Why are Low-Wage Workers Signing Noncompete Agreements? *

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Abstract

Noncompete agreements (NCAs), which contractually limit where an employee may work in the event of a job separation, have been recognized as tools employers use to protect nonphysical production assets and to reduce turnover. However, recent evidence that NCAs are widely and increasingly used in low-wage jobs suggests our understanding of NCA use remains incomplete. In this paper, we show that NCAs arise when employers and employees are limited in their ability to transfer utility via the wage. Our model of the labor market predicts that, when such limitations are present, the terms of trade may dictate that NCAs are used to transfer utility from the employee to the employer, even when NCAs reduce the pair's surplus. We find support for our model's predictions using a new survey of owners of independent hair salons, an industry in which NCAs are widely used. We find that declines in two distinct measures of the terms of trade for employees, and decreases in transferability of utility (measured by the state minimum wage), are associated with increases in NCA use. Furthermore, we generate a test for identifying when NCAs reduce a pair's surplus, and we identify a subset of firms in our sample, characterized by limited access to credit, for which this is the case. Finally, we revisit a recent study of the employment effect of the minimum wage: consistent with our model, we find that minimum wage increases have a negative effect on employment in states where NCAs are not enforced, and no effect in states where they are strictly enforced.

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1 Introduction

When a new worker receives his or her employment contract, it may include a noncompete agreement (hereafter, NCA). NCAs contractually limit a worker's ability to enter into a professional position in competition with his or her employer in the event of a job separation. Indeed, 20 percent of the workforce was bound by an NCA in 2014 (Starr et al., 2017). While NCAs often provide benefits to employers, they may impose significant costs on workers by limiting their ability to pursue outside employment opportunities. More broadly, NCAs are one example of actions employers take to restrict competition in the labor market (Manning, 2011; Ashenfelter and Krueger, 2017).

Recent evidence suggests that our understanding of the reasons behind—and implications of—NCA use remains incomplete. Economic theory of the hold-up problem (Grossman and Hart, 1986) suggests that NCAs can potentially enhance efficiency by aligning incentives to invest in various assets, such as general human capital training, trade secrets, or client lists. It is not surprising, therefore, that NCAs are most prevalent in higher-skill, knowledge intensive industries and occupations. However, they are also frequently used in many traditionally lower-paying occupations,[1] even among fast food workers,[2] leading some to question what benefit NCAs could be bringing to these employment relationships. Furthermore, use of,[3] and litigation over,[4] NCAs have been growing in recent years which, absent corresponding changes in the importance of training, trade secrets, client lists, or other such assets, is difficult to rationalize with the theory of the hold-up problem alone.

These developments have also captured policymakers' attention: in Congress, the MOVE[5] (Mobility and Opportunity for Vulnerable Employees) and LADDER[6] (Limiting the Ability to Demand Detrimental Employment Restrictions) Acts, introduced on June 4, 2015, and June 24, 2015, respectively, would prohibit NCAs for workers earning less than $15 per hour, and bills with similar intents have been introduced by several state

[1] For example, Starr et al. (2017) find that 12% of workers making less than $20,000 a year were bound by an NCA, compared to 19% for the overall population.

[2] Irwin, Neil. "When the Guy Making Your Sandwich Has a Noncompete Clause," *The New York Times*, October 14, 2014

[3] Greenhouse, Steven. "Noncompete Clauses Increasingly Pop Up in Array of Jobs," *The New York Times*, June 8, 2014

[4] Simon, Ruth, and Angus Loten. "When a New Job Leads to a Lawsuit–Litigation Over Noncompete Clauses is Rising; does Entrepreneurship Suffer?" Wall Street Journal, Aug 15 2013

[5] Senate bill S. 1504. Full text available at `https://www.govtrack.us/congress/bills/114/s1504/text`

[6] House of Representatives bill H.R.2873. Full text available at `https://www.congress.gov/bill/114th-congress/house-bill/2873/text`

legislatures.[7] Both the U.S. Treasury[8] and the White House[9] released reports in 2016 pertaining to NCAs among low wage workers, and most recently, former President Barack Obama issued a State Call to Action on NCAs.[10] Despite this policy interest, little is known about the efficiency of NCAs in this context, let alone the rationale for their use in the first place.

In this paper, we show theoretically that NCAs may arise as a tool to transfer utility from employees to employers when the market-clearing wage is constrained. We then generate an empirical test to determine when NCAs reduce employer/employee pairs' surplus. We find strong empirical support for our theory and implement the test using data from a survey we conducted of employers in the hair salon industry. Then, building from a recent study of the employment effects of the minimum wage, we test and find support for a related prediction: that the minimum wage will have a more negative effect on employment when NCAs are unavailable.

We start with a simple, perfectly competitive model of the labor market in which NCAs provide a benefit to the employer and impose a cost on the employee. If utility is fully transferable between the employer and employee via the wage, NCAs will be used only when the firm's net benefit of NCA use is positive: when NCAs maximize the pair's surplus. However, when utility transferability via the wage is limited, the terms of trade in the labor market may dictate that NCAs are used as a tool to transfer utility from the employee to the employer, even if NCAs reduce pairs' surplus. NCA use will therefore increase when the terms of trade become more favorable to the employer or when transferability of utility decreases.

To test the empirical predictions of our model, we surveyed owners of independent hair salons in April 2015 via the Professional Beauty Association, the industry's leading trade association. The benefits of NCAs are clear in this setting, due to the importance of client attraction and retention in production, and the prevalence of on-the-job training. At the same time, the costs of NCAs to workers are also potentially high due to, for example, state-level occupational licensing laws that make mobility to other areas costly. We find

[7] Some examples include Washington (HB 1926; introduced February 2, 2015), Utah (HB 251; introduced February 1, 2016), Massachusetts (H.4434; substituted for H.4323 June 27, 2016), and Illinois (Illinois Freedom to Work Act; went into effect January 1, 2017)

[8] Treasury Report: `https://www.treasury.gov/resource-center/economic-policy/Documents/UST%20Non-competes%20Report.pdf`

[9] `https://www.whitehouse.gov/sites/default/files/non-competes_report_final2.pdf`

[10] Call to Action on NCAs: `https://www.whitehouse.gov/sites/default/files/competition/noncompetes-calltoaction-final.pdf`

NCAs are widely used: 30% of our sample had their most recently hired stylist sign an NCA, and 39% have had at least one stylist sign an NCA in the past.

We find strong empirical support that limitations on transferability of utility via the wage affect NCA use. First, we find that outward shifts in labor supply and increases to the local unemployment rate (both of which are associated with a lower market-clearing wage) lead to higher NCA use. Second, we find that increases in the minimum wage, which limit transferability of utility, also lead to higher NCA use. This result only holds for salons that hire workers as employees; the minimum wage has a small and statistically insignificant effect for salons that hire independent contractors. This latter group is not covered by the Fair Labor Standards Act, and thus acts as a "placebo group" for the minimum wage, bolstering confidence that this result is not driven by unobservable differences across states correlated with the minimum wage.

Combined with our model's predictions, these results imply that NCAs reduce surplus for at least a subset of firms in our sample. However, there may be some firms for which NCAs are actually surplus-maximizing contracts: if the benefits of NCAs are heterogeneous across employers, NCAs may maximize surplus for those firms with the highest benefit. After identifying a measure of employers' ability to invest in production assets—which NCAs potentially make more valuable to employers—we find strong evidence that NCAs reduce surplus for pairs including employers with low capacity for investment, but not for those with high capacity. Employers with high capacity for investment use NCAs at a high rate, regardless of whether the market-clearing wage is likely constrained. On the other hand, employers with low capacity for investment are highly unlikely to use NCAs when the market-clearing wage is unconstrained, but this likelihood increases as the wage becomes constrained.

Overall, these results highlight a potential explanation for the growth of NCAs among lower-wage occupations and industries in recent years. Between 2007 and 2009, the federal minimum wage rose from $5.15 per hour to $7.25 per hour, and several states have increased their minimum wage in more recent years.[11] Furthermore, in the wake of the Great Recession, there is a consensus that the labor market has deteriorated dramatically, especially for low-wage workers. Our results imply employers leveraged this weak labor market to use NCAs as a tool to extract additional utility from workers over this period, even if workers incurred a high cost as a result.

[11] Historical changes to state-level minimum wages are available from the Wage and Hour Division of the Department of Labor (https://www.dol.gov/whd/state/stateMinWageHis.htm, accessed December 2016).

However, while the increase in NCA use for low-wage workers in recent years may have reduced pairs' surplus conditional on employment, our model also suggests that the availability of NCAs may dampen the extent to which a friction like the minimum wage has the capability to *reduce* employment. To test this prediction, we revisit findings from a recent study (Dube et al., 2016) that estimates the effect of the minimum wage on employment. We find heterogeneous employment effects of the minimum wage depending on states' enforceability of NCAs: in states with low NCA enforceability (where NCAs are a less potent tool to transfer utility in firms), a minimum wage increase leads to a decrease in employment. However, in states with higher enforceability, the effect is essentially zero.

Thus, our results yield nuanced implications for policy. On the one hand, our survey results suggest that NCAs may arise as a tool for employers to extract utility from workers in weak labor markets, reducing pairs' surplus and leaving workers worse off. At the same time, even within a narrowly defined industry, we find NCAs reduce surplus for some firms, but do not for others. This finding stresses the need for future research to further investigate the benefits NCAs provide to firms, which can aid policymakers by pinpointing where NCAs are most likely to be surplus-diminishing. Furthermore, our analysis suggests the availability of NCAs can mitigate potential negative employment effects of a minimum wage increase.

This paper contributes to multiple literatures. First, a growing literature has investigated the rationale for NCAs and the effects of their use. Using variation in the enforceability of NCAs across states, an increase in NCA enforceability has been found to increase firm-sponsored training (Starr, 2015), increase firm shareholder value (Younge and Marx, 2015), and decrease employee mobility (Marx et al., 2009; Fallick et al., 2006). Two papers prior to ours use individual-level data on NCA use: employees who sign NCAs have longer tenure and higher monetary returns to tenure among a sample of physicians (Lavetti et al., 2017), and among a nationally representative survey (Starr et al., 2017). Two papers theoretically explore the effects of liquidity constraints that hinder an employee's ability to buy out of noncompete agreements (Rauch and Watson, 2014; Rauch, 2015), finding that such liquidity constraints make NCAs lead to inefficiently low levels of entrepreneurship. We add to the literature by empirically demonstrating how forces external to the firm influence the decision to use NCAs in the first place (in particular, for low-wage workers) and by providing a method to identify the presence of NCAs that reduce a pair's surplus. We also conduct the first survey on NCA use with *employer* information, allowing us to explore determinants and effects of NCA use not available through worker surveys or variation in

enforceability.

This paper also contributes to a literature that addresses the ways in which nontransferability of utility affects a firm's internal decisions. A small literature has empirically investigated the role of the minimum wage on provision of nonwage compensation, such as on-the-job training (Acemoglu and Pischke, 1999), health insurance (Marks, 2011), and fringe benefits (Simon and Kaestner, 2004). Theoretically, it has been shown that a minimum wage may reduce inefficient monitoring (Acemoglu and Newman, 2002). We add to this literature by analyzing how the bindingness of the minimum wage affects the prevalence of NCAs, which are not only an important aspect of nonwage compensation but also an organizational feature of the firm. A related branch of the literature has theoretically investigated how market factors and factors external to the firm affect the internal organizational structure of firms (such as integration and control allocation) in the face of nontransferable utility (Legros and Newman, 2008, 2012). We add to this literature by investigating the ways in which external *labor* market characteristics affect internal organizational decisions of the firm.

Section 2 describes the model and its testable implications. Section 3 describes the survey and the resulting dataset. Section 4 presents our empirical results from the survey, and Section 5 presents results assessing how NCA availability moderates the employment effects of the minimum wage. Finally, Section 6 concludes.

2 Model

Our model seeks to address the relationship between labor market conditions, limitations on the transferability of utility, and NCAs. Broadly speaking, our model yields the insight that, even when NCAs reduce surplus for an employer/employee pair, they may be used as a means to transfer utility to employers when an employee's wage may not be decreased to the market-clearing level. This scenario will be more likely when terms of trade favor employers (which may occur when labor is plentiful). Additionally, we develop a method to empirically identify populations of firms for which NCAs cause a surplus loss.

2.1 Description of the Model

The model has uncountably many of two types of agents: employers (R) and employees (E), with associated measures μ_R and μ_E. R and E form "firms" in frictionless labor markets.

A firm is comprised of at most one R and one E. When firms are formed, they engage in production of a consumer good, which sells for an exogenously determined price, P. A firm containing employer i (called firm i) produces an exogenously determined quantity, $\gamma(i)$, of the consumer good, which results in value of production equal to $\gamma(i)P$. The population distribution of γ is Γ, which has compact support $[\underline{\gamma}, \bar{\gamma}]$ and no mass points. Employers are denoted R_i, where the index i is ordered such that $\gamma(i)$ is decreasing in i. Employers have an outside option with value equal to π_R. Employee productivity is assumed to be homogeneous, and employees have an outside option with value equal to π_E. Singleton agents, whether they are of type R or E, do not produce the consumer good, and receive only their outside option.

Contracts written by an R and an E consist of two elements: a wage payment (w) and, possibly, an NCA (A). The wage may be constrained by a monetary transferability limitation, l, which requires that $w \geq l$. The constraint $w \geq l$ may reflect the inability of an employer to lower wages due to the need for incentive provision (Shapiro and Stiglitz, 1984; Arnott et al., 1988), an employee's borrowing constraints, fairness concerns (Akerlof and Yellen, 1990), turnover reduction (Campbell III and Kamlani, 1997), employee cooperation (Fehr and Falk, 1999), or a regulated minimum wage.

If a firm writes a contract with an NCA ($A = 1$), a positive benefit of B accrues to R and a positive cost of C is paid by E. B may represent many different elements: the ability of the employer to make investments in the employee without facing a hold-up problem, retention of the firm's client list if the employee quits, protection of trade secrets, or prolonging worker tenure (and thus reducing employee replacement costs, which can be substantial (Dube et al., 2010)), among others. C primarily represents the employee's foregone future employment opportunities, but may also include the inability of an employee to take advantage of favorable labor markets in the future or to leverage a client list or other assets to garner future wage increases.

R and E are risk neutral. Let $V_i(w, A)$ be the utility function of R_i if she is a member of a firm. $V_i(w, A)$ includes the value of production, the wage payment, and the benefit gained from use of an NCA:

$$V_i(w, A) = \gamma(i)P - w + AB$$

Any R who is not a member of a firm receives her outside option, π_R.

The utility function of an E if he is a member of a firm includes the wage payment and

the cost, C, incurred by an E if his contract includes an NCA:

$$W(w, A) = w - AC$$

Any E who is not a member of a firm receives his outside option, π_E.

An equilibrium is a set of firms and a contract for each firm, $\{w, A\}$, such that all matches are stable (i.e., there does not exist an R and an E who may form a new firm with a contract that yields strictly greater utility to one member of the pair and weakly greater utility to the other member of the pair) and contracts are optimal (i.e., there does not exist a deviation contract for a firm that yields strictly greater utility to one member of the pair and weakly greater utility to the other member of the pair).

In the following sections, we first construct labor demand and labor supply curves by analyzing a firm's optimal contracting problem. Using those results, we characterize equilibrium contracts. Finally, we generate testable implications based on comparative statics of the model.

2.2 The Firm's Problem

The wage that an employer is willing to pay an employee depends on whether or not the contract includes an NCA. The willingness to pay of employer R_i under an optimal contract may be found by maximizing E's utility over all possible contracts (to rule out Pareto dominated contracts), subject to satisfying the limited transferability constraint, LTC, and both agents' participation constraints, PCR and PCE:

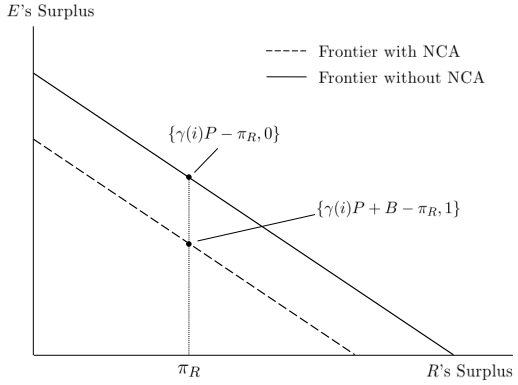
$$\max_{w \in \mathbb{R}, A \in \{0,1\}} w - AC$$

$$w \geq l \tag{LTC}$$

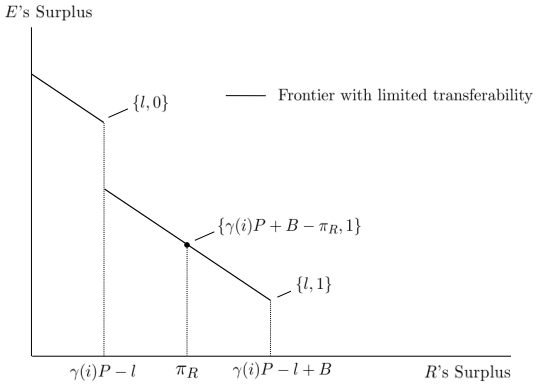
$$\gamma(i)P - w + AB \geq \pi_R \tag{PCR}$$

$$w - AC \geq \pi_E \tag{PCE}$$

Consider first a simplified problem which ignores the limited transferability constraint, (LTC). Assuming that (PCR) binds but (PCE) does not, substituting (PCR) into the



(a) With unlimited transferability of utility, R_i's participation constraint may be satisfied on the surplus-maximizing frontier. Here, $B < C$, so surplus-maximizing contracts do not include NCAs.



(b) With a transferability limitation, the Pareto frontier includes contracts with NCAs. A firm may need to use an NCA in order to satisfy R_i's participation constraint.

Figure 1: Pareto frontiers with and without utility transferability limitations.

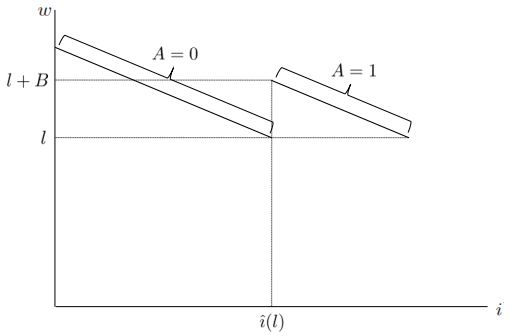
maximand yields the reduced problem:

$$\max_{A \in \{0,1\}} \gamma(i)P + A(B - C) - \pi_R$$

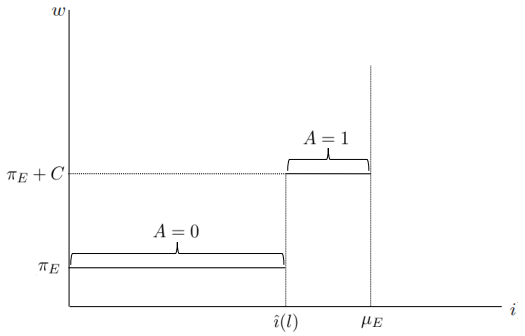
The solution to this problem is $A = 0$ whenever $B < C$, and $A = 1$ whenever $B > C$. In other words, when utility is fully transferable via the wage (i.e., LTC does not bind), NCAs that maximize the pair's surplus are optimal, and NCAs that reduce the pair's surplus are not. The wage allocates the value of production and the benefit of an NCA to E, net of R_i's outside option: $w = \gamma(i)P + AB - \pi_R$.[12] The simplified problem (ignoring (LTC)) when $B < C$ is illustrated in Panel (a) of Figure 1. In that example, the optimal contract that satisfies (PCR), $\{\gamma(i)P - \pi_R, 0\}$, lies on the frontier without an NCA, since $B < C$.

Now, consider the full problem with limited transferability, so that the wage cannot be lower than l. If $l > \gamma(i)P - \pi_R$, the transferability constraint and R_i's participation constraint may be satisfied simultaneously only if $A = 1$, even when NCAs reduce the pair's surplus ($B < C$).

[12]Note that the assumption that (PCE) does not bind is equivalent to $\gamma(i)P + A(B - C) > \pi_E + \pi_R$: if PCE binds, there is no contract that R_i and E both prefer to simply receiving their outside options, and the maximization problem has no solution.



(a) The labor demand curve. The increase in willingness to pay at $\hat{\imath}(l)$ represents the benefit, B, associated with NCA use.



(b) The labor supply curve. The increase in willingness to accept at $\hat{\imath}(l)$ represents the cost, C, associated with NCA use.

Figure 2: Labor demand and labor supply when $B < C$.

The solution to this problem is:

$$\{\gamma(i)P - \pi_R, 0\} \qquad \text{if } B < C \text{ and } l \leq \gamma(i)P - \pi_R \tag{1}$$

$$\{\gamma(i)P + B - \pi_R, 1\} \qquad \text{if } B > C \text{ or } l > \gamma(i)P - \pi_R. \tag{2}$$

This problem, with $B < C$, is illustrated in Panel (b) of Figure 1. The most favorable contract for R_i with $A = 0$, $\{l, 0\}$, does not satisfy R_i's participation constraint. Thus, the optimal contract that satisfies (PCR) is $\{\gamma(i)P + B - \pi_R, 1\}$. Naturally, this contract does not maximize the pair's surplus: the total surplus generated under this contract falls short of that generated under the unconstrained optimal contract.

Given values for B, C, and l, Expressions 1 and 2 represent the inverse labor demand curve. When $B > C$, all contracts have $A = 1$, and the inverse demand curve (hereafter denoted by $D(i)$) is $D(i) = \gamma(i)P + B - \pi_R$. When $B < C$, the inverse labor demand curve has a discontinuity at $\hat{\imath}(l)$, given by $\gamma(\hat{\imath}(l))P - \pi_R = l$ (i.e., $R_{\hat{\imath}}$ is indifferent between the contract $\{l, 0\}$ and receiving her outside option). For $i \leq \hat{\imath}(l)$, inverse labor demand is $D(i) = \gamma(i)P - \pi_R$ with $A = 0$. For $i > \hat{\imath}(l)$, inverse labor demand is $D(i) = \gamma(i)P + B - \pi_R$ with $A = 1$.

Panel (a) of Figure 2 shows the labor demand curve when $B < C$, taking into account the limitation on monetary transferability of utility. The increase in willingness to pay at the discontinuity represents the value of an NCA to the employer, B.

Labor supply is constructed in an analagous fashion. The relevant maximization problem is:

$$\max_{w\in\mathbb{R},A\in\{0,1\}} \gamma(i)P - w + AB$$

$$w \geq l \tag{LTC}$$

$$\gamma(i)P - w + AB \geq \pi_R \tag{PCR}$$

$$w - AC \geq \pi_E \tag{PCE}$$

Whenever (PCR) does not bind but (PCE) does, the solution to this problem is:

$$\{\pi_E, 0\} \text{ if } B < C \text{ and } l \leq \gamma(i)P - \pi_R \tag{3}$$

$$\{\pi_E + C, 1\} \text{ if } B > C \text{ or } l > \gamma(i)P - \pi_R \tag{4}$$

The inverse labor supply curve, hereafter denoted by $S(i)$, is given by expressions 3 and 4. It is a horizontal line when $B > C$ at $S(i) = \pi_E + C$. When $B < C$, $S(i)$ has a discontinuity at $\hat{\imath}(l)$, jumping from $S(i) = \pi_E$ to $S(i) = \pi_E + C$. It is illustrated in Panel (b) of Figure 2.

2.3 Characterization of Equilibrium

When $B > C$, all firms will use NCAs, since they are the constrained optimal contract for any firm, no matter the values of other parameters. Recall that μ_E and μ_R denote the measures of E and R in the labor market. The unconstrained market-clearing wage in this case, which we denote by $w^{B>C}$, is determined by the intersection of supply and demand:

$$w^{B>C} = \begin{cases} \gamma(\mu_E)P + B - \pi_R & \text{if } \mu_E < \mu_R \text{ and } D(\mu_E) > S(\mu_E) \\ \pi_E + C & \text{otherwise} \end{cases}$$

If the market-clearing wage is constrained ($w^{B>C} < l$), then the market contract is $\{l, 1\}$, and there will be a surplus of labor.

When $B < C$, the contract of the marginal firm in the labor market (hereafter denoted firm $\bar{\imath}$) will have $A = 1$ if $\bar{\imath} > \hat{\imath}(l)$: that is, if $R_{\bar{\imath}}$'s willingness to pay lies on the portion of the labor demand curve for which the firm's optimal contract includes an NCA. Indeed, all R_i whose willingness to pay lies on the NCA portion of the labor demand curve (i.e., i such that $\hat{\imath}(l) < i \leq \bar{\imath}$) will use NCAs: they prefer their outside option to the contract

$\{l, 0\}$, which is the most favorable allowable contract with $A = 0$. Denote the market wage in such contracts by w_1^*, which is set by firm $\bar{\imath}$.

Firms whose productivity is high enough that they would be willing to pay a wage equal to l with no NCA are not precluded from writing contracts without NCAs. However, the contract used by the marginal firm sets the market: that contract, $\{w_1^*, 1\}$, yields greater utility to any R than even the most favorable contract for an R with $A = 0$ (the contract $\{l, 0\}$). Otherwise, $\{l, 0\}$ would also be optimal for firms with $i > \hat{\imath}(l)$.

The above logic is summarized in Proposition 2.1. We first simplify the analysis with the following assumptions:

Assumption 1. $\underline{\gamma}P < l + \pi_R$ *(i.e., $\hat{\imath}(l)$ exists)*

Assumption 2. $\gamma(\hat{\imath}(l))P + B - \pi_R > \pi_E + C$

The purpose of Assumptions 1 and 2 is to avoid trivial outcomes in which all firms' productivity is so high, or the cost of NCA use is so great, that no firms may optimally form which use NCAs. Assumption 1 says that there are some R_i for whom a contract with $A = 1$ would be optimal. Assumption 2 says that, at least for the firm that is indifferent between using $A = 0$ and $A = 1$, firm formation with an NCA yields surplus to the pair greater than each agent receiving their outside option.

Proposition 2.1. *Under Assumptions 1 and 2, whenever $B < C$, all firms' equilibrium contracts have $A = 0$ if $\mu_E < \hat{\imath}(l)$. If $\mu_E > \hat{\imath}(l)$, all firms' equilibrium contracts have $A = 1$.*

Proof. When $\mu_E < \hat{\imath}(l)$, the intersection of $D(i)$ and $S(i)$ occurs at $i_0^* = \mu_E$ (since $D(i) > S(i)\ \forall i < \hat{\imath}(l)$ by Assumption 2). Since $\mu_E < \hat{\imath}(l)$, the optimal contract for the marginal firm is $\{w_0^* \equiv \gamma(\mu_E) - \pi_R, 0\}$. No R_i for $i > \mu_E$ is willing to form a firm, and all R_i with $i < \mu_E$ are willing to form firms under that contract, since $\gamma(\cdot)$ is decreasing. Furthermore, the optimal contract for each firm with $i < \mu_E$ has $A = 0$. Therefore, no firm will deviate from the marginal firm's contract, all E are employed receiving the same utility, and no unmatched R can offer a better contract to an E. So, an equilibrium in which $A = 0$ in all contracts exists when $\mu_E < \hat{\imath}(l)$. Since the optimal contract for all $i \leq i_0^*$ has $A = 0$, equilibria with $A = 1$ in any contract do not exist.

When $\mu_R > \mu_E > \hat{\imath}(l)$, the intersection of $D(i)$ and $S(i)$ occurs at $i_1^* > \hat{\imath}(l)$: if $D(\mu_E) > S(\mu_E)$, then $i_1^* = \mu_E$ (all E are able to form firms). If $D(\mu_E) < S(\mu_E)$, then i_1^* solves $\gamma(i_1^*)P + B - \pi_R = \pi_E + C$ (which solution exists by Assumption 2). Since $i_1^* > \hat{\imath}(l)$, the

marginal firm's contract is $\{w_1^* \equiv \gamma(i_1^*)P + B - \pi_R, 1\}$. For any $i \in (\hat{\imath}(l), \mu_E]$, firm i's optimal contract has $A = 1$, and competition drives the wage to w_1^*. However, for $i \leq \hat{\imath}(l)$, firm i's optimal contract has $A = 0$. Consider the most profitable contract for such a firm with $A = 0$: $\{l, 0\}$. That contract yields utility to R_i equal to $\gamma(i)P - l$. The marginal firm's contract yields utility to R_i equal to $\gamma(i)P - (\gamma(i_1^*)P + B - \pi_R) + B$. R_i prefers the contract $\{l, 0\}$ whenever:

$$\gamma(i)P - l > \gamma(i)P - (\gamma(i_1^*)P + B - \pi_R) + B$$

$$\gamma(i_1^*)P - \pi_R > l.$$

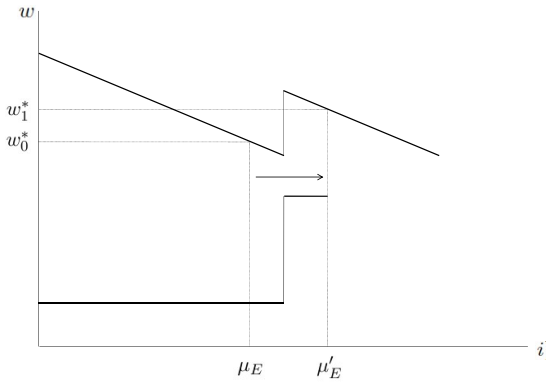
However, $l = \gamma(\hat{\imath}(l))P - \pi_R > \gamma(i_1^*)P - \pi_R$, since $i_1^* > \hat{\imath}(l)$. Therefore, there does not exist a contract with $A = 0$ that any R_i prefers to $\{w_1^*, 1\}$, and competition ensures that all firms use that contract. So, all equilibrium contracts have $A = 1$ when $\mu_R > \mu_E > \hat{\imath}(l)$.

Finally, when $\mu_E > \mu_R$, the logic of the preceding paragraph holds; however, the wage determined by the intersection of $D(i)$ and $S(i)$ may be lower than l if $\pi_E + C < \underline{\gamma}P + B - \pi_R < l$. In that case, the equilibrium market contract is $\{l, 1\}$, and the proof is nearly identical. □

Intuitively, Proposition 2.1 states that, when transferability is limited and there are many E in the market, the marginal R is unwilling to hire an E without an NCA. That firm sets the market, causing NCAs that reduce a pair's surplus to be the optimal contract for all firms. Put another way, limitations on transferability make NCAs "cheaper" for R: the cost of an NCA to an R is the difference in the wages she must pay for a contract with versus without an NCA. This difference is less when the transferability limitation increases the wage paid without an NCA.

When $\mu_E < \mu_R$, we may alternatively interpret the condition which generates equilibria with $A = 1$ (i.e., that $\mu_E > \hat{\imath}(l)$) as $\gamma(\mu_E)P - \pi_R < l$.[13] This condition states that the willingness to pay of R_{μ_E} is constrained by l. These two interpretations correspond directly to the two basic comparative statics described in the next section: the effects of changes in the terms of trade and changes in utility transferability.

[13] This equivalence is straightforward: since $\mu_E > \hat{\imath}(l)$ and $\gamma(\cdot)$ is decreasing, $\gamma(\mu_E)P - \pi_R < \gamma(\hat{\imath}(l))P - \pi_R = l$.



(a) A shift in labor supply from μ_E to μ'_E causes the marginal firm to be one for which NCAs are optimal. The optimal contract changes from $\{w_0^*, 0\}$ to $\{w_1^*, 1\}$.

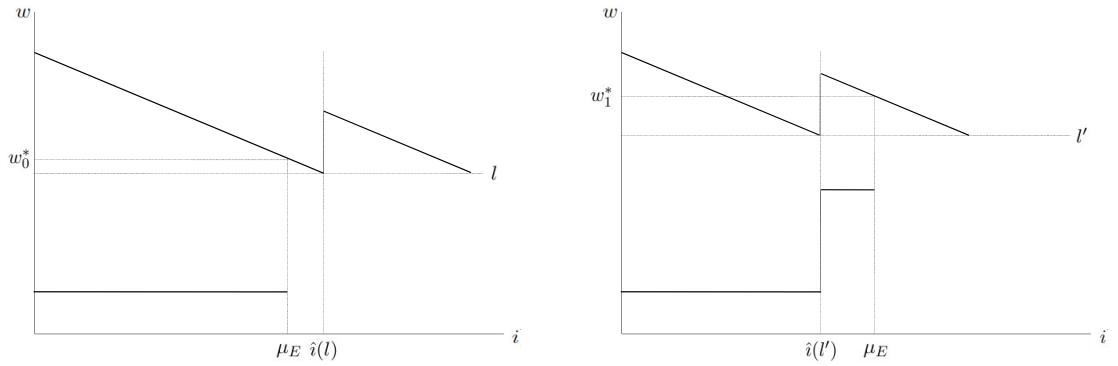
Figure 3: The effect of a change in labor supply.

2.4 Comparative Statics: Terms of Trade, Utility Transferability, and the Minimum Wage

Two immediate predictions arise from Proposition 2.1. First, increases in labor supply (μ_E) may increase the use of NCAs for a given l. When NCAs reduce pairs' surplus ($B < C$), they will be used *only* when $\mu_E > \hat{\imath}(l)$. Holding all other parameters fixed, this inequality is satisfied more easily the larger the value of μ_E. This is illustrated in Figure 3. An outward shift in labor supply causes the marginal firm to be one for which NCAs are optimal, resulting in an equilibrium with NCAs. This result stands in contrast to the environment in which NCAs maximize pairs' surplus ($B > C$). In that case, NCAs are used regardless of the measure of labor supply.

Whether contracts have $A = 1$ in equilibrium is also a function of l, which is clear from the condition $\gamma(\mu_E)P - \pi_R < l$. Holding all else equal, a more binding utility transferability constraint (greater l) may increase the use of NCAs. This result is illustrated in Figure 4. An increased transferability limitation causes the marginal firm to be one for which NCAs are optimal, resulting in an equilibrium with NCAs which reduce pairs' surplus. Note that, when NCAs maximize pairs' surplus ($B > C$), changes in the transferability of utility do not affect NCA use.

These observations are summarized in the following:



(a) When l is low, the marginal firm is one for whom a contract with no NCA is optimal. The market contract is $\{w_0^*, 0\}$.

(b) When l increases to l', the marginal firm becomes one for whom a contract with an NCA is optimal. The market contract is $\{w_1^*, 1\}$.

Figure 4: The effect of a change in l.

Prediction 1. *Increases in μ_E (outward shifts in labor supply) lead to increases in NCA use when $B < C$. When $B > C$, increases in μ_E have no effect on NCA use.*

Prediction 2. *Increases in l (tightening of the monetary transferability constraint) lead to increases in NCA use when $B < C$. When $B > C$, increases in l have no effect on NCA use.*

Corollary 2.2. *When decreases in monetary transferability of utility or increases in labor supply lead to increases in NCA use, NCAs reduce pairs' surplus ($B < C$).*

One outright constraint on monetary utility transferability is a minimum wage. An increase in the minimum wage will increase NCA use insofar as it decreases transferability of utility via the wage, as explained in Prediction 2. However, the minimum wage may also affect the terms of trade in the market by influencing an E's outside option, π_E. On the one hand, a greater minimum wage may provide more desirable alternative employment opportunities (increasing π_E); on the other hand, it could decrease the probability that an individual is able to find a job (decreasing π_E). As changes in π_E act similarly to changes in μ_E, an increase in the minimum wage that has the effect of raising an employee's outside option will decrease NCA use. Therefore, for any increase in the minimum wage, the overall effect on NCA use will depend on the relative magnitudes of its effect on transferability and the outside option. Whenever the impact on transferability dominates the net impact on an employee's outside option, NCA use will increase. Indeed, if a one dollar increase

in the minimum wage directly corresponds to a one dollar increase in the transferability constraint, then as long as an employee's outside option does not increase by *more* than one dollar, NCA use will not decrease, and may increase. For further discussion of the theoretical effect of the minimum wage on NCA use, see Appendix A.

3 Setting, Data and Measures

We test the predictions of our model in two settings: first, in a sample of independent, high-end hair salons, and second, in the population of restaurants from 2000 to 2011 (described in Section 4.3). Hair salons present a ripe setting to understand the use of NCAs. First, the benefits and costs of NCAs are clear in this industry. Client attraction, client retention, and on-the-job general human capital training are essential to production. NCAs protect investment in these inputs by limiting workers' ability to leave, which benefits salon owners. At the same time, the costs of NCAs to workers are also potentially high. NCAs in this industry typically specify a worker may not enter another job in a salon within a specified geographic radius, and all stylists must pass state-specific occupational licensing requirements. As a result, mobility to other areas is extremely costly.

This industry is also a fruitful setting to test the predictions of our model, particularly those related to the minimum wage. The minimum wage is likely binding for many hair stylists, even those in higher-end independent salons. Consider a stylist working in an independent salon earning the 75th percentile of hourly earnings for hairdressers, hairstylists and cosmetologists, which in 2016 was $16.43, according to the Bureau of Labor Statistics[14]. Typical compensation in this industry is largely comprised of tips, meaning that the hourly wage paid by employers is often much lower. If a stylist performs one haircut per hour, with an average price of $75 (which is the average service price among salons we surveyed, described below), at an 18 percent tip rate the implied hourly wage for workers in our sample would be ($16.43-$13.5=) $2.93, which is very close to being bound by the federal tipped minimum wage of $2.13 (and would indeed be bound in 27 of the 50 states in 2017[15]

To analyze determinants of NCA use, we conducted a survey of owners of independent hair salons in the U.S. in April 2015. We conducted the survey by email via the Professional

[14]https://www.bls.gov/oes/current/oes395012.htm

[15]See https://www.dol.gov/whd/state/tipped.htm for minimum wages by state.

Beauty Association (PBA),[16] a trade organization of salon professionals. The survey asked salon owners about various business, employment, compensation, and hiring practices, their experience using NCAs, as well as various geographic and demographic details. We also surveyed individual hair stylists separately, but do not discuss those results in this paper. Individuals who completed the survey were entered into a raffle for one of ten $50 Amazon gift cards.

The PBA emailed its entire email list, with separate links for owners and for stylists. The email list included 26,827 individuals, and PBA estimates 20% of these were salon owners. We received 218 completed surveys, resulting in a response rate of roughly 4% among those receiving an email. However, many of these email addresses may have been inactive, or otherwise unaware of PBA mailings: only 3,523 individuals opened the email. If the ratio of salon owners to stylists among those opening the email was identical to the ratio on the email list as a whole, our response rate among those opening the email would be 218/(3,523*0.20) = 31%. Thus, our "true" response rate lies between 4% and 31%. The response rate was in line with, if not slightly higher than, prior surveys PBA had sent out to its members on a variety of topics.[17] While our response rate is uncertain, we do not anticipate it causes selection that biases our results, as the survey was advertised as part of a research study to learn about the use of certain types of business and hiring practices in the salon industry, and the email did not mention anything about NCAs explicitly.

The model in Section 2 made empirical predictions regarding the use of NCAs, shifts in labor supply, and the minimum wage. Here we describe our measures for each of these items.

To measure labor supply, which determines terms of trade in the labor market, we asked owners for the number of applicants they received for their most recent vacancy. We also asked whether this number was more, about the same, or less than they had received for a typical vacancy in the past.

An additional way we measure variation in the terms of trade is based on the local unemployment rate (see Section 4.2 for rationale behind this measure). We use the county-level annual average unemployment rate from the Bureau of Labor Statistics Local Area Unemployment Statistics. We merge this dataset into our survey dataset using each salon's county.[18]

[16] http://www.probeauty.org

[17] Private email correspondence by authors with PBA staff on 11/19/2015.

[18] We identified each salon's county from the zip code the owner reported, using a zip code-county cross-

To measure the minimum wage, we use the schedule of each state's minimum wage in 2014 from the Bureau of Labor Statistics. Because hair stylists are tipped employees, we use each state's minimum hourly cash wage for tipped employees. We merged this schedule into our survey dataset using each salon's state.

To measure use of NCAs, we asked employers whether their most recently hired stylist signed an NCA and, if not, whether they have ever had a stylist sign an NCA in the past. For empirical tests of how shifts in labor supply and the unemployment rate affect NCA use, we measure NCA use with a dummy equal to one if an owner used an NCA for its most recently hired stylist, as we do not have a measure of labor supply for previously hired stylists. For tests of how the minimum wage affects NCA use, we measure NCA use with a dummy equal to one if an owner has ever used an NCA, either for its most recently hired stylist or in the past. See Section 4.3 for more discussion regarding these dependent variable choices, as well as robustness of results to alternate selections.

We merged in other datasets primarily to include relevant controls in our empirical specification. We use data from Bishara (2010) to measure each state's enforceability of NCAs as of 2009. The measures were created by analyzing case law in each state and comparing laws based on seven dimensions. Each state is assigned a score from 0-10 on each of these dimensions, with a higher score indicating stricter enforcement, and given a composite score based on a weighted sum of the seven scores.[19] We normalize each state's aggregate score by dividing by the highest (i.e., most enforceable) score across all 50 states and the District of Columbia, so that the normalized score ranges from zero to one. We also use each salon's county to merge in the number of salons in each respondent's county in 2012, which comes from the County Business Patterns database from the Census Bureau.[20]

Some of our survey questions had small rates of non-response. To deal with non-responses, we imputed missing values by regressing each variable on the state's Bishara score, the state's minimum wage, a dummy for employment-based salons, and the number of salons in the respondent's county, and generating predicted values for missing responses. We only performed this imputation for potential covariates to our regression models, and not for our primary regressors of interest.

Summary statistics are given in Table 1. Thirty percent of our sample had their most recently hired stylist sign an NCA, and 39% has ever used one. Compare this with prior

walk.

[19] See Bishara (2010) for a more thorough description of the data.

[20] Beauty salons are identified in the County Business Patterns by the NAICS industry code "812112".

studies: Starr et al. (2017) found that 19% of respondents in "Personal Care/Services" (a Standard Occupational Classification which includes Hairdressers, Hairstylists and Cosmetologists, among other personal care occupations) were currently bound by an NCA. Lavetti et al. (2017) find 45% of a sample of physicians were currently working under an NCA, and Marx (2011) finds 47% of a sample of engineers had ever signed one. The average salon in our sample has 7.1 stylists working and an annual revenue of $379,000. Forty-eight percent of our owners own employment-based salons, meaning the stylists work as employees (and are therefore covered by the Fair Labor Standards Act). The remaining 52% are contractor-based salons, meaning the stylists that work there are independent contractors. Stylists in such salons typically rent space from the owner and do not earn wages; income for contractors comes directly from the services they provide. As a point of comparison, in 2014, 7.7 stylists worked in the typical hair salon, the typical salon earned $233,000 in annual revenue, and roughly half of barbers, hairdressers and cosmetologists were self-employed (Small Business Development Center Network, 2014). Thus, the average salon in our sample shares many characteristics with the average hair salon in the U.S. as a whole.

A tabulation of the states in our sample is given in Table B.1

4 Determinants of NCA Use: Evidence from Salon Survey

In this section, we first set out to test Predictions 1 and 2: that increases in labor supply and tightening of monetary transferability constraints increase NCA use. By Corollary 2.2, these results act as a method to identify the presence of NCAs which reduce surplus in our sample.

We then examine whether NCAs reduce surplus for all firms in our sample, or for only a subset of firms. After investigating a potential benefit of NCAs (alleviation of investment hold-up problems), we demonstrate that the effect of labor market conditions on NCA use is moderated by a measure of the importance of this benefit.

4.1 Labor Supply and NCA Use

The first prediction of our model is that, if NCAs that reduce pairs' surplus exist, outward shifts in labor supply increase the use of NCAs. Table 2 tests this prediction.

Columns 1 and 2 investigate the cross-sectional relationship between NCA use and one

measure of labor supply: the number of applicants the owner received for her most recent position. We run a linear probability model with the dependent variable equal to 1 if the most recently hired stylist signed an NCA, and we report the coefficient on the variable equal to the number of applicants the employer received for the position (*#Applicants*). Each specification controls for the state's Bishara enforceability score. Column 2 adds a vector of additional covariates correlated with NCA use: the percent of a salon's stylists hired directly out of school, a dummy for employment-based salons, the owner's age, the number of stylists currently working in the salon, and the number of salons in a respondent's county.[21]

Column 1 shows that one additional applicant for a position is associated with a 1.2 percentage point increase ($p < .01$) in the probability the hired stylist signed an NCA.[22] The coefficient on the *Bishara* score shows going from the state with the lowest to highest NCA enforceability is associated with a 30 percentage point increase in NCA use, a point estimate very similar to that found in Lavetti et al. (2017).[23] The coefficient on *# Applicants* shrinks by a small amount to 0.97 percentage points, but remains highly statistically significant, when we add controls in Column 2.

Still, these controls may not capture unobserved variables that jointly determine NCA use and the number of applicants an owner gets. If an unobserved variable is correlated with overall NCA use, not just for the most recent hire, we can capture it by controlling for NCA use prior to the most recent hire. Thus, Column 3 includes a dummy indicating whether an owner ever used NCAs prior to her most recent hire. As would be expected, its coefficient is large (0.59) and highly significant ($p < .01$). Even controlling for prior NCA use, though, the coefficient on *# Applicants* remains highly significant and decreases in magnitude only slightly to 0.82 percentage points. To put this magnitude in perspective,

[21] Because we had many covariates we thought might be relevant to our analysis, we ran the risk of over-fitting the data by including all of them. Instead, we selected this set of covariates using an approach involving Least Absolute Shrinkage and Selection Operator (LASSO) outlined in Belloni et al. (2014). LASSO penalizes having too many parameters in the model, and uses cross-validation to determine the subset of regressors that yields the best out-of-sample predictions of the dependent variable. LASSO ensures that we are objective in model selection. Following Belloni et al. (2014), we run two LASSO regressions: the first with the dependent variable equal to 1 if the most recently hired stylist signed an NCA, and the second with the dependent variable equal to the number of applicants received for the most recent position. We keep the union of regressors selected in both LASSOs. We also include the number of salons in the owner's county as a covariate, which was not selected in this LASSO procedure, but which we include to ensure that *# Applicants* can be interpreted as labor supply, rather than reflecting the size of the beauty industry in the local labor market.

[22] We obtain results with essentially identical statistical significance using a logit or probit specification.

[23] Lavetti et al. (2017) estimate a coefficient of 0.305: see table A7 of the Appendix.

the standard deviation of *#Applicants* in our sample is 9.4, suggesting a one standard deviation increase in number of applicants received for a position is associated with a roughly 7.7 percentage point increase in the probability the stylist that is hired signs an NCA, which is 25% of the sample mean.

Even though the specification in Column 3 arguably controls for the most likely sources of potential omitted variable bias affecting the coefficient on *# Applicants*, it is still possible the correlation between NCA use and applicants could be driven by an unobserved variable. Thus, Table B.2 investigates the effects of a *change* in the number of applicants an owner gets for a position on the *change* in her use of NCAs. We find that owners receiving more applicants than usual (i.e., an outward shift in labor supply) are more likely to switch into NCA use (though the result is not statistically significant: $p = .15$), supporting the hypothesis that changes in our measure of labor supply also lead to within-owner changes in the use of NCAs.

4.2 The Unemployment Rate and NCA Use

Next, we test how the local unemployment rate affects NCA use. In the frictionless labor market presented in Section 2, unemployment only occurs as a result of monetary transferability constraints. However, other models of the labor market, such as Mortensen and Pissarides (1994) and Beaudry and DiNardo (1991), generate a direct negative relationship between the unemployment rate and the wage, under mild assumptions.[24] If the wage is bound by a transferability constraint, increases in the unemployment rate, in such cases, may instead be associated with increases in NCA use among firms for which NCAs reduce pairs' surplus. Therefore, we can use variation in the unemployment rate as an additional test of the prediction that NCA use is induced by constraints on the wage.

To implement the test, we calculate the change in the unemployment rate between 2006

[24] In particular, in the canonical search model of the labor market introduced by Mortensen and Pissarides (1994), exogenous positive shocks to the separation rate, the cost of capital, the cost of hiring a worker, or exogenous negative shocks to production technology lead to an increase in the equilibrium unemployment rate and a decrease in the equilibrium wage, yielding a negative relationship between the unemployment rate and the wage. In contrast, exogenous increases in worker bargaining power or unemployment benefits lead to an increase in both the unemployment rate and the wage. In the "implicit contracts" model of the labor market (Beaudry and DiNardo, 1991), a *causal* negative relationship between the unemployment rate and wages arises, regardless of the reason for variation in the unemployment rate, due to the effect of the unemployment rate on a worker's reservation wage. Therefore, as long as variation in the unemployment rate is not driven by shocks to worker bargaining power or changes to unemployment benefits, both of these models predict a negative relationship between the unemployment rate and the unconstrained equilibrium wage.

and 2012 at the county level.[25] The period over which this change is calculated roughly spans the Great Recession, a period in which the national unemployment rate increased from 4.7% to 8.3%.[26] We estimate how the change in a county's unemployment rate over 2006-2012 led to a change in the likelihood an owner used NCAs over this same period.

Results are shown in Table 3. The dependent variable is *Last Applicant NCA*. All regressions include the full set of controls used in Column 2 of Table 2,[27] and standard errors are clustered by county. Column 1 displays the coefficient on the change in the county's unemployment rate between 2006 and 2012. The coefficient suggests a 1 percentage point increase in the change in the local unemployment rate is associated with a 0.041 percentage point increase in the probability that an owner's most recently hired stylist signed an NCA ($p = .066$). However, our goal is to test how the change in the unemployment rate led to a *change* in NCA use. Thus, Column 2 restricts the sample to owners who reported being in the beauty industry since at least 2006, and includes a dummy equal to 1 if she reported using NCAs in 2006 or earlier. The point estimate and statistical significance on the change in the unemployment rate are essentially unchanged.

Overall, these results provide further evidence that NCA use increases when the market-clearing wage is more likely to be bound by monetary utility transferability constraints.

4.3 The Minimum Wage and NCA Use

The second prediction of our model is: if the cost of an NCA to an employee is higher than the benefit accruing to his employer, then NCA use will be higher when monetary utility transferability is more limited. If the minimum wage is a binding transferability constraint,

[25] The results presented in this section are robust to using different years as start and end points to calculate the change in the unemployment rate (*i.e.* using 2005 or 2007 as the start point, or using 2011 or 2013 as the end point).

[26] There is overwhelming evidence that the overall increase in the unemployment rate over this period, as well as regional variation in the change, were due to factors other than increases in worker bargaining power or unemployment benefits (therefore justifying the mild assumptions necessary for the model of Mortensen and Pissarides (1994) to generate a negative relationship between the unemployment rate and the wage). County-level variation in the increase in non-employment over the Great Recession was driven by factors such as variation in the deterioration in housing net worth (Mian and Sufi, 2014), which points to a demand-level channel akin to a negative shock to production technology. Additionally, the cost of capital for small business increased in the Great Recession (Greenstone et al., 2014). Both of these explanations point to factors that would lead to a negative relationship between the unemployment rate and the wage in a search model of the labor market.

[27] For simplicity, we use the same set of controls from the variable selection procedure specific to the regressions involving *# Applicants*. If we instead use the approach in Belloni et al. (2014) to separately choose controls for every regression, we obtain essentially identical results to those we report.

then as long as a one dollar increase in the minimum wage does not induce an increase in an employee's outside option that is *greater* than one dollar, we expect that NCA use will be higher when the minimum wage is higher.

Table 4 investigates this relationship. The coefficient of interest is that on the *Minimum Cash Wage*, the 2014 state minimum wage excluding tips for tipped employees. The dependent variable is now equal to 1 if the employer has ever used an NCA, either for its most recently hired stylist or in the past (*Ever Used NCA*). Note we use this as our dependent variable, rather than *Last Applicant NCA*, which we use in our regressions of NCA use on labor supply and the unemployment rate. Whereas our measure of labor supply (*# Applicants*) pertained only to an employer's most recently hired stylist, the minimum wage affects all hiring decisions, not just the most recent one. *Ever Used NCA* is a more stable measure of NCA use than *Last Applicant NCA*, which is more idiosyncratic and potentially subject to more classical measurement error. Furthermore, because most states' minimum wages for tipped employees have remained largely unchanged over the last several years, our prediction regarding the minimum wage is more closely tied to this broader measure of NCA use. The results we report in this section are all qualitatively very similar when we use *Last Applicant NCA* rather than *Ever Used NCA*. See Table B.3 for results using *Last Applicant NCA*.

Column 1 reports the coefficient on *Minimum Cash Wage*, controlling only for the state's Bishara enforcement score. The coefficient is positive and significant at the 5 percent level. Column 2 includes the additional controls used in the previous sections, and the coefficient on *Minimum Cash Wage* increases in magnitude and is highly significant ($p < .01$).[28]

Cross-sectional variation in the minimum wage might be driven by other unobservable differences across states, biasing the coefficient on *Minimum Cash Wage*. However, minimum wage laws are only applicable to employment-based salons; independent contractors are not covered by the Fair Labor Standards Act. Thus, to the extent the minimum wage may bind the market-clearing wage, it could only do so for employment-based salons, and we can treat contractor-based salons as a "placebo group." If we found the minimum wage affected NCA use for contractor-based salons, we would worry the observed effect of the

[28] The inclusion of controls increases the coefficient on *Minimum Cash Wage* primarily due to the dummy indicating whether a salon is employment-based. That the inclusion of the employment-based dummy increases the coefficient on *Minimum Cash Wage* so much suggests these two variables are negatively correlated, which a simple correlation shows to be the case in our data (correlation coefficient=-0.20).

minimum wage is plagued by omitted variable bias.

Column 3 includes an interaction term of the Minimum Wage with *Emp-based Salons* (the main effect of *Emp-based Salons* is not shown).[29] Thus, the main effect of *Minimum Cash Wage* indicates the effect of the minimum wage for contractor-based salons, and the interaction term indicates the difference in the effect for employment-based salons versus contractor-based salons. Reassuringly, the difference is large and statistically significant (0.057, $p = .03$), while the effect for contractor-based salons is small and insignificant (0.032, $p = .14$).

These results strongly support our prediction that the minimum wage affects NCA use, and they also provide evidence that the observed effect of the minimum wage on NCA use is not driven by omitted variable bias or sampling error.

4.4 Do NCAs Reduce Surplus for *All* Firms?

The empirical findings in Sections 4.1, 4.2 and 4.3 suggest that characteristics of the labor market–both shifts in the market-clearing wage and outright constraints on wages–affect NCA use in our sample of independent hair salons. Taken together with Corollary 2.2, these results suggest NCAs reduce surplus ($B < C$) for at least some of the firms in our sample: if NCAs were surplus-maximizing for all firms, their use would be unaffected by the terms of trade and the minimum wage.

However, our results do not necessarily imply that NCAs reduce surplus for *every* firm in our sample. If we relax the assumption that the benefit employers derive from NCAs (B) is constant across employers, it is possible that B is high enough for some employers to cause NCAs to be surplus-maximizing contracts.

To investigate the extent to which this is the case, the next section seeks to unpack one potential benefit of NCAs to employers: that they enhance incentives for employers to invest in nonphysical assets. In the section that follows, we test whether the value of this benefit to an employer moderates the effect of labor market conditions on NCA use.

4.4.1 Analyzing the Potential Benefits of NCAs: Enhancing Investment

One commonly cited potential benefit of NCAs is that, by effectively assigning control rights over nonphysical assets to the employer, they mitigate hold-up problems that distort

[29] This regression is a fully interacted model, meaning that *Emp-based Salon* is also interacted with the Bishara score and each of the additional controls.

incentives to invest in those assets (Lavetti et al., 2017). For example, states with higher NCA enforceability have been shown to have higher rates of firm-sponsored training (Starr, 2015), and employees signing NCAs are more likely to receive such training (Starr et al., 2017). If such assets are valuable to production, the benefits of NCAs could indeed be quite large.

To investigate the importance of this benefit of NCAs in our sample, in our survey we asked salon owners about their investment in two types of assets essential to production for hair salons: client attraction and on-the-job training. Regarding client attraction, we asked owners whether they did any of the following to attract or retain clients: have a website, have a social media account, give offers on daily deal sites (e.g., Groupon), maintain a client email list with regular promotions, and/or engage in some other type of marketing. Regarding training, we asked whether the owner's salon provided on-the-job training for newly hired stylists. We run a series of regressions with the dependent variable equal to one if the owner indicated engaging in each corresponding type of investment. Our independent variable of interest is the *Ever Used NCA* dummy, and we include the Bishara score and our full set of controls from previous regressions. Because the decisions to make these investments and use NCAs are made jointly, these regressions should be interpreted as correlations rather than causal.

The results are shown in Table 5. Columns 1-5 display results for each of the five outcomes related to client attraction. The coefficient on *Ever Used NCA* is positive for all but one form of client attraction (social media), and is statistically significant for *Deal Sites* and nearly so for *Email List* ($p = .102$). These latter two forms of client attraction are the two that specifically offer discounts and promotions, and are likely the most costly, and thus are most likely the forms most affected by the hold-up problem.

Column 6 gives the results for on-the-job training. The coefficient of 0.11 ($p = .01$) on *Ever Used NCA* suggests salons that use NCAs are 14% more likely to provide training to new workers relative to the sample mean ($0.11/0.798 = 0.14$).[30]

These results, while not necessarily causal, support the idea that NCAs can indeed offer significant benefits by improving employers' incentives to invest in transferable assets valuable to production. Next, we test whether the extent to which this benefit is likely to

[30]The magnitude of our result on training is strikingly similar to Starr et al. (2017): we find salons using NCAs are 11 percentage points more likely to offer training, relative to a sample mean of 0.8. (Starr et al., 2017) find workers that have signed an NCA are 7.5 percentage points more likely to receive training, or 15% of the sample mean of 50%.

be valuable for an employer moderates the relationship between labor market conditions and NCA use.

4.4.2 Moderating Role of Employer Access to Credit on NCA Use

The empirical results from the previous section support the premise that one primary benefit of NCAs to employers is to alleviate hold-up problems that distort investment. If the value of this benefit is heterogeneous across employers, it is possible that NCAs maximize surplus for those firms in our sample containing an employer who values this benefit the most, even though our findings in Sections 4.1, 4.2 and 4.3 provide evidence they reduce surplus for at least a portion of our sample. In this section, we identify a proxy for the magnitude of the benefit of an NCA for an employer, and then we test if this measure moderates the effect of the labor market on NCA use.

A potentially important source of heterogeneity in the magnitude of B is employers' capacity to make investments in transferable assets. An insight from the corporate finance literature is that financing constraints limit an employer's ability to make valuable investments (Fazzari et al., 1988; De Mel et al., 2008). If such constraints are present, they may result in less potential investment to be "held-up," limiting the benefits of NCAs.

To measure the extent to which an employer is financially constrained from making investments, we asked employers "Do you have a line of credit or other ongoing banking relationship you use to finance cash outlays?" Access to lines of credit have been shown to be a statistically powerful measure of financial constraints (Sufi, 2009). Lines of credit alleviate capital market frictions, ensuring funds are available to firms for valuable investments. If owners with access to a line of credit have higher capacity for investment, they also likely have more to gain from using NCAs. Indeed, in Table B.4, we find employers in our sample with access to lines of credit have statistically significantly higher rates of investment in all forms of client attraction and worker training. This relationship suggests that an employer's access to a line of credit is a meaningful proxy for the magnitude of the benefit she reaps from using NCAs.[31]

If the benefit of NCAs to owners with a line of credit is high enough to cause an NCA to maximize surplus for a pair ($B > C$), NCAs will be used among such employers

[31]This statement is true even if a line of credit does not have a causal effect on investment. If the relationship instead reflects that employers that make larger investments are more likely to obtain a line of credit, it still means that employers that have a line of credit have more potential for investment, and thus more potential benefit of NCAs.

independent of whether or not the unconstrained market-clearing wage is bound by the minimum wage. Thus, if some employers have a line of credit (and therefore have $B > C$) and some employers have no line of credit (and therefore have $B < C$), all else equal, owners with a line of credit will a) be more likely to use NCAs, and b) their use will be less affected by shifts in labor supply and the minimum wage.

Two extreme examples provide intuition on these results. First, consider a labor market with no minimum wage. Each firm will write a surplus-maximizing contract: i.e., employers with $B > C$ will have NCAs in their contracts, and employers with $B < C$ will not. The wage will adjust so that workers are indifferent between working for an employer with and without a line of credit.[32] Now, suppose the minimum wage (l) is quite high. For an employer with $B > C$, the minimum wage will not affect her ability to pay a wage premium associated with NCA use (i.e., for any contract $\{w, 1\}$ for a firm with $B > C$, there does not exist a contract that is a profitable deviation for both E and R, regardless of the minimum wage). An employer with $B < C$ with the contract $\{w, 1\}$ also may not have a profitable deviation contract with $A = 0$ if l is large enough: even the most favorable contract for R with $A = 0$, $\{l, 0\}$, is worse for R if $B > w - l$. Therefore, the minimum wage may induce employers with low benefit to use NCAs while not changing the contracts of employers with high benefit.

Table 6 tests these predictions. Columns 1-3 report results examining how access to a line of credit affects NCA use, and how it moderates the relationship between NCA use and labor supply. As in Section 4.1, the dependent variable is a dummy equal to 1 if the most recently hired stylist signed an NCA, since our measure of labor supply pertains to the most recently filled vacancy. In all regressions, we control for the same full set of controls as previous tables. Column 1 shows owners with a line of credit (*Line of Credit*) are 15 percentage points more likely to have had their most recently hired stylist sign an NCA ($p = .024$). One potential concern is that access to a line of credit may be picking up a measure of overall business acumen or management quality of the employer, and not just its ability to access credit for investment. One piece of evidence this is not a practical concern is that the coefficient on *Line of Credit* changes very little if we do not include the full set of controls (results not shown). As a second piece of evidence, if better managed

[32] A clear empirical prediction of this model is that the wage of an employee with an NCA will be higher than the wage of an employee without an NCA. This prediction is supported by existing empirical work, such as Lavetti et al. (2017) and Starr et al. (2017), which both find that workers who have signed NCAs have higher earnings.

firms also get a higher number of applicants, then including our *# Applicants* measure should change the coefficient on *Line of Credit*. However, the coefficient on *Line of Credit* is essentially unchanged when we control for *# Applicants* (Column 2).[33]

Column 3 includes an interaction of *Line of Credit* with *# Applicants*. If the benefit of NCAs for those employers with a banking relationship is large enough such that $B > C$, then by Prediction 1, changes in labor supply should have no effect on their use. The results in Column 3 strongly support this prediction: the main effect of *# Applicants* (0.017) and its interaction term with *Line of Credit* (-0.016) completely cancel each other out, meaning that shifts in applicants have no effect on NCA use among employers with a banking relationship. On the other hand, the main effect on *# Applicants* shows that, among employers without a banking relationship, one additional applicant is associated with a 1.7 percentage point increase in the probability the hired worker signed an NCA ($p < .01$).

To visualize these results, Figure 5 plots the average predicted probabilities that *Last Hire NCA* equals 1 if all employers in our sample did and did not have a line of credit, by different values of number of applicants received. These predicted values correspond to the model in Column 3 of Table 6. The average predicted probability that employers with a line of credit in our sample used an NCA for their most recent hire is stable at roughly 0.37 no matter the number of applicants received. On the other hand, the predicted probabilities for employers without a line of credit vary significantly with the number of applicants. If the number of applicants received is 1 (the 10th percentile in our sample, where the market-clearing wage is least likely constrained by the minimum wage), the predicted probability is 0.12. If the number of applicants is 15 (the 90th percentile, where the market-clearing wage is most likely constrained by the minimum wage), the predicted probability jumps to 0.36.

Turning back to Table 6, Columns 4-5 investigate how access to credit moderates the relationship between NCA use and the change in the local unemployment rate. In Column 4, the main effect of *Line of Credit* holds controlling for the change in the local unemployment rate between 2006-2012. In Column 5, the inclusion of an interaction between these two variables leads to results remarkably similar to Column 3: the main effect of the

[33] Also note the coefficient on *# Applicants*, 0.01, is nearly identical to that obtained in the model in which we did not control for *Line of Credit* (Table 2, Column 2), which provides further evidence that *# Applicants* is a measure of labor market conditions rather than driven by an unobserved employer-specific factor (at least one correlated with access to a line of credit).

change in the unemployment rate and its interaction with *Line of Credit* completely cancel out, suggesting changes in the unemployment rate have no effect on NCA use among employers with a line of credit. On the other hand, among employers without a line of credit, a one percentage point increase in the unemployment rate over the 2006-2012 period is associated with an 8.3 percentage point increase in the probability the most recently hired worker signed an NCA ($p < .01$).

Columns 6-8 report results examining how access to credit moderates the relationship between NCA use and the minimum wage. Now, as in Section 4.3, the dependent variable is a dummy equal to one if the owner has ever used NCAs. Column 6 shows a coefficient on *Line of Credit* slightly smaller than Column 1 (when the dependent variable is a dummy if the most recently hired stylist signed an NCA). The coefficient is unchanged controlling for the state's minimum wage (Column 7). Column 8 includes an interaction of *Line of Credit* with the minimum wage. The interaction term, significant at the 5% level ($p = .024$), suggests the effect of the minimum wage on the probability of NCA use is 60% smaller for the group of owners with a banking relationship compared to the group without one (0.067-0.038=0.029, compared to 0.067).

A final note about these results is they each consistently show that, when wages are unconstrained, only those firms for which we expect NCAs to be surplus-maximizing are likely to use them. The main effects of *Line of Credit* in Columns 3, 5 and 6 (0.27, 0.44 and 0.31, respectively, all $p < .01$) provide estimates of the difference in the probability that owners with high versus low B use NCAs in 3 different scenarios when the market-clearing wage is least likely to be constrained. This similarity in the main effect across these regressions provides further support that our model is capturing the determinants of NCA use in our sample: regardless of how we proxy for a scenario when the market-clearing wage is unconstrained, we get a very similar estimate of the difference in probabilities that employers with high versus low benefit from NCAs use them.

These results paint a nuanced portrait of NCA use and surplus maximization for the firms in our sample. We find strong evidence that constraints on wages in the labor market have a statistically significant and economically meaningful effect on NCA use. However, this relationship only exists for the employers in our sample likely to benefit the least from NCA use. On the other hand, among employers likely to benefit the most from NCAs, and thus for which NCAs are most likely to maximize the pair's surplus, NCAs are both more widely used, and are unaffected by constraints on wages. These results suggest NCAs may be surplus-maximizing for some firms in our sample, but not others.

5 NCAs, the Minimum Wage, and Employment

The results in Section 4 provide strong evidence that firms use NCAs to transfer utility when there are frictions to transferability via the wage, and when the terms of trade are less favorable to the employee, consistent with the predictions derived from the model in Section 2. Our model makes a related testable prediction: when NCAs are available, the negative employment effects of one particular friction on the wage–the minimum wage–will be smaller than if NCAs are not available.[34] In the presence of a binding minimum wage, some employers who would otherwise be unwilling to hire at the minimum wage are willing to do so with an NCA as long as NCAs provide any benefit to them.

We test this prediction in the context of a recent study that uses a credible research design to estimate the effect of minimum wage increases on employment. Dube et al. (2016) estimate the effect of state-level minimum wage increases from 2000-2011, using contiguous counties on state borders as control groups. The authors provide evidence that this approach has desirable properties to estimate the effect of the minimum wage on employment and other outcomes.

Following Dube et al. (2016), we start with a regression of the following form:

$$y_{ipt} = \beta ln(MW_{s(i)t}) + \mathbf{\Gamma X_{it}} + \delta_i + \rho_{pt} + \epsilon_{it} \tag{5}$$

Here, y_{ipt} refers to log employment in county i that is part of pair p (with another cross-border contiguous county j) at time t. The minimum wage variable[35] is set at the level of the state, $s(i)$, and $\mathbf{X}$ includes a vector of time-varying controls. δ_i is a fixed effect for each county, and ρ_{pt} is a fixed effect for each pair-time. Thus, Equation 5 estimates the elasticity of employment with respect to the minimum wage (since both the outcome variable, employment, and the minimum wage are log-transformed), comparing adjacent border counties in the same time period, and purging the data of county-specific effects. Standard errors allow for two-way clustering by state, $s(i)$, and border-pair, p.[36]

[34] This is because the maximum measure of employed workers in the economy when NCAs are unavailable (which is determined by the measure of firms that are able to earn positive profit under a contract that pays the minimum wage with no NCA) is less than the maximum measure of employed workers in the economy when NCAs are available, as NCAs allow otherwise unprofitable firms to exist.

[35] Following Dube et al. (2016), we use the standard (untipped) minimum wage in this section.

[36] We obtain standard errors that are slightly different from those reported in Dube et al. (2016). This difference arises because we use an updated procedure (reghdfe) to estimate a regression with multiple fixed effects that allows for multi-way clustering, based on Correia et al. (2016).

Dube et al. (2016) measure quarterly employment using the Quarterly Workforce Indicators (QWI) from the Census Bureau, and they use state and federal changes to the minimum wage over 2000-2011 to identify changes to the minimum wage. They perform their analysis separately for teens and for restaurant workers, two groups considered in the literature to typically be bound by the minimum wage. We restrict attention to restaurant workers.

To test our prediction that a minimum wage increase reduces employment by a smaller amount when NCAs are available, we examine whether the overall effect this study finds is moderated by states' enforceability of NCAs. In states in which NCAs are unenforceable (like California), they are likely a less valuable tool to transfer utility than in states where they are highly enforceable (like Florida).[37] We adapt Equation 5 the following way:

$$y_{ipt} = \beta_1 ln(MW_{s(i)t}) + \beta_3 ln(MW_{s(i)t}) \times Enforce_{s(i)} + \mathbf{\Gamma X_{it}} + \delta_i + \rho_{pt} + \epsilon_{it}$$

Enforce is the standardized state NCA enforceability score from Bishara (2011), described above. Here, the coefficient β_3 estimates the differential effect of a minimum wage increase for a state with the highest NCA enforceability relative to a state with the lowest enforceability; the coefficient β_1 estimates the effect of the minimum wage increase for a state with the lowest enforceability. Note that we do not include a main effect for *Enforce* because, since it is constant within counties, it is absorbed by the county fixed effects.

Table 7 shows the results. Column (1), replicating Dube et al. (2016), finds an overall employment elasticity that is negative, but small in magnitude and statistically insignificant.[38] Introducing an interaction term with NCA enforceability in Column (2) reveals substantial heterogeneity in this average effect. The main effect on $ln(MW)$ implies that the employment elasticity of the minimum wage in the lowest NCA enforcement states is much more negative (-0.38) than the average effect ($p = .024$). On the other hand, the point estimate on the interaction term, 0.44 ($p = .011$), implies that the employment elasticity of the minimum wage is significantly closer to zero when NCAs are available as

[37] NCA enforceability could theoretically change the effect of the minimum wage on employment for reasons other than allowing transferability of utility. However, plausible alternative explanations yield an opposite prediction to our own. For example, stricter NCA enforceability could mean workers that lose their job after a minimum wage increase stay non-employed for a longer duration because they are unable to take a new job that violates their prior NCA. However, this story implies that stricter NCA enforceability leads to a *larger* effect of the minimum wage on employment, which is the opposite of the prediction generated by our model.

[38] This estimate corresponds to Table 3, Column 4, Row 2 in Dube et al. (2016).

a tool for firms to transfer utility: the combination of the main effect and interaction term implies that the elasticity is essentially zero in the state with greatest enforceability.

These results, consistent with our model, suggest that a minimum wage increase will lead to a larger reduction in employment when NCAs are a less potent tool to transfer utility between workers and employers. However, these results may be misleading if NCA enforceability is correlated with other variables that moderate the employment effects of the minimum wage. We address this concern in two ways. First, prior studies have shown NCA enforceability is uncorrelated with modern-era political preferences of states (Lavetti et al., 2017), as well as an array of economic outcomes and cultural views (Hausman and Lavetti, 2015). Second, we add controls to our model in Columns 3 and 4 for different labor laws. Column 3 includes a dummy equal to 1 for states with right-to-work laws interacted with $ln(MW)$ to control for any differential effect the minimum wage might have in right-to-work states. Right-to-work laws limit the power of labor unions and are considered to be correlated with other pro-business policies favorable to employers relative to workers (Holmes, 1998). Column 4 instead controls for $ln(MW)$ interacted with each state's adoption of wrongful discharge laws that give exceptions to at-will employment (Autor et al., 2006).[39] Reassuringly, the coefficients of interest are stable to the inclusion of these controls.

6 Conclusion

Noncompete agreements are part of a large and growing share of employment relationships in the U.S., and questions about their rationale, effects, and efficiency have made NCAs a controversial topic among policymakers. This paper shows NCAs may arise for reasons unrelated to their ability to maximize an employer/employee pair's surplus–or even *despite* the fact that they reduce a pair's surplus. We develop a simple model with the implication that, when employees and employers are constrained in their ability to use monetary transfers to equilibrate labor markets, NCAs may arise as a non-pecuniary tool to transfer utility from employees to employers. Such constraints can only affect NCA use if NCAs are not used in an unconstrained world, which they will not be if the employee's cost of an

[39] Specifically, there are 3 exceptions to at-will employment that have been adopted across various states and years in the U.S. since 1970. Starting with three dummies indicating if a state had adopted each exception as of 2000, we create a variable equal to the mean of these three dummies to capture each state's level of exceptions. This variable has a mean of 0.60 in our sample.

NCA exceeds the employer's benefit (i.e., when NCAs reduce pairs' surplus). Our model generates a method that provides a sufficient condition for existence of NCAs which reduce pairs' surplus: if the bindingness of transferability constraints affects NCA use, then NCAs which reduce pairs' surplus exist.

Using a new survey of independent salon owners in the beauty industry, we find strong empirical evidence that changes to the bindingness of transferability constraints—in the form of forces associated with the market-clearing wage as well as the minimum wage—have statistically significant and economically meaningful effects on NCA use. These results serve as a test which implies that contracts that cause a surplus loss exist in this labor market, and we provide some of the first evidence that changes to the labor market affect internal non-monetary contracting decisions of firms. We then go on to find that these surplus-diminishing NCAs are concentrated among a well-defined subset of firms in our sample: those for which the benefit of NCAs are likely to be low.

While the test we propose identifies NCAs which reduce surplus for employee/employer pairs, it does not necessarily follow that NCAs identified in this way reduce *social* surplus. Indeed, we find the extent to which NCAs are enforceable substantially mitigates employment losses arising from increases to the minimum wage, increasing economy-wide surplus. On the other hand, NCAs may also have negative externalities that reduce social surplus. While outside the scope of this paper, prior studies have found NCAs depress levels of entrepreneurship (Rauch and Watson, 2014; Samila and Sorenson, 2011) or decrease labor market churn (Marx et al., 2009) which may limit efficient matching.

From a policy standpoint, our findings highlight a tradeoff inherent in policies currently being proposed around the U.S. which would render NCAs unenforceable for low-wage workers. If NCAs are made unenforceable, surplus will increase among firms productive enough to hire workers with no NCA, but employment may decrease among firms unwilling to hire a worker without one. The net effect will depend on the magnitude of the difference between an NCA's cost to an employee and the benefit to an employer. Policymakers should weigh each of these forces, and future research may seek to measure their relative magnitudes.

This paper also highlights a potentially unintended consequence of minimum wage laws, as our results suggest a higher minimum wage leads to an increased use of NCAs. Many papers have sought to estimate the effects of the minimum wage on employment and wages. A smaller literature has investigated the effect of the minimum wage on non-wage job attributes, such as Acemoglu and Pischke (1999), who find no evidence that an increase

in the minimum wage affects on-the-job training, and Simon and Kaestner (2004), who find no evidence that an increase in the minimum wage leads to a reduction in fringe benefits of low-wage workers. Our results point to a previously overlooked component of non-wage compensation that employers can adjust in response to minimum wage increases. If we take as given that minimum wage laws are desirable for equity or welfare reasons (Lang, 1987; Rebitzer and Taylor, 1995), policymakers must be aware of employers' abilities to extract utility from workers in other ways, especially using contract provisions like NCAs that potentially limit workers' future employment opportunities.

Finally, while our study analyzed how limited transferability via the wage affects NCA use specifically, there are other ways firms could transfer utility between workers and employers. For example, recent years have seen a rise in other job attributes that plausibly benefit employers but cost workers, such as on-call scheduling. Our model and empirical framework generalize to other such job attributes, and a promising line for future research is to investigate whether the forces considered in this paper can also explain these changes.

References

Acemoglu, D. and A. F. Newman (2002). The labor market and corporate structure. *European Economic Review 46*(10), 1733–1756.

Acemoglu, D. and J.-S. Pischke (1999). Minimum wages and on-the-job training. Technical report, National bureau of economic research.

Akerlof, G. A. and J. L. Yellen (1990). The fair wage-effort hypothesis and unemployment. *The Quarterly Journal of Economics*, 255–283.

Arnott, R. J., A. J. Hosios, and J. E. Stiglitz (1988). Implicit contracts, labor mobility, and unemployment. *The American Economic Review*, 1046–1066.

Ashenfelter, O. and A. B. Krueger (2017). Theory and evidence on employer collusion in the franchise sector. NBER Summer Institute Labor Studies.

Autor, D. H., J. J. Donohue III, and S. J. Schwab (2006). The costs of wrongful-discharge laws. *The Review of Economics and Statistics 88*(2), 211–231.

Beaudry, P. and J. DiNardo (1991). The effect of implicit contracts on the movement of wages over the business cycle: Evidence from micro data. *Journal of political Economy*, 665–688.

Belloni, A., V. Chernozhukov, and C. Hansen (2014). Inference on treatment effects after selection among high-dimensional controls. *The Review of Economic Studies 81*(2), 608–650.

Bishara, N. D. (2010). Fifty ways to leave your employer: Relative enforcement of covenants not to compete, trends, and implications for employee mobility policy. *U. Pa. J. Bus. L. 13*, 751.

Campbell III, C. M. and K. S. Kamlani (1997). The reasons for wage rigidity: evidence from a survey of firms. *The Quarterly Journal of Economics*, 759–789.

Correia, S. et al. (2016). Reghdfe: Stata module to perform linear or instrumental-variable regression absorbing any number of high-dimensional fixed effects. *Statistical Software Components*.

De Mel, S., D. McKenzie, and C. Woodruff (2008). Returns to capital in microenterprises: evidence from a field experiment. *The Quarterly Journal of Economics*, 1329–1372.

Dube, A., E. Freeman, and M. Reich (2010). Employee replacement costs. *Institute for Research on Labor and Employment*.

Dube, A., T. W. Lester, and M. Reich (2016). Minimum wage shocks, employment flows, and labor market frictions. *Journal of Labor Economics 34*(3), 663–704.

Fallick, B., C. A. Fleischman, and J. B. Rebitzer (2006). Job-hopping in silicon valley: some evidence concerning the microfoundations of a high-technology cluster. *The Review of Economics and Statistics 88*(3), 472–481.

Fazzari, S. M., R. G. Hubbard, B. C. Petersen, A. S. Blinder, and J. M. Poterba (1988). Financing constraints and corporate investment. *Brookings papers on economic activity 1988*(1), 141–206.

Fehr, E. and A. Falk (1999). Wage rigidity in a competitive incomplete contract market. *Journal of political Economy 107*(1), 106–134.

Greenstone, M., A. Mas, and H.-L. Nguyen (2014). Do credit market shocks affect the real economy? quasi-experimental evidence from the great recession and normaleconomic times. Technical report, National Bureau of Economic Research.

Grossman, S. J. and O. D. Hart (1986). The costs and benefits of ownership: A theory of vertical and lateral integration. *The Journal of Political Economy*, 691–719.

Hausman, N. and K. Lavetti (2015). Physician concentration and negotiated prices: Evidence from state law changes. *Unpublished paper, Department of Economics, Ohio State University*.

Holmes, T. J. (1998). The effect of state policies on the location of manufacturing: Evidence from state borders. *Journal of Political Economy 106*(4), 667–705.

King, M., S. Ruggles, J. T. Alexander, S. Flood, K. Genadek, M. B. Schroeder, B. Trampe, and R. Vick (2010). Integrated public use microdata series, current population survey: Version 3.0.[machine-readable database]. *Minneapolis: University of Minnesota 20*.

Lang, K. (1987). Pareto improving minimum wage laws. *Economic Inquiry 25*(1), 145.

Lavetti, K., C. Simon, and W. D. White (2017). The impacts of restricting mobility of skilled service workers: Evidence from physicians. *Unpublished paper, Department of Economics, Ohio State University*.

Legros, P. and A. F. Newman (2008). Competing for ownership. *Journal of the European Economic Association 6*(6), 1279–1308.

Legros, P. and A. F. Newman (2012). A price theory of vertical and lateral integration. *The Quarterly Journal of Economics 1*(46), 46.

Lipsitz, M. (2017). Noncompete agreements and the labor market. *Unpublished paper, Department of Economics, Miami University*.

Manning, A. (2011). Imperfect competition in the labor market. *Handbook of Labor Economics 4*, 973–1041.

Marks, M. S. (2011). Minimum wages, employer-provided health insurance, and the non-discrimination law. *Industrial Relations: A Journal of Economy and Society 50*(2), 241–262.

Marx, M. (2011). The firm strikes back non-compete agreements and the mobility of technical professionals. *American Sociological Review 76*(5), 695–712.

Marx, M., D. Strumsky, and L. Fleming (2009). Mobility, skills, and the michigan non-compete experiment. *Management Science 55*(6), 875–889.

Mian, A. and A. Sufi (2014). What explains the 2007–2009 drop in employment? *Econometrica 82*(6), 2197–2223.

Mortensen, D. T. and C. A. Pissarides (1994). Job creation and job destruction in the theory of unemployment. *The review of economic studies 61*(3), 397–415.

Rauch, J. E. (2015). Dynastic entrepreneurship, entry, and non-compete enforcement. *European Economic Review*.

Rauch, J. E. and J. Watson (2014). Client-based entrepreneurship. *Journal of Law, Economics, and Organization*, ewt023.

Rebitzer, J. B. and L. J. Taylor (1995). The consequences of minimum wage laws some new theoretical ideas. *Journal of Public Economics 56*(2), 245–255.

Samila, S. and O. Sorenson (2011). Noncompete covenants: Incentives to innovate or impediments to growth. *Management Science 57*(3), 425–438.

Shapiro, C. and J. E. Stiglitz (1984). Equilibrium unemployment as a worker discipline device. *The American Economic Review 74*(3), 433–444.

Simon, K. I. and R. Kaestner (2004). Do minimum wages affect non-wage job attributes? evidence on fringe benefits. *Industrial & Labor Relations Review 58*(1), 52–70.

Small Business Development Center Network (2014). Small business market research reports: Beauty salon 2014. Technical report.

Starr, E. (2015). Consider this: Firm-sponsored training and the enforceability of covenants not to compete. *Unpublished manuscript*.

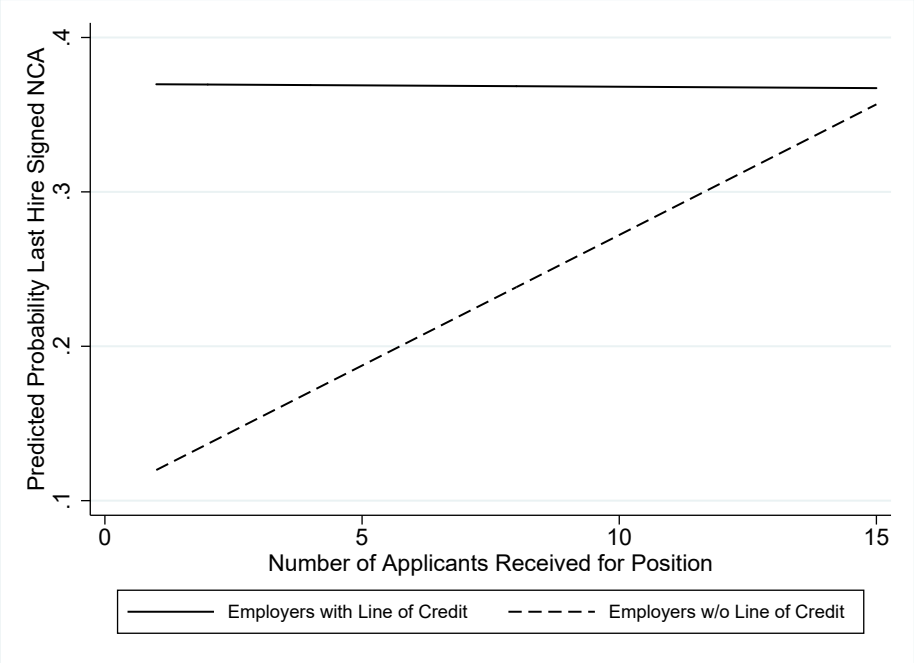
Starr, E., N. Bishara, and J. Prescott (2017). Noncompetes in the us labor force.

Sufi, A. (2009). Bank lines of credit in corporate finance: An empirical analysis. *Review of Financial Studies 22*(3), 1057–1088.

Younge, K. A. and M. Marx (2015). The value of employee retention: Evidence from a natural experiment. *Journal of Economics & Management Strategy*.

Zou, H. and T. Hastie (2005). Regularization and variable selection via the elastic net. *Journal of the Royal Statistical Society: Series B (Statistical Methodology) 67*(2), 301–320.

Figure 5: How Access to a Line of Credit Moderates the Effect of Labor Supply Shifts on NCA Use



The figure shows the average predicted probability that an employer had its most recent hire sign an NCA if all employers did or did not have a line of credit, for different values of the number of applicants received for the position. The predicted probabilities are generated from the regression corresponding to Column 3 in Table 6. The range shown for Number of Applicants across the x-axis is 1 to 15, which are the 10th and 90th percentiles in our sample, respectively.

Table 1: Summary Statistics

	n	mean	sd	median	min	max
Last Hire Signed NCA	218	0.30	0.46	0.00	0.00	1.00
Ever used NCA	218	0.39	0.49	0.00	0.00	1.00
Num stylists working in salon	218	7.13	8.79	4.00	0.00	52.00
Salon 2014 annual revenue, 000s	218	379.00	390.53	250.00	25.00	1500.00
% of stylists hired out of school, bin avg	218	42.33	36.65	32.69	5.00	95.00
Appointment only	218	0.32	0.47	0.00	0.00	1.00
Years in beauty industry	218	27.39	13.29	27.00	1.00	59.00
Employment-based salon	218	0.48	0.50	0.00	0.00	1.00
Bishara State NCA score, standardized	218	0.62	0.33	0.76	0.07	1.00
Line of Credit	218	0.50	0.50	0.50	0.00	1.00
# applicants for last vacancy	195	6.79	9.37	4.00	0.00	60.00
# applicants fewer than usual	218	0.31	0.46	0.00	0.00	1.00
# applicants same as usual	218	0.50	0.50	0.50	0.00	1.00
# applicants more than usual	218	0.10	0.30	0.00	0.00	1.00
Num beauty salons in county, 2012	218	386.68	498.22	183.50	1.00	1762.00

Revenue, Number of Applicants, and Number of Salons in County topcoded at 99th percentile.

Table 2: The Relationship Between Shifts in Labor Supply and NCA Use

	(1)	(2)	(3)
	DV=last hire signed NCA		
# applicants for last vacancy	0.012	0.0097	0.0082
	(0.0038)***	(0.0037)***	(0.0034)**
Bishara State NCA score, standardized	0.31	0.27	0.16
	(0.087)***	(0.10)***	(0.091)*
Emp-based salon		0.17	0.053
		(0.071)**	(0.061)
% of stylists hired out of school, bin avg		0.0011	0.00034
		(0.00095)	(0.00074)
Num stylists working in salon		-0.0024	-0.0049
		(0.0047)	(0.0042)
Age of owner		-0.0031	-0.0061
		(0.0033)	(0.0027)**
Num beauty salons in county, 2012, 000s		-0.024	0.0069
		(0.070)	(0.050)
Used NCAs prior to most recent hire			0.59
			(0.073)***
Constant	0.029	0.12	0.28
	(0.059)	(0.19)	(0.16)*
Observations	195	195	195
R^2	0.099	0.148	0.418
Mean Dep Var	0.303	0.303	0.303
Bishara Score	Y	Y	Y

The dependent variable is a dummy equal to 1 if the most recently hired stylist signed a NCA.
Bishara score is a standardized measure of each state's enforceability of NCAs.
Linear Probability Model. Robust SEs in parentheses. ***P<.01., **P<.05, *P<.1

Table 3: The Effect of the Local Unemployment Rate on NCA Use

	(1)	(2)
	DV = last hire signed NCA	
Change in local Unemployment Rate 2006-2012	0.041	0.040
	(0.022)*	(0.024)*
Used NCAs in 2006 or earlier		0.46
		(0.11)***
Observations	218	202
R^2	0.117	0.242
Mean Dep Var	0.298	0.287
Bishara Score	Y	Y
Other Controls	Y	Y

The dependent variable is a dummy equal to 1 if the most recently hired stylist signed a NCA. In Column 2, the sample is restricted to owners who reported being in the beauty industry since 2006.
Bishara score is a standardized measure of each state's enforceability of NCAs.
Other controls include the percent of a salon's stylists hired directly out of school, a dummy for employment-based salons, the owner's age, the number of stylists working in the salon, and the number of salons in a respondent's county.
Linear Probability Model. Robust SEs clustered by county in parentheses.
***P<.01., **P<.05, *P<.1

Table 4: The Relationship Between The Minimum Wage and NCA Use

	(1)	(2)	(3)
	DV = has ever used NCA		
Minimum Cash Wage in 2014	0.030	0.050	0.032
	(0.013)**	(0.015)***	(0.021)
Emp-based salon=1 × Minimum Cash Wage in 2014			0.057
			(0.026)**
Observations	218	218	218
R^2	0.044	0.141	0.229
Mean Dep Var	0.385	0.385	0.385
Bishara Score	Y	Y	Y
Other Controls	N	Y	Y

Emp-based salon is a dummy if the salon hires stylists as employees, as opposed to independent contractors.
Bishara score is a standardized measure of each state's enforceability of NCAs.
Other controls include the percent of a salon's stylists hired directly out of school, a dummy for employment-based salons, the owner's age, the number of stylists working in the salon, and the number of salons in a respondent's county.
Linear Probability Model. Robust SEs clustered by state in parentheses. ***P<.01., **P<.05, *P<.1

Table 5: The Relationship Between NCA Use and the Investment Holdup Problem

	(1)	(2)	(3)	(4)	(5)	(6)
	Outcomes related to investment in client attraction					
	Social Media	Web-site	Deal sites	Email List	Other Marketing	Trains workers
Ever used NCA	-0.036	0.059	0.11	0.11	0.081	0.11
	(0.057)	(0.062)	(0.052)**	(0.066)	(0.069)	(0.043)**
Observations	218	218	218	218	218	218
R^2	0.110	0.154	0.063	0.207	0.052	0.301
Mean Dep Var	0.807	0.720	0.115	0.583	0.362	0.798
Bishara Score	Y	Y	Y	Y	Y	Y
Other Controls	Y	Y	Y	Y	Y	Y

The dependent variable in each column is a dummy for whether the employer indicated using the corresponding tool. Columns 1-5 are tools to attract clients. Bishara score is a standardized measure of each state's enforceability of NCAs. Other controls include the percent of a salon's stylists hired directly out of school, a dummy for employment-based salons, the owner's age, the number of stylists working in the salon, and the number of salons in a respondent's county.
Linear Probability Model. Robust SEs in parentheses. ***P<.01., **P<.05, *P<.1

Table 6: The Moderating Effect of Employer Financial Constraints on NCA Use

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	DV = last hire signed NCA					DV = any hire signed NCA		
Line of Credit	0.15	0.17	0.27	0.11	0.43	0.11	0.10	0.31
	(0.065)**	(0.064)**	(0.072)***	(0.066)*	(0.16)***	(0.068)	(0.061)*	(0.13)**
# applicants for last vacancy		0.010	0.017					
		(0.0039)***	(0.0029)***					
Line of Credit=1 × # applicants for last vacancy			-0.016					
			(0.0062)***					
Change in local Unempl. Rate 2006-2012				0.041	0.083			
				(0.022)*	(0.023)***			
Line of Credit=1 × Change in local Unempl. Rate 2006-2012					-0.083			
					(0.034)**			
Minimum Cash Wage in 2014							0.049	0.067
							(0.015)***	(0.016)***
Line of Credit=1 × Minimum Cash Wage in 2014								-0.038
								(0.016)**
Observations	195	195	195	218	218	218	218	218
R^2	0.139	0.177	0.200	0.130	0.150	0.121	0.151	0.163
Mean Dep Var	0.303	0.303	0.303	0.298	0.298	0.385	0.385	0.385
Bishara Score	Y	Y	Y	Y	Y	Y	Y	Y
Other Controls	Y	Y	Y	Y	Y	Y	Y	Y

Bishara score is a standardized measure of each state's enforceability of NCAs.
Other controls include the percent of a salon's stylists hired directly out of school, a dummy for employment-based salons, the owner's age, the number of stylists working in the salon, and the number of salons in a respondent's county.
Linear Probability Model. Robust SEs clustered by county in Columns 4-5 and by state in Columns 6-8, in parentheses. ***P<.01., **P<.05, *P<.1

Table 7: The Moderating Role of NCA Enforceability on the Employment Effects of the Minimum Wage: Dube *et al* 2016 replication

	(1)	(2)	(3)	(4)
	DV = log county employment			
ln(Min wage)	-0.022	-0.38	-0.41	-0.40
	(0.064)	(0.16)**	(0.17)**	(0.18)**
ln(Min wage) * NCA Enforceability Score		0.44	0.45	0.43
		(0.17)**	(0.17)***	(0.16)**
Observations	78528	78528	78528	78528
Right to work	N	N	Y	N
Wrongful Discharge Law	N	N	N	Y

The table reports estimates that replicate, and build from, Dube *et al* (2016). Column (1) replicates the result reported in Column (4), row (2), of Table 3 in Dube *et al* (2016), which estimates the elasticity of employment with respect to the minimum wage for restaurant workers. The regressions include county fixed effects, and period fixed effects interacted with county pairs (adjacent counties on state borders). Robust standard errors, in parentheses, are clustered at the state and border-segment level. See Dube *et al* (2016) for detailed discussion. *NCA Enforceability Score*, a variable ranging from zero to one, is a normlaized measure of each state's 2009 NCA enforceability score from Bishara (2009). Column (3) includes a dummy equal to 1 if a state passed a Right-to-Work law as of 2009 interacted with *ln(MW)*. Column (4) does the same, but for a variable equal to the mean of 3 dummies, each indicating if a state had passed one of 3 Wrongful Discharge Laws as of 2000.
Linear Probability Model. Robust SEs, clustered by state, in parentheses. ***P<.01., **P<.05, *P<.1

A The Theoretical Impact of Changes in the Minimum Wage on NCA Use

Suppose that utility transferability and the employee's outside option are both functions of the minimum wage, m: $l(m)$ and $\pi_E(m)$. We assume that $l'(m) > 0$: increases in the minimum wage unambiguously decrease monetary utility transferability. When $B < C$, the condition that ensures that equilibrium contracts have $A = 1$ ($\gamma(\mu_E)P - \pi_R < l(m)$) is not a function of $\pi_E(m)$. Since $l'(m) > 0$ by assumption, increases in m allow this condition to be satisfied more easily: the willingness to pay of R_{μ_E} is more easily bound by l. Thus, increases in the minimum wage may only increase NCA use through this channel, which we call the Bindingness Effect (BE).

Changes in m also affect Assumption 2. If an increase in m causes a decrease in $\pi_E(m)$, the assumption will continue to hold unambigiously if m increases. However, if an increase in m causes an increase in $\pi_E(m)$ (such as, for example, if the employee may easily find a job in another industry that pays the minimum wage), the assumption may be violated if the corresponding increase in productivity of $\hat{\imath}(l(m))$ is not large enough. We call these two competing effects the Outside Option Effect and the Transferability Effect, respectively. A sufficient condition for increases in the minimum wage not to decrease NCA use is that the Transferability Effect (TE) dominates the Outside Option Effect (OOE):

Proposition A.1. *Suppose that there exists an equilibrium in which $B < C$ and $A = 1$ in all contracts when the minimum wage is m. If the minimum wage increases from m to $\tilde{m}$, in the new equilibrium, $A = 1$ in all contracts if the TE dominates the OOE: $l(\tilde{m}) - l(m) \geq \pi_E(\tilde{m}) - \pi_E(m)$.*

Proof. By Proposition 2.1, $\mu_E > \hat{\imath}(l(m))$, since the equilibrium under m has $A = 1$ in all contracts. Since $l'(m) > 0$ and $\tilde{m} > m$, $l(\tilde{m}) > l(m)$, and therefore $\hat{\imath}(l(\tilde{m})) < \hat{\imath}(l(m))$. So, $\mu_E > \hat{\imath}(l(\tilde{m}))$. Thus, if Assumption 2 is satisfied under $\tilde{m}$ when the TE dominates the OOE, the equilibrium will have $A = 1$ in all contracts.

Assumption 2 under m states that $\gamma(\hat{\imath}(l(m)))P + B - \pi_R > \pi_E(m) + C$, which is equivalent to $l(m) + B > \pi_E(m) + C$ by the definition of $\hat{\imath}(l(m))$. Adding $l(\tilde{m}) - l(m)$ to the left hand side and adding $\pi_E(\tilde{m}) - \pi_E(m)$ to the right hand side preserves the inequality, since the TE dominates the OOE. Reducing, we are left with

$$l(\tilde{m}) + B > \pi_E(\tilde{m}) - C$$

$$\gamma(\hat{\imath}(l(\tilde{m}))) + B - \pi_R > \pi_E(\tilde{m}) - C,$$

which is Assumption 2 under $\tilde{m}$. Therefore, all contracts have $A = 1$ in equilibrium under $\tilde{m}$. □

The interpretation of Proposition A.1 is straightforward. As long as a one dollar increase in the minimum wage does not increase an employee's outside option by *more* than one

dollar, NCA use will not decrease. If NCAs were not used prior to an increase, they may be used after if the conditions of Proposition 2.1 become satisfied. Assumption 2 may become satisfied if the TE outweighs the OOE, or the BE may cause the inequality $\gamma(\mu_E) - \pi_R < l(m)$ to hold.

B Appendix Tables and Figures

Table B.1: State Tabulation

State	Number	State	Number
AL	5	MT	1
AZ	3	NC	3
CA	54	NE	1
CO	5	NH	1
CT	4	NJ	5
DC	1	NM	1
FL	15	NV	1
GA	3	NY	9
IA	3	OH	5
IL	19	OK	1
IN	7	OR	2
KS	2	PA	10
KY	2	RI	1
LA	2	SC	1
MA	4	SD	1
MD	5	TN	2
ME	2	TX	9
MI	3	VA	5
MN	4	WA	3
MO	6	WI	7
		Total	218

Table B.2: The Relationship Between Within-Owner Shifts in Labor Supply and Within-Owner Changes in NCA Use

	(1)	(2)
	DV=change in NCA use	
# applicants more than usual	0.12	0.12
	(0.083)	(0.094)
Observations	195	195
R^2	0.008	0.093
Mean Dep Var	0.036	0.036
Bishara Score	Y	Y
Other Controls	N	Y

The dependent variable is the difference between a dummy indicating whether an owner had its most recently hired stylist sign an NCA, and a dummy indicating whether the owner reported using NCAs prior to its most recent hire. A value of 1 indicates an owner switched from not using to using NCAs, and vice versa for a value of -1. A value of 0 indicates NCA use remained constant.
Number of applicants more is a dummy if the number of applicants the owner received for its most recent vacancy was "More than usual" (the omitted category is either "Fewer than usual" or "About the Same").
Bishara score is a standardized measure of each state's enforceability of NCAs.
Other controls include the percent of a salon's stylists hired directly out of school, a dummy for employment-based salons, the owner's age, the number of stylists working in the salon, and the number of salons in a respondent's county.
Linear Probability Model. Robust SEs in parentheses. ***P<.01., **P<.05, *P<.1

Table B.3: The Relationship Between The Minimum Wage and NCA Use At Time Of Most Recent Hire

	(1)	(2)	(3)
	DV = last hire signed NCA		
Minimum Cash Wage in year of last hire	0.029	0.038	0.027
	(0.012)**	(0.014)***	(0.019)
Emp-based salon=1 × Minimum Cash Wage in year of last hire			0.036
			(0.034)
Observations	218	218	218
R^2	0.047	0.124	0.166
Mean Dep Var	0.298	0.298	0.298
Bishara Score	Y	Y	Y
Other Controls	N	Y	Y

Emp-based salon is a dummy if the salon hires stylists as employees, as opposed to independent contractors.
Bishara score is a standardized measure of each state's enforceability of NCAs.
Other controls include the percent of a salon's stylists hired directly out of school, a dummy for employment-based salons, the owner's age, the number of stylists working in the salon, and the number of salons in a respondent's county.
Linear Probability Model. Robust SEs clustered by state in parentheses. ***P<.01., **P<.05, *P<.1

Table B.4: The Correlation Between Employers' Access to a Line of Credit or Banking Relationship and Investment in Client Attraction and Worker Training

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Outcomes related to investment in client attraction						
	Social Media	Web-site	Deal sites	Email List	Other Marketing	Sum of marketing	Trains workers
Line of Credit	0.12	0.10	0.095	0.21	0.15	0.68	0.084
	(0.051)**	(0.060)*	(0.047)**	(0.063)***	(0.066)**	(0.17)***	(0.049)*
Observations	218	218	218	218	218	218	218
R^2	0.113	0.131	0.037	0.221	0.048	0.220	0.285
Mean Dep Var	0.807	0.720	0.115	0.583	0.362	2.587	0.798
Bishara Score	Y	Y	Y	Y	Y	Y	Y
Other Controls	Y	Y	Y	Y	Y	Y	Y

The dependent variable in each column is a dummy for whether the employer indicated using the corresponding tool. Columns 1-5 are tools to attract clients, and Column 6 is a simple sum of the responses from Columns 1-5.
Bishara score is a standardized measure of each state's enforceability of NCAs.
Other controls include the percent of a salon's stylists hired directly out of school, a dummy for employment-based salons, the number of years the owner has been in the beauty industry, and the number of salons in a respondent's county.
Linear Probability Model. Robust SEs in parentheses. ***P<.01., **P<.05, *P<.1