Buying Loyalty:
Theory and Evidence from Physicians

Kurt Lavetti*
Ohio State University

Carol Simon
The Lewin Group

William D. White
Cornell University

February 1, 2014

Abstract

Skilled-services firms often lack full control over their key assets—the relationships between their workers and clients. This problem can lead to investment holdups that distort labor market equilibria. We study how non-compete agreements (NCAs), which prohibit a worker from leaving a firm and then competing against it, can overcome this control problem. We show theoretically that NCAs reduce investment holdups and increase productive efficiency. These direct effects lead to higher worker earnings, larger returns to tenure, and longer job spells. However, NCAs also reduce the ex post bargaining power of workers, which can alter the structure of contracts. Using new survey data from physicians, we find that physicians with NCAs have contracts with output incentives that are more than twice as strong, they are over 40% more productive, earn 14% higher wages, and have within-job earnings growth that is 21 percentage points higher, despite being of the same average quality as physicians without NCAs. Decomposing earnings growth, we find that NCAs increase returns to both tenure and experience, suggesting that they promote general as well as firm-specific human capital investment. All of the effects increase in magnitude with the enforceability of state NCA laws.

JEL Classifications: J60, J30, K31
Keywords: Non-Compete Agreements, Human Capital, Compensation Contracts

*An earlier version of this paper is contained in the second chapter of Lavetti's graduate dissertation at Cornell University, and he is grateful to Nicholas Kiefer, George Jakubson, Lawrence Kahn, and Kosali Simon for their guidance. We also thank Nicholas Bloom, David Card, Jed DeVaro, Pat Kline, Matt Marx, Jim Rebitzer, Jesse Rothstein, Alan Sorensen, Amanda Starc and participants at AHEC, Northwestern Kellogg; APPAM; ASHE; McGill; Ohio State; Oregon State; Rochester Simon School; SOLE; Stanford; University of Illinois, Urbana-Champaign, University of Tennessee; UC Berkeley and UC Irvine for helpful comments, and Norman Bishara for generously sharing data and legal expertise. Financial support from the RWJF Scholars in Health Policy Program, AHRQ, and The California Endowment is gratefully acknowledged. Correspondence: lavetti.1@osu.edu.

1 Introduction

Firms that provide skilled services face unusual difficultly in controlling their assets, the most valuable of which are often the relationships that exist between their workers and clients. While this problem is not unique, it is more severe for high-skilled service firms, where information asymmetries between clients and workers make search costly and generate loyalty. Skilled workers that leave a service firm often have the ability to take customers with them to another firm in the market. As a result, service firms that face opportunities to invest in increasing the output of their workers or in expanding their client base may fail to do so if they cannot control their relationship-assets.[1] While they may not be able to overcome this control problem directly, high-skilled service firms can instead mitigate investment holdup problems using personnel policies to control the rights of the worker over the asset.[2]

This paper examines how non-compete agreements (NCAs)[3] can alleviate inefficiencies that may arise in service firms that cannot control their relationship-assets in more conventional ways. NCAs are elements of employment contracts that prevent workers from exiting a firm and then competing against it. In the context of physicians, which we base our empirical analyses upon, NCAs prohibit a physician who leaves a group practice from practicing medicine anywhere within a specified geographic market for fixed period of time, generally several years.[4] While indirect, NCAs allow the firm to transitively control valuable relationship-specific assets by making them worthless outside of the firm. However, this control comes at the cost of restricting the choice set of workers, which can create distortions in labor markets.

At face-value, the distortions caused by NCAs seem to be inefficient. Most directly, NCAs impose exit barriers on workers that increase the cost of mobility. If workers and firms cannot commit to self-enforcing long-term labor contracts, then higher mobility costs give firms ex post monopsony power over workers that are bound by NCAs.[5] When earnings are renegotiated firms can exploit this power to reduce earnings or earnings growth. Workers who anticipate these dynamic effects of NCAs on bargaining power may demand front-loaded contracts, which can lead in turn to inefficiently high levels of turnover. Although we focus in this paper on effects within the firm, NCAs also have the potential to reduce competition in output markets.[6]

However, there are also ways in which NCAs could improve social welfare. NCAs allow firms to allocate relationship-assets across workers without the risk that a worker will leave the firm and take

[1] Grossman and Hart (1986) present a model in which contracts that assign specific rights may be incomplete. Due to contractual incompleteness, residual rights of control assigned to one party or another inevitably create distortions. To the extent that these distortions affect the ex post allocation of returns to ex ante investments, they can lead to investment holdup problems.

[2] Rebitzer and Taylor (2007) describe one such policy common in large law firms: up-or-out promotion contests in which the winners of the contest are the residual claimants of the assets.

[3] NCAs are also known as covenants not-to-compete.

[4] See Section 3 for more details on the structure and enforceability of NCAs in medicine.

[5] See Boal and Ransom (1997) for a more thorough discussion of how moving costs can lead to monopsony in labor markets.

[6] To the extent that they deter entry of potential competitors, from either within and outside the firm, NCAs may increase the size of firms and concentration of markets, which could increase prices and limit the choices of consumers. We discuss the potential effects of NCAs on firm structure and competition in output markets in greater detail in the online appendix, and leave empirical analyses for future work.

the client with them. Removing the externality of client interaction on asset control can increase the productive efficiency of the firm, and improve matching between clients and workers if workers are specialized. In addition, NCAs have the potential to mitigate the effects of pre-existing labor market inefficiencies. They may either causally lengthen job spells by imposing exit barriers on workers, or induce self-selection by workers with private knowledge of their own propensity to leave the firm and compete against it. In markets where hiring is costly, increasing job spell durations can raise total welfare, and the gains are distributed between workers and consumers.[7] If the costs of turnover or the benefits of asset ownership vary across firms, self-selection by workers can also improve the matching between workers and firms. NCAs can also provide insurance against the unraveling of partnerships.[8]

We develop a theoretical model in Section 2 that expands upon these ideas. The foundation of the theory is similar to Grossman and Hart (1986) and Hart and Moore (1990), which model the role of property rights in firms' investment decisions in relationship-specific assets. More broadly, the model also relates to general theories of firm investment in human capital beginning with Becker (1962), and subsequent refinements that examine the effects of labor market distortions, such as Acemoglu and Pischke (1999).[9] While such distortions can make skills that are "technologically general" de facto specific, we model the unique situation of service firms that can choose ex ante whether to make investments in relationship-assets general or specific by imposing an NCA. The key consequence of the ex ante decision is that the full menu of contractual options is negotiated jointly with the decision to make these human capital investments either general or specific. In addition, we show that when turnover is relatively costly and long-term contracts are not credible, commitments to productivity-based piece-rate linear compensation contracts can overcome the effects of dynamic changes in bargaining power without front-loading compensation. This explanation for the use of the use of piece-rate compensation contracts has not, to our knowledge, been discussed in the literature on sharing contracts, which has focused on moral hazard, risk sharing, and imperfect financial markets.[10] We show that sharing contracts are more strongly tied to output when accompanied by NCAs, and necessarily increase the expected returns to tenure. Consequently, when separations are endogenously determined by on-the-job search, NCAs increase the expected length of job spells, reducing aggregate hiring costs.

Using new survey data from 1,967 primary care physicians in 5 states (CA, GA, IL, PA, and TX), we provide the first micro-level evidence of the systematic use of NCAs by skilled service firms.[11] About 45% of the employed primary care physicians in the sample are bound by NCAs, and we find that

[7] Salop and Salop (1976) show that when hiring is costly and firms differ in the costs of hiring, self-selection by workers can result in better matching between workers and firms, increasing social welfare. The gains are shared specifically between workers who are less likely to quit and consumers of the goods or services produced by firms that hire workers who are more likely to quit.

[8] In the online appendix we present a model of partnerships with free entry and endogenous use of NCAs that builds upon theories of partnerships by Ward (1958), Farrell and Scotchmer (1988), and Levin and Tadelis (2005).

[9] Also see Acemoglu (1997) and Acemoglu and Shimer (1999) for discussion of general human capital investments with labor market distortions. See Morrison and Wilhelm (2004) for a model of on-the-job human capital investments in the forms of client relationships and reputation.

[10] See Stiglitz (1974), Gibbons (1987), Gibbons and Murphy (1992), and Signh (1987).

[11] Even outside of service firms, there is relatively little prior empirical evidence on the use of NCAs. Prior research has focused on the use of NCAs among technical professionals involved in the development and use of proprietary intellectual property, Marx et al (2009) and Marx (2011), and high-level corporate executives, Garmaise (2011).

variation in the use of NCAs across physicians, practice types, and markets is consistent with economic theory.

We then empirically test the hypotheses from the theoretical model. The first hypothesis is that since NCAs shift ex post bargaining power to the firm, workers will require contracts that tie compensation to individual output so that wages rise as productivity increases.[12] We find that physicians with NCAs negotiate contracts with incentive components tied to individual output that are more than twice as large, relative to total earnings, as contracts without NCAs. The second hypothesis is that the use of NCAs allows the owners of firms to allocate more of the firm's client-assets to employees, increasing the productive efficiency of the firm. We find two forms of evidence to support this hypothesis. Firms that use NCAs have much more uniform distributions of patients across part-owners and workers, with the difference in average weekly patient-visits more than twice as large in firms that do not use NCAs. In addition, firms that use NCAs are able to retain more valuable privately-insured and Medicare patients, and treat relatively fewer Medicaid or uninsured patients. These two factors lead to enormous differences in the productivity of employed physicians with and without NCAs: physicians with NCAs are over 40% more productive, measured by revenue generated per hour, and the mean difference is even larger conditional on physician characteristics. The third hypothesis from the theoretical model is that the use of share-based contracts and the larger allocation of clients to workers should increase the labor supply of workers with NCAs. We find that share-based contracts do not significantly affect hours worked, but NCAs do significantly reduce the difference in hours worked between owners and employees, consistent with the more uniform allocation of patients.

We also test for evidence that by reducing investment holdups, NCAs increase earnings growth. The fourth hypothesis from the theoretical model, more specifically, is that NCAs increase returns to tenure, one component of earnings growth. Although we don't explicitly include investments in general training in the model, a topic that has been thoroughly discussed in the literature, the use of NCAs could increase training and the returns to experience by reducing turnover. Therefore we use the term 'investment' to broadly include the allocation of clients to workers, which increases worker output and creates generally transferable human capital in the presence of loyalty, as well as more traditional investments in training. Using variation in earnings over time, we estimate that NCAs increase the rate of within-job real earnings growth, controlling for unobserved worker-firm match effects, by about 21 percentage points. Moreover, we find no evidence of positive within-job earnings growth at all for physicians who do not have NCAs.

Using a two-step model to account for endogeneity due to job search behavior that may be correlated with unobserved firm effects, we decompose the total earnings growth into the component due to returns to experience and the component from returns to firm tenure. This decomposition provides evidence on the mechanisms through which NCAs affect earnings growth. Investments in mentoring or training

[12] An alternative theory is that workers could demand front-loaded contracts. However, this can lead to higher than optimal levels of turnover. Since a primary motivation behind the use of NCAs is to prevent turnover where it is costly, front-loading tends to offset the key benefits of using NCAs. An additional consideration is the cost of measuring individual output. For physicians providing primary care services, measuring output is typically straightforward, making share-based contracts relatively attractive.

to increase general human capital that is transferable to other firms should increase the returns to experience, while investments in firm-specific human capital, including client allocations to physicians with NCAs, should increase returns to job tenure. We find that NCAs significantly increase both components of earnings growth. About 10 percentage points of the difference in growth is due to returns to experience and 12 percentage points due to firm tenure.

Fifth, we expect that NCAs increase the length of job-spells. We show that physicians with NCAs have longer tenures, and present suggestive evidence that part of the difference is likely to be causal while part is due to sorting on unobserved preferences for mobility. Either effect is of value to the firm when hiring is costly. Comparing the differences in tenure to the estimated differences in earnings, along with plausible estimates of hiring costs, suggests that reductions in turnover alone cannot explain the earnings differentials. This combined evidence suggests that property rights and investment holdups play a larger role than turnover reductions in explaining the use of NCAs.

One concern with interpreting these results as causal effects is the possibility that workers sort into jobs with NCAs based on unobserved ability.[13] We test for this in three ways, and find no discernable relationship between the use of NCAs and the quality of physicians. First we test for differences in the prices negotiated between each physician practice and private commercial insurance companies. We find no difference in prices charged by physicians with NCAs, both unconditionally and conditional on observed characteristics and unobserved primary care service market effects, based on definitions from the Dartmouth Atlas of Health Care. Second, we use data from patient vignette questions that directly elicit clinical knowledge and diagnoses and treatment recommendations, and test for compliance with recommended guidelines. We find no systematic difference in either the responses to particular questions or to aggregate measures of compliance with guidelines. Finally, we test for evidence that firms that use NCAs prefer to hire physicians with more prior experience, and find precisely no difference. Collectively, this evidence suggests that any systematic difference in quality among physicians with NCAs is limited to dimensions that are neither valued by consumers nor insurance companies, are unrelated to elicited clinical knowledge, diagnosis patterns, or treatment recommendations, and are unrelated to experience.

The paper proceeds as follows: Section 2 provides background on the empirical setting and the nature of NCA contracts. Section 3 presents a theoretical model of the use of NCAs in service firms. Section 4 describes the data used in the analyses. Section 5 discusses the empirical methodology and results for each hypothesis in turn, as well as robustness checks. Section 6 concludes and discusses policy implications.

2 Background

Although the theoretical discussions in the paper apply generally to firms that provide high-skilled services, our empirical analyses focus on primary care physicians. In particular, our data include physicians in family medicine, general internal medicine, and pediatrics. Primary care physicians, which comprise about 39% of practicing physicians in the US, typically serve as the first point of contact for

[13] See Ackerberg and Botticini (2002) for a discussion of how endogenous matching can affect empirical estimates of the determinants of contract forms.

patients and as coordinators of their care. Because of this, primary care physicians tend to have lasting relationships with their patients.[14]

Physician practices are generally organized as either solo practices with one physician, or as group practices with multiple physicians, covering one or more specialities. In group practices, physicians may be either owners or employees, and in some states it is possible that a practice may be owned by a non-physician entity such as a hospital, and that all physicians in a practice may be employees. Group practices typically use compensation contracts that combine a fixed salary, an individual productivity component, and a firm profit component. This creates incentives for physicians who make referrals to keep patients within a practice whenever reasonable.[15] Operating a group practice generally requires substantial investments in recruiting new physicians, and in developing relationships with a stock of patients to maintain demand for the new physicians' services. Accordingly, practices have strong incentives to protect these investments from competitive threats. In particular, the key threat to such investments is that a physician will exit the practice and take some, or all, of the practice's patients with them to another firm.

NCAs impose a very direct restriction on physicians who exit a practice by preventing a departing physician from practicing medicine anywhere in a defined geographic area for a specified period of time.[16] Whereas NCAs used by firms that invest in intellectual property may restrict exiting workers from competing anywhere in the same industry, in service industries like healthcare NCAs are geographic in scope. NCA restrictions without geographic limits are generally not enforceable for physicians, which allows physicians to continue to work in medicine without a career detour, but only if they move out of the local area and bear the associated costs. The geographic market relevant to a contract is defined ex ante in the contract.[17] Although states differ in how large the defined geographic markets can be, examples of common market definitions used in NCAs involving physicians are the county containing the practice or a 20-mile radius around the practice. NCAs must also not be excessive in duration, and two to three years is often deemed reasonable. Some NCA contracts allow physicians to pay damages in lieu of leaving the market. For example, under an NCA recently upheld in Kansas, a family physician leaving a medical group was prohibited from practicing for three years in the same county as the group unless she paid the group 25% of her earnings during the period.[18]

As elements of labor contracts, NCAs are subject to review at the state level, and the ability to enforce NCAs is based on state case law and applicable statutes. Currently, NCAs are enforceable to at least some extent in every state except North Dakota. Thirty-nine states follow common law, while the remaining eleven states have passed specific legislation that guides the enforcement on NCAs.[19] In

[14]For primary care physicians, the nature of these relationships is well captured by the phrase "my doctor". In this context, in 2008-9, over 80% of U.S. adults 18-64 reported a "usual source of care".

[15]We refer to Shortell (1972) for a thorough discussion of physician referral behavior that is consistent with the idea that physician referrals are affected by financial interests.

[16]The American Medical Association has discouraged the use of NCAs in medicine. See AMA Code of Ethics, Section Opinion 9.02.

[17]In some states, courts protect workers from NCAs with excessively large geographic markets by nullifying such agreements entirely rather than redefining a smaller market.

[18]See Sorrel, AL (2008). For other anecdotal examples see Ligos (2000) or Wilson (2006).

[19]The eleven states are: AL, CA, CO, DE, FL, LA, MA, MT, ND, OK, and TX. Of these states, CO, DE, MA, TN,

common-law states, the precedent that guides the enforceability of NCAs was generally shaped long before the modern healthcare delivery system existed or health insurance was available. The inertial nature of common law makes it difficult for such policies to adapt to changing market conditions.[20]

While variation in the ability to enforce NCAs across states offers an opportunity for comparative analysis, a difficulty for empiricists has been finding a way to characterize this variation. Popular summaries of the enforcement of NCAs, such as Wilson (2006) broadly divide states into three groups: those where non-competes are judged "unenforceable" (7 states), those where they are judged "enforceable" (36 states) and those where case law is judged uncertain (9 states). While this categorization has the appeal of being easy to apply, in practice issues of enforcement are much more nuanced then these summaries suggest.[21] Recently, a much more careful and precise quantification system was developed in Bishara (2011). Based on legislation and case law in each state, Bishara (2011) scores the overall ability to enforce NCAs on a state-by-state basis along each of eight different dimensions. Our empirical analyses make use of these quantified restrictiveness scores, which we refer to as 'Bishara Scores,' and Appendix Table A2 reports the questions and rules used in developing these scores.

3 Theory

We model the relationships between workers and firms, focusing on the firm's problem of controlling relationship-assets, allocating clients to achieve productive efficiency, and designing incentive-compatible compensation contracts, taking into account endogenous responses by workers. Throughout the discussion we consider a firm that is owned by a single individual who controls the physical capital required for production. We focus our attention on the bargaining between the firm owner and a worker, and abstract from considering the structure of the firm itself, and simplify the role of physical capital in production. After developing the theory we then briefly discuss how NCAs might affect the optimal organizational structure of firms as partnerships or corporations, ensure the stability of partnerships against unraveling due to entry of competitors, and affect firm concentration in output markets. We elaborate upon the aspects of firm structure and stability in other research.

3.1 A Model of Professional Service Firms with NCAs

We begin with a very simple two-period model that demonstrates the effect of NCAs on workers' bargaining power and the design of compensation contracts. We then introduce the opportunity for firms to make investments that increase the productivity of workers through the allocation of assets used in production. Next we discuss the interactions between elastic labor supply, modeled as effort,

and TX have laws that expressly prohibit NCAs among physicians, citing the public interest as a primary concern.

[20] In states that follow common law, courts evaluate three criteria to assess the enforceability of NCAs. The first is whether the firm has a legitimate business interest behind the use of the NCA, and whether that interest is capable of being protected by the NCA. In the past, courts have recognized business assets such as confidential client lists as protectable. The second is whether the NCA imposes an undue burden on the worker. Evaluation this criterion often focuses on the breadth of the market definition and the duration of the restriction, with a great deal of variation across states in interpretation and common law precedent. The third is whether the NCA is contrary to the public interest.

[21] See Malsberger (2006) for a detailed review of the legal treatment of non-competes on a state by state basis.

and optimal share contracts. Finally, we discuss how NCAs can affect the rate of job switching when mobility is endogenous.

3.1.1 Environment

We consider a firm consisting of an entrepreneur-agent, indexed by subscript a, who owns the physical capital K required for production, one employed worker, indexed by w, and two periods. In each period the entrepreneur and worker perform services for clients who have unit demand. Each firm begins with a stock of clients, P, that grows exogenously by a factor $\delta > 1$ per period. The entrepreneur-agent controls the allocation of clients within the firm, and chooses how many clients to keep for herself, P_a, and how many to allocate to the worker, P_w, where $P_a + P_w = P$. Production requires both a stock of clients and labor, L, which we initially assume to be fixed at $\overline{L}$. The production process is:

$$Y = F(P_w, \overline{L}) + F(P_a, \overline{L})$$

whenever there is enough physical capital for production, $K \geq K^\star$, and $Y = 0$ whenever $K < K^\star$.[22] The share of output that is paid as rent to physical capital is $1 - \theta$. Assuming constant returns to scale in P and L,[23] we express output per unit of labor as:

$$Y/\overline{L} = F(P_a/\overline{L}, 1) + F(P_w/\overline{L}, 1) \equiv f(p_a) + f(p_w)$$

Workers' compensation contracts are linear in output:

$$M = S + \alpha y$$

where S is a fixed salary, α is an output-share rate, and y is the worker's output. Firms can choose whether to include an NCA in the contract. With probability $(1 - \rho)$ the employment relationship exogenously becomes unproductive and the worker and firm separate after the first period. In the event of a separation, a worker with an NCA must relocate to a different market at cost R_i, which can depend on worker-specific geographic preferences, whereas a worker without an NCA can take their patients to a new firm in the same market at no cost. This is the feature that makes the model specific to professional service firms: due to information asymmetries patients remain loyal to their physician as long as the physician remains in the geographic market. A contract is characterized by $\{\alpha, S, \{N, C\}\}$, where N corresponds to a contract with an NCA, and C to contract where the worker is free to leave and compete against their prior firm. There are no forward contracts, but firms can commit to not reducing S or α in the second period if a worker signs an NCA.

[22] As noted above, we leave the discussion of the relationship between NCAs and firm size for other research, and focus here on the relationship between workers and firms.

[23] The CRS assumption is not necessary for the results that we show, but it allows for notational simplification.

3.1.2 Property Rights and Productive Efficiency

We now consider the firm's choice of the allocation of clients, P. The entrepreneur can allocate clients to the worker, increasing p_w and decreasing p_a. There are several reasons why the allocation decisions of the entrepreneur may have consequences for productive efficiency. Client referrals to workers may occur either because the entrepreneur and worker are differentiated and have comparative advantages at serving different clients, or because leisure is valuable, constraining the amount of time each agent has available to serve clients.[24]

NCAs can provide firms with a mechanism to reduce productive inefficiencies caused by such asset-allocation problems by allowing firms to implicitly lease clients to employed workers rather than transferring ownership of these intangible assets. To see this, consider the first-order conditions of the two firms faced with the same client allocation problem:

$$\frac{\partial \pi_C}{\partial p_a} = f'(p_a) + \beta f'(\delta p_a) = 0$$

so the entrepreneur retains all of the firm's clients as long as the marginal product is non-negative. The entrepreneur who imposes NCAs faces a different first-order condition:

$$\frac{\partial \pi_N}{\partial p_a} = f'(p_a)+\rho\beta f'(\delta p_a)-\frac{\partial \alpha}{\partial p_a}\theta f(p_w)+(1-\alpha)\frac{\partial \theta f(p_w)}{\partial p_a}-\frac{\partial S}{\partial p_a}-\rho\beta\frac{\partial \alpha}{\partial p_a}\theta f(\delta p_w)+\rho\beta(1-\alpha)\frac{\partial \theta f(\delta p_w)}{\partial p_a}-\rho\beta\frac{\partial S}{\partial p_a} = 0$$

where $f'(p_a) > 0$ but $\frac{\partial \theta f(p_w)}{\partial p_a} < 0$ since the total stock of patients $\bar{p} = p_a + p_w$ is fixed. Fixing earnings at their reservation value and implicitly differentiating gives:

$$\frac{\partial \alpha}{\partial p_a} = \frac{-\theta f(p_w) - \rho\beta\theta f(\delta p_w)}{\alpha\frac{\partial \theta f(p_w)}{\partial p_a} + \alpha\rho\beta\frac{\partial \theta f(p_w)}{\partial p_a}} > 0$$

and

$$\frac{\partial S}{\partial p_a} = \frac{-1 - \rho\beta}{\alpha\frac{\partial \theta f(p_w)}{\partial p_a} + \alpha\rho\beta\frac{\partial \theta f(p_w)}{\partial p_a}} > 0$$

The first order conditions thus imply:

$$f'(p_{Na}) + \beta f'(\delta p_{Na}) > f'(p_{Ca}) + \beta f'(\delta p_{Ca})$$

which implies

$$p^\star_{Na} < p^\star_{Ca} \quad \text{and} \quad p^\star_{Nw} > p^\star_{Cw}$$

The worker at the firm that uses NCAs receives more clients and has higher output. The increase in productive efficiency occurs because the NCA allows the entrepreneur to decrease the difference between his own asset-labor ratio and that of the worker. As shown by Cheung (1968, 1969) and discussed further by Reiersen (2001), productive efficiency with linear contracts is obtained if the firm

[24] See Garicano and Santos (2004) for a general model of contracts and referral incentives between differentiated agents in professional service firms.

makes the labor input decision, which we have abstracted from to this point. Thus the asset-labor ratio of the entrepreneur and the employee will not generally be equal unless the worker has an NCA and either $\alpha = 0$ or the entrepreneur chooses the amount of labor to be provided. Still, the difference in asset-labor ratios cannot possibly be larger than in the case without NCAs, as this would require the entrepreneur to transfer all of the assets of the firm to the worker, which is not an incentive-compatible outcome. The net effect is that NCAs increase the productive efficiency of the firm, but the requirement that NCAs be paired with linear contracts due to their effects on bargaining power creates an inefficiency unless firms can choose the amount of labor supplied. If contracts cannot specify the amount of labor to be supplied, for example if monitoring labor supply is costly, linear contracts can introduce inefficiency due to moral hazard.

Despite the benefit to the worker of a referral, the firm of the referring agent may be unable to extract the rents from the referral directly, often because ethics or laws prevent kickback payments for referrals.[25] NCAs provide insurance to the firm that the benefits of such referrals will be retained by the firm by transforming the generally transferable asset into a de facto firm-specific asset. A well-known result on firm-sponsored training is that firms will not invest in productivity increases that are generally transferable to other firms, unless there are labor market inequalities that induce wage compression, but they will invest in productivity increases that are specific to the firm. The intuition behind this result holds identically for client referrals, and NCAs offer a mechanism for firms to retain property rights over intangible assets and thus internalize investments in productivity increases through referrals.

3.1.3 Compensation Contracts with Sorting

Without an NCA, for any value of α the worker's salary is given by $S(\alpha) = (1 - \alpha)y$. That is, the worker is indifferent between any contract $\{\alpha, S(\alpha), C\}$ such that they are paid their marginal product in each period. In the second period, however, output increases to $f(\delta p_w)$. The worker's outside option is to take their patients to another firm in the market and earn $M = \theta f(\delta p_w)$. This allows the worker to renegotiate their contract in the second period, such that $S_2 + \alpha_2 y_2 = \theta f(\delta p_w)$, where S_t, α_t, and y_t denote the salary, share rate, and output in period t.

Without NCAs this model is quite simple, and since agents are risk-neutral price-takers there is no meaningful reason to use share-based contracts.[26] Singh (2000) argues it is not plausible for price-takers in a perfectly competitive model to use share-based contracts. Instead we consider two contracts: a fixed wage contract, $\{\alpha_t, S_t\} = \{0, \theta y_t\}$, and an implicit lease contract,[27] $\{\alpha_t, S_t\} = \{\theta, 0\}$.

For workers with NCAs, however, the outside option in the second period is different. The worker cannot move patients to another firm, and so cannot use the larger stock δP_w to renegotiate a new contract. The reservation wage is determined by the outside option to switch markets, incurring cost

[25] Kickback payments for referrals are generally illegal in medicine, for example. There may be some limited exceptions to this law if the purchase of a stock of patients is done implicitly through equity investments in firms, which could still substantially limit such arrangements.

[26] Reasons discussed in the literature for the use of piece-rate or sharecropping contracts include: moral hazard, risk aversion, and capital market imperfections (which could lead to cost sharing or screening-based explanations for the use of share-based contracts.) See Singh (2000).

[27] Note that the lease payment need not be zero, but allowing for this possibility does not affect the results of interest.

R_i, and reducing the stock of patients back to P_w. Thus for any contract with an NCA in which the worker receives their marginal product in the first period, it is impossible for the worker to renegotiate in the second period to again earn their marginal product. Anticipating that her bargaining leverage will fall in the second period, the worker is only willing to accept a contract containing an NCA in period one if it yields an expected payoff, without renegotiation, that is at least as high as the payoff of a contract without an NCA. That is, the incentive compatability constraint of the worker is $M_N \geq M_C$, where

$$M_N = \alpha\theta f(p_w) + S + \rho\beta\alpha\theta f(\delta p_w) + \rho\beta S + (1-\rho)\beta\left[\theta f(p_w) - R_i\right]$$

and

$$M_C = \alpha_1\theta f(p_w) + S_1 + \beta\alpha_2\theta f(\delta p_w) + \beta S_2$$

The incentive compatability constraint required for the firm to offer a contract with an NCA is $\pi_N \geq \pi_C$, where

$$\pi_N = \max_{\alpha,S}(1-\alpha)\theta f(p_w) - S + \rho\beta(1-\alpha)\theta f(\delta p_w) - \rho\beta S + \theta f(p_a) + \rho\beta\theta f(\delta p_a) + (1-\rho)\beta\theta f(\delta p_a + \delta p_w)$$

and

$$\pi_C = \max_{\alpha_1,S_1,\alpha_2,S_2}(1-\alpha_1)\theta f(p_w) - S_1 + \rho\beta(1-\alpha_2)\theta f(\delta p_w) - \rho\beta S_2 + \theta f(p_a) + \beta\theta f(\delta p_a)$$

In a mixed equilibrium:

$$\alpha_N^\star = \theta + \frac{(1-\rho)\beta}{\rho\beta}\left[\frac{f(\delta p_w + \delta p_a) - f(\delta p_a)}{f(p_w) + f(\delta p_w)}\right] > \theta \geq \alpha_C^\star \tag{1}$$

In this mixed equilibrium workers sort into jobs with NCAs according to relocation costs, R_i. Workers with $R_i \leq R^\star$ accept contracts with NCAs, and vice versa, where:

$$R^\star = L\left[\theta f(p_w) - \theta f(\delta p_a) + \theta f(\delta p_a + \delta p_w) - \frac{\rho\beta}{(1-\rho)\beta}\theta f(\delta p_w)\right]$$

This simple model is intended to demonstrate two points: (1) although NCAs decrease workers' bargaining power, there exists a linear compensation contract that equates expected earnings in all periods, even if there are no forward contracts, and (2) linear compensation contracts are more share-based when NCAs are used:

$$\alpha_N^\star > \alpha_C^\star$$

3.1.4 Elastic Labor Supply

If labor supply is elastic, share contracts can introduce moral hazard. Suppose workers provide effort, e, that augments output per labor input:[28]

$$e\frac{Y}{L} + \varepsilon = e\theta f(p) + \varepsilon$$

Effort costs $g(e)$, where $g(0) = 0$, $g'(e) > 0$, and $g''(e) > 0$. Effort is not directly observable, and cannot be inferred from output because production is stochastic due to ε. We abstract from risk aversion, which has been thoroughly discussed in the literature on linear contracts.[29] Workers choose effort to solve:

$$M_N = \max_{e_1,e_2} \alpha e_1 \theta f(p_w) + S + \rho\beta\alpha e_2 \theta f(\delta p_w) + \rho\beta S + (1-\rho)\beta\left[\nu - R^\star\right]$$

where ν is the worker's reservation earnings. The first-order conditions show that both the larger asset stock and higher value of α contribute to workers with NCAs providing greater effort in each period, $e_{1N} > e_{1C}$ and $e_{2N} > e_{2C}$. Plugging the worker's response function into the firm's asset allocation problem shows that higher effort levels associated with NCAs further increase the productive efficiency of the firm that uses NCAs, assuming workers' labor supply functions are upward sloping.[30] Although output unambiguously increases due to the incentive-based response, productive efficiency may not necessarily increase if workers over-supply labor.[31]

With higher share ratios, the output of workers with NCAs increases relative to workers without NCAs. However, this can have ambiguous effects on productive efficiency since it is possible for workers to over-supply labor.

3.1.5 Returns to Tenure and Endogenous Mobility

In a mixed equilibrium in which some firms use NCAs and others do not, the increase in productive efficiency associated with NCAs increases the returns to tenure of workers with NCAs and decreases $K^\star$. Intuitively this must hold because the expected earnings of workers with and without NCAs are

[28] While we have assumed the number of hours worked to be fixed, NCAs may also affect hours worked and the elasticity of labor supply for several reasons. The direct effect on hours comes from larger allocation of clients. Hansen and Imrohoroglu (2009) show that when the impact of learning by doing is greater, labor supply is more elastic. Thus if the net effect of NCAs on the slope of the wage profile is positive, workers with NCAs are likely to have higher intertemporal substitution elasticities of labor supply. An indirect reason why hours may be affected by NCAs is that the undesirable restrictions imposed by an NCA are independent of the number of hours worked. Unlike undesirable non-wage job characteristics that occur in proportion to the number of hours worked, like occupational hazard rates, NCAs impose a fixed cost. To the extent that workers are compensated for accepting NCAs, firms may prefer to spread this additional compensation over a greater number of hours of work.

[29] See Stiglitz (1974) and Singh (2000).

[30] Specifically, the requirement is

$$\frac{\partial e}{\partial p_a} = \frac{\partial e}{\partial \alpha}\frac{\partial \alpha}{\partial p_a} + \frac{\partial e}{\partial p_w}\frac{\partial p_w}{\partial p_a} < 0$$

This holds true if $\frac{\partial e}{\partial \alpha} > 0$ and $\frac{\partial e}{\partial p_w} > 0$, which is loosely interpreted as: workers exert more effort if their shares increase and if complementary production inputs increase. The assumption may not hold if the income effect outweighs the substitution effect, and labor supply is backward bending. Empirical evidence from US physicians suggests that the uncompensated wage elasticity of labor supply is close to zero (Nicholson and Propper, 2012).

[31] This could occur if g is private knowledge, so that the firm cannot anticipate the effort response to a change in α.

equal in each period, but the cost in the second period conditional on moving is higher for workers with NCAs. Denoting the return to tenure in the two-period model by T:

$$T_C = \theta f(\delta p_{Cw}) - \theta f(p_{Cw})$$

$$T_N = \alpha\theta f(\delta p_{Nw}) + S - \alpha\theta f(p_{Nw}) - S$$

Equal expected earnings in the second period implies:

$$\theta f(\delta p_{Cw}) = \rho\alpha\theta f(\delta p_{Nw}) + \rho S + (1-\rho)\left[\theta f(p_{Cw}) - R^{\star}\right]$$

Earnings conditional on $\rho = 0$ are $\theta f(p_{Cw}) - R^{\star} < \theta f(\delta p_{Cw})$, which directly implies $T_N > T_C$.

For simplicity, we have ignored transaction costs associated with hiring in the model. Hiring costs, however, could be a significant motivation behind the use of NCAs.[32] As discussed in Pissarides (1990), search frictions such as hiring costs create match-specific rents that are allocated by bargaining between workers and firms. In models of on-the-job search, regardless of whether wage offers are exogenous or determined by a full general equilibrium, hiring costs combined with higher earnings and returns to tenure make it less likely that workers will switch jobs.[33] Thus, if one were to relax the assumption of exogenous separations, hiring costs would increase the gap in wages between workers with NCAs and those without by lengthening average job-spell durations of workers with NCAs and reducing total expenses for hiring costs.

Note that NCAs may reduce endogenous mobility and lengthen job spells even if the direct exit barriers they impose have no causal effects. If workers have unobservable preferences for occupational mobility within the geographic market, NCAs may provide a mechanism for firms to induce self-selection by workers. Workers who are least averse to signing a contract with an NCA are those who do not anticipate switching jobs within the geographic market, providing firms with potentially valuable information about workers' expectations.[34]

3.2 Firm Organization and Competition in Output Markets

A potentially important consequence of asymmetric information in high-skilled service firms is that the reputation of the firm may be more salient than the quality of any particular worker.[35] In this setting there are important interdependencies between firm structure and quality, which was pointed out by Levin and Tadelis (2005). Specifically, entry of new workers or firms into a market can cause

[32] Waldman et al (2004) estimate the cost to a large medical practice of recruiting a new physician to be over $150,000. Other estimates, such as Erra and Hogue (2009), that account for the costs of lost revenue from unfilled positions are several times higher.

[33] See Jovanovic (1979), Pissarides (1990, 1994), and Devine and Kiefer (1993).

[34] An alternative possibility is that preferences for local mobility are negatively correlated with preference for long-distance mobility, in which case self-selection could lead to an ambiguous effect on the length of job-spells. As we discuss in Section 5, empirical evidence supports the former explanation, that NCAs are associated with longer job-spells.

[35] This distinction is especially important for services that are provided by a single worker, as opposed to a team of workers. For example, individual quality may be more salient for primary care medical services than for legal services provided by a group of lawyers.

partnerships to become unstable, resulting in unraveling from the top down. A recent example of this was the dissolution of the prominent law firm Dewey & LeBoeuf in 2012, as a group of top partners defected, leading to a wave of defections among the majority of the partners. Not coincidentally, the American Bar Association forbids the use of NCAs in the legal industry, deeming them unethical restrictions on clients' choices.[36] NCAs can prevent the threat of entry and the dissolution of partnerships, potentially creating broad effects on entry and competition in output markets. By preventing workers from becoming competitors and by deterring entry to the extent that entry involves hiring in local labor markets, NCAs can maintain or increase concentration in a local market, potentially raising prices to consumers.

In the online appendix we present a brief reputation-based model of partnerships that builds upon Levin and Tadelis (2005) and examines the relationship between the ability of workers and the use of NCAs by firms. The simple model of partnership organization begins with workers sorting into partnerships that partition ability-space, as in Farrell and Scotchmer (1988). We then allow for free-entry of workers into the market, which can lead to the unraveling of partnerships. Finally, the model allows for the option for partners to make side-payments to other partners in the firm in exchange for all partners committing to NCAs. This protects the firm from the threat of unraveling. We show that in this model, which emphasizes worker ability above all else, the use of NCAs weakens the strength of assortative matching based on ability, and there is no clear relationship between ability and the incentive to use NCAs.[37]

3.3 Testable Implications

We empirically test the hypotheses that follow from this model in Section 5. Although the model is written generally to apply to high-skilled service firms, within the stylized context of physicians these hypotheses must be specified more precisely.

The first hypothesis is that NCAs are accompanied by compensation contracts with higher share ratios. We use data on the fraction of earnings that come from incentive payments that are determined by individual production, and test that the fraction of earnings that is directly determined by individual revenue generated is higher in contracts with NCAs.

The second hypothesis is that firms that use NCAs allocate more clients to workers, increasing productive efficiency. The incentive for a firm to use NCAs is clearly affected by whether a firm has valuable clients to protect, so one might expect that all agents at firms that use NCAs have more clients, which we do not model. If the total stock of patients can differ across firms, the test of interest is whether there is less disparity in the allocation of patients between employees and owners in firms that use NCAs. In the medical context, however, all patients are not alike. Payments in healthcare exhibit extreme price discrimination, so that when physicians treat privately insured patients they receive more compensation than if they treat patients covered by Medicaid. In addition to testing for overall disparities in the number of clients, we also test for differences in the allocation of valuable

[36] See Disciplinary Rule 2-108(A) of the ABA Model Code and Rule 5.6 of the Model Rules of Professional Conduct.

[37] More precisely, a relationship between the average quality of a firm and the use of NCAs in the model requires a restriction on the third moment of the distribution of ability within the firm.

clients, based on the reimbursement rates of clients' insurance coverage.

The third hypothesis is that workers with NCAs exert greater effort. In the model we refer to effort rather than hours worked for notational simplicity, although stronger incentive contracts and increased patient referrals have the same qualitative effects on hours worked. Since we cannot directly observe effort, we empirically test this hypothesis by examining hours worked, and more specifically hours spent on patient care. One reason we cannot observe effort, despite the fact that we can observe the average amount of time each physician spends with a patient, is because reimbursements in primary care services are based on the durations of visits. Thus a longer visit could be considered a different type of service than a shorter visit.

The fourth and fifth hypotheses are that jobs with NCAs have larger returns to tenure and longer tenures. There are no unique characteristics of physicians that relate to testing these hypotheses. We leave analyses of the effects of NCA policies on firm organization and market concentration for future research.

4 Data

Our empirical analyses rely primarily on two data sources. The first is a survey of physicians, which to our knowledge is the largest existing dataset that contains micro-level information on the use of NCAs linked to labor-market outcomes. The second dataset quantifies variation in state laws that govern the enforceability of NCAs.

4.1 Physician Survey

Our empirical analyses rely primarily on data from the Physician Perspectives on Managed Care Survey, conducted in 2007.[38] The study sampled physicians who were listed in the American Medical Association (AMA) Masterfile as providing patient care in the specialties of general family practice, general practice, general internal medicine, and general pediatrics in five states, California, Texas, Illinois, Georgia, and Pennsylvania, which were selected to be representative of a variety of practice environments. Using a state-based sample rather than a national survey permitted collection of larger samples for local market areas. Excluded from the target population were residents, fellows, physicians not in clinical practice, and those over 70 years old. Pediatricians and minority physicians were over-sampled.[39]

The AMA database provides information on physician location and contact information, specialty and training, age, and race. Telephone calls verified contact information and whether sample physicians were providing patient care. A multi-mode (mail and web) self-administered survey was conducted. A packet was sent by Federal Express to a total of 2,831 physicians containing a mail survey accompanied by an advance letter, a pre-paid business return envelope and an honorarium check of $100. Physicians

[38]The survey was funded by the Agency for Healthcare Research and Quality (AHRQ), the California Endowment, and the Commonwealth Fund.

[39]While pediatricians made up approximately 23% of the population of eligible physicians in the study states, they were over-sampled so that they made up 45% of the sample. Minority physicians were over-sampled to ensure a sample of at least 200 responses in order to provide a meaningful basis for analyses examining this subgroup.

were given the option of responding by web. Follow-up was conducted for those physicians who did not respond, with separate follow-up with those who did not respond but cashed their checks. Altogether, a total of 1,967 usable responses were received, 216 (11%) of which were by web. The overall response rate was 69.8%.[40]

The survey questionnaire included detailed questions on the following topics: physician characteristics, practice characteristics, physician demographics, practice financial performance, physician earnings over several years, patient mix, practice administrative controls, average prices negotiated with insurance companies, and patient vignettes to elicit knowledge of clinical guidelines, diagnoses, and treatment recommendations.

Physicians were asked how many medical practices they worked in and their ownership status in their main practice. If they responded they were a sole-owner, the survey proceeded to questions about general practice characteristics. However, if the physician indicated that they were not a sole-owner, they were asked about their employment status and the following question regarding NCAs: "Were you to leave your (main) practice, would you be subject to a non-compete clause?"

4.1.1 State NCA Laws

We use data from Bishara (2011) to measure the relative strength of enforceability of NCA laws across different states. The measure was created by analyzing case law in each state, and comparing laws based on eight different dimensions. Each dimension was assigned a weight based on legal knowledge about the relative importance of the dimensions. The specific questions that define the eight dimensions, along with benchmarks for how states were scored and relative weights of each question are included in Appendix Table A2. For example, one important dimension upon which state laws differ is whether NCAs are still enforceable in the event that the employer makes the decision to terminate the relationship. In some states NCAs would still be enforceable, while in others NCAs apply only to voluntary separations made by workers.

In the raw data, the highest score, corresponding to the most strictly enforceable NCA laws, was Florida, with a score of 470 points. We normalize the scores as a continuous measure between 0 and 1 by dividing all scores by the maximum score observed. Appendix Table A1 shows the ratings from Bishara (2011) for the 5 states in our sample, California, Illinois, Georgia, Pennsylvania and Texas. Bishara (2011) ranks these states respectively as 50th, 4th, 43rd, 23rd, and 32nd in strength of enforcement. As shown in the table, the quantified ratings range from 31 in California to 430 in Illinois, providing substantial variation across states within our sample. We provide more details on the relationships between state NCA laws and other state-level policies that are likely to be correlated with voters' political preferences in Section 5.7.2 and Figure 6.

[40]Base sampling weights were assigned to each physician based on the inverse of their probability of selection and then adjusted for the probability of non-response and the probability of being sampled based on race.

5 Empirical Methodology and Results

5.1 Determinants of NCA Usage

Since there has been no prior empirical analysis of the use of NCAs in service firms, we begin by documenting their use. Table 1 reports the share of physicians with employment contracts that contain NCAs in each state in our sample. The use of NCAs varies substantially across states, ranging from 31.3% in California to 60.6% in Pennsylvania, with an average of 45.1% of all physicians in the sample subject to an NCA. This variation in usage is consistent with differences in enforceability—physicians are more likely to have contracts with NCAs if they work in states in which NCAs are more enforceable.

NCAs are also used more frequently for physicians who are employees (49.2%) rather than part-owners (43.1%) of a practice. Part-owners have some deterrent to competing against their current practice because doing so could devalue their share of the practice's equity, which may be a relatively illiquid investment. The illiquidity of equity investments in physician practices is also likely to lengthen job spells of owners, directly decreasing the benefits of NCAs. We show in Table 15 that owners have longer job spells.[41]

There is some evidence that the use of non-compete agreements may have increased slightly over time. The last column of Table 2 shows that for employee physicians who graduated medical school within 7 years of the survey, about 51.4% were subject to NCAs, compared to about 45%-49% of physicians who graduated between 1978 and 1998.[42]

To understand the characteristics that influence the decision to enter into an NCA, one must also consider the decision by a worker whether to join a group practice. We model the simultaneous decisions to work in a group practice or solo practice and whether to accept an NCA conditional on joining a group practice using a bivariate probit model that accounts for sample selection. The selection equation for entering a group practice or hospital, as opposed to a solo practice, is a probit model:

$$g_i = z_i\gamma + u_i$$

where g_i equals 1 if physician i chooses a group practice and z_i is a vector of physician and market characteristics that affect this decision, and the decision to accept an NCA as:

$$N_i = x_i\beta + \varepsilon_i$$

where N_i equals 1 if physician i accepts an NCA and x_i contains observable characteristics of the group practice, the geographic market, and physician i. The reason for estimating the equations simultaneously is that u_i may be correlated with ε_i. For example, latent preferences for geographic mobility could affect

[41] Note that states also differ in their legal treatment of the enforceability of NCAs on employees versus owners. This is one reason why the relative proportions of employees and part-owners with NCAs varies across states. For example, in CA and IL, part-owners are slightly *more* likely than employees to be bound by NCAs.

[42] We do not know the exact percentage of new jobs each year that imposed NCAs. Information provided by comparing the share of workers with NCAs across medical school cohorts may be limited to the extent that more experienced workers may have learned to avoid jobs with NCAs. There is some evidence that this may be the case, as experienced physicians with low job tenure were slightly less likely to have NCAs (about 42%).

both the decision to start a solo practice and the costs associated with accepting an NCA.

The selection equation is fully observed in that we have complete information for the entire sample, but the NCA equation exhibits incidental truncation since we do not know whether physicians in solo practices would have accepted NCAs if they had instead chosen to work in a group practice. The log-likelihood function is:

$$\begin{aligned}\log L &= \sum_{i=1}^{N}\{g_i N_i \ln \Phi_2(z_i\gamma, x_i\beta; \rho) + g_i(1-N_i)\ln[\Phi_1(x_i\beta) - \Phi_2(z_i\gamma, x_i\beta; \rho)] \\ &+ (1-g_i)\ln \Phi_1(-x_i\beta)\}\end{aligned}$$

where Φ_1 is the distribution of ε_i and Φ_2 is the bivariate normal distribution of (ε_i, u_i). The selection equation includes a geographic index of the overhead costs associated with operating a physician practice, which is excluded from the NCA equation. This index affects the incentive to share overhead costs across a group. The NCA model includes characteristics of the group practice, which are excluded from the selection equation.

Other characteristics in both z_i and x_i include: age, specialty, whether the physician plans to retire within 3 years, a control for US medical training, race, and ownership status. To a limited extent we control for preferences for mobility by including a variable that equals one if the physician has an employed spouse or partner, which may affect the cost of geographic mobility.[43] We also control for practice and local market conditions, including whether the practice is office-based, free-standing, or associated with a University; whether it is a large practice with 25 or more physicians; whether there are physicians with different specialties at the practice; and the log of median household income in the market. In some models we control for the state in which the practice is located to account for differences across states in the strength of NCA enforcement, and an interaction between state and ownership status. The interaction terms capture possible state-level differences in the treatment of part-owners versus employees. State effects may capture both differences in NCA laws and other unobserved state characteristics. An alternative specification uses Bishara Scores as measures of NCA enforceability.

Table 3 shows that physician, practice, and market characteristics have a large role in determining NCA use. The results shown are marginal effects of characteristics on the probability of having an NCA conditional on selection into an group practice. Based on Model 2, physicians in office-based practices are about 18 percentage points more likely to have NCAs, while those in free-standing clinics and university practices are about 20 and 18 percentage points less likely, respectively. Ownership status also plays a role: part owners are about 11 percentage points less likely to have NCAs. Physicians who are likely to be less mobile for observable reasons, such as having an employed spouse, are also less likely to be bound by NCAs. However, this coefficient is difficult to interpret, as there could be several opposing possibilities. One possibility is that observable signals of geographic stability are substitutes

[43] We also tested controls for geographic differences in average mobility preferences using census data to estimate the probability that a person in a given zip code will move to another zip code more than 100 miles away in a given year. This variable had little explanatory power and was dropped from the analysis.

for NCAs. Another is that the physician's spouse is more likely to be employed if the physician does not have an NCA because earnings are lower, as we will show. In Model 3 we include the Bishara Score and find that it is strongly predictive—an increase in enforceability from the least restrictive state (ND) to the most restrictive state (FL) is associated with a 30 percentage point increase in the probability that a physician will have an NCA. This suggests that firms consider state laws to be important factors in calculating the expected benefits to imposing NCAs.[44] Selection into NCAs also appears to be related to the decision whether to start a solo practice or join a group practice. The p-values of an LR test of no selection, shown in Table 3, range from 0.01 to 0.09 in the three models shown.

5.2 Compensation Structures

The first test of the theoretical model presented in Section 2.1 is that in contracts with NCAs, compensation is based more heavily on individual output. Table 2 shows summary statistics from a breakdown of each physician's total earnings by source. Physicians with NCAs receive about 59% of their total income as guaranteed fixed salary, compared to 74% of income for physicians without NCAs. The variable earnings component due to individual workers' output is measured based on responses to the question: "What percent of your [annual] earnings was based directly on fees-for-services you provided, or your own productivity?" The share of total earnings that comes from individual productivity is more that twice as high for physicians with NCAs, 27.1% compared to 13.0%. The disparity in the *level* of individual incentive payments in even larger, since physicians with NCAs earn more on average, which we discuss below. Other incentive payments tend in the same direction, accounting for about 7.4% of total earnings for physicians with NCAs and 4.6% for physicians without. Data about these payments are based on responses to the question: "What percent of your [annual] earnings was in the form of pay-outs from practice withholds, practice bonuses, or other incentive payments, including pay-for-performance bonuses?"

Firm size can also affect compensation structures when workers are risk-averse.[45] Redistribution of earnings across workers can provide insurance against worker-level income shocks, but the size of the redistributed share falls as a percentage of income as the size of the firm grows, holding constant the expected variance of earnings. Table 5 shows the percentage of physicians with NCAs by firm size. Among employees, the percentage generally falls with firm size, suggesting that insurance against earnings risk cannot explain the differences in compensation structures, and may attenuate the true difference.

5.3 Patient Allocation and Productivity

The second set of theoretical hypotheses that we test relates to the allocation of clients between owners and workers within group practices. Client allocations are measured by the number of clients treated, and by the estimated revenue generated by clients. We expect that in firms that use NCAs there is

[44] It is still possible that some firms use unenforceable NCAs simply as threats. This may explain why about 30% of employed physicians in CA have NCAs despite their lack of enforceability in the state.

[45] See Gaynor and Gertler (1995).

less difference between owners and workers in the number of patients treated and the estimated revenue generated.

Table 6 shows the mean number of weekly patient visits for employees and practice owners with and without NCAs. Employed physicians with NCAs see over 12% more patients per week than those without NCAs, while the number of patients seen by practice owners does not vary much with NCA use. However, even more important differences underlie these totals—the composition of patients by source of insurance coverage is also substantially affected by NCA use. Physicians with NCAs have significantly more privately insured patients and Medicare patients, which have the highest reimbursement rates, while treating fewer patients with Medicaid coverage and uninsured patients.[46] Medicaid payment rates averaged roughly half of the private insurance rates in our data.

Next, we estimate the weekly revenue generated by each physician using data on the number of patients served, the shares of patients that are covered by private insurance, Medicare, and Medicaid, and the average reimbursement prices for each type of patient. For privately insured patients, data on negotiated reimbursement prices are based on responses to the survey question: "On average, what is your net fee after discount for an initial office visit with a private, commercially-insured patient?" Similarly, we apply reimbursement rates in the corresponding geographic area at the time of service for primary care services to new patients making initial visits who are insured by Medicare or Medicaid.[47] Although this estimated revenue index cannot account for unobserved variation in the mixture of services provided by different physicians, it does provide an estimate of the effect of variation in the absolute number of patients as well as the composition of patients across physicians.

Both higher patient levels and more favorable patient mixes contribute to the significantly larger estimated weekly revenue generated by physicians with NCAs. The mean weekly revenue generated by an employed physician with an NCA is \$8,975, about 41.5% higher than that of an employed physician without an NCA. With only about 10% more hours worked per week, physicians with NCAs are also significantly more productive, generating on average \$229.50 per hour compared to \$180.10 for employed physicians without NCAs.

There are several possible explanations for the difference in patient mixes that lead to productivity differences. Clearly, patient mixes can affect the incentive to use NCAs—firms that have the most valuable assets that are capable of being protected by NCAs are the most likely to impose NCAs. However it is also possible that firms that use NCAs have more valuable patients because they have successfully prevented workers from poaching valuable clients in the past. In the theoretical model we abstracted from differences in aggregate asset levels and focused on client allocation within the firm, so differences in the levels of patients, although informative, do not fully address the hypothesis.

More revealing are the differences between firms that use NCAs and those that do not in the disparities in the allocation of clients between owners and workers. Table 6 shows that in firms that use

[46] It is difficult to draw conclusions based on the number of uninsured patients, some of whom may be treated as charity or below-cost care, while others may pay out-of-pocket.

[47] Medicare rates are based on HCPCS service code 99203, which provides an approximately 30-minute face-to-face visit by a new patient. This billing code requires 3 components: a detailed medical history, a detailed physical examination, and medical decision-making of at least low complexity. Medicaid reimbursement rates are average rates for a primary care service visit by state, based on survey data from physicians reported in Zuckerman et al (2009).

NCAs, employed physicians generate about $8,975 in revenue per week while owners generate about $9,112, a statistically insignificant difference. In firms that do not use NCAs, however, the difference is substantially larger and statistically significant—employed physicians generate about $6,339 per week, compared to $8,249 for owners. This difference in disparities within firms provides evidence in support of the second theoretical prediction.

In Table 7 we look for evidence that the difference in productivity associated with the use of NCAs is due to selection based on the types of workers or firms that choose to use NCAs. In Model 1 we find that, conditional on observed worker and firm characteristics, the use of NCAs by employees is associated with a significant $145 per hour increase in productivity. That is, the difference in productivity levels associated with the use of NCAs cannot be explained by differences in physician and practice characteristics. Moreover, controlling for observable characteristics that affect revenue tends to increase the estimated productivity effects of NCAs. Model 2 adds unobserved primary care market effects based on market definitions from the Dartmouth Atlas of Health Care. In this model, the mean estimate of the effect of NCAs on employee productivity increases further, but the standard errors become too large for meaningful inference.

5.4 Earnings Growth and Returns to Tenure

In the theoretical model we showed that the higher productivity of jobs with NCAs allows firms to compensate workers for the restrictions on workers' future job choices. We then showed how incentive compatibility requires that earnings grow faster in jobs with NCAs than in jobs without. Since we abstracted from the possibility of there being returns to experience for jobs with NCAs in the model, earnings growth required that jobs with NCAs have higher returns to tenure. More generally, any form of larger earnings growth can be incentive compatible with accepting an NCA.

In this section we look for empirical evidence on the underlying causes of earnings growth associated with NCAs. If earnings indeed grow faster in jobs with NCAs, as theory predicts, then decomposing the earnings growth into components due to returns to tenure and experience provides information about the mechanisms that are affected by the use of NCAs. If the rise in earnings is primarily due to tenure at firms that use NCAs, this suggests that incentives to provide firm-specific training or increase the efficiency of client allocation are likely to be important factors connected the use of NCAs.

To estimate the effects of NCAs on within-job earnings growth, and decompose earnings growth into returns to tenure and experience, we begin with the basic model of interest:

$$Y_{ijt} = \alpha + x_{it}\beta_1 + e_{it}\beta_2 + e_{it}NCA_{ij}\beta_3 + T_{ijt}\beta_4 + T_{ijt}NCA_{ij}\beta_5 + NCA_{ij}\beta_6 + \varepsilon_{ijt} \tag{2}$$

where the earnings of physician i at firm j in period t, Y_{ijt}, depend on observable characteristics of the worker and firm, x_{it}, the (potential) experience of the worker, e_{it}, measured in the data as the number of years since graduating from medical school, and the tenure of the worker at firm j, T_{ijt}, and the returns to experience and tenure may depend on whether the worker has an NCA. The well-known concerns with estimating the returns to general experience and firm tenure are that job search or matching cause

the error term to be correlated with e_{it} and/or T_{ijt}. Specifically, if the error term were decomposed as:

$$\varepsilon_{ijt} = \mu_i + \phi_j + u_{ijt}$$

where μ_i is a worker effect, ϕ_j is a firm effect, and u_{ijt} is a statistical residual, one concern is that ϕ_j and T_{ijt} may be positively correlated if workers tend to stay in high wage jobs. The correlation could also depend on total experience if workers with low tenure but high experience are likely to have switched jobs because they found a match with a high ϕ_j, causing the net bias to be ambiguous. Topel (1991) describes an auxiliary regression similar to:

$$\phi_j = e_{it}b_2 + e_{it}NCA_{ij}b_3 + T_{ijt}b_4 + T_{ijt}NCA_{ij}b_5 + \nu_{ijt} \tag{3}$$

That is, experience provides more time over which matching can occur, inducing a correlation with ϕ_j, tenure may depend on unobserved firm productivity, and NCAs can interact with both effects by altering mobility and/or unobserved productivity.

We first estimate the effect of NCA use on total earnings growth using within-job variation in earnings. For each worker in the sample we have data on up to three years of annual earnings, spread out over a five year window. For workers with NCAs, taking differences in earnings within-job identifies:

$$Y_{Nijt} - Y_{Nijt-1} = \beta_2 + \beta_3 NCA_{ij} + \beta_4 + \beta_5 NCA_{ij} + u_{ijt} - u_{ijt-1} + \nu_{ijt} - \nu_{ijt-1}$$

We write NCA_{ij} explicitly in the difference equation since we will consider both binary and continuous measures of enforceability. For workers without NCAs:

$$Y_{Cijt} - Y_{Cijt-1} = \beta_2 + \beta_4 + u_{ijt} - u_{ijt-1} + \nu_{ijt} - \nu_{ijt-1}$$

The difference in within-job earnings growth associated with NCAs is identified by $\widehat{(\beta_3 + \beta_5)}NCA_{ij}$.

To separately identify the effects of NCA use on returns to tenure, β_5, and returns to experience, β_3, we estimate a two-step model that is a modified version of the model proposed by Topel (1991). The first step is the within-job earnings growth model above, and the second-step is:

$$Y_{ij} = e_{0i}\beta_2 + e_{0i}\beta_3 NCA_{ij} + T_{ij}B_4 + T_{ij}NCA_{ij}B_5 + \xi_{ij} \tag{4}$$

where e_{0i} is the prior experience of worker i at the beginning of the job spell, $B_4 \equiv (\beta_2 + \beta_4)$ and $B_5 \equiv (\beta_3 + \beta_5)$. Taking first differences of the within-job earnings growth and (4) gives

$$Y_{ij} - T_{ij}\widehat{B_4} - T_{ij}NCA_{ij}\widehat{B_5} = e_{0i}\beta_2 + e_{0i}\beta_3 NCA_{ij} + \epsilon_{ij}$$

where

$$\epsilon_{ij} = \xi_{ij} + T_{ij}(B_4 - \widehat{B_4}) + T_{ij}NCA_{ij}(B_5 - \widehat{B_5})$$

This provides unbiased estimators $\widehat{\beta_3}$ and $\widehat{\beta_5} = \widehat{B_5} - \widehat{\beta_3}$ under the assumption $\mathbb{E}[e_{0i}\xi_{ij}] = 0$. We test

this assumption empirically in our data and estimate the bias caused by correlation between e_{0i} and ξ_{ij}. As reported in Table 10, we fail to reject the assumption, and estimate the empirical bias to be more than 100 times smaller than the baseline estimate of within-job earnings growth associated with NCAs.

Table 8 presents estimates of static fixed effects models of the wage premium associated with the use of NCAs. Model 1 suggests that the hourly earnings of physicians with NCAs are about 14% higher, conditional on observed worker and firm characteristics and unobserved market effects. Other significant estimates in the model are consistent with theory as well: part-owners and pediatric specialists earn significantly more per hour.

Model 2 includes a continuous measure of NCAs that accounts for variation in state enforceability interacted with the binary NCA indicator. This model suggests that having an NCA in a state with the most enforceable laws is associated with a 18.6% hourly earnings premium relative to either not having an NCA or having an unenforceable NCA (the continuous measure treats these as equivalent).[48] A higher earnings premium in states where NCAs are more enforceable is also consistent with theory. If firms are unsure whether an NCA they have imposed will be enforceable, they may temper their investments in workers. This could lead to an equilibrium somewhere between that with perfectly enforceable NCAs and that without NCAs. In addition, Section 5.1 discusses how the use of NCAs by firms increases with their enforceability in a state. If workers have heterogeneous preferences for occupational mobility within their geographic labor market, theory suggests they will sort into jobs with NCAs according to these preferences, and the equilibrium wage differential will be determined by the preferences of the marginal worker. If more workers are bound by NCAs in a market, the marginal worker ought to be more averse to accepting an NCA, increasing the observed wage premium.

Table 9 includes similar models that interact 'NCA' and 'Bishara Score' with quadratic terms in log experience and log job tenure. Figures 1 and 2 graphically depict how hourly earnings grow over time with changes in potential experience and job tenure, conditional on observed worker, firm and market characteristics included in Model 1 in Table 9. As shown in the figures, the hourly earnings of workers with NCAs begin around the same level as workers without NCAs, but rise over time at a much faster rate. After about 20 years of either potential experience or job tenure, hourly earnings of workers with NCAs are about 25 log points higher than observably similar workers without NCAs. Without accounting for job search, however, these estimates do not separately identify the effects of experience from those of tenure.

To separately identify each component of earnings growth, we estimate the two-step model described above. Table 10 presents estimates of the first step, which identify total within-job earnings growth. The model estimated is a fixed effects model with job-match effects, using up to three years of earnings data per physician, from 2002, 2005, and 2006. Focusing on Model 3, the main effects estimates imply that total within-job earnings growth is indistinguishable from zero for physicians without NCAs (a mean estimate of 1% per year with a standard error of 4%). However, for physicians with NCAs, within-job earnings growth is significantly higher at 22% per year.[49]

[48] In practice the lowest enforceability measure in our data is 0.06 in CA, so the extrapolation is minimal.

[49] Our results on the effects of NCAs on earnings growth differ from those in Garmaise (2011), which uses data from Execucomp on executives from large publicly-traded US companies. Although Garmaise (2011) does not use micro-level

Table 11 presents the remaining estimates of the two-step model. The second-step model suggests that returns to experience associated with NCAs are about 9.8% per year, which implies a lower-bound estimate of the returns to tenure of 12.0%, compared to just 1.6% for workers without NCAs.[50] The estimated bias induced by correlation between e_{0i} and ξ_{ij} is very small, 0.002. These estimates provide evidence that firms that use NCAs invest in their workers in ways that improve both general human capital as well as firm-specific capital. The total earnings growth comes slightly more from firm-specific investments. The estimates also reveal an interesting point: although prior experience does not appear to be valued by firms that do not use NCAs, experience is valued by firms with NCAs. We discuss this point further in Section 5.7, where we present evidence that firms with NCAs do not appear to differentially select workers with more prior experience. This suggests the difference in returns to experience are not due to positive selection.

5.5 Labor Supply

The third hypothesis from the theoretical model is that employed physicians with NCAs work more hours. The relationship between labor supply and moral hazard with share-based contracts has been studied both theoretically, by Cheung (1968) and Stiglitz (1974), and empirically, by Braido (2008). In addition, to the extent that the availability of patients is a constraining factor in labor supply decisions, physicians with NCAs are likely to work more hours as a consequence of the client allocation problem. Conversely, physicians who are part-owners of a practice that uses NCAs are likely work fewer hours as they allocate more of the firm's patients to employees. In theory, differences in hourly earnings may also affect labor supply. However, a recent review of the literature on the uncompensated elasticity of labor supply of US physicians by Nicholson and Propper (2012) suggests the empirical elasticity is close to zero.

Table 12 compares the unconditional number of hours worked by physicians with and without NCAs by ownership status. Employed physicians with NCAs work about 220, or about 12%, more hours annually, while physicians who are part-owners of firms that use NCAs work about 123 fewer hours,

data on which executives are bound by NCAs, the paper estimates correlates of differences in state NCA policies, and intent-to-treat effects of changes in policies over time. The findings suggest that NCAs are associated with lower average total compensation, and that stronger state-level enforceability of NCAs shifts the composition of earnings away from stock options and towards salaried earnings. One explanation for the differences is that the motivation for using NCAs outside of service firms is very different from the their use in controlling relationship-assets. In particular, we examine the market for services in which information asymmetries are strong, and reputation drives transactions. The relative abilities of workers, as opposed to firms, in overcoming these information asymmetries can affect which agent is better suited for making investments, which could lead to different results outside of service firms.

[50] There has been much discussion about the sensitivity of estimates of returns to tenure to model specifications, for example in Altonji and Williams (2005) and Nevos and Waldman (1997). Altonji and Williams (2005) replicate the estimates from Topel (1991) and show that when years of tenure are matched to annual earnings rather than lagged earnings, and observations with tenure equal to zero are included, the estimated returns to tenure fall by over 43%. We use this specification, which corresponds to Panel C in Table 3 of Altonji and Williams (2005). Altonji and Williams (2005) also discuss the sensitivity of estimates to the form of time detrending or year effects, to the inclusion of union status and marital status in the second stage model, and to measurement error in tenure in the PSID. We remove year effects before the first stage model rather than using the detrending proceedure proposed by Topel (1991). Our sample does not include unionized workers. Marital status is not significant in our model, and increases the estimated returns to tenure slightly, by 0.0007. Similarly, spousal employment status has negligible effects. The unique concerns with the PSID data, including potentially endogenous attrition, do not apply to our data, which was collected at a point in time.

both significant differences. Table 13 shows conditional estimates of annual hours worked, controlling for physician and practice characteristics and for unobserved market effects. Model 1 shows that owner-physicians with NCAs work significantly fewer hours, about 207 annually, than comparable physicians without NCAs. Employed physicians work slightly more hours, although the difference is not statistically significant. The net effect is that the distribution of hours worked by ownership status within firms that use NCAs is far more even than in firms without NCAs, similar to the findings on patient-visits. Model 2 includes a continuous measure of NCA enforceability, and the estimates suggest that the effects of NCAs on hours worked are stronger where NCAs are more enforceable. Model 3 shows that for employees the coefficients remain relatively stable when log annual earnings are added. Model 4 includes the incentive-share percentages for each physician, measured as the fraction of total earnings that come from incentive payments for individual output. The insignificant and relatively small coefficient (the variable is measured from zero to one) suggests that moral hazard due to the structure of share contracts has negligible effects on hours worked in our data. This finding is consistent with the focus of our theoretical model on the use of share contracts as a mechanism for mitigating the effects of NCAs on dynamic bargaining power rather than reducing moral hazard.[51]

5.6 Mobility

As suggested by the theoretical model, NCAs have the potential to increase the length of job spells in three ways. They could deter exit directly by making it more costly, they could induce self-selection by workers with private knowledge about their expectation for remaining at the firm, and they could reduce the probability that an outside offer will exceed earnings by increasing the returns to tenure. While it is not possible to identify each of these effects separately with available data, the net effect of NCAs on the duration of job spells is identified. To the extent that hiring is costly for firms, the net effect of NCA use on job-spell lengths is the appropriate measure for estimating the mobility component of the benefit to the firm of using NCAs.

The effects of NCAs on mobility is one topic that has been studied in the empirical literature. Marx et al (2009) use an exogenous inadvertent change in enforcement of NCAs in Michigan in 1985 and find that the average mobility of inventors producing patents in Michigan fell relative to the mobility of inventors in other states as a result of the increase in the enforceability of NCAs. And Marx (2011) finds 40% of electrical engineers surveyed had signed NCAs, and that workers who left firms were more likely to switch industries if they were subject to an NCA.

Note that although we focus our attention on geographic and occupational mobility, there is an interesting comparison to be made with prior literature, including Fallick et al (2006), which has focused on inter-industry mobility. When markets are defined by products rather than by geography, NCAs can have very different types of mobility effects since workers may have to switch industries to avoid violating the contract. We ignore the possibility of inter-industry job switches because our analysis focuses on physicians, who are unlikely to switch industries due to the high fixed costs of training. This

[51] It is also possible that labor contracts could contractually specify the number of hours that each employed physician must work, in which case moral hazard should not affect the hours dimension of labor supply.

simplification can also alleviate concerns about the endogeneity of the location decisions of firms with respect to state NCA laws. Whereas technology research companies may benefit from agglomeration economies in places like Silicon Valley, where NCAs are relatively unenforceable under California law,[52] physicians and other on-site service firms are widespread.

In Table 14 we show the unconditional distribution of job tenures for physicians with and without NCAs. As expected, physicians with NCAs are significantly less likely to have begun their job within the prior seven years. Figure 3 shows a similar result conditional on observed characteristics. The estimates shown are the differences in the conditional probabilities of observing a given year of tenure for a physician with and without an NCA. Physicians with NCAs were significantly less likely to have tenures between one and seven years, and significantly more likely to have tenure of nine or more years. As shown in Figure 4, the conditional CDF of job tenures of physicians with NCAs first-order stochastically dominates the distribution for physicians without NCAs.

Table 15 presents estimates from fixed effects negative binomial models of job tenure, conditional on observed worker and firm conditions and unobserved market effects from the Dartmouth Atlas. Model 1 shows physicians with NCAs have about 29% longer job spells, conditionally. Model 2 shows that the difference in job spell lengths increases with the enforceability of state NCA laws. Although this evidence is not strong enough to conclude causality, it is suggestive that NCAs have some causal effect. The reason for this is because, as shown in Table 3, firms are substantially more likely to use NCAs where they are more enforceable. This suggests that if the entire difference in job tenures were due to sorting on unobserved preferences for mobility, then as enforceability increases the marginal workers who accept NCAs would be more likely to switch jobs. Model 2 suggests the opposite—where enforceability is higher job spells are longer. Model 3 adds the 'Bishara Score' without interacting with NCA use. The coefficient reveals information about sorting on unobservables. For workers without NCAs, who should not be directly affected by state enforceability laws at all, higher enforceability is actually associated with shorter job spells. This suggests that physicians sort into jobs based on preferences for mobility. In combination, the three models provide evidence that each effect separately plays a role in increasing the length of job spells. To be clear, with only a single cross-sectional sample a direct relationship between tenure and job-spell length requires a stationarity assumption in the difference between the rates of job flows for jobs with and without NCAs.[53]

5.7 Robustness Checks

5.7.1 Selection on Quality

One potential challenge to interpreting the effects and policy relevance of NCA laws would be if there were systematic selection of high quality workers into jobs with NCAs. If workers with NCAs provide

[52] Gilson (1999) argues that differences in employee mobility patterns, a mechanism for transferring knowledge between firms, in Silicon Valley and Route 128 can be explained in part by differences in legal infrastructure, NCA laws in particular, and that efficient transfers of knowledge through mobility have played a large role in the creation and development of industrial districts.

[53] See Kiefer et al (1985).

higher quality services than workers without, this could explain the substantially larger rate of within-job earnings growth associated with NCAs.[54]

We examine evidence on several direct and indirect measures of quality and find no significant differences between physicians with and without NCAs. First, we compare the prices negotiated between private commercial insurance plans and physicians. There is substantial variation in negotiated reimbursement rates for standard primary care office visits, which are billed according to fixed amounts of time spent with a physician, even within markets. In our data, the within-market standard deviation in prices, based on Dartmouth Atlas Primary Care Service Area (PCSA) definitions, is $35.49. This suggests that characteristics of physician services are implicitly priced. However, as Table 16 shows, there is no significant difference between the average prices negotiated by physicians with NCAs, $91.14, and those without NCAs, $89.14, for an initial office visit by a private, commercially-insured patient.[55] Table 17 shows results from fixed effects models that regress prices on physician and practice characteristics, with geographic market effects based on county in Model 1 and PCSA in Models 2 and 3. All three models suggest that prices vary with physician characteristics as expected. For example, physicians with two or more specialties receive on average $25 to $31 more per visit than family practice or general physicians. Still, we find no significant difference in prices charged by physicians based on the use of NCAs. The difference in conditional mean prices is also very small, between $1 to $2. This suggests that any difference in quality between physicians with NCAs is not priced by markets, despite evidence that other characteristics are priced as expected.

Second, we compare data that directly tests the clinical knowledge of physicians in our sample. The survey included a series of hypothetical clinical situations followed by questions about the diagnoses and recommended treatments for the patients described in the scenarios. The vignettes and questions were designed by clinical consultants and pre-tested with a clinical panel to ensure that they provide meaningful and accurate assessments of physician practice patterns. Similar vignette-based surveys have been used extensively in the medical literature to measure variations in the approaches to diagnoses and treatment recommendations among physicians, and have been convincingly shown to provide measures of quality of care that are even more reliable than data from medical records.[56] We first test for any differences in the responses of physicians with and without NCAs using a chi-square test. As shown in Figure 5, of the 62 chi-square tests for differences in responses to each question, there was only one question to which physicians with NCAs responded significantly differently (at the 5% level) than physicians without NCAs. We also compare an aggregate measure of compliance with clinical guidelines for a vignette based on the diagnosis and treatment of Asthma.[57] Compliance with Asthma guidelines

[54] For example, reputation effects could explain why earnings begin at similar levels in early career stages, but diverge over time.

[55] Data on negotiated prices come from responses to the question: "On average, what is your net fee after discount for an initial office visit with a private, commercially-insured patient?"

[56] See Veloski et al (2005) for an assessment of vignette-based surveys in measuring physician quality and practice variation.

[57] Specifically, we construct a measure of Asthma Guideline Compliance by comparing responses to guidelines developed by NIH Heart, Lung and Blood Institute and the American Academy of Pediatrics. We define Asthma Guideline Compliance as a binary variable equal to one if three conditions are met. First, the physician diagnosed the patient's condition as persistent moderate asthma (versus mild-intermittent, mild-persistent or severe-persistent). Second, they recommended

was tested specifically because it provides a relatively objective assessment of clinical knowledge, whereas expert opinions may differ for other vignettes. As shown in the bottom two rows of Figure 5, we found no statistically significant difference in overall compliance with clinical guidelines among physicians with NCAs.[58] There was, however, considerable potential for measuring variation, as slightly fewer than half of physicians responded in accordance with clinical guidelines.

Third, we test whether physicians that had more experience prior to beginning their current job were more likely to have NCAs. Table 18 reports marginal effects from a probit model that regresses NCA use on experience prior to the beginning of a physician's current job, along with physician, practice, and market characteristics similar to the ones included in Table A1. We find that experience in prior jobs has no effect, precisely estimated, on the probability of having an NCA.

Collectively, this evidence suggests that any systematic difference in quality among physicians with NCAs would have to be a characteristic that is neither valued by consumers nor insurance companies, is unrelated to clinical knowledge, diagnosis patterns, and treatment recommendations, and is unrelated to experience.

5.7.2 Correlation with Other State Policies

A second concern is whether estimates that are based on differences in the strength of NCA enforceability are instead being driven by other state laws. For example, ideologies of voters about laissez-faire governance or workers' rights may affect a broad array of state policies that are correlated with NCA laws. However, the extent to which this is a concern is limited for several reasons. The controversy surrounding the use of NCAs as potentially restrictive and anti-competitive provisions has existed for hundreds of years, and predates US common law.[59] As common law, the enforceability of NCAs in states has primarily evolved through precedent, the majority of which was established long before most of the legislation that shapes state policies currently. In addition, US states differ in both the strength of influence and geography of origin of their civil law traditions, for reasons that are unrelated to current voters' ideologies.

We show empirical evidence that the enforceability of NCA laws is on average uncorrelated with the modern-era political preferences of states. Figure 6 graphs the relationships between the Bishara score of state enforceability of NCA laws in each state, measured in both 1991 and again in 2009, compared to the share of voters in each state that voted for US presidential candidates from the Republican and Democratic parties in the last 5 elections (1992-2008). The expectation is that states that tend to favor pro-business policies and impose fewer regulatory restrictions are likely to favor Republican Party candidates, and also allow businesses to enforce the provisions of labor contracts that are freely agreed-upon by both parties. We find that this is not the case; there is no systematic relationship between the political preferences of voters and state NCA policies. The mean estimate shown in the

prescribing inhaled corticosteroids year-round. Third, they would schedule the patient for a follow-up visit with one month. Otherwise, we define Asthma Guideline Compliance to equal zero.

[58] Coincidentally, the one question out of 62 to which physicians with NCAs responded differently is included in the aggregate measure on compliance with Asthma guidelines, which does not differ according to NCA use.

[59] Bishara (2011)

graph is slightly negative, the opposite of the predicted direction. Although this does not imply that there are no correlations between NCA enforceability and other state laws, it suggests that on average such correlations are likely to be limited to policies with similar common law origins rather than those driven by current political preferences.

6 Discussion

Nearly every state permits the use of NCAs, but the economic rationales behind their use are not always transparent. Our goal is to articulate the arguments behind the use of NCAs from both theoretical and empirical perspectives. We present a theoretical model of the use of NCAs in service firms. High-skilled service firms face the problem that they do not directly control valuable client-assets, which can lead to investment holdups. Our model shows how NCAs provide a second-best solution of indirect control by breaking the link between producing a service and controlling the associated relationship-asset. Overcoming the asset-control problem increases the productive efficiency of the firm. However, NCAs also distort labor markets in many ways, including altering the bargaining power of workers and increasing the cost of worker mobility. We show that share-based compensation contracts can overcome the effects of NCAs on bargaining power, allowing for an incentive-compatible equilibrium with NCAs in which workers with NCAs are more productive, have higher earnings, larger returns to tenure, and longer job spells.

We provide the first known empirical evidence on the use of NCAs among service firms. Using new survey data from primary care physicians, we document the systematic use of NCAs among physician practices. We show that as a personnel tool, NCAs can benefit workers as well as firms, as suggested by our theoretical model but contrary to popular misconceptions. Counteracting the potentially harmful effects of NCAs on the bargaining power of workers, contracts with NCAs tie earnings to individual output with incentive components that are more than twice as large relative to total earnings. We estimate that physicians who commit to NCAs are 40% more productive in terms of revenue per hour and earn about 14% higher wages. In addition, the within-job rate of real earnings growth is 21 percentage points higher for physicians with NCAs, controlling for unobserved worker-firm match heterogeneity. When earnings growth is decomposed into components, both the returns to tenure (12 percentage points) and returns to experience (10 percentage points) are significantly higher in jobs that use NCAs, consistent with larger investments in both general and firm-specific human capital. All of these empirical findings hold despite an array of tests that find no evidence of selection on observed or unobserved quality.

These estimates can assist policymakers in evaluating the welfare effects of NCAs and shaping public policy. Several states have changed their laws to expressly prohibit the use of NCAs by physicians, despite a dearth of empirical evidence on the effects of NCAs.[60] We also draw attention to an important

[60] In 2008, Massachusetts legislators banned the use of NCAs for physicians and nurses, citing issues with their effects on medical professionals' rights to practice and patients' rights to choose practitioners. In Tennessee, in 2005 the Supreme Court banned the use of NCAs for physicians under Murfreesboro Medical Clinic, PA v. Udom, 166 S.W.3d 674 (Tenn. 2005). This prompted the state legislature to enact a bill in 2008 that specifically permitted NCAs for physicians other

policy-relevant distinction between the use of NCAs by service firms to control relationship-assets and by technology firms that use NCAs to protect intellectual property. Whereas evidence, such as that in Fallick et al (2006), has suggested that the absence of enforceable NCAs may have contributed to the microfoundations of local agglomeration economies, we find that the presence of enforceable NCAs increase earnings growth and investment among service firms. Although further analysis is needed in both settings to assess the total net welfare effects of NCA policies, the findings suggest that decoupling NCA policies across different industries may be beneficial.

than emergency physicians and radiologists, and as of 2011 further modifications of the statutes are under discussion. CO, DE, and TX have also banned the use of NCAs by physicians. The role of NCAs in physician labor markets in particular has come into question surrounding the Affordable Care Act (ACA). A substantial concern about the implementation of the ACA is that shifts in demand for physician services will be strongly heterogeneous due to geographic correlations in uninsurance. For example, demand may increase by substantially more in poorer urban areas than in affluent suburbs. To the extent that NCAs restrict intra-market movement, they have the potential to exacerbate disparities in access by limiting supply responses.

References

[1] Acemoglu, Daron (1997), "Training and Innovation in an Imperfect Labor Market," *Review of Economic Studies*, Vol. 64, (1997), pp. 445-464.

[2] Acemoglu, D. and JS Pischke (1999), "The Structure of Wages and Investment in General Training," *Journal of Political Economy*, Vol. 107, No. 3 (June, 1999), pp. 539-572.

[3] Acemoglu, D. and R Shimer (1999), "Holdups and Efficiency with Search Frictions," *International Economic Review*, Vol. 40, No. 4, (Nov., 1999), pp. 827-849.

[4] Ackerberg, D. and M Botticini (2002), "Endogenous Matching and the Empirical Determinants of Contract Form," *Journal of Political Economy*, Vol. 110, No. 3, pp. 564-591.

[5] Altonji, J. and N Williams (2005), "Do Wages Rise with Job Seniority? A Reassessment," *Industrial and Labor Relations Review*, Vol. 58, No. 3, (April, 2005) pp. 370-397.

[6] American Medical Association (1998) Code of Medical Ethics, Section Opinion 9.02 - Restrictive Covenants and the Practice of Medicine, last visited 6/9/10 at http://www.ama-assn.org/ama/pub/physician-resources/medical-ethics/code-medical-ethics/opinion902.shtml

[7] Becker, Gary (1962), "Investment in Human Capital," *Journal of Political Economy*, Vol. 70, Issue 5, Part 2: *Investment in Human Beings* (Oct., 1962), pp. 9-49.

[8] Bishara, Norman (2011), "Fifty Ways to Leave Your Employer: Relative Enforcement of Noncompete Agreements, Trends, and Implications for Employee Mobility Policy," *University of Pennsylvania Journal of Business Law*, Vol. 13 (forthcoming)

[9] Blau, Francine and Lawrence Kahn (1999), "Institutions and Laws in the Labor Market," *Handbook of Labor Economics*, Vol. 3, Part 1, 1999, pp. 1399-1461.

[10] Boal, W. and M. Ransom (1997), "Monopsony in the Labor Market," *Journal of Economic Literature*, Vol. 35, No. 1, (Mar., 1997) pp. 86-112.

[11] Braido, L (2008), "Evidence on the Incentive Properties of Share Contracts," *Journal of Law and Economics*, Vol. 51, No. 2, (May, 2008) pp. 327-349.

[12] Cheung, S. (1968), "Private Property Rights and Sharecropping," *Journal of Political Economy*, Vol. 76, No. 6, (Nov., 1968) pp. 1107-1122.

[13] Cheung, S. (1969), "Transaction Costs, Risk Aversion, and the Choice of Contractual Arrangements," *Journal of Law and Economics*, Vol. 12, No. 1, (Apr. 1969), pp. 23-42.

[14] Devine, T., and N.M. Kiefer, (1993) "The Empirical Status of Job Search Theory," *Labour Economics* Vol. 1, No. 1, (1993) pp. 3-24.

[15] Falick, Bruce, Charles Fleishman, and James Rebitzer (2006) "Job-Hopping in Silicon Valley: Some Evidence Concerning the Microfoundations of a High-Technology Cluster," *Review of Economics and Statistics*, Vol. 88, No. 3, (Aug, 2006), pp. 472-483.

[16] Farrell, J. and S. Scotchmer (1988), "Partnerships," *Quarterly Journal of Economics*, Vol. 103, No. 2, (May, 1988) pp. 279-297.

[17] Garicano, Luis and Tano Santos (2004) "Referrals," *American Economic Review*, Vol. 94, No. 3, (2004) pp. 499-525.

[18] Garmaise, M. (2011) "Ties that Truly Bind: Non-Competition Agreements, Executive Compensation, and Firm Investment," *Journal of Law, Economics, and Organization*, Vol. 27, No. 2, (August) pp. 376-425.

[19] Gaynor, M. and P. Gertler (1995) "Moral Hazard and Risk Spreading in Partnerships," *RAND Journal of Economics*, Vol. 26, No. 4, (Winter, 1995) pp. 591-613.

[20] Gibbons, Robert (1987), "Piece-Rate Incentive Schemes," *Journal of Labor Economics*, Vol. 5, (1987), pp. 413-29.

[21] Gibbons, Robert and Kevin J. Murphy (1992), "Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence," *Journal of Political Economy* Vol. 100, (1992), pp. 468-505.

[22] Gilson, R. (1999), "The Legal Infrastructure of High Technology Industrial Districts: Silicon Valley, Route 128, and Covenants Not to Compete," *New York University Law Review*, Vol. 74 (1999).

[23] Grossman, Sanford and Oliver Hart (1986), "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economy*, Vol. 94, No. 4, (Aug, 1986), pp. 691-719.

[24] Hansen, G and S. Imrohoroglu (2009) "Business Cycle Fluctuations and the Life Cycle: How Important is On-The-Job Skill Accumulation," *Journal of Economic Theory*, Vol. 144 (2009), pp. 2293-2309.

[25] Hart, Oliver and John Moore (1990) "Property Rights and the Nature of the Firm," *Journal of Political Economy*, Vol. 98, No. 6 (Dec., 1990), pp. 1119-1158.

[26] Hogue, M. and D. Erra (2009) "Creating a Cost-Effective Process for Physician Recruitment," *Human Resource Strategy*, Third Quarter, 2009, pp. 57-63.

[27] Jovanovic, B. (1979) "Firm-Specific Capital and Turnover," *Journal of Political Economy*, Vol. 87, No. 6, pp. 1246-60.

[28] Kiefer, NM, Shelly Lundberg, and George Neumann (1985), "How Long is a Spell of Unemployment? Illusions and Biases in the Use of CPS Data" *Journal of Business and Economic Statistics* Vol. 3, No. 2, (April 1985), pp. 118-128.

[29] Levin, J. and S. Tadelis, (2005) "Profit Sharing and the Role of Professional Partnerships," *Quarterly Journal of Economics*, Vol. 120, No. 1, (Feb., 2005), pp. 131-171.

[30] Ligos, M (2000), "Job Contract with Noncompete Teeth," New York Times, Business Section, Nov. 1, 2000. Last visited 6/13/10 http://www.nytimes.com/2000/11/01/jobs/job-contracts-with-noncompete-teeth.html?scp=1&sq=job%20contracts%20with%20noncompete%20teeth&st=cse

[31] Malsberger BM, Blackstone RA, Pedowitz AH (2006), "Covenants not to compete: a state-by-state survey" (Arlington, VA : BNA Books)

[32] Marx, Matt (2011), "The Firm Strikes Back: Non-Compete Agreements and the Mobility of Technical Professionals," *American Sociological Review*, Forthcoming October 2011.

[33] Marx, M., D. Strumsky, and L. Fleming (2009). "Mobility, Skills, and the Michigan Non-compete Experiment," *Management Science* Vol. 55, No. 6, pp. 875-889.

[34] Morrison, A and W Wilhelm (2004) "Partnership Firms, Reputation, and Human Capital" *American Economic Review*, Vol. 94, No. 5, (Dec, 2004), pp. 1682-1692.

[35] Murphy, K and R Topel (1985) "Estimation and Inference in Two-Step Econometric Models" *Journal of Economics and Business*, Vol. 3, No. 4, (1985).

[36] Nevos, Ian and Michael Waldman (1997), "Returns to Tenure: Conceptual and Empirical Issues," *Eastern Economic Journal*, Vol. 23, (Summer 1997), pp. 337-346.

[37] Nicholson, S. and C. Propper (2012) "Medical Workforce," *Handbook of Health Economics, Volume 2, eds. M. Pauly, T. McGuire, and P. Barros* (2012): 873-926.

[38] Pissarides, C. (1990) "Equilibrium Unemployment Theory" Cambridge, MA: MIT Press, 1990.

[39] Pissarides, C. (1994), "Search Unemployment with On-the-job Search," *The Review of Economic Studies*, Vol. 61, No. 3, (Jul. 1994), pp. 457-475.

[40] Rebitzer, James and Lowell Taylor (2007), "When Knowledge is an Asset: Explaining the Organizational Structure of Large Law Firms," *Journal of Labor Economics*, Vol. 25, No. 2, (April 2007), pp. 201-229.

[41] Rierson, J. (2001), "Bargaining and Efficiency in Sharecropping," *Journal of Agricultural Economics*, Vol. 52, No. 2, (May 2001), pp. 1-17.

[42] Salop, J and S Salop, (1976) "Self-Selection and Turnover in the Labor Market," *Quarterly Journal of Economics*, Vol. 90, No. 4, (Nov., 1976), pp. 619-627.

[43] Shortell, S. " A Model of Physician Referral Behavior: A Test of Exchange Theory in Medical Practice" Research Series No. 31, Chicago: Center for Health Administration Studies, University of Chicago, 1972.

[44] Singh, N. (2000) "Theories of Sharecropping," *Readings in Development Microeconomics, ed. Pranab K. Bardhan and Christopher Udry* (2000): 19-72.

[45] Sorrel, AL (2008), "Kansas Court Enforces Noncompete Clause," American Medical News Aug. 4, 2008. Last visited 6/13/10 http://www.ama-assn.org/amednews/2008/08/04/prsa0804.htm

[46] Stiglitz, J., (1974), "Incentives and Risk Sharing in Sharecropping," *The Review of Economic Studies*, Vol. 41, No. 2, (Apr. 1974), pp. 219-255.

[47] Topel, R., (1991), "Specific Capital, Mobility, and Wages: Wages Rise with Job Seniority," *Journal of Political Economy*, Vol. 99, No. 1, pp. 145-176.

[48] Veloski, J., S. Tai, A. Evans, and D. Nash (2005), "Clinical Vignette-Based Surveys: A Tool for Assessing Physician Practice Variation," *American Journal of Medical Quality*, Vol. 20, pp. 151-157.

[49] Waldman, D., F. Kelly, S. Arora, and H. Smith (2004), "The Shocking Cost of Turnover in Health Care," *Health Care Management Review*, Vol. 29, No. 1, (Jan. 2004), pp. 2-7.

[50] Ward, B, (1958), "The Firm in Illyria: Market Syndicalism," *American Economic Review*, Vol. 48, No. 4, (Sep. 1958) pp. 566-589.

[51] Wilson, B. (2006), "Location, location, location: The geographic facts about noncompete clauses", *American Medical News*, Jan. 30, 2006. Last visited 6/13/10 http://www.ama-assn.org/amednews/2006/01/30/prsa0130.htm

[52] Zuckerman, S., A. Williams, and K. Stockley (2009), "Trends in Medicaid Physician Fees, 2003-2008," *Health Affairs*, Vol. 28, No. 3, (Apr. 2009), pp. w510-w519.

Table 1: % of Respondents with NCAs, By State and Employment Status

	Full Sample		Employees		Part Owners	
California	511	31.3%	225	29.8%	206	36.9%
Georgia	120	51.7%	51	60.8%	53	43.4%
Illinois	217	52.1%	124	50.0%	73	54.8%
Pennsylvania	231	60.6%	147	66.0%	62	54.8%
Texas	268	49.6%	129	58.9%	97	45.4%
All States	1347	45.1%	723	49.2%	534	43.1%

Table 2: % of Employees with NCAs, By Potential Experience and Practice Tenure

	Tenure				
Potential Experience	1 to 7	8 to 14	15 to 21	22+	
1 to 7	51.4%				51.4%
8 to 14	37.1%	55.6%			47.0%
15 to 21	41.5%	49.2%	58.0%		49.0%
22+	42.4%	47.1%	47.6%	47.4%	45.6%
	44.1%	53.6%	54.2%	47.4%	48.6%

Notes: Sample includes physicians who are employees and are not part-owners of the practices at which they work, and who completed medical school within the prior 27 years.

Table 3: Bivariate Probit Model with Sample Selection: Determinants of NCA Usage
Dependent Variable: Non-Compete Agreement

	(1)			(2)			(3)		
	$(dy/dx\|s=1)$		SE	$(dy/dx\|s=1)$		SE	$(dy/dx\|s=1)$		SE
Bishara Score							0.305	***	[0.069]
Office-Based	0.178	***	[0.037]	0.184	***	[0.039]	0.180	***	[0.037]
Free-Standing Practice	−0.215	*	[0.122]	−0.203		[0.125]	−0.214	*	[0.121]
University Practice	−0.184	***	[0.058]	−0.184	***	[0.058]	−0.181	***	[0.059]
Multi-Specialty Practice	0.040		[0.036]	0.037		[0.036]	0.045		[0.035]
Large Practice (25 Plus)	0.027		[0.042]	0.022		[0.044]	0.024		[0.042]
Part Owner	−0.116	***	[0.032]	−0.150		[0.094]	−0.117	***	[0.032]
Independent Contractor	−0.207	***	[0.054]	−0.199	***	[0.056]	−0.208	***	[0.054]
Internal Medicine	0.049		[0.040]	0.052		[0.041]	0.055		[0.040]
Pediatrics	0.054		[0.036]	0.053		[0.036]	0.059	*	[0.035]
Secondary Specialty	0.055		[0.038]	0.055			0.058		[0.038]
Male	0.005		[0.033]	0.006		[0.033]	0.005		[0.033]
Employed Spouse	−0.070	**	[0.031]	−0.068	**	[0.032]	−0.070	**	[0.031]
US Med. School	0.054		[0.046]	0.056		[0.046]	0.057		[0.045]
Log Potential Experience	−0.526		[0.578]	−0.377		[0.477]	−0.516		[0.566]
Log Potential Experience Sq.	0.211		[0.212]	0.154		[0.174]	0.217		[0.208]
Plan to Retire	−0.224	***	[0.085]	−0.209	**	[0.090]	−0.226	***	[0.084]
Median HH Income	−0.096		[0.176]	−0.028		[0.179]	−0.093		[0.169]
Poverty Rate	−0.018	*	[0.010]	−0.017	*	[0.010]	−0.019	**	[0.009]
Unemployment Rate	−0.018		[0.020]	−0.017		[0.021]	−0.020		[0.020]
State PA	0.099		[0.090]	0.109		[0.110]			
State CA	−0.191	***	[0.069]	−0.255	***	[0.088]			
State TX	−0.004		[0.072]	0.043		[0.093]			
State IL	0.073		[0.080]	0.051		[0.104]			
State PA*Part Owner				−0.066		[0.118]			
State CA*Part Owner				0.173		[0.120]			
State TX*Part Owner				−0.075		[0.109]			
State IL*Part Owner				0.059		[0.133]			
Log Likelihood	-1600.68			-1595.26			-1610.02		
Log Likelihood under Null of No Selection Bias	-1604.35			-1597.91			-1611.43		
p-value of LR Test	0.007			0.021			0.093		
N	1676			1676			1676		

Notes: Marginal effects at means reported conditional on selection into a group practice. Selection equations, not reported, include a geographic physician practice cost index (GPCI), and its squared value. GPCI is calculated by the US Government Accounting Office to estimate geographic variation in the cost of operating a private medical practice, and is used to set geographic adjustment factors for Medicare reimbursement rates. The group practice equations exclude GPCI, and include group practice characteristics, which are excluded from the selection equations. All models also include cubic function of county population, and physician race. Standard errors are in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < .01$.

Table 4: NCAs and Compensation Structure

	NCA	No NCA
% Earnings from Flat Salary	58.92%	74.01%
(S.E.)	(2.60%)	(2.33%)
% Earnings from Individual Productivity	27.12%	13.03%
(S.E.)	(2.60%)	(1.88%)
% Earnings from Other Incentive Payments	7.35%	4.59%
(S.E.)	(0.70%)	(0.59%)

Notes: 'Earnings from Individual Productivity' are based on responses to the question: "What percent of your 2005 earnings was based directly on fees-for-services you provided, or your own productivity?" 'Earnings from Other Incentive Payments' are based on responses to the question: "What percent of your 2005 earnings was in the form of pay-outs from practice withholds, practice bonuses, or other incentive payments, including pay-for-performance bonuses?" Sample includes physicians who were employees below the age of 65 who worked at least 200 hours at the job in question during in the year.

Table 5: NCA Use by Firm Size

	All Physicians		Employees Only	Part-Owners
	Mean	N	Mean	Mean
2 to 3 Physicians	31.59%	383	52.44%	15.98%
4 to 6 Physicians	46.57%	350	51.23%	40.14%
7 to 9 Physicians	50.31%	161	51.69%	48.61%
10 to 19 Physicians	50.00%	180	47.71%	53.52%
20 to 99 Physicians	40.12%	167	30.36%	60.00%
100 to 499 Physicians	44.07%	118	42.62%	45.61%
500+ Physicians	7.80%	218	34.15%	1.69%

Notes: Firm sizes include survey respondent. Median size of firm for physicians in non-solo practices with NCAs is 7 and without NCAs is 6. Average size of firms (number of physicians) at which physicians with NCAs work is 26.5, compared to 28.8 for physicians without NCAs, excluding very large firms with more than 500 physicians.

Table 6: Patient Stocks, Revenue, and Productivity

	Employees		Owners	
	Without NCA	With NCA	Without NCA	With NCA
Total Patient Visits (Weekly)	86.5	97.3	111.8	109.5
Privately Insured	44.6	55.0	61.5	78.1
Medicare	12.0	17.2	22.3	14.6
Medicaid	20.6	18.5	20.5	11.6
Uninsured	9.3	6.6	7.5	5.2
Estimated Weekly Revenue Generated	\$6,339	\$8,975	\$8,249	\$9,112
Hours of Patient Care per Week	35.2	39.1	42.5	39.0
Productivity (Revenue per Hour)	\$180.1	\$229.5	\$194.1	\$233.6

Notes: 'Estimated Weekly Revenue Generated' is computed by multiplying the number of weekly privately-insured patient visits by the reported average prices based on responses to the question: 'On average, what is your net fee after discount for an initial office visit with a private, commercially-insured patient?', plus the number of patient-visits covered by Medicaid multiplied by a state-level index of reimbursement rates for a standard bundle of primary care services based on data from Zuckerman et al (2009), plus the number of patient-visits covered by Medicare times the reimbursement rate in the relevant geographic area for CPT code 99214.

Table 7: NCAs and Productivity
Depedent Variable: Revenue Generated per Hour

	(1) OLS		(2) Fixed Effects	
	β	SE	β	SE
NCA	145.18 **	[71.63]	153.99	[163.30]
Owner	16.26	[38.12]	25.07	[102.75]
Owner*NCA	−127.99	[90.45]	−101.19	[192.93]
Office-Based	16.87	[102.98]	65.51	[192.08]
Free-Standing Practice	−125.93	[139.19]	−42.01	[248.86]
University Practice	−166.37 *	[97.61]	−155.52	[188.42]
Multi-Specialty Practice	17.14	[37.05]	−34.45	[70.20]
Independent Contractor	122.74	[148.85]	0.89	[151.15]
Internal Medicine	−105.72 **	[40.95]	−137.37	[110.23]
Pediatrics	−5.73	[47.13]	88.72	[90.14]
Secondary Specialty	18.95	[35.55]	64.74	[95.15]
Male	57.79	[40.50]	63.41	[89.81]
US Med. School	−30.73	[46.81]	−97.39	[123.86]
Potential Experience	1.78	[8.20]	1.63	[16.81]
Potential Experience Sq.	−0.15	[0.20]	−0.24	[0.40]
Job Tenure	4.36	[8.85]	−8.53	[19.44]
Job Tenure Sq.	0.02	[0.26]	0.34	[0.56]
Primary Care Market Effects	No		Yes	
R Sq.	0.04		0.53	
N	521		482	

Notes: Dependent variable is revenue per hour of patient care. Revenue is calculated by multiplying the number of weekly privately-insured patient visits by the reported average prices based on responses to the question: 'On average, what is your net fee after discount for an initial office visit with a private, commercially-insured patient?', plus the number of patient-visits covered by Medicaid multiplied by a state-level index of reimbursement rates for a standard bundle of primary care services based on data from Zuckerman et al (2009), plus the number of patient-visits covered by Medicare times the reimbursement rate in the relevant geographic area for CPT code 99214. Model 1 is OLS, Model 2 is a fixed effects model with Primary Care Service Area market effects, as defined by the Dartmouth Atlas of Health Care. Sample includes physicians who reported between 200 and 4000 annual hours worked and are less than 65 years old. White-Huber standard errors in brackets. * $p < 0.10$, ** $p < 0.05$.

Table 8: Fixed Effects Wage Models
Dependent Variable: Log Hourly Earnings

	(1)			(2)		
	β		SE	β		SE
Non-Compete	0.140	**	[0.062]			
Bishara Score*NCA				0.186	**	[0.092]
Office-Based	−0.074		[0.078]	−0.068		[0.078]
Free-Standing Practice	−0.137		[0.236]	−0.153		[0.238]
University Practice	0.155		[0.157]	0.157		[0.158]
Large Practice (25 Plus)	0.068		[0.074]	0.067		[0.074]
Multi-Specialty Practice	0.049		[0.068]	0.050		[0.068]
Part Owner	0.122	*	[0.063]	0.123	**	[0.062]
Sole Owner	−0.064		[0.094]	−0.082		[0.092]
Independent Contractor	−0.055		[0.138]	−0.065		[0.137]
Internal Medicine	0.056		[0.078]	0.053		[0.079]
Pediatrics	0.070		[0.068]	0.062		[0.068]
Secondary Specialty	0.054		[0.079]	0.049		[0.079]
Plan to Retire	0.282		[0.245]	0.267		[0.248]
Male	0.107	*	[0.063]	0.104	*	[0.062]
US Med. School	−0.036		[0.099]	−0.033		[0.100]
Patients per Week	0.002	***	[0.001]	0.002	***	[0.001]
Years Tenure	0.005		[0.004]	0.005		[0.004]
Potential Exp.	−0.002		[0.005]	−0.002		[0.005]
Primary Care Market Effects	Yes			Yes		
R Sq.	0.508			0.507		
N	900			900		

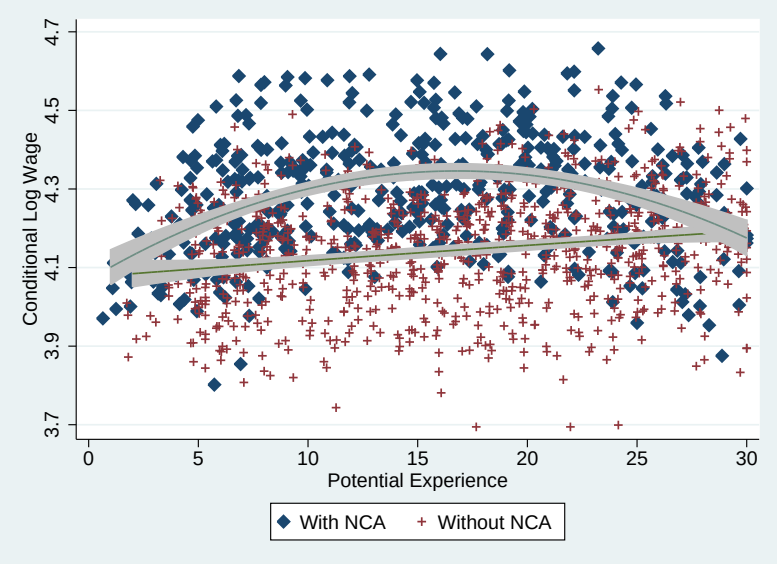
Notes: All models include Primary Care Service Area market effects, as defined by the Dartmouth Atlas of Health Care, and physician race indicators. Sample includes physicians who reported between 200 and 4000 annual hours worked and are less than 65 years old. White-Huber standard errors in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < .01$

Table 9: Fixed Effects Earnings Profile Models

	(1)			(2)			(3)		
	Dep Var: Log Hourly Earnings						Dep Var: Log Annual Earnings		
	β		SE	β		SE	β		SE
NCA	−1.193	**	[0.592]				−1.002	*	[0.562]
NCA*Log Exp.	1.260	**	[0.500]				1.010	**	[0.471]
NCA*Log Exp. Sq.	−0.272	***	[0.103]				−0.214	**	[0.096]
Bishara Score*NCA				−1.508	**	[0.621]			
Bishara Score*NCA*Log Exp				1.312	**	[0.536]			
Bishara Score*NCA*Log Exp Sq.				−0.239	**	[0.114]			
Log Tenure	0.281	**	[0.132]	0.290	**	[0.131]	0.274	**	[0.117]
Log Tenure Sq.	−0.054		[0.035]	−0.055		[0.035]	−0.051	*	[0.030]
Log Exp.	−0.582		[0.450]	−0.447		[0.370]	−0.437		[0.421]
Log Exp. Sq	0.118		[0.093]	0.078		[0.078]	0.082		[0.087]
Log Annual Hours							0.297	***	[0.071]
Office-Based	−0.077		[0.075]	−0.072		[0.075]	−0.091		[0.065]
Free-Standing Practice	−0.109		[0.229]	−0.126		[0.234]	−0.024		[0.194]
University Practice	0.152		[0.146]	0.160		[0.150]	0.088		[0.097]
Multi-Specialty Practice	0.038		[0.060]	0.033		[0.060]	0.056		[0.053]
Small Practice (1-3)	0.007		[0.064]	0.000		[0.064]	−0.043		[0.057]
Part Owner	0.113	*	[0.061]	0.097		[0.061]	0.156	***	[0.056]
Sole Owner	−0.096		[0.095]	−0.094		[0.093]	−0.048		[0.084]
Independent Contractor	−0.105		[0.144]	−0.114		[0.145]	−0.101		[0.161]
Patients per Week	0.002	***	[0.001]	0.002	***	[0.001]	0.004	***	[0.001]
Internal Medicine	0.070		[0.078]	0.075		[0.078]	0.090		[0.069]
Pediatrics	0.053		[0.068]	0.057		[0.069]	0.006		[0.061]
Secondary Specialty	0.031		[0.080]	0.043		[0.080]	0.097		[0.070]
Male	0.141	**	[0.062]	0.133	**	[0.062]	0.246	***	[0.057]
US Med. School	−0.022		[0.100]	−0.029		[0.101]	0.017		[0.087]
Primary Care Market Effects	Yes			Yes			Yes		
R Sq.	0.521			0.519			0.641		
N	896			896			896		

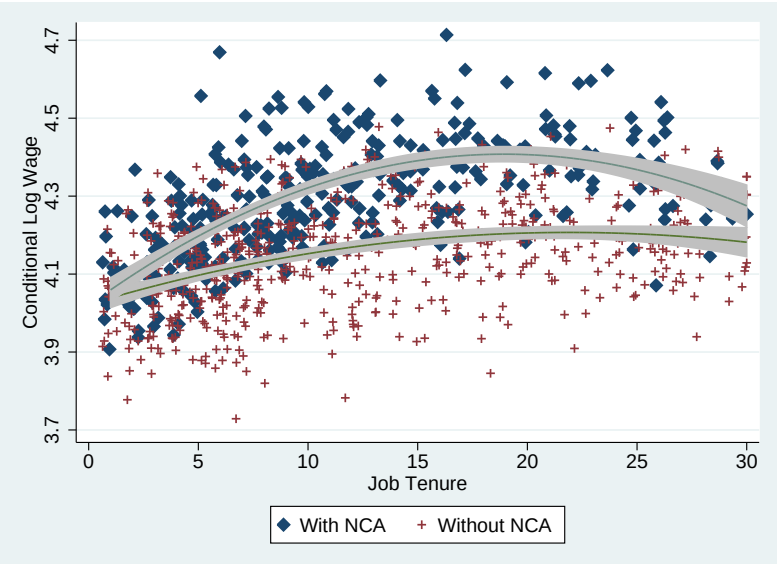
Notes: All models include Primary Care Service Area market effects, as defined by the Dartmouth Atlas of Health Care, and physician race indicators. Sample includes physicians who reported between 200 and 4000 annual hours worked and are less than 65 years old. White-Huber standard errors in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < .01$

Figure 1: Potential Experience Wage Profile



Notes: Vertical axis is expected hourly earnings conditional on covariates in Model 1 in Table 9 and demeaning Primary Care Market Effects. Sole owners are excluded. Line is best-fitting quadratic function, with 95% confidence interval.

Figure 2: Tenure Wage Profile



Notes: Vertical axis is expected hourly earnings conditional on covariates similar to those in Model 1 in Table 9 except with tenure instead of experience interacted with NCA, and demeaning Primary Care Market Effects. Sole owners are excluded. Line is best-fitting quadratic function, with 95% confidence interval.

Table 10: Fixed Effects Models: Within-Job Earnings Growth

	(1)			(2)			(3)			(4)		
	β		SE	β		SE	β		SE	β		SE
NCA*Job Tenure	0.18	***	[0.06]	0.18	***	[0.06]	0.22	***	[0.07]			
NCA*Job Tenure Sq.				0.00		[0.00]	−0.01	*	[0.01]			
NCA*Job Tenure Cu.							0.00	*	[0.00]			
NCA*Job Tenure 4th							0.00	*	[0.00]			
NCA*BS*Job Tenure										0.23	**	[0.09]
NCA*BS*Job Tenure Sq.										−0.02	*	[0.01]
NCA*BS*Job Tenure Cu.										0.00	*	[0.00]
NCA*BS*Job Tenure 4th										0.00	**	[0.00]
Job Tenure	0.01		[0.03]	0.02		[0.03]	0.01		[0.04]	0.05		[0.03]
Job Tenure Sq.				0.00	**	[0.00]	0.00		[0.00]	0.00		[0.00]
Job Tenure Cu.							0.00		[0.00]	0.00		[0.00]
Job Tenure 4th							0.00		[0.00]	0.00		[0.00]
NCA*Potential Exp. Sq.	−0.03	***	[0.01]	−0.02	***	[0.01]	−0.02	**	[0.01]			
NCA*Potential Exp. Cu.	0.00	***	[0.00]	0.00	***	[0.00]	0.00	**	[0.00]			
NCA*Potential Exp. 4th	0.00	**	[0.00]	0.00	**	[0.00]	0.00	*	[0.00]			
NCA*BS*Potential Exp. Sq.										−0.01		[0.01]
NCA*BS*Potential Exp. Cu.										0.00		[0.00]
NCA*BS*Potential Exp. 4th										0.00		[0.00]
Potential Exp. Sq.	0.00		[0.00]	0.00		[0.00]	0.00		[0.00]	0.00		[0.00]
Potential Exp. Cu.	0.00		[0.00]	0.00		[0.00]	0.00		[0.00]	0.00		[0.00]
Potential Exp. 4th	0.00		[0.00]	0.00		[0.00]	0.00		[0.00]	0.00		[0.00]
Job Match Effects	Yes			Yes			Yes			Yes		
R Sq.	0.96			0.96			0.96			0.96		
N	2255			2255			2255			2255		

Notes: All models include job match effects. Dependent variable is annual earnings, observed in up to three years over a five year window between 2002 and 2006. 'BS' stands for Bishara Score. Sample includes physicians who reported between 200 and 4000 annual hours worked and are less than 65 years old. White-Huber standard errors in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < .01$.

Table 11: Effects of Experience and Tenure on Real Earnings Growth

	Experience Effect	Within-Job Earnings Growth	Tenure Effect	Wage Growth Bias
	$\underline{\beta_2}$	$\underline{\beta_2 + \beta_4}$	$\underline{\beta_4}$	$\underline{b_2 + b_4}$
Main Effect	-0.005	0.011	0.016	0.001
	(0.003)	(0.036)	(0.034)	(0.003)
	$\underline{\beta_3}$	$\underline{\beta_3 + \beta_5}$	$\underline{\beta_5}$	$\underline{b_3 + b_5}$
Main Effect*NCA	0.098 ***	0.218 ***	0.120 **	0.002
	(0.010)	(0.068)	(0.061)	(0.002)

Notes: Estimate of within-job earnings growth is from Table 10, Model 3. Dependent variable in other models is log annual earnings minus estimated within-job growth effects. The second step model also includes physician specialty, practice setting, ownership status, gender, foreign medical school graduate, race, and firm size variables. Sample includes physicians who reported between 200 and 4000 annual hours worked and are less than 65 years old. Standard errors, reported in parentheses, are White-Huber heteroskedasticity-adjusted and Murphy-Topel adjusted for first-step sampling error. * $p < 0.10$, ** $p < 0.05$, *** $p < .01$.

Table 12: Unconditional Annual Hours Worked by NCA Use

	Employees		Part-Owners	
	NCA	No NCA	NCA	No NCA
Mean Price	2,095	1,875	2,231	2,354
(S.E.)	(45)	(40)	(45)	(43)

Notes: P-value of t-test for employees < 0.001, p-value of t-test for part-owners is 0.049.

Table 13: Fixed Effects Models: Annual Hours Worked

	(1)	(2)	(3)	(4)
NCA	-207.40 **		-348.65 ***	-280.15 **
	[91.54]		[117.07]	[110.01]
Bishara Score*NCA		-457.27 ***		
		[135.33]		
Employee	-371.73 ***	-376.79 ***	-352.16 ***	-405.78 ***
	[91.54]	[81.37]	[130.35]	[116.34]
Employee*NCA	260.56 **		386.23 **	325.83 **
	[125.16]		[171.74]	[159.83]
Employee*Bishara Score*NCA		530.65 ***		
		[171.21]		
Log Earnings			398.52 ***	
			[89.95]	
Incentive %				125.92
				[104.93]
Married	98.40	87.89	165.77	215.79
	[116.60]	[116.25]	[160.63]	[139.48]
Spouse Employed	-214.15 **	-211.34 **	-229.18 **	-279.32 ***
	[83.66]	[83.54]	[109.22]	[101.41]
Children Under 6	-186.08 **	-191.26 **	-271.34 **	-235.92 **
	[90.51]	[89.71]	[120.41]	[112.85]
Primary Care Market Effects	Yes	Yes	Yes	Yes
N	1018	1018	683	824
R Sq.	0.50	0.51	0.62	0.53

Notes: Dependent variable is annual hours worked. All models include Primary Care Service Area market effects, as defined by the Dartmouth Atlas of Health Care. All models also control for age, age squared, tenure, tenure squared, gender, physician specialty, practice type, practice size, US medical school graduate indicator, and three race indicators. Sample includes physicians who worked at least 10 hours per week at their main practice and are less than 65 years old. White-Huber heteroskedasticity-adjusted standard errors reported in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < .01$.

Table 14: Unconditional Comparison of Job Tenure and Experience

	Job Tenure		Experience	
	Without NCA	With NCA	Without NCA	With NCA
1 to 7 Years	61.70%	50.49%	26.75%	30.10%
8 to 14 Years	27.96%	33.98%	32.22%	30.42%
15 to 21 Years	8.51%	12.94%	30.70%	31.72%
22+ Years	1.82%	2.59%	10.33%	7.77%
P-Value of Chi-Square Test	0.032		0.572	

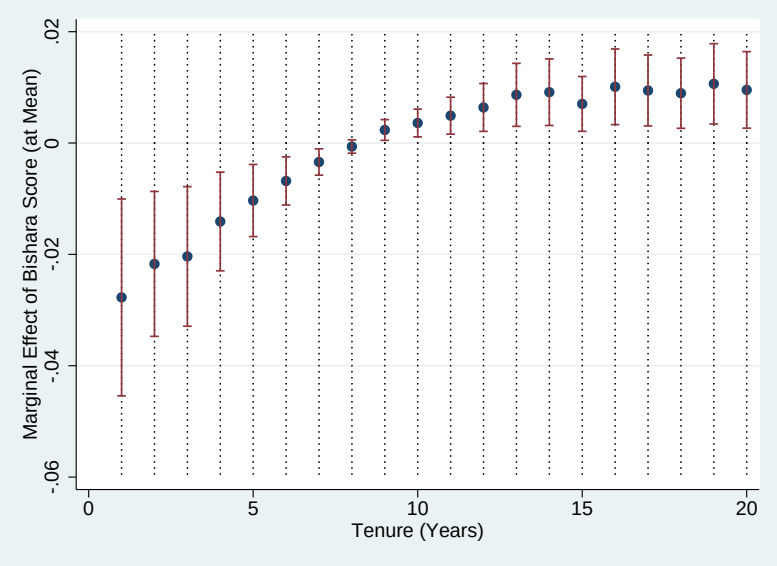
Note: Values are percentages of physicians in sample with tenure or experience within the corresponding range of years. Sample includes employed physicians who are neither partners nor sole owners of the practices at which they work, and who graduated from medical school since 1980.

Table 15: Negative Binomial Fixed Effects Models of Job Tenure

	(1)		(2)		(3)	
	IRR	SE	IRR	SE	IRR	SE
NCA	1.120 **	[0.055]				
Bishara Score*NCA			1.290 ***	[0.106]	1.207 ***	[0.068]
Bishara Score					0.831 ***	[0.049]
Office-Based	1.119	[0.079]	1.111	[0.078]	1.205 ***	[0.069]
Free-Standing Practice	1.086	[0.220]	1.077	[0.217]	0.842	[0.149]
University Practice	1.107	[0.115]	1.118	[0.115]	1.297 ***	[0.101]
Multi-Specialty Practice	0.951	[0.048]	0.948	[0.048]	0.941 *	[0.032]
Small Practice	0.877 **	[0.053]	0.873 **	[0.053]	0.902 **	[0.037]
Part Owner	1.319 ***	[0.070]	1.337 ***	[0.071]	1.271 ***	[0.042]
Internal Medicine	0.980	[0.066]	0.973	[0.065]	0.925 *	[0.041]
Pediatrics	1.020	[0.061]	1.009	[0.060]	0.982	[0.036]
Secondary Specialty	1.007	[0.058]	0.994	[0.057]	0.961	[0.040]
Male	1.052	[0.052]	1.050	[0.052]	1.032	[0.035]
Employed Spouse	1.023	[0.052]	1.020	[0.051]	1.063 *	[0.038]
US Med. School	1.340 ***	[0.099]	1.337 ***	[0.098]	1.383 ***	[0.074]
Log Potential Experience	1.061 ***	[0.004]	1.062 ***	[0.004]	1.068 ***	[0.003]
Log Likelihood	−1206.28		−1204.20		−2502.44	
N	648		648		892	

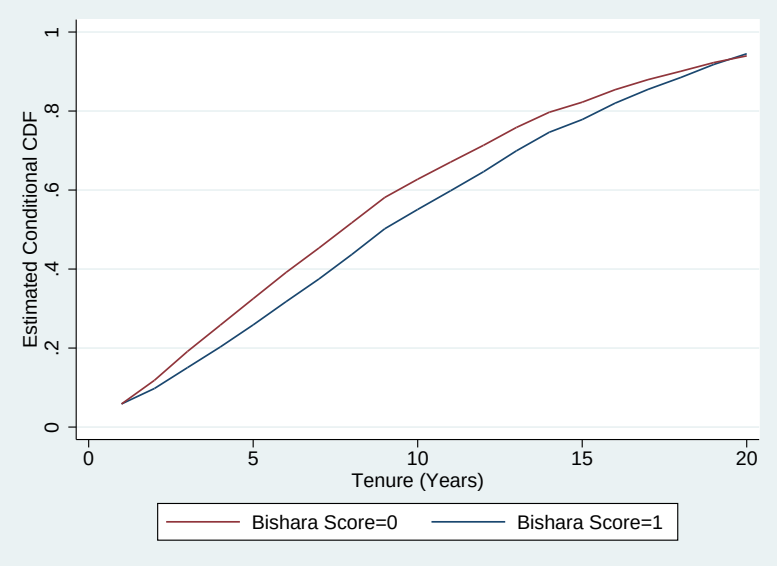
Notes: Dependent variable is number of years of tenure at current job for physicians who completed medical school since 1980. Incidence-rate ratios (IRR) reported. Models 1 and 2 include Primary Care Service Area market effects, as defined by the Dartmouth Atlas of Health Care, and all models include race indicators and county-level unemployment and uninsurance rates. Sample excludes sole owners, and includes primary care markets with at least two observations. Standard errors are in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < .01$.

Figure 3: Marginal Effects of NCA on Years of Tenure



Notes: Graph shows the effects of a one unit increase in 'Bishara Score*NCA' on the conditional probability of observing a given year of tenure based on estimates from an ordered probit model with covariates identical to Model 1 in Table 15. 95% confidence intervals shown in bars.

Figure 4: Estimated Conditional CDF of Job Tenures



Notes: CDF calculated based on average marginal effects of NCA enforceability at Bishara Score=0 and Bishara Score=1 by year of tenure.

Table 16: Unconditional Mean Prices by NCA Use

	NCA	No NCA
Mean Price	\$91.14	\$89.14
(S.E.)	(\$2.90)	(\$2.29)

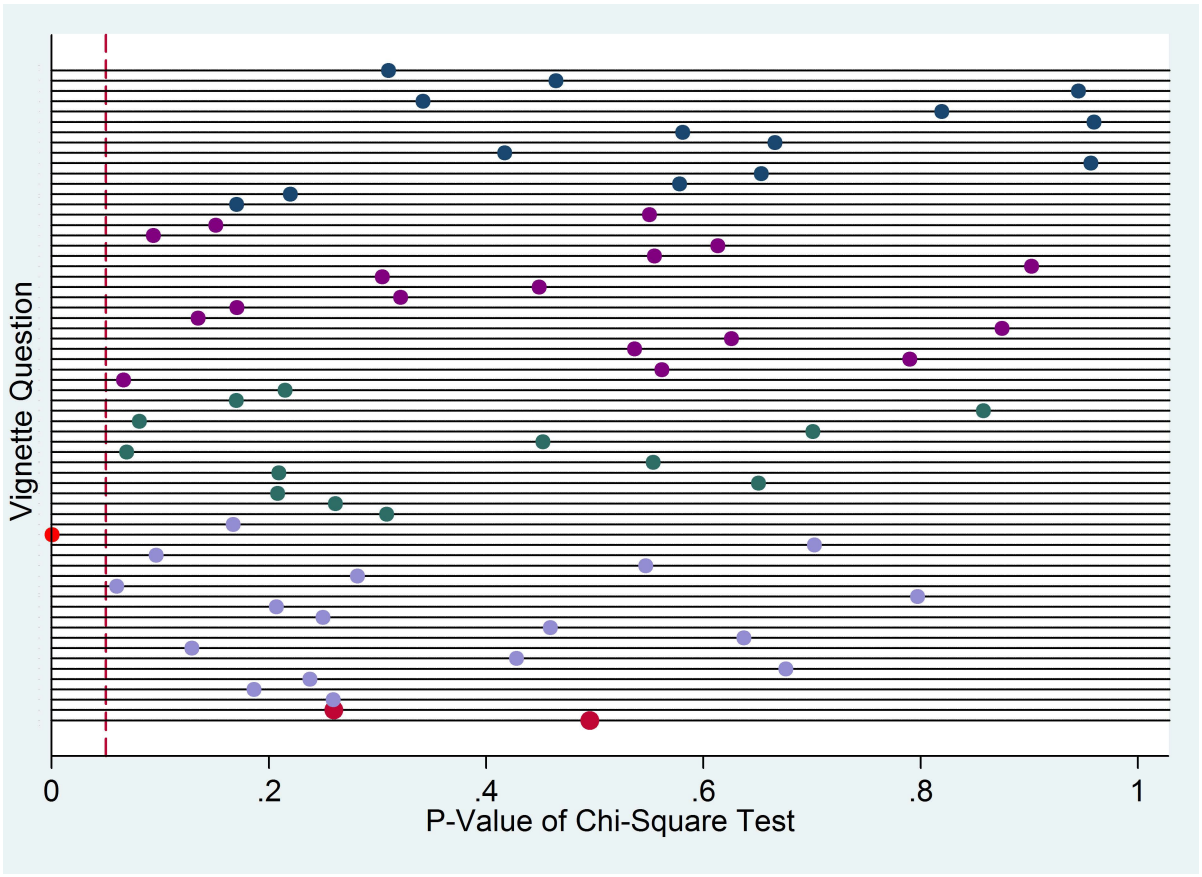
Notes: Data based on responses to the survey question: 'on average, what is your net fee after discount for an initial office visit with a private, commercially-insured patient?' Sample size is 711 respondents. P-value of t-test is 0.64.

Table 17: Fixed Effects Models: Prices Charged by Practices that Use NCAs

	(1)		(2)		(3)	
	β	SE	β	SE	β	SE
NCA	−1.24	[4.54]	2.05	[8.26]		
Bishara Score*NCA					2.03	[11.88]
Office-Based	12.60	[10.61]	3.11	[20.15]	3.01	[20.19]
Free-Standing Practice	−8.58	[15.07]	−30.05	[25.52]	−30.18	[25.53]
University Practice	46.91	[38.02]	40.66	[57.72]	41.00	[57.21]
Large Practice (25+)	−5.44	[5.59]	−5.01	[10.94]	−4.97	[10.96]
Multi-Specialty Practice	0.30	[5.35]	5.00	[9.39]	5.23	[9.28]
Part Owner	−8.45 *	[4.57]	−9.44	[7.58]	−9.27	[7.60]
Independent Contractor	6.20	[12.62]	−3.76	[15.28]	−3.55	[15.38]
Internal Medicine	10.22 *	[6.16]	8.15	[11.11]	8.11	[11.11]
Pediatrics	−2.65	[4.79]	−5.42	[8.07]	−5.49	[8.00]
Secondary Specialty	25.65 ***	[6.38]	31.46 ***	[9.73]	31.38 ***	[9.75]
US Med. School	15.52 ***	[5.56]	18.40 **	[9.08]	18.35 **	[9.08]
Male	−2.14	[4.70]	−3.28	[7.96]	−3.37	[7.98]
Job Tenure	−0.52	[0.37]	−0.81	[0.64]	−0.81	[0.64]
Potential Experience	0.12	[0.38]	0.40	[0.65]	0.40	[0.65]
County Effects	Yes		No		No	
Primary Care Market Effects	No		Yes		Yes	
R Sq.	0.34		0.60		0.60	
N	657		659		659	

Notes: Dependent variable is the reimbursement rate for privately-insured patient. The survey question was worded: 'On average, what is your net fee after discount for an initial office visit with a private, commercially-insured patient?' Model 1 includes county effects, and Models 2 and 3 include Primary Care Service Area (PCSA) market effects from the Dartmouth Atlas of Health Care. PCSAs market definitions are calculated based on patient travel patterns for primary care services. All models also include race indicators. Standard errors in brackets are heteroskedasticity-adjusted. * $p < 0.10$, ** $p < 0.05$, *** $p < .01$.

Figure 5: Tests of Differences in Responses to Clinical Questions:
Comparison of Physicians With and Without NCAs



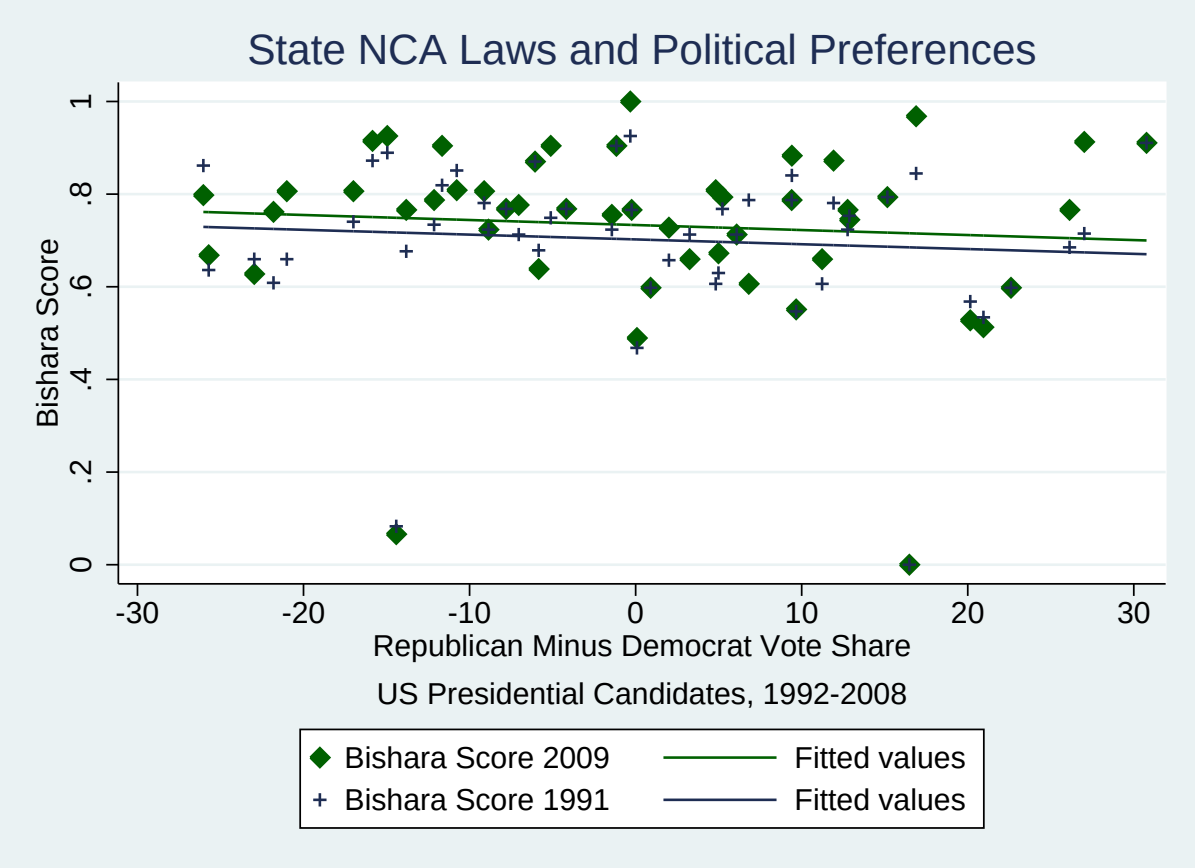
Notes: Dots are p-values of chi-square tests of the null hypothesis that physicians with NCAs gave the same responses to the corresponding vignette question as physicians without NCAs. Samples include physicians with 15 of fewer years of experience. Colors correspond to distinct vignettes, and each dot to a question related to that vignette. Dark blue dots correspond to questions related to a vignette about a hypothetical patient with symptoms of hyperlipidemia and possible depression. Purple dots correspond to questions about a vignette regarding adult asthma. Dark green dots correspond to vignette sent to pediatricians only about a child with headaches and fatigue that probes questions about a potential diagnosis of depression. Lavender dots correspond to a vignette sent to pediatricians only about a child with asthmatic symptoms. Red dots in bottom two rows are p-values of test for differences in Asthma Guideline Compliance, which is a comparison of responses to questions with established clinical guidelines for the treatment of asthma, as defined by the NHLBI and AAP. The vertical red line corresponds to cutoff of p-values below 0.05. Vignette questions were designed by clinical consultants and pre-tested with a clinical panel.

Table 18: Probit Model: Are Firms that Use NCAs More Likely to Hire Physicians with More Prior Experience?

	β		SE
Prior Experience	0.00		[0.00]
Internal Medicine	0.03		[0.03]
Pediatrics	0.06	**	[0.03]
Secondary Specialty	−0.01		[0.03]
Planning to Retire Soon	−0.24	***	[0.04]
Office-Based	−0.06		[0.04]
Free-Standing Practice	−0.25	***	[0.05]
University Practice	−0.14	***	[0.05]
Large Practice (25+)	0.06		[0.03]
Multi-Specialty Practice	0.17	***	[0.03]
Part Owner	0.12	***	[0.03]
Independent Contractor	−0.01		[0.06]
% Patients Uninsured	0.00		[0.00]
US Med. School	0.12	***	[0.03]
N	1532		

Notes: Marginal effects at sample means reported. Model also includes race indicators, geographic practice cost index, log physicians per capita in county, a cubic in county population, county household median income, unemployment rate, and poverty rate, and state effects. Standard errors in brackets are heteroskedasticity-adjusted. * $p < 0.10$, ** $p < 0.05$, *** $p < .01$.

Figure 6: State NCA Laws and Political Preferences



Notes: Data points are Bishara Scores normalized such that the highest value, Florida in 2009, equals 1. The horizontal axis measures the difference between the percentage of voters in the corresponding state that voted for the Republican Party presidential candidate minus the share that voted for the Democrat Party candidate, averaged over the five elections between 1992 and 2008. 'Fitted Values' shows the predicted equation from an OLS regression of the Bishara Score on vote shares. The slope coefficient is -0.059 with a standard error of 0.097 in 1991, and -0.061 with a standard error of 0.106 in 2009.

Appendices

A Bishara Measure of State NCA Enforceability

Table A1: Bishara (2011) Summary of State Restrictiveness of Non-Compete Agreements

	California	Georgia	Illinois	Pennsylvania	Texas
Average Total Score	31	285	430	365	350
State Rank*	50	43	4	23	32
Q1	10	30	50	50	80
Q2	10	70	70	70	80
Q3	5	25	30	20	35
Q3(a)	0	50	50	50	20
Q3(b&c)	0	50	50	25	15
Q4	0	0	90	80	60
Q8	0	60	90	70	60

Note: *Out of 51, including D.C.. 1 is the most restrictive.
Source: Bishara (2011). See Table A2 for explanation of question numbers.

Table A2: Bishara (2011) Rating of the Restrictiveness of Non-Compete Agreements

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

Source: Bishara (2011).

B Survey Vignette Sample

Asthma Vignette:

Todd, a 9-year-old white boy, arrives with his mother for a new patient visit. He was diagnosed with asthma 2 years ago. In the past year, he has had 2 emergency room visits, one hospitalization, and 1 short course of oral steroids. He has some wheeze and cough 2 to 3 times a week and awakens once or twice a month with cough. His mother states it "doesn't seem to bother him." He gets albuterol nebulizer treatments for his coughing and wheezing episodes.

Family History: One older sibling with a history of wheezing.
Allergies: No known drug, food or seasonal allergies.
Social History: There is a cat at home. Patient's mother smokes cigarettes.
Physical Exam: His weight for height is above the 75th percentile. He has no audible wheezing.

---

40. Which would you include as part of this initial visit? **(CHECK ALL THAT APPLY)**

G Assess peak flow in your office
G Perform pulmonary function testing (spirometry) in the office
G Order pulmonary function tests at a local pulmonary lab
G Order in vitro allergy tests (RAST)
G Refer to asthma specialist (pulmonologist) or allergist
G Provide written asthma care plan
G Other: _____
G No action

41. What, if any, medical therapies would you recommend now? **(CHECK ALL THAT APPLY)**

G No medical therapy
G Albuterol MDI
G Cromolyn sodium MDI
G Oral corticosteriod
G Inhaled corticosteroids seasonally or for short periods
G Inhaled corticosteroids year-round
G Leukotriene modifier
G Other: _____

42. How would you classify the severity of this child's asthma? **(CHECK ONE BOX)**

G Mild intermittent
G Mild persistent
G Moderate persistent

G Severe persistent

G Don't Know

43. Would you schedule the patient for a follow-up visit?

G Yes → 43a. In how many weeks? _____

G No

44. What do you think is the most important factor contributing to this patient's condition? **(CHECK ONE BOX)**

G Insufficient prior therapy

G Lack of environmental control

G Parental underestimation of patient's condition

G Insufficient parental education about patient's condition

G Physician underestimation of severity of disease

G Other: _____.