Noncompetes in the U.S. Labor Force[*]

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Abstract

Due to limited empirical evidence and controversial anecdotes, speculation over the ubiquity and importance of covenants not to compete in the U.S. labor market is rampant. We present an equilibrium framework to account for the existence and incidence of noncompetition agreements. We then populate this framework using data from a new large-scale survey of U.S. workers. The data show that noncompetes are a perhaps surprisingly common feature of the labor market. As a lower bound, we estimate that at least one in four employees have ever signed a noncompete, and that at least 12.3% are currently working under one. Of those with college education or above, at least one in five are currently subject to a noncompete agreement. The occupations in which noncompetes appear most frequently are engineering (30%) and computer and mathematical occupations (28%), though they are prevalent in typically lower-skilled occupations as well, including installation and repair (11%), production occupations (11%), and personal services (12%). The observed heterogeneity in the incidence of noncompetes provides evidence that employers use noncompetes to prevent employees holding key resources from joining competitors. We also examine explicitly whether or not noncompetes are associated with the implications of our framework. We find that noncompetes are associated with longer tenures, increases in the reservation wage for competitors, and increased training. We also show that employees rarely report negotiating over noncompetes, and that noncompetes are associated with no wage premium at signing but greater wage growth.

Keywords: Noncompetes, Noncompetition Agreements, Covenants Not to Compete, Employment Contracts, Restrictive Covenants
JEL Codes: J4, J6, K31, L41, M5

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1 Introduction

In September 2014, Adidas poached three Nike designers who were responsible for developing successful product lines in running, soccer, and basketball shoes. Nike sued the departing employees for contract breach and trade secret misappropriation, seeking to enjoin the designers from joining Adidas and to recover $10 million in damages. Each designer had signed a contract prohibiting him for working for a competitor, explicitly naming Adidas, for one year after the termination of their employment at Nike, as well as a nondisclosure agreement prohibiting them from sharing protected information with any third party for two years postemployment.[1] The defendants denied Nike's claims and the case ultimately settled in June 2015 for an undisclosed amount, with the defendants remarking that they were " looking forward to bringing new and innovative ideas and designs to adidas [soc] when our non-competition agreement expires" (Peterson, 2014).

The *Nike* case highlights the inherent tension between a firm's desire to protect its intellectual property and retain key employees and an employee's interest in unfettered mobility to maximize the value of his training and knowledge. This same tension is present in the more than 1,000 reported noncompete cases in 2014 (Beck, 2014). Not all cases involve such highly skilled labor, however. For example, a recent class action lawsuit against Jimmy John's argues that its use of noncompetes preventing minimum wage employees from working in food services within three miles of *any* Jimmy John's store is egregiously unfair (Jamieson, 2014). Indeed, Stone (2002) reports that noncompete cases have been litigated against many low-skill occupations including manicurists, carpet installers, liquor deliverymen, bartenders, cosmetologists, pest exterminators, garbage collectors, janitors, night-watchmen, undertakers, and security guards.

The breadth and frequency of noncompete litigation highlights the fact that a firm's most valuable asset is often its stock of human capital. Employees develop key innovations, hold a firm's trade secrets, and build trust with clients. But employees can also walk out the door at any moment, taking with them their entire knowledge portfolio, potentially to the significant detriment of the firm. As a result, there is a dynamic tension between a firm's desire to create value via innovation and firm-sponsored investments in training and research and the employee's

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[1] The lawsuit alleges that in spite of these contracts the defendants "conspired to and developed for themselves, and then for Adidas, a strategic blueprint for a creative design studio to compete against Nike, began consulting with Adidas, misappropriated Nike trade secrets for use in their new business venture …". See Nike, Inc. v Dekovic, Dolce, and Miner (Oregon 2015).

ability to capture that value. Patents resolve part of this tension by giving firms monopoly rights to inventions. But most confidential information is not patentable due to its lack of codifiability or tacit nature. Firms may employ other tactics to restrict employee mobility such as using delayed compensation or stock options, but such choices may do little in many circumstances to prevent employees from appropriating the value of confidential information their firm shares with them. Alternatively, as in the *Nike* case, firms may seek to protect themselves by relying on covenants not to compete and nondisclosure agreements. Among restrictive covenants (including nondisclosure, non-poaching, and non-solicitation agreements), noncompetes arguably offer the greatest protection because they *prohibit* the movement of employees to competitors.

Such contractual restrictions are not new. For over 600 years (Blake, 1960) employers have asked employees to agree to forgo joining or starting a competing business upon their departure. The enforceability of noncompetes has been seen as necessary to provide sufficient incentives for firms to invest in the development of trade secrets, good will, and employee skills (Rubin and Shedd, 1981; Posner et al., 2004). If employees were free to take their employer's secrets and clients with them, then firms would underinvest in developing those assets in the first place.[2] Yet by their nature, noncompetes impede employee mobility and entrepreneurship, potentially stifling competition and preventing employees from making the most of their skills and ideas at another firm. The challenge courts and legislatures face in the treatment of noncompetes is how to appropriately balance a firm's incentive to invest in employee training and knowledge creation and the freedom of employees to move freely to more productive jobs.

Scrutiny over noncompetes and noncompete policies is intense and growing. Within the last three years alone, Massachussetts, Rhode Island, Hawaii, Michigan, Missouri, Maryland, New Jersey, and the state of Washington all proposed bans on noncompetes (McGaugh, 2015; Gesmer, 2014; Woodward, 2014; Devore, 2015; Vanko, 2013; Mendelson and Milligan, 2013; Walsh, 2015), while Senator Murphy (D-CT) and Senator Franken (D-MN) proposed federal legislation in June 2015 to ban noncompetes for workers earning under $15 per hour (Depillis, 2015). The increased interest in noncompetes is primarily a result of three phenomena. First, in spite of the argument that noncompetes are necessary for firm-sponsored investment and innovation, California's refusal

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[2]Indeed, Nike claims in their lawsuit that "These confidentiality and noncompete provisions ... are essential to Nike maintaining its leading and competitive position in the global athletic footwear industry." [cite.]

to enforce noncompetes (California Business and Professions Code §16600) is often regarded as a crucial ingredient to Silicon Valley's rise as the innovation capital of the world (Saxenian, 1996; Gilson, 1999; Hyde, 2003; Lobel, 2013). Gilson (1999) argues that without enforceable noncompetes, Californian employees move more frequently across firms, sharing knowledge and building networks, which in turn spurs innovative activity that trumps the disincentives to innovate due to the lack of noncompete enforceability. Second, recent anecdotes about the use of noncompetes in surprising occupations, including camp counselors, yoga instructors (Greenhouse, 2014) and temporarily employed 'packers' a Amazon (Woodman, 2015), have caused many to wonder who actually signs noncompetes and how signing a noncompete affects an employee's future mobility and earnings. Third, empirical research primarily in the last six years has begun to examine how noncompetes and noncompete enforceability affect workers, firms, and regions. This nascent literature finds, to this point, mostly negative effects of noncompete enforceability, which has both propelled policy makers to propose reforms and given them some ground on which to stand.[3]

Yet despite the importance of noncompetes, the recent legislative interest and the growing empirical literature, there remain fundamental gaps in our understanding of the use and impacts of noncompetes and noncompete policies, which have stymied debates of noncompete policy changes. How frequently do workers sign noncompetes and which workers are more likely to sign?[4] How does signing a noncompete affect the worker's career development, wages, and skill accumulation?[5] How does the use of noncompetes within the firm affect the firm's investments in R&D and training? The sole reason our understanding of noncompetes is so limited is a paucity of data.[6] Major surveys do not ask about noncompetes and firms are not required to report the contracts that

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[3] This research includes Stuart and Sorenson (2003); Hyde (2003, 1998); Marx et al. (2009, 2015); Lobel and Amir (2013); Lobel (2013); Garmaise (2009); Samila and Sorenson (2011).

[4] The existing research on who signs noncompetes covers only three occupations – physicians (Lavetti et al., 2014), electronics engineers (Marx et al., 2015), and CEOs (Bishara et al., 2012; Garmaise, 2009; Schwab and Thomas, 2006), which together constitute just 1.2% of the U.S. labor force.

[5] Marx (2011) considers how noncompetes may cause career detours among electronics engineers, and Lavetti et al. (2014) offers an analysis of how noncompetes affect physician tenure and earnings. There are no other studies that examine the impacts of noncompetes themselves, to our knowledge.

[6] The existing literature indeed attempts to address these issues, albeit without data on who actually signs noncompetes, relying instead on rough proxies of noncompete enforceability. The two primary limitations of such studies are that (1) the measurement of noncompete enforceability is necessarily mismeasured without data on who signs noncompetes, and (2) such studies may substantially underestimate the impact of noncompetes themselves if noncompetes are perceived to be a barrier to mobility regardless of its enforceability. See Bishara and Starr (2015) for a complete review of the limitations of these studies and of the existing empirical noncompete literature.

their employees sign. Indeed, there has not been even one systematic empirical investigation into the use and impacts of noncompetes in the U.S. labor force.

In this paper we use new data collected specifically to study the use, implementation, and consequences of noncompetition agreements to answer three questions: (1) Why do noncompetes exist? (2) Who signs noncompetes? (3) What labor market outcomes are associated with noncompete agreements? In providing the first comprehensive empirical assessment of the incidence of noncompetes across the U.S. labor force, we show that noncompetes are a common part of the employment relationship in virtually every context: between 25% and 63% of employees have signed a noncompete at some point in their lives, while between 12% and 51% of those in the U.S. labor force are presently working under a noncompetition agreement. These estimates indicate that at least 19.2 million employees are currently subject to a noncompete.

The incidence of noncompetition agreements overall and across different employee and employer characteristics is determined by both the employers' demand for such commitments and the willingness of employees to make them. The relative frequency in any particular industry or occupation is thus an equilibrium outcome, one defined by the point where supply equals demand. Identifying the circumstances under which an employer might especially value a noncompetition agreement—as well as the circumstances under which an employee is likely to assent to one—is important, both for appreciating the significance of patterns in noncompete incidence and for understanding the likely consequences of noncompete use. We argue that employers are incentivized to use noncompetes when they extend valuable employment relationships, when they prevent departing employees who possess commercially valuable information from joining competitors, and when they increase the per period profitability of the relationship, which could take the form of either increased productivity from investments in training or simply reduced wage growth. Employees agree to noncompetes when they receive sufficient compensation for signing, or when the costs of not signing, which include the possibility of the job offer being revoked and the consequent inability to smooth consumption, are high.

We find that the incidence of noncompetes by employee characteristics is highly heterogeneous. A 1% increase in income is associated with a 3.7 percentage point increase in the probability of having signed a noncompete. At least one in every three employees making over $100k a year have agreed to a noncompete, while at least 10% of those earning less than $40k are bound.

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Occupational incidence yields a similar pattern. Individuals in higher-skill, knowledge-intensive occupations are the most likely to agree to a noncompete: engineering and architecture (30.1%), computer and mathematical (27.8%), business and financial (23.1%), and managers (22.7%). Yet even low-skill occupations such as office support (8.7%), installation and repair (10.5%), production (11.0%), and personal care and services (11.8%) involve significant noncompete activity. Of the traditional protectable interests required for the enforcement of a noncompete (client lists and relationships, trade secrets, confidential information), working with trade secrets is the strongest predictor of a noncompete. At least 10-12% of those who work with clients or have access to client-specific information agree to noncompetes, as compared to 24-30% of those who have access to trade secrets.

The fact that noncompetes appear significantly more frequently in higher skilled jobs in which the individuals hold key resource suggests that a primary motivation for using noncompetes is to prevent such sensitive information from reaching competitors. Yet the finding that low skill, low earning occupations that hold no confidential information still sign somewhat frequently suggests that other motivations are also in play. We further find a relatively small but positive correlation between the enforceability of the noncompete and the use of noncompetes. The incidence of noncompetes in California (at least 14%) is higher than elsewhere (at least 12.1%), despite California's virtual ban on noncompetes. This relationship holds even in single unit firms (9.9% in California and 8.8% elsewhere). These results suggest that while noncompetes are more likely to be found in places where they are more likely to be enforced, firms have other motivations for using noncompetes outside of their potential enforcement, perhaps because individuals feel bound by them regardless of their enforceability. Thus noncompetes may be used to save on turnover costs or contracting costs, to depress wages, or to prevent both high and low skill employees leaving to create a competing 'spinoff' (Starr et al., 2015).

To investigate our theory, we consider the relationship between noncompetes and individual employee outcomes, controlling for employee and employer heterogeneity. We find that noncompetes are associated with a 17% higher minimum percentage wage increase to move to a competitor, suggesting that noncompetes indeed create moving costs between competitors. Noncompetes also shifts the observed tenure distribution, increasing the probability that an employee has a tenure of greater than 5 years by 16%. Given both of these effects, our theoretical model predicts that

employers should have additional incentives to train and share information with their employees. As predicted, we find that employees who sign noncompetes are 13.3% more likely to be promised training, and have a 13% increase in the probability of receiving training paid for by the firm in the last year.

On the supply side, we find that only 10% of employees negotiate over their noncompete, and that timing, a lack of information, a lack of outside offers, and transaction costs play a role in the employee's willingness to negotiate. Given the lack of negotiation, it is unsurprising that we find that noncompetes are not associated with a wage premium upon hiring. It is surprising, however, that the cross-sectional estimates show that those who sign noncompetes earn 14% more on average, due primarily to significantly higher wage growth for those who stay: at 9 years into tenure those who sign noncompetes are making $15k more than the non-signers, controlling for a hosts of employee and employer characteristics.

Our findings make important contributions to numerous literatures. To the policy and academic debates about noncompetes, we provide the first set of facts regarding the use of noncompetes and labor market outcomes associated with their use. Such facts have two benefits: they help corroborate theories of the use and impacts of noncompetes and noncompete enforceability, and they also provide evidence on the appropriate assumptions to make in such models. For example, Posner et al. (2004); Garmaise (2009) and Callahan (1985) assume that individuals who sign noncompetes are sufficiently sophisticated to properly negotiate and consider their noncompete: our results suggest that for most workers this is likely not the case. A second contribution of our results is to identify that noncompetes are more common in states where they are more likely to be enforced, but that they are still prevalent even in states where they are nonenforceable. Since almost all the evidence in the noncompete literature comes from studies comparing states that do and do not enforce noncompetes,[7] this result suggests that the effects of noncompete enforceability are likely to be significantly smaller than the effects of noncompetes themselves. In the literature on human resource management practices and productivity (Bloom and Reenen, 2011; Shaw, 2004) and the literature on firm-sponsored training (Acemoglu and Pischke, 1999; Autor,

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[7]See Bishara and Starr (2015) for a complete review of the empirical noncompete literature. Such work includes Marx et al. (2015, 2009); Garmaise (2009) on employee mobility, Stuart and Sorenson (2003); Samila and Sorenson (2011); Starr et al. (2015) on new venture formation, Conti (2014) on the riskiness of firm R&D, Starr (2015) on firm-sponsored training, and Younge and Marx (2013) and Younge and Fleming (2014) on acquisitions and firm-value from anticipated reductions in employee mobility.

2001; Lazear, 2009; Loewenstein and Spletzer, 1997; Barron et al., 1999), we empirically identify the particular role of contractual restrictions on employee mobility as a tool to spur investment in human capital. Lastly, this study points towards many unanswered but important questions involving the chilling effects of noncompetes themselves, the impacts of noncompetes on firm-level outcomes such as R&D, and the interaction of noncompetes and noncompete enforceability on employee and firm outcomes.

The structure of the paper is as follows: In Section 2, we develop a simple framework in which employers may demand noncompetition agreements and employees may agree to them. Supply and demand curves incorporate idiosyncratic employer and employee characteristics, respectively, but are also functions of *observable* industry, occupation, and enforcement-level parameters. Later, we use this framework to draw inferences about the underlying drivers of noncompete contracting from the heterogenous noncompete incidence rates we observe in the U.S. labor market. Section 3 describes our data by briefly introducing our comprehensive individual-level survey, the data collection process, and the sampling frame. Section 4 examines the relationship between the incidence of noncompetes and various employee- and employer-level variables. Section 6.1 examines the correlation between noncompetes noncompetes and tenure, willingness to leave for a competitor, training, and wages. Section 7 discusses the implications of these results.

2   Conceptual Framework

In this section, we outline a basic framework to understand the incidence of noncompetes. In a competitive labor market, identical employers would bid an employee's wages up to the employee's marginal product, the employee would choose an employer and never leave. In such a market there is no need for noncompetes. Yet noncompetes do exist, and can be attributed to various market features including liquidity constraints, asymmetric information, search frictions, transaction costs, and risk preferences. In this paper, we are agnostic about which particular feature is the main driver of noncompetes. Instead, we consider the incentives of the employer to offer a noncompete and the incentives of the employee to agree. In this framework, an employer and an employee will enter into a noncompetition agreement when both view the arrangement

as mutually beneficial relative to all alternatives.[8] An employer's demand for a noncompete and an employee's willingness to enter into a noncompete are both functions of observable (as well as unobservable) parameters. The empirical results we present in Section 4 allow us to make inferences about the nature of these key parameters.

2.1 Employer Demand for Noncompetes

An employer decides whether to enter into a noncompetition agreement with an employee by comparing the expected profitability of the most attractive employment contract *without* a noncompete to that of the most attractive employment contract *with* a noncompete, taking into account the employee's information set. We assume that the best contract among the set of feasible contracts (i.e., those that are acceptable to the employee) produces nonnegative profits in expectation that exceed any feasible arrangement with any other potential employee.[9] In general, an employer will ask the employee to sign a noncompetition provision when it believes a noncompete will increase the expected net present value of the employment relationship. The expected net present value of the employment relationship is determined by primarily the expected duration of the relationship, the expected per period profitability, and expected post-employment losses when the employee leaves. Below, we describe how noncompetes interact with these three variables.

First, if turnover is costly, a noncompete may enhance an employer's expected profitability simply by increasing the expected duration of an employee's tenure – even if the employee is no more productive during those additional years. Of course, the choice to leave is the employee's. Therefore the noncompete will increase the employer's expectation of the duration of the employment relationship if the employer believes the employee will stay longer due to the noncompete. An employee may stay longer with the employer if the employee perceives that the contract limits his employment opportunities.[10] Thus employers are incentivized to use noncompetes when employees are very costly to replace or turnover costs are otherwise large.

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[8]Note that accompanying modifications to any other part of the overall employment contact—such as adjustments to wages or changes to other investments in the employee, e.g., training—are included in what we are referring to as the noncompete agreement.

[9]We leave bargaining to one side for the moment. When a contract is expected to produce surplus ex ante, the agreement over how to divide that surplus depends on the nature of the bargaining process.

[10]The employee's perspective is explored in section 2.2.

Second, the employer may use noncompetes to increase the per-period productivity of the employment relationship. We conceive of per-period profitability generally as productivity minus wages and additional costs including training, research and development, and related costs. Noncompetes may increase per-period profitability simply by allowing the employer to refuse to match outside offers from competitors, resulting in lower wage growth over time. If, as suggested above, noncompetes also increase the duration of the employment relationship, then by reducing wage growth the noncompete further increases the present value of the employment relationship.

Furthermore, a longer employment duration also increases the employer's return on investments in employee training and information sharing, all else equal. As a result, if noncompetes increase the expected duration of employment, then employers have an increased incentive to invest in screening employees, training them, and providing them with the valuable information they need to perform their job. The increased incentives to invest in training or information sharing is likely to be asymmetric across occupations and industries. Employers have greater incentives to use noncompetes in occupations and industries where the return to additional training and information is large.

Third, the employer's incentive to provide training and confidential and proprietary information to employees is perhaps more strongly related to the post-employment restrictions of noncompetes. By restricting employees from joining or starting competitors, employers using noncompetes insure themselves against former employees sharing their trade secrets, client lists and relationships, or other damaging information with competitors. The result is that noncompetes help employers sustain any information-based or client-based competitive advantage. Furthermore, without fear that competitors will procure such information from defecting employees, the employer is incentivized to train and equip its employees with all necessary information to be maximally productive.

Thus far, we have treated training and information shared with the employee equally. Providing additional training or relevant confidential information to an employee do share the common effect of increasing employee productivity, but the costs of provision may be substantially different. In particular, classic models of training (Becker, 1962) assume that employees pay for general training either directly or indirectly through a reduction in current or future wages. Under this model, when general training is sufficiently costly such that employees are unable to pay for it

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themselves, either directly or through a reduction in wages, employers will only provide training if they can guarantee the employee will stay with the employer for a certain amount of time to recoup the investment. If the employer were to provide training in the absence of a noncompete, once the employee is trained, a competitor can effectively appropriate the value of the training by offering the employee a higher wage, one based on the employee's post-training productivity, without bearing any of the training costs.[11]

Thus, a noncompete may enhance general training returns in two distinct ways: not only are direct returns from training potentially higher as a result of an employee's longer expected duration, but indirect returns may also be also higher in expectation, because investments in training are less likely to subsidize a competitor. Without a noncompete, access to a trained employee would allow the competitor to compete at lower cost, in which case the former employer suffered not only the training costs but may also lose additional business to the competitor.[12]

This "double effect" does not necessarily apply with respect to the sharing of at least certain kinds of confidential information. Assume that developing confidential information (such as trade secrets and client lists) is very costly, but that "sharing" the information is often a relatively costless activity. Absent any threat of competition, employers would make this valuable information freely available to their employees regardless of their expected length of employment. A noncompete that just increased expected employment employment duration, therefore, would not increase the sharing of confidential information that is not time sensitive. However, if confidential information allows the employer to better position its product to capture more producer surplus or allows the employer to produce at below the industry's marginal cost, sharing confidential information with an employee has a significant indirect cost: in the absence of a noncompete or a legal enforcement option, competitors may hire employees away to obtain this information and then use it to eliminate any associated competitive advantage for the employer. Thus by deterring employees from joining competitors, a noncompete protects the employer's information

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[11]Empirical evidence in support of the theory that employees pay for general on-the-job training is minimal at best, with most of the empirical work supporting a friction-driven model of employer-sponsored training (Barron et al., 1999; Acemoglu and Pischke, 1999; Starr, 2015). The results of the employer-sponsored training model are identical to the case presented above when training costs are sufficiently high such that an employee could never repay them.

[12]For a formal model, see Starr (2015).

and client-based competitive advantage and incentivizes the employer to invest to further increase this advantage.

The competitive-advantage enhancing value of a noncompete will turn on both the value and the transferability of training and confidential information in a particular occupation and industry. Where the value of the training or information is high and these commodities are easily transferable to a competitor, employers may demand noncompetes more frequently. Where neither of these features of production exist–for example, in occupations involving easily learned skills (e.g., low-skilled employment) and all relevant information is common knowledge–noncompetition agreements offer no competitive edge.

2.2 Employee Willingness to Supply Labor Under a Noncompete

An employee decides whether to enter into – or supply his labor services under – a covenant not to compete with an employer by comparing the expected return of that option to the expected return of all feasible alternatives, including rejecting the offer of employment outright (and so continuing the search) or negotiating with the employer over the noncompete's terms and the consideration for those terms. We assume that the employee has some expectation as to the future flow of job offers (under both the 'accept' and 'reject' scenarios), that the employee may be able to influence the volume of this flow through effort, and that negotiation is costly, perhaps to the point of the employer's offer being effectively a take-it-or-leave it proposal. The rational and informed employee makes these comparisons by anticipating the effects of the noncompete on the duration of the employment arrangement, the per-period compensation he receives during that duration, and value of the opportunities he is likely to face upon departure.

Functionally, agreeing to a noncompete imposes moving costs, whether temporal or litigation-based, on the employee for movements to competitor firms. As a result, noncompetes will tend to increase the expected duration of the present employment opportunity. In particular, the presence of a noncompete may deter competitors from making offers for the employee because of higher expected litigation costs due to the noncompete or may reduce the employee's search effort for outside offers from competitors.[13] The consequent reduction in the offer arrival rate from

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[13]Theoretically, noncompetes may encourage recruitment if the noncompete signals the value of the employee to the competitor.

competitors and/or increase in the employee's reservation wage increases the employee's expected duration of employment, all else equal.

As we noted in the previous subsection, if the noncompete increases the expected employment duration or hinders the ability of the employee to join a competitor, the presence of a noncompete may be combined with explicit promises of training or information sharing, or, without such explicit promises, may be a signal to the employee that such investments may occur. All else equal, whether the employee agrees to the noncompete depends upon the extent to which he believes that his per-period compensation will rise with such productivity-enhancing investments. Of course, because under a noncompete the employer need not respond to alternative job offers from competitors, the lack of competition may reduce wages, providing a countervailing negative effect on per period compensation.

This analysis highlights the fact that a noncompetition agreement may increase or decrease the per-period compensation the employee can expect from the employer (the overall effect on the welfare of the employee is likewise ambiguous). When the employee expects many offers from non-competing employers (generating higher expected wages with this employer under a matching model as well as a shorter expected duration), or is also able to productively use the employer's confidential information under the noncompete (also resulting in higher wages, in expectation), the employee is likely to earn more per period. On the other hand, when the noncompete eliminates virtually all offers (because only competitors are likely to offer a reasonably attractive wage) and the employee is no more productive because training is unnecessary and information sharing is unimportant—e.g., a situation in which the members of an industry would appear to be using noncompetition agreements anticompetitively simply to extract more surplus out of employees by limiting competition in the labor market—wages will be lower in expectation.

Finally, the employee will consider the expected per-period compensation *after* separation. Absent a noncompete, the employee can take any training or confidential information to a competitor, where it would presumably have at least some value and lead to a higher wage. Under a noncompete, two scenarios arise: First, the employee may depart to a non-competing employer, which may have either large or small costs, but the employee's training and access to confidential information will be worth relatively little. Second, the employee may depart to a competing employer (or start a firm of his own). Under a noncompete, choosing to transition to a competitor is

both less likely (because the additional expected costs – threat of litigation and associated costs – make these offers less attractive) and less lucrative when it does happen, all else equal. Therefore, assuming noncompetes are accurately enforced, unless the noncompete increases productivity significantly and productivity is tied to wages, the noncompete makes the employee worse off.

Up to this point we have yet to consider the possibility of negotiation. Conditional on being asked to sign a noncompete, the employee can attempt to negotiate over the terms of the noncompete. Whether the employer will agree to negotiate depends upon the costs of writing a different contract for a new employee, which may be non-negligible in larger employers or in employers where 'fairness' matters and transparency is widespread, and whether the employer can attract a similarly productive employee who is willing to sign. From the employee's perspective, there may be large transaction costs associated with negotiating *ex ante*. For example, if the employee is worried about souring his relationship with his potential supervisor, perhaps even before it commences, by creating additional costs for the employer, then the employee is unlikely to negotiate. If the employee is worried that by attempting to negotiate the employer will retract the job offer or that questioning the employer's request to sign a noncompete would be a sign of disloyalty or untrustworthiness, then the employee is also unlikely to negotiate. Relatedly, employees may face strong pressure to smooth consumption over time. If labor markets are not competitive and the revocation of a job offer means the inability to pay for essential items, then such search frictions are likely to interact with these transaction costs creating even stronger disincentives to negotiate over the noncompete. These expected costs are likely to be even larger in recessions, when offer arrival rates fall precipitously, and for especially risk averse individuals. As a result, we expect that bargaining will be uncommon, except potentially for high level positions that are not easily replaceable.

In the context of the equilibrium framework described above, we seek to examine the reasons employers use noncompetes by assessing each rationale's implications for the observed incidence of noncompetes. Before doing so, however, we briefly describe the data and summarize the incidence of noncompetes.

3 Data and Survey Methodology

The data for this study comes from a large scale online survey the authors developed and implemented.[14] The survey has three parts: (1) lifetime experiences with noncompetes, (2) knowledge of noncompete laws and perceptions of enforcement, and (3) experiences with noncompetes in a current job. The project was run through Qualtrics, who used eight panel partners to collect the data. Potential respondents to the survey had previously agreed to respond to online surveys and were sent the survey via a confidential e-mail link or as part of an online game.[15]

The sample population are labor force participants aged 18 to 75, who are either unemployed or employed in either the private sector or in a public healthcare system. Through the use of quotas, the online survey platform gave us significant control over the final composition of the survey. The target for this survey was 10,000 completed surveys with 50% male, 60% with at least a bachelor's degree, 50% earning at least $50,000 from their current, highest paying job, and 30% over the age of 55. These numbers were chosen either to align with the corresponding moments in the data for labor force participants in the 2012 American Community Survey, or to oversample certain groups of the population for further subgroup comparisons. In addition, to examine states with particularly unique noncompete laws, we oversampled respondents from Colorado, Oregon, Massachusetts, and Florida. Respondents were compensated through a variety of mechanisms: being paid $1.50 directly, receiving credits in online games, or being entered into a sweepstakes.

We used an online platform instead of a more standard probability sampling technique such as random digit telephone dialing for six reasons. First, the cost per respondent was orders of magnitude lower for the online survey. Second, the data were collected quickly: over 11,500 responses in two months. Third, the online platform allows for a very functional graphical technology to ask complicated questions. Fourth, Qualtrics guaranteed a sample size of at least 10,000 respondents, mitigating worries about small sample size. Fifth, Qualtrics agreed to replace respondents whom we could identify as being intentionally noncompliant on the survey. Sixth, Qualtrics allows the use of quotas to control the final demographics of the sample.

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[14]For more details on the survey instrument, the data cleaning process, and the weighting process, see our technical paper, which is available upon request.

[15]The survey was not an open survey in the sense that anyone with the link could take it.

There are of course drawbacks to using an online platform, the most salient of which is sample selection. Using a convenience sample as opposed to a probability sample complicates inference about the population as a whole because the probability of selection into the sample is unknown. In particular, there are four selection issues from an online survey:

1. Not all of the labor force is online.

2. Not all of those online sign up to take online surveys.

3. Not all of those who sign up to take online surveys are invited to take the survey.

4. Not all of those who are invited to take the survey finish it.

All survey methods must confront the first, third, and fourth issues. For example, random digit dialing will miss individuals without a phone, it will miss some individuals who do have phones, and even those it does reach may decide not to take the survey. These issues are very serious even in probability samples. Kohut et al. (2012) find that response rates from random digit dialing surveys were 36% in 1996 but are merely 9% in 2012. Thus, even if one started with a random sample of the population of interest, sample selection into who finishes the survey may seriously bias any estimates.

The most important selection issue for online surveys is the second point, that not all employees online sign up to take online surveys. The question of who signs up for online surveys and why is critical for understanding any potential biases in our analysis. To get a sense of online panel compositions, Table A8 in the Appendix compares the demographics of the two largest sources of respondents in our survey to the US population. Taken together, the table shows that while the gender differences are sizable, the average education of members of the online panel are not seriously different from the US population. The employment characteristics present the most stark contrast to the US population. Only 35.3% of the ClearVoice population is employed full-time while 51% of the Sample Strategies population is, relative to 70% for the US population as a whole. Indeed, these panel partners have a population made up of many more part time employees and homemakers. Notably, however, we our online sample consists only of individuals who are a part of the labor force, so overall characteristics of the population of online survey takers are not directly comparable the US labor force numbers. Indeed, when restricting the online survey

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taking population to only the full-time, part-time, or unemployed employees, the proportion of employees employed full time for ClearVoice is 63.1% while the same proportion is 75.5% for Sample Strategies. These numbers are much closer to the US numbers.

Importantly, because we can control for demographic characteristics such as income, education, and occupation, the crucial question is what motivates somebody in a particular income and education category to sign up for online surveys, and how does that motivation relate to their noncompete status. To understand the motivations for signing up for online surveys, we asked exactly why they decided to sign up to take online surveys. The results are shown in Table 1, categorized by income quartile. Interestingly, most people report signing up because they like the rewards or want to share their opinions, and many find it fun or enjoy learning new things. The financial motivation is stronger among the lower income quartiles, but there is surprisingly little heterogeneity across income categories. Thus the selection question regards whether or not those who are motivated to share their opinion or like rewards, conditional on their age, gender, income and education, are systematically more or less likely to sign noncompetes. It is not obvious to us that either of these motivations will be systematically related to noncompete incidence. We conclude that Table 1 shows relatively little evidence of selection.

Table 1: Why Sign Up for Online Surveys?

| Reason | Income Quartile | | | | Total |
	0-25%	25-50%	25-75%	75-100%	
Like Rewards	0.58	0.59	0.61	0.60	0.59
Share Opinion	0.55	0.56	0.59	0.61	0.58
Want Money	0.44	0.43	0.40	0.32	0.40
Learn	0.40	0.39	0.39	0.39	0.39
Fun	0.31	0.31	0.32	0.33	0.32
Need Money	0.37	0.29	0.19	0.10	0.24
Game Benefits	0.12	0.12	0.11	0.10	0.11
Other	0.02	0.01	0.01	0.02	0.01
Accidental	0.00	0.00	0.00	0.00	0.00

Note: This table shows the reasons respondents selected when asked why they signed up to take surveys in the first place. More than one answer was allowed. The numbers in the table refer to column percentages.

Another major concern for online surveys is that quality may be lower if individuals are simply clicking randomly to get through the survey or are simply lying about their demographics. To address these serious issues, we clean the data in four stages, which are described in Table 2.

Overall, 712,181 individuals were invited to take the survey, with 105,053 acknowledging receipt of the e-mail. Of those, 79,328 started the survey and 28,785 were filtered out because they were not in the population of interest (11,073 of whom were not employed and not looking for work). Almost 29,000 individuals didn't finish the survey, and the attention filters caught 5,929 individuals. Following the first round of cleaning we are left with 14,668 individuals. Round 2 of cleaning involves keeping only the first observation of a given IP address if that attempt resulted in a completed survey. Round 3 identified repeat takers with different IP addresses, and round 4 cleaned out individuals who we identified as intentionally noncompliant. The final sample results in 11,529 respondents. The cleaning and imputation procedures are further detailed in the technical paper, which is available from the authors.

To weight the final sample to match the population distribution, we consider three different weighting schemes: (1) post-stratification, (2) iterative proportional fitting (raking), and (3) inverse probability weighting. We choose iterative proportional fitting because of its ability to match the marginal distributions in the data while still matching relatively well the joint occupation-industry distribution. Fortunately, the various weighting methods provide qualitatively and quantitatively similar results. Further details on the weighting methods are available in the technical paper. All results presented below use weights generated from raking.[16]

4 The Incidence of Noncompetes

Before turning to tests of possible reasons why employers use noncompetes as described in the theoretical framework above, in this section we describe the incidence of noncompetes by broad characteristics of the US labor force.[17]

4.1 Have Employees Ever Heard of or Signed a Noncompete?

The primary challenge in quantifying the incidence of noncompetes is that respondents may not know what noncompetes are, or may not even know that they have signed them. Therefore, to begin our analysis of the incidence of noncompetes, we first ask respondents if they have ever

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[16]For a review of weighting methods, see Kalton and Flores-Cervantes (2003).

[17]While the breadth and generality of these characterizations make it difficult to test any of the reasons employers might use noncompetes as presented above, we hope that this novel information is useful to practitioners and others interested in how frequently these contracts are being used.

Table 2: Sample Selection

	Number	
Total Invites	712,181	
Total Acknowledged Invite	105,053	
Total Started Survey	79,328	
Not in Population of Interest	28,824	
Not Working and Not Looking	11,073	
Self Employed	4,417	
Non-Healthcare Public Non-Profit	3,876	
Government	3,031	
IP Address Not in USA	2,253	
Not 18-75	1,920	
Over quota	1590	
Unemployed (Over Quota)	631	
Not US Resident	33	

	Number	%
Total Started Survey in Population of Interest	50,504	100
Did Not Finish (Not Otherwise Filtered Out)	28,906	57.2
Attention Filters	5,929	11.7
Within-Survey Inconsistency or Unreasonableness	1,001	1.98
Kept Through Cleaning Round 1	14,668	29.0
Multiple Obs. from Same IP Address	2,299	4.55
Kept Through Cleaning Round 2	12,369	24.49
Repeat Takers	279	0.55
Kept Through Cleaning Round 3	12,090	23.94
Intentionally Noncompliant	561	1.11
Final Sample	11,529	22.83

Note: This table presents the frequencies of the respondents who were filtered out of the survey. The *Attention Filters* section refers to three questions that were placed in the beginning, middle, and end of the survey the survey, which require the respondent to answer a question in a certain way in order to continue the survey. Respondents do not get to go back and correct answers. The *Within-Survey Inconsistency or Unreasonableness* filtering section was installed by Qualtrics after the first round of about 8,000 completes, and thus affects only the completes collected later. More details can be found in the technical paper, which is available upon request.

heard of noncompetes, giving them a written explanation of what they are. Table 3 shows that 65.47% claim to have heard of noncompetes, while 34.53% have not heard of them.

Table 4 shows the cross tabulation of whether respondents report ever signing a noncompete against whether or not they have heard of it. The data show that one in four labor force partic-

Table 3: Ever Heard of Noncompetes?

Heard of Noncompetes?	
Yes	65.47%
No	34.53%

ipants have ever signed a noncompete, representing over 30 million employees.[18] Of those who have heard of noncompetes, 39.4% report having signed a noncompete at some point in their life.

Table 4: Ever Signed vs Ever Heard of Noncompetes?

	Heard of Noncompetes?		
	No(%)	Yes(%)	Total(%)
Ever signed a noncompete?			
Yes	0	39.4	25.8
No	0	57.4	37.6
Don't know	0	3.2	2.1
Never heard	100	0	34.5
Total	100	100	100

Note: The numbers represent column percentages.

Table 5 considers what percentage of those who have ever signed or have heard of noncompetes have also currently signed a noncompete in their job. Of those who have ever signed a noncompete, 47.7% report having signed one in their current or most recent position. Of those who have heard of noncompetes, 18.8% report having signed one currently. In the overall sample, 12.3% report signing a noncompete in their current occupation.

Table 5: Currently Signed vs Ever Signed or Heard?

	Ever Signed?		Ever Heard?		
	Yes(%)	No(%)	Heard(%)	Never heard(%)	Total(%)
Currently signed a noncompete?					
Yes	47.7	0	18.8	0	12.3
No	44.6	100	74.9	0	49.1
Cannot remember	6.7	0	2.6	0	1.7
Don't want to say	1.0	0	0.4	0	0.3
Don't know if ever signed	0	0	3.2	0	2.1
Never heard	0	0	0	100	34.5
Total	100	100	100	100	100

Note: The numbers represent column percentages.

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[18]This is an underestimate because those who are currently self employed or work for the government are not in this sample and may have signed a noncompete in previous jobs.

In all of our empirical specifications, the signed noncompete dummy refers only to those who report actually signing. Those who say they have never heard of noncompetes, those who have heard but don't know if they have signed, and those who refuse to say have not actually signed a noncompete, are grouped into the 'have not signed' group. To get a sense of how frequently we might be miscategorizing signers as non-signers, we asked respondents who had ever signed a noncompete if they had ever unknowingly signed and later became aware of their noncompete. The responses indicate that 8.1% of those who have ever signed have experienced this phenomenon.

Next we break down the incidence of noncompetes by employee, employer, and regional characteristics. For each characteristic, we show the bivariate correlations and the results from a multivariate analysis.

5 Variation in the Use of Noncompetes

The theoretical framework developed above argued that the existence of a noncompete is predicated upon the employer's demand for a noncompete and a employee's willingness to supply his labor under a noncompete.[19] We argued that employers will demand noncompetes when they save on turnover costs by extending the duration of the employee's job, increase the profitability of the employee, and when they reduce the post-employment damages suffered by the employer. Due to the extended duration and lower damages, the employer also has increased incentives to make productivity-enhancing investments, such as in the employee's training and in providing information to the employee, in order to make the employee maximally productive throughout his tenure.

Employees deciding whether to work under a noncompete will choose to do so if the expected net present utility of the job exceeds their alternatives. This might be the case when the job is associated with significant training and wage growth, when the employee expects to leave for a non-competitor or an alternative like further education, when the employee expects to be with the employer for a long time, or when the employee believes the employer will not sue over the noncompete or a court will not enforce it. Employees unhappy with the noncompete can choose

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[19]Theoretically, if working under a noncompete is efficient, an employee would be as willing as the employer to 'offer' to work under it. In practice, however, we believe that such restrictions are typically initiated by the employer.

to turn the job down or attempt to negotiate the terms of the noncompete or for other benefits in exchange for signing.

In order to test for the reasons employers use noncompetes, we ask what the observed distribution of noncompetes by employee and employer characteristics can tell us about the underlying motivation for using noncompetes. We begin by studying the incidence of noncompetes by occupation.

5.1 Occupation

There are many reasons to suspect that the incidence of noncompetes will vary by occupation. As discussed in the conceptual framework above, occupations vary both in the information and skills necessary to perform the job, and in the value of additional training and information. Occupations that have more important responsibilities or involve the knowing or generation of important company secrets are a greater threat to the employer if they were to leave for a competitor. Occupations that have no information are less of a threat, though may also sign noncompetes due to the increased expected duration of the employment relationship. Alternatively, lower level employees with little sensitive information to protect may also be asked to sign noncompetes in order to protect against groups of individuals jumping ship to join a competitor, as in the case of a manager leaving and taking his team of employees with him.

To characterize the incidence of noncompetes by occupation, we take two approaches. The first is simply to tabulate the proportion signing a noncompete by occupation in the data. The second approach is to ask individuals how common noncompetes are in their occupation and industry. The idea behind this approach is that while the employee's experience is only one data point, his knowledge about the occupation and industry as a whole represents many data points.[20] For each of these approaches, we group the occupations into 2 digit Standard Occupational Classification (SOC) system groups.[21]

Figure 1 presents the possible range of the incidence of noncompetes in each occupation, as shown by the red bars, the 95% confidence interval on the upper and lower bounds of the range, and the within-occupation projected incidence. The lower bound of the range is determined

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[20]See Rothschild and Wolfers (2013) for an example of this method in a voting context.

[21]Detailed information on job titles and job duties were also collected in order to pursue a finer occupational analysis, though at this writing, the detailed occupation and industry categories are still being coded.

by assuming that all of the individuals who did not know if they had signed a noncompete (including those who have never heard of a noncompete) did not sign. The upper bound is calculated by assuming that they did. The 95% confidence intervals relate to the overall frequency of that occupation in the data – occupations with low frequencies in the data have significantly larger 95% confidence intervals. The figure indicates that there is significant heterogeneity in the use of noncompetes across occupations. Taking the lower bounds as the most conservative estimate, the occupations most likely to sign are architecture and engineering (30.1%), computer and mathematical (27.8%), business and financial (23.1%), and managers (22.7%). Interestingly, individuals in occupations where noncompetes are used more frequently are also more likely to be aware of noncompetes. The occupations which are least likely to have signed noncompetes are grounds maintenance (1.3%), food prep and serving (2.7%), construction and extraction (4.9%), and protective services (6.8%). Not surprisingly, the occupations which do not work with sensitive information or manage others are significantly less likely to have signed noncompetes.

Figure 1: Proportion of Occupation Signing a Noncompete
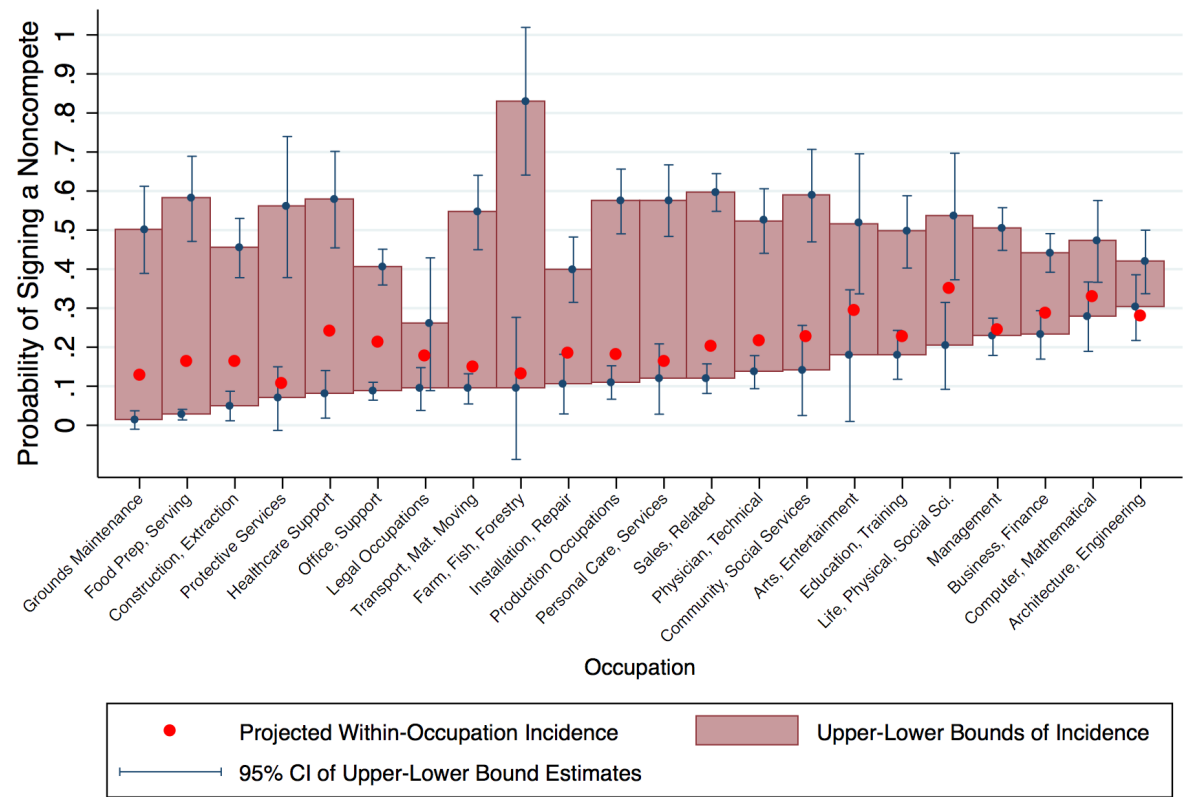
The upper-lower bounds of the incidence of noncompetes assume that those who don't know if they have signed a noncompete did and did not sign, respectively. The projections refer to within-occupation average of the projected proportion of noncompete signers.

As evidenced by the figure, the within-occupation projections tell a similar story as the lower bound. The exact lower bound and projections are given in Table 6. Column (1) provides the raw lower bound corresponding to Figure 1, while columns (2)-(6) provide occupation specific averages of the projections broken down by the individual's current noncompete status. Column (2) represents the overall average of the projections. The table shows three interesting patterns. First, the projections generally align in rank order with the data. Second, the projections of noncompete incidence from those who sign is much greater than those who have ever signed, which is greater than those who have heard, which is greater than those who haven't signed. This suggests that respondents tend to believe that their noncompete situation is common within their occupation. Third, the projections tend to be systematically larger than the incidence in the data. The estimates for arts and entertainment is only 17.8% from the data, but is 28.5% in the projections. Similarly, the estimate for office support is 21% in the projections but only 8.7% in the data. In every occupation, the projected incidence is above 11%. Given these differentials, we must ask which numbers are more reliable?

To get a better sense of why the projections differ from the data, Figure 2 shows histograms of the distribution of occupation projections by whether or not the respondent has currently signed a noncompete. The figure shows that about 50% of the non-signers projected that 0% of their occupation signs, whereas about 20% of signers projected that 100% of their occupation signs. To understand how the projections could diverge from the lower bound in the data, note that to get back the mean in the data one simple way would be for everybody who had never heard or did not sign to project that nobody in their occupation signs. If those who signed projected that 100% of their occupation signed, then the average projected incidence would match the lower bound in the data. Therefore, a positive difference between the projected incidence and the incidence in the data comes about from the non-signers making a non-zero projection.

So which numbers are more accurate? As we've noted above, the incidence in the data is likely biased downward because of the assumption that those who have never heard of noncompetes have not currently signed one. For the projection numbers to be more accurate, it must be that those who have not currently signed have information on the likely incidence in their occupation. We believe to that this is a reasonable assumption. Our optimism, however, is tempered by the mass point at 50%. If individuals who are unsure about the incidence in their occupation simply put

Table 6: Proportion Signed Noncompete by Occupation

| Occupation | In Data (1) | Projections | | | | |
		All (2)	Signed (3)	Ever Signed (4)	Heard (5)	Didn't Sign (6)
Architecture, Engineering	30.1	28.3	55.1	41.3	29.7	16.1
Computer, Mathematical	27.8	31.5	64.4	44.9	33.7	17.2
Business, Financial	23.1	29.2	58.9	44.0	32.0	19.8
Management	22.7	25.3	52.3	38.6	29.5	17.7
Life, Physical, Social Sci.	20.3	30.5	59.6	45.8	33.5	20.5
Education, Training	18.0	22.3	58.8	41.6	24.8	13.0
Arts, Entertainment	17.8	28.5	67.1	48.0	34.8	21.7
Community, Social Services	14.0	18.1	59.8	35.6	25.6	13.5
Physician, Technical	13.6	21.2	55.0	40.0	25.7	17.3
Sales, Related	11.9	20.6	62.1	43.8	27.3	16.5
Personal Care, Services	11.8	18.1	57.7	43.2	24.4	14.2
Production Occupations	11.0	18.2	66.2	42.2	24.3	12.4
Installation, Repair	10.5	19.3	64.7	38.1	21.3	12.6
Farm, Fish, Forestry	9.4	14.8	75.0	75.0	28.5	2.7
Legal Occupation	9.3	19.8	56.4	38.2	21.7	16.7
Transport, Mat. Moving	9.3	16.1	60.1	38.2	21.8	11.1
Office, Support	8.7	21.0	68.8	39.9	25.4	18.6
Healthcare Support	7.9	19.7	61.9	44.0	25.1	15.4
Protective Services	6.8	11.1	58.2	30.5	17.6	13.9
Construction, Extraction	4.9	16.2	49.5	24.1	18.6	16.1
Food Prep, Serving	2.7	15.6	45.4	25.2	17.8	14.6
Grounds Maintenance	1.3	12.1	51.6	18.2	13.4	12.0
Mean	12.3	20.4	59.7	39.6	25.3	15.9

Note: Column (1) gives the proportion of the occupation signing noncompetes as observed in the weighted data. Columns (2)-(6) provide the mean projections by occupation categories regarding the incidence of noncompetes in the respondent's occupation, according to the respondent's current noncompete status.

50%, then this will bias our estimates upward if the true incidence is less than 50%, which we believe is unlikely. Thus, we believe that the true incidence of noncompetes by occupation lies somewhere in between the projections and the estimated lower bound in the data.

To examine the extent to which these cross-occupation differences are driven by other factors such as education, income, and job characteristics, Table A10 in the Appendix shows a series of regressions in which successive controls are added. Managers are the omitted category. The table shows a number of interesting patterns. First, the difference in the incidence rate between managers and engineers, computer and mathematical, business and finance, and a few other occupations is never statistically significant. Second the addition of controls for 'legitimate business interests' in column (4) reduces the differences between occupations. This particular control measures whether or not the employee knows trade secrets, works with clients, or has access

Figure 2: Distribution of Occupation Incidence Projections
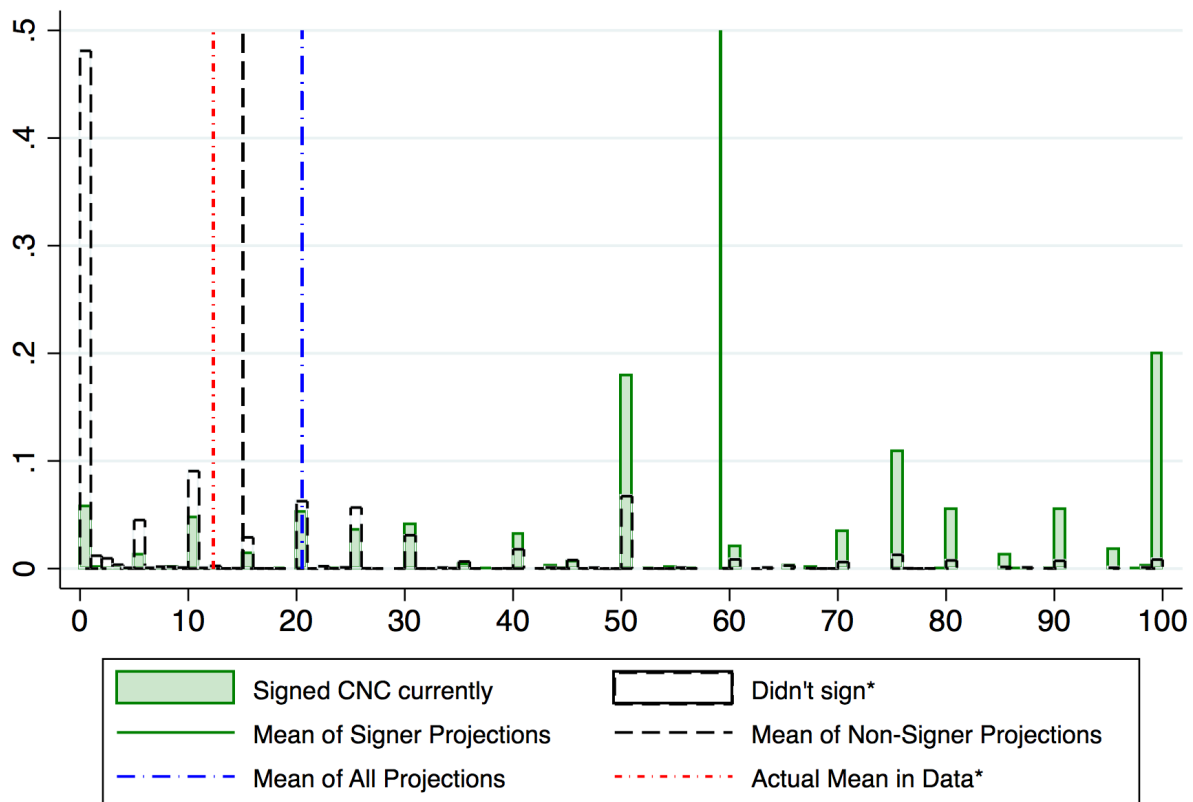
* Assumes that those who have never heard, can't remember, or don't want to say, have not signed CNCs.

to confidential client information. Similarly, controlling for industry appears to further explain cross-occupation differences in the incidence of noncompetes.

This section provides strong evidence that noncompetes are a regular feature in many occupations, but that there is significant heterogeneity. The fact that noncompetes are more prevalent in knowledge-intensive occupations suggests that employers are using noncompetes to prevent their sensitive information and clients from being coopted by competitors. Yet the existence of noncompetes for those in less knowledge intensive occupations is certainly non-zero. Indeed, the projections suggest that at least one in ten employees in every occupation is subject to a noncompete. Since low skill occupations are less likely to damage the employer by moving to a competitor, unless they move as a team, the employer is likely motivated to ask these employees to sign in order to save on turnover costs or reap benefits to training.

5.2   Earnings

To the extent that earnings reflect employee value to the employer, we would expect noncompetes to be utilized with more valuable employees. Figure 3 shows the range of the incidence of noncompetes and the 95% confidence interval on the upper and lower bounds by $20k annual compensation bins. We find that increases in income are associated with both signing noncompetes and with more awareness about noncompetes. The proportion that have never heard of noncompetes falls markedly from almost 50% for those earning less than $15k to around 10% for those earning more than $100k.

Figure 3: Earnings and Proportion Signing a Noncompete

The upper-lower bounds of the incidence of noncompetes assume that those who don't know if they have signed a noncompete did and did not sign, respectively.

Figure 3 also shows that the lower bound on the proportion of noncompete signers rises rapidly from 8% for those earning less than $15k per year to 45.8% for those earning over $150k per year. While there is less data for the higher income levels, the trend is strongly positive. Importantly,

however, the lower income respondents continue to sign noncompetes at relatively high rates. For example, the lower bound suggests that 8% of those earning $40k per year sign noncompetes.

To examine the strength of the relationship between income and noncompete incidence, Table 7 displays results from a regression of signing a noncompete on log annual income, controlling for various individual and job characteristics. The results show that income is a strong predictor of the incidence of noncompetes. Controlling for occupation, industry, whether the respondent works with trade secrets, clients, or has access to client-specific information, a one percent increase in income results in a 3.7 percentage point increase in the probability of signing a noncompete.

Table 7: Multivariate Analysis: Noncompete Incidence by Log Annual Income

	(1)	(2)	(3)	(4)	(5)	(6)
Log Annual Income	0.050***	0.053***	0.042***	0.039***	0.037***	0.037***
	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
Constant	-0.384***	-0.402***	-0.303***	-0.201**	-0.194*	-0.217*
	(0.078)	(0.075)	(0.086)	(0.097)	(0.115)	(0.114)
R-squared	0.028	0.029	0.053	0.073	0.082	0.091
Controls						
Gender	No	Yes	Yes	Yes	Yes	Yes
Education	No	No	Yes	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes	Yes
Industry	No	No	No	No	Yes	Yes
Business Interests	No	No	No	No	No	Yes

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors in parentheses, clustered at the state level. Results are from a linear probability model. The dependent variable is a dummy for signing a noncompete.

This evidence is consistent with the explanation for the occupation-specific incidence above in that those who create more value and can damage the employer more by joining a competitor are more likely to sign, but that even those earning relatively low annual incomes are still signing frequently.

5.3 Legitimate Business Interests

While the heterogeneity of the occupation and income results suggest that high earnings individuals are more likely to sign, we hypothesized that this was due to their knowledge and their ability to harm the employer if they were to leave. To understand better if the type of information the employee holds is really what predicts the use of the noncompete, we asked the employee directly

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if he works with clients, has client specific information, or works with some kind of trade secret because that sort of information is more likely to be legally protectable with a noncompete in many jurisdictions.

These categories were also developed to provide evidence on whether and to what extent noncompetes are employed in conjunction with the 'reasonableness criterion,' which many courts have adopted as the method of determining whether a noncompete should be enforced. This 'reasonableness criterion' stipulates that a necessary condition for the enforcement an employee's noncompete is that the employee's departure will harm the employer's legitimate business interests. Courts have traditionally defined these protectable interests as clients, trade secrets, and other sensitive information which is not generally known. With regard to clients, courts have often differentiated between their handling of cases in which the defendant works directly with clients and when the defendant has access to client lists or other client information (Malsberger et al., 2012; Garmaise, 2009).

Since the concept of legitimate business interests has never before been explored empirically, we begin by exploring the distribution of legitimate business interests across occupations in Table 8. The table shows for each occupation the proportion of respondents who report any combination of working with clients (WC), knowing client-specific information (CI), or working with Trade Secrets (TS). The overall distribution is given in the total row at the bottom, showing that 26.42% of all occupations do not have any of the legitimate business interests, 32.4% work with clients only, 11.2% work with clients and have client specific information, and 11.6% have all three business interests. The occupations which contain the highest proportion of all three business interests are management, business finance, computer and mathematical, architecture and engineering, and legal occupations.

Figure 4 plots the range of the incidence of noncompetes and the 95% confidence intervals on the upper and lower bounds by whether in their position they work directly with clients, have access to client lists or client specific information, or know trade secrets. Few of those who work with none of the protectable interests report signing noncompetes (lower bound 3%), though there is considerable uncertainty because many of these employees have never heard of noncompetes. Those who work only with clients have a lower bound of 9.1%, while those who only have client-specific information have a lower bound of 10.2%. The most striking pattern is

Table 8: Legitimate Business Interest Distribution by Occupation

	None	WC	CI	TS	WC, CI	WC, TS	CI, TS	WC, CI, TS
Management	12.99	26.85	4.42	10.49	7.42	5.11	6.49	26.23
Business, Finance	15.64	22.44	10.3	9.21	13.15	1.57	9.95	17.74
Computer, Mathematical	17.82	26.31	6.38	11.09	8.31	2.34	6.88	20.85
Architecture, Engineering	15.29	16.79	3.19	22.69	9.47	5.65	8.15	18.77
Life, Physical, Social Sci.	23.96	24.21	4.69	22.77	6.63	2.09	3.92	11.72
Community, Social Service	0.66	57.18	1.8	0.92	30.23	0.00	1.11	8.10
Legal Occupations	15.53	17.6	8.06	1.58	22.51	0.39	9.75	24.57
Education, Training	16.87	47.28	1.08	8.55	13.25	1.74	2.11	9.13
Arts, Entertainment	30.88	27.09	1.18	4.32	10.16	8.02	9.21	9.14
Physician, Technical	6.04	47.26	2.47	2.48	28.45	1.03	1.02	11.24
Healthcare Support	8.93	45.82	4.45	1.34	28.95	0.03	1.05	9.43
Protective Services	26.57	27.48	12.82	9.56	12.66	0.05	1.71	9.14
Food Prep, Serving	27.00	54.58	0.39	4.59	3.27	3.84	0.15	6.18
Grounds Maintenance	65.20	19.63	1.54	5.95	4.62	0.02	0.00	3.03
Personal Care, Services	16.07	52.32	2.22	1.01	23.25	0.62	0.24	4.26
Sales, Related	22.87	50.37	1.26	3.38	6.75	2.91	0.66	11.8
Office, Support	19.67	22.07	16.79	3.83	17.81	1.45	5.21	13.17
Farm, Fish, Forestry	55.95	11.36	13.82	9.43	0.00	0.00	0.00	9.44
Construction, Extract	41.21	30.47	6.14	4.43	5.29	2.05	0.00	10.41
Installation, Repair	38.87	33.98	1.59	8.39	3.14	3.00	1.82	9.21
Production Occupations	57.72	5.40	4.58	20.5	2.56	1.56	3.5	4.17
Transport, Mat. Moving	42.54	23.58	7.92	8.49	6.02	1.95	3.09	6.41
Total	26.42	32.37	5.82	7.12	11.17	2.25	3.22	11.64

Note: The numbers represent row percentages. 'WC' stands for work with clients. 'CI' stands for Client Information. 'TS' stands for Trade Secret.

that those who work with trade secrets are dramatically more likely to sign noncompetes: at least 24% for those who only work with trade secrets and at least 30.4% for those who work with all three protectable interests sign noncompetes. This indicates that at least to some extent employer demanded restrictions are commensurate with the underlying legal enforcement regimes in most states.

To examine the stability of the relationship depicted in Figure 4, Table 9 regresses a dummy for signing a noncompete on indicators for working with clients (WC), having client specific information (CI), and working with trade secrets (TS). The omitted category is working with none of the legitimate business interests. The results show remarkable consistency across the specifications. All of the point estimates fall as controls are added, though most of them only marginally. The variable most correlated with the legitimate interests is education, as shown by the drop in the coefficients from column (2) to column (3).

Figure 4: Legitimate Business Interest vs Signing a Noncompete

The upper-lower bounds of the incidence of noncompetes assume that those who don't know if they have signed a noncompete did and did not sign, respectively. WC stands for 'Works directly with clients', CI stands for 'Access to client lists or information', TS stands for 'Knowledge of Trade Secrets.'

Are businesses more likely to use noncompetes in occupations which require obtaining more valuable information or assets? Yes, particularly when the occupational duties involve learning trade secrets. This significant heterogeneity is suggestive of the fact that employers use noncompetes in order to protect themselves from losing valuable information to their competitors.

5.4   Poaching Rates and Sensitive Information

Though employees of all types sign noncompetes, the incidence of noncompetes by occupation, income, and protectable interest all suggest that the dominant reason employers use noncompetes is to protect themselves from damages if the employee were to leave for competitors. To examine more directly whether or not employers are trying to protect their confidential information from competitors, we examine how the use of noncompetes varies by the poaching rate of the industry.[22]

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[22]As a result of such protection, employers may have incentives to invest in training and information sharing. We examine these in detail in Section 6.

Table 9: Multivariate Analysis: Noncompete Incidence by Protectable Interest

Business Interest	(1)	(2)	(3)	(4)	(5)	(6)
WC	0.060***	0.063***	0.055***	0.051***	0.051***	0.050***
	(0.010)	(0.009)	(0.010)	(0.011)	(0.010)	(0.009)
CI	0.071***	0.064***	0.055***	0.063***	0.058***	0.060***
	(0.019)	(0.020)	(0.019)	(0.022)	(0.021)	(0.020)
TS	0.217***	0.197***	0.186***	0.173***	0.173***	0.169***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.032)	(0.031)
WC, CI	0.099***	0.095***	0.074***	0.077***	0.070***	0.073***
	(0.021)	(0.021)	(0.021)	(0.020)	(0.020)	(0.019)
WC, TS	0.198***	0.186***	0.178***	0.164***	0.173***	0.175***
	(0.060)	(0.059)	(0.057)	(0.058)	(0.055)	(0.055)
CI, TS	0.199***	0.176***	0.151***	0.137***	0.133***	0.133***
	(0.021)	(0.020)	(0.020)	(0.022)	(0.022)	(0.020)
WC, CI, TS	0.274***	0.252***	0.235***	0.227***	0.222***	0.220***
	(0.018)	(0.021)	(0.022)	(0.019)	(0.020)	(0.018)
Constant	0.031***	-0.299***	-0.196**	-0.155	-0.138	-0.152
	(0.005)	(0.075)	(0.087)	(0.093)	(0.109)	(0.109)
R-squared	0.076	0.087	0.103	0.116	0.123	0.130
Controls						
Log Annual Income	No	Yes	Yes	Yes	Yes	Yes
Education	No	No	Yes	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes	Yes
Industry	No	No	No	No	Yes	Yes
Estab/Firm Size	No	No	No	No	No	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses, clustered at the state level. Results are from a linear probability model. The dependent variable is a dummy for signing a noncompete. The omitted category is not working with any of the legitimate business interests. 'WC' stands for work with clients. 'CI' stands for Client Information. 'TS' stands for Trade Secret.

According to the expropriation rationale described above, the choice to use a noncompete depends upon both what the employee knows and how frequently employees are poached by competitors. Below we examine directly whether or not individuals who have valuable information and are in high frequency poaching industries are more likely to sign noncompetes.

Poaching rates were gauged by three questions asking how often the respondent's employer poaches, how often employees leave the employer for a competitor, and how frequently employees move between competitors in the industry in general. Table A12 in the Appendix shows summary statistics for the three poaching measures. About half of the sample report that poaching occurs less than or equal to once a year. About 10% of the sample reports being in an industry where

poaching occurs a few times a month or more. Table A11 in the Appendix shows the distribution of poaching rates by industry. The table shows that there is surprisingly little variation across industries in poaching rates, with most respondents reporting poaching of less than once per year or a few times per year.

For our purposes, we are interested in how frequently an employee is poached from the employer. Figure 5 plots the range of noncompete signers and the 95% confidence intervals around the upper and lower bounds of the range. The bivariate plot shows that the noncompete incidence does not strongly covary with poaching frequency. For example, in industries where employees are poached less than once a year, the lower bound on the incidence of noncompetes is 10.41%, while in industries where employees are poached once a week of more, the lower bound on the incidence is 12.8%. The numbers are similar for the two other measures of poaching frequency.

Figure 5: Poaching Rates vs Signing a Noncompete
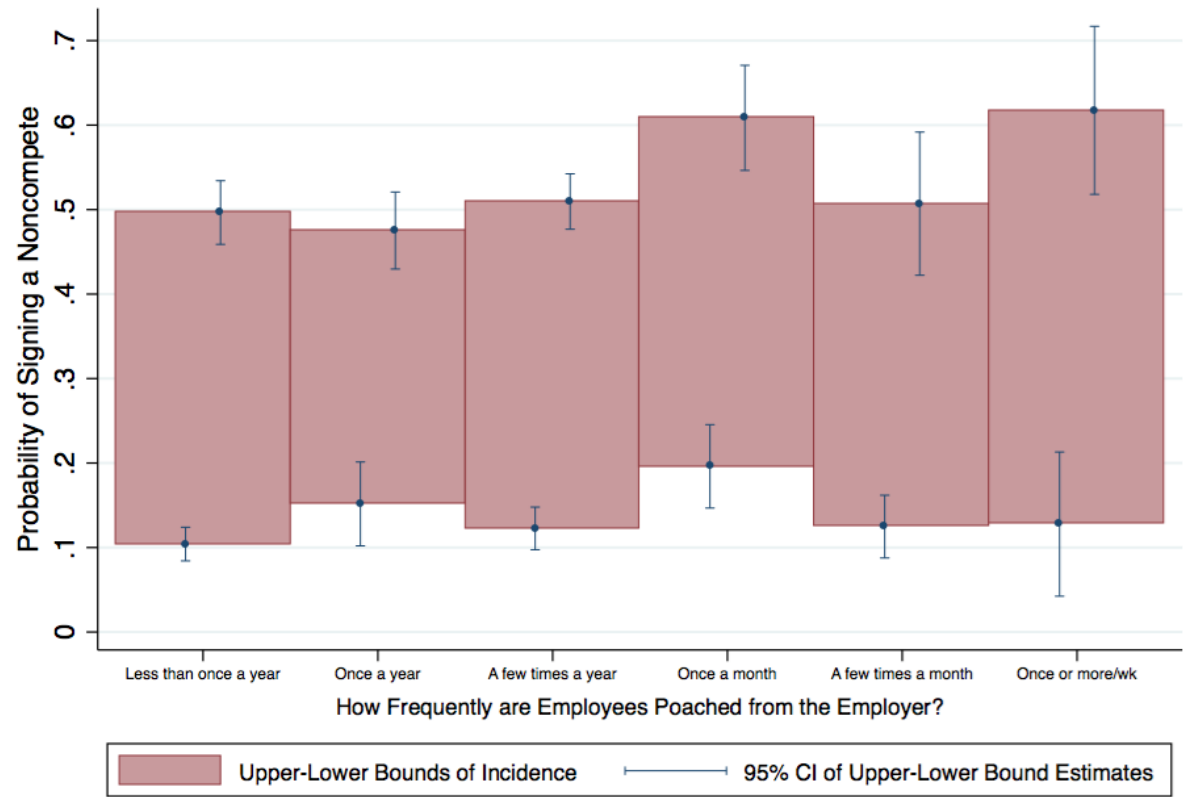
The upper-lower bounds of the incidence of noncompetes assume that those who don't know if they have signed a noncompete did and did not sign, respectively. WC stands for 'Works directly with clients', CI stands for 'Access to client lists or information', TS stands for 'Knowledge of Trade Secrets.'

The lack of a correlation between noncompete incidence and poaching frequency does not necessarily imply that employers are not motivated to protect their sensitive information from competitors. Indeed, employers may not necessarily care if employees with little or no information are poached with great frequency. The theory predicts that employers will use noncompetes more frequently in occupations that both have sensitive information and have a higher chance of being poached. To test this interaction, we define high poaching industries to be ones in which employees are poached at a frequency greater than 'less than once a year'. To define occupations which have sensitive information, we use both the legitimate business interests discussed earlier and a dummy for a high earning individual ($> \$50k$). We then regress a dummy for signing a noncompete on a dummy for poaching frequency, dummies for holding sensitive information, their interaction, and controls for employer size. The results are presented in Table 10.

Table 10 shows that individuals that hold sensitive information, whether measured by earning more than \$50k in annual compensation (columns 2-4) or measured by the type of confidential information the employee possesses (columns 5-6), are no more likely to sign noncompetes if they are in a high frequency poaching industry. The lack of correlation between noncompete incidence on poaching frequency for high income earners may be due to the fact that poaching rates are not exogenous. Indeed, the use of noncompetes in an industry may have the effect of reducing poaching rates. As a result, it would not be surprising that noncompetes are found frequently in industries with both high and low poaching rates. Alternatively, the lack of a significant interaction could indicate that we have measured poaching rates poorly, that employers may be wary of an individual being poached even though little poaching exists in an industry (which may be due to the use of noncompetes in the first place), or that employers have other motives for asking employees to sign noncompetes.

5.5   The Use of Noncompetes and Noncompete Enforceability

Lastly, in order to shed new light on the debate over noncompete enforcement policies, we analyze how a state's noncompete policy relates to the incidence of noncompetes. States vary substantially in their noncompete enforcement policies (Bishara 2011, Garmaise 2011, Malsberger 2011). To the extent that employers may actually want to take advantage of their state's noncompete enforcement policy, higher enforcement policies should be positively correlated with the incidence of

Table 10: Noncompete Incidence by Poaching Rates and Sensitive Information

	(1)	(2)	(3)	(4)	(5)	(6)
Poach	0.033**	0.019	0.021	0.015	0.016	0.004
	(0.014)	(0.018)	(0.017)	(0.019)	(0.010)	(0.012)
High Income		0.135***	0.129***	0.126***		
		(0.013)	(0.023)	(0.024)		
Poach*High Income			0.013	0.014		
			(0.028)	(0.029)		
Poach*WC					-0.002	-0.002
					(0.024)	(0.024)
Poach*CI					0.024	0.023
					(0.056)	(0.055)
Poach*TS					-0.130**	-0.127**
					(0.062)	(0.063)
Poach*WC,CI					0.087**	0.085**
					(0.039)	(0.040)
Poach*WC, TS					0.025	0.024
					(0.071)	(0.072)
Poach*CI,TS					0.093	0.094
					(0.061)	(0.062)
Poach*WC,CI,TS					0.046	0.045
					(0.047)	(0.048)
Constant	0.104***	0.061***	0.073***	0.063***	0.022***	-0.003
	(0.010)	(0.013)	(0.010)	(0.013)	(0.006)	(0.013)
R-squared	0.002	0.038	0.037	0.038	0.083	0.086
Controls						
Business Interest (WC, CI, TS)	No	No	No	No	Yes	Yes
Employer Size	No	Yes	No	Yes	No	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses, clustered at the state level. Results are from a linear probability model. The dependent variable is a dummy for signing a noncompete. The variable 'Poach' refers to industries in which poaching rates are more than 'less than once a year.' The variable 'High Income' refers to individuals who earn more than $50k in annual compensation. For the legitimate business interests, the omitted category is not working with any of the legitimate business interests. 'WC' stands for work with clients. 'CI' stands for Client Information. 'TS' stands for Trade Secret.

noncompete utilization. Figure 6 shows the range of noncompete incidence noncompete by state, sorted by noncompete enforcement score. This figure shows that the incidence of noncompetes ranges from a low of 2.8% in North Dakota (which does not enforce noncompetes) to almost 30% in Alaska.

Figure 6: Proportion of State Signing a Noncompete

Upper-Lower Bound on the Incidence of Noncompetes
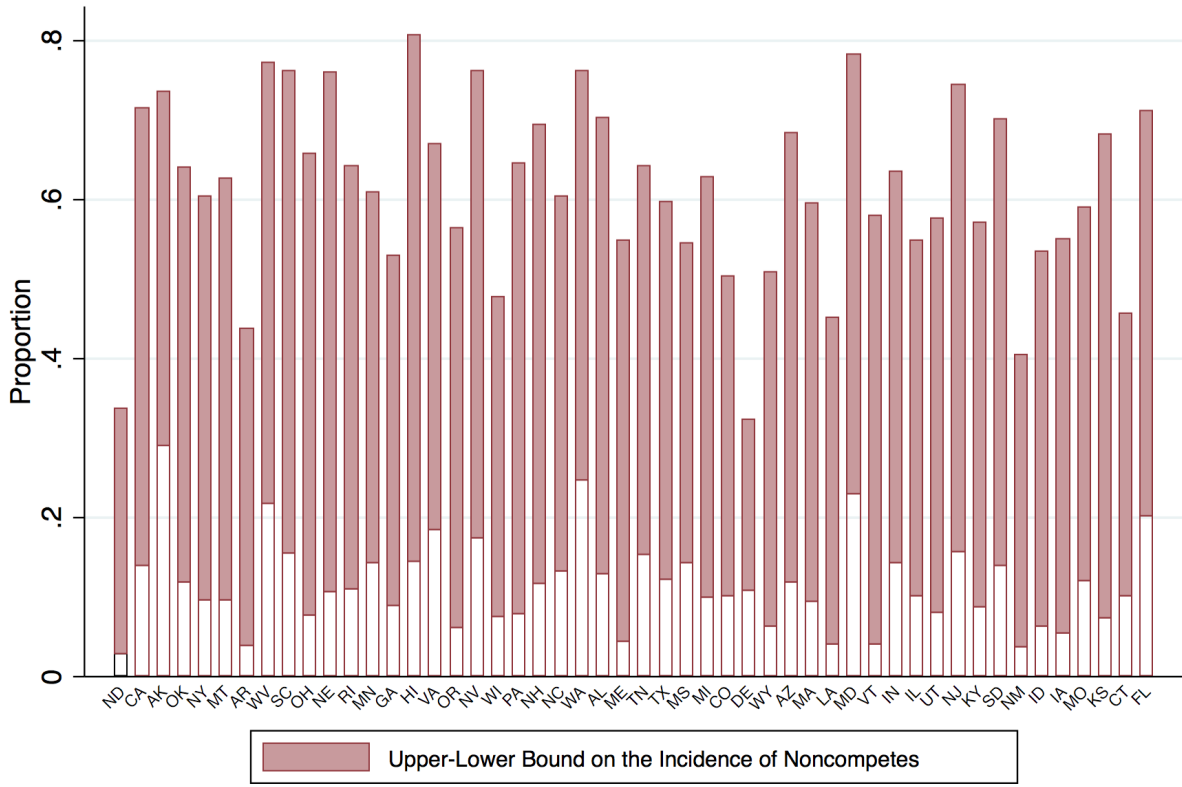
States are ordered by noncompete enforcement score, from lowest to highest, based on the Starr (2014) measure of enforcement.

California, despite its virtual ban on employee noncompetes, still has a higher than average incidence of noncompetes: 13.93%. Even in single unit employers, the lower bound on the incidence in California is 9.9%. The industries in which noncompetes are most frequently found in California, based on the lower bound, are manufacturing (21.8%), information (24.5%), and professional and scientific (20.1%). The use of these contracts despite California's ban suggests that employers have alternative motives for requiring noncompetes. Multi-state employers could hope to try any particular noncompete case with another state's law using a choice of law forum, but this does not explain the high incidence even for single unit employers. An alternative interpretation is that California employers are simply hoping the employees abide by them and are, essentially, knowingly entering unenforceable agreements to create an *in terrorem* effect to chill employee mobility. Another explanation is that California employers do not know their own state law on this point. This could be perhaps out of an abundance of caution on the remote chance that

state policy changes in the future or that having an employee sign a noncompete is a further acknowledgement of the employer's confidential information and trade secrets.

To see if overall employers are responding to the state's noncompete enforcement policy, Table 11 regresses a noncompete dummy on the state's enforcement score. The noncompete enforcement level reflects the state's underlying enforcement policies as characterized initially in Bishara (2011) and further refined in Starr (2014). The unconditional slope of the enforcement-incidence relationship is 0.001 with a standard error of 0.006. The relationship between enforcement and the incidence of noncompetes becomes statistically significant after controlling for more variables. Increasing noncompete enforcement by one standard deviation results in a increase of about 1 percentage point. As a result, a state with a high enforcement law like Florida is about 5 percentage points more likely to ask employees to sign noncompetes than with a law like California's. Thus it appears that the state's particular policy does incentivize employers to use noncompetes. The explanatory power of noncompete enforceability is so small, however, that these results inevitably suggest that firms are using noncompetes for other reasons than to enforce them.

Table 11: Multivariate Analysis: Noncompete Incidence by State Noncompete Enforceability

	(1)	(2)	(3)	(4)	(5)	(6)
Noncompete Enforceability	0.000	0.005	0.009**	0.010**	0.010***	0.009**
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Constant	0.123***	-0.390***	-0.298***	-0.203**	-0.191	-0.148
	(0.008)	(0.077)	(0.088)	(0.096)	(0.116)	(0.109)
R-squared	0.000	0.029	0.054	0.074	0.083	0.125
Controls						
Income FE	No	Yes	Yes	Yes	Yes	Yes
Education	No	No	Yes	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes	Yes
Industry	No	No	No	No	Yes	Yes
Business Interests	No	No	No	No	No	Yes

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors in parentheses, clustered at the state level. Results are from a linear probability model. The dependent variable is a dummy for signing a noncompete. The measure of noncompete enforceability is taken from Starr (2015).

6 Noncompetes and Labor Market Outcomes

The result that noncompetes are found more frequently in higher skill, higher earning jobs and in jobs that require learning trade secrets or working with clients suggests that employers use noncompetes in order to protect their sensitive information from competitors. Yet the results also show that noncompetes are prevalent in occupations without sensitive information or high earnings. Noncompetes may be used in these occupations to save on turnover costs, to increase the return to training or information, or for some other reason such as contract homogeneity or to discourage groups of individuals from leaving. In this section we examine whether or not noncompetes are associated with the outcomes predicted by the theory.

6.1 Competitor Reservation Wage

To fundamental effect of a noncompete is to create a legal barrier between an employee and competing firms. If noncompetes indeed impose temporal and litigation costs in expectation for moves to competitors, then noncompetes should raise the reservation wage required for a move to a competitor. The distribution of competitor reservation wage by noncompete signing status is provided in Figure 7. It shows primarily that individuals who sign noncompetes are less willing to accept low wage increases to move to a competitor. To test whether or not noncompetes divert employees from competitors, we take two approaches: First, we examine whether or not noncompetes increase the probability that a respondent reports that he will never leave for a competitor. The results are shown in Panel A of 12. They show that noncompetes are associated with a 5 percentage point increase in the probability tha an individual reports that they will never leave for a competitor. This result implies that individuals who sign noncompetes feel completely obligated to abide them, or it could signify that the employee-employer match is excellent. Second, among those who report that they are willing to leave, we regress the log of the respondent's reported minimum percentage wage increase required for them to move to a competitor on a dummy for signing a noncompete and a variety of individual and firm level controls. Panel B of Table 12 reports the results of this regression, while including various controls. The regressions show that holding constant an individual's occupation and industry, income, education, and class,

signing a noncompete is associated with on average a 17% increase in the required minimum percentage wage increase to move to a competitor.

Figure 7: Distribution of Competitor's Reservation Wage

kernel = epanechnikov, bandwidth = 2.0000
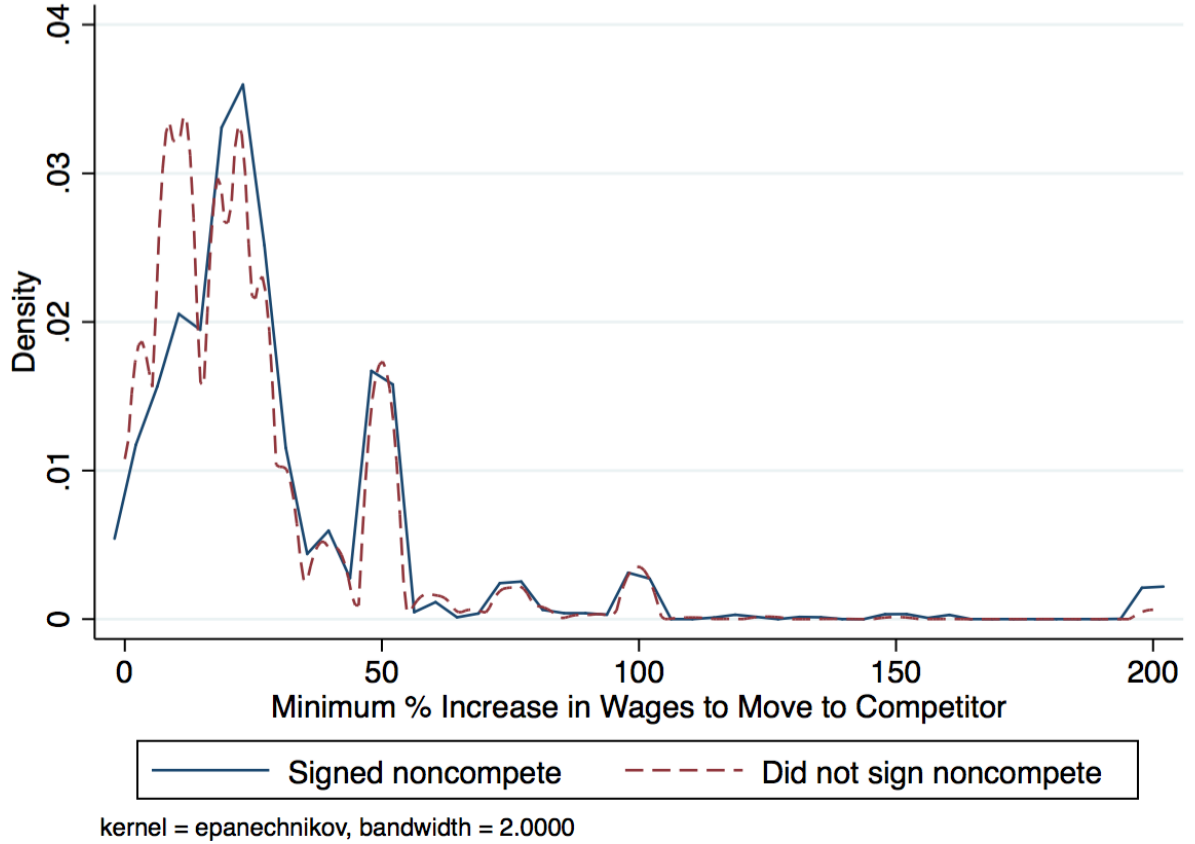
Taken together these results suggest that noncompetes indeed serve to increase the reservation wage of the individual when faced with thepossibility of joining a competitor. As a result, noncompetes may successfully divert individuals from joining competitors post employment.

6.2 Employment Duration?

Given that noncompetes raise an employee's competitor specific reservation wage, in this section we consider whether or not the mere presence of a noncompete extends employment duration. Theoretically, given an arrival rate of competitors and non-competitors, an increase in the competitor-specific reservation wage will increase the expected duration of the current employment spell. Figure 8 shows an unconditional kernel density plot of the weighted distribution of tenure

### Table 12: Competitor Reservation Wages and Noncompetes

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Will Never Leave For A Competitor						
Signed Noncompete	0.038*	0.056***	0.056***	0.054***	0.055**	0.051**
	(0.022)	(0.021)	(0.021)	(0.020)	(0.021)	(0.020)
Constant	0.081***	0.119***	0.137**	0.116**	-0.033	0.046
	(0.005)	(0.040)	(0.053)	(0.057)	(0.128)	(0.048)
R-squared	0.002	0.018	0.018	0.025	0.030	0.110
Panel B: Log Minimum % Wage Increase to Join Competitor, for those Willing to Leave						
Signed Noncompete	0.200***	0.183**	0.200***	0.196**	0.190***	0.169**
	(0.074)	(0.073)	(0.073)	(0.074)	(0.071)	(0.064)
Constant	2.905***	2.740***	3.196***	3.518***	3.997***	3.634***
	(0.027)	(0.135)	(0.262)	(0.349)	(0.385)	(0.277)
R-squared	0.004	0.009	0.011	0.023	0.030	0.108
Controls						
Employee Class	No	Yes	Yes	Yes	Yes	Yes
Education FE	No	Yes	Yes	Yes	Yes	Yes
Income	No	No	Yes	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes	No
Industry	No	No	No	No	Yes	No
Occ-Industry FE	No	No	No	No	No	Yes
Estab/Firm Size	No	No	No	No	No	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses, clustered at the state level. The dependent variable is the minimum percentage increase in annual earnings to move to a competitor, all else equal. The sample is limited to those who required at most a 3 fold increase in their current job in order to join a competitor.

by noncompete status. The data show that noncompetes are associated with fewer individuals just starting their jobs and more individuals staying in years 4 to 6.

To test whether or not the differences observed in Figure 8 are significant, and to control for other occupation and industry specific effects, we run a series of linear probability models of the following form $P(Tenure_{joik} > X) = \beta_0 + \beta_1 Noncompete_j + \gamma X_{jk}\omega_{oi} + \epsilon_{joik}$, where ω_{oi} are occupation by industry fixed effects, j indexes the individual, and k indexes the firm. Included in X_{jk} are controls for firm size, dummies for the protectable interests, gender, education, age, sector (for-profit, not-for profit), hours worked per week, and weeks worked per year This particular specification describes how noncompetes shift the distribution of observed tenure, net of occupation and industry effects. Figure 9 shows the results of these regressions.

Figure 8: Kernel Density Plot of Tenure by Noncompete Status

kernel = epanechnikov, bandwidth = 0.4664
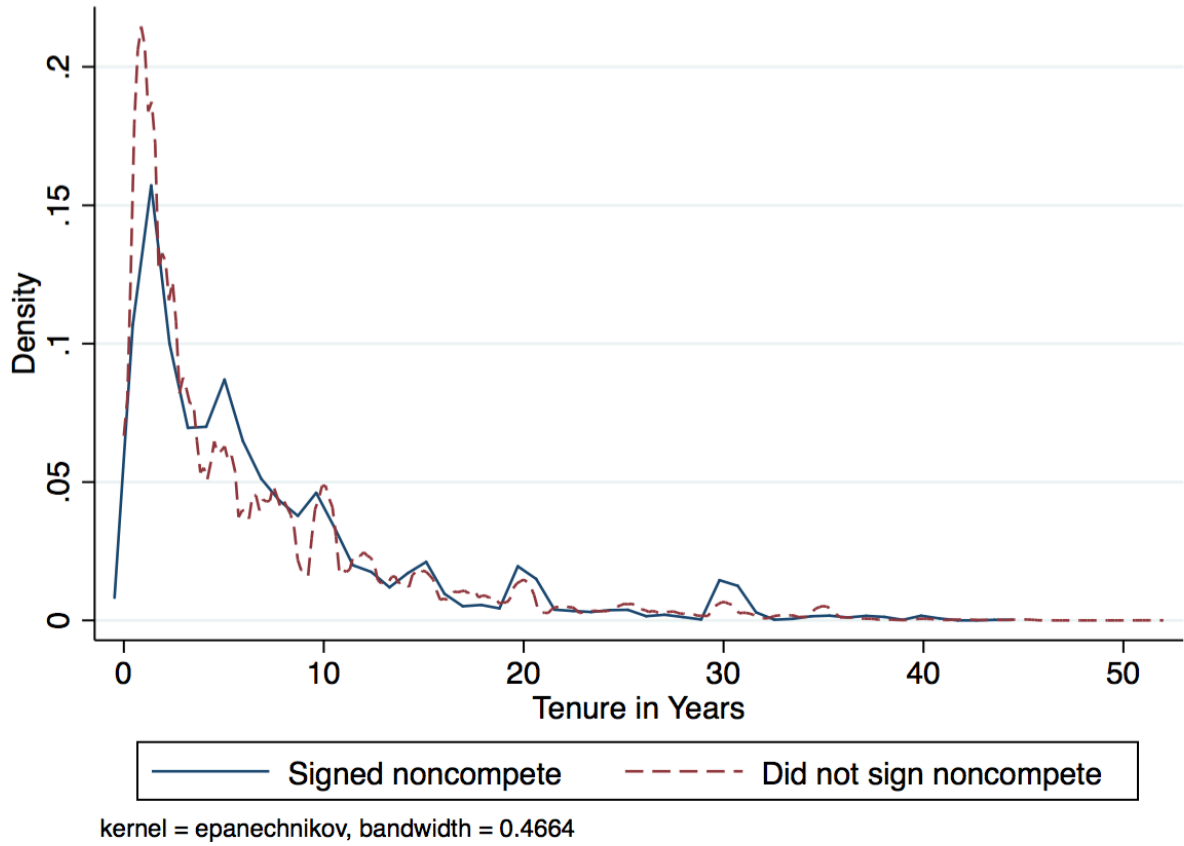
As suggested by the unconditional kernel density plots, Figure 9 shows that noncompetes are associated with increased retention in the beginning of an employee's tenure but show no association past year 6. In particular, noncompetes are associated with a 2.8 percentage point increase in staying beyond the first year, a 7.7 percentage point increase of staying beyond the 4th year (a 15% increase, given that 51.% of the sample have tenures above four years), and a 7.2 percentage point increase in staying beyond the 5th year (15.6% increase).

6.3 Training

Since noncompetes increase expected employment duration and divert individuals away from joining competitors, then employers have additional incentives to invest in and share information with their employees. To study the relationship between noncompetes and training, we asked respondents if they were promised training, if their employer formalized this training promise

Figure 9: Noncompetes and Tenure
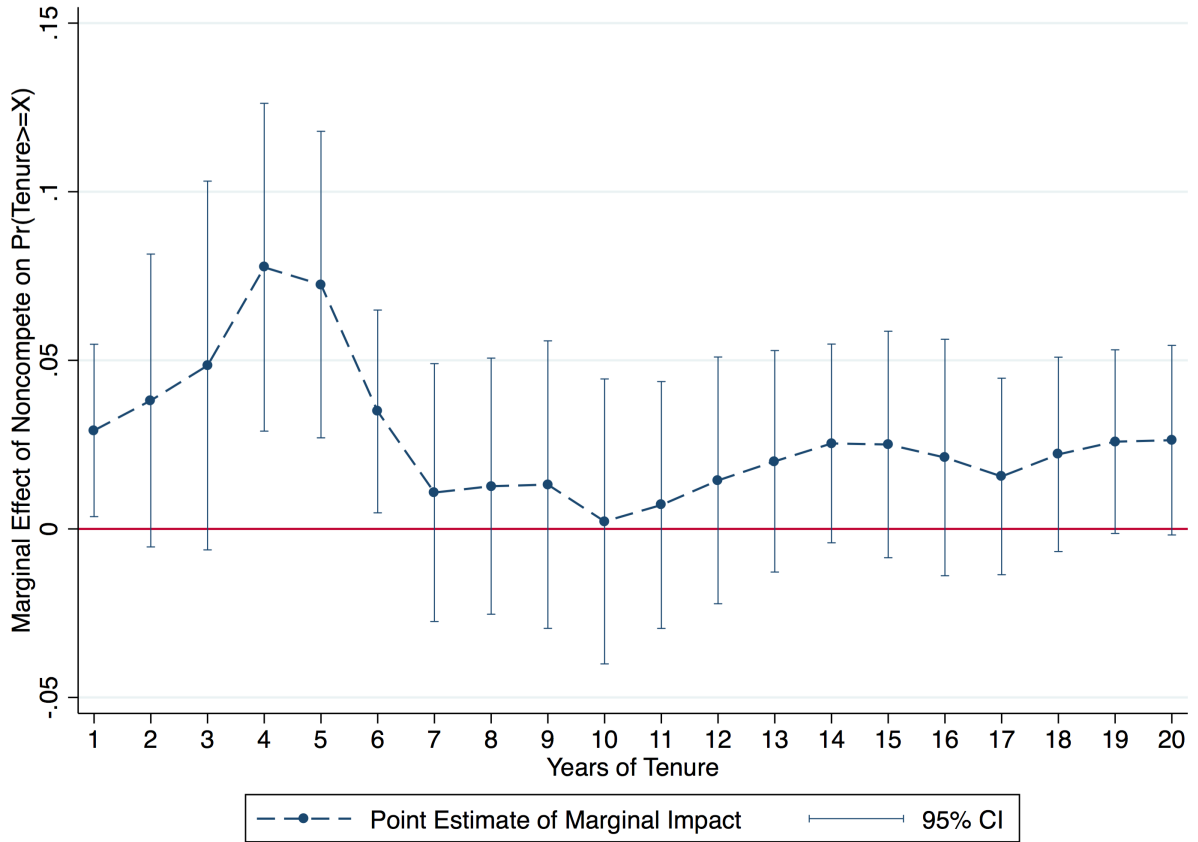
in the form of a training contract, and how recently they received formal or informal training provided by their employer. Overall, 71.4% of individuals reported they were promised training, only 28.6% report their employer using a training contract, and 43.8% report receiving training in the last year.

Table 13 examines whether or not signing a noncompete is associated with an increased probability of the employer promising training, the employer using a training contract, and the employee receiving training in the last year. Column (1) of Panel A shows that 70.2% of those who do not sign noncompetes are promised training, while those who sign noncompetes have a 9.9 percentage point greater chance of being promised training. Columns (2)-(6) show that this difference is robust to controlling for employee class, education, log income, occupation by industry fixed effects, and employer size. Panel B shows that 26.7% of those who do not sign noncompetes use training contracts, while those who sign noncompetes have a 13.5 percentage point higher

probability of using a training contract. Again, columns (2)-(6) show that this difference is both stable and statistically significantly different when controlling for various employee and employer characteristics. Panel C shows that those who sign noncompetes are also between 5.8 and 14.4 percentage points more likely to report receiving training paid for by their employer.

Column (1) of panel D of Table13 shows that those who sign noncompetes are 5.7 percentage points more likely to agree or strongly agree with the statement that their employer shares all work-related information with them, unconditional on other covariates. Columns (2)-(6) show, however, that controlling for education and other individual characteristics causes the coefficient to fall and become statistically insignificant. It is unclear what we should take away from these results: An inherent difficulty in having employees answer this question is that it can be difficult for employees to answer this question if they do not know that the employer is withholding information. Empirical evidence from the employer's perspective would be helpful in clarifying this relationship.

From these cross-sectional comparisons, we observe that noncompetes are associated with additional promises and contracts to provide training, and indeed more observed employee-focused investments, even after controlling for a host of employee level and employer level controls. We do not find statistically significant associations between noncompetes and information sharing, but this may be due to a lack of employee awareness. Of course we should hesitate to interpret these results causally. If workers sign noncompetes only because they are promised additional training then these estimates suffer from simultaneity bias. Nevertheless, these findings support the contention that the additional retention or post-employment diversion effects of noncompetes encourages employers to invest more in and potentially share more information with their employees.

6.4 Negotiation, Wages, and the Return to Tenure

Noncompetes may affect wages in a myriad of ways. First, the existence of a noncompete allows employers to avoid, to some extent, labor market competition among competitors. This effect may be exaggerated if workers respond endogenously to the noncompete by reducing their on-the-job search effort. As a result, noncompetes by themselves are likely to reduce wage growth. Second, if there were perfect competition at the hiring stage and zero transaction costs, workers

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Employer Promised Training?						
Signed Noncompete	0.099***	0.116***	0.112***	0.106***	0.105***	0.095***
	(0.027)	(0.025)	(0.023)	(0.021)	(0.023)	(0.023)
Constant	0.702***	0.688***	0.572***	0.501***	0.632***	0.876***
	(0.010)	(0.056)	(0.145)	(0.166)	(0.200)	(0.166)
R-squared	0.005	0.014	0.015	0.056	0.067	0.162
Panel B: Employer Used Training Contract?						
Signed Noncompete	0.135***	0.141***	0.138***	0.129***	0.129***	0.126***
	(0.025)	(0.026)	(0.027)	(0.029)	(0.028)	(0.025)
Constant	0.267***	0.330***	0.221*	0.236*	0.341*	0.160
	(0.008)	(0.064)	(0.113)	(0.136)	(0.182)	(0.163)
R-squared	0.011	0.015	0.016	0.036	0.044	0.164
Panel C: Employee Reports Receiving Formal or Informal Training in Last Year?						
Signed Noncompete	0.144***	0.112***	0.092***	0.086***	0.078***	0.058**
	(0.023)	(0.025)	(0.025)	(0.022)	(0.023)	(0.024)
Constant	0.420***	0.339***	-0.201**	-0.196*	-0.116	-0.161
	(0.013)	(0.045)	(0.094)	(0.117)	(0.165)	(0.105)
R-squared	0.009	0.032	0.044	0.061	0.074	0.162
Panel D: Employee Agrees/Strongly Agrees Employer Shares All Work-Related Information						
Signed Noncompete	0.057*	0.044	0.031	0.024	0.024	0.040
	(0.032)	(0.030)	(0.032)	(0.032)	(0.033)	(0.033)
Constant	0.540***	0.532***	0.200*	0.463***	0.757***	0.384***
	(0.011)	(0.047)	(0.100)	(0.116)	(0.177)	(0.106)
R-squared	0.001	0.005	0.010	0.028	0.040	0.117
Controls						
Employee Class	No	Yes	Yes	Yes	Yes	Yes
Education FE	No	Yes	Yes	Yes	Yes	Yes
Income	No	No	Yes	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes	No
Industry	No	No	No	No	Yes	No
Occ-Industry FE	No	No	No	No	No	Yes
Estab/Firm Size	No	No	No	No	No	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses, clustered at the state level. Results are from a linear probability model. The dependent variable in *Panel A* is a dummy for the employer promising training to the employee. In *Panel B* the dependent variable is a dummy for the employer using a training contract.

would not agree to a noncompete unless they received increased compensation commensurate with the net present value of their utility without the noncompete. Third, the relationship between noncompetes and training described above has wage implications if training increases productivity and productivity is tied to wages.[23] The net effect of noncompetes on wages is ambiguous.

To examine the extent of bargaining over noncompetes, we asked individuals in the survey if they bargained over their noncompete and, if not, why not. The results, tabulated by various worker characteristics, are presented in Table 6.4. Overall, only 10.2% of employees who signed noncompetes report bargaining over it. The decision to bargain over the noncompete is strongly related to the context in which the employee was asked to sign the noncompete: 33% of individuals who were asked to sign a noncompete as part of a promotion or merit raise were willing to negotiate, whereas only 6-7% of employees were willing to negotiate when the noncompete request did not accompany a promotion or raise. The choice to negotiate was also strongly related to whether or not the employee had an outside offer at the time he was asked to sign, which may have also driven promotion decisions. Of the employees who had no outside offers when they were asked to sign the noncompete, only 6% attempted to bargain over the noncompete. Of the employees with at least one outside offer, 20% attempted to bargain over the noncompete. Furthermore, more educated individuals are more likely to negotiate and men are significantly more likely to negotiate.

The finding that relatively few individuals bargain over their noncompete does not necessarily signify that employers aren't paying for benefits in exchange for signing. It signifies that employees are not necessarily unhappy enough with the contract to bargain over it. Thus it could be, for example, that employers offer a built-in wage premium for signing a noncompete, or that employers pay for additional training in exchange for signing and no additional bargaining is required. Indeed, when asked why they did not bargain, more than 50% of individuals said they thought the terms were reasonable. Many others, however, either assumed that they could not bargain (40%) or were worried about getting fired or creating tension in the employer (20%). An additional reason individuals may not bargain over the noncompete is because they are not necessarily aware of the

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[23]Training may not be the sole choice of the employer, as in the classic model Becker (1962) and the full-competition model of Acemoglu and Pischke (1999), where employers compete for workers using wage-training contracts. Recent evidence from Starr (2015) and Dustmann and Schönberg (2012) suggest that much training is, however, not contractible.

Table 14: Noncompete Negotiation

What Did You Do When Asked to Sign?	%
Signed without reading	7.2
Read it quickly	32.6
Read it slowly	54.8
Consulted friends or family	10.1
Sought legal advice	7.5

	Negotiate over Noncompete?	
	Yes	No
When Were You Asked to Sign?		
Before accepted job (%)	7.64	92.36
After accepted job (%)	6.33	93.67
Before promotion, raise, or increase in responsibilities (%)	32.86	67.14
Have Outside Offers at the Time?		
Yes (%)	19.93	80.07
No (%)	5.97	94.03
Education		
Less than a Bachelor's Degree (%)	7.22	92.78
Bachelor's Degree (%)	11.28	88.72
More than a Bachelor's Degree (%)	16.02	83.98
Gender		
Male (%)	13.33	86.67
Female (%)	6.28	93.72
Overall (%)	10.22	89.78

If No, Why Not Negotiate?	%
Was Reasonable	50.5
Assume Couldn't	40.4
Fired	22.9
Create Tension	20.2
Employer Wouldn't Sue	7.0
Court Wouldn't Enforce	5.3
Other	5.1

noncompete or its terms: When asked how carefully they read the noncompete before agreeing to it, 7% report signing without reading, 33 % read it quickly, 55% said they read it slowly, 10% said they consulted friends or family before signing, and 8% reported consulting a lawyer. Given the social desirability bias to appear thoughtful, we believe these estimates are likely biased upwards,

thus suggesting that even fewer employees take the time and effort to adequately comprehend what future rights and freedom of mobility they are giving up. Still, the data suggest that over 40% of individuals read the contract quickly or not at all. Taken together, these results about the negotiating behavior of employees do not strongly suggest that supply side constraints will affect the wages that employers offer.

To examine whether noncompetes are associated with the wage-tenure relationship, we regress wages on a noncompete dummy, a quartic in tenure, and an interaction between the noncompete dummy and the tenure polynomial. We include occupation by industry fixed effects and controls including a third degree polynomial in hours worked per week, age, and weeks worked per year, and indicators for employer size, multi unit employer, worker class, education, gender, and the type of information the employee works with. The standard errors are clustered at the state level. The mean predicted values for various levels of tenure are shown in Figure 10.

Figure 10: Noncompetes and the Return to Tenure

46
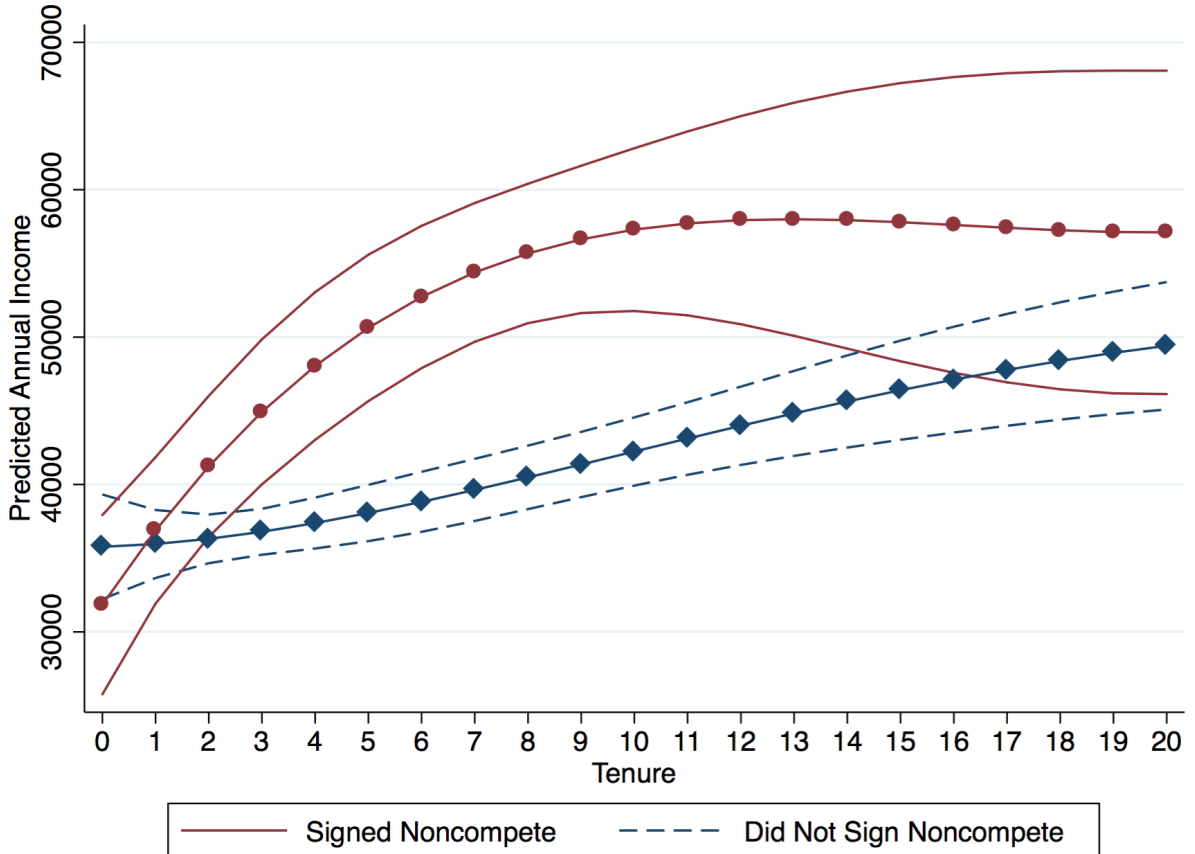
The results show that the difference in starting wages between those that do and do not sign noncompetes is small,[24] but that the wage growth of noncompete signers is far greater than those that do not sign such that 9 years into tenure noncompete signers are making around $15k more per year than non-signers. We caution here against a causal interpretation of these results for two reasons: (1) tenure is indeed a bad control in the sense that it is also an outcome of signing a noncompete, and (2) the choice to use noncompetes is endogenous and as a result it is difficult to isolate the impact of noncompetes because unobservable characteristics, such as the quality of the employer, the number of trade secrets a employee is exposed to or the employer-employee match quality, which may be correlated with both noncompete usage and higher wages. Furthermore, these estimates are conditional on the individual recognizing that he signed a noncompete. If individuals who are aware of their noncompete are unobservably more productive then they will likely command a higher wage.[25] Such unobservables bias upward our estimate of the wage premium due to noncompetes.

Taken at face value, however, these cross-sectional estimates of the relationship between non-competes and the wage-tenure profile indicate that the downward pressure on wage growth due to the noncompete is outweighed by some combination of wage enhancing investments in employees or some other factor which is causing wages of noncompete signers to grow faster.

7 Discussion

In the first part of this paper, we argue that the observation of a noncompete is an equilibrium outcome in which the employer asks the worker to agree to a noncompete and the worker assents.[26] Employers receive potentially many benefits by using noncompetes: savings on turnover costs from increased employment duration, higher per profits due to lower wages (as a result of not needing to respond to competitor wage offers), reduced damages by diverting departing employees from joining competitors, and consequent incentives to invest in and share information with employees

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[24]Noncompete signers make on average about $4k less in the first year, but the difference is not statistically significant. In the second year, noncompete signers make about $900 more.

[25]Incorporating the 'maybe' group, who tend to be lower earning, into the 'noncompete signing' group, reduces the wage premium due to noncompetes to zero. Because most of the 'maybe' group has likely not signed a noncompete, we view these results as less accurate.

[26]Theoretically, if noncompetes are efficient then workers may well invite one upon themselves. We focus on the employer's incentives because we believe that employees asking for noncompetes is likely to be rare in practice.

to increase the productivity of employees while they are employed. From the employee's perspective, noncompetes limit their post-employment mobility and potential wage growth on the job, though they may experience additional benefits via the additional training and information they receive. In theory, an employee unhappy with a particular noncompete can choose to negotiate the terms of the contract with the employer and reach an agreeable state. Using this theory as a guide to where we might observe noncompetes, we examine how the incidence of noncompetes varies by worker and employer characteristics.

We showed two essential features of the observed incidence of noncompetes by worker characteristics. First, there is significant heterogeneity in the types of employees that are required to sign noncompetes. Employees that hold sensitive information, especially trade secrets, are more educated, and earn more money, are more likely to sign noncompetes. The occupations with the highest lower bounds on the incidence of noncompetes are architecture and engineering (30.1%), computer and mathematical (27.8%), business and financial (23.1%), and management (22.7%). We argue that the primary explanation for the observed heterogeneity is that noncompetes are used to divert strategic resources from competitors.

The second feature of the data is that the lower bound of the incidence of noncompetes for those that hold no sensitive business information, have relatively less education, or are earning relatively low incomes, is nonzero. At least 8.5% of those without a college education and at least 9% of those earning under \$40k sign noncompetes. That noncompetes are prevalent in jobs which do not require confidential and proprietary information may be driven by the expectation that noncompetes extend employment durations in order to save on turnover costs and increase the return to investments in training. Multiple other explanations exist, however. One possibility is that lower level employees sign noncompetes because employers are worried about the competitive harm from "spinoffs" where a manager with sensitive information and valuable skills can take a whole team of employees with him. Another is that it is simpler for employers to use the same contract for all employees rather than rewrite them for employees of different types.

In the third section of the paper we examine whether there is evidence to support the expected effects of noncompetes developed in the theory. Controlling for observable employee and employer characteristics, we find that noncompetes are associated with longer tenures, and in particular that individuals who sign noncompetes are 6 percentage points more likely to have a tenure

beyond five years. We also find that noncompetes are associated with a 3.8 percentage point higher wage premium necessary to join a competitor. Taken together, these results suggest that noncompetes save on turnover costs by extending employment durations and reduce the likelihood that employees will join competitors. As a result of these effects, employers also have an increased incentive to invest in and share information with their employees. With regards to training, we find that noncompetes are associated with a 10 percentage point increase in the probability the employer promises training, a 13 percentage point increase in the probability of using a training contract, and an 8 percentage point increase in the probability of the employee reporting the receipt of training in the last year. We find weak evidence supporting the argument that employers have an incentive to share more information with their employees, though we note that employees may be ill equipped to reliably answer an information sharing question if they are unaware that their employer is withholding information from them.

On the employee's side, we show that only 10% of noncompete signers report bargaining over their noncompete and that 40% of the non-bargainers did not know that they could bargain in the first place. Furthermore, about 20% of employees were afraid they would be fired if they tried to negotiate or were worried that it would create tension with the employer. Despite the asymmetric information, high transaction costs, and consequent lack of negotiation, the cross-sectional wage-tenure profiles show that noncompetes are not associated with a wage premium at hiring, but that noncompetes are associated with significantly more wage growth such that by the 9th year of tenure noncompete signers are making about $15k more dollars per year. We emphasize that these results are merely cross-sectional correlations and that we hesitate to make any causal claims. Still, these findings are surprising given that the classic economic framework would predict that noncompetes are associated with lower wage growth and a wage premium upon signing.

These findings have implications for noncompete policy, for our understanding of the labor market, and for our understanding how employers create and sustain competitive advantage. First, given the heterogeneity in who signs noncompetes and the labor market outcomes they are associated with, noncompetes sustain and potentially help to create competitive advantage. By preventing the misappropriation of vital resources, noncompetes insure the employer against poaching and therefore provide incentives to increase investment in both employees and potentially

research and development. As a result, noncompetes allow the employer to create and retain sensitive information without fear that competitors will acquire it. These results accord with recent work from Conti (2014), who finds that strict noncompete policies encourage employers to take more risks in their investment choices, and Starr (2015), who shows that states with higher enforcement policies increase the employer's willingness to provide training.

Second, these results have major ramifications for how we view the labor market. In particular, the lack of negotiating over these contracts suggests that search frictions, transaction costs, and potentially even reading costs are high. As a result, employers can bind employees to the employer, such that they may have to take 'career detours' in order to leave the employer. Despite the lack of negotiating, however, employees who sign noncompetes may receive additional training and wage benefits in return – indeed noncompetes appear to increase wage growth significantly. This wage growth may be due in part to additional investments in employees, or to unobservable factors such as match quality. Still, however, binding workers to employers in this way, without workers appropriately vetting these contracts, may contribute to employees not moving to their most productive employer. Further, due to the heterogeneity in who signs these contracts, the more skilled, higher earning occupations are more likely to suffer from any such misallocation. These findings support recent work by Marx (2011) and Marx et al. (2015) which show that engineers are likely to take career detours to avoid potential litigation over their noncompete, and sometimes leave the state entirely. These detours may be accompanied by large wage and moving costs for individuals. On balance, the welfare effects of these contracts on employees is unclear.

Lastly, the debate over noncompete enforcement trades off the harm done to the employee and society with the protection needed by employers. Early scholars (Callahan, 1985; Sterk, 1993) argued that the types of employees who sign noncompetes would be skilled enough to properly assess the value of a noncompete contract. The evidence provided in this paper finds that indeed more skilled employees are likely to sign noncompetes, but that many low skilled individuals still sign. Furthermore, there remain serious questions over whether employees of all levels of sophistication properly assess the value of a noncompete before signing. Lastly, the data show that there is a slight positive relationship between state noncompete enforcement and the incidence of noncompetes, which is, in part, encouraging that contract drafters are cognizant of the actual legal policies. However, we confirm that employers in states that are very unlikely enforce noncompetes,

such as California, still use them regularly. Thus we can reason that employers in these states are likely using noncompetes without necessarily the intention of enforcing them, perhaps relying on the employee's lack of information. Also, the positive correlation between enforcement and noncompete incidence suggests that states considering whether to adjust their policies should consider that while their policies may be designed to induce training (Starr, 2015) or encourage innovation (Conti, 2014), a stricter enforcement policy will also result in more employees signing noncompetes. The increased benefits from such a policy must be weighed against the potentially increased misallocation of labor.

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Appendix

A   The Incidence of Noncompetes by Employee Class, Education, Industry, and Firm Size

A.1   Employee Class

There has been no literature on the utilization of noncompetes in private for-profit, private non-profit, or public non-profits such as public healthcare systems. Anecdotes exist of unpaid interns or volunteers signing noncompetes, but to date there is no empirical evidence of how and when noncompetes are deployed generally, let alone by employee class. Table A1 tabulates the employment status and employee class for the weighted sample. Overall, 83% of the sample holds one job, 11% hold more than one job, and 6% are currently unemployed. Those who are unemployed answer the questions regarding their previous employment relationship. The employees are primarily in the private sector, with 90% in a private for profit, 6% in a private non-profit, though 4% are employed by a public healthcare system.

Table A1: Summary Statistics	%	Cum.
Current job situation		
One job	83.15	83.15
More than one job	10.75	93.90
Unemployed	6.10	100
Type of Employer		
Private For-Profit	89.71	89.71
Private Non-Profit	6.17	95.89
Public Health-care System	4.11	100

Table A2 cross tabulates employee class with noncompete use. The table shows that at least 13.2% of those in private for-profit companies sign noncompetes, whereas at least 4.3% in public healthcare systems and 5.3% in private non-profits sign. That the difference for for-profit companies is larger is not unexpected, but perhaps that one in every 20 employees at a non-profit or public healthcare system sign noncompetes is more unexpected. The occupations with the largest lower bounds on the fraction signing noncompetes within the non-profit class are managers (9.4%),

business and finance (10.4%), protective services (19.1%), and grounds maintenance (18.1%). The magnitude of the low skill numbers is striking, though we caution that some of these numbers may be inflated due to the small sample size.

Table A2: Class of employee and Noncompetes

	Private for profit (%)	Private non-profit (%)	Public healthcare (%)
Currently signed a noncompete?			
Yes	13.2	5.3	4.3
No	49.6	48.9	38.3
Cannot remember	1.8	0.5	2.3
Don't want to say	0.3	0.02	0.4
Don't know if ever signed	2.1	0.9	3.2
Never heard	33.1	44.4	51.5
Total	100	100	100

Note: The numbers represent column percentages.

Table A3 shows how the incidence across classes changes when additional controls are included. The omitted group are for-profits. For both public healthcare and private non-profit the incidence of noncompetes are consistently between 7 and 8 percentage points lower than in the for-profit sector. Controlling for education, income, occupation, industry, and establishment and employer size, we estimate that the incidence of noncompetes in private-non profits is 7.7 percentage points lower than in for-profit employers, while it is 7.3 percentage points lower in public healthcare systems.

A.2   Education

We next describe the incidence of noncompetes by educational attainment. Figure A1 shows the range of the potential incidence of noncompetes by varying degrees of education. The upper and lower bound reflect the uncertainty about whether those who have never heard of noncompetes or those who report not knowing if they are under a noncompete have actually signed one. Given the numbers presented above, we know that the vast majority of these 'maybes' are individuals who have never heard of noncompetes. The lower bound assumes that all such 'maybes' have not signed, while the upper bound assumes that they have. The 95% confidence intervals around the lower and upper bounds reflect sampling uncertainty and the size of the underlying sample.
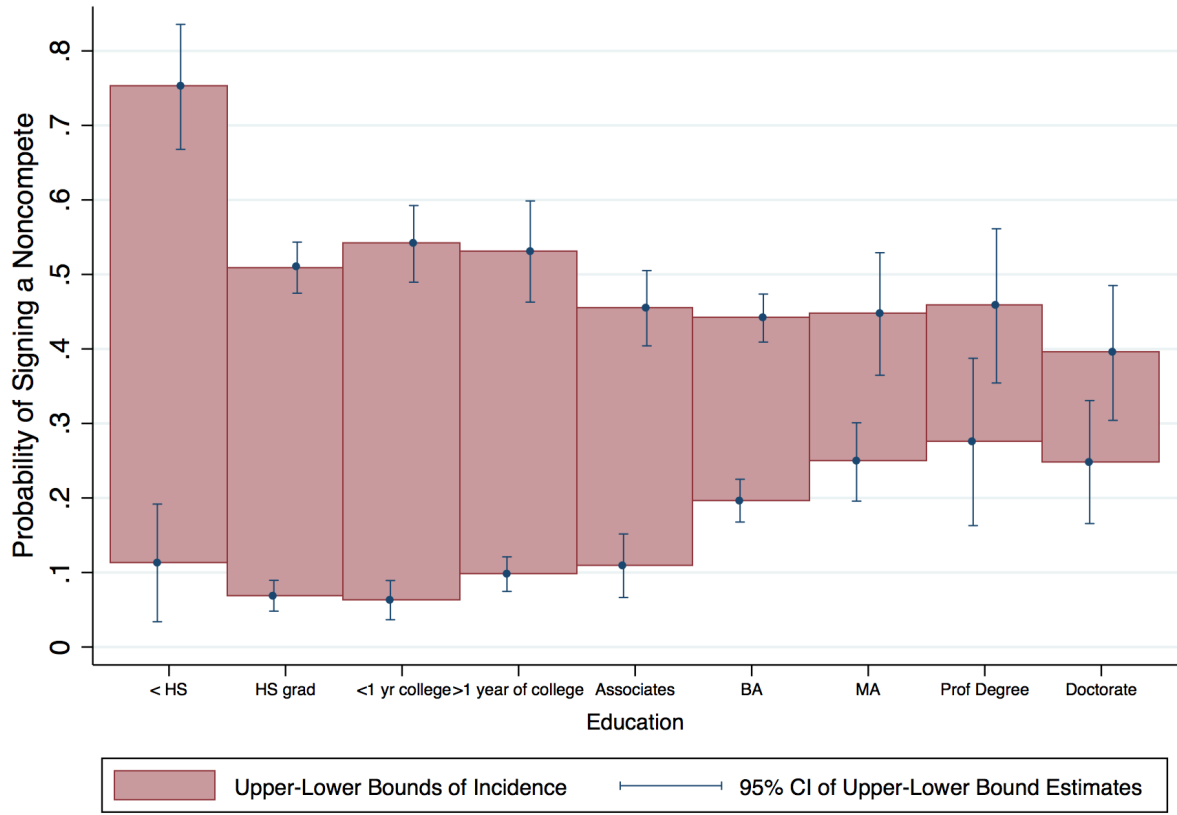
Table A3: Multivariate Analysis: Employee Class

	(1)	(2)	(3)	(4)	(5)	(6)
Private Non-Profit	-0.078***	-0.096***	-0.066***	-0.072***	-0.084***	-0.078***
	(0.017)	(0.015)	(0.018)	(0.020)	(0.022)	(0.022)
Public Healthcare	-0.089***	-0.085***	-0.074***	-0.065***	-0.079***	-0.073***
	(0.014)	(0.014)	(0.014)	(0.020)	(0.023)	(0.024)
Constant	0.132***	0.123***	-0.244**	-0.149	-0.157	-0.179
	(0.009)	(0.039)	(0.095)	(0.104)	(0.121)	(0.120)
R-squared	0.006	0.044	0.056	0.076	0.086	0.094
Controls						
Education FE	No	Yes	Yes	Yes	Yes	Yes
Income	No	No	Yes	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes	Yes
Industry	No	No	No	No	Yes	Yes
Estab/Firm Size	No	No	No	No	No	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses, clustered at the state level. Results are from a linear probability model. The dependent variable is a dummy for signing a noncompete. The omitted category is private for-profits.

Figure A1 shows three interesting patterns: First, the lower bound on the incidence is positively correlated with education. The lower bound shows that around 9% of those with an associates degree or less sign noncompetes, while those with a bachelor's degree are twice as likely to sign (19.6%), and those with a professional degree are three times as likely to sign (27.5%). Second, the proportion of individuals who have never heard or do not know if they have signed is negatively correlated with education. Thus more educated individuals are both more likely to sign noncompetes and, not surprisingly, more likely to be aware of them in the first place. Third, even the lower limit of the 95% confidence interval around the lower bound does not include zero. As a result, for each education category, we can reject that the incidence is zero.

To examine whether or not the observed differences in educational categories are actually due to education or due other characteristics related to education such as occupation and income, Table A4 shows the noncompete incidence differences by education when controlling for gender, income, occupation, industry, and employer size. The omitted category is those without a bachelor's degree. The estimates show that the differences between college graduates and non-college graduates is persistent even when controlling for a host of control variables including occupation and industry. The difference between education groups falls noticeably when controlling for occu-

Figure A1: Proportion of Education Levels Signing Noncompetes

The upper-lower bounds of the incidence of noncompetes assume that those who don't know if they have signed a noncompete did and did not sign, respectively.

pation, however. The difference between those with college grads and those with post-graduate degrees is significant only in columns (1) and (2). The difference becomes insignificant when controlling for income.

The incidence of noncompetes varies considerably by education. Controlling for the types of occupations and industries that educated employees sort into, college graduates are 6 percentage points more likely to sign a noncompete while those with graduate degrees are 9 percentage points more likely to sign. Still, almost 1 in 10 of those without a college degree are signing noncompetes.

A.3 Industry

In which industries do noncompetes appear more frequently? We ascertain the industry of the respondent's current or most recent (if unemployed) job by asking the respondent to describe what their employer does or produces and to place their industry within the 2 digit NAICS codes.

Table A4: Multivariate Analysis: Noncompete Incidence by Education

Education	(1)	(2)	(3)	(4)	(5)	(6)
Bachelor's Degree	0.111***	0.111***	0.094***	0.069***	0.059***	0.058***
	(0.015)	(0.015)	(0.016)	(0.016)	(0.017)	(0.016)
Graduate Degree	0.168***	0.167***	0.133***	0.110***	0.094***	0.091***
	(0.023)	(0.022)	(0.021)	(0.026)	(0.025)	(0.024)
Constant	0.085***	0.083***	-0.314***	-0.213***	-0.204**	-0.232**
	(0.009)	(0.013)	(0.068)	(0.077)	(0.097)	(0.095)
R-squared	0.034	0.034	0.050	0.071	0.080	0.089
Controls						
Gender	No	Yes	Yes	Yes	Yes	Yes
Income	No	No	Yes	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes	Yes
Industry	No	No	No	No	Yes	Yes
Estab/Firm Size	No	No	No	No	No	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses, clustered at the state level. Results are from a linear probability model. The dependent variable is a dummy for signing a noncompete. The omitted category is less than a bachelor's degree.

The results presented below correspond to the self-selected NAICS 2 digit industry, while a finer industry-level analysis is pending the coding of the data.

Figure A2 shows the range of noncompete signers – again treating the 'maybes' as both having signed (the upper bound) and not having signed (the lower bound) – and the 95% confidence interval around these bounds. The red dots represent an overall estimate of the incidence, which is derived by taking the industry average of answers to the survey question: What proportion of individuals in your industry signed noncompetes?

The lower bound of the incidence of noncompetes in the data is given in column (1) of Table A5. The industries which exhibit the most frequent noncompete usage are the information industry (28.9%), professional, scientific, and technical companies (23.7%), and finance and insurance (18.1%). Many of the industries the literature has focused on[27] do show relatively high rates of noncompete utilization including, manufacturing (14.8%) and health care and social assistance (12.7%). Accommodation and food services has the lowest percentage signing in the data with only 2.8%.

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[27]Physicians in Lavetti et al. (2014) and Engineers in Marx (2011) and Marx et al. (2009)

Figure A2: Proportion of Industry Distribution by Signing a Noncompete
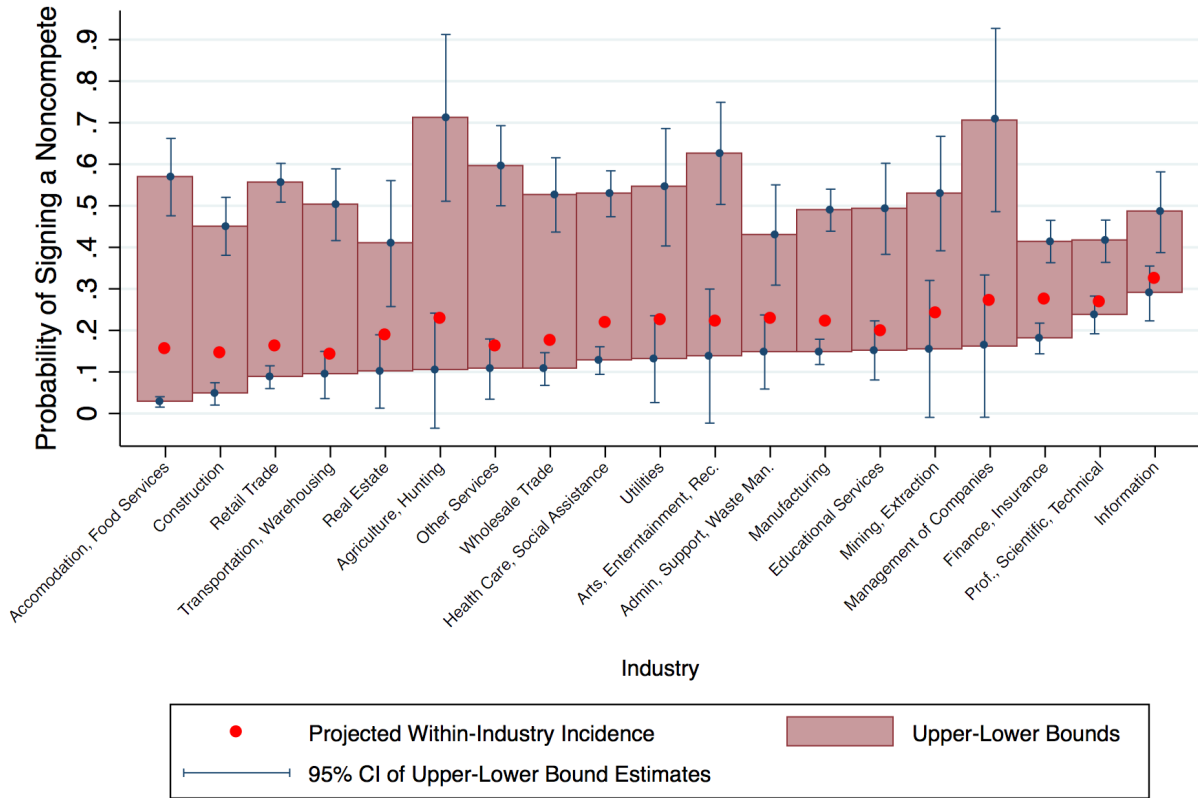
The upper-lower bounds of the incidence of noncompetes assume that those who might have signed a noncompete did and did not sign, respectively. The projections within-industry refer to within-industry average of the projected proportion of noncompete signers.

The projections of incidence across industries, seen in column (2) through (6) of Table A5 are far higher on average than the lower bound in data. Those who sign are more likely to believe that people in the industry sign a noncompete, while those who did not sign project that most people did not sign. The projections are greater than the observed level in the data because many of the non-signers predict non-zero incidences, as can be seen in the histogram of the projections in Figure A3.

To examine the stability of the cross-industry noncompete incidence rates, we examine how the difference in incidence rates across industries change as we add control variables to our regression model. The results are shown in Table A9 in the appendix. Using retail services as a control group, we find that many industries do not exhibit statistically significantly differences relative to retail. The information and the professional and scientific industries have a 20 and 15 percentage point higher incidence respectively, though after controlling business interests, occupation, and

Table A5: Proportion Signed Noncompete by Industry

	In Data	Projections				
Industry	(1)	All (2)	Signed (3)	Ever Signed (4)	Heard (5)	Didn't Sign (6)
Information	28.9	33.1	53.9	43.8	35.8	25.5
Prof., Scientific, Technical	23.7	28.6	52.6	41.5	30.8	22.0
Finance, Insurance	18.1	27.8	54.5	41.6	29.5	20.4
Management of Companies	16.2	26.1	41.4	33.7	28.1	18.7
Mining, Extraction	15.5	25.0	49.4	36.2	27.9	21.0
Educational Services	15.2	19.8	52.3	39.2	22.4	13.0
Manufacturing	14.8	22.4	51.2	37.4	25.7	17.7
Admin, Support, Waste Man.	14.8	22.1	57.3	38.3	28.1	19.8
Arts, Entertainment, Rec.	13.8	22.9	56.9	41.3	29.8	17.9
Utilities	13.1	21.1	53.0	37.2	25.4	15.4
Health Care, Social Assistance	12.7	20.5	51.6	35.5	25.1	17.5
Wholesale Trade	10.7	18.5	36.7	27.9	22.3	16.4
Other Services	10.7	17.6	56.4	36.7	24.5	16.2
Agriculture, Hunting	10.3	24.2	59.4	47.7	38.2	23.1
Real Estate	10.1	20.9	48.2	30.6	23.6	19.1
Transportation, Warehousing	9.3	15.2	53.8	36.0	19.9	13.2
Retail Trade	8.7	17.2	48.2	33.0	21.8	15.2
Construction	4.7	15.9	43.6	23.1	18.7	16.4
Accommodation, Food Services	2.8	16.0	44.7	24.0	18.3	15.4
Mean	12.3	20.6	51.7	36.1	25.0	17.5

Note: Column (1) gives the proportion of the industry signing noncompetes as observed in the weighted data. Columns (2)-(6) provide the mean projections by industry categories regarding the incidence of noncompetes in the respondent's industry, according to the respondent's current noncompete status.

employer size characteristics the estimated differences fall by half. Aside from these two industries, no statistically significant differences remain.

The result of the industry analysis suggests that despite a few outliers (Information and professional and technical employers), the cross-industry differences in the incidence of noncompete enforcement can be explained by the occupations employees are in and the types of confidential information they have access to. Perhaps this lack of significance should be expected since an industry is made up of many occupations, many of which are not exposed to trade secrets, clients, or any confidential proprietary information. As a result, as we will see, the cross-industry averages are less volatile than cross-occupation averages.

Figure A3: Industry Noncompete Incidence Projections
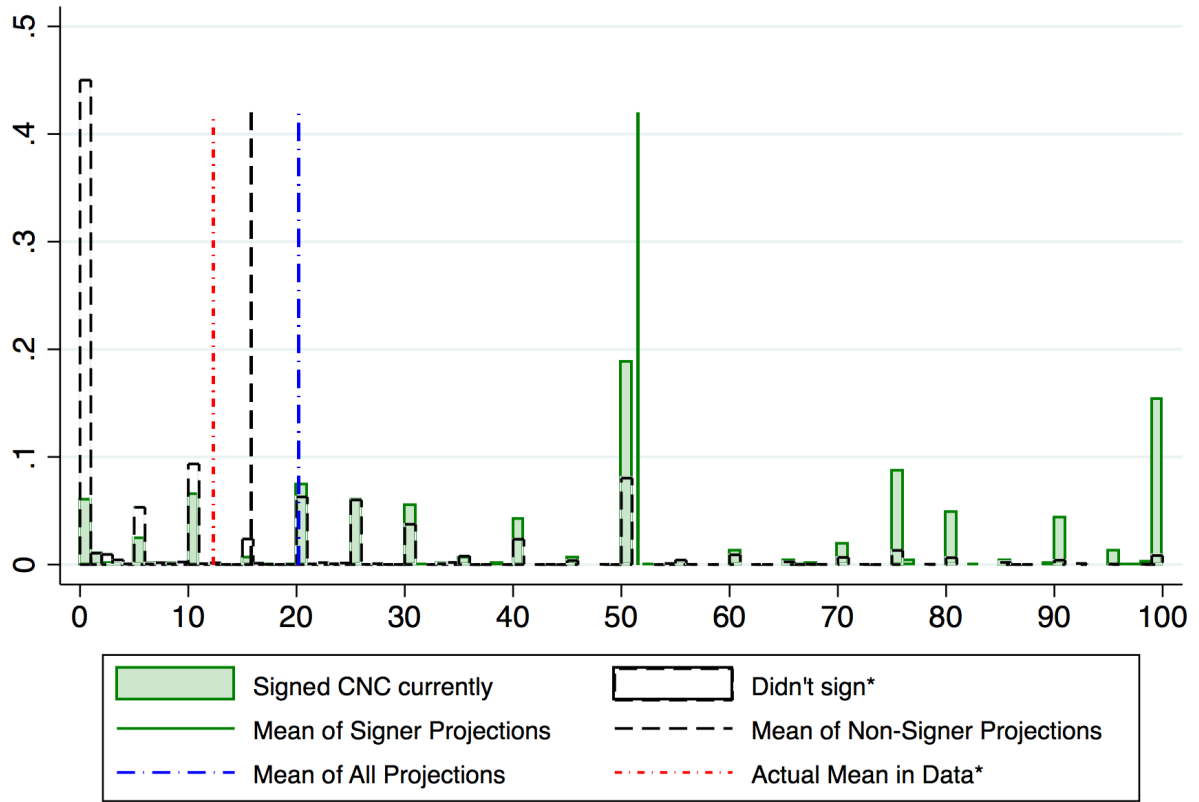
* Assumes that those who have never heard, can't remember, or don't want to say, have not signed CNCs.

A.4 Establishment and Employer Size

Do employers vary in their use of noncompetes simply based on the size of their workforce? The theoretical prediction is ambiguous. While large employers by their nature are more likely to have standardized employment contracts to manage their workforce, their size mitigates the adverse effects from the departure of a key employee to a competitor. Smaller employers, on the other hand, are more likely have informal employee contracts, but also face severe consequences if a key employee were to be poached.

The distribution of employees across establishment and employer size is given by Table A6. While only 2.33% of the sample are employed in establishments with over 5,000 employees, 22.9% of the sample is employed by an employer with more than 5,000 employees. On the other side of the distribution, 36.1% of employees report working in an establishment with less than 25 employees, while 22.4% report working in an employer of that size. Outside of the bunching at

the ends of the size distributions, the respondents are relatively evenly distributed across the rest of the establishment and employer size categories.

Table A6: Establishment and Employer Size Distribution

	Establishment Size (%)	Employer Size(%)
Number of Employees		
<25 employees	36.06	22.38
25-100 employees	26.53	16.33
101-250 employees	14.72	9.91
251-500 employees	8.56	7.37
501-1000 employees	6.314	7.51
1001-2500 employees	2.85	6.67
2501-5000 employees	2.33	6.96
>5000 employees	2.33	22.87

Note: The numbers in the table are column percentages.

We begin our analysis of the incidence of noncompetes and employer size by providing cross tabulations of noncompete signing status and both multi-unit and multi-state employers. Table A7 shows that 14.4% sign noncompetes in multi-unit employers, as compared to 8.9% in single unit employers. The incidence for multi-state employers is higher at 16%. employees in multi-state or multi-unit employers are also almost 6 percentage points more likely to have heard about noncompetes.

Table A7: Currently Signed vs Employer Size

	Multi-Unit employer?		Multi-State Employer	
	Yes(%)	No(%)	Yes(%)	No(%)
Currently signed a noncompete?				
Yes	14.4	8.9	16.0	9.2
No	48.3	50.3	47.6	50.3
Do not want to say	0.4	0.1	0.3	0.2
Cannot remember	2.3	0.8	2.3	1.3
Don't know if ever signed	2.1	2.1	2.3	1.9
Never heard	32.5	37.8	31.5	37.1

Note: The numbers in the table are column percentages.

Next we examine how the incidence of noncompetes varies by both establishment size and overall employer size. The respondents were asked separately to place their establishment size and employer size (if they indicated it was a multiple establishment employer) into pre-established size categories. They were later asked what proportion of employees in their establishment, in

their occupation at their establishment, and in their employer across all establishments, sign noncompetes. Figures A4 and A5 plot both the projected incidence for whether or not individuals in their establishment or employer have signed a noncompete and the actual incidences reported in the data.

Figure A4: Establishment Size vs Signing a Noncompete
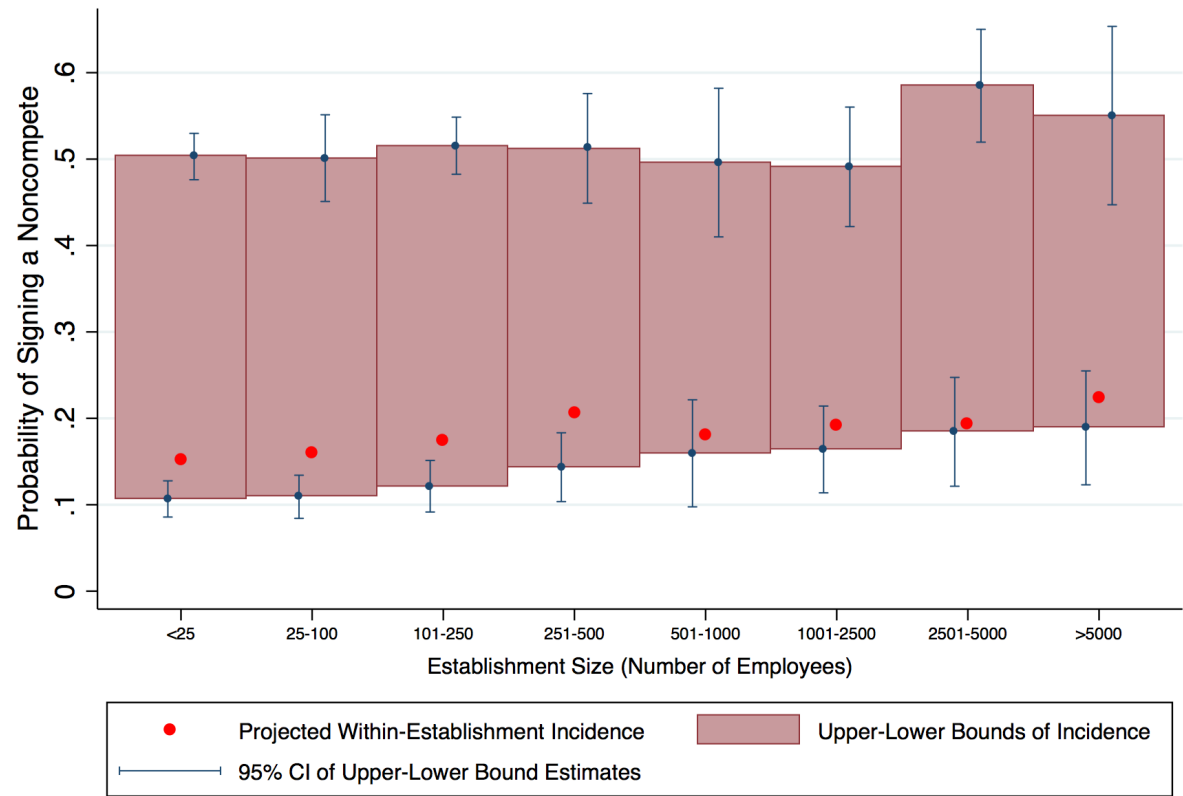
The upper-lower bounds of the incidence of noncompetes assume that those who might have signed a noncompete did and did not sign, respectively.
The projections refer to within-establishment-size average of the projected proportion of noncompete signers.

The plots show similar patterns. There is a slightly positive, though small relationship between the incidence of noncompetes and the size of the employer. For the employer size results, employers with less than 25 employees have an incidence rate of 8.9% while employers with over 5,000 employees have an incidence rate of 14.1%. This relatively slow growth across employer size may be partially explained via the occupation results above: if larger employers hire more in the low skilled occupations and low skilled occupations are less likely to sign noncompetes, then this will bring down the average use of noncompetes within large employers. The slightly positive
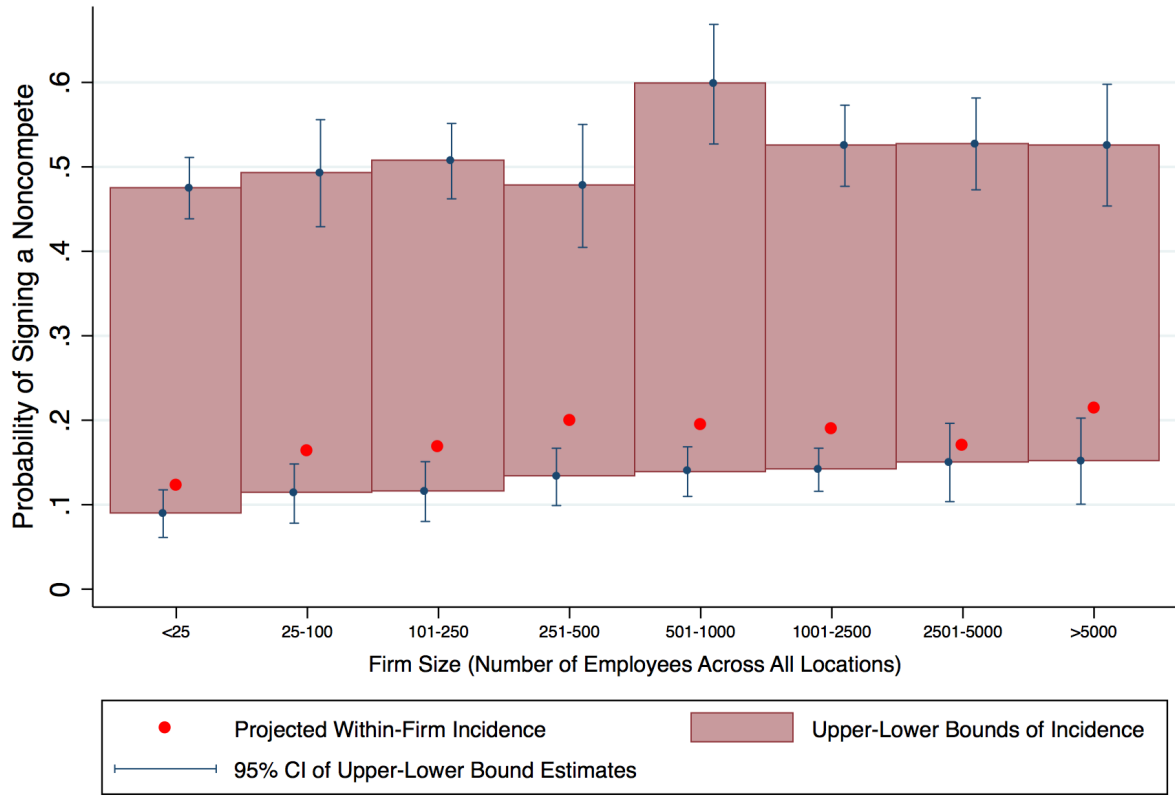
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Figure A5: Employer Size vs Signing a Noncompete

The upper-lower bounds of the incidence of noncompetes assume that those who might have signed a noncompete did and did not sign, respectively.
The projections refer to within-firm-size average of the projected proportion of noncompete signers.

relationship between employer size and noncompete incidence is not robust to include controls for industry, occupation, education, or income (regressions not shown).

Additionally, projections about the use of noncompetes within the employer are still well above the actual incidence in the data. As before, the cause of this is non-signers projecting that a non-zero proportion of employees in their employer sign. This calls us to question which results we should trust. As before, we discussed the notion that while the projections may be a better point estimate because they represent multiple data points, the projections may also be upward biased because of the tendency to choose 50% when in reality the respondent is entirely unsure. Though smaller than in Figure 2, the mass point can be seen in the histogram of the projections below in Figure A6.

To test whether individuals are spuriously choosing 50% or if it is related in some way to their true knowledge base, we asked employees the incidence of noncompetes among their coemployees in

Figure A6: Employer Level Noncompete Incidence Projections
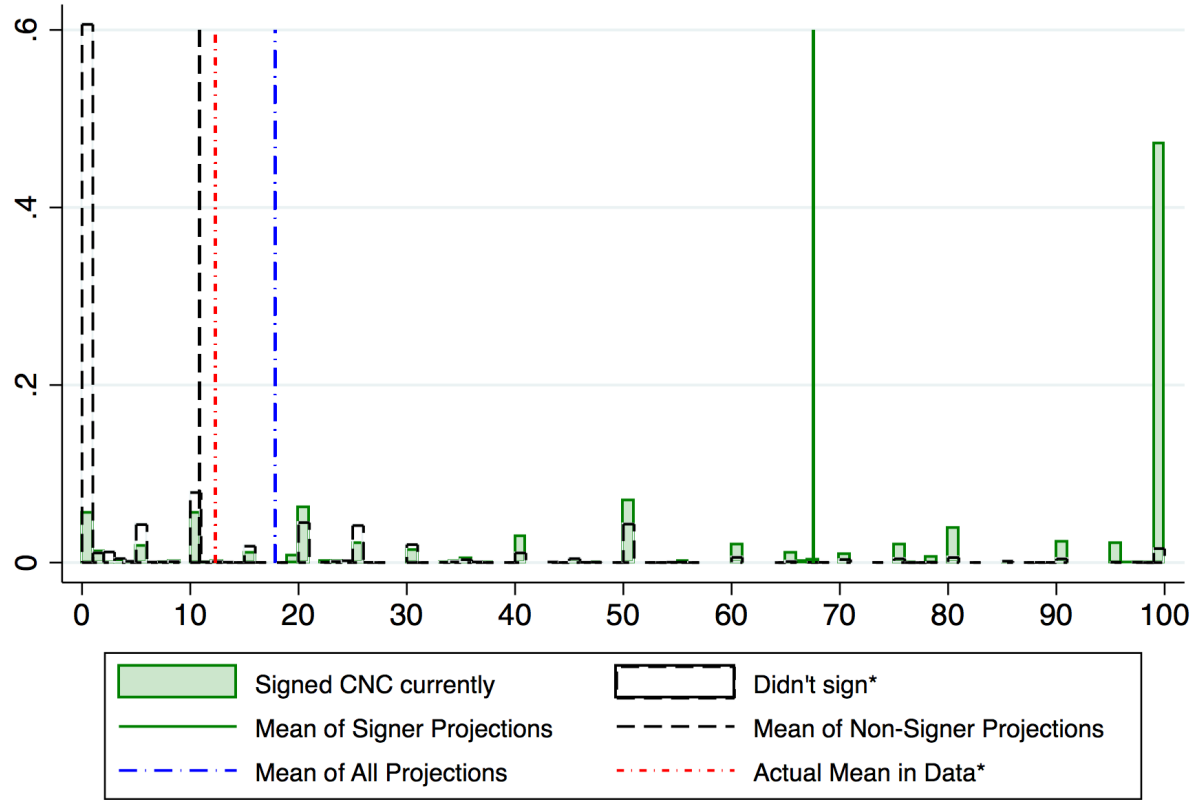
Signed CNC currently — Didn't sign*
Mean of Signer Projections — Mean of Non-Signer Projections
Mean of All Projections — Actual Mean in Data*

* Assumes that those who have never heard, can't remember, or don't want to say, have not signed CNCs.

their individual workplace. Presumably, employees should have very good knowledge about what goes on among their confirm in their individual establishment. The results of the projections are plotted in Figure A7, and confirm our suspicions that the mass point at 50% does not reflect a spurious choice, but is more closely related to actual knowledge. Evidence of this point can be found in the size of the mass points at either end of the distribution and in the much smaller mass point at 50%.

B Additional Tables

Figure A7: Employer Level Occupation Specific Noncompete Incidence Projections
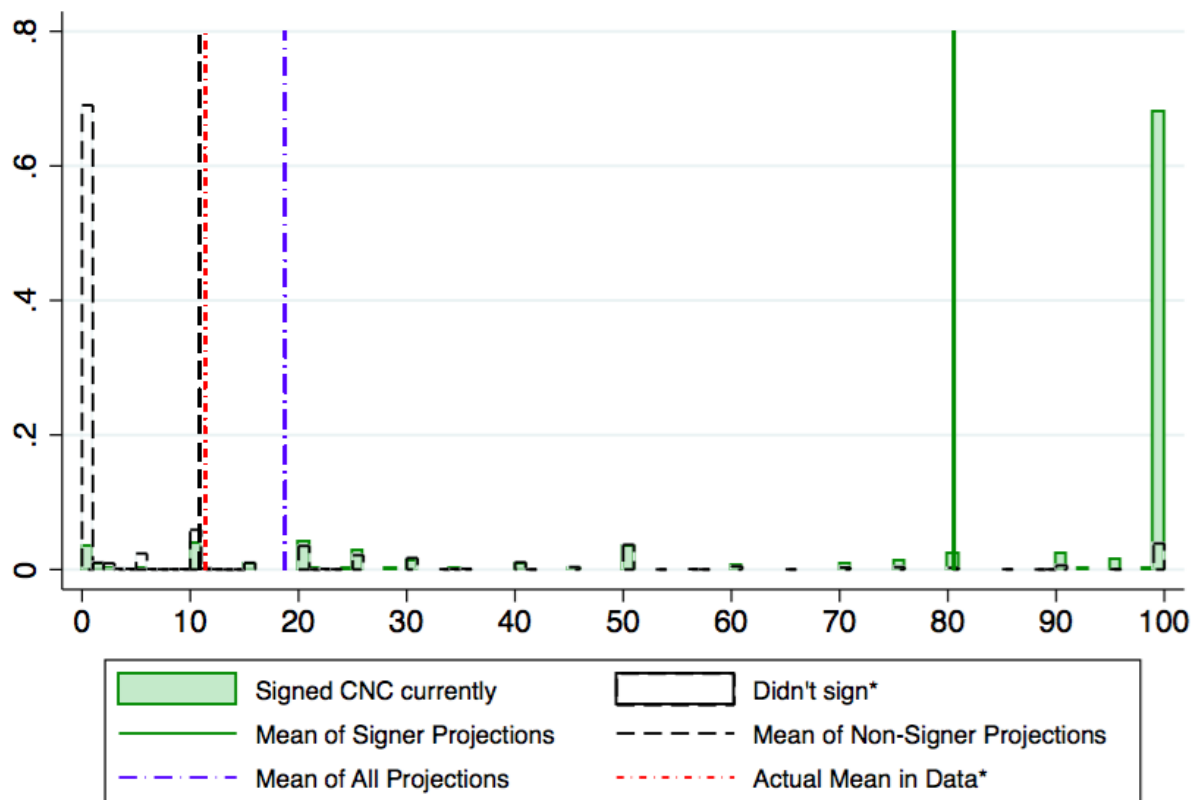
* Assumes that those who have never heard, can't remember, or don't want to say, have not signed CNCs.

Table A8: ClearVoice and Sample Strategies Panel Demographics

	ClearVoice	Sample Strategies	US Labor Force
Panel Size	902,878	425,413	
Responses in Sample	4,949	2,299	
Proportion of Sample	42.9	19.9	
Gender			
Male	56.6	41.0	52.8
Female	43.4	59.0	47.2
Education			
< High School	10.0	14.3	10.9
High School Grad	26.8	25.3	27.7
Some College	24.3	21.1	25.7
Associate's degree	7.5	5.2	8.7
Trade School	2.2	.	.
Bachelor's degree	16.3	28.5	18.8
Some postgraduate	2.5	2.0	.
Graduate Degree	8.2	10.0	8.5
None of the above	2.2	3.65	.
Age			
13-17	2.1	.	
18-24	9.7	23.0	15
25-34	10.6	27.0	23.8
35-44	13.6	19.0	21.9
45-54	6.3	16.0	22.1
55-64	3.9	10.0	14.1
65-99	2.1	5.0	3.3
Employment			
Employed full-time	35.3	51.0	69.8
Employed part-time	10.9	13.0	22.4
Unemployed	9.7	3.5	7.8
Student full-time	9.9	15.0	.
Student part-time	3.6	.	.
Homemaker	8.8	5.0	.
Self employed	7.7	5.3	.
Permanently U/E	7.2	.	.
Retired	6.9	3.5	.

Note: This table shows the panel demographics for ClearVoice Surveys and Sample Strategies, as they compare to the American Community Survey. The demographic information comes from the panel books from the respective partners.

Table A9: Multivariate Analysis: Noncompete Incidence by Industry

Industry	(1)	(2)	(3)	(4)	(5)	(6)
Information	0.202***	0.162***	0.134***	0.110***	0.118***	0.119***
	(0.035)	(0.038)	(0.038)	(0.040)	(0.040)	(0.036)
Prof., Scientific, Technical	0.150***	0.098***	0.068**	0.042	0.070**	0.071**
	(0.029)	(0.031)	(0.033)	(0.032)	(0.033)	(0.030)
Finance, Insurance	0.093***	0.061***	0.029	0.014	0.039	0.038
	(0.020)	(0.020)	(0.020)	(0.023)	(0.027)	(0.025)
Management of Companies	0.075	0.030	-0.004	-0.011	-0.005	-0.007
	(0.083)	(0.072)	(0.073)	(0.071)	(0.076)	(0.080)
Mining, Extraction	0.068	0.043	-0.001	-0.025	-0.004	-0.006
	(0.087)	(0.081)	(0.077)	(0.087)	(0.088)	(0.086)
Educational Services	0.064*	0.010	0.050	0.040	0.044	0.052
	(0.034)	(0.031)	(0.033)	(0.032)	(0.033)	(0.036)
Manufacturing	0.061**	0.051**	0.020	0.020	0.040*	0.040**
	(0.023)	(0.021)	(0.019)	(0.017)	(0.021)	(0.019)
Admin, Support, Waste Man.	0.061	0.036	0.018	0.020	0.054	0.056
	(0.045)	(0.046)	(0.045)	(0.046)	(0.052)	(0.051)
Arts, Entertainment, Rec.	0.051	0.031	0.065	0.062	0.054	0.061
	(0.077)	(0.075)	(0.077)	(0.076)	(0.049)	(0.047)
Utilities	0.043	0.033	-0.011	0.008	0.033	0.031
	(0.055)	(0.051)	(0.050)	(0.045)	(0.047)	(0.046)
Health Care, Social Assistance	0.040*	0.010	0.001	0.003	0.042	0.048*
	(0.021)	(0.022)	(0.022)	(0.023)	(0.029)	(0.028)
Wholesale Trade	0.020	0.006	-0.021	-0.033	-0.020	-0.015
	(0.030)	(0.024)	(0.022)	(0.021)	(0.022)	(0.021)
Other Services	0.019	0.006	0.038	0.028	0.042	0.048
	(0.038)	(0.039)	(0.040)	(0.038)	(0.040)	(0.037)
Agriculture, Hunting	0.016	0.023	0.002	0.023	0.031	0.025
	(0.065)	(0.067)	(0.068)	(0.056)	(0.052)	(0.054)
Real Estate	0.014	0.007	-0.006	-0.019	0.013	0.013
	(0.048)	(0.048)	(0.047)	(0.045)	(0.048)	(0.046)
Transportation, Warehousing	0.005	0.008	-0.014	0.001	0.017	0.017
	(0.030)	(0.030)	(0.029)	(0.029)	(0.037)	(0.036)
Construction	-0.040**	-0.033	-0.059***	-0.054***	-0.030	-0.024
	(0.020)	(0.020)	(0.019)	(0.018)	(0.021)	(0.019)
Accomodation, Food Services	-0.060***	-0.050***	-0.049***	-0.057***	-0.038*	-0.032
	(0.014)	(0.014)	(0.014)	(0.016)	(0.020)	(0.019)
Constant	0.087***	0.106***	-0.297***	-0.211**	-0.169*	-0.177*
	(0.014)	(0.039)	(0.088)	(0.084)	(0.090)	(0.090)
R-squared	0.031	0.052	0.065	0.113	0.123	0.130
Controls						
Education FE	No	Yes	Yes	Yes	Yes	Yes
Income	No	No	Yes	Yes	Yes	Yes
Business Interests	No	No	No	Yes	Yes	Yes
Occupation	No	No	No	No	Yes	Yes
Estab/Firm Size	No	No	No	No	No	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses, clustered at the state level.
Results are from a linear probability model. The dependent variable is a dummy for signing a noncompete.
The omitted category is Retail Trade.

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Table A10: Multivariate Analysis: Noncompete Incidence by Occupation

Occupation	(1)	(2)	(3)	(4)	(5)	(6)
Architecture, Engineering	0.075	0.045	0.037	0.042	0.028	0.025
	(0.046)	(0.045)	(0.045)	(0.042)	(0.045)	(0.045)
Computer, Mathematical	0.051	0.047	0.055	0.067*	0.037	0.030
	(0.046)	(0.044)	(0.045)	(0.039)	(0.037)	(0.037)
Business, Finance	0.005	-0.017	-0.007	0.011	0.002	-0.001
	(0.034)	(0.034)	(0.035)	(0.032)	(0.035)	(0.033)
Life, Physical, Social Sci.	-0.023	-0.063	-0.040	-0.018	-0.043	-0.039
	(0.054)	(0.043)	(0.042)	(0.048)	(0.051)	(0.053)
Education, Training	-0.046	-0.069*	-0.013	0.013	-0.009	-0.009
	(0.038)	(0.037)	(0.040)	(0.037)	(0.036)	(0.036)
Arts, Entertainment	-0.048	-0.034	0.024	0.044	0.019	0.018
	(0.079)	(0.077)	(0.077)	(0.080)	(0.059)	(0.056)
Community, Social Services	-0.086	-0.101*	-0.066	-0.032	-0.042	-0.033
	(0.052)	(0.052)	(0.052)	(0.049)	(0.043)	(0.039)
Physician, Technical	-0.091***	-0.116***	-0.096***	-0.060**	-0.077**	-0.077**
	(0.032)	(0.027)	(0.026)	(0.025)	(0.031)	(0.033)
Sales, Related	-0.107***	-0.079***	-0.039	-0.010	0.000	-0.005
	(0.029)	(0.030)	(0.031)	(0.028)	(0.027)	(0.028)
Personal Care, Services	-0.108**	-0.074*	-0.028	0.010	0.002	0.008
	(0.043)	(0.041)	(0.041)	(0.040)	(0.040)	(0.039)
Production Occupations	-0.117***	-0.082***	-0.068**	-0.022	-0.041	-0.040
	(0.028)	(0.029)	(0.029)	(0.027)	(0.029)	(0.029)
Installation, Repair	-0.121***	-0.091**	-0.082*	-0.037	-0.052	-0.047
	(0.041)	(0.043)	(0.044)	(0.044)	(0.044)	(0.044)
Farm, Fish, Forestry	-0.132	-0.084	-0.059	-0.010	-0.020	-0.008
	(0.096)	(0.100)	(0.099)	(0.084)	(0.083)	(0.081)
Legal Occupations	-0.134***	-0.185***	-0.174***	-0.153***	-0.185***	-0.187***
	(0.039)	(0.038)	(0.037)	(0.039)	(0.038)	(0.038)
Transport, Mat. Moving	-0.133***	-0.096***	-0.078**	-0.031	-0.027	-0.027
	(0.032)	(0.034)	(0.033)	(0.029)	(0.032)	(0.031)
Office, Support	-0.139***	-0.116***	-0.087***	-0.063**	-0.075***	-0.073**
	(0.026)	(0.026)	(0.028)	(0.027)	(0.028)	(0.028)
Healthcare Support	-0.147***	-0.115***	-0.082**	-0.054	-0.074	-0.071
	(0.040)	(0.039)	(0.038)	(0.038)	(0.047)	(0.046)
Protective Services	-0.158***	-0.145***	-0.125**	-0.087	-0.088	-0.082
	(0.047)	(0.047)	(0.048)	(0.054)	(0.058)	(0.059)
Construction, Extraction	-0.177***	-0.139***	-0.126***	-0.077**	-0.039	-0.036
	(0.030)	(0.033)	(0.033)	(0.034)	(0.033)	(0.035)
Food Prep, Serving	-0.200***	-0.160***	-0.113***	-0.078***	-0.038	-0.042
	(0.026)	(0.029)	(0.031)	(0.029)	(0.029)	(0.030)
Grounds Maintenance	-0.213***	-0.178***	-0.138***	-0.073**	-0.070**	-0.071**
	(0.025)	(0.029)	(0.032)	(0.028)	(0.032)	(0.033)
Constant	0.227***	0.208***	-0.188*	-0.155	-0.138	-0.152
	(0.024)	(0.048)	(0.098)	(0.093)	(0.109)	(0.109)
R-squared	0.043	0.061	0.072	0.116	0.123	0.130
Controls						
Education FE	No	Yes	Yes	Yes	Yes	Yes
Income	No	No	Yes	Yes	Yes	Yes
Business Interests	No	No	No	Yes	Yes	Yes
Industry	No	No	No	No	Yes	Yes
Estab/Firm Size	No	No	No	No	No	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses, clustered at the state level.
Results are from a linear probability model. The dependent variable is a dummy for signing a noncompete.
The omitted category is managers.

Table A11: Poaching Rates by Industry

Industry	Less than once per year	Once per year	A few times per year	Once a month	A few times a month	≥ Once a week
Agriculture, Hunting	55.6	14.1	20.2	4	5.1	1
Mining, Extraction	32.1	17.3	30.9	9.9	8.6	1.2
Utilities	46.3	9.9	31.4	2.5	8.3	1.7
Construction	50.1	14.7	24.9	5.1	3.5	1.6
Manufacturing	46.8	13.1	27.2	6.9	4.5	1.5
Wholesale Trade	51.8	18.2	23.7	2.8	3.2	0.4
Retail Trade	32	10.9	35.5	8.8	9.5	3.3
Transportation, Warehousing	41.6	14.7	27.7	6.3	6.5	3.1
Information	40.4	13	28.9	6.4	6.9	4.3
Finance, Insurance	31.4	11.4	38.2	7.7	8.3	3
Real Estate	51.1	12.4	25.8	6	3	1.7
Prof., Scientific, Technical	42	14.9	27.7	7.6	6.1	1.6
Management of Companies	34.1	20.7	29.3	9.8	4.9	1.2
Admin, Support, Waste Man.	49.3	11.9	23.9	4.5	6	4.5
Educational Services	37.3	21.2	31.1	5.7	3.1	1.6
Health Care, Social Assistance	32.3	12.5	31.3	9.7	10.8	3.5
Arts, Enterntainment, Rec.	44	16.8	25.1	6.1	5.9	2.1
Accomodation, Food Services	26	14.2	37	10.9	9.8	2.2
Other Services	50.2	12.3	23.1	6.6	5.7	2
Total	40.1	13.6	29.6	7.5	7	2.4

Note: The numbers represent row percentages.

Table A12: Poaching Rate Summary Statistics

	Employer Poaches (%)	Employee Poached (%)	Industry Poaching (%)
Frequency			
Less than once a year	45.0	40.1	39.6
Once a year	10.9	13.3	12.6
A few times a year	28.6	29.7	28.5
Once a month	6.3	6.8	8.1
A few times a month	6.2	7.3	7.7
Once a week or more	2.9	2.8	3.5
Total	100	100	100

C   Questions from the Survey

Figure A8: Text of Noncompete Signing Question

Did you sign a non-competition agreement with your current employer?

(If you are currently unemployed, please answer regarding your most recent employer.)

Recall that non-competition agreements can be signed:
(a) as stand-alone contracts related to a job;
(b) as part of a policy manuals or employee handbooks you acknowledge receiving;
(c) as part of the "fine print" in any employment material you have ever signed at work, such as a job application form;
(d) along with other contracts such as non-disclosure agreements, confidentiality agreements, non-solicitation, and non-poaching agreements.

A non-competition agreement may be signed before you are employed, at the time of hire, well into your employment, or as part of a severance arrangement.

Also, please note that noncompetes are different from non-disclosure agreements. Noncompetes prohibit you from moving to a competitor, while non-disclosure agreements prohibit the disclosure of trade secrets or other proprietary information to competitors but do not prohibit your movement to a competitor.

○ Yes

○ No

○ Cannot remember

○ Do not want to say