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Ties that Truly Bind: Noncompetition Agreements, Executive Compensation, and Firm Investment

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We study the effects of noncompetition agreements by analyzing time-series and cross-sectional variation in the enforceability of these contracts across US states. We find that tougher noncompetition enforcement promotes executive stability. Increased enforceability also results in reduced executive compensation and shifts its form toward greater use of salary. We further show that stricter enforcement reduces capital expenditures per employee. These results are consistent with a model in which enforceable noncompetition contracts encourage firms to invest in their managers' human capital. On the other hand, our findings suggest that these contracts also discourage managers from investing in their own human capital and that this second effect is empirically dominant. (JEL D86, G31, J33, J62, K12)

1. Introduction

For most firms, the human capital of their employees is a core asset, but it is one over which they cannot exercise full ownership. Noncompetition agreements (also known as covenants not to compete) are contracts that restrict workers from joining (or forming) a rival company, and they represent one of the most important mechanisms binding employees to a firm. In this article, we make use of time-series and cross-sectional variation in noncompetition enforceability across the states of the United States to analyze the effects of these agreements. We find that increased enforceability does, in fact, reduce executive mobility. Increased enforceability also results in lower executive compensation and shifts its form toward a heavier reliance on salary. We further show that tougher noncompetition enforcement reduces capital expenditures per employee. We demonstrate that these findings are consistent with an incomplete contracting model that has the following three features: enforceable noncompetition contracts encourage firms to invest in their managers' human capital, the contracts discourage managers from investing in their own human capital,

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and managers' investments have a greater effect than those of the firm. Our empirical and theoretical results show that noncompetition regulations help to determine optimal firm choices on a wide set of issues, including executive pay, the stability of the managerial team, and firm investment strategy.

The inalienability of human capital (Hart and Moore 1994; Diamond and Rajan 2000) is universally accepted in developed economies as a basic personal right. This right, however, restricts the ability of a manager to make certain commitments to a firm; it may be regarded, essentially, as a form of legally mandated contractual incompleteness. The extent of noncompetition enforceability in a jurisdiction determines the scope of this incompleteness. We present a theoretical framework that applies insights from the incomplete contracting literature (e.g., Grossman and Hart 1986; Hart and Moore 1990) to study the effects of varying noncompetition enforcement. We then test the implications generated by the theory. Although the theory of incomplete contracts is well developed, there have been relatively few tests of its predictions; our work contributes to the empirical literature on incomplete contracting (Baker and Hubbard 2003, 2004; Feenstra and Hanson 2005).

We consider two contrasting theoretical models. In the first model (Model A), we study the effects of noncompetition enforceability on a firm that is deciding whether to make a noncontractible partially firm-specific investment in the human capital of its manager. We show that increased enforceability encourages the firm to invest, which makes it more likely that the manager will remain with the firm. The firm's investment raises the manager's human capital, and we demonstrate that this implies that the optimal contract will grant the manager a higher expected compensation in a high-enforcement jurisdiction. The optimal contract will also have a greater performance-linked (and smaller fixed) component if enforceability is high. We also show that a firm in the high-enforcement jurisdiction is more likely to choose a form of production that is skill intensive because the managers in that jurisdiction have greater human capital. Model A is similar to that of Posner et al. (2004), though our results on executive compensation and on the optimal form of production are not the focus of their analysis.

We also analyze a second model (Model B) in which, in addition to the firm investment just described, managers also have the option to make a noncontractible investment in their own general human capital. We find that an increase in enforceability makes it less likely that managers will make their investment but, as in Model A, makes it more likely that firms will invest. Model B shares with Model A the implication that a manager in a high-enforcement jurisdiction firm benefits less from transferring to a new firm and hence is more likely to remain with his current employer. If, however, the manager's investment in his own human capital has a greater effect than the firm's, then Model B yields several predictions that differ from those of Model A. In Model B, the manager's human capital will be greater in the low-enforcement jurisdiction, and thus, the optimal contract will grant a higher expected compensation with a smaller tilt toward salary in that jurisdiction. Model B also suggests that it is the firm in the low-enforcement jurisdiction that is more likely to undertake

skill-intensive production because managers in that area will have more human capital.

We make use of data on state regulations and the Execucomp database of executive compensation to test the predictions of Models A and B by analyzing the effects of noncompetition enforceability. We first show that noncompetition are quite commonly utilized; we find that 70.2% of firms use them with their top executives. We then perform two types of tests. Our time-series tests consider changes in noncompetition enforceability law that took place in Texas, Florida, and Louisiana. These tests employ firm fixed effects to analyze the impact of the legal shifts, controlling for all firm-specific variables. Our cross-sectional tests analyze differences in enforceability across all states. We argue that noncompetition law is particularly important to firms with substantial within-state competition since covenants not to compete typically have limited geographic scope and are easiest to enforce in the same legal jurisdiction. We then use the interaction between enforceability and the extent of in-state competition as a measure of the power and relevance of noncompetition law for a given firm. We include state fixed effects in our cross-sectional tests to control for differences between states unrelated to noncompetition enforceability, and we also control for industry effects.¹

Our first finding is that enforceability strongly reduces executive mobility, particularly decreasing the likelihood that a firm will experience a within-industry managerial transfer (either in or out). In a related result, we show that executives in high-enforcement jurisdictions have longer job tenures. Thus, covenants not to compete do serve to attach human capital assets to companies in the way predicted by both Models A and B.

Our analysis of executive compensation shows that it is both lower and more salary based in high-enforcement jurisdictions. These results hold both in time-series specifications with fixed effects at the executive level and in the cross-sectional regressions. The findings support Model B and suggest that the role of noncompetition agreements in discouraging managerial investment may be substantial. In addition, these results indicate that the regulatory environment can have an important effect on compensation levels and complement the recent empirical literature on optimal executive contracts (Gibbons and Murphy 1992a; Kole 1997; Hermalin and Wallace 2001; Gillan et al. 2005).

Both Models A and B predict that managers from high-enforcement jurisdictions will benefit less from transferring to a new firm. In support of this prediction, we find that managers in firms in high-enforcement areas receive relatively smaller compensation increases when they transfer firms. These managers also tend to assume lower ranked positions in their new firms relative to those who transfer from low-enforcement areas.

Our work draws a link between managerial incentives and compensation and firm investment strategy (Gibbons and Murphy 1992b; Oyer 1998). Models A

1. In previous empirical work on noncompetition enforceability, Stuart and Sorenson (2002) linked noncompetition law to local business founding rates and Kaplan and Stromberg (2003) found that venture capitalists frequently require entrepreneurs to sign noncompetition agreements.

and B make contrasting predictions about the effects of nonenforceability on the likelihood that firms will engage in skill-intensive production. We use the capital intensity of production as a first proxy for skill-intensive production. Controlling for fixed effects at either the firm (time-series analysis) or the industry and state (cross-sectional analysis) levels, we find that noncompetition enforceability reduces capital investment per employee, which is consistent with Model B. Our findings indicate that low-enforcement jurisdictions have a comparative advantage in funding capital-intensive production. We also make use of research and development (R&D) investment as a second proxy for skill-intensive projects but find mixed results. We further find that firm performance improves more over the course of a CEO's tenure in low-enforcement jurisdictions, which suggests that executives accumulate more human capital over time in those areas in the manner described in Model B.

Our empirical findings on executive mobility and posttransfer compensation are consistent with the idea (developed in Models A and B) that enforceable noncompetition agreements encourage firms to make investments in their managers' human capital. Our results on the level and form of executive compensation and on the capital intensity of production, however, support the argument (analyzed in Model B) that enforceable covenants not to compete discourage managers from investing in their own human capital and that managerial investments have a greater impact than those of firms. Our findings linking enforceability to mobility and to the performance effects of CEO tenure also favor Model B over alternative theories that do not focus on the human capital investment implications of noncompetition agreements. Overall, the evidence is that noncompetition agreements do bind human capital to firms, but in doing so, they change the quality of that capital.

We find no evidence that the enforceability regime has a general effect on either firm market to book ratios or profitability. There are three natural explanations for these results. The first is that the negative managerial incentive effects of requiring enforceable covenants not to compete may roughly balance the benefits. (This is consistent with the less than 100% adoption of noncompetition contracts that is observed in high-enforcement jurisdictions.) The second is that enforceable noncompetition contracts may yield benefits to individual firms but may also generate offsetting negative externalities by restricting labor mobility. The third is that noncompetition agreements may affect firms' investments in both physical capital and R&D in a manner that roughly balances the impact of these two forms of investment on overall performance.

The remainder of the article is organized as follows. Section 2 describes the theoretical framework. Section 3 details the data, and we outline the empirical strategy in Section 4. The results are analyzed in Section 5, and we conclude in Section 6.

2. Model

Noncompetition agreements are contracts signed by employees and firms that prohibit employees from joining (or forming) a competing firm. The agreements

usually specify a time period and geographic location within which the employee agrees not to compete with his current employer. Employees from senior managers to salespeople may be required to sign a covenant not to compete, and an agreement accepted at the time of hiring will typically continue to hold throughout the employment relationship and will extend beyond the end of the relationship for a contractually specified period. As we discuss in Section 4, the enforceability of noncompetition agreements varies substantially across the states of the United States. In high-enforceability jurisdictions, courts are willing to implement agreements of long duration and wide geographical scope, even if employees entered into such contracts with no reciprocal compensation other than employment. In low-enforceability jurisdictions, it can be very difficult to enforce any noncompetition agreement at all.

The property rights literature (e.g., Grossman and Hart 1986; Hart and Moore 1990, 1994) examines the effects of incomplete contracts on the willingness of economic actors to make investments. In this section, we apply the insights of that literature to study the specific case of one legally mandated form of contractual incompleteness: the refusal of certain jurisdictions to enforce noncompetition contracts. We explore the impact of noncompetition enforceability on executive mobility, the form and level of executive compensation, and the type of production in which firms choose to engage. We present two models. In Model A, we analyze the effects of the enforceability of noncompetition contracts on the decision of a firm whether to make an investment in the human capital of its employee. This model is similar to that of Posner et al. (2004), though we develop results on the level and type of executive compensation and on the mode of production that they do not consider. In Model B, we also allow the manager to make an investment in his own human capital.² In the following sections, we provide a general description of the two models. More details and formal proofs are given in Appendix A. We describe tests of the implications of these two models in Section 5.

2.1 General Model Framework

We model a labor production game with two companies and a manager. The manager is matched to a company in a labor market as described below. A matched company-manager pair can then together produce output.

2.1.1 Noncompetition Contracts. In the model, a noncompetition contract binds a manager not to leave a company for its competitor, without the company's permission. We will consider two equilibria: one in which the companies are located in a jurisdiction in which noncompetition contracts are enforced by

2. Models A and B present simplified theoretical frameworks for ideas that are developed in several models of incomplete contracts. For example, Almazan et al. (2003) considered the effects of both firm and employee human capital investments on the formation of industrial clusters. Fulghieri and Sevilir (2006) analyzed the relationship between employees' investments in their own human capital and innovation.

the courts and a second in which the companies are located in a jurisdiction in which they are not.

2.1.2 Labor Market. In Period 0, the manager is randomly assigned to a company. For convenience, we will refer to the company to which the worker is initially assigned as the firm and we will refer to the other company as the competitor. The firm may offer the manager a noncompetition contract, along with a signing bonus, which the manager is free to accept or reject.

In Period 1, public information arrives about the quality q of the match between the worker and the firm. The quality \hat{q} of the manager match to the competitor is also revealed in Period 1. After the public information is reported, the manager may receive an offer to join the competitor. In Period 2, the manager makes a final decision about which company to join (perhaps in exchange for a signing bonus), the company offers him a production contract, production occurs, and final payoffs are made. We assume that q and \hat{q} are nonnegative and identically distributed, and they may be either correlated or uncorrelated.

2.1.3 Production. The Period 2 profit generated by a company-manager pair depends on the quality q' of the company-manager match and the effort e exerted in Period 2 by the manager. We assume that if a manager has a match of quality q' and exerts effort e , then he will generate profit x , where x is a normal random variable with mean $q'e$ and standard deviation σ . The profit x is observable, but effort e is not. Exerting effort is costly to the manager: we assume that the manager must bear a cost of e^2 when he exerts effort e . A company without a manager will produce nothing.

2.1.4 Production Contracts, Preferences, and Bargaining. After a manager has joined a company in Period 2, the company may offer him a production contract that links compensation to output. For simplicity, and to generate clear empirical implications, we consider linear contracts of the form $ax + b$. We assume that companies are risk-neutral, whereas managers are risk-averse with negative exponential utility $U(w) = -\exp(-\rho w)$. In Period 2, the firm and its competitor both require the services of a single manager, so the manager may bargain over any surplus that will be created by his production. A manager who has not signed an enforceable noncompetition contract will negotiate with the company that most values his services.³

2.1.5 Optimal Linear Production Contracts. In Period 2, after a final manager-company match has been arranged, the company offers the manager a production contract of the form $ax + b$ to motivate him to exert effort. A higher incentive component a will induce the manager to provide more effort, but it also raises the risk of the manager's compensation. The manager

3. The bargaining model is detailed in Section A.1 of Appendix A.

will only accept the production contract if it offers him a nonnegative certainty equivalent (for he can always choose not to work for any company at all), so the company may also have to provide a salary component b to convince the manager to participate in production. (Constraining b to be nonnegative has no effect on the results.)⁴

2.1.6 Information Structure. At Time 0, neither the manager, the firm, nor the competitor knows the quality of the manager-company matches. Match quality is publicly revealed in Period 1 for both the firm and its competitor.

2.2 Model A: Firm Investment in Manager Human Capital

Firm investments in manager human capital, which may take the form of training, permitting the manager (at some cost to the firm) to engage in human capital-improving projects or the revelation of trade secrets, are highly vulnerable to the departure of the manager. This model describes the role of enforceable noncompetition contracts in facilitating these investments and thereby building manager human capital.

2.2.1 Firm Investment. We assume that at Period 0, after the firm and manager have agreed on whether a noncompetition agreement will be signed, the firm may make an investment in the human capital of its manager (Becker 1993). (This option is not available to the competitor.) We presume that the investment has cost to the firm I and raises the firm-manager match quality from q to $q + \lambda$ for some $\lambda > 0$. The investment is partly firm specific but may also increase the manager's general human capital: we assume that it raises the quality of the manager's match with the competitor by $\delta\lambda$, for $\delta \in [0, 1]$. The investment is assumed to be nonverifiable by the courts.

If the required investment is very high, then firms will not make the investment, irrespective of the noncompetition contract regime, whereas if the required investment is very low, the opposite will be true. We consider the more interesting case of an intermediate level of required investment.

Assumption A. The cost of the investment is greater than the expected benefit to the firm for firms without an enforceable noncompetition agreement. The cost of the investment is less than the expected benefit to both the firm and the firm and manager jointly in firms with enforceable noncompetition agreements.

Assumption A implies that noncompetition enforceability is required for investment by the firm.

Result 1A. In the equilibrium in the enforcement jurisdiction, the firm offers a signing bonus in exchange for a noncompetition agreement with the

4. The optimal linear production contract is derived in Section A.2 of Appendix A.

manager. The manager accepts this agreement, and the firm makes the investment in managerial human capital. In the equilibrium in the nonenforcement jurisdiction, the firm does not make the investment.

A formal statement of Assumption A and a proof of Result 1A are given in the Section A.3 of Appendix A.

2.3 Model B: Manager Investment in Human Capital

A manager who has signed a noncompetition agreement that limits his future ability to negotiate a favorable compensation scheme will be less willing to make investments in his own human capital. These investments may include accepting foreign work assignments (Carpenter et al. 2001), cultivating social contacts in other firms, and taking on leadership positions in industry associations (Meversen 1994). Firms that require noncompetition contracts may discourage human capital investments by their managers and thereby end up with low-quality employees. Firms may be willing to accept this cost if firm investments in human capital (which are only made in the presence of noncompetition covenants) are relatively more efficient than manager investments. This model explores this trade-off.

2.3.1 Manager and Firm Investment. At Time 0, after the firm and manager have determined whether a noncompetition contract will be signed, the manager may make an investment in his own human capital. This investment has a cost to the manager and raises the quality of the manager: the investment is in general human capital and improves the manager's quality in the same way for both the firm and its competitor. The investment is assumed to be nonverifiable. If the manager declines to invest in his own human capital, the firm may make an investment, which we assume is the same as the investment described in Model A. For simplicity, we presume that either the manager or the firm may invest (but not both), and the manager is granted the first option to invest. We assume that the manager's investment has cost J to the manager himself and raises his human capital by $\gamma > \lambda$. We discuss below the motivation for this assumption that the manager's investment has a greater effect than the firm's.

As before, we consider the case in which investment is moderately attractive.

Assumption B. The cost of investment is greater than the expected benefit to the manager for managers with an enforceable noncompetition agreement, and the cost of the investment is less than the expected benefit to the manager for managers without enforceable noncompetition agreements.

We also assume that the net benefit (i.e., benefits minus costs) of an investment made by the firm is greater than the net benefit of an investment made by the manager. In other words, managerial investments have a large effect,

but they are also very costly and are hence relatively less efficient than firm investments.

Assumption C. The net benefit to the firm and the manager of an investment made by the firm is greater than the net benefit to the firm and the manager of an investment made by the manager.

In Model B, we therefore presume that the manager's investment has a greater gross benefit ($\gamma > \lambda$) but that the firm's investment is more efficient and yields a greater net benefit (Assumption C). That is, the relative cost of the manager's investment outweighs its relative benefit, making it less efficient than the firm's investment. What motivates these specific assumptions? First, we note that the empirical evidence on the relative benefits and efficiencies of investments in general and firm-specific human capital is ambiguous.⁵ Given these mixed findings, there are three plausible regions of the parameter space:

1. Firm investments are more efficient and have greater impact on human capital.
2. Firm investments are more efficient, but managerial investments have greater impact on human capital.
3. Managerial investments are more efficient.

The first region described is covered in Model A.⁶ The second region is analyzed in Model B. In the third region, firms in neither jurisdiction will offer noncompetition agreements because these agreements discourage the efficient investment of the managers. This is true irrespective of whether firm or manager investments yield greater gross benefits—firms will seek managerial investment because it is most efficient. As a result, in the third region, there will be no differences between firms in enforceable and nonenforceable jurisdictions. We can therefore regard the third region as part of the null hypothesis that noncompetition enforceability has no impact on firm and manager behavior.

In this theoretical discussion, we will not take a stand on which of the three parameter regions is most likely to apply in practice. Instead, we view this as an empirical question to be addressed in our data analysis.

5. Pennings et al. (1998) showed that both general and firm-specific human capital matter for firm dissolution and fixed mixed results on their relative importance. Cooper et al. (1994) demonstrated that the general human capital of managers matters for firm performance. Almeida and Carneiro (2009) estimate that the average return to firm investments in training is zero, though it is positive for the group of firms that actually does provide training. For that subset of firms, they argue that the returns from firm training are comparable to those from investment in education, a form of general human capital.

6. For simplicity, Model A essentially assumes that $\gamma = 0$, but the results are analogous for any $\gamma < \lambda$: human capital is higher in the enforcement jurisdiction.

The assumptions in Model B yield an equilibrium in which the manager invests in the nonenforcement jurisdiction and the firm invests in the enforcement jurisdiction.

Result 1B. In equilibrium in the enforcement jurisdiction, the firm offers a signing bonus in exchange for a noncompetition agreement with a manager. The firm makes an investment and the manager does not. In equilibrium in the nonenforcement jurisdiction, the manager makes an investment and the firm does not.

A formal statement of Assumptions B and C and a proof of Result 1B are given in the Section A.4 of Appendix A.

2.4 Empirical Implications

We now consider the implications of the two models described above. For all the results below, we assume that the necessary conditions for Results 1A and 1B hold. Formal proofs of these results are given in Section A.5 of Appendix A.

Result 2. In both Models A and B, the firm in the high-enforcement jurisdiction is less likely to experience a manager transfer.

In both models, the firm in the high-enforcement jurisdiction is more likely to make an investment that makes the manager more valuable within the firm. Consequently, the result of the bargaining between the firm, the manager, and the competitor will more often result in the manager remaining with the firm. In Model B, the manager in the firm in the nonenforcement regime invests in his general human capital, but this has no effect on his relative value to the firm and to its competitor.

We note here that since noncompetition agreements can only restrict manager movements to competitors, Result 2 in particular predicts fewer within-industry transfers for the firm in the high-enforcement jurisdiction.

We now turn to the question of expected compensation.

Result 3. In Model A, the manager in the enforcement jurisdiction has higher expected compensation than the manager in the nonenforcement jurisdiction. In Model B, the manager in the nonenforcement jurisdiction has higher expected compensation.

The intuition for Result 3 is that in both Models A and B, the firm invests in the manager's human capital only in the enforcement jurisdiction. In Model B, the manager invests in his own human capital only in the firm in the nonenforcement jurisdiction, and the manager's investment is presumed to have a greater effect than the firm's. As a result, the manager in the enforcement jurisdiction has greater human capital in Model A and less human capital in Model B relative to the manager in the nonenforcement jurisdiction. We show in Appendix A that this implies that the manager in the enforcement jurisdiction will receive higher expected compensation in Model A and lower expected

compensation in Model B. We also show that the manager in the enforcement jurisdiction will have a compensation contract tilted away from salary in Model A and tilted toward salary in Model B. This intuition is formalized in Result 4.

Result 4. In Model A, the optimal production contract offers an expected ratio of salary to total compensation that is higher for the manager in the nonenforcement jurisdiction than for the manager in the enforcement jurisdiction. In Model B, the optimal production contract offers an expected ratio of salary to total compensation that is higher for the manager in the enforcement jurisdiction.

In both models, the firm-specific investments made by firms in the enforcement jurisdiction decrease the relative benefits to managers from transferring to the competitor. Therefore, managers from the nonenforcement jurisdiction derive greater gains from transferring, in general. Managers from both jurisdictions, however, transfer only when their gains from doing so are above a threshold. (In this model, with no direct transfer costs, the threshold is 0.) That is, any improvement in firm-manager match quality that is observed in the data is conditional upon its exceeding the threshold for transferring. The following condition ensures that the higher average transfer gains of managers in the enforcement jurisdiction do not raise so many additional managers with low gains above the threshold than the overall average gain of those above the threshold falls.

Assumption D. We presume that $q = \alpha + \beta_1$ and $\hat{q} = \alpha + \beta_2$, where β_j , $j \in \{1, 2\}$ are independent of α and identically distributed. We also assume that α , β_1 , and β_2 have log-concave and nonnegative continuously differentiable density functions.

The truncated normal, uniform, exponential, and a number of other densities are log-concave (Bagnoli and Bergstrom 2005).⁷

Result 5. Under Assumption D, in both Models A and B, the average increase in match quality for managers who transfer companies is higher for managers in the nonenforcement jurisdiction.

For our last empirical implication, we consider a modification to the basic model framework presented above. In particular, in the second period, we allow firms to select a skill-intensive mode of production that, for a manager-company match of quality q' , generates profits with mean $s(q')e$ rather than $q'e$ as in the basic model. We presume that skill-intensive production is beneficial for high-quality managers but harmful for low-quality managers: there is a q_1 such that $s(q') \geq q'$ for $q' \geq q_1$ and $s(q') \leq q'$ for $q' \leq q_1$. Result 6 describes the optimal use of skill-intensive production.

7. Log concavity essentially restricts the probability weighting of managers with transfer gains at the threshold relative to the weighting of those above the threshold.

Result 6. In Model A, the company in the enforcement jurisdiction is more likely to choose skill-intensive production. In Model B, the company in the nonenforcement jurisdiction is more likely to choose skill-intensive production.

Skill-intensive production will be chosen by companies with high-quality managers. In Model A, these companies are in the enforcement jurisdiction, and in Model B, the opposite is true.

2.5 Alternative Theories

Alternative theories may share some of the empirical implications of Models A and B. In this section, we briefly outline two such theories and indicate some of their distinguishing predictions.

2.5.1 Pure Bargaining. Models A and B analyze the bargaining and human capital investment implications of noncompetition enforcement. In a pure bargaining model without investment, managers in high-enforcement areas may experience slower compensation growth and may choose different projects simply due to their weaker bargaining positions. Models A and B do, however, have several implications that differ from those of a model of bargaining alone. First, if renegotiation costs are low, then in a pure bargaining model, executive mobility should not depend on noncompetition enforceability; managers should work for the firm at which they are most productive, with ex post transfers to their original firm if they signed an enforceable noncompetition agreement. Second, average compensation will not vary across jurisdictions in the bargaining model: managers will demand up-front compensation for signing enforceable noncompetition agreements if it leads to lower ex post pay. Third, the bargaining model does not make predictions about what form the compensation will take. Fourth, Models A and B describe differential patterns of human capital accumulation over time in enforcement and nonenforcement jurisdictions. The pure bargaining model does not have this feature.

2.5.2 Selection. In a selection model, managers who know their quality is high choose to work for firms in low-enforcement jurisdictions, so that their future compensation will not be constrained. Like Model B, the selection model predicts that manager human capital quality will be lower in high-enforcement regions and that compensation will therefore be lower and less performance based in those areas. The selection model does have several implications, however, that differ from those of Model B. First, as in the pure bargaining model, if renegotiation costs are low, the selection model does not predict lower mobility in high-enforcement areas. Second, the selection model does not suggest that human capital will improve over time in different ways in different jurisdictions, as occurs in Model B. Third, some of the tests we describe in our empirical study analyze the impact of changes in noncompetition enforceability on given executives. Model B predicts that these executives will invest differently in their human capital after such a change, whereas the selection

model has little to say about the impact of a shift in regulations on a fixed manager.

3. Data

To test the predictions detailed in Section 2, we require data on executive job transfers, executive compensation, firm R&D spending, and firm capital investment. Our data source for details on executives is Standard and Poor's Execucomp database. Execucomp includes compensation data on the five most highly paid executives for 2610 large publicly traded US firms. (Execucomp also backfills some data for executives who rise to the top five, so some firms have reported data for more than five executives in a given year.) Data are available for 1992–2004. Executive-specific identifiers allow us to track managers who move from one firm to another.

We supplement the Execucomp data with firm-level data from Compustat on R&D investment and capital expenditures. We proxy for firm age by considering the firm's first appearance in Compustat. We use the location of firms' headquarters in implementing our empirical strategy (as discussed below in Section 4), but Execucomp and Compustat report only the current and not the historical headquarters location. We match the Execucomp data set to the Compact Disclosure database to determine historical headquarters locations. One hundred and thirty (5.0%) of the firms shifted locations during the sample period. Data on state unemployment rates and per capita personal income are provided by the Bureau of Economic Analysis. Our last data source is 10kwizard.com, which provides Securities and Exchange Commission (SEC) filings for the sample companies. Summary statistics on these data are reported in Table 1.

4. Empirical Strategy

The central empirical challenge is to generate a measure of the enforceability of noncompetition agreements across the states of the United States. To this end, we construct an index of noncompetition enforcement.⁸

4.1 Noncompetition Enforcement Index

Malsberger (2004) is the central resource describing noncompetition law in the 50 US states and the DC. We consider 12 questions analyzed by Malsberger for each jurisdiction and assign 1 point to each jurisdiction for each question if the jurisdiction's enforcement of that dimension of noncompetition law exceeds a given threshold. Possible totals therefore range from 0 to 12, and we scale the totals by dividing by 12 to generate a score from 0 to 1. A complete list of

8. Our study applies the insight of the law and finance literature (La Porta et al. 1997, 1998, 1999, 2000; Beck et al. 2003) that legal institutions can have a strong effect on the structure and workings of the firm. In our setting, however, regulations vary at the state level within a given country. Recent studies exploiting cross-state analysis include Bebchuk and Cohen (2003), Jolls (2004), and Wald and Long (2007).

Table 1. Summary Statistics

Variable	Mean	Median	SD
Increased enforceability	0.07	0	0.25
Enforceability	0.32	0.33	0.18
In-state competition	0.10	0.01	0.18
3-year total return	13.04	11.29	33.63
Firm age	21.23	16.00	15.53
Book value	1538.43	369.21	4650.71
Sales	3312.71	760.75	9850.77
State unemployment rate	5.56	5.40	1.50
State personal income per capita	27,371.04	26,862.00	5327.60
Within-industry transfers	0.03	0	0.18
All transfers	0.08	0	0.32
Executive job tenure	14.69	9.00	12.82
Compensation level	2,173,953.72	932,828.00	6,606,673.16
Compensation growth	0.33	0.10	1.01
Salary/compensation	0.38	0.34	0.2344
Options granted?	0.73	1.00	0.45
Reload options granted?	0.02	0	0.13
Research and development spending	123.40	14.68	502.22
Capex per employee	325,226.73	13,131.31	5,176,368.54

Book value, market value, sales, assets, and research and development spending are expressed in millions of dollars. Compensation growth is truncated at -90% and +900%.

questions and thresholds is given in Appendix A. State totals are reported in Table A1. We provide here a broad overview of the basic issues in noncompetition law and provide some examples illustrating differences among the laws of varying states.

The first question is whether noncompetition agreements are generally enforceable in any respect. The focus of our study is on the effects of noncompetition agreements signed by executives who are employed by large firms, so we ignore laws that apply to noncompetition arrangements concluded in the context of the sale of a business. (Those are permitted to some degree in every jurisdiction.) Almost all states allow some form of covenant not to compete between employers and employees, though California and North Dakota do not. For this question, all jurisdictions that save these two are awarded a score of 1.

Even though most states allow some form of noncompetition agreement, there is great variation in the types of contracts permitted. For example, the nature of what a firm can claim as a legitimate protectable interest depends on the jurisdiction. In some states (e.g., New Hampshire), a firm can restrict an employee from future independent dealings with customers with whom he had direct contact but cannot prevent him from seeking business from other customers once he leaves the firm. In other states (e.g., Georgia), a noncompetition agreement can ban an employee from trading with any current clients of the firm, even if the employee has no contact with the client.

States also have different requirements for the compensation that an employee must receive in order for the noncompetition contract to be valid. In some states (e.g., Wisconsin), at-will employment is sufficient consideration. In other states (e.g., Texas), some ancillary compensation must be granted to the employee at the time the agreement is made.

The geographical and time restrictions that are considered reasonable can be quite different in different jurisdictions. In some states (e.g., Missouri), an agreement will be enforced in a region even if the firm has no current business in that area. In other states (e.g., Virginia), the noncompetition agreement must usually be restricted to the firm's current markets. Some states (e.g., Pennsylvania) will routinely enforce 3-year covenants, whereas others (e.g., Florida) presume that covenants more than 2 years in length contracted upon outside a sale-of-business context are unreasonable. State laws also vary in determining whether employees are released from their contracts if they are fired.

In our empirical work, we consider the effects of both changes in the regulations of given states over time and cross-sectional differences in state laws. We note here that the enforcement of noncompetition agreements is governed by employment law, not corporate law, so the relevant jurisdiction is typically the one in which the employee works (Pentelovitch 2003; Malsberger 2004). Our study analyzes top executives at large firms, who will typically work at headquarters, so it is the headquarters location, not the state of incorporation, that we consider.⁹

4.2 Time-Series Changes in State Laws

Although laws governing the enforcement of noncompetition agreements are largely static, three states experienced significant shifts in the treatment of covenants not to compete during our sample period of 1992–2004.

4.2.1 Texas. In June 1994 in *Light v. Centel Cellular Co. of Tex.*, 883 S.W.2d 642, 644–45 (Tex. 1994), the Texas Supreme Court developed a new set of requirements that were needed for enforceability of noncompetition agreements. The ruling, in this important case that redefined the legal standards in the state, stated that a covenant not to compete must be “ancillary to or part of an otherwise enforceable agreement” between the employer and the employee. In other words, the employer must offer the employee some specific consideration in exchange for the noncompetition agreement, and continued at-will employment does not constitute acceptable consideration. Moreover, it must be that the covenant not to compete is designed to enforce the promises made

9. As discussed below in Section 4.3, there was some ambiguity during the sample period about which state's law governed cases in which an employee left a firm with a headquarters in one state and moved to a competitor with a headquarters in a different state. This adds noise to our estimation (though no systematic bias), but the state of incorporation, in any case, is rarely of significant importance.

by the employee as part of the agreement. This latter condition was a new requirement added by the court (Malsberger 2004), and it serves to make it substantially more difficult to enforce noncompetition agreements in Texas.¹⁰ The noncompetition enforcement index score for Texas is 5 before 1994 and 3 after the decision. The court also ruled that its interpretation of the law applied both retroactively to all agreements previously signed in Texas and prospectively to any future agreements.

4.2.2 Louisiana. The Louisiana Supreme Court radically changed the enforcement of noncompetition agreements in the state with its June 2001 ruling in *SWAT 24 Shreveport Bossier, Inc. v. Bond*, 808 So. 2d 294 (La. 2001). The court ruled that Louisiana's statutes on covenants not to compete only permitted contracts that restricted employees from setting up their own businesses in competition with a previous employer; employees could not be prohibited from joining a competing firm in which they held no equity interest. From the perspective of a manager of a large corporation, the *SWAT* ruling made noncompetition agreements significantly less enforceable in Louisiana; the relevant labor market opportunities for such a manager would typically lie with other large competitors. The ruling applied to all previous covenants not to compete. In 2003, the state legislature altered the law to permit noncompetition agreements barring employees from joining other firms in which they have no ownership interest.¹¹ The noncompetition enforcement index score for Louisiana is 0 during the period 2002–03 and 4 otherwise.

4.2.3 Florida. The change in law in Florida, by contrast with the above two cases, arose from the actions of the state legislature, not from a court. In late May 1996, the state legislature repealed the previous law governing covenants not to compete and replaced it with a new law. In addition to adding clarity to the rules governing noncompetition agreements, the new law strengthened employers' positions in three significant ways. First, the 1996 statute prohibits courts from considering the individual hardship that the noncompetition agreement will cause the former employee. This represents a dramatic change from the previous law that balanced the interests of the employer and the former employee (Malsberger 2004). Second, the 1996 law requires courts to modify geographic or time restrictions that are overbroad rather than simply declaring the covenant unenforceable. Prior law allowed for such modifications but did not require them. This change made it easier for employers to write highly restrictive covenants without fear of their being overturned in court. Third, under the new law, there is a presumption of injury to the firm when a noncompetition agreement is violated. This enhances the firm's powers to get an injunction preventing its former employee from working for another company

10. Bundren (2005), Schueler and Solomon (2001), and Fowler (2002) detailed the significant effects of the *Light v. Centel* decision on Texas noncompetition law.

11. Terrell (2004) discussed the history of Louisiana noncompetition law.

(Gallo and Adler undated). The noncompetition enforcement index score for Florida is 7 before the 1996 law and 9 afterward. The new law was specifically stated to apply only to contracts signed after July 1996—previous contracts are governed by the law in effect at the time they were signed. The purely prospective change in Florida law differs from the prospective and retroactive changes in the law in Texas and Louisiana. When considering the impact of these various legal changes on executive compensation, we will take into account in our analysis below the fact that the Texas and Louisiana rulings abrogated some past agreements, whereas the Florida change in statute law served only to expand the scope for future agreements and had no effect on previous contracts.

We make use of these changes in the legal environment to generate a variable we label Increased Enforceability. We assume that the legal changes detailed above affected compensation and firm investment starting in the year following their occurrence. The variable therefore takes the value of 1 for firms in Florida in 1997–2004, takes the value of -1 for firms in Texas in 1995–2004 and for firms in Louisiana in 2002–03, and is set equal to 0 otherwise. Observations from these three states constitute 13% of the data. To avoid any possible selection effects, we only consider the effects of the legal shifts on the large majority (95%) of firms that did not change the state of their headquarters locations throughout the entire sample period. We use a simple three-level ($\{-1, 0, +1\}$) measure of the changes for the results reported in the article, but a measure based on differences in the nonenforcement index scores yields similar findings. The changes described above can be regarded as exogenous shocks to the legal environment from the perspective of any given firm. All the changes had substantial effects on the enforceability of noncompetition agreements. Since these legal changes affected firms in different states at different times, we are able to incorporate firm (or executive) fixed effects into our analysis. In our analysis of the level of R&D spending, for example, we consider the effect of the change in the legal environment on the R&D investment of a given firm. Firms in the states that did not experience any legal shifts serve as controls for any time-series variation in compensation levels that occurs nationwide.

Our econometric model considers the effect of Increased Enforceability on the following firm characteristics: executive transfers into and out of the firm, executive job tenures, level and composition of executive compensation, firm research and development spending, firm investment, and firm performance. The equation estimated is

$$\text{firm characteristic}_{it} = F(\text{Increased Enforceability, controls}_{it}) + \varepsilon_{it}, \quad (1)$$

where controls_i is a vector of controls for firm i in year t including a firm fixed effect and industry-year fixed effect and ε_{it} is an error term. We most often estimate linear models, though we also consider Poisson models. Given the small number of firm headquarters moves discussed in Section 3, state fixed effects are essentially subsumed by the firm fixed effects and are therefore omitted. We calculate robust standard errors clustered at the state level.

In some tests, we analyze the characteristics of a given executive (such as growth in compensation) and estimate

$$\text{executive characteristic}_{jt} = F(\text{Increased Enforceability, controls}_{jt}) + \varepsilon_{jt}, \quad (2)$$

where controls_{jt} is a vector of controls for executive j in year t including an executive fixed effect and ε_{jt} is an error term.

4.3 Cross-sectional Variation in State Laws

To supplement the time-series evidence, we also consider cross-sectional variation in legal environments across states. One approach would be to simply use the nonenforcement index scores without any state fixed effects, but that analysis would presume that the differences in, for example, compensation levels between firms in different states are entirely driven by noncompetition law. That is clearly not true; states vary in numerous ways, not all of which can be specified, so state fixed effects are required. Just using the nonenforcement index scores along with state fixed effects would essentially replicate the time-series approach described above. Instead, we argue that the level of the nonenforcement index will have a different effect on firms that face different competitive environments. We focus on the extent of in-state competition since it is in-state competition that is most affected by a covenant not to compete. This is true for two reasons:

1. As discussed above, enforceable noncompetition agreements typically have a restricted geographical scope, and this scope is often a state or a part of a state, for example, a county, a city, or a 10 or 50 mile radius around the place of business (Malsberger 2004).
2. During the sample period, it was considerably more difficult to enforce a noncompetition agreement across state boundaries than within a state. Managers from states with tough noncompetition enforceability on several occasions accepted offer from California firms and asked California courts to void their noncompetition agreements. California courts typically agreed, arguing that the contracts were not enforceable in California.¹²

We thus propose the interaction between the noncompetition enforcement index and the level of in-state competition as a measure of effect of

12. The governing case is *Application Group, Inc. v. Hunter Group, Inc.*, 61 Cal. App. 4th 881, 72 Cal. Rptr. 2d 73 (1st Dist. 1998) in which the Maryland-based employee of a Maryland firm who had signed a noncompetition agreement moved to California to work for a California-based competitor. A California court voided the noncompetition agreement based on California law. This case also showed that courts would not be bound by a choice-of-law provision in the contract asserting under which state law the noncompetition agreement was to be enforced. *Keener v. Covergys Corp.*, 342 F.3d 1264 (11th Cir. 2003) and *Advanced Bionics Corp. v. Medtronic, Inc.*, 29 Cal. 4th 697, 707, 128 Cal. Rptr. 2d 172, 179 (2002) confirmed that state courts have a very limited ability to enforce noncompetition agreements when employees move to other states. Cheskin and Lerner (2003) detailed the difficulties previous employers face in enforcing noncompetition covenants across state lines. It is clear that it is easiest and least costly to enforce noncompetition agreements when the executive remains in state.

enforceability. For firms with considerable in-state competition, an increase in the noncompetition index will substantially reduce the probability that an executive will leave the firm and join a competitor. For firms with little in-state competition, an increase in enforceability will have little impact, for the two reasons given above. We also incorporate state fixed effects in the analysis to control for statewide variables other than noncompetition enforceability. We are thus comparing the relative effects of noncompetition enforcement.

We cannot use firm fixed effects in this specification because most states (and hence most firms) experience no time-series variation in the noncompetition index. Thus, relative to the time-series variable, the cross-sectional measure sacrifices the precision of firm fixed effects but makes use of variation in noncompetition enforceability across more firms and more states. The econometric model we use to estimate the cross-sectional effects of differences in state laws is

firm characteristic_{kt}

$$= F((\text{Enforcement score}) \times (\text{in-state competition}), \text{controls}_{kt}) + \varepsilon_{kt},$$

where (in-state competition) is the fraction of total industry sales (excluding those of the firm itself) generated by in-state competitors,¹³ controls_{kt} is a vector of controls for firm *k* in year *t* including (in-state competition) and state-year and industry-year fixed effects and ε_{kt} is an error term. We calculate robust standard errors clustered at the state level. The level of the nonenforcement index is almost perfectly collinear with the state fixed effects and is therefore not included in equation (3). (It is not completely collinear only because of the time-series variation that we analyze in the method described in Section 4.2.) We interpret the coefficient on Enforcement × (In-state competition) as a measure of the effects of noncompetition enforceability since it reflects the impact of enforceability on the firms within a given state for which it should matter most.

4.3.1 Is the Level of Noncompetition Enforceability Exogenous? It is clear that a firm can choose the location of its corporate headquarters. Our study of the effects of cross-sectional variation in noncompetition enforcement is therefore subject to the following objection: perhaps firms that plan to have a corporate policy requiring noncompetition contracts locate in jurisdictions that will enforce these contracts. Any results we may find linking noncompetition enforceability to, for example, executive mobility may thus be driven simply by sorting in the types of firms that choose to locate in different areas.

13. Industry sales are calculated using the full universe of Compustat firms with the same four-digit industry NAICS code, and in-state sales are those of firms with headquarters in the state. Our results are robust to using a measure of competition based on the number of competitors. The (in-state competition) measure may also be viewed as agglomeration, in which case this specification tests for whether noncompetition agreements matter more in agglomerations. I thank an anonymous referee for this point.

We do not view this objection as particularly forceful for two reasons. First, the business location literature has emphasized the effects of natural resources (Ellison and Glaeser 1999), unionization levels, input-output relationships (Ellison et al. 2009), state taxes (Bartik 1985), founder's home location, energy costs (Carlton 1983), and environmental regulation on the siting decisions of firms. The local noncompetition enforcement regime has not been proposed as a first-order determinant of firm location nor do we think it a likely candidate. Moreover, the time-series results in Section 5 show that noncompetition enforceability has no effect on value or performance for affected firms, so it seems unlikely that it is driving firm location decisions. We also find no evidence that the time-series changes in enforceability that we observe led to any change in the rate of in- or out-migration of firms to the relevant states.

Second, the sorting argument presumes that differences in noncompetition law do have an effect or else there would be no reason for firms to sort into states based on varying enforceability. That is, the sorting argument can suggest at most that any effects we find are a combination of treatment effects from differences in the laws and sorting effects. Our specification, however, is designed to negate sorting effects. Suppose, for example, that firms that have no interest in noncompetition contracts locate in California (a low-enforcement state), whereas firms that do want noncompetition agreements locate in Massachusetts (a high-enforcement state). We make use of state fixed effects in all our cross-sectional regressions that completely net out such effects.

The type of sorting for which we cannot control is sorting that takes place across the enforceability and within-state competition measures simultaneously. If there are firms that are particularly averse to executive mobility, they may locate in states that have both high enforceability and little in-state competition since these features should reduce managerial transfers. Result 2 predicts that high enforceability reduces executive transfers. Our interaction variable can essentially be thought of as

$$(\text{Enforcement} - \text{mean}(\text{Enforcement})) \\ \times (\text{in-state competition} - \text{mean}(\text{in-state competition})).$$

Stability-seeking firms locating in high-enforcement, low-in-state competition states will generate negative values for this interaction but will presumably have low executive mobility. This would bias the results away from a finding consistent with Result 2 (since our empirical strategy regards a positive value for the interaction as indicative of high-enforceability effects), and similar arguments apply to the other predictions. In other words, any sorting effects are likely to be quite small and, in any case, will disfavor finding evidence in support of the predictions of the theoretical framework.

The time-series tests offer clear exogenous shocks to individual firms, but the cross-sectional tests provide additional evidence using variation across all states.

5. Results

5.1 Do Firms Use Noncompetition Agreements for Top Executives?

To answer this question, we selected a random sample of 500 Execucomp firms and conducted searches in 10kwizard.com of the 10-K, 10-Q, and other SEC filings of these firms. For 351 of the firms (70.2%), we found evidence of noncompetition agreements between the firm and its top executives. In many cases, firms supplied explicit employment agreements detailing the terms of these noncompetition covenants. In other cases, the firms simply specified that certain top officers had signed noncompetes. Firms need not, of course, disclose this information, so 70.2% should be regarded as a lower bound for the fraction of firms that employ these covenants.¹⁴ This finding is consistent with previous research on the frequency of noncompetition provisions in contracts with entrepreneurs (Kaplan and Stromberg 2003), CEOs (Gillan et al. 2005), and technology sector workers (Jauhainen et al. 2003). A logistic regression of whether a firm has disclosed the use of noncompetition agreements on the level of the enforceability index in the firm's state yields a coefficient estimate of 1.313 with a *t* statistic of 3.14 (robust standard errors, clustered at the state level). A one-standard deviation increase in the enforceability index from its mean raises the probability of disclosed use of noncompetition agreements from 0.705 to 0.754. Although this evidence is essentially descriptive, lacking the state and industry (or firm) controls we will use in our formal analysis, it suggests that noncompetition agreements are widely used and that their use increases with state enforceability. The choice by firms to use an agreement, however, is endogenous, and the relevance of an agreement will vary with the level of enforceability. For example, we find that 58% of the California firms in our sample report using noncompetition agreements, despite the extremely limited legal scope of those agreements. (Kaplan and Stromberg [2003] found a similar fraction in their sample of California entrepreneurs.) The more important question is the extent to which noncompetition covenants are enforceable. Consequently, having established the common use of noncompetition agreements, our analysis now turns to the central issue of the effects of plausibly exogenous variation in enforceability on employment patterns, executive compensation, and project selection.

5.2 Are Noncompetition Agreements Effective?

We apply our empirical strategy to test the predictions listed in Section 2. Result 2 shows that in both Models A and B, the frequency of executive job transfers (especially within-industry) is decreasing in the level of noncompetition enforceability faced by the firm.¹⁵ To test this prediction, we first analyze

14. We did not include in this accounting nonsolicitation agreements that bind departing executives from soliciting other employees at their previous firm to join them at their new firm. That is, we found that 70.2% of firms used noncompetition agreements that restricted executives from working at competitors.

15. In the theoretical framework, in the enforcement jurisdiction, the firm experiences fewer out-transfers and its competitor experiences fewer in-transfers. Overall, there are fewer transfers.

the set of job transfers. Execucomp provides information on the top executives, and unique executive identifiers allow us to establish that executives have left one firm and joined another. Using 10kwizard.com searches, we also track all the executives who have left the Execucomp database for other public firms. We exclude all transfers that result from mergers and spin-offs. We also exclude transfers between subsidiaries of the same parent. In total, we find 1883 transfers between independent firms over the sample period.¹⁶ We define a transfer to be within-industry if it is between two firms that have primary businesses in the same four-digit industry North American Industry Classification System (NAICS) code. For firms outside Compustat without NAICS codes, we match industries at the four-digit Standard Industrial Classification (SIC) code level. We observe 637 within-industry transfers. For each firm, we calculate the total number of transfers both into and out of the firm.

The first column of Table 2 reports results for the regression of the number of within-industry transfers on Increased Enforceability, firm fixed effects, industry-year fixed effects (subsuming year fixed effects), and a set of controls. The controls include for each firm-year the firm's 1- and 3-year total returns, the log of firm equity book and market values, the log of firm sales, and the log of firm assets. We also include as additional controls for the condition of the local business cycle the log of the state unemployment rate and the log of the state personal per capita income in the year. This regression explores the effects of time-series changes in state laws (specification (1)). The estimation is via Poisson fixed effects regression as it is for all the regressions reported in this table. The coefficients are expressed as intensities relative to a base level (equivalent to no effect) of 1. Reported t statistics compare coefficients to 1. We find that increased enforceability of noncompetition agreements significantly ($t = -3.15$) reduces within-industry transfers, as suggested by Result 2. (Robust t statistics corrected for clustering at the state level are reported.) A shift to a tougher enforcement regime reduces the arrival intensity of within-industry transfers by 47%. A change in state law to greater enforceability leads to a reduction in within-industry transfers that is both economically and statistically significant.¹⁷

We next consider the impact of cross-sectional variation in the noncompetition enforcement index (specification (3)). The second column of Table 2 reports results for the regression of the number of within-industry transfers on $\text{Enforcement} \times (\text{In-state competition})$, $(\text{In-state competition})$, state-year and

Implicitly, the model assumes that the firm and its competitor are governed by the same law, but this need not be true in reality. The discussion in Section 4.3, however, shows that the laws of both the previous and the new employers are relevant in noncompete cases. That suggests that an increase in enforceability will reduce both out- and in-transfers for a firm.

16. Due to the nature of the data, we observe fewer transfers in 1992–93, but this is accounted for by our year fixed effects.

17. The coefficients (with t statistics in parenthesis) for the increased enforceability in individual states are as follows: Texas 0.65 (–3.60), Florida 0.34 (–2.52), and Louisiana 0.73 (–0.37). The joint hypothesis that these coefficients are 0 may be rejected at the 1% level.

Table 2. Executive Mobility

Dependent variable (no. of observations)	Within-industry transfers (20,965)	Within-industry transfers (20,474)	Between-industry transfers (20,965)	Between-industry transfers (20,474)	All transfers (20,965)	All transfers (20,474)
Increased enforceability	0.5297** (-3.15)		0.7481 (-1.20)		0.6495** (-4.92)	
Enforce x (In-state Comp.)		0.0248** (-3.03)		2.3202 (0.75)		0.3489 (-1.34)
In-state competition		7.6845** (7.52)		1.0090 (0.03)		2.1954** (4.23)
1-year total return	1.0000 (0.53)	1.0000 (1.24)	0.9596 (-0.77)	0.9992 (-1.19)	1.0000 (0.15)	1.0000 (0.46)
3-year total return	0.9970* (-1.75)	0.9926** (-5.13)	0.9964 (-1.20)	0.9931** (-2.67)	0.9965* (-1.67)	0.9924** (-4.62)
Log (firm age)		1.2144** (3.70)		1.2929** (3.19)		1.2627** (4.23)
Log (book value)	0.9620 (-0.35)	1.1541 (1.31)	1.0277 (0.41)	0.9757 (-0.41)	1.0185 (0.33)	1.0335 (0.54)
Log (market value)	1.0103 (0.10)	0.9817 (-0.24)	0.9041 (-0.96)	0.9168 (-1.40)	0.9225 (-0.84)	0.9353 (-1.13)
Log (sales)	1.2972* (1.92)	1.2638** (2.58)	0.8936 (-0.61)	1.1724* (1.79)	1.0603 (0.46)	1.2102** (2.78)
Log (assets)	1.0870 (0.45)	0.9356 (-0.46)	1.3141 (1.19)	1.2388** (2.17)	1.2004 (1.28)	1.1205 (1.21)
Log (state unemployment)	0.7915 (-0.47)		1.0939 (0.35)		0.9799 (-0.08)	
Log (state personal income)	14.7891 (1.31)		6.7132* (1.67)		10.3232** (2.10)	
Estimation method	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson
Firm fixed effects?	Yes	No	Yes	No	Yes	No
State-year fixed effects?	No	Yes	No	Yes	No	Yes
Industry-year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	State	State	State	State	State	State

The regressions are estimated via Poisson fixed effects as described, with *t* statistics (comparing coefficients to 1) reported in parentheses using robust "sandwich" SE.
 **, * Significant at the 10% and 5% levels, respectively.

industry-year fixed effects, and the previous set of firm controls, along with log of firm age. (Log(Firm Age) and (In-state competition) were omitted in the previous regression due to the presence of firm fixed effects—these variables exhibit very little time-series variation for a given firm, especially in the presence of year fixed effects.) State unemployment rates and per capita incomes are subsumed in the state-year fixed effects in this specification. Firms that produce more than 90% of their industry's sales (1.9% of the sample) are excluded from this regression (and the analogous regressions throughout the article) because they face so little within-industry competition that variation in the (in-state competition) measure will not reflect substantive differences in the same-industry employment opportunities of their executives. We find that the coefficient on $\text{Enforcement} \times (\text{In-state competition})$ is negative and significant ($t = -3.03$), providing further support for Result 2. (Robust t statistics corrected for clustering at the state level are reported.) Tough enforcement of noncompetition agreements serves to particularly reduce within-industry transfers for firms with substantial in-state competition, as hypothesized. A one-standard deviation increase in the interaction between the enforcement index and the level of in-state competition reduces the intensity of the arrival of within-industry transfers by 20.8%.

The third and fourth columns display results from regressing between-industry transfers on Increased Enforceability and $\text{Enforcement} \times (\text{In-state competition})$, respectively. Both the time-series and the cross-sectional measures of noncompetition enforcement have statistically insignificant effects on between-industry transfers. Although the group of companies within a firm's industry likely does not perfectly correspond to the firm's set of competitors that can be excluded as potential employers by a noncompetition agreement, our empirical findings show that the industry matching performs quite well in describing the scope of covenants not to compete. Results for all transfers (both within-industry and between-industry) are exhibited in the fifth and sixth columns of Table 2. The effects are economically smaller than for the within-industry regressions and are significant in the time-series regression but not in the cross-sectional analysis.

The results displayed in Table 2 establish that our measures of Increased Enforceability and Enforcement capture differences in the legal environment that have an important effect on within-industry executive mobility. Moreover, the results also suggest that our variables are not simply correlated with some endogenous measure of executives' general propensity to move since we show that Increased Enforceability and Enforcement reduce within-industry, but not between-industry, moves.¹⁸

18. The 47% reduction in within-industry mobility that we find is large, but its magnitude is consistent with other research. Marx et al. (2007) found that increased enforcement of noncompetition agreements in Michigan in the 1980s led to a 34% decrease in the mobility of inventors. Fallick et al. (2006) showed that the nonenforcement jurisdiction California has employee mobility that is 56% higher than other states in the computer industry, though they do not find any effect in other industries.

Result 2 suggests that executives should have longer job tenures in tough enforcement jurisdictions. Execucomp provides data on the start and departure dates for a subset of managers. We use these data to generate a record of completed job tenure lengths for these executives. We consider that an executive has departed a firm if Execucomp records his leaving date or if the executive appears as an employee of a different firm. Our time-series variable Increased Enforceability measures a change, so we consider its impact on the rate of departures (which is also a change). In the first column of Table 3, we report results from regressing via ordinary least squares (OLS) the number of departures in each firm-year on Increased Enforceability, firm fixed effects, and the standard controls. The coefficient is statistically significant, and we find that a shift to a higher enforcement regime reduces the rate of departures by 25% of the mean.

In the cross-sectional test, we study the effect of the Enforcement variable on observed job tenures (since both are levels). For each firm-year, we calculate the average completed job tenure across all executives for whom data are available. In the second column of Table 3, we display the results from regressing job tenures on $\text{Enforcement} \times (\text{In-state competition})$ and the usual controls. The coefficient is positive and significant ($t = 2.85$). (The tenure measure is highly correlated within firms, but our results are very similar when we cluster the standard errors at the firm level.) A one-standard deviation increase in $\text{Enforcement} \times (\text{In-state competition})$ increases job tenures by 16% of the mean. Overall, the results are supportive of Result 2. Noncompetition arrangements clearly reduce executive mobility and increase stability.

5.2.1 Robustness. In this section, we describe several untabulated robustness tests. The basic result that increased noncompetition enforceability reduces within-industry mobility continues to hold if the competition measure is logged or if it is calculated using payroll data from the census County Business Patterns for large firms (i.e., those with more than 1000 employees). It is in-state competition (interacted with enforceability) that drives the result, not another industry characteristic, such as local industry sales growth. Though California is the most represented state in the data (see Table A2 in Appendix A), the main finding is not driven by the California firms. The use of state fixed effects and the zero enforceability score for California imply that California firms do not contribute directly to the estimation of the coefficient on $\text{Enforcement} \times (\text{In-state competition})$; California firms serve as controls and allow for more precise estimation of the other coefficients. Throughout the empirical results, omitting the California firms has only a minor effect on the coefficient estimates for $\text{Enforcement} \times (\text{In-state competition})$. The results are also robust to omitting the most represented industry, Depository Credit Intermediation. Overall, the effect appears quite uniform in the various components of the enforcement index; regressing within-industry mobility on the interactions of the score on each question with (In-state competition) yields 10 negative coefficients out of 12. The hypotheses that the interaction coefficients are

Table 3. Executive Tenure

Dependent variable (no. of observations)	Departures (20,965)	Tenure (5628)
Increased enforceability	-0.0669** (-2.77)	
Enforce \times (In-state Comp.)		40.7413** (2.85)
In-state competition		-6.6291** (-2.32)
1-year total return	0.0000 (-0.46)	-0.0001 (-0.54)
3-year total return	-0.0012** (-3.26)	-0.0268** (-2.16)
Log (firm age)		3.7479** (7.16)
Log (book value)	0.0023 (0.13)	2.0251** (2.63)
Log (market value)	-0.0611** (-3.72)	1.5686** (2.47)
Log (sales)	-0.0258** (-2.08)	0.3038 (0.37)
Log (assets)	0.0567** (2.66)	-1.7209 (-1.44)
Log (state unemployment)	-0.1226** (-2.78)	
Log (state personal income)	0.5310** (4.41)	
Estimation method	OLS	OLS
Firm fixed effects?	Yes	No
State-year fixed effects?	No	Yes
Industry-year fixed effects?	Yes	Yes
Clustering	State	State
R ²	0.24	0.56

The regressions are estimated via OLS as described, with *t* statistics reported in parentheses using robust "sandwich" SE.

**, **Significant at the 10% and 5% levels, respectively.

jointly 0 and that the sum of the coefficients is 0 are both rejected at the 1% level.

5.3 Executive Compensation

We now turn to the issue of executive compensation. Result 3 shows that Models A and B provide competing hypotheses about the effect of noncompetition agreement enforcement on the level of compensation. We first consider the impact of a shift in legal enforcement. As discussed in Section 4.2, the change in Florida's laws differed from the changes in Texas and Louisiana. In Florida, the law change in 1996 in favor of tougher enforcement was purely prospective and had no effect on preexisting contracts. In Models A and B, managers who work for the firm in enforcement jurisdiction accept signing bonuses in Period 0, whereas managers who are employed in the

nonenforcement jurisdiction receive their compensation at a later period. This suggests that Florida executives may have negotiated higher compensation in 1997 (the year after the law change) in exchange for signing new, more restrictive covenants not to compete. In future years, these covenants may have limited growth in compensation. By contrast, the abrogating of all historical contracts that occurred in Texas and Louisiana would be expected to raise salaries immediately. We thus define a new variable *Increased Enforceability*' that is equal to *Increased Enforceability*, except that it is equal to 0 for Florida firms in 1997 and takes the value of 1 for Florida firms from 1998 to 2004.

The *Increased Enforceability*' variable measures a change, so we study its effect on the change in compensation. We define compensation to be the sum of the following Execucomp data items: salary, bonus, other annual, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total. We analyze compensation at the individual executive level, and we truncate the growth in compensation at -90% and $+900\%$. (This eliminates 1.5% of the data.) In the first column of Table 4, we report results from regressing compensation growth on *Increased Enforceability*', executive fixed effects, and the previous set of firm controls (specification (2)). We find a negative and significant ($t = -3.10$) coefficient on *Increased Enforceability*' (robust t statistics corrected for clustering at the state level are reported). For a given executive, a shift to a tougher enforcement regime reduces compensation growth by 8.2%, which is 25% of the mean growth rate. This economically significant decrease in the growth rate of compensation, using individual executive fixed effects, is strong evidence in support of Model B, indicating that increased enforcement of noncompetition agreements reduces compensation growth. The individual fixed effect controls indicate that this finding is evidence in favor of the direct effect of noncompetition enforceability on a given executive; there is no selection effect like the one detailed in Section 2.5.2 that is at work in this regression. Regressing log growth rates on *Increased Enforceability*' yields similar (unreported) results in the untruncated sample.

We also consider the effect of the level of Enforcement on the level of compensation. Since the *Enforcement* \times (*In-state competition*) variable does not vary within a firm, we are unable to make use of firm (or executive) fixed effects. We regress the log of average compensation across the top five executives for each firm-year on the level variable *Enforcement* \times (*In-state competition*), (*In-state competition*), state-year and industry-year fixed effects, and the usual firm controls. As displayed in the second column of Table 4, we find that *Enforcement* \times (*In-state competition*) significantly ($t = -2.82$) reduces compensation (robust t statistics corrected for clustering at the level of the state are reported). A one-standard deviation increase in *Enforcement* \times (*In-state competition*) reduces the log of compensation by 1.2% of the mean. (By comparison, a one-standard deviation increase in 3-year total return increases the log of compensation by 0.7% of the mean.) This result provides further cross-sectional support for Model B in addition to the previous time-series evidence: top executive compensation is lower in high-enforcement jurisdictions.

Table 4. Executive Compensation

Dependent variable (no. of observations)	Compensation growth (74,068)	Log of compensation level (16,337)
Increased enforceability'	-0.0821** (-3.10)	
Enforce \times (In-state Comp.)		-1.3575** (-2.82)
In-state competition		0.3870** (2.28)
1-year total return	0.0000 (1.51)	0.0000** (2.99)
3-year total return	0.0029** (6.08)	0.0017** (5.60)
Log (firm age)		-0.0484** (-3.94)
Log (book value)	-0.0491 (-1.27)	-0.0605** (-4.35)
Log (market value)	0.1272** (5.93)	0.2255** (11.98)
Log (sales)	0.0351 (1.15)	0.0000
Log (assets)	-0.0579 (-0.91)	0.0000
Log (state unemployment)	0.1095 (1.13)	
Log (state personal income)	-0.4850 (-1.05)	
Unit of observation	Executive	Firm
Estimation method	OLS	OLS
Executive fixed effects?	Yes	No
State-year fixed effects?	No	Yes
Industry-year fixed effects?	Yes	Yes
Clustering	State	State
R^2	0.28	0.70

The regressions are estimated via OLS as described, with t statistics reported in parentheses using robust "sandwich" SE.

*,**Significant at the 10% and 5% levels, respectively.

We have shown that compensation is lower in high-enforcement jurisdictions, and we now consider whether the form of compensation differs with non-competition enforceability. Result 4 shows that Model A predicts that salary should constitute a smaller proportion of overall compensation in areas in which covenants not to compete are more strictly enforced, whereas Model B predicts the opposite. To test the time-series implication of these predictions, we regress via OLS the difference between salary growth and overall compensation growth on Increased Enforceability', executive fixed effects, and the standard set of firm controls. As exhibited in the first column of Table 5, we find a positive and significant ($t = 2.44$) coefficient on Increased Enforceability': a shift to greater enforcement of noncompetition agreements leads to greater growth in salary relative to other forms of compensation. This fixed

Table 5. Form of Executive Compensation

Dependent variable (no. of observations)	Salary growth – compensation growth (73,899)	Log of Salary compensation (16,337)	Options granted? (74,997)	Options granted? (16,337)	Reload options? (74,997)	Reload options? (16,337)
Increased enforceability ^a	0.0474** (2.44)		0.0391* (1.88)		–0.2422** (–3.14)	
Enforce \times (In-state Comp.)		1.3401** (3.66)		–1.4775 (–1.41)		–0.74829* (–1.92)
In-state competition		–0.4329** (–3.37)		0.6107** (2.41)		0.17037 (1.58)
1-year total return	0.0000 (–1.41)	0.0000** (–3.58)	0.0000** (2.01)	0.0000* (1.79)	–0.0003 (–1.26)	0.00000 (–0.64)
3-year total return	–0.0032** (–6.36)	–0.0021** (–7.12)	0.0000 (0.23)	–0.0013* (–1.96)	0.0023* (1.90)	–0.00010 (–0.66)
Log (firm age)		0.0904** (7.72)		–0.0591 (–1.52)		0.00243 (0.14)
Log (book value)	0.0481 (1.19)	0.0653** (3.16)	0.0470** (2.89)	–0.0447 (–0.74)	0.0246 (0.52)	–0.00600 (–0.33)
Log (market value)	–0.0979** (–4.43)	–0.2103** (–10.52)	0.0191 (1.53)	0.1825** (4.08)	0.1272** (3.38)	0.04775** (3.02)
Log (sales)	–0.0232 (–0.73)	0.0620** (2.52)	0.0374** (2.00)	0.0257 (0.47)	0.0566 (0.61)	–0.01149 (–0.78)
Log (assets)	0.0737 (1.06)	–0.1531** (–4.71)	–0.0337 (–1.52)	0.0402 (0.62)	–0.1183 (–1.18)	0.01446 (0.69)
Log (state unemployment)	0.1545** (4.47)		–0.0996** (–3.06)		–0.1407 (–1.37)	
Log (state personal income)	–0.0049 (–0.05)		0.0485 (0.61)		0.1142 (0.41)	
Unit of observation	Executive	Firm	Executive	Firm	Executive	Firm
Estimation method	OLS	OLS	OLS	OLS	OLS	OLS
Executive fixed effects?	Yes	No	Yes	No	Yes	No
State-year fixed effects?	No	Yes	No	Yes	No	Yes
Industry-year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	State	State	State	State	State	State
R ²	0.28	0.49	0.28	0.18	0.38	0.15

The regressions are estimated via OLS with *t* statistics reported in parentheses using robust "sandwich" SE.

*,**Significant at the 10% and 5% levels, respectively.

effect finding provides evidence for Model B (and the result is not predicted by the selection model in Section 2.5.2). To test the cross-sectional implications of the predictions arising from Result 4, we regress the log of the ratio of salary to overall compensation on $\text{Enforcement} \times (\text{In-state competition})$, (In-state competition), and the standard controls. Column 2 of Table 5 shows that we find a positive and significant ($t = 3.66$) coefficient on $\text{Enforcement} \times (\text{In-state competition})$. The time-series and cross-sectional results provide consistent evidence in favor of Model B.

To further study the question of compensation composition, we consider whether firms provide any options to their executives. For each executive-year, we regress an indicator variable for whether the executive receives any option compensation on Increased Enforceability^a, executive fixed effects, and the standard controls. Although the dependent variable is binary, we again employ OLS estimation due to the multiple dimensionality of the fixed effects. (Logit is inconsistent in the presence of multiple fixed effects.) As displayed in Column 3 of Table 5, we find a weak significant effect (t statistic = 1.88) of Increased Enforceability^a on options granting. We also regress the number of top five executives receiving options on $\text{Enforcement} \times (\text{In-state competition})$,

(In-state competition), and the previous controls. In Column 4 of Table 5, we report that the coefficient on $\text{Enforcement} \times (\text{In-state competition})$ is insignificant. Thus, although the total value of nonsalary compensation (as a proportion of total compensation) is increasing in noncompetition enforceability, we do not find strong and consistent evidence that enforceability affects whether or not firms use any options at all. In unreported results, we also find no evidence that the use of restricted stock in executive compensation varies with noncompetition enforcement.

The use of reload options in executive compensation received particular attention during our sample period (Dybvig and Loewenstein 2003). An executive who pays the exercise price for these options by selling currently held shares receives both shares and new reload options with a higher strike price but the same maturity as the original option. Dybvig and Loewenstein (2003) showed that, relative to standard options, reload options are more valuable and have higher deltas, but the two option types are otherwise somewhat similar. Reload options are designed to ensure that an executive's exposure to the stock price is not diminished by his selling previously owned shares in order to pay the exercise price on his options.¹⁹ As Result 4 makes clear, Model B suggests that compensating managers in a manner directly tied to stock price performance should be more important in low-enforcement jurisdictions, so we might expect a greater use of reload options in such areas. Model A predicts the opposite.

We regress a binary variable for whether an executive received any reload options in a given year on 'Increased Enforceability', executive fixed effects, and the usual controls. The estimation is by OLS. As exhibited in Column 5 of Table 5, the coefficient on 'Increased Enforceability' is negative and significant ($t = -3.14$). This is evidence for a direct effect of enforceability on a given executive. We also regress the number of top five executives who received any reload options in a given firm-year on $\text{Enforcement} \times (\text{In-state competition})$, (In-state competition), and the standard controls. The coefficient on $\text{Enforcement} \times (\text{In-state competition})$ is negative and weakly significant ($t = -1.92$). Both findings are consistent with the idea explored in Model B that maintaining a manager's exposure to his firm's stock price through the use of reload options is less important in high-enforcement jurisdictions.²⁰

19. Executives commonly liquidate most of the shares they receive upon exercising options (Ofek and Yermack 2000). Chen (2004) studied the role of options in encouraging executive retention.

20. The result of Dybvig and Loewenstein (2003) that reload options are worth more than standard options, combined with our finding that reload options are used more frequently in low-enforcement jurisdictions, strengthens our previous result on compensation composition. We showed that nonsalary compensation is larger in low-enforcement jurisdictions, using the Execucomp valuation measure that does not distinguish between reload and non-reload options. If reload options were valued properly, we would presumably find an even stronger result linking low-enforcement to high-nonsalary compensation.

5.4 Posttransfer Compensation

Result 5 states that both Models A and B predict that among the set of managers who transfer, those from the nonenforcement jurisdiction will enjoy greater increases in match quality due to the largely firm-specific human capital of managers in the enforcement region. To test this prediction, we first make use of compensation as a proxy for firm-manager match quality. We consider all transfers within the Execucomp database (compensation information is not available for managers who transfer out of Execucomp).

The time-series implication of Models A and B is that managers will accumulate relatively more firm-specific human capital after an increase in noncompetition enforceability. Testing the time-series implication of Result 5 therefore requires comparing managers who leave their firms before the regulatory shift with those who join their firms after the regulatory shift and then depart for a new firm. There are, however, fewer than 15 managers in the second group. Consequently, we are only able to test the cross-sectional implication of Result 5 that managers who depart firms in high-enforcement jurisdictions will receive relatively low-compensation increases at their new companies.

There are 912 transferring executives with compensation data available at both their previous and new firms. For each executive, we regress the log of the compensation he receives at his new firm on $\text{Enforcement} \times (\text{In-state competition})$, $(\text{In-state competition})$, the log of the compensation he received at his previous firm, his compensation rank at his previous firm (all those below the top five are assigned the sixth rank), state-year and industry-year dummies for both the previous and the new firms, and the full set of firm controls. As shown in the first column of Table 6, the coefficient on $\text{Enforcement} \times (\text{In-state competition})$ is negative and significant ($t = -3.22$). Relative to their previous compensation, executives who transfer from high-enforcement jurisdictions receive relatively lower pay increases. This finding supports Result 5. It is also interesting to note that the costs (e.g., renegotiation costs) of moving to a new company may plausibly be higher for executives who have signed noncompetition agreements, so they might be expected to switch firms only for very large compensation inducements. Despite this point, executives transferring from high-enforcement jurisdictions receive smaller compensation increases upon transferring. That suggests that renegotiation costs are not especially large. (We set these costs equal to zero in the theoretical framework, although the results are not sensitive to this assumption.)

It may be argued that executives transferring from high-enforcement jurisdictions are only able to do so when they are fired and that their lower posttransfer compensation reflects their involuntary termination from their previous firm. Against this point, we first note that in only nine states is a firing considered a justification for releasing an employee from a noncompetition covenant. Second, in the second column of Table 6, we report results from repeating the regression in the first column for the subset of managers who are hired as CEOs at their new firms. These managers are presumably much less likely to have been fired from their previous jobs. (Given the small size

Table 6. Posttransfer Compensation

Dependent variable (no. of observations)	Log (compensation) at new firm (912)	Log (compensation) at new firm (226)	Rank at new firm (770)
Enforce \times (In-state Comp.)	-13.5330** (-3.22)	-25.2526** (-3.30)	38.4642** (4.57)
In-state competition	2.5360** (2.40)	4.0465** (3.10)	-3.8926* (-1.78)
Log (compensation) at previous firm	0.6352** (3.84)	0.9908** (5.88)	-0.4254 (-1.62)
Previous rank	0.0923* (1.74)	0.2034** (3.02)	-0.0082 (-0.08)
1-year total return	0.0031** (2.32)	0.0049** (2.66)	-0.0030** (-3.03)
3-year total return	-0.0028 (-0.52)	-0.0039 (-0.78)	0.0200** (2.01)
Log (firm age)	0.0398 (0.44)	-0.1042 (-0.19)	-0.4636 (-0.95)
Log (sales)	0.1357 (0.29)	0.1485 (0.42)	0.1304 (0.63)
Log (book value)	-0.3147* (-1.76)	1.1048** (3.33)	0.8254** (2.44)
Log (market value)	0.2168 (1.38)	-0.5870** (-2.21)	-0.8911** (-2.65)
Log (assets)	-0.0351 (-0.05)	-0.1225 (-0.31)	-0.0760 (-0.20)
Estimation method	OLS	OLS	OLS
Sample	All	CEOs at at new firm	All
State-year fixed effects?	Yes	Yes	Yes
Industry-year fixed effects?	Yes	No	Yes
Industry fixed effects?	No	Yes	Yes
R ²	0.96	0.97	0.94

The regressions are estimated via OLS as described, with *t* statistics reported in parentheses using robust "sandwich" SE.

**, *Significant at the 10% and 5% levels, respectively.

of this sample, we use state-year and industry, rather than industry-year, fixed effects.) The coefficient on Enforcement \times (In-state competition) is significant for this set of managers as well.

As a last test, we consider the compensation rank of a manager as a second proxy for the quality of the manager-firm match. We regress the compensation rank on Enforcement \times (In-state competition), (In-state competition), his compensation rank at his previous firm, and the previously described set of controls. We report in the third column of Table 6 that the coefficient on Enforcement \times (In-state competition) is positive and significant ($t = 4.57$). Managers from firms in high-enforcement areas move to higher (i.e., worse) ranked positions in their new firms. This is further evidence in support of Result 5.

5.5 R&D Spending and Firm Investment

As described in Result 6, Model A predicts that an increase in noncompetition enforceability will lead to more skill-intensive production, whereas Model B predicts the opposite. To test these predictions, we consider two proxies for skill-intensive production: R&D spending and the capital intensity of production. R&D is an investment that should especially benefit from the presence of highly skilled managers. Model A suggests that the managers in the high-enforcement firm have higher human capital and are thus better suited to making R&D investments. (It is also the case that in Model A, the firms in high-enforcement jurisdictions may be more willing to invest in R&D because noncompetition agreements can protect the firms from the loss of their investments that would ensue if key managers depart.) Model B, by contrast, indicates that managers in low-enforcement jurisdictions will be more likely to make the investments in their own human capital that make success in R&D more likely. As a result, firms in low-enforcement jurisdictions should be more likely to invest in R&D rather than in other projects.

To test these competing hypotheses, we regress the log of 1 plus R&D spending on Increased Enforceability, firm fixed effects, and the standard firm controls from previous regressions. We include only firms with non-zero R&D spending. As reported in the first column of Table 7, we find an insignificant ($t = -0.22$) coefficient on Increased Enforceability. A shift to tighter enforcement of noncompetition agreements does not appear to change R&D investment.

We test the cross-sectional implications of Result 6 by regressing the log of 1 plus R&D spending (firms with zero R&D spending are again excluded, though the results are not sensitive to this) on $\text{Enforcement} \times (\text{In-state competition})$, (In-state competition), state-year and industry-year fixed effects, and the usual set of firm controls. We show in the second column of Table 7 that the coefficient on $\text{Enforcement} \times (\text{In-state competition})$ is negative and significant ($t = -2.89$). A one-standard deviation increase in $\text{Enforcement} \times (\text{In-state competition})$ reduces the log of 1 plus R&D spending by 4.2% of the mean. The time-series and cross-sectional results thus do not provide a consistent picture, though there is some evidence in favor of Model B and none in favor of Model A. Even though enforceability of noncompetition agreements may protect R&D intellectual property, we do not find that it promotes R&D investment. Model B suggests that requiring covenants not to compete discourages employees from making investments in their own human capital, which is crucial to R&D, so firms in enforcement jurisdictions pursue less of it. The empirical evidence is that this mechanism is at least enough to offset any effect that these agreements have in increasing the appeal of R&D to employers.

This result provides a new perspective on the discussion by Saxenian (1996) of the differences between the computer industries in California and Massachusetts. Saxenian describes the greater communication among Silicon Valley firms relative to those along Massachusetts's Route 128 and argues that this information-sharing advantage led to the success of the California firms. Gilson (1999) and Rajan and Zingales (2001) argued that differences in

Table 7. Research and Development and Capital Expenditures

Dependent variable (no. of observations)	Log of R&D spending (10,608)	Log of R&D spending (10,351)	Log of capex per employee (18,939)	Log of capex per employee (18,456)
Increased enforceability	-0.0071 (-0.22)		-0.1299** (-8.79)	
Enforce×(In-state Comp.)		-2.3904** (-2.89)		-1.4873** (-4.02)
In-state competition		0.5454** (2.63)		0.4838** (4.51)
1-year total return	0.0000** (-3.87)	0.0000** (-2.46)	0.0000** (-2.37)	0.0000** (-1.98)
3-year total return	-0.0021** (-5.83)	-0.0051** (-7.98)	0.0015** (6.64)	0.0008** (3.28)
Log (firm age)		0.0915** (2.54)		-0.1452** (-4.49)
Log (book value)	-0.0487** (-2.14)	-0.0832** (-3.44)	0.0988** (5.01)	0.0626** (2.74)
Log (market value)	0.0930** (5.77)	0.3361** (10.59)	0.0859** (4.66)	0.1778** (8.33)
Log (sales)	0.1403** (3.85)	-0.0629* (-1.72)	-0.0696 (-1.40)	-0.2675** (-5.98)
Log (assets)	0.4766** (9.59)	0.6601** (12.95)	0.0446 (1.19)	0.1467** (4.66)
Log (state unemployment)	-0.0868** (-2.06)		-0.0486 (-0.90)	
Log (state personal income)	0.1217 (0.74)		0.3172 (1.34)	
Estimation method	OLS	OLS	OLS	OLS
Firm fixed effects?	Yes	No	Yes	No
State-year fixed effects?	No	Yes	No	Yes
Industry-year fixed effects?	Yes	Yes	Yes	Yes
Clustering	State	State	State	State
R ²	0.98	0.88	0.87	0.73

The regressions are estimated via OLS, with *t* statistics reported in parentheses using robust "sandwich" SE.

***Significant at the 10% and 5% levels, respectively.

noncompete enforcement between the California and Massachusetts can explain organizational and cultural differences between firms in the two states. Our empirical findings, though they do not allow for definitive conclusions, may indicate that firms in low-noncompetition enforcement jurisdictions are better suited to make investments in R&D. This suggests that the success of Silicon Valley may in part be linked to California's public policy of not enforcing covenants not to compete. Our empirical findings, however, are not driven simply by a state-to-state comparison; there are, after all, many differences between states that are unrelated to noncompetition law. Instead, we analyze both time-series variation in the laws of given states and cross-sectional variation in noncompetition enforceability that interacted with in-state competition while controlling for state fixed effects.

We also consider the capital intensity of production as a second proxy for skill-intensive production.²¹ To test the predictions generated by Result 6, we regress the log of 1 plus the ratio of capital expenditures to the number of employees on Increased Enforceability, firm fixed effects, and the usual controls. The results, displayed in the third column of Table 7, show that increased noncompetition enforceability significantly ($t = -8.79$) reduces capital expenditures (capex) per employee. A shift to a regime of greater enforceability leads to a decrease in the log of capex per employee by 5.2% of the mean. We test the cross-sectional implications of Result 6 by regressing the log of 1 plus the ratio of capital expenditures to the number of employees on Enforcement \times (In-state competition), (In-state competition), state and industry fixed effects, and the standard set of firm controls. As shown in the fourth column of Table 7, the coefficient on Enforcement \times (In-state competition) is negative and significant ($t = -4.02$). A one-standard deviation increase in Enforcement \times (In-state competition) reduces the log of the capex per employee by 3.7% of the mean. The time-series and cross-sectional evidence both provide strong support for Model B. Firms in high-non-compete enforcement jurisdictions have substantially lower physical capital to labor ratios. The much stronger results for capital-intensive production relative to R&D expenditures may reflect the fact that enforceability has two effects. The first is to discourage managers from investing in their own human capital, which reduces the incentive to invest in both R&D and capital-intensive production. The second is to protect the intellectual property created by R&D, which has a countervailing impact (but enforceability has no such effect on the security of capital expenditures). The stronger impact of enforceability on capital-intensive production may therefore reflect its pure incentive effect on human capital investment.

5.6 Firm Performance and Value

We now consider the net impact of noncompetition on firm performance. In both Models A and B, the firm in the enforcement jurisdiction may choose not to require a noncompetition contract, so the firm value should be at least weakly higher for firms in high-enforceability jurisdictions. To explore the impact of noncompetition enforcement on firm value, we regress the log of the ratio of the firm's equity market value to its equity book value on Increased Enforceability, firm and industry-year fixed effects, the log of the book value of debt, the log of sales, the log of assets, the log of the state unemployment rate, and the log of the state personal income. The results, exhibited in the first column of Table 8, show that the coefficient on Increased Enforceability is insignificant. To study cross-sectional effects, we regress the log of the market to book ratio on Enforcement \times (In-state competition), (In-state competition), state-year and industry-year fixed effects, the log of the firm age, and the previous set of firm controls. As shown in the second column of Table 8,

21. That physical capital is more complementary to skilled than to unskilled human capital is well established in the literature (see, e.g., Goldin and Katz 1998).

Table 8. Firm Performance

Dependent variable (no. of observations)	Log of market to book ratio (20,875)	Log of market to book ratio (20,384)	Return on equity (17,746)	Return on equity (17,313)
Increased enforceability	-0.0266 (-0.50)		-0.0345 (-1.63)	
Enforce \times (In-state Comp.)		0.0515 (0.15)		-0.3772 (-1.13)
In-state competition		0.1200 (1.01)		0.2613** (2.15)
Log (firm age)		-0.0919** (-5.04)		-0.0457** (-3.16)
Log (debt)	-0.0017 (-0.24)	-0.0327** (-4.06)	-0.0083 (-0.66)	-0.0129** (-2.03)
Log (sales)	0.2620** (6.51)	0.1816** (5.75)	0.7859** (12.23)	0.4175** (15.77)
Log (assets)	-0.3306** (-9.39)	-0.0791** (-2.19)	-0.7848** (-12.87)	-0.3271** (-11.01)
Log (state unemployment)	-0.1439** (-3.01)		-0.1785* (-1.89)	
Log (state personal income)	0.4040* (1.69)		0.6028 (1.31)	
Estimation method	OLS	OLS	OLS	OLS
Firm fixed effects?	Yes	No	Yes	No
State-year fixed effects?	No	Yes	No	Yes
0 Industry-year fixed effects?	Yes	Yes	Yes	Yes
Clustering	State	State	State	State
R ²	0.66	0.35	0.52	0.24

The regressions are estimated via OLS as described, with *t* statistics reported in parentheses using robust "sandwich" SE.

*,**Significant at the 10% and 5% levels, respectively.

the coefficient on Enforcement \times (In-state competition) is insignificant. We repeat these regressions, replacing the dependent variable with the log of the return on equity (results reported in Columns 3 and 4 of Table 8) and the return on assets (results not reported), and find insignificant results throughout. The clear conclusion from this evidence is that noncompetition enforcement has no significant effect on firm value or profitability.

There are three natural explanations for this result. The first is that requiring an enforceable noncompetition agreement may yield small (or no) net benefits to a firm. This might arise, for example, if the firm payoff from encouraging managers to invest in their own human capital is substantial. The second explanation is that noncompetition agreements may yield sizable benefits to firms but might also create substantial negative externalities. The free flow of managers and intellectual capital across firms may generate positive gains for all the firms in an industry and particularly for those in the same state. Thus, the positive spillovers from low enforceability may roughly balance out the disadvantages at the individual firm level. This argument is particularly plausible, given that we have shown that low enforceability may encourage

R&D, an investment to which positive externalities are commonly attributed (e.g., Hall 2002). The third reason is that, as shown in Table 7, firms in low-enforceability jurisdictions tend to make more investments in physical capital and may also invest more in R&D. Recent work shows that R&D investment is associated with higher returns and physical investment with lower returns (Abel and Eberly 2005; Lin 2007), and the balance between these two factors may lead to no net difference in performance.²²

Models A and B have differing implications for the pattern of human capital accumulation over time. Model B suggests that manager quality will rise more quickly in the nonenforcement jurisdiction (due to the manager's ongoing investment in his human capital), whereas Model A predicts the opposite effect. The performance of a firm may be regarded as a proxy for the CEO's quality. We consider the set of firms that had new CEOs appointed during the sample period and analyze their performance over time. All such firms with $\text{Enforcement} \times (\text{In-state competition})$ values above the median we place in a high-enforcement group and the remainder are designated low-enforcement firms. We regress the log of the firm return on equity on the log of the CEO tenure, (In-state competition), state-year and industry-year fixed effects, and the usual firm controls. As displayed in Table 9, firm performance increases significantly (t statistic = 2.19) with CEO tenure in the low-enforcement sample, and the coefficient on CEO tenure is insignificant (t statistic = -0.89) in the high-enforcement sample. This finding is consistent with Model B. Moreover, other models that do not involve human capital accumulation over time, such as the pure bargaining (Section 2.5.1) and selection models (Section 2.5.2), do not make this prediction.

5.7 Firm Investment versus Managerial Investment

We found support for the importance of both firm investment in firm-specific human capital and managerial investment in general human capital. The reduced mobility and lower posttransfer compensation of executives in high-enforcement jurisdictions are both evidence that noncompetition enforceability encourages firm investment, as proposed by both Models A and B. Models A and B differ, however, in their predictions relating enforceability to managerial human capital and hence to executive compensation and firm investment. The findings that managers in low-enforcement areas have higher compensation and receive less of their compensation in the form of salary and that firms in low-enforcement areas invest more in capital-intensive production all support Model B. For R&D investment, our findings are mixed but offer more support for Model B.

The alternative theories of pure bargaining and selection find some support in the data, but the results linking noncompetition enforceability to reduced mobility and longer executive tenures are not well explained by these theories,

22. I thank an anonymous referee for this point.

Table 9. Performance over Time

Dependent Variable (no. of observations)	Return on equity (571)	Return on equity (560)
Log (tenure as CEO)	0.2076** (2.19)	-0.0827 (-0.89)
In-state competition	1.2377 (0.97)	0.1876 (0.37)
1-year total return	0.0002 (0.30)	0.0014 (0.74)
3-year total return	0.0051* (1.91)	0.0051 (1.18)
Log (firm age)	0.2903** (-3.72)	0.0659 (0.21)
Log (debt)	0.0085 (0.22)	0.0195 (0.44)
Log (sales)	0.0085 (1.08)	0.4507** (3.85)
Log (assets)	0.2903 (-1.07)	-0.3211** (-2.86)
Estimation method	OLS	OLS
Sample	Low enforcement	High enforcement
State-year fixed effects?	Yes	Yes
Industry-year fixed effects?	Yes	Yes
Clustering	State	State
R ²	0.72	0.79

The regressions are estimated via OLS as described, with *t* statistics reported in parentheses using robust "sandwich" SE.

*,**Significant at the 10% and 5% levels, respectively.

given that renegotiation costs are apparently quite low (Section 5.4). The finding that firm performance improves more with CEO tenure in low-enforcement jurisdictions also favors Model B over both the pure bargaining and the selection models. The tests linking compensation to enforceability that include executive fixed effects offer additional support to Model B relative to the selection model. The weight of the evidence, therefore, favors the idea in Model B that firm investments are important but that managerial investments in their own human capital have greater empirical relevance.

6. Conclusions

Our study of the time-series and cross-sectional variation in noncompetition enforceability across the US states demonstrates the importance of these legal regulations for executive mobility, executive compensation, and firm investment. We show that increased enforceability leads to fewer executive within-industry transfers, lower and more salary-based compensation, reduced posttransfer compensation, and reduced capital expenditures per employee. These findings are consistent with a model that has the following three

features: noncompetition agreements encourage firm investments in managerial human capital, the agreements discourage managerial investments in their own human capital, and managerial investments have a greater impact than firm investments.

A new stream of literature on the theory of the firm has emphasized the important role and somewhat unstable character of human capital assets. Our results show that noncompetition agreements can serve as an effective means for securing employee resources within the boundary of the firm. Our findings also indicate, however, that the human capital of the firm's managers is changed by the presence of covenants not to compete. Overall, we find that the enforceability of noncompetition agreements has no net effect on firm value.

This suggests two directions for analysis. First, it would be useful to distinguish between the direct effects on firm value of noncompetition enforceability and the spillover effects arising from the restrictions on the free flow of labor (and hence ideas) across firms. These may differ across industries. Second, noncompetition enforceability may affect the attractiveness of mergers between firms. Acquirers often list noncompetition contracts among the assets they are purchasing. The value and meaning of these contracts are clearly dependent on the extent to which covenants not to compete are enforceable and assignable to purchasers. In an economy in which human capital is growing in prominence, determining the socially optimal level of noncompetition enforceability is likely to become increasingly important.

Appendix A

A.1 Bargaining Model

We assume that in two-party bargaining with his firm, the manager will receive a fraction $\theta_m \in (0, 1)$ of the surplus, with the remaining going to the company. For the manager who has signed an enforceable noncompetition contract, there are two possible scenarios. In the first, he is valued most by the firm with which he signed the contract, in which case the firm will not release him since the competitor would not be willing to fully reimburse the firm for its loss of the manager. In the second, the competitor values him more, and the surplus from his transfer must be shared among the manager, the firm, and the competitor. We assume that in this three-party negotiation, the manager receives $\varepsilon_m \in (0, 1)$ of the surplus, the firm receives $\varepsilon_f \in (0, 1)$, and the competitor receives the remainder.²³ We assume that both the manager and either company receive more of the surplus in the two-party bargaining than in the three-party bargaining: $\theta_m \geq \varepsilon_m$ and $(1 - \theta_m) \geq \max\{\varepsilon_f, 1 - \varepsilon_m - \varepsilon_f\}$. At the conclusion of the bargaining, the surplus is divided as described and

23. The model is also robust to assuming that the firm receives nothing in this negotiation ($\varepsilon_f = 0$).

the manager makes a final match with the company that values him most. This company then has the exclusive right to offer the manager a production contract.

A.2 Optimal Linear Production Contracts

For a manager and company with a final Period 2 match quality q' , we denote by $V_F(q')$ the expected payoff of the company, and we define $EC(q')$ to be the total expected compensation of the manager. The optimal contract maximizes V_F subject to the manager's optimal choice of effort and subject to the manager's agreeing to participate in the company. When the company offers the production contract, the quality of the manager-company match is known, and the contract will be made contingent on this quality, as the following lemma shows.

Lemma 1. In the optimal linear production contract, the incentive component $a^*(q')$ is increasing in the manager-company match quality q' . The ratio of the optimal salary to the total expected compensation $\frac{b^*(q')}{EC(q')}$ is decreasing in q' . The expected Period 2 manager compensation $EC(q')$ and the expected Period 2 payoff to the company $V_F(q')$ are increasing in q' .

Proof of Lemma 1. The certainty equivalent to the manager of a contract offering him $ax + b$, given match quality q and effort e , is

$$aqe - \frac{\rho a^2 \sigma^2}{2} + b - e^2.$$

Presented with this contract, the manager will thus exert effort $e^*(a, b, q) = \frac{aq}{2}$. The expected value to the company of offering the contract is $(1 - a)qe^*(a, b^*(q), q) - b^*(q)$. Since salary b has no effect on the optimal effort choice, the company will choose b^* to set the manager's certainty equivalent equal to zero: $b^*(q) = \frac{a^2}{2}(\rho\sigma^2 - \frac{q^2}{2})$. This yields

$$V_F(q, a) = \frac{(1 - a)aq^2}{2} - \frac{a^2}{2} \left(\rho\sigma^2 - \frac{q^2}{2} \right).$$

Maximizing V_F provides the optimal incentive component

$$a^*(q) = \frac{\frac{q^2}{2}}{\frac{q^2}{2} + \rho\sigma^2},$$

which is increasing in q . The manager's expected compensation is given by

$$EC(q) = a^*(q)qe^*(a^*(q), b^*(q), q) + b^*(q) = \frac{a^*(q)^2}{2} \left(\rho\sigma^2 + \frac{q^2}{2} \right),$$

so the ratio of salary to expected compensation is

$$\frac{b^*(q)}{EC(q)} = \frac{\left(\rho\sigma^2 - \frac{q^2}{2} \right)}{\left(\rho\sigma^2 + \frac{q^2}{2} \right)},$$

which is decreasing in q . Since $a^*(q)$ is increasing in q , so is $EC(q)$. Last, we have

$$V_F(q) = \frac{q^4}{4q^2 + 8\rho\sigma^2},$$

which is increasing in q . \square

We define $\pi_F(q, \hat{q})$ to be the expected total payoff of a firm without a non-competition agreement that learns in Period 1 that its manager has a match with it of quality q and a match with its competitor of quality \hat{q} . This payoff will depend on both the Period 2 expected payoff described in Lemma 1 and the division of the surplus outlined above. The expected total payoff of the manager is set equal to $\pi_M(q, \hat{q})$. We use the notations π_F^{ncc} and π_M^{ncc} for a firm and a manager, respectively, that have signed a noncompetition contract. The bargaining and labor-company matching assumptions given earlier yield

$$\begin{aligned}\pi_F(q, \hat{q}) &= (1 - \theta_m) \max\{V_F(q) - V_F(\hat{q}), 0\} \\ \pi_M(q, \hat{q}) &= (1 - \theta_m) \min\{V_F(q), V_F(\hat{q})\} + \theta_m \max\{V_F(q), V_F(\hat{q})\} \\ \pi_F^{\text{ncc}}(q, \hat{q}) &= V_F(q) + \varepsilon_f \max\{V_F(\hat{q}) - V_F(q), 0\} \\ \pi_M^{\text{ncc}}(q, \hat{q}) &= \varepsilon_m \max\{V_F(\hat{q}) - V_F(q), 0\}.\end{aligned}$$

A.3 Model A

Assumption A. $I > E[\pi_F(q + \lambda, \hat{q} + \delta\lambda) - \pi_F(q, \hat{q})]$, $I < E[\pi_F^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda) - \pi_F^{\text{ncc}}(q, \hat{q})]$, and $I < E[\pi_F^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda) + \pi_M^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda) - \pi_M^{\text{ncc}}(q, \hat{q}) - \pi_F^{\text{ncc}}(q, \hat{q})]$.

Lemma 2 shows that there are values for investment I that satisfy Assumption A.

Lemma 2. The increase in expected firm payoff from making the investment is greater for firms with an enforceable noncompetition agreement than for those without such an agreement. Moreover, the joint benefit to the firm and manager who have signed an enforceable agreement is greater than that for a firm without an agreement. Formally, $E[\pi_F(q + \lambda, \hat{q} + \delta\lambda) - \pi_F(q, \hat{q})] < E[\pi_F^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda) - \pi_F^{\text{ncc}}(q, \hat{q})]$ and $E[\pi_F(q + \lambda, \hat{q} + \delta\lambda) - \pi_F(q, \hat{q})] < E[\pi_F^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda) + \pi_M^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda) - \pi_M^{\text{ncc}}(q, \hat{q}) - \pi_F^{\text{ncc}}(q, \hat{q})]$.

Proof of Lemma 2. We begin by proving the first clause of the lemma. We let q and \hat{q} be given. It is sufficient to show that

$$(1 - \theta_m)(\max\{V_F(q + \lambda) - V_F(\hat{q} + \delta\lambda), 0\} - \max\{V_F(q) - V_F(\hat{q}), 0\}) \leq \quad (\text{A1})$$

$$\begin{aligned}V_F(q + \lambda) + \varepsilon_f \max\{V_F(\hat{q} + \delta\lambda) - V_F(q + \lambda), 0\} \\ - V_F(q) - \varepsilon_f \max\{V_F(\hat{q}) - V_F(q), 0\}\end{aligned} \quad (\text{A2})$$

and that this inequality is strict with positive probability.

If $q \geq \hat{q}$ (which occurs with positive probability), then the expression in (A2) is equal to $V_F(q + \lambda) - V_F(q)$, whereas the expression in equation (A1) is equal to $(1 - \theta_m)(V_F(q + \lambda) - V_F(\hat{q} + \delta\lambda) - V_F(q) + V_F(\hat{q}))$. In this case, the inequality is strict because V_F is strictly increasing.

If $q < \hat{q}$ and $q + \lambda \geq \hat{q} + \delta\lambda$, then the expression in equation (A1) is equal to $(1 - \theta_m)(V_F(q + \lambda) - V_F(\hat{q} + \delta\lambda))$, whereas the expression in equation (A2) is greater than $(V_F(q + \lambda) - V_F(\hat{q} + \delta\lambda))$. If $q < \hat{q}$ and $q + \lambda \leq \hat{q} + \delta\lambda$, the expression in equation (A1) is equal to zero, whereas the expression in equation (A2) is nonnegative. To prove the second clause of the lemma, repeat this argument with $(\varepsilon_f + \varepsilon_m)$ replacing ε_f . \square

Proof of Result 1A. Assumption A shows that a firm will make an investment if and only if it has an enforceable noncompetition agreement with its manager. The following argument shows that the firm in the high-enforcement jurisdiction will offer a signing bonus in exchange for a noncompetition agreement and that this offer will be accepted. The signing bonus s^* will be set equal to $s^* = E[\pi_M(q, \hat{q}) - \pi_M^{ncc}(q + \lambda, \hat{q} + \delta\lambda)]$ to make the manager indifferent between agreeing and not agreeing to accept the noncompetition contract. We have

$$\begin{aligned} E[\pi_F^{ncc}(q + \lambda, \hat{q} + \delta\lambda) + \pi_M^{ncc}(q + \lambda, \hat{q} + \delta\lambda)] &> I + E[\pi_M^{ncc}(q, \hat{q}) + \pi_F^{ncc}(q, \hat{q})] \\ &\geq I + E[\pi_M(q, \hat{q}) + \pi_F(q, \hat{q})] = I + s^* + E[\pi_M^{ncc}(q + \lambda, \hat{q} + \delta\lambda) + \pi_F(q, \hat{q})], \end{aligned}$$

where the first inequality follows from Assumption A, the second from the fact that $\varepsilon_m + \varepsilon_f \geq \theta_m$ and the equality from the definition of s^* . This shows that $E[\pi_F^{ncc}(q + \lambda, \hat{q} + \delta\lambda)] - I - s^* > E[\pi_F(q, \hat{q})]$. \square

A.4 Model B

Assumption B.

$$\begin{aligned} J &> \max\{E[\pi_M^{ncc}(q + \gamma, \hat{q} + \gamma) \\ &\quad - \pi_M^{ncc}(q + \lambda, \hat{q} + \delta\lambda)], E[\pi_M^{ncc}(q + \gamma, \hat{q} + \gamma) - \pi_M^{ncc}(q, \hat{q})]\}, \end{aligned}$$

$$J < E[\pi_M(q + \gamma, \hat{q} + \gamma) - \pi_M(q, \hat{q})].$$

Lemma 3 shows that there are values for investment J that satisfy Assumption B.

Lemma 3. The increase in expected manager payoff from making the investment is greater for a manager without an enforceable noncompetition agreement than for one with such an agreement. Formally,

$$E[\pi_M(q + \gamma, \hat{q} + \gamma) - \pi_M(q, \hat{q})] > E[\pi_M^{ncc}(q + \gamma, \hat{q} + \gamma) - \pi_M^{ncc}(q, \hat{q})] \quad (\text{A3})$$

and

$$E[\pi_M(q + \gamma, \hat{q} + \gamma) - \pi_M(q, \hat{q})] > E[\pi_M^{ncc}(q + \gamma, \hat{q} + \gamma) - \pi_M^{ncc}(q + \lambda, \hat{q} + \delta\lambda)]. \quad (\text{A4})$$

Assumption A guarantees that the firm will not make an investment in the absence of a noncompetition agreement, so showing the above two inequalities are sufficient to prove the lemma.

Inequality (A3) follows directly from $\theta_m \geq \varepsilon_m$. To show equation (A4), we consider several cases. If $q \geq \hat{q}$, then $\pi_M(q + \gamma, \hat{q} + \gamma) - \pi_M(q, \hat{q}) > 0 = \pi_M^{\text{ncc}}(q + \gamma, \hat{q} + \gamma)$. If $q < \hat{q}$ and $q + \gamma \geq \hat{q}$, then

$$\begin{aligned} \pi_M(q + \gamma, \hat{q} + \gamma) - \pi_M(q, \hat{q}) &\geq \theta_m(V_F(\hat{q} + \gamma) - V_F(\hat{q})) \\ &\geq \varepsilon_m(V_F(\hat{q} + \gamma) - V_F(q + \gamma)) = \pi_M^{\text{ncc}}(q + \gamma, \hat{q} + \gamma). \end{aligned}$$

If $q < \hat{q}$ and $q + \gamma < \hat{q}$, then if $\pi_M^{\text{ncc}}(q + \gamma, \hat{q} + \gamma) - \pi_M^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda) \leq 0$, the lemma is proved. Otherwise,

$$\begin{aligned} \pi_M(q + \gamma, \hat{q} + \gamma) - \pi_M(q, \hat{q}) &\geq \theta_m(V_F(\hat{q} + \gamma) - V_F(\hat{q})) \\ &\geq \varepsilon_m(V_F(\hat{q} + \gamma) - V_F(q + \gamma) - V_F(\hat{q} + \delta\lambda) + V_F(q + \lambda)) \\ &= \pi_M^{\text{ncc}}(q + \gamma, \hat{q} + \gamma) - \pi_M^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda), \end{aligned}$$

where the second inequality follows from $\gamma \geq \lambda$. □

Assumption C.

$$\begin{aligned} E[\pi_F^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda) + \pi_M^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda)] \\ - I > E[\pi_F^{\text{ncc}}(q + \gamma, \hat{q} + \gamma) + \pi_M^{\text{ncc}}(q + \gamma, \hat{q} + \gamma)] - J. \end{aligned}$$

Proof of Result 1B. We consider the following candidate equilibrium. In exchange for a noncompetition agreement, the firm in the enforcement jurisdiction offers the signing bonus

$$s^{**} = E[\pi_M(q + \gamma, \hat{q} + \gamma) - \pi_M^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda)] - J,$$

which a manager accepts. Assumption B shows that the manager who accepts the noncompetition agreement will not make an investment, and Assumption A shows that his firm will. Assumption A shows that the firm in the nonenforcement jurisdiction will not make an investment, and Assumption B shows that the manager who works for this firm will make an investment. To show that the firm in the enforcement regime will offer the signing bonus s^{**} , consider that

$$\begin{aligned} E[\pi_F^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda)] - I - s^{**} \\ &> E[\pi_F^{\text{ncc}}(q + \gamma, \hat{q} + \gamma) + \pi_M^{\text{ncc}}(q + \gamma, \hat{q} + \gamma) - \pi_M^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda)] - J - s^{**} \\ &\geq E[\pi_F(q + \gamma, \hat{q} + \gamma) + \pi_M(q + \gamma, \hat{q} + \gamma) - \pi_M^{\text{ncc}}(q + \lambda, \hat{q} + \delta\lambda)] - J - s^{**} \\ &= E[\pi_F(q + \gamma, \hat{q} + \gamma)], \end{aligned}$$

where the first inequality follows from Assumption C, the second from the fact that $\varepsilon_m + \varepsilon_f \geq \theta_m$, and the third equality from the definition of s^{**} . □

A.5 Proofs of Empirical Implications

Proof of Result 2. In Model A, only the firm in the enforcement jurisdiction makes a firm-specific investment. We denote the underlying probability measure by P . The probability that the manager transfers from the nonenforcement firm is $P(\hat{q} > q)$. The probability that the manager transfers from the enforcement firm is $P(\hat{q} + \delta\lambda > q + \lambda) \leq P(\hat{q} > q)$.

In Model B, the firm makes the investment in the enforcement regime and the manager makes the investment in the nonenforcement regime. In the enforcement regime, the probability of transfer is $P(\hat{q} + \delta\lambda > q + \lambda)$. In the nonenforcement regime, the probability of transfer is $P(\hat{q} + \gamma > q + \gamma) \geq P(\hat{q} + \delta\lambda > q + \lambda)$. \square

Proof of Result 3. We use the notation $y \geq_{\text{FOSD}} z$ to denote that y dominates z in the sense of first-order stochastic dominance (FOSD). In Model A, the quality of the manager in the enforcement jurisdiction is $\max\{q + \lambda, \hat{q} + \delta\lambda\}$ and the quality of the manager in the nonenforcement jurisdiction is $\max\{q, \hat{q}\}$. It is clear that for all $k \geq 0$, $k \leq \max\{q, \hat{q}\} \Rightarrow k \leq \max\{q + \lambda, \hat{q} + \delta\lambda\}$, so

$$\max\{q + \lambda, \hat{q} + \delta\lambda\} \geq_{\text{FOSD}} \max\{q, \hat{q}\}. \quad (\text{A5})$$

Lemma 1 shows that expected compensation is increasing in quality, which completes the proof of the first statement of Result 3.

In Model B, the quality of the manager in the nonenforcement jurisdiction is given by $\max\{q + \gamma, \hat{q} + \gamma\}$. The quality of the manager in the enforcement jurisdiction is given by $\max\{q + \lambda, \hat{q} + \delta\lambda\}$. The fact that $\gamma > \lambda$ shows that

$$\max\{q + \gamma, \hat{q} + \gamma\} \geq_{\text{FOSD}} \max\{q + \lambda, \hat{q} + \delta\lambda\}. \quad (\text{A6})$$

The second statement of Result 3 follows from Lemma 1. We note here that in both models, the firm in the enforcement jurisdiction sets the Period 0 signing bonus awarded to its manager equal to the expected Period 2 signing bonus realized by the manager in the nonenforcement jurisdiction since the production contract is designed to grant the manager zero expected utility. \square

Proof of Result 4. Lemma 1 shows that the ratio of salary to total compensation is decreasing in managerial quality. The result follows from equations (A5) and (A6). \square

Proof of Result 5. We require a preliminary lemma to prove this result. For any random variable y , we denote its density by f_y and its cumulative distribution function by F_y . We use the notation $y =_D z$ to denote that y and z are equal in distribution, and we denote the distribution of y conditional on an event A by $(y|A)$.

Lemma 4. If the random variable c has a log-concave density function, then for all $a > 0$, $(c + a)$ dominates c in the sense of the monotone likelihood ratio property (MLRP), which we denote by $(c + a) \geq_{\text{MLRP}} c$.

Table A1. Noncompetition Enforceability Index

State	Score	State	Score
Alabama	5	Missouri	7
Alaska	3	Montana	2
Arizona	3	Nebraska	4
Arkansas	5	Nevada	5
California	0	New Hampshire	2
Colorado	2	New Jersey	4
Connecticut	3	New Mexico	2
Delaware	6	New York	3
DC	7	North Carolina	4
Florida 1992–96	7	North Dakota	0
Florida 1997–2004	9	Ohio	5
Georgia	5	Oklahoma	1
Hawaii	3	Oregon	6
Idaho	6	Pennsylvania	6
Illinois	5	Rhode Island	3
Indiana	5	South Carolina	5
Iowa	6	South Dakota	5
Kansas	6	Tennessee	7
Kentucky	6	Texas 1992–94	5
Louisiana 1992–2001, 2004	4	Texas 1995–2004	3
Louisiana 2002–03	0	Utah	6
Maine	4	Vermont	5
Maryland	5	Virginia	3
Massachusetts	6	Washington	5
Michigan	5	West Virginia	2
Minnesota	5	Wisconsin	3
Mississippi	4	Wyoming	4

Proof of Lemma 4. The log concavity of f_c implies that for any y , $\frac{d \log f_c(y-a)}{dy} \geq \frac{d \log f_c(y)}{dy}$, which implies that $\frac{f'_c(y-a)}{f_c(y-a)} \geq \frac{f'_c(y)}{f_c(y)}$. This last inequality implies that $\frac{f_c(y-a)}{f_c(y)}$ is increasing in y . \square

We define $z = \beta_2 - \beta_1$. In Model A, the increase in match quality for managers who transfer from the enforcement firm is given by

$$(\hat{q} + \delta\lambda - q - \lambda|\hat{q} + \delta\lambda \geq q + \lambda) =_D (z - (1 - \delta)\lambda|z - (1 - \delta)\lambda \geq 0). \quad (A7)$$

The increase in match quality for managers who transfer from the nonenforcement firm is $(\hat{q} - q|\hat{q} \geq q) =_D (z|z \geq 0)$.

Table A2. Representation of States and Industries

State	Frequency (%)	Industry	Frequency (%)
California	16	Depository Credit Intermediation	6
Texas	9	Software Publishers	4
New York	8	Insurance Carriers	4
Illinois	6	Semiconductor Manufacturing	4
Massachusetts	5	Pharmaceutical Manufacturing	3

Assumption D and corollary 2 of Miravete (2001) show that z has a log-concave density function. Lemma 4 shows that $z \geq_{\text{MLRP}} z - (1 - \delta)\lambda$ and hence $(z|z \geq 0) \geq_{\text{MLRP}} (z - (1 - \delta)\lambda|z - (1 - \delta)\lambda \geq 0)$.

In Model B, the increase in match quality for managers who transfer from the enforcement firm is given by equation (A7). The increase in match quality for managers who transfer from the nonenforcement firm is $(\hat{q} + \gamma - q - \gamma|\hat{q} + \gamma \geq q + \gamma) =_D (z|z \geq 0)$. The result follows from the argument given in the case of Model A. \square

We denote the firm profit from the use of skill-intensive production by $W_F(q')$. The firm's overall profit is then given by $\max\{V_F(q'), W_F(q')\}$. The previous analysis can be replicated, modifying the assumptions by replacing $V_F(q')$ with $\max\{V_F(q'), W_F(q')\}$.

Proof of Result 6. It is clear that skill-intensive production will be employed if and only if $q' \geq q_1$. The result follows from equations (A5) and (A6).

Given Assumption D, Results 3, 4, and 6 are also true conditional on the manager remaining with the firm. The proof is available upon request.

A.6 Questions and Thresholds

The following 12 questions from Malsberger (2004) are used to evaluate the level of noncompetition agreement enforceability in each state. Each state is granted 1 point for each question concerning which its laws lie above the threshold.

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

Threshold 1. States that enforce noncompetition agreements outside a sale-of-business context receive a score of 1.

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

Threshold 2. States in which the employer can prevent the employee from future independent dealings with all the firm's customers, not merely with the customers with whom the employee had direct contact, receive a score of 1.

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

Threshold 3. Laws that place greater weight on the interests of the firm relative to those of the former employee are above the threshold. For example, a law that requires that the contract be reasonably protective of the firm's business interests and only meet the condition of not being unreasonably injurious to the employee's interests would receive a score of 1.

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

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

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

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

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

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

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

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

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

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

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

Threshold 9. Jurisdictions in which 3-year statewide restrictions have been upheld receive a score of 1.

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

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

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

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

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

Threshold 12. If, in addition to lost profits, there is a potential for punitive damages against the former employee, the state receives a score of 1. States that explicitly exclude consideration of the reasonableness of the contract from the calculation of damages are also above the threshold.

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