Consider This: Firm-Sponsored Training and the Enforceability of Covenants Not to Compete*

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Abstract

This paper theoretically and empirically examines the impact of noncompete enforceability on firm-sponsored training. A change from non-enforcement to maximal enforceability increases firm-sponsored for training by at least 13.7% and reduces wages by 2.35% for occupations frequently found in noncompete litigation. Estimates using aggregate measures of noncompete enforceability, however, mask significant heterogeneity in the impact of consideration-specific dimensions of enforceability: Laws tying the enforceability of noncompetes to the receipt of additional consideration (training, wages, promotions), reduce noncompete enforceability and increase both training and wages. Such consideration laws substitute for the lack of individual negotiation over noncompetes and training.

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1 Introduction

The poaching of employees presents a challenge for firms who wish to improve the skills of their workforce. Firms that fear a worker is likely to join a competitor may decide to invest less in developing the skills of that worker, especially if it involves the transfer of valuable information such as client lists or trade secrets. Firms have found a contractual solution to this problem in the form of covenants not to compete ('noncompetes'), which prevent the worker from joining or starting a competing firm for a fixed amount of time post separation. Noncompetes are common today; between 12% and 50% of the U.S. labor force have currently signed one (Starr et al., 2015b).[1] Yet despite the prevalence of noncompetes and their 600 year history, vast differences in the treatment of noncompetes across states remain, spanning non-enforcement to enforcement even if the worker is fired (Blake, 1960; Bishara, 2011). Due to claims that California's ban on noncompetes led to the rise of Silicon Valley (Gilson, 1999), and recent research finding negative effects of noncompete enforceability (Marx et al., 2009; Samila and Sorenson, 2011; Garmaise, 2009), scrutiny over noncompete policies is intensifying: Within the last few years, bills in Hawaii, Rhode Island, Washington, Michigan, Maryland, Missouri, Massachusetts, and Federally have sought to ban noncompetes for all or some groups of workers. This paper contributes to the growing noncompete debate and to the on-the-job training literature by theoretically and empirically investigating whether and under what circumstances enforcing noncompetes encourages firms to invest in the skills of its employees.

Noncompetes create a legal barrier between the employee and competitor firms, raising the employee's reservation wage to join a competitor to overcome potential litigation costs. As a result, noncompetes reduce the probability an employee will leave for a competitor and consequently increase the employee's expected employment duration.[2] If firms unilaterally choose to train and share information with their employee, then the reduced likelihood that the employee will misappropriate company secrets at a competitor and his increased employment duration both increase the firm's private return to training and sharing productivity-enhancing information. Furthermore, if firms are knowledgeable about their state's noncompete policies, then when the state is more likely to enforce a given noncompete the firm's incentives to train are strengthened. Despite the increases in training due to noncompete enforceability, inefficient training levels will nevertheless result if training is chosen to maximize firm profits instead of total surplus. Additionally, increases in noncompete enforceability may also prevent workers from moving to jobs in which they are more (or less) valuable.

By contrast, if training was contractible, such that firms competed to hire the worker by offering wage-

[1] Starr et al. (2015b) show that there is remarkable heterogeneity in who signs noncompetes: At least one in three workers earning over $100k have signed one, while 10% of those earning less than $40k have also signed.

[2] It is possible that signing a noncompete may signal to competitors that the individual is valuable, which could increase the likelihood he joins a competitor.

training contracts, and workers were knowledgeable of their noncompete laws, were willing and able to negotiate over their contracts, and were able to take sufficient wage cuts, then the positive externality to training would be fully internalized and increases in noncompete enforceability would only affect the ability of employees to move across firms. Recent work has shown that the strong assumptions of this contractible model are unlikely to hold: Dustmann and Schönberg (2012) argue that training is likely not contractible because it is not easily verifiable by a third party and that it may simply be too complex to be specified in a contract in a way that is legally enforceable, while Starr et al. (2015b) finds that just 20% of workers have signed explicit training contracts. Even if training is contractible, however, Starr et al. (2015b) find that competition for the worker is often nonexistent, with only 30% of workers reporting an alternative offer when they were asked to sign their noncompete. With regards to negotiation, Arnow-Richman (2006) argues that workers typically possess little bargaining power, in part because firms strategically manage the noncompete signing process by asking workers to sign the noncompete after they have accepted the job offer (Marx, 2011). Indeed, Starr et al. (2015b) finds that only 10% of workers report negotiating over their noncompete. And even if workers do negotiate, they are unlikely to be informed about the enforceability of their noncompete: Starr et al. (2015a) shows that only 31% correctly estimate their noncompete's enforceability. And even if they are informed and negotiate, Rubin and Shedd (1981) argue that liquidity constraints limit the ability of individuals to independently finance the learning of trade secrets procured by their employer. Hence, recent work has shown that each of the assumptions of the contractible model are unlikely to hold, let alone all of them.

Nevertheless, the spirit of the contractible framework – that competition and negotiation by workers over training and wages allows them to capture the full return to training – is embodied by consideration-specific noncompete policies, which tie the enforceability of the noncompete to the receipt of additional consideration (wages, training, promotions). Consideration-specific policies both reduce the circumstances under which a noncompete is enforceable and, by partially mimicking the assumptions of the contractible model, increase training and wages by effectively negotiating on behalf of the worker. Although the training and mobility levels are still likely to be inefficient under consideration-specific laws, enforcing noncompetes when the employee is given only continued employment in exchange for signing reduces training relative to the consideration-specific case, and makes it more difficult for all workers, regardless of the training they received, to move to their most productive job.

To empirically examine the relationship between noncompete enforceability and whether consideration laws have a differential effect on training, I use confirmatory factor analysis to create an improved aggregate measure of enforceability which weighs two consideration dimensions and five non-consideration dimensions of noncompete enforceability recently quantified by Bishara (2011). With this new index, I employ a difference-

in-differences identification strategy which exploits the fact that only occupations present in litigation (high litigation) are subject to state enforceability policies. In order to map occupations to high litigation and low litigation groups, I use the occupation distribution reported in two surveys of litigated noncompete cases (LaVan, 2000; Whitmore, 1990).[3] Because individuals in the low litigation group may be affected by noncompete enforceability, the estimates represent an underestimate of the causal, intent-to-treat effect of state noncompete enforceability.[4]

The results show that a one standard deviation increase in a state's overall enforceability level increases the probability that the average high litigation occupation receives firm-sponsored training by 2.4% relative to low litigation occupations.[5] This estimate suggests that if the lowest enforcing state, California, were to adopt the highest enforcing state's laws (Florida) then high litigation occupations in California would receive at least a 13.7% increase in the likelihood of receiving firm-sponsored training. The positive effect of enforceability on training is strongest when the training content is meant to upgrade skills and when that training is offsite and outsider taught. By contrast, the effect of enforceability on the probability that the most recent training event was self-sponsored is small and statistically insignificant.

Disaggregating aggregate enforceability into separate consideration-specific and non-consideration indices shows that the estimates from the aggregate enforceability index mask substantial negative effects of enforcing noncompetes when no additional consideration is given beyond continued employment. A one standard deviation increase in the non-consideration index of enforceability increases the probability of receiving firm-sponsored training by 4.4%, while a one standard deviation increase in the enforceability of the consideration index results in a 1.8% decrease in training.[6] Thus, when state policies make it easier to enforce noncompetes, there is more training generally, but when states pass laws requiring workers to receive additional consideration in exchange for signing noncompetes (which decreases noncompete enforceability), the result is substantially more training. These findings are consistent with consideration laws substituting for the lack of individual negotiation over noncompetes.

The impact of enforceability on wages confirms this view of the role of consideration laws. Indeed, firms need not respond to consideration laws by providing only more training, but may also pay employees more or promote them. I show that a one standard deviation increase in aggregate noncompete enforceability is associated with a 0.45% decrease in hourly wages, but that this negative effect is entirely driven by states that do not require additional consideration for enforcement: a one standard deviation increase in consideration-

[3]The high litigation group refers only to occupations which are present in litigation, regardless of whether the noncompete was ultimately enforced.

[4]Since the data does not contain information on which workers actually signed noncompetes, the estimates are intent-to-treat.

[5]The mean probability of receiving firm-sponsored training in the last year is 0.23 for high litigation occupations and 0.13 for low litigation occupations.

[6]Note that high scores in the consideration-specific enforceability index refer to noncompetes being enforced without the receipt of any additional consideration beyond continued employment.

specific enforceability dimensions reduces wages by 1.2%, while a one standard deviation increase in non-consideration enforceability increase wages by 0.68%. Thus, not only do increases in non-consideration enforceability increase wages, but pegging the enforceability of noncompetes to additional consideration further raises wages.

Noncompete enforceability also increases observed tenure and changes the composition of hired workers. A move from non-enforcement to maximal enforceability increases mean tenure by 10.1% and reduces the potential experience of new hires by 3%. The negative relationship between noncompete enforceability and the potential experience of new hires may reflect the fact that noncompetes are also hiring barriers: in high enforceability states it may be difficult to attract experienced workers who are not bound by noncompetes and as a result firms may hire less experienced workers. Conversely, firms in lower enforceability states may hire more experienced workers to avoid paying training costs they will be unlikely to recoup.

The theoretical and empirical results of this paper contribute to both the on-the-job training literature, and to the growing literature on the impacts of noncompete enforceability. In the on-the-job training literature, recent work has identified that, despite initial theoretical predictions (Becker, 1962), it is firms, not workers, that tend to pay for general training (Barron et al., 1999; Loewenstein and Spletzer, 1999, 1998; Autor, 2001). Acemoglu and Pischke (1999) argue that firms invest in general skills because labor market imperfections generate a gap between wages and productivity that increases with training investments, creating incentives for firms to invest in the general skills of employees. Subsequent empirical work has been concerned with identifying these labor market imperfections, including technological complementarities (Acemoglu, 1998), minimum wages (Acemoglu and Pischke, 2003), the "thinness" of labor markets (Wolter et al., 2013), asymmetric information (Autor, 2001; Stevens, 1994), search frictions (Moen and Rosén, 2004), moving costs (Katz and Ziderman, 1990; Benson, 2013), and commitment to training (Dustmann and Schönberg, 2012). Broadly, these studies reflect a growing trend towards an understanding of monopsony power in the labor market and the firm's incentives to invest in human capital (Manning, 2003). This paper contributes to this literature by identifying noncompete enforceability as a barrier to employee mobility, which provides firms with greater incentives to invest in their employees. It similarly contributes to the growing literature in personnel economics emphasizing the relationship between human resource management practices and productivity (Shaw, 2004; Bloom and Reenen, 2011).

With regards to the literature on the efficacy of noncompetes, there is a growing reluctance towards the enforceability of these agreements (Lobel, 2013) due to the tremendous growth of Silicon Valley and California's ban on noncompetes (Gilson, 1999; Hyde, 2003), and the negative impacts of noncompete enforceability on employee mobility (Marx et al., 2009; Garmaise, 2009; Fallick et al., 2006) and new venture creation (Samila and Sorenson, 2011; Stuart and Sorenson, 2003; Starr et al., 2015c). Few studies, however,

have empirically examined to what extent firms and workers actually benefit from the protection offered by enforceability.[7] My results contribute to this line of inquiry by estimating an important parameter necessary to understand the overall welfare effects of noncompete enforceability: firms indeed respond to the increased protection of their confidential information by providing more training to their employees. Increased training need not be brought about by higher enforceability per se, however, since state courts can reduce noncompete enforceability and increase training and wages by enforcing noncompetes only when workers are provided additional consideration in exchange for signing.

The rest of the paper is organized as follows: Section 2 describes the use of noncompetes and how noncompete enforceability is quantified. Section 3 extends the classic two-period training model to include noncompete enforceability and mobility. Section 4 introduces the data and the identification strategy. Section 5 discusses the results and robustness checks, and Section 6 concludes.

2 Noncompetes and Noncompete Enforceability

2.1 The Incidence of Noncompetes

While claims of the ubiquity of noncompetes are common, until recently there has been very little systematic evidence on the incidence of noncompetes.[8] Starr et al. (2015b) presents the first systematic investigation into the use of noncompetes in the U.S. labor force, providing bounds on the incidence of noncompetes by education, income, occupation, and industry.[9] The lower bounds on the incidence of noncompetes show that individuals in higher-skill, knowledge-intensive occupations involve the most noncompete activity: 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%) sign noncompetes relatively frequently.

2.2 Quantifying Noncompete Enforceability

In this section I describe existing measures of noncompete enforceability and provide an improved measure, focusing in particular on how noncompete enforceability depends on the process from noncompete signing to

[7] Lavetti et al. (2014) find that physicians who sign noncompetes tend to earn 11% more because they are allocated more clients. Conti (2014) finds that noncompete enforceability is associated with more risky firm R&D investments.

[8] Previous studies consider a few high skill occupations, showing that that about 80% of CEOs sign noncompetes (Bishara et al., 2012; Garmaise, 2009), 45% of physicians (Lavetti et al., 2014), 40% of engineers (Marx, 2011), and 70% of entrepreneurs with venture capital contracts (Kaplan and Strömberg, 2003). Galle and Koen (2000) survey practicing human resource professionals and find that of the 123 returned surveys (12.3% response rate), 55% of firms used noncompetes. The authors did not investigate which occupations within the firm were asked to sign noncompetes.

[9] Individuals are categorized into signers, non-signers, and the maybe group, which is composed of individuals who do not know if they have signed, refuse to say, or have never heard of noncompetes. The bounds on the incidence of noncompetes are determined by assuming the maybes did and did not sign.

noncompete enforcement. Employees tend to sign covenants not to compete on the first day of their new job, or soon after (Marx, 2011). These agreements typically stipulate that upon separation from the employer the employee cannot work for a competitor, or start a competing business, for a certain amount of time and in a specified geographic region. Upon violating the terms of the noncompete, a number of steps must be taken by the prior employer in order for the worker to be prevented from actually working for the competitor. The prior employer must first learn of the violation, then it must choose to file suit in court. When the case reaches court, the prior employer usually seeks a preliminary injunction, which will prevent the employee from working for the competitor until the judge determines whether or not he will enforce the employee's noncompete. Noncompetes are considered common law and are decided by judges based on state statutes or case law precedents.[10] In 2014 there were 1,005 reported, litigated noncompete cases (Beck, 2014). This number is an underestimate of the number of cases, however, because most cases settle out of court, and workers may take career detours to explicitly avoid potential litigation (Marx, 2011).

While some states, such as California and North Dakota, refuse to enforce noncompetes, most states will enforce them by implementing their own version of the 'reasonableness doctrine,' which balances the protection necessary for the firm with the injury to the worker and society.[11] Among enforcing states there is unanimous agreement that a necessary condition for the enforceability of a noncompete is that the worker possesses some kind of valuable information, called 'protectable interests,' in which the firm has made a significant investment it seeks to protect, such as trade secrets, client lists, and other confidential information which gains value from not being publicly known. Some states, such as Florida and Kentucky, include extraordinary general skills training in this list of protectable interests, but traditionally it has been omitted (Blake, 1960). Regardless of whether general training is itself a protectable interest, however, the training a firm chooses for its employees is closely related to the traditional protectable interests: Once an employee is exposed to the firm's secret formula, client lists, advertising strategies, or other confidential information, the employee is bonded to the firm by the noncompete and the firm has the same increased incentives to invest in the worker as if training was itself a protectable interest. Those further investments in training may include learning more trade secrets and confidential information, but it is the first exposure to confidential information that counts.[12]

[10] Inter-jurisdictional issues regarding noncompete enforceability can be quite complex. See Glynn (2008) for a discussion on choices of law and forum and conflict of law. See also *Advanced Bionics Corp.* v. *Medtronic, Inc.* 59 P.3d 231, 238 (California 2002) for a complicated case.

[11] See Blake (1960) for an in-depth review of the history of noncompete enforceability.

[12] There exists a debate in the legal literature about whether general training should be a protectable interest. The arguments hinge on whether or not the worker is able to stay at the firm long enough to pay back the training costs borne by the firm. If the worker leaves too soon, the firm cannot capture enough of the return to training to cover the cost (Lester, 2001). On the other hand, if the worker leaves long after he has repaid his training cost, it seems unfair to restrict his post-employment options by enforcing his noncompete (Long, 2005). As a result of this debate, many legal scholars advocate the use of training recoupment contracts such that if the worker leaves too soon he must pay back damages to the firm (Von Bergen and Mawer, 2007).

Even after courts identify whether the worker possesses a trade secret or has access to client lists, significant variation remains in how states perceive reasonableness or respond to the unreasonableness of various other dimensions of the case. For example, some states will only enforce a worker's noncompete if the worker voluntarily quits, while others will enforce it even if the worker is fired. State courts also vary in the manner in which they handle unreasonably overbroad covenants. Most states will rewrite overbroad noncompetes to be more reasonable and subsequently enforce them. Wisconsin, for example, will throw out the entire contract if it is deemed overbroad. Colorado will only enforce noncompetes for workers in upper management. States also have different enforceability protocols for whether continued employment is sufficient consideration for the enforcement of the noncompete: In Oregon, for example, firms have to notify prospective employees that they will be asked to sign a noncompete two weeks before employment commences. If the firms do not notify the worker in advance, the firm must provide the worker with additional benefits ex post in order for the noncompete to be enforceable.[13]

Malsberger tracks these and other dimensions of enforceability in his volume *Covenants Not to Compete: A State-by-State Survey.* Three attempts have been made to quantify the enforceability of noncompetes (Bishara, 2011; Garmaise, 2009; Stuart and Sorenson, 2003), but they have done so without explicitly stating the object being measured. One natural metric would capture the probability a randomly chosen employee's noncompete would be enforced if the employee left for a competitor and his parent firm sued. To capture this probability, one would have to know (1) under what situations a state would enforce a noncompete, and (2) how frequently those circumstances occur in the noncompete signing population. All existing indices capture (1) in various ways, but ignore (2). The simplest approach is taken by Stuart and Sorenson (2003) who create a simple enforceability dummy. The Garmaise (2009) index measures 12 dimensions of enforceability with a binary score and adds up the scores for each state, assuming that each dimension has equal weight.[14] Bishara (2011) assigns each state a score between 0 to 10 on seven dimensions of noncompete enforceability for 2009 and 1991 and aggregates the individual dimensions using subjectively chosen weights.[15] I improve upon Bishara's weighting scheme by using confirmatory factor analysis on his seven scores to generate weights for each dimension, which may better approximate the underlying importance of the various dimensions of enforceability.[16] Due to the highly correlated nature of the individual dimensions of enforceability, however,

[13] See generally Malsberger et al. (2012) and earlier editions.

[14] A complete explanation of the Garmaise (2009) scoring method is available in Appendix B.

[15] A complete explanation of Bishara (2011) scoring method is available in Appendix B.

[16] A better index would incorporate the distribution of characteristics relevant for enforceability into the index itself. Relatedly, note that the benefits of incorporating each dimension into a single index as opposed to considering the impact of each component individually are twofold: (1) Since the standard errors of my estimates will be clustered at the state level, worries about micronumerosity (See Goldberger (1991)) increase as the number of state-level regressors increases and (2) if each dimension of enforceability is considered a measurement error ridden proxy for latent noncompete enforceability intensity, then combining the measures into a single index reduces attenuation bias. An alternative is the method by Lubotsky and Wittenberg (2006) shows that including the individual measures in the baseline regression specification and then using the coefficients on the individual dimensions as weights in the aggregation into a single index is the best way to reduce measurement error. Their

all weighting schemes which give non-negative weights to each dimension result in highly correlated aggregate indices. Confirmatory factor analysis as a reweighting tool is therefore a modest improvement.

Factor analysis postulates that each particular dimension of noncompete enforceability depends linearly upon latent enforceability. Defining x_{is} as observed enforceability dimension i for state s and $Enfc_s$ as latent enforceability, the model is defined by the set of equations

$$x_{is} = \lambda_i Enfc_s + \epsilon_{is} \quad \text{for } i = 1, 2...7, \tag{1}$$

where ϵ_{is} is measurement error.[17] Under the normalization that $\lambda_1 = 1$, the correlation matrix of the observed enforceability dimensions identifies the other λ_i terms because $corr(x_i, x_j) = \lambda_i \lambda_j$. Given estimates of the λ_i terms, we can back out an estimate of the enforceability index. Regressing this estimate of the enforceability index on the dimensions of enforceability gives the weights.[18] The enforceability index is normalized to have a mean of zero and a standard deviation of one in a sample where each state is given equal weight. Table 1 reports the mean, standard deviation, weight of each dimension of enforceability for 1991 and 2009 from Bishara (2011) and the resulting weights from the factor analysis.

Table 1: Noncompete Enforceability Index Weights

	1991		2009			
Question	Mean	SD	Mean	SD	Bishara Weight	Factor Analysis Weight
Statute of Enforceability	4.90	1.53	4.96	1.79	0.10	0.09
Protectable Interest	5.80	2.03	0.07	1.93	0.10	0.12
Plaintiff's Burden of Proof	5.36	2.06	5.59	1.93	0.10	0.10
Consideration At Inception	8.45	2.35	8.73	2.39	0.05	0.13
Consideration Post Inception	7.04	2.78	7.15	2.86	0.05	0.08
Overbroad Contracts	5.71	3.07	5.83	2.91	0.05	0.04
Quit v. Fire	6.23	2.32	6.45	2.37	0.10	0.09
Constant						-4.23

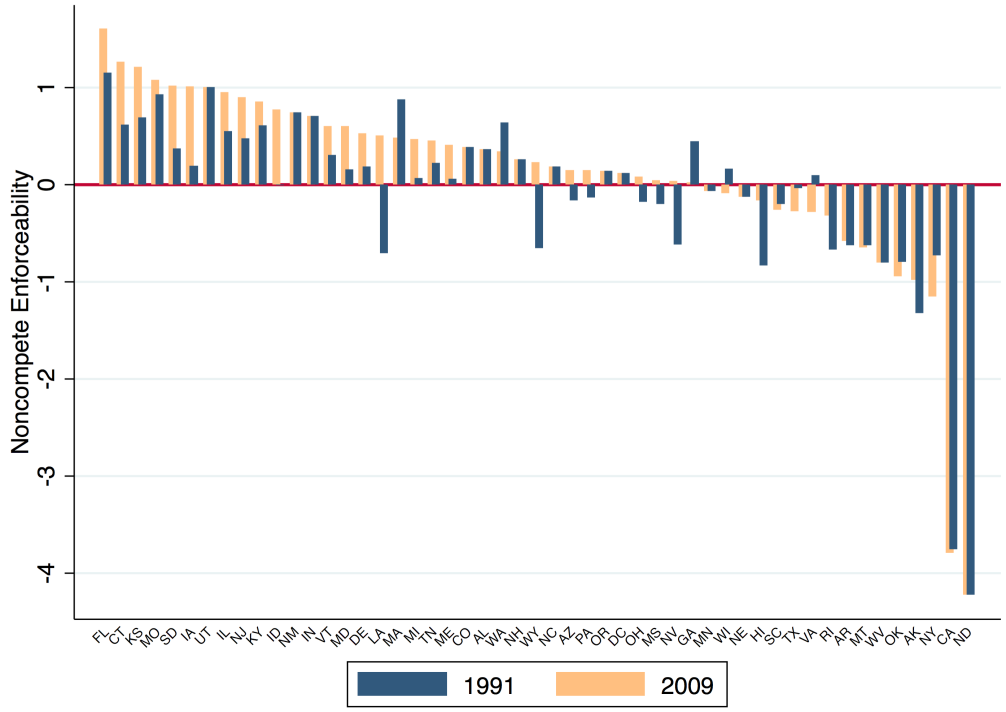
Note: The exact commands used in Stata 14 to generate the factor analysis index and weights are as follows: First, `sem (X -> q1 q2 q3 q3a q3bc q4 q8), method(ml) latent(X) iterate(100)`, identifies the λ_i coefficients from (1), where `q1, ..., q8` are the seven dimensions of noncompete enforceability quantified by Bishara (2011). Second, the `predict FC_temp, latent(X)` command generates the noncompete enforceability index. Third, the index is normalized to have a mean of 0 and a standard deviation of 1 in a sample where each state has a weight of 1, and, following normalization, the index is regressed on the seven dimensions of enforceability to generate the weights.

method generates different weights with different dependent variables, which is unappealing in this context. Regardless, their method of aggregation is utilized as a robustness check.

[17] It is assumed that $E[\epsilon_{is}] = 0$, $E[\epsilon_{is}^2] = \sigma_i$, $E[\epsilon_{is}\epsilon_{js}] = 0$ for all $i \neq j$, $E[\epsilon_{is}\epsilon_{ik}] = 0$ for all $s \neq k$.

[18] See Kolenikov (2009) for details, Harman (1976) for further details on exploratory factor analysis. See Black and Smith (2006) for an example of using factor analysis to generate an index of college quality.

Figure 1: Factor Analysis Enforceability Index for 2009 and 1991



The factor analysis generated weights correspond surprisingly well with Bishara's subjectively chosen weights. The factor analysis weighted index puts slightly more weight the extent of protectable interests within the state, and on consideration at the inception and after the inception of employment. The correlation between the Bishara measures and the factor analysis measures is at least 0.97 for each of the years. Figure 1 shows the noncompete enforceability score for each state for each year, using the weights in Table 1, while the exact scores are shown in Table A1 in Appendix B. California and North Dakota have the lowest scores, while the highest scores belong to Florida and Connecticut. Overall, the variation across states is large both in levels and relative to the within-state variation over time.[19] Enforceability is not correlated with a state's political leanings (Lavetti et al., 2014) and does not appear to be clustered geographically.[20]

[19]There are two reasons why there might be differences between the 1991 and 2009 scores: (1) New cases or statutes caused changes in state laws; (2) Many states had not established firm policies in 1991 with regards to some of the dimensions and therefore have missing information. These missing values are imputed based on the state's average non-missing score. If by 2009 the court had determined an outcome, it may differ from the imputed value. With regards to actual changes in state laws, the only reversal occurred in Louisiana, which had an initial reversal in mid-2001 and then reverted back to pre-2001 enforceability levels in 2003. This reversal period is unlikely to affect my estimates because (1) the affected number of workers is very small (only 104 workers in the final sample of 70,374), and (2) the survey asks about training during the past year, while workers were surveyed only two months into the reversal. To account for any further changes over time, I assign data from 1996 and 2001 the 1991 enforceability scores, while the rest of the years receive the 2009 enforceability score. Robustness checks in Table 10 confirm that using either the 1991 and 2009 scores does not change the results.

[20]See the map in Appendix C.1.

3 A Theory of Noncompete Enforceability, Training, and Mobility

3.1 Prior Theory on Noncompete Enforceability and Training

Four recent papers have theoretically approached the topic of noncompetes and training, though with different objectives and structures (Meccheri, 2009; Garmaise, 2009; Posner et al., 2004; Ghosh and Shankar, 2015). Meccheri (2009) examines how noncompetes differentially affect the firm's incentives to invest in general and firm-specific training, while Garmaise (2009) examines the contrasting incentives of firms and individuals to invest in human capital as a result of a noncompete. Posner et al. (2004) link the use of noncompetes to alternative breach remedies, suggesting that noncompetes are a hybrid between specific performance for movements within the scope of the noncompete and zero liquidated damages outside the scope of the noncompete. They suggest that as long as the scope of the noncompete is sufficiently limited that noncompetes should be enforced. Ghosh and Shankar (2015) seek to theoretically identify efficient noncompete enforceability policies, allowing firms and employees to invest in human capital while worker match quality to varies across firms. Similar to Posner et al. (2004), they find that optimal noncompete enforceability is nonzero.

Relative to these studies, the models presented here make four primary improvements. First, by contrasting the unilateral firm choice model, which generates the standard prediction that enforceability encourages firms to train, with the contractible training model, I identify that optimal noncompete enforceability depends on the way in which training is determined. Second, under the plausible assumption that training is determined unilaterally, these models suggest that laws which bring training choices closer to the contractible model, such as consideration laws which effectively negotiate on behalf of the employee, can simultaneously reduce noncompete enforceability and increase training. Third, by allowing individuals to not be perfectly informed about state enforceability laws, I identify the fact that noncompetes themselves may chill employee mobility, regardless of their actual enforceability. Fourth, I allow individuals to bring sensitive information across firms, in addition to their marginal product, and examine how optimal enforceability changes as a result.

3.2 Model Setup

The theory developed in this section formalizes the tension between noncompete enforceability, general human capital investment and worker mobility, seeking both to understand the assumptions underlying a relationship between noncompete enforceability and firm-sponsored general skills training and to characterize optimal noncompete enforceability. The theory is based on the two-period full-competition and constrained

regimes laid out in Acemoglu and Pischke (1999), which I refer to as 'contractible' and 'unilateral firm choice' regimes, respectively. These two training regimes contrast the incentives of firms and workers to invest in general skills training.[21] In the constrained, or 'unilateral firm choice,' regime, workers are not allowed to contribute to training and firms unilaterally choose training to maximize profits. In the full-competition, or 'contractible,' regime, identical firms compete to hire a worker by offering wage and training contracts, denoted $\{W, T\}$, where W refers to the worker's wage in the training stage, and T corresponds to the amount of training the worker will receive. In either regime, the worker's second period wage is determined in a Nash bargain with worker bargaining weight β, based on the worker's expected outside option from quitting, $\mathbf{E}[v(T)]$.

The worker's output in the hiring and training stage is normalized to zero, while the worker produces $y(T)$ in the second period if the worker stays with the firm. The cost of training, $c(T)$, is paid in the first period. The cost and production functions satisfy the standard conditions.[22]

In the poaching stage, the now trained worker meets another firm.[23] He observes a wage offer equal to his productivity at that firm, $ay(T)$ plus the value of any information he brings to the new competitor, $zk(T)$, where $k(T)$ is increasing and concave in training, and a and z are random variables with cumulative joint distribution $G(a, z)$, probability distribution $g(a, z)$, and domains $a \in [0, \bar{a}]$ and $z \in [0, \bar{z}]$.[24] If the worker decides to stay, then he earns $w(T)$ and produces $y(T)$ at the initial firm. If the worker successfully quits and joins the poaching firm, then his firm initial firm loses any sensitive information the employee carried with him, which the initial firm values at $lk(T)$ where l is a constant. Such information is zero sum if $z = l$, such that the losses at one firm are valued equally at another firm.

When the worker is hired, the firm decides whether to offer the worker a noncompete and the worker decides whether to sign it. If the worker signs it and eventually joins the poaching firm, then the worker's noncompete is enforced with probability $\lambda \in [0, 1]$.[25] The worker's expected wage from quitting is $(1 - \lambda)(ay(T) + zk(T))$, where the worker is assumed to earn nothing if his noncompete is enforced. Intuitively, λ reflects the proportion of an individual's productivity that is firm-specific. This perspective highlights the

[21] The justification for the general skills assumption is that most skills are reported to be explicitly transferable (Loewenstein and Spletzer, 1999; Dustmann and Schönberg, 2012). Furthermore, recent work tends to consider skills transferable along some dimension whether it is within industries (Neal, 1995; Parent, 2000), occupations (Kambourov and Manovskii, 2009), or tasks (Gibbons and Waldman, 2004; Gathmann and Schönberg, 2010). Lazear (2009) notes that while some skills may be more idiosyncratic to the firm, it is likely that "'each of these skills is general in the sense that it is used at other firms as well." In his model, it is the thickness of demand for skills ('skill-weights') which determine their specificity – firm specificity being a limiting case. Thus I follow the growing trend of treating human capital as general in at least some sense.

[22] These conditions are: $y(0) = 0$, $y'(T) > 0$, $y'(0) = \infty$, $y''(T) < 0$ and $c'(T) > 0$ if $T > 0$, $c'(0) = 0$, and $c''(T) > 0$.

[23] Or equivalently, mulls starting his own business

[24] The assumption that the worker earns his full marginal product plus the value of his information simplifies the math but is not necessary for the results. Nash bargaining will yield the same results.

[25] By focusing on enforceability, I am abstracting from the firm's choice to sue the worker over the noncompete – leaving λ independent of l. Indeed, one would think that firms would be more likely to sue a departing employee if they were to suffer greatly from the departure. Incorporating this logic into the model would suggest that noncompete enforceability is significantly more important for the training of individuals with high l. I leave a complete derivation of such a model to future work.

fact that noncompete enforceability makes general human capital de facto firm specific.[26] Thus, in order for an individual to move between firms, it must be that the poaching firm values the 'general' part of his productivity $(1-\lambda)$ enough (i.e. a high a or z). In this specification, not signing a noncompete can be thought of as $\lambda = 0$; that is, not signing a noncompete is equivalent to having signed a noncompete which is entirely unenforceable.[27]

3.3 Solving the Model

I solve the model via backwards induction, starting with the worker's quit decision. In the poaching phase, the worker meets a new firm at which he will have a wage equal to his productivity, $w_p(T) = ay(T) + zk(T)$. The worker quits if his pay at the competitor firm exceeds his bargained wage at the incumbent firm:

$$(1-\lambda)w_p(T) > w(T) \tag{2}$$

The worker's post-training wages, $w(T)$, are determined in a Nash bargain after the worker is trained but before he meets a firm in the poaching stage. At this point, the worker has an expectation of his wage in the poaching firm, $\mathbf{E}[w_p(T)] = \mathbf{E}[a]y(T) + \mathbf{E}[z]k(T)$. The worker's expected outside option from quitting at the time the wage is bargained is $\mathbf{E}[v(T)] = (1-\lambda)\mathbf{E}[w_p(T)]$.

His bargained wage gives him his outside option plus his share, β, of the surplus,[28] which simplifies to

$$w(T) = \beta y(T) + (1-\beta)(1-\lambda)\mathbf{E}[w_p(T)] \tag{3}$$

Substituting the wage from (3) back into the quit equation from (2) gives the quit decision:

$$w_p(T) > \frac{\beta y(T)}{1-\lambda} + (1-\beta)\mathbf{E}[w_p(T)] \equiv \hat{w}(\lambda) \tag{4}$$

If the worker meets a firm with $\{a, z\}$ in the region determined by (4) then the worker quits. Denote the quit probability, $P(w_p(T) > \hat{w}(\lambda))$, by $q(\lambda)$.[29] It is clear that an increase in noncompete enforceability, λ,

[26] One might also think of λ as the percentage of time in the poaching period that the worker will be prevented from working for the competitor firm.

[27] In practice, this may not be true if individuals who sign noncompetes in very low enforcing states, such as California, perceive them to be enforceable. I consider individual perceptions of enforceability in Section 3.5

[28] Nash bargaining results in wages being determined by $w(T) = \mathbf{E}[v(T)] + \beta(y(T) - \mathbf{E}[v(T)])$.

[29] The formula for the probability of a quit, $q(T)$, is

$$P(w_p(T) > \hat{w}(\lambda)) = q(\lambda) = \int_0^{\bar{a}} \int_{\hat{z}(\lambda,a)}^{\bar{z}} g(a,z)dzda$$

$$\text{where} \quad \hat{z}(\lambda,a) \equiv \frac{\beta y(T)}{(1-\lambda)k(T)} - \frac{ay(T)}{k(T)} + (1-\beta)\left[\frac{\mathbf{E}[w_p(T)]}{k(T)}\right] \quad \text{from (4)}$$

increases the threshold $\hat{w}(\lambda)$ required to quit, reducing the probability of a quit, all else equal.

3.3.1 Case 1: Firm Chooses Training Unilaterally

This model examines the case in which the worker is not allowed to contribute to training and the firm unilaterally chooses training for its worker, competing for the worker only on first period wages.[30] Because an untrained worker's marginal product is assumed to be zero, competition induces first period wages of $W = 0$.[31] Under these assumptions, the employer's problem is given by:

$$\max_T \mathbf{E}[\pi(T)] = (1 - q(\lambda))(y(T) - w(T)) + q(\lambda)(1 - \lambda)(-lk(T)) - c(T)$$

If the worker stays, then the firm earns $y(T) - w(T)$. If the worker leaves then the firm loses $lk(T)$, and it pays the cost of training $c(T)$ either way. Plugging in for the value of $w(T)$ from (3) and solving for the optimal training level, $T_u^*(\lambda)$, gives:

$$(1 - q(\lambda))(1 - \beta)\left[y'(T_u^*(\lambda)) - \frac{d(\mathbf{E}[v(T_u^*(\lambda))])}{dT}\right] = q(\lambda)(1 - \lambda)lk'(T_u^*(\lambda)) + c'(T_u^*(\lambda)) \tag{5}$$

The term on the left hand side represents the marginal benefit of training, which is the additional profit the firm receives by marginally increasing training. The right hand side represents the marginal cost of training, which includes the direct marginal cost of training and the marginal loss if the worker leaves.[32]

Under the assumption that the set $\{a, z, \lambda\}$ satisfy $y'(T_u^*(\lambda)) > \frac{d(\mathbf{E}[v(T_u^*(\lambda))])}{dT}$, such that training increases productivity more than the worker's wage, noncompete enforceability has an unambiguously positive effect on training. Increasing noncompete enforceability increases the marginal benefit of training by increasing the probability the worker stays, $(1-q(\lambda))$, and reducing wages by reducing the value of quitting, $\frac{d(\mathbf{E}[v(T_u^*)])}{dT}$ which increases the marginal profitability of training. Increasing noncompete enforceability simultaneously reduces the marginal cost of training by reducing the expected marginal loss through reducing the probability of a quit, $q(\lambda)$ and the likelihood that any such quit is successful $(1 - \lambda)$.

The Choice to Offer and Sign a Noncompete

The firm will offer a noncompete if it's profits are greater than from not offering it; if $E[\pi(T_u^*(\lambda), \lambda)] >$

[30] If firms could compete over post-training wages in addition to pre-training wages, then competition among employers would reduce the total expected profit from hiring the worker to zero, which is identical to the contractible case. Restricting wage competition to only the training stage results in zero profits only in the training period.

[31] Assuming $y(0) > 0$ does not substantively change any analysis. If this were the case, competition simply bids up his wage to $W = y(0)$ and does not affect the marginal training decision.

[32] To avoid complications with nonmonotonicity in the marginal cost of training, assume that $c''(T) > q(\lambda)(1 - \lambda)lk''(T)$ for all T, such that the marginal cost of training is always increasing in T.

$E[\pi(T_u^*(0),0)]$. Equilibrium profits are given by

$$\mathbf{E}[\pi(T_u^*(\lambda)),\lambda)] = (1-q(\lambda))(1-\beta)\Big[y(T_u^*(\lambda)) - \mathbf{E}[v(T_u^*(\lambda)]\Big] - q(\lambda)(1-\lambda)lk(T_u^*(\lambda)) - c(T_u^*(\lambda))$$

Since increases in noncompete enforceability reduce the chance of a quit, reduce the wage the firm has to pay the worker, and increase training, increases in enforceability will lead to greater profits. As a result, firms will always choose to use noncompetes.

Theoretically, workers agree to noncompetes when their earnings are greater under the noncompete than otherwise. Considering (3), increases in λ have opposing effects on wages: increases in enforceability reduce the value of outside options, reducing the wage, but also increase the amount of training, which increases the wage. The net effect is ambiguous. Conceptually, individuals who strongly benefit from the increased training, or for whom few opportunities are reduced from the noncompete, are likely to sign noncompetes.

The empirical evidence from Marx (2011) and Starr et al. (2015b) does not perfectly align with the theory: it suggests that more than 90% of those asked to sign indeed do sign, that firms frequently delay offering the noncompete until the employee has started, that more than two-thirds of those asked to sign noncompetes have no alternative options when they are asked, that less than 10% of individuals consult a lawyer before signing, and that just 10% of individuals report negotiating over their noncompete. This evidence suggests that for most individuals, when the firm asks the employee to sign, they do without negotiation.

3.3.2 Case 2: Training is Contractible

To contrast with the previous model, which prior work has suggested is the dominant framework, I now consider how training outcomes differ when firms compete for the worker by offering wage contracts of the form $\{W,T\}$ and ask the worker to sign a noncompete. Despite the implausibility of the assumptions underlying the model, the results of are relevant for thinking about how consideration laws, which give workers time to negotiate over their noncompetes or negotiate on the worker's behalf, effectively create outcomes closer to the contractible framework.

Assuming that the worker is equally valuable to all firms in the hiring stage, competition ensures that firms earn zero expected profits. Given the zero expected profits condition, the worker chooses the utility maximizing $\{W,T\}$ contract:

$$\begin{aligned} \max_{T,W} \quad U(W,T) &= W + (1-q(\lambda))w(T) + q(\lambda)(1-\lambda)\mathbf{E}[w_p(T)|w_p(T) > \hat{w}(\lambda)] \\ s.t. \quad W &= (1-q(\lambda))(y(T)-w(T)) - q(\lambda)(1-\lambda)lk(T) - c(T) \end{aligned}$$

Substituting for W from the firm's zero profit constraint into the worker's maximization problem gives:

$$\max_T U(T) = (1-q(\lambda))y(T) + q(\lambda)(1-\lambda)\Big(\mathbf{E}\Big[w_p(T)|w_p(T) > \hat{w}(\lambda)\Big] - lk(T)\Big) - c(T) \tag{6}$$

The firm's indifference between zero expected profit wage-training contracts turns the worker's optimal contract choice problem into a problem of joint surplus maximization.[33] If the worker stays, $y(T)$ is produced and if the worker quits and his noncompete is not enforced then he produces $\mathbf{E}[w_p(T)|w_p(T) > \hat{w}(\lambda)]$ at the poaching firm and his initial firm loses $lk(T)$. Simplifying the objective function and taking the derivative with respect to T from (6) yields the first order condition for the optimal training level $T_c^*(\lambda)$ of the contract selected by the worker:

$$(1-q(\lambda))y'(T_c^*(\lambda)) + q(\lambda)(1-\lambda)\Big(\frac{d\mathbf{E}\Big[w_p(T_c^*(\lambda))|w_p(T) > \hat{w}(\lambda)\Big]}{dT}\Big) = q(\lambda)(1-\lambda)lk'(T_c^*(\lambda)) + c'(T_c^*(\lambda)) \tag{7}$$

The optimal training level equates the marginal social benefit and marginal social cost of training. The marginal social benefit of training consists of the increased productivity in the initial firm, and the increased productivity of the worker at the poaching firm, inclusive of both his additional marginal product and the additional value of his sensitive information. The marginal social cost includes the increased marginal loss to the initial firm if the worker quits as well as the direct cost of training.

Whether increases in noncompete enforceability induce more training is ambiguous: Noncompete enforceability unambiguously decreases the marginal cost of training by reducing the expected loss through reducing the likelihood of a quit and the probability that a quit is successful, but whether increases in enforceability increase the marginal benefit of training is uncertain. Increasing noncompete enforceability increases the marginal value of training at the current firm (by reducing the likelihood of a quit), but reduces the likelihood of a successful quit and the consequent marginal benefit of training at successful poaching firms. If workers are sufficiently likely to quit to join firms in which their training is more valuable, then noncompete enforceability reduces the marginal benefit of training, rendering the relationship between enforceability and optimal training ambiguous. Alternatively, if workers are sufficiently likely to quit to a firm in which their training is less valuable (an inefficient quit), then increasing noncompete enforceability increases the marginal benefit of training and, together with the reduction in the marginal cost of training, induces a positive relationship between enforceability and training.

Comparing the training outcomes from the two cases leads to the following proposition.

[33] The positive training externality is internalized to the extent that the worker earns his full marginal product at the competitor.

Proposition 1. *For a given enforceability level, λ, optimal training levels and wages are higher when training is contractible, $T_c^*(\lambda) > T_u^*(\lambda)$, and $w(T_c^*(\lambda)) > w(T_u^*(\lambda))$.*

The proof is in Appendix section A, but the intuition is clear: In the contractible case, training is chosen to maximize total surplus whereas in the unilateral firm choice model training is chosen to maximize firm profits, which are less than total surplus because they exclude worker benefits and benefits to alternative employers.

3.3.3 The Contractible Model and Consideration Laws

The contractible model relies on five implicit assumptions: (1) training is contractible; (2) competition drives expected profits to zero; (3) workers are able to negotiate and choose the optimal wage-training contract; (4) workers are fully informed about the level of noncompete enforceability; and (5) workers are able to finance any training. Each of these strong assumptions has been shown to be unlikely. Starr et al. (2015b) show that (1) that only 20% of respondents reported signing formal training contracts, that (2) competition for workers at hiring is far from perfect – only 30% of workers having an alternative offer when they were asked to sign the noncompete – and that (3) only 10% of workers report negotiating over their noncompete. Starr et al. (2015a) show that (4) that just 31% of workers correctly estimate the enforceability of their noncompete. Rubin and Shedd (1981) argue that (5) liquidity constraints will prevent individuals from paying the firm enough to obtain confidential information that presumably cost the firm considerable time and money to procure. Hence the results of the contractible model are unlikely to obtain.

Despite the implausibility of these assumptions, consideration laws, which tie the enforceability of the noncompete to the employee receiving additional consideration beyond continued employment, mimic the assumptions required by the contractible model. In the absence of competition for workers at hire, consideration laws require that the employee receives some additional compensation which reduces the profits of the firm (though likely not to zero profits). In doing so, the consideration laws effectively negotiate on behalf of the worker, who is both unlikely to negotiate and unlikely to know his state's enforceability policy. Thus, consideration laws effectively create a hybrid of the unilateral choice and contractible models.

What exactly constitutes sufficient consideration for a noncompete to be enforceable is frequently unclear. The language of the Oregon consideration law requires two weeks of notice before the commencement of employment or 'a bona fide advancement' of the employee by the employer.[34] The firm would presumably

[34]The text of Oregon Revised Statutes §653.295 (1)(a) reads

> *(1) A noncompetition agreement entered into between an employer and employee is voidable and may not be enforced by a court of this state unless:*
> *(a)*

like to satisfy the consideration requirement in the least costly way, but the vagaries of the consideration language often make it unclear exactly how to do so. Thus firms may increase employee wages, invest more in employee training, or promote the focal employee, which likely comes with both an increase in wages and training. Alternatively, the additional time given to the worker to consider the noncompete may lead to increased negotiation along the lines of the contractible model.[35]

3.4 Efficiency

Given that firms train their workers unilaterally and workers make optimal quit decisions, what is the optimal level of noncompete enforceability? Theoretically, noncompete enforceability trades off the misallocation of labor with underinvestment in human capital. Increases in noncompete enforceability reduce the ability of workers to move across firms, whether it is to firms that value the worker's training more or less than the initial firm. Under the unilateral model, noncompete enforceability also increases training by increasing the private returns to training through increasing the expected duration of the employment relationship and decreasing the expected losses conditional on a quit. Optimal noncompete enforceability will balance the marginal benefit of investment with the marginal (net) cost of labor misallocation.

Formally, the social planner's problem is given by

$$\begin{aligned}\max_{\lambda} \quad \mathbf{E}[S(T_u^*(\lambda),\lambda)] =& (1-q(\lambda))y(T_u^*(\lambda)) \\ &+ q(\lambda)(1-\lambda)\Big[\mathbf{E}\Big[w_p(T_u^*(\lambda))|w_p(T)>\hat{w}(\lambda)\Big] - lk(T_u^*(\lambda))\Big] - c(T_u^*(\lambda))\end{aligned}$$

where $\mathbf{E}[S(T_u^*(\lambda),\lambda)]$ is expected total surplus evaluated at the optimal unilateral firm choice training level, $T_u^*(\lambda)$ and the quit probability is determined optimally by the worker, $q(\lambda)$.

(A) The employer informs the employee in a written employment offer received by the employee at least two weeks before the first day of the employees employment that a noncompetition agreement is required as a condition of employment or

(B) The noncompetition agreement is entered into upon a subsequent bona fide advancement of the employee by the employer;

For an example in Minnesota's case law see, Sanborn Mfg.Co. v. Currie, 500 N.W.2d 161 (Minn. App. 1993), where the worker's offer letter did not include reference to a noncompete and the employee was asked to sign upon reporting to work. The judge decided, "Sanborn provided no evidence of independent consideration to support the noncompetition agreement and thus showed no likelihood of winning this case on the merits.")

[35]The contractible model makes the assumption that the worker knows about the noncompete ahead of time and can properly consider it. Marx (2011) finds that most engineers who sign noncompetes do not know about them at the time of the offer. Indeed, the typical vignette is of a worker who accepts an offer without knowing about the noncompete in advance, then signs the noncompete on the first day while working through a pile of paper work. Incorporating this strategic timing into the contractible model, it is straightforward to show that noncompete enforceability can only have a non-negative impact on training. In this scenario, the worker bargains for training level $T_c^*(0)$ and starting wage $W_c^*(0)$. In the second period the firm would make an incentive compatible training choice. If the the training chosen by the contract is such that $T_u^*(\lambda) > T_c^*(0)$, then the firm will provide more training. Alternatively, assuming that the firm cannot 'untrain' the employee, if $T_u^*(\lambda) \leq T_c^*(0)$ the firm will leave the training level at $T_c^*(0)$. Thus noncompete enforceability in this scenario can only have a non-negative impact on training. This blend of the contractible and unilateral training models indeed may be representative of the training received by the typical worker.

Increases in noncompete enforceability have three fundamental effects in this model: First, they induce the firm to provide more training ($T_u^{*'}(\lambda) > 0$). Second, they increase the reservation wage of the worker ($\hat{w}'(\lambda) > 0$), preventing quits to firms with $w_p(T_u^*(\lambda)) < \hat{w}(\lambda)$. Third, conditional on quitting, increases in noncompete enforceability reduce the likelihood that any quit is successful $(1 - \lambda)$. Optimal noncompete enforceability balances the marginal benefit from increased investment and the marginal (net) cost of labor misallocation. To build intuition about what drives optimal noncompete enforceability, assume that the firm's losses from losing the employee, $lk(T)$ are the same as the poaching firms gain from his confidential information, $zk(T)$, for all z.[36] In this case, the second term then simply reflects the expected productivity conditional on quitting to join the poaching firm, $\mathbf{E}[a|w_p(T_u^*(\lambda)) > \hat{w}(\lambda)]y(T_u^*(\lambda))$. Such a quit may be productivity enhancing if the employee joins a firm where his training is more valuable (an efficient quit), but it may also be productivity reducing if the employee joins a firm at which his training is less valuable (an inefficient quit). If the worker is less valuable at the poaching firm, then the social planner has a strong incentive to increase noncompete enforceability to keep the worker at his firm and to increase his training level.

Allowing the value of the confidential information to not be zero-sum, the calculus of the optimal enforceability policy changes slightly. Now the social planner is not only concerned with properly allocating the productivity of the worker, but is also concerned with creating value with his information. That is, even if the worker is no more productive at the poaching firm, but his information is more highly valued than at his initial firm, then a social planner has contrasting incentives: he has an incentive to reduce noncompete enforceability to allow the move, but needs to increase enforceability sufficiently to encourage the initial firm to provide training. Alternatively, the poaching firm may value very little the sensitive information, but it could create enormous losses for the initial firm, resulting in net social losses if the worker is allowed to move. In this case, increases in noncompete enforceability reduce the likelihood of such an inefficient quit and incentivize the initial firm to provide the worker with more training.

By contrast, if training is determined via the contractible model, $T_c^*(\lambda)$, then as shown in (6), the training choice is already chosen to maximize social surplus and optimal enforceability need only balance the marginal benefit of reducing inefficient quits and the marginal cost of preventing efficient moves. Thus, if the unilateral firm choice model is operative, but consideration laws result in outcomes closer to the contractible model, then such consideration laws reduce the need to enforce noncompetes for training purposes.

[36] In other words, the confidential information is zero-sum, such as in the case of clients leaving one employer for another.

3.5 The *in terrorem* Effect

The *in terrorem* effect refers to the chilling effect of noncompetes themselves, allowing a distinction between the worker's perceived enforceability, λ_p, and actual enforceability, λ_a. The perceived enforceability level affects the worker's quit decision, while the actual enforceability probability affects the actual probability the worker is allowed to switch firms by the court. Given that workers know little about noncompete enforceability (Starr et al., 2015a) but that firms are likely to be keen to remind them of their noncompete after they decide to quit (regardless of its actual enforceability), the *in terrorem* effect looms large. With these definitions, the worker's quit decision can be rewritten as $w_p > \hat{w}(\lambda_p)$ and the worker's training under the unilateral choice model is determined by:

$$\max_T \mathbf{E}[\pi(T)] = (1 - q(\lambda_p))(y(T) - w(T)) + q(\lambda_p)(1 - \lambda_a)(-lk(T)) - c(T)$$

If workers believe their noncompete to be enforceable, or feel ethically bound by it, $\lambda_p = 1$, then workers will never quit, $q(\lambda) = 0$, and the optimization problem becomes:

$$\max_T \quad y(T) - c(T)$$

Thus the impact of perceived enforceability eliminates the effect of actual noncompete enforceability. The same can be shown in the contractible case.[37] As a result of the *in terrorem* effect, noncompete signers in low and high enforceability states may be similarly dissuaded from quitting, suggesting that the effect of noncompete enforceability on training is likely to underestimate the effects of actual noncompetes on training.

4 Empirical Analysis

4.1 Training Data

The training data comes from the topical module from Wave 2 of the Survey of Income and Program Participation (SIPP) panels from 1996, 2001, 2004, and 2008. The primary benefit of the SIPP relative to other training data sets such as the Employment Opportunities Pilot Project, the Small Business Administration data (Barron et al., 1999), the NLSY (Loewenstein and Spletzer, 1997), and the PSID is that the number of respondents in each panel is about 40,000. This size difference is crucially important to the project because power issues demand a large enough number of workers who sign noncompetes across the enforceability

[37] Notably, this setup assumes individuals do not learn anything about the actual λ from wage offers or contract. Adding in such a signal could be an interesting avenue for future theoretical work. I thank an anonymous referee for this point.

spectrum. The SIPP is a longitudinal survey that interviews respondents once every four months for three to four years. I pool all of the cross-sections together. The SIPP tracks up to two occupations for each individual and in order to assure that I analyze the occupation in which the training actually occurred, I restrict the sample to workers who hold only one job. I also drop workers younger than 22 and older than 55, as well as workers with jobs in the non-profit sector, government, community service, education, military, and protective services. There remain 70,374 individuals in the sample. Occupation codes are updated to 2007 two-digit Standard Occupational Classification (SOC) codes and industry codes are updated to 2007 two-digit NAICS codes.

The SIPP contains training data reflecting answers to the following question: *"During the past year, has [the respondent] received any of kind of training intended to improve skill in one's current or most recent job?"* For the 21% of individuals who respond "yes" to this question, the SIPP asks follow up questions on the number of such training events in the last year, as well as questions about the most recent training event including where it occurred, what the training covered, and who paid for it. In the analyses that follow, I examine each of these variables, although the main results concern the receipt of firm-sponsored training. Table 2 shows descriptive statistics for these training variables among the population of individuals who report receiving training.

The data do not directly contain information on whether training is general or firm-specific. The fact that most training is meant to upgrade existing skills, teach basic skills, or teach new skills suggests that the training is general in nature. It is also unclear whether a worker who reports receiving firm-sponsored training is referring to informal or formal training, and the SIPP does not make the formal/informal distinction explicitly. The SIPP does, however, ask the location in which the training occurred and who provided the training. The tabulation shows that of those who report receiving firm-sponsored training, 40% report that it was on the job taught by somebody from the firm, 15% report that it was on the job taught by somebody outside the firm, and 32% say it was away from the firm. Hence, almost half of training received could be informal. However, given that overall only 21% of the respondents report receiving training, informal training is likely underreported. As a result, if noncompete enforceability increases informal training, perhaps because it is unilaterally chosen by its nature, then the estimates will understate the actual effect of noncompete enforceability on *total* training.

In order to exploit the cross-sectional state level heterogeneity in noncompete enforceability, I compare training outcomes between occupations likely to see noncompete litigation (high litigation) and occupations unlikely to see such litigation (low litigation) using two surveys of litigated, noncompete cases (LaVan, 2000; Whitmore, 1990). Panel A of Table 3 shows the occupation distribution of LaVan's study of 104 randomly

Table 2: Training Variables and Other Summary Statistics

	Low Litigation			High Litigation			Overall		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
Panel A: Received training to improve skills?									
Received Training	0.15	0.36	29016	0.25	0.43	41358	0.21	0.41	70374
Panel B: How many training activities in the last year, conditional on receiving training?									
Number of Training Events	4.01	7.21	4348	4.56	7.88	10318	4.4	7.69	14666
Panel C: Who paid for the most recent training?									
Firm Paid	0.88	0.32	4348	0.90	0.30	10318	0.90	0.30	14666
Self or Family Paid	0.06	0.23	4348	0.06	0.24	10318	0.06	0.24	14666
Panel D: Where did the most recent firm-sponsored training event occur and who provided it?									
OTJ Co-Worker Taught	0.50	0.50	4348	0.38	0.49	10318	0.42	0.49	14666
OTJ Taught by Outsider	0.13	0.33	4348	0.16	0.37	10318	0.15	0.36	14666
Away from Job	0.25	0.43	4348	0.34	0.48	10318	0.32	0.46	14666
Panel E: What was the firm-sponsored training content?									
Basic Skills	0.30	0.46	4348	0.25	0.43	10318	0.26	0.44	14666
New Skills	0.43	0.49	4348	0.40	0.49	10318	0.41	0.49	14666
Upgrade Skills	0.62	0.49	4348	0.66	0.47	10318	0.65	0.48	14666
Company Policies	0.24	0.42	4348	0.22	0.41	10318	0.22	0.42	14666
Panel F: Full Sample Characteristics									
Bachelor's Degree	0.09	0.29	29016	0.24	0.43	41358	0.18	0.38	70374
Graduate School	0.02	0.14	29016	0.08	0.27	41358	0.06	0.23	70374
Metropolitan Area	0.79	0.41	29016	0.81	0.39	41358	0.80	0.40	70374
Male	0.51	0.50	29016	0.58	0.49	41358	0.55	0.50	70374
White	0.65	0.48	29016	0.75	0.43	41358	0.71	0.45	70374
Hours Worked	38.93	10.13	29016	41.86	9.68	41358	40.65	9.97	70374
Unionized	0.12	0.32	29016	0.08	0.28	41358	0.10	0.30	70374
Tenure	5.95	6.72	29016	7.33	7.46	41358	6.76	7.19	70374
Potential Experience at Hire	31.81	9.12	29016	31.59	8.89	41358	31.68	8.99	70374
Hourly Wages	16.55	20.12	27043	24.93	37.07	39485	21.52	31.58	66528
Panel G: Measures of Noncompete Enforceability									
Overall Enforceability	-0.21	1.37	29016	-0.19	1.35	41358	-0.20	1.36	70374
Enforceability of Non-Consideration Dimensions	-0.12	1.32	29016	-0.12	1.3	41358	-0.12	1.31	70374
Enforceability of Consideration Dimensions	-0.29	1.32	29016	-0.24	1.3	41358	-0.26	1.31	70374

Note: The first row for the receipt of training is for the full sample. The reported number of training activities is conditional on having received training, regardless of who paid. The training content and where it occurred are defined as equal to 1 only if the firm reported paid for it and 0 otherwise. The overall measure of noncompete enforceability uses the weights developed in Table 1 and the scores from Bishara (2011). The 'Enforceability without Consideration' variable uses the weights from Table 1 with the scores from Bishara (2011) for only the two consideration dimensions. The 'Enforceability of Non-Consideration Dimensions' uses the weights from Table 1 for the other 5 dimensions of enforceability and the Bishara (2011) scores. Each measure is normalized to be mean zero, standard deviation of one in a sample where each state is given equal weight. Higher numbers reflect a higher chance of enforceability. That mean enforceability is less than zero suggests that the SIPP sample is more likely to reside in low enforceability states.

selected cases and Whitmore's 1990 study of 105 cases.[38] To map SOC occupations into the rough categories in LaVan (2000) and Whitmore (1990), I first selected SOC occupations that easily fit into the litigation categories (defined by Whitmore and LaVan): sales (sales), management (managerial), business and financial (professional), computer and mathematical (professional), engineering (professional), healthcare practitioners (professional), life, physical, and social sciences (professional), and arts and entertainment (entertainer). I include personal care and services and installation and repair as high litigation occupations because it is unclear if such services were considered separately from traditional sales occupations. I include production occupations as high litigation occupations because of Whitmore's finding of 'skilled labor' being common in litigation. The mapping of two digit Standard Occupational Classification (SOC) system codes is presented in Panel B of Table 3. Inclusion into low litigation occupations is defined by not being present in any of the litigated cases or being in a legal field, since noncompetes are unenforceable for lawyers (Stroud, 2001; Starr et al., 2015c).

An important feature of this identification strategy is that mistakes in the division of occupations into low and high litigation groups tends to bias the estimates towards zero.[39] The logic is as follows: Suppose that managers are not actually affected by noncompete enforceability and should actually be put in the low litigation category. Then leaving managers in the high litigation category reduces the average impact of enforceability for the high litigation group, reducing the difference between the high and low litigation groups. Alternatively, if construction workers are affected by noncompete enforceability, then they should be in the high litigation group. But by leaving them in the low litigation group, this raises the average impact of enforceability for the low litigation group, shrinking the difference with the high litigation group. This feature strongly suggests that the difference-in-difference estimates are likely to underestimate the true effect.[40]

Selection into low litigation is determined by four possibilities: (1) Workers in these occupations do not actually sign noncompetes, thereby exempting them from potential litigation, (2) firms decide not to attempt to enforce noncompetes for these occupations, presumably because the expected costs of legal action outweigh the expected benefits, (3) the outcome of enforceability is certain, and therefore firms and workers do not bother litigating, and (4) the worker and firm settle outside of court. Examining the two-digit SOC occupations in the low litigation group shows that with the exception of lawyers, most of the occupations tend to be low skill and low earnings occupations. This evidence suggests that selection into low litigation is primarily determined by either not signing noncompetes (Starr et al., 2015b) or firms choosing not to

[38] It is unclear if Whitmore (1990) studies a random sample.

[39] While this would be true is a simple difference-in-difference model it is not generally true in multivariate models. I thank an anonymous referee for this comment.

[40] The 209 cases analyzed by LaVan (2000) and Whitmore (1990) is a relatively small number. A more robust categorization awaits a larger study of occupations present in noncompete litigation.

enforce because the occupation is a low value occupation. Summary statistics for key variables are presented by litigation status in Table 2, while state and industry distributions are shown in Figures 2 to 3.

Table 3: Mapping SOC codes to Occupations in Noncompete Litigation

Panel A: Distribution of Occupations in Noncompete Litigation

LaVan (2000)		Whitmore (1990)	
Occupation	Percent of Cases	Occupation	Percent of Cases
Sales	31	Sales	51
Professional	37	Middle Management	14
Managerial	25	Skilled Labor	9
Entertainer	1	Business Executive	7
		Physician	9
		Other Professional	5
		Other	3
		Engineer	2
		Entertainer	1

Note: The percentages in Panel A are reproduced from LaVan (2000) Table II (p. 227) and Whitmore (1990) footnote 213 (p. 520). LaVan (2000) studied 104 randomly selected cases, while Whitmore (1990) studied 105 cases.

Panel B: Mapping SOC Codes to High/Low Litigation Occupations

Low Litigation		High Litigation	
Occupation	Percent of Sample	Occupation	Percent of Sample
Office Support	15.6	Sales	13.0
Transportation, Materials Moving	8.4	Production	12.5
Construction and Extraction	6.4	Management	10.5
Food Prep, Serving	5.2	Business, Financial	4.8
Healthcare Support	2.8	Installation, Repair	4.6
Grounds Maintenance	1.8	Computer, Mathematical	3.1
Farming, Fishing, and Forestry	1.4	Engineering	3.1
Legal	0.6	Healthcare Practitioners, Technical	3.0
		Personal Care, Services	2.0
		Arts, Entertainment	1.5
		Life, Physical and Social Sciences	0.7
Total	41.2	Total	58.8

Note: Education, Community Service, Protective Service, and Military occupations have been dropped from the sample, along with all non-profit and government workers. Service workers, such as installation and repair and personal care, are included as high litigation because LaVan (2000) and Whitmore (1990) do not distinguish between selling a product and performing a service.

Workers in high litigation occupations are very different from those in low litigation occupations. In this sample they report receiving 10 percentage points more training than low litigation occupations. They are also more educated, more likely to be male, white, and less likely to be unionized. Panel B of Table 3 shows that the high litigation occupations are dominated by sales, production workers, and management, while the low litigation group is dominated by office support workers, transportation and materials moving workers, and construction workers. Figure 2 shows that manufacturing and retail trade are the most represented industries and that most industries are fairly mixed in their employment of high litigation and low litigation

Figure 2: Industry Distribution by Litigation Type

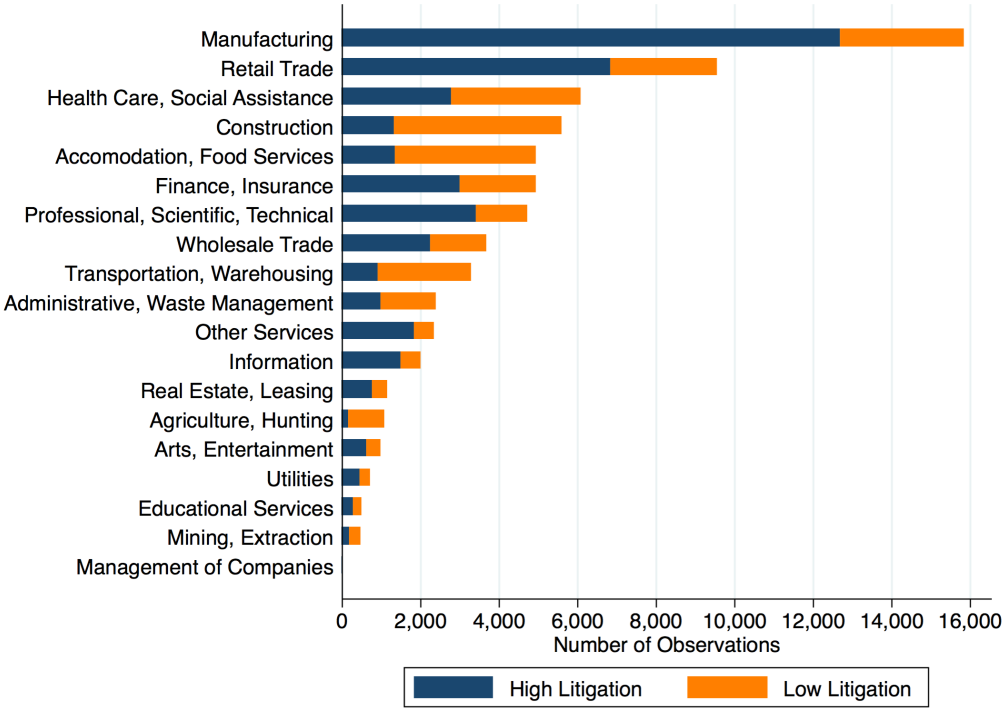
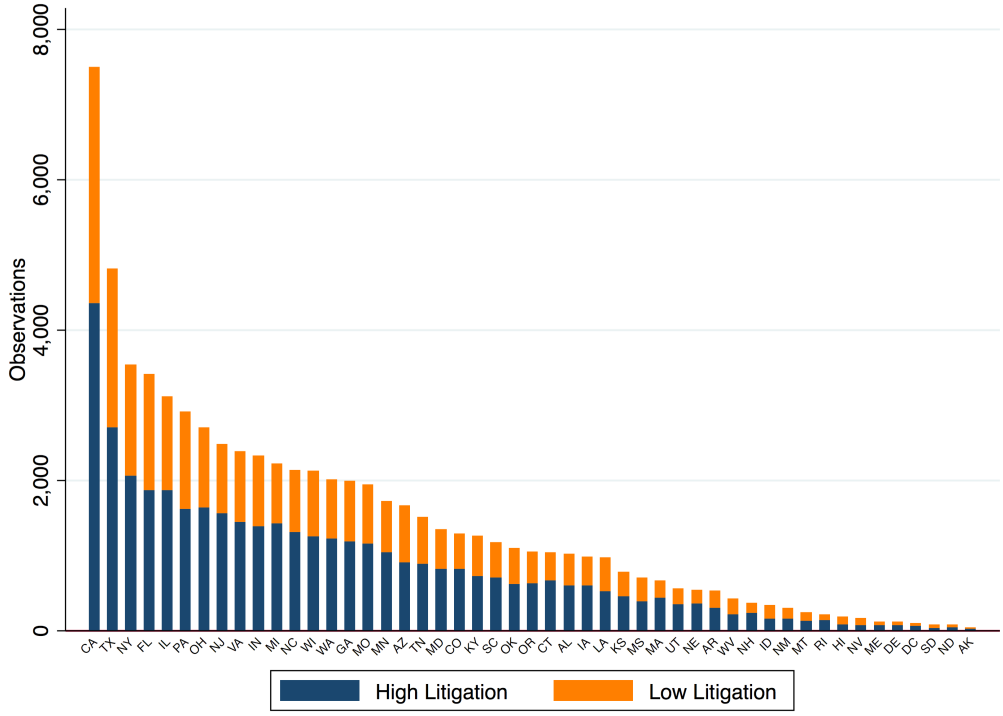


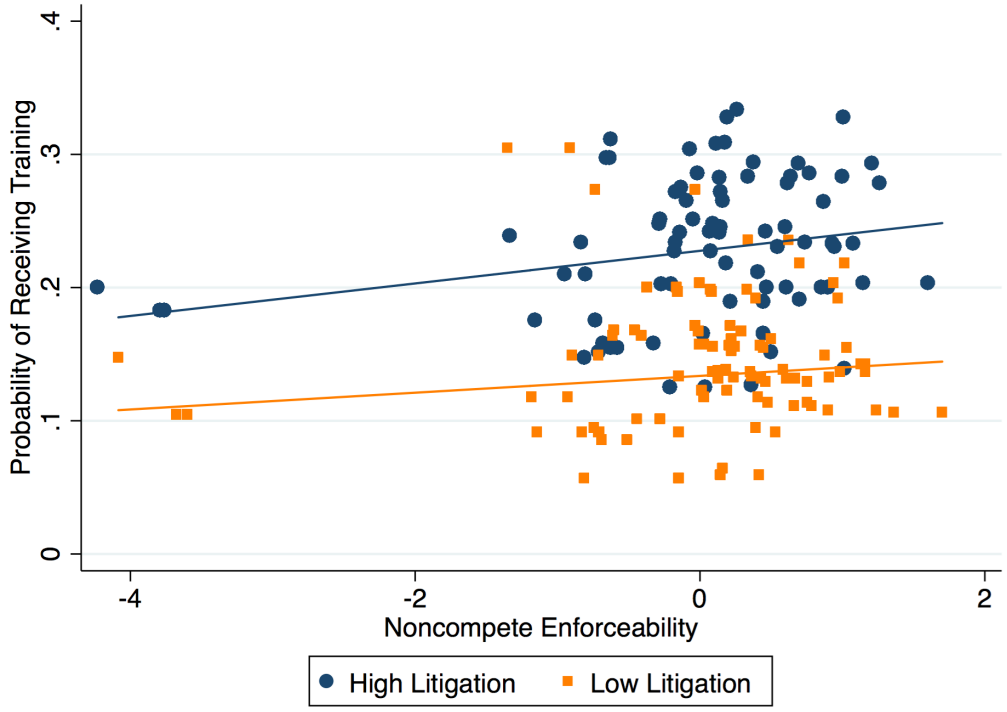
Figure 3: State Distribution by Litigation Type



workers. Figure 3 shows that the within-state distribution of litigation types is balanced across states. This is important because the empirical strategy I employ relies on within state-year differences in training between high and low litigation occupations.

To get a sense of the unconditional relationship between noncompete enforceability and the within-state difference between firm-sponsored training received by high and low litigation occupation, Figure 4 plots the average probability of receiving training in high and low litigation occupations within each state against noncompete enforceability intensity. The unconditional difference-in-differences estimate is the difference between the slopes, which is 0.48 percentage points, as shown in column (1) of Panel C in Table 5.

Figure 4: Within-State Training and Noncompete Enforceability



4.2 Identification

Due to the fact that noncompete enforceability varies primarily in the cross section, I employ a difference-in-differences strategy with state by year fixed effects to identify the relative impact of noncompete enforceability between occupations which appear frequently in noncompete litigation (high litigation) and those which appear infrequently or not at all (low litigation). Importantly, low litigation occupations are not necessarily unaffected by enforceability because these workers may also sign noncompetes, but the likelihood of litigation is lower for this group. Indeed, Figure 4 shows that there is a positive relationship between training and

noncompete enforceability for workers in low litigation occupations, which implies that the difference-in-difference estimates are a lower bound on the overall effect.

With this strategy, the most parsimonious empirical specification would include noncompete enforceability, a high litigation dummy, and their interaction. To soak up residual variance and increase the precision of the model, the main specification subsumes the high litigation dummy with occupation by industry by year dummies, and state by year fixed effects subsume the main effect of enforceability. The full specification is:

$$T_{iost} = \beta_0 + \beta_1 Enfc_{st} * HL_o + \gamma X_{ist} + +\Omega_{o,i,t} + \theta_{s,t} + \epsilon_{iost} \tag{8}$$

In equation (8), T_{ijost} refers to a variety of training measures for worker i in occupation o and state s having received firm-sponsored training in year t. State by year fixed effects are represented by $\theta_{s,t}$ and two-digit SOC occupation by two-digit NAICS by year fixed effects are given by $\Omega_{o,i,t}$. Individual controls are given by X_{ist}, which includes hours worked, and indicators for working in a metro area, bachelors degree, graduate degree, male, white, and whether the worker is unionized.[41] High litigation occupations are denoted HL_o, and $Enfc_{st}$ is the noncompete enforceability level of state s at time t. The 1991 enforceability scores are assigned to years 1996 and 2001, and the 2009 enforceability scores to years 2004 and 2008, though the results are robust to using either set of enforceability scores (see Table 10). The standard errors are clustered at the state level to account for state-level correlations in the disturbances (Moulton, 1990; Bertrand et al., 2004). The coefficient of interest is β_1 in equation (8), which captures an underestimate the causal, intention-to-treat effect of noncompete enforceability on high litigation occupations.

Due to the state by year fixed effects, only cross-sectional variation in noncompete enforceability identifies the impact of interest. The identifying assumption is that there are no unobserved variables which differentially affect within-state-year training choices for high litigation groups relative to low litigation groups that are also correlated with noncompete enforceability; $\mathbf{E}[Enfc_{st} \cdot HL_o \cdot \epsilon_{ijost} | X_{ist}, \Omega_{o,i,t}, \theta_{s,t}] = 0$.

4.2.1 Intent to Treat vs. Treatment on the Treated

Unfortunately, whether a worker has signed a noncompete is not contained in the data. Therefore, one way to interpret a coefficient like β_1 from equation (8) is as an intent-to-treat effect. The state with a high intensity of enforceability is offering a treatment, but firms can choose to opt out of treatment by not using noncompetes.[42] While identifying the effect of enforceability on those who do and do not sign non-

[41] In some specifications, X_{ist} includes state by year variables including exceptions to at will employment, right to work dummies, and corporate tax rates. Notably, tenure, wages, and potential experience are omitted as controls because they are 'bad controls' in the sense that they are outcomes of noncompete enforceability (Lavetti et al., 2014; Starr et al., 2015c). They are treated as outcomes in Table 8.

[42] The 'intent to treat' label is not entirely accurate, since noncompete enforceability may have external effects on those who do not sign noncompetes – for example, reduced mobility among noncompete signers in higher enforceability states may create

competes are important parameters, the intent-to-treat effect is the relevant parameter for state judiciaries and legislatures to consider since they choose the intensity of enforceability but cannot force firms to use noncompetes.

5 Results

5.1 Who Pays for Training?

Before providing evidence on the impact of noncompete enforceability on training, I confirm work by Barron et al. (1999) and others that in the SIPP data those who receive training do not take an observable wage cut to pay for it. In the SIPP data, individuals who receive training earn significantly higher wages even with less than or equal to one year of tenure. In Table 4, the receipt of firm sponsored training is associated with 11% higher hourly wages after controlling for occupation, industry and individual level variables. The correlation is stronger for workers in their first year of tenure (13%). Using the log of the number of training events instead of a dummy for firm-sponsored training reveals similar results. A 1% increase in training events is associated with 7% increase in hourly wages for workers of all tenures and 8% for workers with tenures less than 1 year. This coefficient may be biased upward if high skill individuals sort into high training jobs. Thus we cannot be completely confident that individuals are not taking wage cuts to pay for training, but the results here and from prior studies suggest that it is firms, not workers, who are paying for training.

5.2 Baseline Training Results

Table 5 reports the results from estimating equation (8) with various dependent variables. In Panel A, the dependent variable is simply a dummy for reporting the receipt of skill upgrading training in the last year.[43] Columns (1)-(4) show the breakdown of the effect of noncompete enforceability when adding individual controls, occupation by industry by year fixed effects, and state by year fixed effects. Column (1) of Panel A shows that a one standard deviation increase in noncompete enforceability is associated with a 0.53 percentage point increase in the probability of receiving training for low litigation occupations, and an additional 0.53 percentage point increase in the probability of receiving training for high litigation occupations. Including individual controls, occupation by industry by year fixed effects, and state by year year fixed effects does not appreciably change the marginal impact of noncompete enforceability on high litigation occupations relative to low litigation occupations.

fewer openings for non-signers (through a 'vacancy chain'), which may cause the firms of nonsigners to provide more training.

[43]Note that because the enforceability index is a generated regressor, there is error associated with the generation process which is not captured in the estimation procedure.

Table 4: Is the Receipt of Training Associated with Lower Wages?

Dependent Variable: Log Hourly Wages								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	All	All	Tenure ≤ 5	Tenure ≤ 1	All	All	Tenure ≤ 5	Tenure ≤ 1
Firm-Sponsored Training	0.30***	0.11***	0.11***	0.13***				
	(0.01)	(0.01)	(0.01)	(0.02)				
Log # of Training Events					0.18***	0.07***	0.07***	0.08***
					(0.01)	(0.00)	(0.01)	(0.02)
Bachelor's		0.24***	0.24***	0.21***		0.24***	0.23***	0.20***
		(0.01)	(0.01)	(0.03)		(0.01)	(0.01)	(0.03)
Grad School		0.48***	0.48***	0.44***		0.48***	0.48***	0.44***
		(0.01)	(0.02)	(0.04)		(0.01)	(0.02)	(0.04)
Metro		0.11***	0.10***	0.09***		0.11***	0.10***	0.09***
		(0.01)	(0.01)	(0.02)		(0.01)	(0.01)	(0.02)
Male		0.20***	0.19***	0.20***		0.20***	0.19***	0.21***
		(0.01)	(0.01)	(0.01)		(0.01)	(0.01)	(0.01)
White		0.14***	0.11***	0.10***		0.14***	0.11***	0.10***
		(0.01)	(0.01)	(0.01)		(0.01)	(0.01)	(0.01)
Union		0.23***	0.20***	0.24***		0.23***	0.20***	0.23***
		(0.01)	(0.02)	(0.02)		(0.01)	(0.02)	(0.02)
Constant	2.82***	2.57***	2.46***	2.30***	2.83***	2.57***	2.46***	2.28***
	(0.02)	(0.02)	(0.01)	(0.03)	(0.02)	(0.02)	(0.01)	(0.03)
Observations	66,528	66,528	36,351	7,628	66,528	66,528	36,351	7,628
R-squared	0.03	0.38	0.38	0.39	0.03	0.38	0.38	0.39
Occupation-Industry-Year FE	X	X	X	X	X	X	X	X
State-Year FE	X	X	X	X	X	X	X	X

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parentheses, clustered at the state level. The dependent variable is the log of hourly wages.

Panel B examines how the log number of skill-upgrading training events is associated with noncompete enforceability. Columns(1)-(4) show that the impact of a one standard deviation increase in noncompete enforceability is associated with about a 0.8% increase in the number of training events, and that this association is stable even when controlling for additional individual variables or fixed effects. To get a better sense of exactly how noncompete enforceability shifts the distribution of training events received, Figure 5 shows the results of a series of linear probability models estimating (8) where the dependent variable is a dummy for receiving at least 1, 2, ..., 10 training events. The results show that noncompete enforceability is associated with an increase in the probability of receiving at least 6 training events in the last year.

Due to the ambiguity of what a training event means and the lack of clarity around who pays for such events, Panel C uses as a dependent variable a dummy if the most recent training was reported to be paid for by the firm. Because this is the only variable which reflects that the training was truly firm-sponsored, I use this variable throughout the rest of the analysis to refer to 'firm-sponsored training.' Columns (1)-(4) show that relative to low litigation occupations, the impact of a one standard deviation increase in noncompete enforceability increases the probability that the most recent training event was firm-sponsored by 0.53 percentage points for high litigation occupations. To gauge the size of this effect, consider that the mean probability of receiving firm sponsored training for high litigation occupations is 22.5%. Thus, a

one standard deviation increases the probability of receiving firm-sponsored training by 2.4% (0.53/22.5). If a state was to change it's policy from complete non-enforcement (an enforceability score of -4.23) to the highest enforceability level across all states (an enforceability score of 1.6), this would result in a change of 5.83 standard deviations in enforceability and an increase of 14% ($5.83 \cdot 2.4\%$) in the probability of receiving firm-sponsored training.

Panel D examines how noncompete enforceability affects the probability that the last skill-upgrading training event was paid for by the individual. Garmaise (2009) suggests that high enforceability reduces the individual's incentives to invest in themselves and Lobel and Amir (2013) similarly suggest that noncompetes reduce employee effort. The results do not bear out the theorized negative relationship between noncompete enforceability and self investment. The point estimates for high litigation are positive, though extremely small – in the 0.03 to 0.05 percentage point range – but statistically insignificant. Notably, the point estimates for low litigation occupations are negative and significant in one specification without any fixed effects. The identification strategy, however, is not built to identify the causal effect of noncompete enforceability on low litigation occupations (since they are the control group). Thus, the evidence does not appear to support a negative relationship between enforceability and self-investment in high litigation occupations.

Figure 5: Marginal Effect of Noncompete Enforceability on Receiving at Least 1, 2, ... 10 Training Events

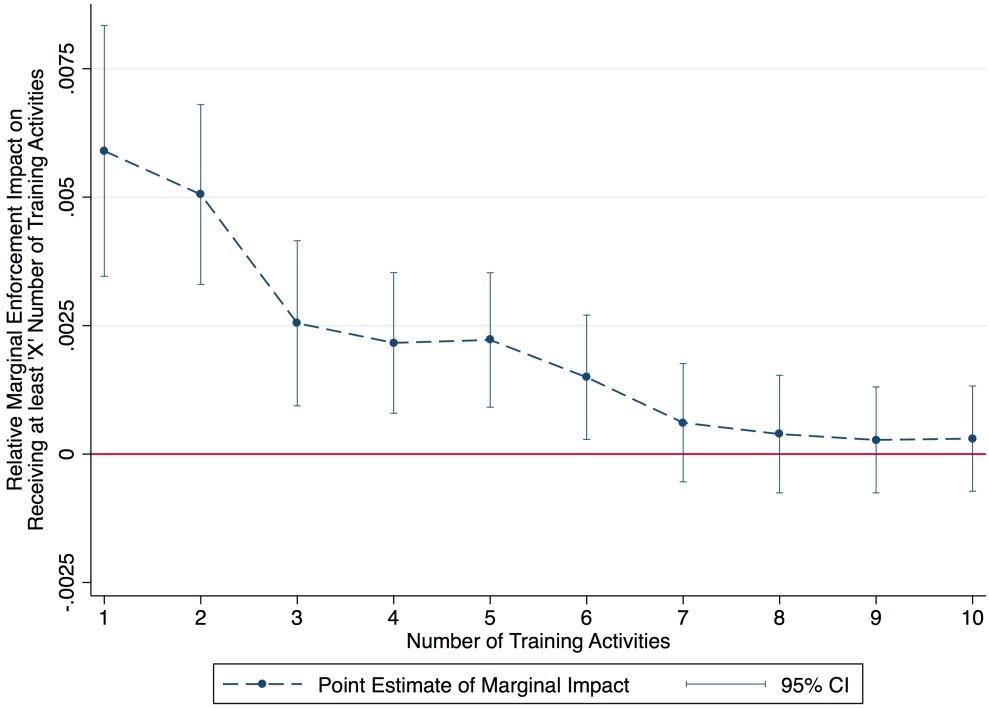


Table 5: Baseline Training Results

	(1)	(2)	(3)	(4)
Panel A Dependent Variable: Received Training In Last Year				
High Lit * Enforceability	0.0053***	0.0061***	0.0062***	0.0059***
	(0.0014)	(0.0012)	(0.0011)	(0.0011)
Enforceability	0.0053*	0.0002	0.0023	
	(0.0027)	(0.0021)	(0.0019)	
High Litigation	0.1005***	0.0644***		
	(0.0042)	(0.0035)		
R-squared	0.0154	0.0443	0.1041	0.1171
Panel B Dependent Variable: Log Number of Training Events in Last Year				
High Lit * Enforceability	0.0071***	0.0085***	0.0087***	0.0084***
	(0.0026)	(0.0023)	(0.0021)	(0.0020)
Enforceability	0.0067*	-0.0009	0.0018	
	(0.0036)	(0.0027)	(0.0028)	
High Litigation	0.1515***	0.0948***		
	(0.0078)	(0.0066)		
R-squared	0.0143	0.0426	0.0942	0.1066
Panel C Dependent Variable: Most Recent Training is Firm Sponsored				
High Lit * Enforceability	0.0048***	0.0054***	0.0056***	0.0053***
	(0.0013)	(0.0012)	(0.0011)	(0.0011)
Enforceability	0.0057**	0.0010	0.0029	
	(0.0028)	(0.0022)	(0.0018)	
High Litigation	0.0936***	0.0598***		
	(0.0040)	(0.0036)		
R-squared	0.0147	0.0423	0.1003	0.1114
Panel D Dependent Variable: Most Recent Training is Self Sponsored				
High Lit * Enforceability	0.0003	0.0005	0.0003	0.0004
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Enforceability	-0.0007	-0.0010**	-0.0008	
	(0.0005)	(0.0005)	(0.0005)	
High Litigation	0.0063***	0.0044***		
	(0.0006)	(0.0007)		
R-squared	0.0008	0.0038	0.0434	0.0469
Individual controls		X	X	X
Occupation-Industry-Year FE			X	X
State-Year FE				X
Observations	70,374	70,374	70,374	70,374

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parentheses, clustered at the state level. The dependent variable is noted in the panel description. The omitted group is low litigation occupations. Individual controls consist of hours worked, and indicators for working in a metro area, bachelors degree, graduate school degree, male, white, and whether the worker is unionized.

5.3 The Type and Content of Training, and When it was Received

In this section I examine details about the most recent training event including the content of training, who provided it and where, and when it was provided. Training content is categorized into the following non-mutually exclusive categories: basic skills, new skills, upgrade existing skills, and company policies. Summary statistics of these outcomes by high and low litigation status are given in Table 2. Two-thirds of the firm-sponsored training is upgrading skills, about half is teaching new skills, and one-third is teaching basic skills and introducing company policies, though there is substantial overlap.

Panel A of Table 6 reports results from the main specification using indicators for content received as the dependent variable. The results in Table 6 show that noncompete enforceability is associated with an increase in basic training, new skill training, upgrading existing skills, and training in company policies. While the effects of enforceability are present for all types of training, the effects of enforceability on upgrading existing skills is twice as large as the effects on any other type of training (0.34 percentage points compared to 0.14-0.18 percentage points).

The SIPP divides how and where the training was provided into four categories: (1) onsite taught by somebody from the firm, (2) onsite taught by somebody outside the firm, (3) offsite, and (4) other. Since the 'other' category is small (1.53% of those who receive training) and nebulous, I consider only the first three categories. Summary statistics for the types of training are given in Table 2. Using a dummy for the type of training as the dependent variable in the main specification (8), Panel B of Table 6 examines which type of training noncompete enforceability is likely to affect. The results show that a one standard deviation increase in noncompete enforceability increases the probability of receiving offsite training by 0.33 percentage points. The increase for onsite training programs taught by outsiders is 0.17 percentage points, while the impact for coworker taught training onsite is estimated to be 0.03 percentage points. Given the additional expense of offsite training and of bringing in outside teachers, these estimates suggest that noncompete enforceability provides valuable enough protection to merit a more costly investment in workers.

Panel C of Table 6 examines how the relationship between enforceability and the receipt of firm-sponsored training varies by the tenure of the employee. Restricting the sample to workers at various tenures, the results show that for workers less than five years into their tenure a one standard deviation increase in enforceability increases the probability of receiving firm sponsored training by 0.52 percentage points. In years 5-10, the effect falls to 0.18 percentage points and becomes statistically insignificant, but becomes large and statistically significant at 1.53 and 1.66 percentage points in years 10-15 and 15-20 respectively. The effect of noncompete enforceability on training for those with more than 20 years of tenure is -0.78 percentage points.

The pattern of results across tenure is somewhat unexpected. In light of the Loewenstein and Spletzer

(1997) finding that firms delay the provision of training to ensure they train 'stayers', we might expect that most of the delayed formal training is replaced by training up front since the firm does not have to worry about the worker leaving because of the enforceable noncompete. Indeed, this appears to be happening, as individuals with low tenures are more likely to receive training in their early years in higher enforceability states. But the impact of enforceability on training is not entirely at the beginning of the employee's tenure. The effect of enforceability on training falls off between years 5-10 then rises dramatically for years 10-20. One explanation for these results is that individuals 5-10 ten years in have developed the necessary skills to perform their job and are no longer in need of more training, while individuals who are 10 to 20 years in are both more likely to be promoted, requiring the acquisition of new skills, and are more likely to suffer from skill depreciation. Furthermore, employees with long tenures are more likely to have acquired valuable company trade secrets, client relationships, and other confidential information, and thus the noncompete becomes a more important feature of the employee-firm relationship. The finding of a negative impact of enforceability on training for those with over 20 years of tenure could be a result of differential promotion rates across high and low enforceability states: if in high enforceability states individuals are promoted sooner because individuals do not need to show their loyalty by staying longer, and promotions are associated with more training, then it could be that in low enforceability states promotions are delayed until past 20 years while in high enforceability states individuals were already promoted.

Table A2 in the Appendix breaks down the effect by high litigation occupations and by the content of the most recent training. The occupation specific impact on of enforceability on training ranges from -1.8 to 1.2 percentage points. Management, business, financial, computer and mathematical occupations, engineers, healthcare practitioners and technical healthcare workers (not support), and personal care and service occupations are significantly affected by noncompete enforceability relative to low-litigation occupations.[44] As for the training content, the overall training effects appear to be driven primarily by the effect of noncompete enforceability on skill-upgrading training.

5.4 Consideration Policies

The enforceability index generated from factor analysis is useful because it provides relatively objective weights for the seven underlying dimensions of noncompete enforceability intensity, but it is less useful to courts and state legislatures that want to know to *which* dimension of enforceability training responds the most. In order to provide direct policy relevance, and to examine the differential impact of consideration laws, in this section I break up the enforceability index into its separate components to see which components of the index cause the observed increase in firm-sponsored training. The results appear in Table 7.

[44] Alternative specifications using logit and probit models find substantively similar results.

Table 6: Firm-Sponsored Training Content, Type, and By Tenure

	(1)	(2)	(3)	(4)	(5)
Panel A: Content of Most Recent Firm-Sponsored Training					
	Basic	New	Upgrade	Policies	
High Lit * Enforceability	0.0018**	0.0015**	0.0034***	0.0014*	
	(0.0008)	(0.0007)	(0.0012)	(0.0007)	
R-squared	0.0419	0.0526	0.0865	0.0395	
Observations	70,374	70,374	70,374	70,374	
Panel B: Type of Most Recent Firm-Sponsored Training					
	Onsite Taught By				
	Coworker	Outsider	Offsite		
High Lit * Enforceability	0.0003	0.0017***	0.0033***		
	(0.0007)	(0.0005)	(0.0009)		
R-squared	0.0488	0.0398	0.0735		
Observations	70,374	70,374	70,374		
Panel C: Receipt of Firm-Sponsored Training by Tenure					
	0-5 Yrs	5-10 Yrs	10-15 Yrs	15-20 Yrs	20+ Yrs
High Lit * Enforceability	0.0052***	0.0018	0.0153**	0.0166**	-0.0078*
	(0.0016)	(0.0028)	(0.0061)	(0.0071)	(0.0045)
R-squared	0.1183	0.1612	0.2209	0.2665	0.2291
Observations	39,176	14,226	7,191	4,422	5,359
Individual controls	X	X	X	X	X
Occupation-Industry-Year FE	X	X	X	X	X
State-Year FE	X	X	X	X	X

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parentheses, clustered at the state level. The omitted group is low litigation occupations. All dependent variables are indicator variables for the type of firm-sponsored training received. Basic refers to training for basic skills. New refers to training to learn new skills. Upgrade refers to training that improves existing skills. Policies refers to training that introduces company policies. Individual controls consist of hours worked, and indicators for working in a metro area, bachelors degree, graduate school degree, male, white, and whether the worker is unionized.

The results from including only one dimension of enforceability in columns (1) - (7) show that, aside from the handling of overbroad contracts and the consideration dimensions, four dimensions of noncompete enforceability are statistically significantly associated with more training, with the largest effects coming from the extent the burden on the plaintiff and the state's definition of protectable interests. Due to the fact that the variables are highly correlated, however, omitting the six other dimensions of enforceability leads to omitted variable bias. Including each of the variables linearly, the results in column (8) show two

Table 7: Policy Options

Enforceability Dimension	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
High Lit *Enforceability of Non-Consideration Dimensions									0.0098***
									(0.0022)
High Lit * Enforceability of Consideration Dimensions									-0.0041*
									(0.0021)
High Lit * Statute	0.0028*							-0.0011	
	(0.0015)							(0.0020)	
High Lit * Protectable Interest		0.0034***						0.0022	
		(0.0010)						(0.0021)	
High Lit * Plaintiff's Burden			0.0034***					0.0018	
			(0.0011)					(0.0018)	
High Lit * Consideration at Inception				0.0015				-0.0013	
				(0.0010)				(0.0011)	
High Lit * Consideration post Inception					0.0006			-0.0015*	
					(0.0011)			(0.0009)	
High Lit * Overbroad Contracts						0.0018		0.0014	
						(0.0011)		(0.0009)	
High Lit * Quit v Fire							0.0029***	0.0027*	
							(0.0007)	(0.0015)	
Observations	70,374	70,374	70,374	70,374	70,374	70,374	70,374	70,374	70,374
R-squared	0.1114	0.1114	0.1114	0.1114	0.1114	0.1114	0.1114	0.1115	0.1115
Individual controls	X	X	X	X	X	X	X	X	X
Occupation-Industry-Year FE	X	X	X	X	X	X	X	X	X
State-Year FE	X	X	X	X	X	X	X	X	X

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parentheses, clustered at the state level. The dependent variable is an indicator equal to one if the worker received firm-sponsored training in the last year. Individual controls consist of hours worked, and indicators for working in a metro area, bachelors degree, graduate school degree, male, white, and whether the worker is unionized.

interesting points. First, the only variable which is statistically significant and positively related to training is the state's treatment of quits versus fires. The second, more notable point, regards the negative point estimate on consideration at and post inception. To understand what those variables represent, note that they are state-level scores from 0-10 (Bishara, 2011) on the following questions from Malsberger et al. (2012):

> Consideration at inception: *Does the signing of a covenant not to compete at the inception of the employment relationship provide sufficient consideration to support the covenant?*
>
> Consideration post inception: *Will continued employment provide sufficient consideration to support a covenant not to compete entered into after the employment relationship has begun? Will a change in the terms and conditions of employment provide sufficient consideration to support a covenant not to compete entered into after the employment relationship has begun?*

High scores reflect the enforceability of a noncompete when only continued employment is provided, while lower scores reflect state policies that require firms to provide some other type of consideration, such as training, increased wages, or other benefits, in order for the noncompete to be enforceable. Thus the empirical results suggest that holding other dimensions of enforceability constant, state policies that enforce noncompetes only when these workers are provided additional benefits receive more training.

Because including all of the enforceability dimensions into the specification results in multicollinearity and

micronumerosity (Goldberger, 1991),[45] I provide a more powerful test of the differential effect of consideration laws by aggregating the two consideration dimensions together using the weights from Table 1, and then normalize the variable to have a mean of zero and a standard deviation of one in sample where each state is given a weight of one. I perform the same steps for the five non-consideration dimensions and allow the consideration and non-consideration enforceability indices to have differential effects on the probability of receiving firm-sponsored training. The results, shown in column (9), indicate that consideration laws have a dramatically different effect on the probability of receiving firm-sponsored training relative to non-consideration dimensions of enforceability. In particular, while a one standard deviation increase in non-consideration dimensions increases the probability of firm-sponsored training by 0.98 percentage points, a one standard deviation increase in enforceability of consideration dimensions results in a 0.41 percentage point *decrease* in the probability of receiving firm-sponsored training. The net effect of both consideration and non-consideration increases is 0.57 percentage points, almost identical to the baseline estimate of the impact of enforceability (0.53). Similarly, if a state were to increase its non-consideration enforceability policy by one standard deviation and simultaneously decrease it's consideration-specific enforceability policies by one standard deviation, then it would result in a 1.39 (0.98+0.41) percentage point increase in the probability of receiving firm-sponsored training, a 6.2% increase (1.39/22.5).

These results show that aggregating the enforceability dimensions into a single index can generate misleading results if individual dimensions of enforceability have differential effects. In this case, incorporating consideration laws into an aggregate index reduces the estimate of the impact of noncompete enforceability laws by almost half.[46]

To explain the differential effect of consideration laws, I argue that these laws substitute for the lack of negotiation over training and noncompetes as evidenced by Starr et al. (2015b). In negotiating on behalf of the worker, these laws result in training outcomes that more closely resemble outcomes under the contractible training model. Without such negotiating, training is likely chosen unilaterally by the firm, resulting in training levels which are lower than if the worker had negotiated properly over the contract (Proposition 1). State policies that require additional consideration for the enforceability of noncompetes interfere with the firm's training choice by 'bargaining' on behalf of the worker, improving training outcomes for workers while simultaneously reducing the likelihood of enforceability.

[45] Including all of the enforceability variables into the specification is subject to the problem of micronumerosity, which arises because clustering at the state level reduces the effective sample size to 48.

[46] Calculation: (0.98-0.53)/(0.98)=46%.

5.5 Wages

Firms need not respond to consideration laws by providing training. Indeed, the firm can promote the worker or otherwise give the worker a raise. In this subsection, I test for evidence of post-training wage effects of noncompete enforceability and of consideration-specific laws. Recall equation (3). If noncompete enforceability increases training, then there are two contrasting effects: (1) workers in higher enforcing states may have lower wages because they are not fully compensated for their outside options, and (2) they also receive the wage boost from the extra training they receive. I examine the impact of noncompete enforceability on wages by regressing log hourly wages on noncompete enforceability using the same identification strategy as (8), and by allowing consideration and non-consideration enforceability to have differential effects.[47]

Column (3) of Table 8 shows that noncompete enforceability is associated with a decrease of 0.45% in hourly wages. Column (4) shows, however, that the negative effect of enforceability on wages is driven entirely by consideration laws. A one standard deviation increase in non-consideration dimensions of enforceability increase wages by 0.68%, while a one standard deviation increase in consideration-specific dimension laws decreases hourly wages by 1.2%. These wage results coincide with training results: enforcing noncompetes when all the employee receives in exchange for signing is continued employment reduces the incidence of training and lowers wages. Conversely, pegging the enforceability of noncompetes to additional consideration (which reduces effective enforceability), increases both wages and training (Proposition 1).

5.6 Tenure, and Starting Experience

Given the training and wage effects documented above, I examine two related outcomes: tenure and starting experience. First, the model shows that higher noncompete enforceability leads to lower quit probabilities, which in turn lead to longer tenures. The lower probability of a quit encourages the firm to invest in their worker's training. Given the cross-sectional nature of the data, I estimate the effects of enforceability on tenure using the same difference-in-differences strategy.[48]

Second, the training results could be driven by the type of worker that is hired. In particular, Starr et al. (2015c) note that noncompete enforceability is also a hiring constraint: In higher enforceability states it may be harder to hire experienced workers if they are bound by a noncompete. Thus firms in higher enforceability states may be more likely to hire individuals with less experience and provide them with additional training. Conversely, firms in lower enforcing states may choose to hire more experienced workers in order to avoid having to pay training costs, which may be difficult to recoup. To examine the relationship

[47] Individual controls include indicators for working in a metro area, bachelors degree, graduate school degree, male, white, and whether the worker is unionized.

[48] Individual controls include indicators for working in a metro area, bachelors degree, graduate school degree, male, white, hours worked per week, and whether the worker is unionized.

between enforceability and initial experience, I use starting potential experience as the dependent variable with the same estimation strategy from (8).[49]

The results of these regressions are shown in columns (1)-(4) of Table 8. Column (1) shows that a one standard deviation increase in noncompete enforceability increases observed tenure by 0.13 years. Thus a full shift from non-enforceability to maximum enforceability increases observed tenure by 0.7 years (10.1% of the mean tenure). These results accord with the model showing that enforceability reduces the likelihood of a quit. Column (2) shows that noncompete enforceability causes firms to hire individuals with less initial experience: a one standard deviation increase in enforceability reduces the potential experience at hire by 0.16 years (3% of the mean moving from non-enforcement to maximal enforceability).

Table 8: Tenure, Starting Experience, and Wages

	(1)	(2)	(3)	(4)
	Tenure in Years	Years of Experience at Hire	Log Hourly Wage	Log Hourly Wage
High Lit * Enforceability	0.1274***	-0.1574**	-0.0045**	
	(0.0414)	(0.0595)	(0.0020)	
High Lit * Enforceability of Non-Consideration Dimensions				0.0068**
				(0.0031)
High Lit * Enforceability of Consideration Dimensions				-0.0123***
				(0.0035)
Observations	70,374	70,374	66,528	66,528
R-squared	0.1460	0.0444	0.3763	0.3763
Individual controls	X	X	X	X
Occupation-Industry-Year FE	X	X	X	X
State-Year FE	X	X	X	X

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parentheses, clustered at the state level. The omitted group is low litigation occupations. For other control variables, the initial experience specification includes hours worked per week, indicators for working in a metro area, and whether the worker is unionized. The tenure specification includes indicators for working in a metro area, bachelors degree, graduate school degree, male, white, hours worked per week, and whether the worker is unionized. The wage specification includes indicators for working in a metro area, bachelors degree, graduate school degree, male, white, and whether the worker is unionized.

[49] The individual control variables are hours worked per week, indicators for working in a metro area, and whether the worker is unionized.

5.7 Robustness and Interpretation

5.7.1 Threats to Identification

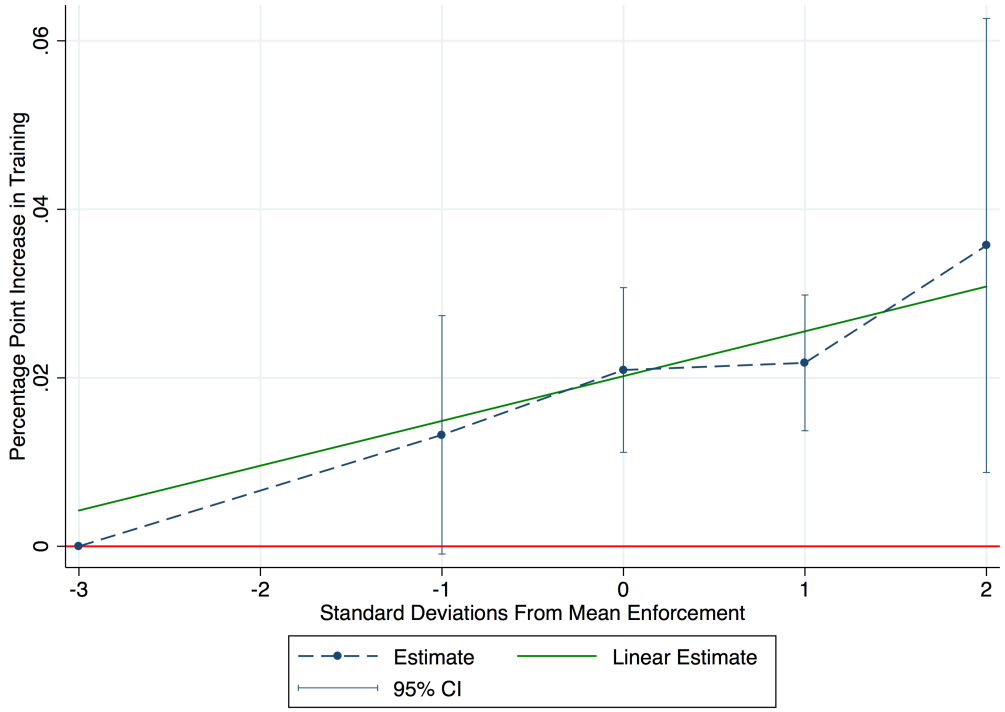
In this section I consider threats to the identification of noncompete enforceability on firm-sponsored training. First, it could be that states adjust their noncompete laws in response to training outcomes, not vice versa. Such reverse causality is unlikely, however, as most states have not changed their policies over time. Indeed, California's ban on noncompetes began when it adopted the laws written by David Dudley Field in 1872 (Gilson, 1999). Some states within the time frame have included extraordinary training as a protectable interest of the firm. To assure that state policies are not responding to training, I use only the 1991 enforceability scores, which occur before any of the training in the data. The results, shown in Column (1) of Table 10, are nearly identical to the baseline results.

Second, unobserved confounding treatments may make training more likely for high litigation occupations (or less likely for low litigation occupations) in higher enforceability states. I use four approaches to address this endogeneity issue. First, I check for the existence of 'pre-trends.' That is, instead of assuming the effect of noncompete enforceability on training is linear, I allow the impact of enforceability to vary by the number of standard deviations away from the mean (which was normalized to zero). Pretrends are normally thought of in a dynamic sense, whereupon differences in pretrends before treatment occurs can be explicitly analyzed. This dynamic assessment translates roughly into this setting, the difference being that there is not exactly a point along the enforceability dimension whereupon enforceability suddenly takes effect. To check for pretrends in this case, I examine whether or not the difference between high litigation and low litigation occupations is significantly different in the set of states that are slightly more enforcing than the non-enforcing states. This amounts to checking whether or not the difference in training between those states three standard deviations below the mean (the non-enforcing states) and those one standard deviation below the mean is large and significant. Figure 6 shows that impact of enforceability for those one standard deviation below the mean, relative to the least enforcing states, is neither large nor statistically significant. These results provide some confidence that low litigation occupations represent the counterfactual outcomes for high litigation occupations in the absence of noncompete enforceability.[50]

Despite the encouraging results from the pre-trends test, I include three separate checks that noncompete enforceability is really the driving factor behind the training differentials. In the first two of these checks, I identify high litigation or similarly high skill occupations that are unlikely to be subject to noncompetes and

[50]Incidentally, the estimates from 6 also show that the linear assumption is a relatively good assumption. The impact by standard deviation is increasing and convex, but not too convex. As a result of the slight convexity, the linear approximation underestimates the impact for the highest enforceability states and overestimates the impact for the lower enforceability states. Overall, however, the differences are minimal and as such provide strong support that the linearity assumption is a good one.

Figure 6: Relaxing Linearity: Effects by Number of Standard Deviations from Mean



thus exempt from noncompete enforceability: (1) high litigation occupations in the not for-profit sector[51] and (2) lawyers.[52] If noncompete enforceability is simply correlated with some unobserved state-level variable driving increased training in high litigation occupations, then noncompete enforceability interacted with dummies for these two groups should pick up a positive and statistically significant effect. The results are shown in columns (1) and (2) of Table 9. The intent to treat estimates from column (1) is small at 0.07 percentage points and statistically insignificant. The point estimate using lawyers as the treated group in column (2) is larger, 0.92 percentage points, but still statistically insignificant, likely because of the small number of lawyers. These results provide some evidence that a higher likelihood of skill-related training in higher enforceability states is not driving these results, though the positive point estimate for lawyers is somewhat disconcerting.

Column (7) of Table 9 examines whether or not the enforceability impact on training is affected by the inclusion of various other state policies that might differentially affect skill-specific training. In particular, column (7) includes controls for the public policy, good faith, and implied contract exceptions to at will employment (Autor et al., 2006), corporate tax rates (Seegert, 2012), and right to work laws, all interacted

[51] Evidence from Starr et al. (2015b) shows that indeed noncompetes are much more likely in the private for-profit sector (13%) than the private not-for-profit sector (5%).

[52] Lawyers are a high skill occupation which are unaffected by noncompetes per the American Bar Association's Model Rule 5.6 (Stroud, 2001; Starr et al., 2015c)

with a high litigation dummy. The results show that point estimate of the impact of noncompete enforceability is unchanged, although the standard error rises slightly. Together, the pre-trends test, the alternative treatment groups, and the inclusion of various other state controls provide relatively consistent evidence that noncompete enforceability, not some other state-level correlate, is causing the training differentials between high and low litigation occupations.

Lastly, firms may sort into high and low enforceability states based on some unobserved characteristic which is correlated with the training differential between high litigation and low litigation workers. For example, if high training firms are more likely to locate in high enforceability states and low training firms are equally likely to locate anywhere, then a random sample of workers from all states is more likely to sample workers from high training firms in high enforceability states. Before addressing whether such sorting is occurring, note that sorting is not a confounding treatment but rather a mechanism linking enforceability to training. If sorting is operative, then if California were to begin enforcing noncompetes then the instantaneous effect would be little increase in training since the types of firms in California are not high training firms; over time, however, as firms move their training activities to California, we would begin to observe an increase in training in high litigation occupations in California.

In order to address the extent to which this type of sorting is occurring, I divide the sample based on the tradability of the good sold by the worker's firm. Some firms, such as hairdressers or other personal service firms, sell highly non-tradable goods because their client base and markets are local in nature. These types of firms have no choice but to operate where their client base is located. Others, such as manufacturing and consulting firms, can sell their product from any state and therefore can move towards higher enforcing states. I rely on Jensen and Kletzer (2005) to divide industries into tradable and non-tradable categories.[53] The correlation between enforceability and a tradable dummy is -0.013, which provides some evidence that this type of sorting is not happening. In columns (3) through (6) of Table 9, I re-run the baseline specification for tradable and non-tradable industries, as well as the specification treating consideration and non-consideration dimensions separately. The results show that the impact of enforceability is larger in tradable industries than non-tradable industries (0.67 to 0.13 percentage points), but that the difference is entirely due to the composition of the effect through consideration and non-consideration dimensions. In non-tradable industries, the effect of a one standard deviation increase non-consideration enforceability increases training by 0.94 percentage points, but it is almost entirely offset by the negative impact of a one standard deviation increase in the enforceability of consideration policies, a decrease of 0.83 percentage points. Interestingly, there is no such differential effect of the enforceability of consideration policies on training in tradable industries. Such differences could arise because noncompetes in industries selling non-tradable goods may

[53] Appendix C.3 shows the tradable versus non-tradable breakdown by industry.

be more binding because individuals are not able to leave the state. By contrast, in tradable industries, an employee bound by a noncompete may be able to leave for a different state, which may render the noncompete less enforceable.[54]

Table 9: Skill-Related Training, Tradability, and Additional State Control Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Not-Profit	Law	Tradable Goods		Non-Tradable Goods		State Controls
Not Profit High Lit * Enforceability	0.0007						
	(0.0027)						
Law*Enforceability		0.0092					
		(0.0115)					
High Lit * Enforceability			0.0067***		0.0013		0.0052**
			(0.0014)		(0.0012)		(0.0022)
High Lit * Enforceability of Non-Consideration Dimensions				0.0063*		0.0094**	
				(0.0033)		(0.0037)	
High Lit * Enforceability of Consideration Dimensions				0.0011		-0.0083**	
				(0.0032)		(0.0036)	
Observations	37,475	29,229	37,226	37,226	33,148	33,148	70,374
R-squared	0.1385	0.1025	0.1092	0.1092	0.1027	0.1029	0.1115
Individual controls	X	X	X	X	X	X	X
Occupation-Industry-Year FE	X	X	X	X	X	X	X
State-Year FE	X	X	X	X	X	X	X

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parentheses, clustered at the state level. The dependent variable is an indicator equal to 1 if the worker received firm-sponsored training in the past year. High Lit. is a dummy equal to one if the worker is a high litigation worker. Columns (1) and (2) run the difference-in-differences specification comparing not-for-profit high litigation workers to for-profit low litigation workers. Columns (2) compares lawyers to other for-profit low litigation workers. Column (3)-(6) divides industries into tradable and non-tradable based on Jensen and Kletzer (2005). Column (7) includes exceptions to at-will employment, corporate tax rates, and a right to work dummy all interacted with a high litigation dummy. Individual controls consist of hours worked, and indicators for working in a metro area, bachelors degree, graduate school degree, male, white, and whether the worker is unionized.

5.7.2 Variations in the Enforceability Index, and Excluding Extreme States

Next I test whether the results are robust to variations of the factor analysis enforceability index, using alternative enforceability indices and excluding states at the ends of the enforceability distribution. Unfortunately, limitations of the data preclude using variation in enforceability over time within a state as an additional robustness check. The Michigan reversal of 1985 studied in Marx et al. (2009) occurs well before the start of the data, and the major changes identified by Garmaise (2009) occur in 1996 in Florida and 1994 in Texas, which do not allow for a 'pre' treatment period. The temporary Louisiana reversal from June 2001 to 2003 results in 104 treated individuals in my sample, which is too small for reliable inference. Other major changes in Oregon and New York in 2008 occur at the end of the data's time frame resulting in

[54]The enforceability of noncompetes across different jurisdictions is a complicated issue that has not formally been resolved. See Glynn (2008) for a recent discussion.

no post-period for a difference-in-difference estimation. Given the lack of an adequate quasi-natural experiment, the only longitudinal variation is the potentially endogenous variation that comes from the Bishara (2011) index, which captures the enforceability landscape in 1991 and 2009. The primary challenge with this approach is that courts develop policies on, for example, enforcing noncompetes on the quit versus fire margin when they get a case that brings it up. As a result, in 1991, many dimensions of enforceability are imputed to be able to perform the factor analysis. In 2009, many states have clarified their policies due to cases that came about between 1991 and 2009. Thus differences between 1991 and 2009 are not necessarily changes in existing noncompete policies, but are instead clarifications of nonexistent policies. Due to this ambiguity and the limitations of the data, any longitudinal estimates would be unreliable.

In order to examine whether or not the results are driven by the factor analysis approach, I re-run the training regressions using variations of the enforceability index. In columns (1) and (2) of Panel A, I use only the 1991 scores in the factor analysis index, and then only the 2009 scores. The results are almost identical to the baseline results. In columns (3) and (4) of Panel A, I use the Lubotsky-Wittenberg aggregation method to generate a different index of enforceability. The Lubotsky and Wittenberg (2006) method takes the linear regression of training on the seven individual enforceability dimensions from Bishara (2011) and uses the coefficients on the high litigation interactions as weights in a weighted sum of the dimensions of enforceability to generate the linear factor which best mitigates attenuation bias. The index is then normalized to be mean zero and standard deviation of one in a sample where each state is given the same weight, in order to be comparable to the other measures. Notably, factor analysis is preferable to this method because, as column (8) of Table 7 shows, the weights on the dimensions of enforceability are negative in some instances, which defeats the purpose of making an index that reflects true 'enforceability' within a state. Importantly, however, the Lubotsky-Wittenberg index, incorporates the negative effects of consideration-specific enforceability laws, which results in a 77% to 145% greater impact on firm-sponsored training, which is similar in size to the estimates in column (9) of Table 7 which treat consideration and non-consideration dimensions separately.

In *Panel B* of Table 10, I consider how the baseline estimates change if instead I utilize the Bishara (2011) index from 1991 and 2009, and the 1992 and 2001 indices developed by Garmaise (2009).[55] The robustness checks show that there is very little difference between the factor analysis estimates and the Bishara indices, which is unsurprising since the correlation between these indices is greater than 0.97. The Garmaise index points in the expected direction but is statistically insignificant. These differences are not unexpected because

[55] Garmaise (2009) considers various dimensions of noncompete enforceability for each state using the same Malsberger et al. (2012) text as Bishara (2011), though he assigns each dimension a binary score and simply adds them up. See Appendix B.3 for a complete description of the questions Garmaise (2009) considers.

the Garmaise index varies less than the factor analysis index.[56] Furthermore, the generated factor analysis index has two benefits over the Garmaise index which allow it more precision: (1) It is more finely coded and (2) the arbitrary weights chosen by Garmaise may overemphasize the importance of various dimensions of noncompete enforceability, while the factor analysis generates weights which account for the covariation in the dimensions.

In addition to worries about the validity of the index, one might be concerned about the fact that California and Florida, which represent the ends of the enforceability distribution might be driving the results.[57] To address these concerns, I re-run the baseline specification without California, Florida, or both. The results are presented in *Panel C* of Table 10. The results show that excluding California reduces the overall estimate of enforceability to 0.37 percentage points, but that when consideration and non-consideration dimensions of enforceability are allowed to have disparate impacts, non-consideration policies increase training as before while the enforceability of consideration dimensions decrease training. The results are essentially unchanged when removing Florida, and the results point in the same direction but become slightly noisier when both California and Florida are removed. Overall, the evidence suggests that the results are robust to excluding the ends of the enforceability distribution.

5.7.3 Interpretation

Interpreting the results is challenging because the data does not contain information on who signs noncompetes. Theoretically, the impact of enforceability could be driven by three margins. First, it could be that those who sign noncompetes actually receive more training in higher enforceability states. Second, if noncompetes themselves are associated with an increase in training (regardless of enforceability), and noncompetes are used more frequently in higher enforceability states (as found by Starr et al. (2015b)), then the enforceability impact identified here may simply correspond to the higher incidence of noncompetes in higher enforceability states. Third, there may be external effects of enforceability on those who do not sign noncompetes. In particular, if individuals who sign noncompetes in higher enforceability states are less likely to move, then their lack of movement reduces openings (through the 'vacancy chain'), and thus individuals who do not sign noncompetes in higher enforceability states may be more likely to stay with their firm. Due to the increased expected employment duration, firms have an increased incentive to provide them with training. Without data on who has signed a noncompete, there is no way to distinguish between these three interpretations.

[56] The Garmaise index has a standard deviation of 1.17 and the factor analysis index has a standard deviation of 1.32.

[57] Excluding North Dakota does not affect the results because it includes only 79 observations, which constitutes 0.1% of the sample.

Table 10: Index and State Exclusion Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Factor Analysis Index Specification Robustness Check						
	Factor Analysis Scores		Lubotsky-Wittenberg			
	1991	2009	1991	2009		
High Lit * Enforceability	0.0057***	0.0051***	0.0090***	0.0130***		
	(0.0011)	(0.0011)	(0.0016)	(0.0019)		
Observations	70,374	70,374	70,374	70,374		
Panel B: Other Noncompete Indices Robustness Check						
	Bishara Index		Garmaise Index			
	1991	2009	1992	2001		
High Lit * Enforceability	0.0059***	0.0053***	0.0033	0.0021		
	(0.0012)	(0.0011)	(0.0030)	(0.0032)		
Observations	70,374	70,374	70,374	70,374		
Panel C: State Exclusion Robustness Check						
	Without California		Without Florida		Without California and Florida	
High Lit * Enforceability	0.0037		0.0062***		0.0068	
	(0.0042)		(0.0010)		(0.0044)	
High Lit * Enforceability of Non-Consideration Dimensions		0.0095**		0.0110***		0.0131***
		(0.0040)		(0.0023)		(0.0038)
High Lit * Enforceability of Consideration Dimensions		-0.0045*		-0.0043*		-0.0034
		(0.0024)		(0.0023)		(0.0026)
Observations	62,880	62,880	66,964	66,964	59,470	59,470
Individual controls	X	X	X	X	X	X
Occupation-Industry-Year FE	X	X	X	X	X	X
State-Year FE	X	X	X	X	X	X

Note: *** p<0.01, ** p<0.05, * p<0.1. The reported estimates are the intention-to-treat coefficients on high litigation occupations. Robust standard errors are in parentheses, clustered at the state level. The dependent variable is an indicator equal to one if the worker received firm-sponsored training in the last year. The omitted group is low litigation occupations. In the column headings, 1991 and 2009 refer to the scores used from the various indices. The Lubotsky and Wittenberg (2006) method refers to using their aggregation procedure with the individual dimensions from Bishara (2011). In *Panel C*, the specification simply drops the noted states. Individual controls consist of hours worked, and indicators for working in a metro area, bachelors degree, graduate school degree, male, white, and whether the worker is unionized.

6 Conclusion

The development of skills and the proper allocation of workers to firms are crucial for economic growth (Heckman et al., 1999). Concerns about underinvestment in firm-sponsored training are commonplace because firms do not want their workers to leave and utilize any training they provided at another firm, especially a competitor. The enforceability of covenants not to compete is a legal labor market friction which restricts the

flow of workers across competitors and increases firms' incentives to provide employee training. Due to claims that California's ban on noncompetes caused the tremendous growth of Silicon Valley and recent research finding negative impacts of noncompete enforceability on employee mobility and new venture creation, such restrictions have been the focus of significant legislative scrutiny.

Utilizing cross-sectional variation in state noncompete laws, this paper shows that a change from non-enforcement to maximal enforceability increases the probability of receiving firm-sponsored training by at least 13.7%. Estimates from the aggregate measure of noncompete enforceability, however, mask significant heterogeneity in the impact of consideration specific laws: Laws that tie the enforceability of noncompetes to the receipt of additional consideration (training, wages, promotions, etc.), reduce noncompete enforceability and increase both training and wages. Given the lack of individual negotiation over noncompetes, these laws effectively negotiate over the noncompete on behalf of the worker.

References

Acemoglu, Daron, "Why Do New Technologies Complement Skills? Directed Technical Change and Wage Inequality," *The Quarterly Journal of Economics*, 1998, pp. 1055–1089.

_ and Jorn-Steffen Pischke, "The Structure of Wages and Investment in General Training," *Journal of Political Economy*, 1999, *107* (3), 539–572.

_ and _ , "Minimum Wages and on-the-job Training," *Research in Labor Economics*, 2003, *22*, 159–202.

Arnow-Richman, Rachel S, "Cubewrap Contracts and Worker Mobility: The Dilution of Employee Bargaining Power Via Standard Form Noncompetes," *University Denver Legal Studies Research Paper*, 2006, (07–01).

Autor, David H, "Why Do Temporary Help Firms Provide Free General Skills Training?," *The Quarterly Journal of Economics*, 2001, pp. 1409–1448.

_ , John J Donohue III, and Stewart J Schwab, "The Costs of Wrongful-Discharge Laws," *The Review of Economics and Statistics*, 2006, *88* (2), 211–231.

Barron, John M, Mark C Berger, and Dan A Black, "Do Workers Pay for on-the-job Training?," *Journal of Human Resources*, 1999, *34*, 235–252.

Beck, Russel, "Trade Secret and Noncompete Reported Decisions," *Accessed on October 10, 2015 at https://faircompetitionlaw.files.wordpress.com/2015/01/noncompete-and-trade-secret-cases-survey-graph-201501171.jpg*, 2014.

Becker, Gary S, "Investment in Human Capital: A Theoretical Analysis," *The Journal of Political Economy*, 1962, *70*, 9–49.

Benson, Alan, "Firm-Sponsored General Education and Mobility Frictions: Evidence from Hospital Sponsorship of Nursing Schools and Faculty," *Journal of Health Economics*, 2013, *32* (1), 149–159.

Bergen, CW Von and William Will T Mawer, "Recouping Training and Development Costs Using Preemployment Agreements," *Employee Responsibilities and Rights Journal*, 2007, *19* (2), 127–143.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan, "How Much Should We Trust Differences-In-Differences Estimates?," *The Quarterly Journal of Economics*, 2004, *119* (1), 249–275.

Bishara, Norman D, "Fifty Ways to Leave Your Employer: Relative Enforcement of Noncompete Agreements, Trends, and Implications for Employee Mobility Policy," *University of Pennsylvania Journal of Business Law*, 2011, *13*, 751–795.

Bishara, Norman, Kenneth J Martin, and Randall S Thomas, "When Do CEOs Have Covenants Not to Compete in Their Employment Contracts?," *Ross School of Business Paper*, 2012, (1181), 12–33.

Black, Dan A and Jeffrey A Smith, "Estimating the Returns to College Quality with Multiple Proxies for Quality," *Journal of Labor Economics*, 2006, *24* (3), 701–728.

Blake, Harlan M, "Employee Agreements Not to Compete," *Harvard Law Review*, 1960, pp. 625–691.

Bloom, Nicholas and John Van Reenen, "Human Resource Management and Productivity," *Handbook of Labor Economics*, 2011, *4B*, 1697–1767.

Conti, Raffaele, "Do Non-competition agreements lead firms to pursue risky R&D projects?," *Strategic Management Journal*, 2014, *35* (8), 1230–1248.

Dustmann, Christian and Uta Schönberg, "What Makes Firm-based Vocational Training Schemes Successful? The Role of Commitment," *American Economic Journal: Applied Economics*, 2012, *4* (2), 36–61.

Fallick, Bruce, Charles Fleischman, and James B. Rebitzer, "Job-Hopping in Silicon Valley: Some Evidence Concerning the Microfoundations of a High-Technology Cluster," *The Review of Economics and Statistics*, 2006, *88* (3), 472–481.

Galle, William P Jr and Clifford M Koen, "Reducing Post-Termination Disputes: A National Survey of Contract Clauses Used in Employment Contracts," *Journal of Individual Employment Rights*, 2000, *9* (3), 227–241.

Garmaise, Mark J., "Ties that Truly Bind: Noncompetition Agreements, Executive Compensation, and Firm Investment," *Journal of Law, Economics, and Organization*, 2009.

Gathmann, Christina and Uta Schönberg, "How General is Human Capital? A Task-Based Approach," *Journal of Labor Economics*, 2010, *28* (1), 1–49.

Ghosh, Suman and Kameshwari Shankar, "Optimal Enforcement of Non-compete Covenants," *Working Paper*, 2015.

Gibbons, Robert and Michael Waldman, "Task-Specific Human Capital," *American Economic Review*, 2004, pp. 203–207.

Gilson, Ronald J, "The Legal Infrastructure of High Technology Industrial Districts: Silicon Valley, Route 128, and Covenants Not to Compete," *New York University Law Review*, 1999, *74*, 575–629.

Glynn, Timothy P, "Interjurisdictional Competition in Enforcing Noncompetition Agreements: Regulatory Risk Management and the Race to the Bottom," *Washington and Lee Law Review*, 2008, *65*, 1381–1444.

Goldberger, Arthur S, *A Course in Econometrics*, Harvard University Press, 1991.

Heckman, James J, Robert J LaLonde, and Jeffrey A Smith, "The Economics and Econometrics of Active Labor Market Programs," *Handbook of Labor Economics*, 1999, *3*, 1865–2097.

Hyde, Alan, *Working in Silicon Valley: Economic and Legal Analysis of a High-Velocity Labor Market*, ME Sharpe, 2003.

Jensen, J Bradford and Lori G Kletzer, "Tradable Services: Understanding the Scope and Impact of Services Outsourcing," *Working Paper 05-9, Peterson Institute for International Economics*, 2005.

Kambourov, Gueorgui and Iourii Manovskii, "Occupational specificity of human capital*," *International Economic Review*, 2009, *50* (1), 63–115.

Kaplan, Steven N and Per Strömberg, "Financial Contracting Theory Meets the Real World: An Empirical Analysis of Venture Capital Contracts," *The Review of Economic Studies*, 2003, *70* (2), 281–315.

Katz, Eliakim and Adrian Ziderman, "Investment in General Training: The Role of Information and Labour Mobility," *The Economic Journal*, 1990, pp. 1147–1158.

Kolenikov, Stanislav, "Confirmatory Factor Analysis Using confa," *Stata Journal*, 2009, *9* (3), 329–373.

LaVan, Helen, "A Logit Model to Predict the Enforceability of Noncompete Agreements," *Employee Responsibilities and Rights Journal*, 2000, *12* (4), 219–235.

Lavetti, Kurt, Carol J Simon, and William White, "Buying Loyalty: Theory and Evidence from Physicians," *Available at SSRN 2439068*, 2014.

Lazear, Edward P, "Firm Specific Human Capital: A Skill-Weights Approach," *Journal of Political Economy*, 2009, *117* (5), 914–940.

Lester, Gillian, "Restrictive Covenants, Employee Training, and the Limits of Transaction-Cost Analysis," *Indiana Law Journal*, 2001, *76*, 49–76.

Lobel, Orly, *Talent Wants to be Free: Why We Should Learn to Love Leaks, Raids, and Free Riding*, Yale University Press, 2013.

_ **and On Amir**, "Driving Performance: A Growth Theory of Noncompete Law," *Stanford Technology Law Review*, 2013, *16* (3), 14–146.

Loewenstein, Mark A and James R Spletzer, "Delayed Formal On-the-Job Training," *Industrial and Labor Relations Review*, 1997, *51* (1), 82–99.

_ **and** _ , "Dividing the Costs and Returns to General Training," *Journal of Labor Economics*, 1998, *16* (1), 142–171.

_ **and** _ , "General and Specific Training: Evidence and Implications," *Journal of Human Resources*, 1999, *34* (4), 710–733.

Long, Brandon S, "Protecting Employer Investment in Training: Noncompetes vs. Repayment Agreements," *Duke Law Journal*, 2005, pp. 1295–1320.

Lubotsky, Darren and Martin Wittenberg, "Interpretation of regressions with multiple proxies," *The Review of Economics and Statistics*, 2006, *88* (3), 549–562.

Malsberger, Brian M, Samuel M Brock, Arnold H Pedowitz, American Bar Association et al., *Covenants Not to Compete: A State-by-State Survey*, Bloomberg BNA, 2012.

Manning, Alan, *Monopsony in Motion*, Princeton University Press Princeton, 2003.

Marx, Matt, "The Firm Strikes Back Non-Compete Agreements and the Mobility of Technical Professionals," *American Sociological Review*, 2011, *76* (5), 695–712.

_ , **Deborah Strumsky, and Lee Fleming**, "Mobility, Skills, and the Michigan Non-Compete Experiment," *Management Science*, 2009, *55* (6), 875–889.

Meccheri, Nicola, "A Note on Noncompetes, Bargaining and Training by Firms," *Economics Letters*, 2009, *102* (3), 198–200.

Moen, Espen R and Åsa Rosén, "Does Poaching Distort Training?," *The Review of Economic Studies*, 2004, *71* (4), 1143–1162.

Moulton, Brent R, "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units," *The Review of Economics and Statistics*, 1990, *72* (2), 334–383.

Neal, Derek, "Industry-Specific Human Capital: Evidence from Displaced Workers," *Journal of Labor Economics*, 1995, pp. 653–677.

Parent, Daniel, "Industry-Specific Capital and the Wage Profile: Evidence from the National Longitudinal Survey of Youth and the Panel Study of Income Dynamics," *Journal of Labor Economics*, 2000, *18* (2), 306–323.

Posner, Eric A, Alexander Triantis, and George G Triantis, "Investing in Human Capital: The Efficiency of Covenants Not to Compete," *University of Virginia Legal Working Paper Series*, 2004, pp. 1–33.

Rubin, Paul H and Peter Shedd, "Human Capital and Covenants Not to Compete," *Journal of Legal Studies*, 1981, *10*, 93.

Samila, Sampsa and Olav Sorenson, "Noncompete Covenants: Incentives to Innovate or Impediments to Growth," *Management Science*, 2011, *57* (3), 425–438.

Seegert, Nathan, "Optimal Taxation with Volatility: A Theoretical and Empirical Decomposition," *Working Paper*, 2012.

Shaw, Kathryn, "The Human Resources Revolution: Is It a Productivity Driver?," *Innovation Policy and the Economy*, 2004, *4*, 69–114.

Starr, Evan, James J Prescott, and Norman Bishara, "Does Knowledge of Enforcement Laws Mitigate the Chilling Effect of Noncompetes? Evidence from an Information Experiment," *Working Paper*, 2015.

_ , _ , **and** _ , "Noncompetes in the US Labor Force," *Working Paper*, 2015.

_ , **Natarajan Balasubramanian, and Mariko Sakakibara**, "Screening Spinouts? How Noncompete Enforceability Affects the Creation, Growth, and Survival of New Firms," *Working Paper 14-27, Center for Economic Studies, U.S. Census Bureau*, 2015.

Stevens, Margaret, "A Theoretical Model of on-the-job Training with Imperfect Competition," *Oxford Economic Papers*, 1994, pp. 537–562.

Stroud, Sela, "Non-Compete Agreements: Weighing the Interests of Profession and Firm," *Alabama Law Review*, 2001, *53*, 1023–1041.

Stuart, Toby E and Olav Sorenson, "Liquidity Events and the Geographic Distribution of Entrepreneurial Activity," *Administrative Science Quarterly*, 2003, *48* (2), 175–201.

Whitmore, Peter J, "A Statistical Analysis of Noncompetition Clauses in Employment Contracts," *Journal of Corporate Law*, 1990, *15*, 483–553.

Wolter, Stefan C, Samuel Muehlemann, and Paul Ryan, "Monopsony Power, Pay Structure, and Training," *Industrial and Labor Relations Review*, 2013, *66* (5), 1097–1114.

Online Appendix

A Proof of Proposition 1

Proposition 1: For a given enforceability level, λ, optimal training levels and wages are higher when training is contractible, $T_c^*(\lambda) > T_u^*(\lambda)$, and $w(T_c^*(\lambda)) > w(T_u^*(\lambda))$.

Proof. The marginal cost of training is the same in the contractible and unilateral firm choice cases. Under the assumption that $c''(T) > -q(\lambda)(1-\lambda)lk'(T)$, such that marginal costs are monotonically increasing, whichever case has a higher marginal benefit of training determines which case results in the higher training level. The marginal benefit of training under the contractible case and unilateral firm choice are

$$MB_u(T,\lambda) = (1-q(\lambda))(1-\beta)\left[y'(T) - (1-\lambda)\frac{d(\mathbf{E}[w_p(T)])}{dT}\right]$$
$$MB_c(T,\lambda) = (1-q(\lambda))y'(T) + q(\lambda)(1-\lambda)\left(\frac{d\mathbf{E}\Big[w_p(T))|w_p(T) > \hat{w}(\lambda)\Big]}{dT}\right)$$

Proof by contradiction. Assuming that $MB_u(T,\lambda) > MB_c(T,\lambda)$, then

$$MB_u(T,\lambda) > (1-\beta)MB_c(T,\lambda)$$
$$(1-q(\lambda))(1-\beta)\left[y'(T) - (1-\lambda)\frac{d(\mathbf{E}[w_p(T)])}{dT}\right] > (1-\beta)\left[(1-q(\lambda))y'(T) + q(\lambda)(1-\lambda)\left(\frac{d\mathbf{E}\Big[w_p(T))|w_p(T) > \hat{w}(\lambda)\Big]}{dT}\right)\right]$$
$$(1-q(\lambda))\left[y'(T) - (1-\lambda)\frac{d(\mathbf{E}[w_p(T)])}{dT}\right] > (1-q(\lambda))y'(T) + q(\lambda)(1-\lambda)\left(\frac{d\mathbf{E}\Big[w_p(T))|w_p(T) > \hat{w}(\lambda)\Big]}{dT}\right)$$
$$-(1-q(\lambda))(1-\lambda)\frac{d(\mathbf{E}[w_p(T)])}{dT} > q(\lambda)(1-\lambda)\left(\frac{d\mathbf{E}\Big[w_p(T))|w_p(T) > \hat{w}(\lambda)\Big]}{dT}\right)$$

which is a contradiction because the left hand side is negative while the right hand size is positive.

Since $w(T) = \beta y(T) + (1-\beta)(1-\lambda)\mathbf{E}[w_p(T)]$, and $w_p(T) = ay(T) + zk(T)$, and $y(T)$ and $k(T)$ are increasing in T, then it follows directly that $w(T)$ is increasing in T and hence $w(T_c^*(\lambda)) > w(T_u^*(\lambda))$. □

B Enforceability Indices

B.1 Factor Analysis Index

Table A1: Factor Analysis Weighted Noncompete Index

State	1991	2009	State	1991	2009
AK	-1.33	-0.98	MS	-0.20	0.04
AL	0.36	0.36	MT	-0.63	-0.65
AR	-0.62	-0.58	NC	0.18	0.18
AZ	-0.16	0.15	ND	-4.23	-4.23
CA	-3.76	-3.79	NE	-0.13	-0.13
CO	0.38	0.38	NH	0.26	0.26
CT	0.62	1.26	NJ	0.47	0.90
DC	0.12	0.12	NM	0.74	0.74
DE	0.18	0.52	NV	-0.62	0.03
FL	1.15	1.60	NY	-0.73	-1.15
GA	0.45	0.02	OH	-0.18	0.08
HI	-0.83	-0.17	OK	-0.80	-0.94
IA	0.19	1.01	OR	0.14	0.14
ID	-0.01	0.77	PA	-0.14	0.14
IL	0.55	0.95	RI	-0.67	-0.33
IN	0.70	0.70	SC	-0.20	-0.27
KS	0.69	1.21	SD	0.37	1.02
KY	0.61	0.85	TN	0.22	0.45
LA	-0.70	0.50	TX	-0.04	-0.28
MA	0.87	0.48	UT	1.00	1.00
MD	0.15	0.60	VA	0.09	-0.29
ME	0.06	0.41	VT	0.30	0.60
MI	0.07	0.46	WA	0.64	0.34
MN	-0.07	-0.07	WI	0.16	-0.09
MO	0.93	1.08	WV	-0.80	-0.80
			WY	-0.65	0.23

This table presents the 1991 and 2009 noncompete enforceability scores for each state, where the weights for the seven dimensions of enforceability are determined via factor analysis, as shown in Table 1, and the scores are from Bishara (2011).

B.2 Bishara 2011 Index

Question #	Question	Criteria	Question Weight
Q1	Is there a state statute that governs the enforceability of covenants not to compete?	10 = Yes, favors strong enforcement 5 = Yes or no, in either case neutral on enforcement 0 = Yes, statute that disfavors enforcement	10
Q2	What is an employer's protectable interest and how is that defined?	10 = Broadly defined protectable interest 5 = Balanced approach to protectable interest 0 = Strictly defined, limiting the protectable interest of the employer	10
Q3	What must the plaintiff be able to show to prove the existence of an enforceable covenant not to compete?	10 = Weak burden of proof on plaintiff (employer) 5 = Balanced burden of proof on plaintiff 0 = Strong burden of proof on plaintiff	5
Q3a	Does the signing of a covenant not to compete at the inception of the employment relationship provide sufficient consideration to support the covenant?	10 = Yes, start of employment always sufficient to support any CNC 5 = Sometimes sufficient to support CNC 0 = Never sufficient as consideration to support CNC	5
Q3b	Will a change in the terms and conditions of employment provide sufficient consideration to support a covenant not to compete entered into after the employment relationship has begun?	10 = Continued employment always sufficient to support any CNC 5 = Only change in terms sufficient to support CNC 0 = Neither continued employment nor change in terms sufficient to support CNC	5
Q3c	Will continued employment provide sufficient consideration to support a covenant not to compete entered into after the employment relationship has begun?	10 = Continued employment always sufficient to support any CNC 5 = Only change in terms sufficient to support CNC 0 = Neither continued employment nor change in terms sufficient to support CNC	5
Q4	If the restrictions in the covenant not to compete are unenforceable because they are overbroad, are the courts permitted to modify the covenant to make the restrictions more narrow and to make the covenant enforceable? If so, under what circumstances will the courts allow reduction and what form of reduction will the courts permit?	10 = Judicial modification allowed, broad circumstances and restrictions to maximum enforcement allowed 5 = Blue pencil allowed, balanced circumstances and restrictions to middle ground of allowed enforcement 0 = Blue pencil or modification not allowed	10
Q8	If the employer teminates the employment relationship, is the covenant enforceable?	10 = Enforceable if employer terminates 5 = Enforceable in some circumstances 0 = Not enforceable if employer terminates	10

Source: Bishara (2011).

B.3 Garmaise (2009) Index

The following twelve questions from Malsberger et al. (2012) are used to evaluate the level of non- competition agreement enforceability in each state. Each state is granted one point for each question concerning which

its laws lie above the threshold.

Question 1: Is there a state statue of general application that governs the enforceability of covenants not to compete?

Threshold 1: States that enforce non-competition agreements outside a sale-of-business context receive a score of one.

Question 2: What is an employer's protectable interest and how is it defined?

Threshold 2: States in which the employer can prevent the employee from future independent dealings with all the firm's customers, not merely with the customers with whom the employee had direct contact, receive a score of one.

Question 3: What must the plaintiff be able to show to prove the existence of an enforceable covenant not to compete?

Threshold 3: Laws that place greater weight on the interests of the firm relative to those of the former employee are above the threshold. For example, a law that requires that the contract be reasonably protective of the firm's business interests and only meet the condition of not being unreasonably injurious to the employee's interests would receive a score of one.

Question 4: Does the signing of a covenant not to compete at the inception of the employment relationship provide sufficient consideration to support the covenant?

Threshold 4: States for which the answer to Question 4 is clearly "Yes" are above the threshold.

Question 5: Will a change in the terms and conditions of employment provide sufficient consideration to support a covenant not to compete entered into after the employment relationship has begun?

Threshold 5: States for which the answer to Question 5 is clearly "Yes" are above the threshold.

Question 6: Will continued employment provide sufficient consideration to support a covenant not to compete entered into after the employment relationship has begun?

Threshold 6: States for which the answer to Question 6 is clearly "Yes" are above the threshold.

Question 7: What factors will the court consider in determining whether time and geographic restrictions in the covenant are reasonable?

Threshold 7: Jurisdictions in which courts are instructed not to consider economic or other hardships faced by the employee are above the threshold.

Question 8: Who has the burden of proving the reasonableness or unreasonableness of the covenant not to compete?

Threshold 8: States in which the burden of proof is clearly placed on the employee are above the threshold.

Question 9: What type of time or geographic restrictions has the court found to be reasonable? Unreasonable?

Threshold 9: Jurisdictions in which three-year statewide restrictions have been upheld receive a score of one.

Question 10: If the restrictions in the covenant not to compete are unenforceable because they are overbroad, are the courts permitted to modify the covenant to make the restrictions more narrow and to make the covenants enforceable?

Threshold 10: States for which the answer to Question 10 is clearly "Yes" are above the threshold.

Question 11: If the employer terminates the employment relationship, is the covenant enforceable?

Threshold 11: States for which the answer to Question 11 is clearly "Yes" are above the threshold.

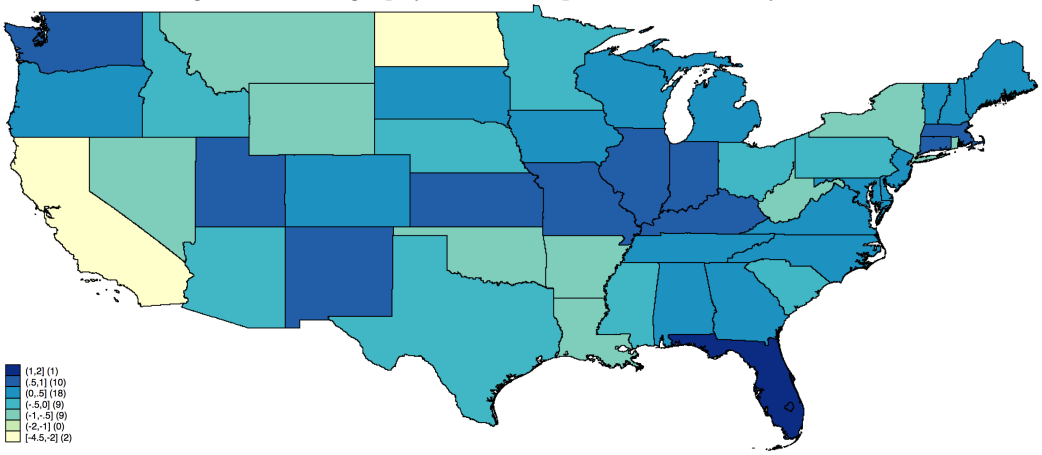
Question 12: What damages may an employer recover and from whom for breach of a covenant not to compete?

Threshold 12: If, in addition to lost profits, there is a potential for punitive damages against the former employee, the state receives a score of one. States that explicitly exclude consideration of the reasonableness of the contract from the calculation of damages are also above the threshold.

C Supporting Figures and Tables

C.1 Map of Noncompete Enforceability in 1991

Figure A1: Geography of Noncompete Enforceability in 1991



C.2 Occupation Specific Effects

Table A2: Firm-Sponsored Training Content

Intent-to-Treat Effect	(1) Training	(2) Basic	(3) New	(4) Upgrade	(5) Policies
Panel A: Average Enforcement Effect for High Litigation Occupations					
High Lit * Enforceability	0.0053***	0.0018**	0.0015**	0.0034***	0.0014*
	(0.0011)	(0.0008)	(0.0007)	(0.0012)	(0.0007)
Panel B: Intent-to-Treat High Litigation Occupation-Specific Effect					
Management	0.0043*	0.0026	0.0012	0.0046*	0.0015
	(0.0026)	(0.0016)	(0.0014)	(0.0024)	(0.0012)
Business, Financial	0.0119***	0.0111***	0.0042*	0.0072*	0.0041**
	(0.0042)	(0.0016)	(0.0022)	(0.0042)	(0.0016)
Computer, Mathematical	0.0101**	0.0036*	0.0059	0.0136***	0.0050**
	(0.0046)	(0.0021)	(0.0041)	(0.0042)	(0.0019)
Engineering	0.0135***	-0.0012	0.0008	0.0114***	0.0001
	(0.0035)	(0.0029)	(0.0025)	(0.0032)	(0.0014)
Life, Physical, Social Sciences	-0.0183**	-0.0042	-0.0043	-0.0113	0.0081*
	(0.0087)	(0.0037)	(0.0060)	(0.0084)	(0.0045)
Healthcare Practitioners, Technical	0.0136**	-0.0046	-0.0003	0.0072	-0.0002
	(0.0054)	(0.0044)	(0.0048)	(0.0044)	(0.0024)
Personal Care, Services	0.0115***	0.0027	0.0052*	0.0094*	0.0056**
	(0.0040)	(0.0029)	(0.0028)	(0.0048)	(0.0026)
Sales	0.0015	0.0014	0.0003	-0.0002	0.0027***
	(0.0017)	(0.0014)	(0.0020)	(0.0017)	(0.0010)
Installation, Repair	0.0049	-0.0007	0.0042	-0.0014	-0.0028
	(0.0045)	(0.0019)	(0.0035)	(0.0039)	(0.0019)
Production	0.0028**	0.0001	0.0001	0.0004	-0.0005
	(0.0013)	(0.0009)	(0.0011)	(0.0013)	(0.0009)
Arts/Entertainment	0.0061	0.0027	0.0004	0.0022	-0.0038
	(0.0076)	(0.0034)	(0.0039)	(0.0048)	(0.0029)
Observations	70,374	70,374	70,374	70,374	70,374

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parentheses, clustered at the state level. The omitted group is low litigation occupations. All dependent variables are indicator variables for the type of firm-sponsored training received. Basic refers to training for basic skills. New refers to training to learn new skills. Upgrade refers to training that improves existing skills. Policies refers to training that introduces company policies. Individual controls consist of hours worked, and indicators for working in a metro area, bachelors degree, graduate school degree, male, white, and whether the worker is unionized.

C.3 Dividing by Tradable and Non-Tradable Industries

Jensen and Kletzer (2005) show the share of total employment by tradable versus non-tradable NAICS sectors. From their Table 4, I classify an industry as tradable if more employment is observed in the tradable portion of that industry. Table A3 categorizes NAICS 2 digit industries by whether they are tradable or

non-tradable.

Table A3: Mapping NAICS 2 Digit Codes to Tradable and Non-Tradable Industries

Non Tradable	Tradable
Utilities	Agriculture, Forestry
Construction	Mining, Quarrying, Oil Extraction
Retail Trade	Manufacturing
Administrative and Support Services	Transportation and Warehousing
Educational Services	Information
Healthcare and Social Services	Wholesale Trade
Arts, Entertainment, and Recreation	Finance and Insurance
Accommodation and Food Services	Real Estate and Rental
Other Services (Except Public Sector)	Professional, Scientific, Technical
	Management of Companies