainty of any estimated effects, under certain conditions, estimating standard errors in the presence of a small number of treated units can lead to important biases when using clustered standard errors, as is common in this literature.[23] Thus, extra care should be taken in interpreting the precision and statistical significance of estimates.

Even when such policy changes are available to the researcher, the possibility that non-competes have external effects on non-signers complicates evaluating the effects of changes in non-compete enforcement. Several papers provide evidence of such spillover effects (Starr, Frake, and Agarwal *forthcoming*; Johnson, Lavetti, and Lipsitz 2019). For example, Johnson, Lavetti, and Lipsitz (2019) show that changes in NCA enforceability can affect workers in areas across the border from states changing their non-compete policy. In such a setting, estimating the impact of changes in enforceability using a difference-in-differences model is complicated by the fact that outcomes in control states may be affected by the changes in policy of contiguous (treated) states, and treated states may be affected by changes in policy of other adjacent (treated) states. It is not obvious exactly what parameter is identified by such a model.

The second approach evaluates the impact of having a high incidence of non-compete agreements in a state with high enforceability in a difference-in-differences (or triple differences) framework. These studies do not exploit policy changes over time (as above), but rather use within-state groups as controls, such as industries with a low-incidence of non-compete agreements. Thus, differences across states in worker outcomes between high and low enforceability are compared for high incidence industries and low incidence industries. Practically, the use of within-state control groups allows the inclusion of state fixed effects to

[22] Johnson, Lavetti, and Lipsitz (2019) is an exception, which exploits 70 changes in an enforceability index over the 1991 to 2014 period.

[23] See, e.g., Imbens and Kolesár (2016) and MacKinnon and Webb (2018). Lipsitz and Starr (2019) is the only paper using a small number of policy changes (one, in its case) that addresses this issue. They find that p-values are—in some specifications and samples—substantially higher when correcting standard errors to account for the small number of treated units.

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control for any unobserved factors that are common to both low and high incidence industries within a state (e.g., cost of living, broad labor market conditions). Examples include Starr (2019), Balasubramanian et al. (2018), Starr, Balasubramanian, and Sakakibara (2017), and Starr, Frake, and Agarwal (2018).

There are several limitations to this second, difference-in-differences approach. First, the types of industries that have low and high incidences of non-competes are markedly different. Non-compete agreements tend to be more prevalent in higher skilled and technical industries such as information technology (IT) and engineering.[24] Any state-level laws or economic factors that affect low-skill workers differently than high-skill workers could potentially bias the models' estimates, to the extent that such laws or factors are correlated with enforceability. For example, state minimum wage laws tend to raise the wages of low-skilled workers more than high-skilled workers.[25] If states that set higher minimum wages tend to have weaker or stronger non-compete enforceability, state fixed effects would be of no use and the estimated impact of non-compete use would be biased.

Another limitation in this second approach is that the underlying variation in non-compete use is poorly understood. It is not clear why—within low- or non-enforcing states—NCAs are common in some industries but not others.[26] Moreover, it is not clear why the *same* industry has a low incidence in some states but high incidence in other states.[27] Without a firm understanding of what drives non-compete use, it is impossible to ascertain whether the necessary exclusion restriction holds and hence whether a difference-in-differences model produces unbiased estimates of the impact of non-compete incidence and enforceability.

The third approach compares labor market outcomes of signers with non-signers after conditioning out the observable characteristics of each group in a regression framework. Some examples include Johnson and Lipsitz (2017), Lavetti, Simon, and White (2018), and Starr et al. (2019). By comparing signers to non-signers, this approach is able to estimate the effect of treatment on the treated. The other two only estimate an intent to treat effect, which does not isolate the effect on signers themselves without information on the change in incidence due to treatment (which none of the studies attempt to estimate).[28]

An important limitation of this approach is the possibility of selection on unobservable worker and firm characteristics that is correlated with NCA use. A general concern with evaluating worker compensation, including arrangements that include non-compete clauses, is that workers are likely to select into jobs that offer a compensation scheme that best meets the preferences and abilities of that worker (Lazear and Shaw 2007). For example, if workers who are most likely to benefit from on-the-job training tend to select into jobs which offer more training, then

[24] SPB (2019b), Marx, Strumsky, and Fleming (2009).
[25] In Johnson and Lipsitz's (2017) model, non-compete use is predicted to be higher in areas where the minimum wage is more likely to be binding, implying that NCAs and minimum wage laws would be correlated.
[26] This fact is not lost on the authors themselves. Starr, Frake, and Agarwal (2018) write that "we have little understanding why the incidence varies in non-enforcing states, given that such provisions are unenforceable".
[27] See Figure 1 in Starr, Frake, and Agarwal (2018), which shows incidence by state and industry. This means that a given industry acts as a treated unit in some states but a control in others.
[28] Angrist and Pischke (2009), pp. 158-164. This assumes there are no externalities to the presence of NCAs.

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comparing workers who have signed non-competes to those who have not will tend to overstate their impact on training. Similarly, if workers who select into jobs with strong training opportunities tend to be more productive in general (positive selection), then comparing signers with non-signers would tend to overstate the effect of non-competes on worker outcomes. Firms may also select into states based on state characteristics, such as state taxes, unionization levels, worker productivity, or environmental regulations, which could potentially be correlated with non-compete enforceability.

Beyond selection, it is possible that unobservable features of compensation are correlated with non-compete use. For instance, technology-based startups may tend to offer a higher portion of compensation in stock options (due to cash flow constraints) and also tend to rely more heavily on proprietary information and production processes (and hence require NCAs of their employees). Evaluating the effect of NCAs on wages alone could potentially under- or over-state the impact on total compensation.

To address these two limitations, the literature incorporates controls for worker and firm characteristics in order to reduce any confounding influence of selection. For example, SPB (2019b) control for worker characteristics (gender, education, age, hours and weeks worked, number of past employers), firm characteristics (size, multi-state status), characteristics of employment (other post-employment covenants such as non-disclosure agreements, compensation features such as the presence of health insurance, a retirement plan, etc.), and state-level factors (unemployment, size of labor force). A number of papers also incorporate a test due to Oster (2017) which quantifies how important selection on unobservables would have to be in order to reverse the sign of the coefficient on the policy variable of interest.[29] They generally find that selection on unobservables would have to be "implausibly" strong to reverse their findings.

C. Effects in the Labor Market

Studies of the labor market effects of non-compete agreements have examined a number of outcomes, with particular focus on investments in non-tangible assets (e.g., worker training), worker mobility, and wages.

1. Investments in non-tangible assets (training, information, and client lists)

Non-compete agreements offer an opportunity for firms to invest in various non-tangible assets that might otherwise be subject to holdup. The most common investments analyzed in the literature are training (investments in human capital), sharing information with workers, and sharing client lists with workers. The bulk of the empirical literature finds that workers signing non-compete agreements, or workers who reside in areas with a higher incidence of NCAs, receive more training, more access to information, and more access to client lists. Nevertheless, there is some variation in this finding depending on the type of non-compete and occupation. Garmaise (2011) argues that non-competes have potentially offsetting effects on investments in training: they increase the incentive for firm-sponsored training but decrease that of self-

[29] Starr, Prescott, and Bishara (2019a), SPB (2019b), Starr (2019), Starr, Frake, and Agarwal (*forthcoming*).

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sponsored training. The overall impact on human capital accumulation, then, is theoretically ambiguous. Using a credible source of variation—changes in state policy in Florida, Louisiana, and Texas—he finds wage effects among top executives of public companies that are consistent with workers in higher enforceability states tending to receive more firm-sponsored training. Notably, though, he finds that the decline in (self-sponsored) general training is even greater, leading to lower levels of overall human capital investment (and hence wages). Note, though, that he does not directly analyze data on worker training, but rather infers the effects of NCAs on training from its effects on compensation.

The remaining studies rely on comparing non-compete signers with non-signers, or comparing outcomes in high enforceability states to low enforceability states, while attempting to control for selection using observable characteristics of individuals. Starr (2019) estimates that moving a state from non-enforcement to average enforcement would increase the incidence of worker training by 18%. NCAs also allow firms to train employees sooner in the employment relationship. Uncertainty regarding an employee's tenure will tend to lead firms to delay investing in costly training as they screen employees for those who will quit soon, but the presence of enforceable non-competes allows firms to reduce this uncertainty and move up training opportunities (Starr 2019). Among hair stylists, Johnson and Lipsitz (2017) find that NCA use is associated with a 14% higher likelihood of firms providing on-the-job training. Starr et al. (2019) find that the timing of when a worker receives an NCA matters: although they find no overall effect of NCA use on training, workers receiving early notice (prior to accepting a job) are 11% more likely to have received training.

Like investments in human capital, client lists and information are "mobile" in the sense that they are attached to the worker rather than the firm, and workers may exploit such investments once they quit. Surveying primary care physicians within group practices, Lavetti, Simon, and White (2018) find that physicians receive more patient referrals when they have signed a non-compete agreement. Starr et al. (2019) find, however, that timing once again matters: workers receiving early notice of an NCA are more likely to have firms share information with them, while those receiving late notification are substantially less likely.

Gurun, Stoffman, and Yonker (2019) study non-compete clauses in the financial advisory industry. The relationships that financial advisers form with clients may allow financial advisers to take clients with them when moving firms or founding a new firm. Such behavior may attenuate firms' incentives to, for instance, engage in marketing activities that would build its employed advisers' portfolio of clients. To address this issue, many firms in the industry require non-compete agreements. Gurun, Stoffman, and Yonker (2019) find that relaxing the enforceability of non-compete agreements leads to important shifts in the assets under management at financial advisory firms, consistent with financial advisers bringing clients with them when switching firms.

2. *Worker mobility and labor market frictions*

By limiting the post-employment options of workers who sign them while also potentially increasing the returns to sticking with a given employer, non-compete agreements are predicted to increase worker tenure and decrease job switching.

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The empirical evidence consistently bears this out, including the studies using state policy changes to identify the effects of interest. For American workers generally, Johnson, Lavetti, and Lipsitz (2019) find that moving from a policy of NCA unenforceability to the highest enforceability observed across U.S. states in their sample is predicted to reduce the month-to-month probability of workers changing employers by 26.1%.[30] Similarly, for low wage (hourly) workers, Lipsitz and Starr (2019) show that Oregon's ban on enforcing non-competes led to an increase in transitions across employers of 12.2 to 18.3%.

Studies of individual industries and occupations also find that higher NCA enforceability is associated with lower worker mobility. Inventors in Michigan were 8.1% less likely to switch jobs after Michigan strengthened its enforcement of non-compete agreements in the mid-1980s, with even lower switching rates among those with firm-specific and technological expertise (Marx, Strumsky, and Fleming 2009). Hawaii's ban on NCAs for technology workers led to an 11% increase in mobility, relative to comparable workers in other states, in years subsequent to the ban (Balasubramanian et al. 2018). Top executives were substantially (47%) less likely to change jobs within industries as non-competes became more strictly enforced, and their tenure increased by 16% (Garmaise 2011).

CEO turnover is more responsive to a firm stock performance when the firm's CEO has a signed non-compete agreement (Kini, Williams, and Yin 2019). This is consistent with firms being reluctant to fire executives for lackluster performance if their CEO is able to join a competitor. Financial advisers are substantially more likely to switch firms when non-competes are not enforced against them (Gurun, Stoffman, and Yonker 2019). However, Gurun, Stoffman, and Yonker (2019) find that a reduction in the enforcement of non-competes leads to an increase in misconduct among financial advisers, which is consistent with firms being reluctant to discipline employees who can take assets (clients) with them when they switch jobs.

The more correlational studies in the literature also conclude that non-competes tend to lengthen employee tenure. Nationwide, workers in average-enforcing states have had 8% fewer jobs than similar workers in non-enforcing states (Balasubramanian et al. 2018). Workers in states with a higher incidence of non-competes tend to have longer tenure, and that the effect of incidence is even higher in states with stronger enforceability. Starr, Frake, and Agarwal (*forthcoming*) find that a 10 percentage point increase in the incidence of NCA use is associated with an 0.8 year increase in tenure in average- vs. non-enforcing states (a 12% increase over the mean). IT workers in Silicon Valley and elsewhere in California exhibit higher rates of mobility compared to comparable workers in other states, though this pattern appears to be unique to IT and does not extend to other industries within California (Fallick, Fleischman, and Rebitzer 2006).

Not only do non-compete agreements affect the mobility of workers who sign them, but some evidence suggests they also affect the mobility of those who have *not* signed one by increasing uncertainty in the hiring process. Starr, Frake, and Agarwal (*forthcoming*) show that, among workers who have not signed a non-compete agreement, higher incidences of non-competes tend to reduce job offers in high enforceability states more than low enforceability states (i.e., the

[30] This estimate is only marginally statistically significant, however. Their sample covers uses CPS data over the 1991 to 2014 period.

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interaction between incidence and enforceability is negative in the regression model).[31] Their model predicts that a 10 percentage point increase in the incidence of non-competes is associated with a 21% lower rate of job offers over the previous year, in average enforceability states relative to non-enforcing states. This finding suggests that the prevalence of non-competes in certain industries could potentially increase frictions in the labor market, generally, not just among those who have signed the agreements. The importance of the externality will depend on how costly it is for firms to discover whether potential hires are bound by a non-compete.[32] Since this paper relies on cross-sectional comparisons of states at different levels of incidence and enforceability, though, rather than (say) an exogenous policy shock, the results should be interpreted with some caution.

Although much of the focus in the literature is on how non-competes introduce frictions in the labor market, one study suggests they may reduce one friction of particular importance to low-wage workers. Johnson and Lipsitz (2017) find that non-competes mitigate the disemployment effects of the minimum wage by allowing firms to pay what is essentially a sub-minimum wage (reducing the wedge between reservation wages and a binding minimum wage). They replicate Dube, Lester, and Reich's (2016) study and find that minimum wage laws have no effect on employment in states with relatively strong enforcement of non-competes, but have negative effects on employment in states which do not enforce non-competes. This finding suggests that non-competes may serve to reduce an important friction in the labor market for low-wage workers. Nevertheless, the fact that non-compete use does not appear to vary considerably across states with different levels of enforceability, as several surveys find, suggests that it may not be the presence of non-competes themselves that are tempering the impact of the minimum wage, but rather other unobservables that are simply correlated with enforceability. If this is true, then it is not clear how important a role that non-competes are playing.

3. *Firm entry*

The evidence on non-compete enforceability and firm entry is mixed. Using Michigan's (lone) law change, Carlino (2017) finds that an increase in enforceability had no impact on the number of firm startups, and had a small (but statistically insignificant) increase in the rate of job creation by startups.

The remainder of the literature, relying more heavily on cross-sectional comparisons, finds that non-compete enforceability is associated with less entry.

Stuart and Sorenson (2003) study "liquidity events" (initial public offerings and acquisitions), which provide an influx of liquid assets to senior employees. They show that these events generally increase the rate of new firm foundings in the biotech industry, but that non-compete enforceability attenuates this effect, likely because potential entrepreneurs are prevented from starting competitor firms by non-compete agreements.

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[31] Curiously, though, within states of average or below average enforceability, workers in high incidence industries are more likely to generate job offers than those in low incidence ones.

[32] In the case of executives, the information is likely to be relatively easy to come by. For instance, Garmaise (2009) gleans it from public 10-K filings.

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Samila and Sorenson (2011) study the differential response of states with high and low enforceability regimes to shocks to venture capital availability. They find that states with less strict NCA enforceability respond to such shocks with higher levels of firm startups and employment. These responses are consistent with non-competes inhibiting new firm creation more, on net, than they encourage investments in human capital or knowledge.

Starr, Balasubramanian, and Sakakibara (2017) provide evidence that higher enforceability is associated with fewer spin-off firms within the same industry as their predecessor.[33] Nevertheless, those spin-offs that do appear are (on average) larger, faster growing, and have a higher likelihood of surviving the initial years. They argue that this is because non-compete agreements introduce expected litigation costs for spin-offs, and these costs dissuade less profitable and smaller firms from ever forming. As with Carlino (2017), this is consistent with greater enforceability leading to startups that are more durable.

4. Wages

There are several channels through which NCAs can affect wages, including increasing investments in human and other non-tangible forms of capital, and reducing wage competition by improving the bargaining position of employers and reducing entry of competitors. The empirical evidence on which channel tends to dominate is mixed.

Using state policy changes, Johnson, Lavetti, and Lipsitz (2019) and Lipsitz and Starr (2019) find that increasing enforceability leads to lower wages. For U.S. workers generally, Johnson, Lavetti, and Lipsitz (2019) estimate that moving from NCAs being unenforceable to the highest level of enforceability observed in their sample would lead to an 8.9% drop in average wages. Since only a fraction of workers actually sign non-competes, the effect of strengthening enforceability will be quite a bit higher on those bound by one. Using the 18% incidence estimate from SPB (2019b) and assuming away spillovers on non-signers, a back-of-the-envelope calculation suggests average wage effects on non-compete signers of nearly 50% (0.89/0.18)! These wage effects only appear among (relatively) more educated workers, though: they find no effect of increasing enforceability on workers with less than a college education.

Lipsitz and Starr (2019) estimate that Oregon's ban on non-competes in 2008 led to a 2.2 to 3.1% increase in average wages for low wage (hourly) workers relative to several control groups. Moreover, they find no wage effects for workers with less than a high school degree. However, the timing of Oregon's law banning non-competes is unfortunate from an inferential point-of-view as it coincides with the onset of the Great Recession, the most severe recession since the Great Depression and one which had significant consequences for labor markets. This raises the possibility that the paper's estimated effects are confounded by macroeconomic factors that—similar to NCAs—also influence wage growth and worker mobility, as well as by the differential policy responses by states.[34] Indeed, in Lipsitz and Starr (2019), the mobility of workers in

[33] They define industry according to the four-digit NAICS code.

[34] Research on regional recessions finds that the timing of recessions (both the onset and recovery) differs across states (Hamilton and Owyang 2012). This includes states in the same Census region or division, which are used as

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Oregon increased (relative to control states) soon after the ban took force in 2008, but average wages did not increase until a full three years post-ban (in 2011). Actual (or threatened) worker mobility is an important channel through which we expect workers to achieve wage growth in Oregon after its ban on non-competes. The fact that Oregon saw an increase in mobility without an increase in average wages raises the possibility that there are confounding factors at play.

Three studies that also exploit state policy changes but concentrate on individual occupations yield mixed findings. Garmaise (2011) provides evidence that increases in non-compete enforceability from state policy changes led to 8.2% lower growth in the compensation of top executives (25% of the mean growth rate). Kini, Williams, and Yin (2019), on the other hand, show that higher enforceability is associated with higher initial compensation among CEOs who have signed non-competes, consistent with the existence of compensating differentials. They find that a one-standard-deviation increase in their enforceability index is associated with an 11.7% increase in the total initial compensation of CEOs bound by NCAs in their sample. Balasubramanian et al. (2018) show that wages rose among new tech hires by 4.2% after Hawaii eliminated the enforceability of non-compete agreements for technology workers.

Several other, more correlational studies find that NCA signers earn higher wages, consistent with non-competes mitigating holdup. Starr et al. (2019) show that workers bound by non-competes earn 7% higher wages compared with comparable unbound workers. Lavetti, Simon, and White (2018) find that wage growth among primary care physicians in group practices is sharply higher among those having signed a non-compete compared with those who have not, which they attribute to greater within-group patient referrals. They estimate that physicians who sign non-competes experience earnings growth that is eight percentage points higher in each year of the first four years as compared to non-signers, and that their earnings are cumulatively 35 percentage points higher after 10 years.

The particulars of the negotiation process appear to matter. Although Starr et al. (2019) find that NCA signers tend to earn more, the wage premium appears among those who received early notification of the non-compete. Those receiving early notice (about two thirds of the sample) receive 10% higher wages than comparable individuals do, while those receiving late notice (about one third of the sample) receive no wage premium.

Other studies find evidence that workers who sign non-competes tend to earn less and experience lower wage growth over their tenure. Starr (2019) finds that wages are lower among workers, generally, in high enforcement states; in particular, moving from non-enforcement to average enforcement is predicted to lower wages by 4%. Balasubramanian et al. (2018), in a similar setup and using the same data, show that tech workers are predicted to receive average wages that are 2.0-2.8% lower in average vs. non-enforcing states. They also show that wages in

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control groups in some of the difference-in-differences specifications, and (plausibly) states with a pre-2008 trend in wages or mobility similar to Oregon's, which are used in the synthetic control approach. States also varied in their policy responses to the Great Recession, including changing the maximum duration and generosity of unemployment insurance as well as state minimum wage policy. Lipsitz and Starr (2019) do control for changes in state minimum wages.

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average enforcing states tend to be lower even early in the employment relationship (at quarter four of the current job spell).

D. Effects in Product Markets

Less firm entry as a result of a higher incidence of non-compete agreements, as discussed above, is suggestive of the fact that competition in product markets may also be attenuated, though no paper has directly studied the link. Given the importance of non-competes in more technical occupations and industries (Marx, Strumsky, and Fleming 2009; SPB 2019b), the impact may tend to be more acute in technical and scientific industries.

A number of papers, though, do consider the implications of non-competes for innovation. Innovation is often measured, somewhat crudely, using data on patent applications. Although patents do not capture every type of innovation in the economy, they have the advantage of being readily measurable as well as available across a number of different industries. Patents are typically assigned a particular geography based on the address of the inventor or inventors, which appears on the application. Patent activity is common enough that it can be analyzed at the state- or even Metropolitan Statistical Area-level.

Samila and Sorenson (2011), in addition to entrepreneurship and employment, also study the impact of venture capital shocks on innovation. They find that states with less enforceability tend to have more new patents. Together, these responses are consistent with non-competes inhibiting new firm creation and innovation more, on net, than they encourage investments in human capital or knowledge.

Several papers find that stricter non-compete enforceability leads to more innovation, consistent with their reducing information spillovers to competitors. Carlino's (2017) evaluation of Michigan's accidental increase in enforceability finds an increase in the number of mechanical patents in Michigan (the most important patent class in the state), though declines in several smaller patent types. The lower mobility among inventors documented by Marx, Strumsky, and Fleming (2009) was likely an important factor in limiting information transfer among Michigan firms. Conti (2014) finds that firms in states with stronger non-compete enforceability tend to pursue riskier R&D projects than firms in states with weaker enforcement.
Little work has been done on whether any cost changes due to the presence or absence of non-competes are ultimately passed on to end consumers. There are two exceptions. Hausman and Lavetti (2019) argue that the use of non-competes can increase the cost structure of physician practices, and that these costs are ultimately passed on to consumers. They document that a 10% increase in their enforceability index is associated with a 4.3% increase in average commercial prices for physician services. Gurun, Stoffman, and Yonker (2019) find that eliminating the enforcement of non-competes among a group of financial advisory firms led to higher fees for end consumers. They argue that a lack of enforceable non-competes increases the cost of worker attrition (as advisers are able to bring clients with them), which is then passed on to consumers.

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IV. Conclusion

Although suggestive, the existing empirical literature on non-compete agreements suffers from several important limitations that raise questions as to whether it has successfully estimated the causal effect of such agreements on mobility, wages, entrepreneurship, and innovation. Due to the limited availability of data and a shortage of natural experiments to assess the impact of non-competes, much of the literature relies on cross-sectional comparisons of signers and non-signers, or high-enforceability states and low-enforceability ones.

Nevertheless, the literature offers some tentative findings. Across the board, the literature finds that non-compete agreements are associated with longer worker tenure and less mobility. The findings for other outcomes, however, are mixed. The papers relying on state policy changes for identification find that non-competes lead to more firm-sponsored training among top public executives (Garmaise 2011) but lower wages generally (Johnson, Lavetti, and Lipsitz (2019) and for technology workers specifically (Balasubramanian et al. 2018). Estimates for executives at public companies are mixed (Garmaise 2011; Kini, Williams, and Yin 2019). Studies relying on cross-sectional comparisons tend to find that non-competes are associated with more training and information sharing, as well as higher wages in some instances.[35]. Regarding firm entry and innovation, the only paper using state law changes (Carlino 2017) finds no discernable effect of a state law that changed non-compete enforceability.

Further research is needed in several areas. First, the determinants of why workers sign non-competes and why firms offer them is not well understood. Second, it is puzzling why non-compete incidence is only weakly correlated with state enforceability. Third, there are only a handful of studies of specific industries and occupations (physicians, tech workers, and hair stylists). Given the wide variation across jobs in the potential for investments and the possibility of lock-in, further work would help shed light on where non-competes are likely to increase or decrease efficiency and welfare. Fourth, exploiting further changes in policy or enforcement would be useful in sharpening the empirics used in this literature, which relies somewhat more heavily on cross-sectional comparisons of non-compete signers with non-signers and high-incidence states with low-incidence ones. These changes could consist of state law changes, increases in enforcement action (as has occurred recently in Washington and Illinois), or changes in firm or franchise use of non-compete agreements. Fifth, little work has been done to study how non-compete agreements affect end consumers.

[35] The sign and magnitude of the effect on wages does vary in the studies based on occupation and characteristics of the negotiation (e.g., early vs. late notice).

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