INVESTING IN HUMAN CAPITAL:
THE EFFICIENCY OF COVENANTS NOT TO COMPETE

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ABSTRACT. Covenants not to compete (CNCs) are used in employment contracts to prevent an employee from working for other employers, and in so doing protect the firm's investment in human capital. We analyze the motives for including a CNC in employment contracts using an incomplete contracts perspective. We allow for both efficient and inefficient breach, and compare covenants not to compete with the alternative breach remedies of specific performance and liquidated damages. We conclude that CNCs may be preferable to specific performance and liquidated damages when renegotiation of the contract is not possible, and thus efficiency-minded courts should enforce CNCs. With renegotiation, a CNC can lead to both first-best performance and investment, but the efficiency of the contract will depend on the scope of the CNC, namely how limiting it is in terms of restricting employment. A CNC with too broad a scope will be inefficient by allowing a firm to extract quasi-rents from other firms, thus overcompensating the employer for investment. A CNC with too narrow a scope may not allow the employer to appropriately recover his investment in human capital. We argue that courts need to deter parties from agreeing to covenants that are too broad, but also to recognize the efficiency of CNCs, in particular when employees are capital constrained and judgment proof.

1. INTRODUCTION

The value of human capital is an increasingly significant component of firms' market value, particularly for knowledge-based companies. Managerial expertise is frequently cited as a key driver of firm value. At the same time, it appears that mobility of human capital has increased. This appears to be due to more highly concentrated labor markets in particular industries that have decreased switching costs, increased access to start-up capital, and greater transferability of skills across firms or industries. The mobility of human capital is a key concern of managers, boards of directors and shareholders of firms that make significant investments in human capital.[1]

[1]See, for example, Coy (2002), Kesner (2002) , and Rajan and Zingales (1998).

Employment contracts now frequently contain covenants not to compete (CNCs) that forbid the employee to compete against the employer or to work for a competitor.[2] Noncompete clauses, however, are not systematically enforced by judges, particularly when they are deemed to be too broad. While courts acknowledge that CNCs provides a method for holding the defendant to his promise, they are concerned that they might also unduly restrict individual freedom, impose hardship, and interfere with competition. The enforcement of CNCs is thus determined on a case-by-case basis, unlike the deference paid to substantive contractual terms like price and quantity.

In this paper, we provide an economic explanation for the use of CNCs in employment contracts by studying its effect on decisions by the firm to invest in human capital. We show that it can lead to optimal investment by the firm, and is superior to alternative remedial terms such as specific performance or liquidated damages. We also provide support for why courts should enforce CNCs when they are limited to employment within the relevant industry and within reasonable geographic and temporal boundaries.

Drawing on Becker's (1964) distinction between specific and general human capital, Rubin and Shedd (1981) argue that a CNC is efficient when it protects the investment of an employer in general training in the absence of perfect capital markets (see also Trebilcock (1986) and Lester (2001)). They imagine an industry in which the worker cannot afford to pay for the efficient amount of training, and he cannot finance this amount by borrowing from a third party because he cannot make a commitment to repay out of future income (because of bankruptcy law, laws against slavery, and so forth). Instead, the employer makes the investment and seeks to recover it over time by paying a wage lower than the worker's marginal product. However, once the worker has received the training, he has the incentive to leave for a higher wage with a competitor who will share with him the benefits from the general skills. At the time of the contract with the first employer, the worker cannot commit to refrain from leaving because he can subsequently avoid damages liability by filing for bankruptcy and because the courts are reluctant to order specific performance. In contrast, a CNC is more likely to be specifically enforced, even in bankruptcy court.[3] Therefore, Rubin and Shedd (1981) conclude that the CNC is an effective alternative to specific performance. They also emphasize that this rationale applies only to general investment (that is, of value to third party employers) and therefore that the case for CNC

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[2]For example, see Kaplan and Stromberg (2001).

[3]Courts usually enforce CNCs in bankruptcy, see In re Udell, 18 F.3d 403 (7th Cir. 1994) (injunction based on covenant not to compete is not a "claim" for bankruptcy purposes), though they may allow the debtor to escape from a CNC that is part of an ongoing contract. An example from the franchising context is In re Register, 95 Bankr. 73 (Bankr. N.D. Tenn. 1989).

enforcement to protect specific investment (of benefit to only the investing company) has yet to be made.

This paper addresses several questions left unresolved by the existing literature. First, we show that parties might rationally prefer CNCs to liquidated damages and specific performance in order to maximize ex post efficiency. By contrast, Rubin and Shedd (1981) find a CNC to be a second best remedy that is attractive only because specific performance is not available, and Lester (2001) argues for liquidated damages equal to training costs. Second, we find that a CNC dominates the alternative remedies when it is conditioned on the movement of the worker only to a defined subset of alternative employers. Third, Rubin and Shedd (1981), Trebilcock (1986) and others do not address circumstances in which it may be ex post efficient for the worker to leave the firm in favor of another employer. We extend the analysis of investment incentives by providing that renegotiation of the CNC is permitted and costless; in this way, ex post efficiency is ensured. Thus, the firm might get its investment return in the form of a payment from the third party employer in exchange for a release of the CNC. Fourth, we provide an economic (investment) justification for judicial interference with the parties' freedom to contract for CNCs that is distinct from the promotion of mobility in labor markets (Hyede (1998), Gilson (1999)). We show that there is a cost externality associated with investment that may lead sophisticated parties to contract for inefficiently broad CNCs. We suggest that an important determinant of the need to police CNCs is the parties' ability to renegotiate.

In Section 2, we set up a stylized model of an incomplete employment contract that anticipates the subsequent entry of alternative employers, and solve this model for the first-best performance result (for whom the worker should optimally work *ex post*), and the first-best *ex ante* investment solution. In Section 3, we assume that the initial parties cannot renegotiate their contract and we investigate whether a CNC can improve performance incentives when the worker is capital constrained and judgment proof. We find that, when these constraints are binding, the CNC has mixed efficiency consequences. Compared to liquidated damages, the CNC deters inefficient breach more effectively, but it also reduces the gain from efficient breach (because the CNC may preclude employment in the highest valued use). Under some conditions, the CNC has a positive net efficiency effect on trade incentives when it is not renegotiable. We also argue that a CNC might improve, but cannot worsen, investment incentives. Therefore, we conclude that the courts should enforce this term when renegotiation is impossible, subject to the usual review for unconscionability.

In Section 4, we allow for costless renegotiation of the CNC, in response to the entry of a new employer. Although renegotiation ensures efficient ex post trade outcomes, we find in our analysis of investment incentives significant support for judicial skepticism and restraint in enforcing these terms. If a prospective employer falls within the scope of the CNC, this employer and the worker must negotiate a release from the initial employer. The initial employer will only agree to a release if paid the worker's value to the firm under the initial contract. To the extent that investment increases the amount of this payment, the investment imposes a cost on the third party. This result is analogous to the finding that contract parties may agree to supercompensatory liquidated damages in order to deter the entry of competitors or to extract from entrants a larger portion of their surplus (see Aghion and Bolton (1987), Spier and Whinston (1995), and Chung (1992)).

This overinvestment incentive associated with the CNC is similar to that which would occur in anticipation of specific performance of the employment contract. However, unlike the specific performance remedy, the CNC does allow the worker to move to the set of firms outside its scope, and this introduces a countervailing effect on investment. If the *ex post* efficient outcome is that the employee works for her original employer, and yet she is free to work for firms outside the CNC scope who may offer a higher wage, the initial employer must pay a negotiated premium to keep the employee. Anticipating this hold-up by the worker, the firm will underinvest. By appropriately selecting the scope of the CNC, the over- and under-investment distortions can be balanced to yield the first-best investment solution.

If the scope of the CNC were limited to employers that are within the initial firm's industry, for example, the original employer will only extract a larger share of the surplus from its investment from future employers who value this investment almost as highly as the initial firm, thus limiting the severity of the overinvestment. Furthermore, the limited scope allows for there to be enough firms to provide the offsetting underinvestment incentive to balance off the tendency to overinvest. However, as long as the employee and the initial firm can externalize the cost of the investment in future bargaining with other employers, the parties cannot be relied on to reach this efficient result, and the courts may be justified in policing their CNC decision.

In Section 5, we compare our findings to the case law concerning enforcement of CNCs. In Section 6, we provide concluding remarks and propose extensions to our model.

2. The Model and First-Best Solution

The model involves a sequence of decisions and events. At $t = 0$, a worker (W) enters into a contract with $Firm$ 0 under which W promises to work for $Firm$ 0 at time T. In turn, $Firm$ 0 promises to pay W a wage, P_0, if W performs. We assume that $Firm$ 0 will not breach this promise. Once the contract is agreed upon, $Firm$ 0 invests I to increase the value of the worker's output. This investment involves, for instance, training in technical or managerial expertise and sharing of knowledge accumulated by the firm.

The value of the worker's performance to $Firm$ 0 depends on four variables: the investment, I; the sensitivity of the output to the firm's investment, α_0; the state of nature at the performance date, θ (with cumulative distribution $F(\theta)$); and the sensitivity of the output to θ, β_0. We define $V^0(I, \theta) \equiv V^0(I, \alpha_0, \theta, \beta_0, T)$ as the value of W's output received by $Firm$ 0 at T if W works for $Firm$ 0, and use the condensed notation V^0 when its meaning is not ambiguous.

There are N other firms $(Firm\ i, i = 1, \ldots, N)$ in the economy at T that W could potentially work for. The initial contract with $Firm$ 0 specifies breach remedies to address the possibility that W might prefer to "perform" for a firm other than $Firm$ 0. For instance, under *specific performance*, the court would enforce the contract by compelling W to work for $Firm$ 0. Under *liquidated damages*, the court would order W to pay $Firm$ 0 an amount D_i should she leave to work for $Firm\ i$.[4] We make the typical assumption here that the level of liquidated damages does not depend on which firm the worker moves to, i.e. $D_i = D, i = 1, \ldots, N$. If $D = 0$, there is no breach penalty and W is free to leave to work for another firm.

A CNC stipulates remedies that are contingent on the firm which W seeks to join. A CNC is a negative covenant - a promise to refrain from working for a defined set of employers. Under a CNC, W would be restricted from working for $Firm\ i$ where $i \in \Omega = 1, \ldots, n$, but is free to work for $Firm\ i$ (i.e. $D_i = 0$) where $i \in \Delta = n + 1, \ldots, N$. It is useful to order firms consecutively in decreasing order of commonality with $Firm$ 0: $Firm$ 1 is most like $Firm$ 0 in terms of its operations and composition of assets; $Firm$ 2 is next most similar; and so on, with $Firm\ N$ sharing the least commonality with $Firm$ 0. The cutoff point, n, that determines the scope of the CNC may be based on factors such as industry or geographic location, and is a critical decision variable, as demonstrated below.

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[4]While liquidated damages represent explicit payments to be made to a firm upon breach, the loss of unvested stock or stock option grants represents an implicit cost to W of leaving her original employer that should be incorporated into D_i.

Should W work for $Firm\ i$, the value of $Firm\ i$'s output associated with W would be $V^i(I,\theta) \equiv V^i(I,\alpha_i,\theta,\beta_i,T)$ (which will be referred to as V^i when appropriate). The cost of the worker's effort at T is implicitly the opportunity cost of his value in alternative employment. We assume that $\alpha_{i-1} \geq \alpha_i$ for $i = 1,\ldots,N$, consistent with the idea that firms that have increasingly less in common with $Firm\ 0$ will derive increasingly lower returns from $Firm\ 0$'s investment I.

Firms in the same industry and geography as $Firm\ 0$ will likely have the highest sensitivity to I, but since $\alpha_1 < \alpha_0$, even the most similar firm to $Firm\ 0$ will not receive all the benefits of $Firm\ 0$'s investment - the difference being what is traditionally viewed as the return to $Firm\ 0$ from its "specific investment". The term "general investment" is typically used to refer to investment which affects the V^i of all firms. In our model, this would be equivalent to the impact of $Firm\ 0$'s investment on the value of W to $Firm\ N$. Since investments in human capital are unlikely to be either purely general or purely specific[5], our characterization of the degree to which $Firm\ 0$'s investment affects the value of W to $Firm\ i$, V^i is more general and flexible than the all-or-none effects captured by the traditional split between general and specific investments.

The following assumption about the firm values V^i (and implicitly about the sensitivity parameters α_i) ensures that investment in human capital will be positive, but finite:

Assumption 1. *For all $i = 0,\ldots,N$, $V^i(I,\theta) > 0$, is bounded, increasing, twice differentiable, and strictly concave in I.*

We assume that all agents are risk-neutral and that the discount rate used to bring back the value at the date of performance to the date of contracting is equal to zero. Both of these assumptions simplify the model exposition, and do not impact the nature of the results we obtain. We assume that W is capital constrained so that she cannot pay for her own training, bond her performance, or make an up-front payment to $Firm\ 0$. Finally, we make the following assumption regarding what is observable by the contracting parties, and what is verifiable by the courts:

Assumption 2. *The values $V^i(I,\theta)$, $i = 0,\ldots N$ are observable to W and to all firms. However, these values, as well as I and θ, are not verifiable by the courts. Courts can only verify the following: the wage P_0 (and whether it has been paid); the liquidated damages amount D_i; the firm that W ultimately works for; and the cutoff*

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[5]See Ehrenberg and Smith (2000)

value n in a CNC which delineates between firms that W is free to work for at T and those firms for which she is restricted from working.

The first-best solution is the socially efficient investment by $Firm$ 0 at $t = 0$ and worker performance at T that a central planner (or a well-diversified investor)[6] would choose. This will serve as the benchmark for our subsequent analysis. At T, W should work for the firm that has the highest value associated with her output. This will depend in part on the realization of the uncertainty θ at that time (as well as α, β and I). We define Θ as the set of all θ, and Φ as a specific decomposition of Θ into $N + 1$ subsets $(\Theta_0, \Theta_1, \ldots, \Theta_N)$, where Θ_i is the (possibly null) subset of θ values for which W works for $Firm\ i$. Φ represents the "performance" policy at T, and it is implicitly a function of I, since the firm which W works for depends not only on the realization of θ but also on the impact of investment on the worker's output when employed by each different firm. For the first-best solution, Φ^{FB} is such that each of the $N + 1$ subsets Θ_i^{FB} contains all θ such that $i = argmax_j\ V^j(I, \theta)$.

$V(I, \Phi^{FB})$ represents the value at $t = 0$ of W's output at T given first-best performance:

$$V(I, \Phi^{FB}) = \sum_{i=0}^{N} \int_{\theta \in \Theta_i^{FB}} V^i(I, \theta)\ dF(\theta) \qquad (1)$$

The optimization problem to determine the first-best investment at time $t = 0$ is:

$$max_I V(I, \Phi^{FB}) - I, \qquad (2)$$

which leads to the following first order condition:

$$V^I(I^{FB}, \Phi^{FB}) = 1. \qquad (3)$$

Investment is set such at the margin the benefit and cost of an additional unit of investment are equal. I^{FB} and Φ^{FB} thus represent the first-best investment and performance policies that we will use as benchmarks in our subsequent analysis.

3. Results Assuming No Renegotiation

We begin by looking at the case where the contract cannot be renegotiated at T after the state of the world is revealed. While renegotiation is unlikely to be completely infeasible, we view this as the limiting case of costly renegotiation. Without renegotiation, performance will not be first-best for at least some values of θ. The frequency and magnitude of inefficient breach or inefficient lack-of-breach will depend on the

[6]From the perspective of an investor who holds a large well-diversified portfolio of stocks, an executive should work for the firm in this investor's portfolio that can best capitalize on the executive's expertise.

breach remedy specified in the contract. Given Assumption 2, courts cannot calculate expectation or reliance damages, and cannot enforce a perfect state contingent contract. Thus, we focus on the following three remedial provisions in our analysis: specific performance of W's promise to work for $Firm$ 0; liquidated damages (and, if $D = 0$, the special case of no sanction for breach); and injunctive relief under a CNC.

3.1. **Specific Performance.** Under specific performance, W will be bound to work for $Firm$ 0 regardless of the realization of θ (i.e. $\Phi^{SP} = \{\Theta, \emptyset, \ldots, \emptyset\}$). Performance will thus be first-best only when $\theta \in \Theta_0^{FB}$. For all $\theta \notin \Theta_0^{FB}$, there will be inefficient lack-of-breach. The lost value associated with this inefficient performance (for a given I) is equal to:

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\begin{aligned}
V^{FB} - V^{SP} &= \int \max_i \{V^i(I, \theta) - V^0(I, \theta)\} \, dF(\theta) \\
&= \int_{\theta \notin \Theta_0^{FB}} \max_i \{V^i(I, \theta) - V^0(I, \theta)\} \, dF(\theta)
\end{aligned}
\tag{4}
$$

This inefficient lack-of-breach is substantial if other firms are much better able to capitalize on W's expertise under particular θ realizations than is $Firm$ 0. We defer discussion of the investment decision under this case until the end of the section, but clearly it will not be I^{FB} given that performance is not optimal.

3.2. **Liquidated Damages.** Under a liquidated damages rule, W can now breach her contract with $Firm$ 0 to go work for $Firm$ i, but must pay damages of D. $P_i(V^i)$ (which is also denoted as P_i below) is defined as the wage that $Firm$ i offers to W at T. If W is able to extract all the value from her output at $Firm$ i (e.g. if she works as a self-funded entrepreneur), then $P_i = V^i$; otherwise, P_i will be less than V^i. W would choose to leave $Firm$ 0 if, for some i, $P_i(V^i)$ minus the liquidated damages penalty, D, would be larger than P_0. Formally, $\theta \in \Theta_0^{LD}$ if $P_0 \geq \max_i(P_i - D)$, and $\theta \in \Theta_i^{LD}$ if $i = argmax_j \, P_j$ and $P_i - D > P_0$.

There will be inefficient breach (relative to first-best performance) when $\theta \in \Theta_i^{LD} - \Theta_i^{LD} \cap \Theta_i^{FB} \, \forall i$ (i.e., cases where W leaves to obtain a higher wage, yet $V^0 > V^i \forall i$). For compact exposition, we define this subset as $\Theta_i^{LD'}$ - namely, the set of θ values where W would find it optimal to leave to work for $Firm$ i, yet this is inefficient from a first-best perspective. There will also be inefficient lack-of-breach relative to the first-best solution for $\theta \in \Theta_0^{LD'} \equiv \Theta_0^{LD} - \Theta_0^{LD} \cap \Theta_0^{FB}$ (i.e. W stays when she should leave because there is some i for which $V^i > V^0$). A higher penalty would make inefficient breach less likely, but would at the same time increase the probability of inefficient lack-of-breach. The value distortion relative to the first-best solution that

is due to inefficient performance is equal to:

$$V^{FB} - V^{LD} = \sum_{i=1}^{N} \int_{\theta \, \in \, \Theta_i^{LD'}} \{V^0(I,\theta) - V^i(I,\theta)\} \, dF(\theta)$$

$$+ \int_{\theta \, \in \, \Theta_0^{LD'}} \max_i \{V^i(I,\theta) - V^0(I,\theta)\} \, dF(\theta)$$

(5)

The first term represents the loss due to inefficient breach, while the second term captures the loss from inefficient lack-of-breach. Relative to specific performance, there will be a lower incidence of inefficient lack-of-breach under a liquidated damages rule, but a higher incidence of inefficient breach. This tradeoff depends of course on the choice of D, and the parties should seek to select the D that minimizes the value loss in equation (5). On balance, a liquidated damages rule will be superior to specific performance if (5) is less than (4) for at least some choice of D. However, the level of D that is necessary to make liquidated damages the superior remedy may be prohibitively large and W may be able to avoid enforcement through bankruptcy.[7] This leads us to investigate the CNC, which may be more effective than liquidated damages when W is capital constrained or judgment proof.

3.3. **Covenant not to Compete.** The performance policy at T in the presence of a CNC, Φ^{CNC}, can be summarized as follows. We define $\Omega = 1, \ldots, n$ to be the set of firms which W is restricted from working for, and $\Delta = n + 1, \ldots, N$ to be the set of firms which W is free to work for at T. For each $i \in \Omega$, Θ_i^{CNC} is a null set by definition. For $i \in \Delta$, Θ_i^{CNC} contains θ values for which the wage offered by $Firm\ i$, $P_i(V^i)$, is greater than P_0. Θ_0^{CNC} contains all other θ values, for which either $P_0 \geq P_i$, or $P_i > P_0$ but $i \in \Omega$. It is clear that this is not equivalent to the first-best policy. Breach will occur in some cases where $V^0 > V^i$ for $i \in \Delta$ because W is only concerned with her wage and not with her relative value to alternative employers, and the CNC does not restrict movement to the firms in Δ. Breach will not occur in some cases where $V^i > V^0$ either because P_0 is too high (larger than P_i) or because the CNC inefficiently (ex-post) restricts W's movement (and cannot be renegotiated).

The value distortion in the presence of a CNC relative to the first-best scenario can be expressed in a manner analogous to equation (5). The following definitions (similar to those made above in the case of liquidated damages) simplify the expression: $\Theta_i^{CNC'}$ for $i \in \Delta$ is the set of θ values where W would find it optimal to leave to work for $Firm\ i$, yet this is inefficient from a first-best perspective; $\Theta_0^{CNC'}$ is the set of θ values

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[7]Alternatively, the wage P_0 would need to be so large that W would have to make an up-front payment on her contract with $Firm\ 0$, and yet she is unable to borrow the necessary amount at $t = 0$.

where W should optimally (from a first-best perspective) leave to work for $Firm\ i$, yet stays at $Firm\ 0$ because she is restricted from going to $i \in \Omega$ by the CNC, and prefers not to leave to go to a $Firm\ j, j \in \Delta$; $\Theta_i^{CNC'}$ for $i \in \Omega$ is the set of θ values where W should optimally leave to work for $Firm\ j, j \in \Omega$, yet instead goes to work for $Firm\ i, i \in \Delta$ since she is restricted by the CNC.

$$
\begin{aligned}
V^{FB} - V^{CNC} = & \sum_{i \in \Delta} \int_{\theta\ \in\ \Theta_i^{CNC'}} \{V^0(I, \theta) - V^i(I, \theta)\}\ dF(\theta) \\
& + \int_{\theta\ \in\ \Theta_0^{CNC'}} \max_i \{V^i(I, \theta) - V^0(I, \theta)\}\ dF(\theta) \qquad (6) \\
& + \sum_{i \in \Omega} \int_{\theta\ \in\ \Theta_i^{CNC'}} \{\max_{j \in \Omega} V^j(I, \theta) - V^i(I, \theta)\}\ dF(\theta)
\end{aligned}
$$

The first term represents the loss due to inefficient breach; the second term captures the loss from inefficient lack-of-breach; and the third term represents breach which is only partially efficient (W should go to an $i \in \Omega$, but instead goes to an $i \in \Delta$). Compared to breach under liquidated damages, we can make the following observations. Under a CNC, breach will be more likely as far as movement to Firms $i \in \Delta$ is concerned given that there is no penalty to changing firms - some of this will be efficient, some not. In other words, the $\Theta_i^{CNC'}$ regions are larger than the $\Theta_i^{LD'}$ regions, but there are fewer of them ($N - n$ instead of N). Breach will of course be less likely than under liquidated damages with respect to moving to $i \in \Omega$ since movement to these firms is not permitted: inefficient breach is prevented, in particular in comparison to the liquidated damages case where D is low; however, efficient breach may be less frequent. This may result, in particular when D is low, in $\Theta_0^{CNC'}$ being a larger region (greater probability of inefficient lack-of-breach) than $\Theta_0^{LD'}$.

The aggregate impact on the value of contracting of a CNC provision relative to either liquidated damages or specific performance will depend on sizes of the regions of inefficient breach or lack-of-breach as well as the relative values of V^0 and V^i under these different θ realizations. For example, a CNC would dominate the other two remedies when V^0 is close to or larger than $\max(V_i, i \in \Omega) > V_0$ for a set of θ values, and when $\max(V_i, i \in \Delta) > V^0$ for the rest of the θ values. Intuitively, this would correspond to the case where $Firm\ 0$ is better able to capitalize on W's labor than other companies in its industry (perhaps because of valuable specific investment), but where there are also states of the world where $Firm\ 0$'s entire industry covered by the CNC may be less profitable than other industries that W could work for.

A CNC can be viewed as a hybrid of specific performance for $i \in \Omega$ and liquidated damages (with $D = 0$) for $i \in \Delta$. Since in the latter case the damages are equal to

zero, a CNC is not undermined by the risk that W is judgement proof. Furthermore, in the absence of renegotiation, a CNC does not face the social welfare problem that authors such as Aghion and Bolton (1987) and Chung (1992) have pinned on liquidated damages, namely that W and $Firm$ 0 have the incentive to choose high liquidated damages in order to extract value from future potential employers who will attempt to bid for W's services. Thus, when renegotiation is impossible, courts should be less hostile to CNCs than to liquidated damages provisions.

3.4. **The Investment Decision.** Regardless of the remedy specified in the contract, we have shown that first-best performance will not generally be obtained in the absence of renegotiation. The extent and magnitude of inefficient performance depends in part on the breach remedy chosen, and also on the parameters of the problem (such as the parameters of the value functions, the size of liquidated damages, the CNC cutoff value n, and the wage P_0). The optimal investment decision under the scenarios we have examined in this section will also not match the first-best solution I^{FB}. $Firm$ 0 will obtain a return on its investment only if W does not breach her contract. Thus, anticipating that W may leave in the case of liquidated damages or a CNC, $Firm$ 0 will tend to underinvest relative to the first-best solution. In contrast, while W will always work for $Firm$ 0 under specific performance, $Firm$ 0 will overinvest since the sensitivity of V^0 to I, α_0, is larger than all other α_i. The deviation from first-best investment is linked to, and in some sense due to, the performance inefficiency. Rather than quantify the exact investment distortion here, we turn now to the more interesting problem where renegotiation is allowed, and both first-best performance and investment are obtainable.

4. Results Assuming Renegotiation

As in the previous section, we study performance and investment under different breach remedies. We now assume that at $t = T$, W can renegotiate her contract with $Firm$ 0. She will choose to do so if another firm offers her compensation that exceeds her contracted wage, P_0. $Firm$ 0 will either respond with a competitive offer, or W will leave to join the other firm. Renegotiation may also take place under conditions where it is preferable that W works for another firm (because $\max_i V^i > V^0$), but W prefers to stay with $Firm$ 0 because P_0 dominates the best offer she can get from any other firm (recall that we assume that $Firm$ 0 cannot breach). $Firm$ 0 will offer a severance payment to W, and W can negotiate with $Firm$ i for a wage P_i that, together with the severance payment, would be larger than P_0. $Firm$ 0 will be at

least as well off (it will be able to decrease the size of the loss it would have incurred since $V_0 < P_0$), as will the other parties (W and $Firm\ i$).

While the breach remedy will affect the circumstances under which these two types of renegotiation will take place, the firm that W will end up working for will ultimately match the first-best renegotiation solution regardless of remedy given that renegotiation is assumed to be costless. However, the investment incentives will differ in the three remedy cases we investigate. We show below that only a CNC can lead to first-best investment, I^{FB}, and it must have a carefully selected scope (n^{FB}). However, we also argue that the initial contracting parties have an incentive to select a broader scope than the socially efficient optimum ($n > n^{FB}$), and thus courts may be justified in carefully enforcing CNCs when renegotiation is possible.

4.1. **Specific Performance.** When specific performance is the chosen breach remedy, if $V^0 > P_0$ and $V^0 > V^i\ \forall i$, there would be no incentive for $Firm\ 0$ to renegotiate the terms of W's contract (and W is bound to perform). Similarly, if $V^0 < P_0$ and $V^0 > V^i\ \forall i$, it is easy to show that W would have no incentive to renegotiate her contract (and $Firm\ 0$ cannot use the threat of breach, by assumption).

If, however, there is some i for which $V^i > V^0$, then there are gains attainable through renegotiation. We denote the renegotiation surplus as $S = \max_i (V^i - V^0)$. Renegotiation effectively involves three parties: $Firm\ 0$ and W renegotiate their initial employment contract, agreeing to terms of separation, and $Firm\ i$ (when $\theta \in \Theta_i^{FB}$) and W negotiate a new employment contract (a wage that is paid for immediate output by W). While W negotiates with each of the two firms separately, ultimately the three parties split the surplus, S. Our results are not contingent on the form or outcome of the renegotiations; we merely require that there is some three-way surplus sharing (π_0, π_i, π_W) such that each π is non-negative and $\pi_0 + \pi_i + \pi_W = 1$.

If $\max_i V^i > P_0$, $Firm\ 0$ will allow W to work for $Firm\ j$ (where $j = argmax_i V^i$) in exchange for a payment $V^0 + \pi_0 S - P_0$ (if negative, $Firm\ 0$ ends up paying out rather than receiving money, but is still better off than without renegotiation); W will make this payment to $Firm\ 0$, but will receive $V^0 + (\pi_W + \pi_0)S$ from $Firm\ j$. If $\max_i V^i < P_0$, $Firm\ 0$ will encourage W to work for $Firm\ i$ (where $i = argmax_j V^j$) by making a severance payment of $-(V^0 + \pi_0 S - P_0)$ to her; W will also receive compensation from $Firm\ i$ of $V^0 + (\pi_W + \pi_0)S$. Under either scenario, the three parties will have the following payoffs after the renegotiation is complete: W will earn $P_0 + \pi_W S$; $Firm\ i$'s profit will be $\pi_i S$; and, $Firm\ 0$'s profit will be $V^0 + \pi_0 S - P_0 = (1 - \pi_0)V^0 + \pi_0 V^i - P_0$.

At $t = 0$, $Firm\ i$'s optimization problem is:

$$max_I \sum_{i=0}^{N} \int_{\theta \in \Theta_i^{FB}} ((1 - \pi_0)V^0 + \pi_0 V^i) \, dF(\theta) - I - P_0 \qquad (7)$$

While, renegotiation leads to the first-best performance solution in terms of W's ultimate employer $(\Theta_i^{SP} \equiv \Theta_i^{FB})$, it is straightforward to see by comparing equation (7) to equations (1) and (2) that investment will be at a higher level than the first-best solution. The proof hinges on the fact that, when $i \neq 0$ and $\pi_0 \neq 1$, $\partial[(1 - \pi_0)V^0 + \pi_0 V^i]/\partial I > V_I^i$, since $\alpha_0 > \alpha_i$ implies that $V_I^0 > V_I^i$. While the degree of overinvestment is not as severe as it is in the case where there is no renegotiation, $Firm$ 0 does commit more investment at $t = 0$ than prescribed by the first-best solution. [8]

4.2. **Liquidated Damages.** As in the case of specific performance, when renegotiation is superimposed on the liquidated damages remedy, first-best performance is obtained, i.e. $\Phi^{LD} = \Phi^{FB}$. In order to determine exactly what $Firm$ 0's expected profit will be, and thus how it will invest at $t = 0$, we need to further partition each Θ_i subset in the following way:

$Case\ I:$ $V^0 \geq V^i$ and $V^i < P_0 + D$, where $i = argmax_{j \neq 0} V^j$ $(\theta \in \Theta_0^-)$

$Case\ II:$ $V^0 \geq V^i$ and $V^i > P_0 + D$, where $i = argmax_{j \neq 0} V^j$ $(\theta \in \Theta_0^+)$

$Case\ III:$ $V^0 < V^i$ and $V^i < P_0 + D$, where $i = argmax_{j \neq 0} V^j$ $(\theta \in \Theta_i^-)$

$Case\ IV:$ $V^0 < V^i$ and $V^i > P_0 + D$, where $i = argmax_{j \neq 0} V^j$ $(\theta \in \Theta_i^+)$

In Cases II and IV, W may "actively" seek to leave $Firm$ 0 since other firms value her output at a level that, net of the penalty she would have to pay to change her employer, exceeds her current wage. Thus she is able to improve her compensation, either by working for another firm (in Case IV), or threatening to do so when renegotiating with $Firm$ 0 (in Case II). In Cases I and III, W would not initially seek to leave, but renegotiation may (in Case III) make this ultimately desirable. Each of these four cases are analyzed below in greater detail.

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[8]The only case in which first-best investment would be attainable would be if $Firm$ 0 were able to extract all the surplus gained from W leaving to work for $Firm$ i (i.e. $\pi = 1$). To achieve this result, W would have to have all the negotiation power when dealing with $Firm$ i (getting a wage $P_i = V^i$), and at the same time no negotiating power when dealing with $Firm$ 0 (essentially giving up all but P_0 from what she extracted from $Firm$ i). This case seems highly unlikely.

Case I. This case is straightforward: W has no incentive to leave (or to threaten to do so) since her wage plus liquidated damages is larger than her value to any other employer; $Firm$ 0 has no incentive to renegotiate to get W to work for another firm, since her value to $Firm$ 0 is higher than to any other firm. Thus, $Firm$ 0's profit is simply $V^0 - P_0$, and the firm receives the full benefit of its investment at $t = 0$. If $\Theta_0^- \equiv \Theta$, i.e. if all θ lied within the region Θ_0^-, then the firm would clearly choose the first-best investment level.

Case II. As in Case I, $Firm$ 0 is able to obtain the highest value from W's labor as compared to other firms in the economy. However, in this case W has outside options that are binding, and thus she will renegotiate her contract with $Firm$ 0. We define π_W^0 to be W's negotiating power (share of surplus) when renegotiating with $Firm$ 0, and π_W^i to be her negotiating power when bargaining with another firm (we assume for sake of exposition that this share would be the same regardless of which firm $i \neq 0$ she is negotiating with). If $Firm\ i$ represents the most attractive alternative to $Firm$ 0 ($i = argmax_{j \neq 0}\ V^j$), then W is able to extract an offer from $Firm\ i$ of $P_i = P_0 + D + \pi_W^i(V^i - P_0 - D)$. With this outside offer in hand, W will renegotiate with $Firm$ 0, who will ultimately be left with a profit from W's labor of $V^0 - \pi_W^0(V^0 - P_i)$, which can be expressed explicitly in terms of V^i as:

$$(1 - \pi_W^0)V^0 + \pi_W^0(\pi_W^i V^i + (1 - \pi_W^i)(P_0 + D)) \tag{8}$$

While W works for $Firm$ 0 in this case, the renegotiation results in W being able to extract a larger share of the surplus than stipulated in the initial terms of the contract. This is the classic hold-up problem (see Hart and Moore (1988) and Williamson (1975)), which results in underinvestment by the firm. From equation (8, it follows that since $V_I^0 > V_I^i$ (and assuming $\pi_W^i < 1$), the firm would indeed invest less that the first-best level.

Case III. For θ values for which $P_0 + D > V^i > V^0$, where $i = argmax_{j \neq 0}\ V^j$, while W should optimally work for $Firm\ i$, she does not have the incentive to do so unless $Firm$ 0 initiates renegotiation of her contract. $Firm$ 0 will do so in order to obtain a share of the surplus, $S = V^i - V^0$. It will offer W a severance payment equal to $P_0 - V^0 - \pi_0 S$, and will waive the penalty D. Together with what W is able to obtain as compensation from $Firm\ i$, $V^0 + (\pi_W + \pi_0)S$, W would receive $P_0 + \pi_W S$ if she left to work for $Firm_i$. For any strictly positive π_W, this will achieve the first-best performance incentive.

W's value to $Firm$ 0 at T is the negative of the severance payment. This amount, $V^0 - P_0 + \pi_0 S = (1 - \pi_0)V^0 + \pi_0 V^i - P_0$, is identical to what we found in the scenario where specific performance was the remedy and it was optimal for W to leave $Firm$ 0. This value is a weighted average of V^0 and V^j, and thus has a higher sensitivity to I than does the first-best value expression (simply V^i) in this region. Thus, if all θ values were in this region Θ_j^-, the firm would overinvest relative to the first-best solution.

Case IV. When $\theta \in \Theta_i^+$, $V^i > P_0 + D$ and $V^i > V^0$, where $i = argmax_{j \neq 0} \ V^j$. Thus, W will be able to increase her compensation by leaving, and $Firm$ 0 will not seek to renegotiate with her, since W is able to extract a better offer from $Firm$ i given that $V^i > V^0$.[9] Thus, $Firm$ 0 would be left with zero value associated with W's employment. If all θ were in Θ_i^+, $Firm$ 0 would clearly have the optimal incentive to invest nothing given that W would always breach the contract.

The Investment Decision. When $Firm$ 0 and W agree to liquidated damages, and when they can renegotiate without cost, the expected value to $Firm$ 0 of its contract with W can be expressed as:

$$
\begin{aligned}
V^{0^{LD}} = &\int_{\theta \in \Theta_0^-} (V^0 - P_0) \ dF(\theta) \\
&+ \int_{\theta \in \Theta_0^+} \{(1 - \pi_W^0)V^0 + \pi_W^0(\pi_W^i V^i + (1 - \pi_W^i)(P_0 + D))\} \ dF(\theta) \\
&+ \sum_{i=1}^{N} \int_{\theta \in \Theta_i^-} (1 - \pi_0)V^0 + \pi_0 V^i - P_0 \ dF(\theta)
\end{aligned}
\tag{9}
$$

The three integrals in (9) correspond to Cases I-III shown above (there is zero value associated with Case IV). The optimal investment amount under the liquidated damages rule with renegotiation is obtained by solving $\max_I \ V^{0^{LD}} - I$, and we can compare the resulting investment level to the first-best solution from $\max_I V^{FB} - I$. Since the first order conditions for these two optimization problems will depend on the derivatives of the value expressions in (9) and (1) with respect to I, we should compare the corresponding derivatives in these two expressions for each of the four regions (Cases) identified above. For the first region (Θ_0^-), both derivatives are equivalent

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[9]It There may be cases where if only a single round of negotiation with each employer is allowed, and $\pi_W^0 > \pi_W^i$, then W might decide to stay at $Firm$ 0 if she can use her superior bargaining power with respect to $Firm$ 0 to negotiate a better deal than she would with $Firm$ i. However, this case seems unlikely given that it would be in the best interest of all parties to continue negotiating, and, furthermore, our conclusions regarding investment would still hold even if this were to be the case.

(V_I^0). For the second region (Θ_0^+), the derivative of the second integral in (9) is smaller than V_I^0 (from equation 1). For the third "set of regions" (Θ_i^- $\forall$ i), the derivative of the third (sum of) integral in (9) is larger than V_I^i (from equation 1). Finally, since the fourth part of (9) is zero, its derivative is clearly less than V_I^i.

Thus, Cases II and IV contribute to underinvestment (significantly so in Case IV), while Case III introduces an incentive to overinvestment (and Case I is first-best). While it appears that overall $Firm$ 0 will be likely to underinvest under the liquidated damages remedy, it is possible for the firm's optimal investment to be aligned with the first-best solution since the overinvestment incentives associated with Case III could offset the underinvestment incentives due to Cases II and IV, in an expected value sense.

By increasing the magnitude of the liquidated damages penalty D or the contracted wage P_0, the probability that $\theta \in \Theta_i^-$ may increase to the point where the increased incentive to overinvest (due to Case III) and the decreased incentive to underinvest (smaller regions for Cases II and IV) lead to the first-best solution. However, the value of D or P_0 may have to be quite large to achieve this solution, and as pointed out in the previous section with no renegotiation, if W is judgement proof or cannot borrow to finance an up-front payment (to offset the high wage P_0), this solution would be infeasible. In contrast, as we shall now see, the scope of a covenant to compete can be set such that first-best investment is attained even when W is judgement proof or has borrowing constraints.

4.3. **Covenant not to Compete.** As pointed out earlier, a CNC can be viewed as a hybrid of specific performance for the subset of firms $i \in \Omega$, and liquidated damages (where $D = 0$) for the complement subset of firms $i \in \Delta$. In the analysis in the prior two sections, we have seen that specific performance leads to overinvestment, while liquidated damages tends to lead to underinvestment. We will show that by designing the appropriate hybrid of specific performance and liquidated damages through the choice of n, the scope of the CNC, we can create a contract where the over- and under-investment incentives balance each other out and lead to the first-best investment solution.[10]

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[10]There are two other hybrid remedies that could also be considered. The first would be a variant of the liquidated damages rule where there are two different levels of liquidated damages, one for $i \in \Delta$ and one for $i \in \Omega$. The second would be a variant of the CNC, where $D > 0$ for $i \in \Delta$. To the extent that deferred compensation such as unvested stock option grants represents a form of liquidated damages in that they are forfeited when an employee leaves a company, these more complex hybrid rules may provide some insight into the co-existence of CNCs together with deferred compensation.

   As in the last section, we divide Θ up into regions or cases that must be analyzed separately:

$$Case\ I: \qquad\qquad V^0 = \max_i\ V^i\ and\ \max_{i\in\Delta}\ V^i < P_0 \qquad\qquad (\theta \in \Theta_0^-)$$

$$Case\ II: \qquad\qquad V^0 = \max_i\ V^i\ and\ \max_{i\in\Delta}\ V^i > P_0 \qquad\qquad (\theta \in \Theta_0^+)$$

$$Case\ III: \qquad \max_{i\in\Delta}\ V^i > \max_{i=0,i\in\Omega}\ V^i\ and\ \max_{i\in\Delta}\ V^i < P_0 \qquad (\theta \in \Theta_i^{\Delta-})$$

$$Case\ IV: \qquad \max_{i\in\Delta}\ V^i > \max_{i=0,i\in\Omega}\ V^i\ and\ \max_{i\in\Delta}\ V^i > P_0 \qquad (\theta \in \Theta_i^{\Delta+})$$

$$Case\ V: \qquad \max_{i\in\Omega}\ V^i > \max_{i=0,i\in\Delta}\ V^i\ and\ \max_{i\in\Delta}\ V^i < P_0 \qquad (\theta \in \Theta_i^{\Omega-})$$

$$Case\ VI: \qquad \max_{i\in\Omega}\ V^i > \max_{i=0,i\in\Delta}\ V^i\ and\ \max_{i\in\Delta}\ V^i > P_0 \qquad (\theta \in \Theta_i^{\Omega+})$$

Cases I-IV. These four cases are virtually identical to Cases I-IV for liquidated damages, other than the fact that $D = 0$ and there is a restriction that $i \in \Delta$ (recall that $\Delta = n+1, \ldots, N$). The implications for investment at $t = 0$ are thus the same as we saw in the previous subsection: Case I is consistent with first-best investment, Cases II and IV will lead to underinvestment, and Case III will lead to overinvestment. The size of these four regions will not be identical to those under liquidated damages. The fact that $D = 0$ will tend to decrease Θ_0^- and increase Θ_0^+ relative to the corresponding liquidated damages regions, but the restriction that $i \in \Delta$ will have the opposite effect. Also, $\Theta_i^{\Delta-}$ and $\Theta_i^{\Delta+}$ will be smaller subsets of θ values than were Θ_i^- and Θ_i^+ due to the restriction that $i \in \Delta$.

Case V. This case is similar to the scenario under specific performance where $\max_i\ V^i < P_0$. The firm must initiate renegotiation in order to get W to work for $i = argmax_j\ V^j$ ($i \in \Omega$ in this case). $Firm\ 0$ will obtain its share of the renegotiation surplus $S = \max_i\ V^i - V^0$, such that its profit will be $V^0 - P_0 + \pi_0 S$. As in earlier analysis, this will be achieved through a severance payment from $Firm\ 0$ that will make it better off than if W had worked for the firm. As with specific performance, the outcome for $Firm\ 0$ under this scenario provides an incentive for the firm to overinvest since on the margin it gets a higher return from this investment than under the first-best case.

Case VI. In this scenario, $\max_{i\in\Omega}\ V^i > \max_{i=0,i\in\Delta}\ V^i$ and $\max_{i\in\Delta}\ V^i > P_0$. W is free to go to work for $Firm\ k$, where $k = argmax_i V^i, i \in \Delta$, and, absent renegotiation, would choose to do so given the $V^k > P_0$. However, it is in all parties'

best interest that W work instead for $Firm\ j$, where $j = argmax_i V^i, i \in \Omega$. W can enter negotiation with $Firm\ j$ with an offer in hand from $Firm\ k$ of $P_k = P_0 + \pi_W(V^k - P_0)$. She will then be able to obtain an offer from $Firm\ j$ of $P_j = P_k + \pi_W(V^j - P_k)$. As in Case IV of the liquidated damages section above, $Firm\ 0$ will see no return to its investment since W will leave and $Firm\ 0$ will not be able to negotiate for a share of the surplus.

The Investment Decision. As in the case of other remedies, the value to $Firm\ 0$ of W's output will be a probability-weighted average over all θ values. In the case of a CNC, there are effectively $4N + 2$ regions (since Cases III-VI apply for each $i = 1, \ldots, N$), though some of these subsets of Θ may be null based on the parameters of the different value functions, V^i. Relative to the first-best case, the sensitivity of $Firm\ 0$'s value to its investment level I is optimal for $\theta \in \Theta_0^-$, but higher in the regions identified in Cases III and V, and lower for Cases II, IV and VI. The sensitivity of $Firm\ 0$'s expected value to the investment level I is a weighted-average of the sensitivities in these regions, and thus may be either the same, higher or lower than first-best depending on the probability of θ being in each of the regions, as well as the magnitude of the deviation of the investment sensitivities from first-best in each of the regions. While the parameters of the V^i functions are exogenous, the CNC can be designed such that its scope, n, can lead to first-best investment incentives.

Proposition 1. *If N is infinitely large, there exists some $0 < n < N$, such that Firm 0's optimal investment under a CNC will be the first-best level of I^{FB}.*

Proof. If $n = 0$ (i.e. W is free to go to work for any other firm), then $I < I^{FB}$ since . If $n = N$ (i.e. the CNC restricts W from seeking employment at any other firm), then $I > I^{FB}$. By the Intermediate Value Theorem, if N is infinitely large such that α_i and β_i are continuous over i, there exists some n for which $I = I^{FB}$. $\square$

While Proposition 1 is precise only when N approaches infinity, for practical purposes it implies that the over- and under-investment problems associated with liquidated damages and specific performance remedies, respectively, can be mitigated, and essentially eliminated, by specifying a CNC in the contract between W and $Firm\ 0$. By increasing the scope of the CNC (i.e. the number of firms for which W is restricted from working for), there will be a greater incentive to overinvest, and a lower incentive to underinvest, and these can be made to balance each other off in an expected value sense. Unlike in the case of liquidated damages, this is done without requiring a large damages penalty that may not be enforced by the courts.

5. Legal Implications

Our model provides a tentative basis for a normative assessment of the legal enforcement of CNCs. We found that CNCs can yield performance outcome and investment incentives that are superior to those produced by specific performance and liquidated damages. We also showed that, where renegotiation is cheap, the parties have contracting incentives to draft CNCs with inefficiently broad scope that causes overinvestment. Given the plausibility of the assumption that renegotiation costs between employer and worker are low, these two results justify the approach of courts in most states to enforce CNCs only to the extent that they protect a legitimate interest of the employer and are in this light reasonable in scope. (e.g. Malsberger, ed., 1996).

Judges do not invoke the justifications we identify in this paper when they enforce CNCs. Consistent with the academic impression of CNCs, judges emphasize the value in protecting an employer's investment by preventing the movement of the employee to a competitor rather than by compelling a transfer from the new employer. The courts' protection is strongest when the employer's investment is in trade secrets, confidential information and customer lists or relations. Only a few states enforce CNCs to protect general skills training. (Decker (1985) pp 82-3, Trebilcock (1986), Lester (2001)). The predominant judicial concern, therefore, is with the loss of rivalrous [11] goods to a competitor, rather than the loss of investment payoffs. In contrast, investment externalities drive our model rather than shifts in competitive advantages.

The judicial distinction drawn between protectible trade secrets and customer lists on the one hand, and nonprotectible general training on the other, is difficult to justify in another respect as well. The former category consists of disembodied assets: they may be transferred to a competitor without requiring that the worker change her employment. A severe sanction on quitting may not be sufficient to deter the worker's disclosure or sale of $Firm$ 0's trade secrets to $Firm$ j. CNCs might be valuable in deterring the sale of trade secrets by bolstering the effect of internal sanctions in $Firm$ 0. Given a CNC, the worker cannot avoid these sanctions by leaving and joining $Firm$ j. However, this justification fails to explain why CNCs would operate any more effectively than specific performance or high liquidated damages.

If a court finds a legitimate interest, it enforces a CNC only if there is a reasonable relationship between the protection of that interest and the duration and scope of the covenant. In some cases, the courts police an overly broad CNC by enforcing only their "blue pencil" revision of the contractual CNC. The case law indicates a judicial appreciation of the incentives of employers and workers to agree to inefficiently

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[11]See (Hyde (1998), citing Romer (1990))

broad and long-term covenants. Very long or unlimited time periods, and very broad or unlimited geographical areas, are rarely upheld. Yet, what the courts find reasonable tends to exhibit only weak links to investment incentives. One might say that geographic restrictions seem to prevent employers from extracting quasi-rents from other employers who would not benefit from the workers' skills because they have limited local value. Time restrictions might similarly prevent employers from extracting quasi-rents from other employers who would not benefit from the workers' training that is time-sensitive. Yet, even along these dimensions, the courts rely largely on rules of thumb rather than the degree to which the investment is specific or general. For example, Whitmore (1990) reports that covenants appear most likely to be enforced if their time limits are two years or less, their geographical restrictions are fewer than 34 miles, and activity restrictions are narrow.

Finally, several commentators have suggested that the success of Silicon Valley is related to the existence of legislation in California that precludes courts from enforcing covenants not to compete, other than in sales or dissolution of businesses. They emphasize the virtues of high-velocity labor markets (Hyde (1998) and Gilson (1999)). In contract economics terminology, their focus is on the ex post performance efficiencies: workers (along with their knowledge and training) are free to move where they are most valued. In contrast, the authors who defend CNCs are most concerned with setting optimal investment incentives (e.g. Rubin and Shedd (1981) and Trebilcock (1986)). Neither group admits the possibility of renegotiation. Low-cost renegotiation is plausible between an employer and worker who have a relationship and share much information. Low-cost renegotiation allows for the movement of workers even in the face of CNCs. And, CNCs can protect the value of investment through a negotiated transfer from the new employer rather than by blocking the movement of the worker.

The refusal to enforce covenants not to compete is difficult to justify under our model. Practitioners suggest that deferred compensation, including delayed vesting of stock options, may discourage the movement of workers between employers in California. Yet, deferred compensation has the same effect as liquidated damages in our analysis. First, if the amount that needs to be deferred is high, the capital constraints of the worker may preclude this solution. Second, even if the deferral can be renegotiated, it is indiscriminate in externalizing investment costs to all alternative employers and consequently shares this disadvantage with conventional liquidated damages.

6. Conclusions and Extensions

The classic challenge in the economics of contracts is the dual optimization of ex post performance outcomes and ex ante investment incentives when significant actions and states of the world are not verifiable. The tension between the two objectives prevents conventional contract terms, such as price, quantity and remedies for breach, from achieving the social (first-best) optimum. This paper adds a new and relatively simple mechanism to the solutions that have been advanced to date. The significant defining characteristic of the covenant-not-to-compete is that (in contrast to both damages or specific performance) it is typically enforced by injunction and is contingent on the worker's choice among alternative employment. When it can be renegotiated to yield the ex post efficient performance outcome, the scope of the CNC can be set so as to yield an optimal balance of investment incentives. The problem in that case is that the parties have contracting incentives to agree to an inefficiently broad.

The model and insights into CNCs might be extended in several directions. First, employees also invest in their human capital and subsequent work should explore their incentives in model with bilateral investment, particularly if the assumption that $Firm$ 0 cannot perfectly commit not to terminate the worker is relaxed. Second, one might examine the effect of costly, but not prohibitively costly, renegotiation on the choice among remedies. Third, future analysis might allow for a wage that is not fixed and which may be tied to a verifiable variable that is partially correlated with the state of the world.

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