Client relationships create value, which employees may try to wrest from their employers by setting up their own firms. Firms counter by inducing workers to sign contracts that prohibit them from competing or soliciting former clients in the event of termination of employment. Society trades off higher effort by self-employed workers against the cost of establishing redundant businesses, and local governments compete to attract clients. If clients, firms, and workers can renegotiate restrictive employment contracts and make compensating transfers, the socially optimal level of entrepreneurship will be achieved regardless of government policies regarding enforcement of these contracts. If workers cannot finance transfers to firms, however, firms and workers will sign contracts that are too restrictive and produce too little entrepreneurship, and governments can increase welfare by limiting enforcement of these contracts. With or without liquidity constraints, more entrepreneurial locations will attract more clients and have higher employment and output.

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I. Introduction

Entrepreneurs often acquire crucial knowledge by working as employees of businesses similar to the ones they later start. According to the 1992 Economic Census of the United States (1997, p. 86), 45.1 percent of nonminority male business owners “previously worked for a business whose goods/services were similar to those provided by the [current] business.” The figure rises to 49.6 percent for Services, the industry group with the largest number of business owners, even though these business owners are the most likely to have a professional or doctoral degree (1997, p. 70) and second most likely (after Finance, Insurance, and Real Estate) to have a bachelor’s degree or higher, which might have suggested a relatively diminished need for on-the-job training.

Part of the knowledge that entrepreneurs acquire when employed, especially in services, is knowledge of potential clients for their future businesses. Unfortunately, no aggregate statistics are available on the extent to which, when establishing their own businesses, entrepreneurs serve clients with whom they built relationships during their previous employment.¹ What we know is that employers try to restrict this type of entrepreneurial activity on the part of their former employees by including non-compete or non-solicitation covenants in their employment contracts (Carnevale and Doran 2001). The perception in the business press is

¹Rauch and Watson (2002, Table 1) find that, when international trade intermediaries handling differentiated products started their firms, clients outside of the United States with whom they had experience from previous employment accounted for over half of their international business. This information is not directly relevant in the present context, however, since these entrepreneurs are not in direct competition with their previous employers but rather serve to facilitate the sales or purchases of potential competitors. In a survey of Stanford MBAs who started their own firms, Ruef (2002) found that in developing their business ideas about 45 percent relied on “discussions with potential or existing customers” and about 15 percent relied on “discussions with existing suppliers/distributors.”
that use of these restrictive employment clauses is increasing (Marino 2003), though we are again unaware of any aggregate statistics. In deciding whether non-compete covenants are enforceable, Carnevale and Doran (2001) state that “courts generally consider whether the covenant protects ‘trade secrets’ to which an employee may have had access or whether the employee’s services are ‘unique or extraordinary’....With regard to customer relationships courts have found that employers have a legitimate interest in protecting the ‘unique’ relationship that an employee develops with the employer’s clients or an interest in protecting ‘customer relations’.”

Enforcement of restrictive employment covenants has been controversial. Rulings can be decidedly vague, as in the New York Superior Court ruling “enjoining departing employees from soliciting former clients for a period of three months but refusing to enjoin them from accepting business from clients who chose to utilize their services” (Carnevale, Lockhart and Olosunde, 1999, italics in original). The laws on which rulings are based vary across U. S. states. Carnevale and Doran (2001) report, “Although there are common threads of legal analysis throughout the nation, several states have enacted statutes governing unreasonable restraints of trade and non-competition covenants specifically. Some limit or purport to limit the enforceability of such covenants.” Gilson (1999) argues that covenants not to compete are much less enforceable in California than in Massachusetts. Examining potential causes of the success of Silicon Valley in California relative to Route 128 in Massachusetts, McMillan (2002, p. 114) claims, citing the work of Gilson, “The post employment covenant lies at the root of the differences between Silicon Valley and Route 128.” McMillan is concerned with the ability of restrictive covenants to prevent departing employees from taking with them technological innovations rather than client relationships, but we conjecture that far more entrepreneurs start
their businesses on the basis of the latter than the former, and will argue that restrictive covenants and other policies can also affect the economic performance of regions through their impact on client-based entrepreneurship.

The cross-state variation in enforcement of restrictive employment covenants suggests that their effects on entrepreneurship and regional output are an area that is ripe for empirical work, but first we need some theoretical predictions to test. In an influential law review article favoring enforcement of restrictive covenants, Sterk (1993, p. 406) makes the Coasian argument that, “nothing prevents the employee from bargaining with his employer for release from the covenant. If either the employee himself or other prospective employers value the employee’s services more than his current employer does, the employee should be willing to pay the employer to release him from the contract.” With regard to client-based entrepreneurship, the Coasian argument can be rephrased as follows: the assignment of “property rights” in client relationships to the employer versus the employee will not affect economic outcomes. We evaluate this argument, as well as the consequences for efficiency (if any) of the choice of property rights assignment. A central theme of our work is that bargaining between the employer and employee may fail to internalize the interests of the rest of society, in particular the clients. Indeed, Carnevale, Lockhart and Olosunde (1999) note that “clients of departing employees are now challenging the enforcement of non-compete agreements.”

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2The most closely related statistical work that we were able to find is Stuart and Sorenson (forthcoming). Their main interest is in how “liquidity infusions” resulting from IPOs and cross-industry acquisitions stimulate entrepreneurial activity in the biotechnology industry. They find that founding rates increase with geographically proximate IPOs or acquisitions of biotech firms by companies outside the biotech industry only in metropolitan areas located in states with weak enforcement of covenants not to compete.
A broader aim of this paper is to integrate the value created by client relationships into economists’ thinking regarding determination of income and social welfare. This will only become more important as the service share of GDP continues to grow. Because of conflicting claims to the value created by client relationships that may interact with market failures, (1) the market outcome may not be optimal; (2) the government cannot avoid intervention through the legal system (because of its role in resolving disputes); therefore (3) we need to seek guidelines for that intervention.

We will analyze a model of the relationships between firms, employees, and clients that has three key elements. First, in a given relationship, production relies on the worker exerting effort, but effort is unverifiable and therefore difficult to motivate. The worker’s incentive to exert effort is greater when the worker starts his own firm, but to do so he must pay a start-up cost. Second, pairs of workers and firms negotiate their initial employment contract — including any restrictive covenants — prior to matching and contracting with their clients. Third, workers may face liquidity constraints that keep them from borrowing money on the basis of expected future returns. In our model, firms, workers, and clients have the opportunity to renegotiate the terms of their relationship, but the liquidity constraint affects the outcome of negotiation.

We show that, because they negotiate before matching with a client, a firm-worker pair can use a restrictive covenant in the employment contract to expropriate value from the client. When the worker is liquidity constrained, restrictive covenants in the employment contract are inefficiently renegotiated, leading to an inefficiently low amount of entrepreneurial activity. We show that limits on the enforcement of non-compete and non-solicitation covenants can increase welfare and also increase the number of clients in a geographical region. Our model also helps to
understand the use of discretionary deferred compensation schemes by employers and cross-industry variation in the propensity of employers to take their disputes with workers over clients to the courts.

Our conclusion that less enforcement of restrictive employment covenants positively affects regional output is in partial agreement with Fallick, Fleishman, and Rebitzer (2003). They emphasize the positive impact on local high-tech industrial output of diffusion of ideas through interfirm worker mobility, following Gilson (1999). They are not concerned with entrepreneurial activity or with endogenizing the choice of restrictiveness of employment contracts by employers and workers, and do not see their mechanism as relevant for determination of regional output outside of high-tech industry.

The kind of liquidity constraint that we posit is also present in the contemporary work of Lewis and Yao (2001), who look at restrictions on the “openness” of a workplace as a substitute for monetary transfers from a worker to a firm. Lewis and Yao focus on the working environment within a firm and how the liquidity constraint causes a distortion in the initial contracting between workers and firms. In contrast, we analyze contractual restrictions that bind entrepreneurial activity by workers after they have departed from firms, and we analyze the renegotiation of restrictive covenants by workers, firms, and clients. We demonstrate how the

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3Lewis and Yao use the term “openness” to refer to the ability of engineers to freely communicate with peers in other firms, as they participate in research and development. In Lewis and Yao’s model, engineers value openness because it allows them to identify profitable opportunities to put their knowledge to work in other firms. Firms dislike openness because it implies higher worker turnover and discontinued projects internally. Lewis and Yao argue that, although openness is efficient, it is actively reduced by firms as a way of compensating the firms when engineers cannot make up front transfers due to liquidity constraints. Firms offer more open environments when engineers have a great deal of bargaining power.
Thus, the general-human-capital story suggests that restrictive covenants should be enforced, whereas our story suggests that these covenants should not be enforced. If one added to our model a general-human-capital investment by the firm, then one could explore in more detail how these competing forces interact.

Posner, Triantis, and Triantis (2003) examine a model of employment in which the firm makes a general-human-capital investment in the worker. They study a class of contractual forms for which there is a tension between (a) the firm and worker’s incentive to expropriate value from outside firms that may employ the worker in the future, and (b) the firm’s incentive to invest. They show that the firm and worker may optimally pick a contract that leads to inefficient investment. However, it is not clear whether the tension between (a) and (b), and their results, would disappear if all feasible contracts were considered.

Our benchmark model is presented in the next section. In section III we see how our worker’s liquidity constraint distorts the outcome of renegotiation.

The insights we provide go beyond those associated with the problem of firms making investments in general human capital (Becker 1964; Mincer 1974). In the familiar story, a restrictive covenant may enhance the firm’s incentive to make a general-human-capital investment in a worker, because otherwise part of the return of its investment will accrue to other firms to which the worker may be joined in the future. One concludes that courts should enforce restrictive covenants unless they distort the socially-desirable interaction between the worker and outside firms. We contribute by analyzing such a distortion, namely frictions (caused by the worker’s liquidity constraint) that constrict the parties’ ability to renegotiate effectively. Our analysis shows that this distortion has economic significance even without an investment decision of the firm, because of the firm and worker’s interest in arranging their contract to extract value from their subsequent clients. Distortions may also arise in some settings if the worker and firm cannot write sophisticated contracts that effectively manage the renegotiation process to align ex ante incentives.

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results are affected by liquidity constraints on workers. We investigate the impact of our results on client choice between locations in section IV, and in section V we extend our model to endogenize the number of firms in a location. In our concluding section, we summarize our results and discuss their robustness. The Appendix contains details of the analysis and proofs not found in the text.

II. The Benchmark Model of Client-Firm-Worker Interaction

We model providers of business services and their clients. We focus on business services for two reasons. First, business services are growing even more rapidly than overall services as a share of total output. Business services increased from 7.3% of U.S. GDP in 1987 to 13.7% of U.S. GDP in 2001, raising their share of overall services from 29.1% to 38.6%.\(^6\) Second, the clients of business service providers are themselves businesses, making business service quality a key to the ability of locations to attract and retain business in general. For example, corporate headquarters locate where there is easy access to high quality accounting, advertising, consulting, financial, legal, and other business services. Klier and Testa (2002) find that the growth of large company headquarters between 1990 and 2000 across U.S. metropolitan areas is significantly associated only with the growth of metro area population and the 1990 share of metro area

\(^6\)The overall service share of U.S. GDP increased from 25.0% in 1987 to 35.4% in 2001. Services are calculated as gross aggregate output for SIC 70-89 and business services are defined as SIC 73, Business Services, plus SIC 87, Engineering, Accounting, Research, Management, and Related Services. All figures are from U.S. Department of Commerce, Bureau of Economic Analysis, Industry Economics Division, http://www.bea.gov/bea/dn2/gpo.htm.
nonfarm earnings in business services.\textsuperscript{7} Our model can also be applied to manufacturers that need to make relationship-specific investments for their clients if clients tend to locate their headquarters or own manufacturing plants near such subcontractors.\textsuperscript{8}

We will assume that a client initially selects a location and then approaches a local business-service provider ("firm") to provide a homogeneous service to support production of a standardized good whose profits have been competed away. For example, a client might ask an advertising firm to update a campaign for an existing product. We further assume that the employee who handles the client’s account acquires knowledge of the client’s preferences, capabilities, business strategy, etc. that allows him to provide a more customized service to the client in support of a more novel and ambitious project. The employee of the advertising firm, in our example, can now develop a campaign to launch a new product for the client.\textsuperscript{9} The quality of the effort or investment that the employee makes to provide this customized service is not

\begin{itemize}
\item \textsuperscript{7}When explaining their results, Klier and Testa supply a quotation from Lichtenberg (1960) that underscores why relationships with outside business service providers are so important for corporate clients: “Like producers of unstandardized products, the central office executives ‘produce’ answers to unstandardized problems, problems that change frequently, radically, and unpredictably.... These problems are solved quickly only by consultation with a succession of experts. But ... most central offices would find it inefficient if not impossible to staff themselves internally with all of the specialized personnel and services that they must call on from time to time to solve their problems.... All of these considerations dictate a concentration of central offices ... near their ‘suppliers’.”
\item \textsuperscript{8}Data collected by Chiu and Ka-chung (2003) show that 14 out of 49 founders of large Hong Kong electronics firms had backgrounds in sales and marketing, nine of whom worked for traders and five of whom worked for other electronics firms, allowing them to develop relationships with the major buying clients of their employers.
\item \textsuperscript{9}In manufacturing, the equivalent to providing a homogeneous service could be making a product with minor modifications to the existing design, and the equivalent to providing a customized service could be making a new product.
\end{itemize}
verifiable and therefore not contractible. Moreover, the value of the customized service itself is not verifiable precisely because it cannot be assessed without the deep knowledge of the client’s business that is acquired by working closely with it.

A. Assumptions, notation, and timing

Our model is populated by three groups of risk-neutral agents: clients, firms, and workers. Within any group, all agents are identical ex ante. Workers are perfectly mobile across locations, hence the opportunity cost of labor to any location is identical. Firms, on the other hand, are attached to a given location. In this section and the next, we analyze one period of interaction for one client-firm-worker relationship in one location. In section IV we allow each firm to hire many workers and serve multiple clients and we consider choice by clients across many locations. Finally, in section V we show how the number of firms in each geographical location can be determined endogenously in an overlapping generations framework.

For the timing of our model, we refer the reader to Figure 1; a more formal description of the interaction between the worker, firm, and client (an extensive-form game with joint decisions) may be found in the Appendix. At the beginning of the period the firm interviews the worker, without either firm or worker having a second chance to match. Under this assumption, the outside option for the firm in its bargain with the worker is zero and the outside option for the worker is his opportunity cost, which we can set to zero for convenience provided it is small relative to the rents generated by client relationships. The firm negotiates a contract with the worker that specifies the probability $p_i$ that the worker will be allowed to serve the client if he separates from the firm; low values of $p_i$ represent enforceable non-compete/non-solicitation
provisions in the contract. In addition to selecting $p_i$, the firm and worker can make an immediate monetary transfer as they reach an agreement.

The allowed range of $p_i$ depends on the rules for enforcement of restrictive employment clauses in the location (i.e., the range of values that the law permits and courts enforce). For example, if non-compete clauses are unenforceable in a particular location, then $p_i$ is constrained to be close to one. We summarize the legal environment in each location by $p_i$, denoting the minimum attainable value of $p_i$, or the most restrictive employment contract that can be enforced in a given location.

After the firm hires the worker, it accepts the client (a worker can only serve one client). The worker then provides the client with homogeneous services and acquires the knowledge required to provide her with more valuable, customized services. For simplicity we assume that the homogeneous services do not create any value.

As the worker engages in the provision of homogeneous services to the client, a random draw takes place. The realization of this random draw, denoted $\eta$, is the idiosyncratic component of the time and expense required for the worker to establish his own business to provide the client with customized services. We assume $\eta$ is commonly observed by the client, firm, and worker. We suppose $\eta$ is drawn from a fixed distribution with support $[\eta, \overline{\eta}]$ and satisfying $\overline{\eta} > \eta > 0$. We let $\mu$ denote the density function for this distribution and we assume that $\mu$ is continuous and positive on $[\eta, \overline{\eta}]$.

Knowing $\eta$, the three parties renegotiate the worker’s contract with the firm. In particular, they can jointly alter the probability that the worker will be allowed to serve the client if he separates from the firm, changing this value from $p_i$ to some $p_i'$. We will see that they have
an interest in setting $p_i' = 1$ because a lower value is inefficient when $\eta$ is small. The parties’ agreement at this time may also include immediate monetary transfers. If the negotiation ends in disagreement, then $p_i' = p_i$ and no transfer is made.

After negotiating over $p_i'$, the client, firm, and worker negotiate over whether to stay together and make some immediate monetary transfers between them. Disagreement leads to separation of the client and worker from the firm.

If the client, firm, and worker stay together, the firm employs the worker to provide the customized service to the client. The worker chooses his level of effort $e$ (which is in monetary units), and customized services are produced according to the following production function:

$$v(e) = f(e) + B,$$

where $v$ is the value of the customized service to the client and $B$ is the default value of the customized service if the worker supplies zero effort. We make the standard assumptions that $f(0) = 0$, $f'' < 0$, $\lim_{e \to 0} f'(e) = \infty$, and $\lim_{e \to -\infty} f'(e) = 0$. Given that the value of the customized service provided to the client is not verifiable to outside parties, the best the client, firm and worker can do is work without a contract and, following the worker’s effort decision, rely on their bargaining powers to obtain shares of the value.

\footnote{We model renegotiation of the worker’s contract and negotiation over whether to stay together as sequential events because it simplifies the analysis of the liquidity-constrained case in Section III.}

\footnote{Here we are assuming that there is a binary, costless “trade decision” that the worker and firm must make to generate the value $v$; this decision comes after the worker’s effort decision and is verifiable. In such a contracting environment, where the worker’s investment affects the client’s value of trade, the optimal contract specifies “no trade” and the parties anticipate that they will renegotiate it after the worker’s effort choice. Che and Hausch (1999) provide the general analysis that yields this conclusion. The contract gives the worker some incentive to exert effort, but the effort is suboptimal. The first-best level of effort cannot be attained.}
If the client and worker separate from the firm, with probability $1 - p_i$, the firm is able to obtain a preliminary injunction that prevents any provision of the customized service by the worker to the client. As described by Carnevale, Lockhart and Olosunde (1999) and Gilson (1999), this is the most effective and often used way for a firm to use a non- compete or non-solicitation clause in its contract with an employee.\textsuperscript{12} We further assume that if a preliminary injunction is obtained the courts will indeed ultimately rule that the worker cannot serve the client. In this case the firm retains the client and provides the customized service without the input of the worker, yielding the default value $B$, divided between the client and firm through negotiation.

With probability $p_i$, the firm is unable to prevent the worker from serving the client. The worker then establishes his own firm (we now call him an entrepreneur), incurring a cost of entry given by:

$$k_i(\eta) = c_i + \eta,$$

where $c_i > 0$ is determined by the location only. The cost $c_i$ consists of the time and expense required to register the firm, open an office, etc., so well described by Djankov et al. (2002).\textsuperscript{13} The idiosyncratic component of entry costs $\eta$ is the time and expense the worker must incur to be able to replicate the functions of his former employer. These could be administrative functions,

\textsuperscript{12}Carnevale, Lockhart and Olosunde (1999) state, “As attorneys litigating these cases will attest, the process is swift and those prosecuting or defending non-compete actions may be called upon to argue the merits of such clauses within hours of the employee’s notice.”

\textsuperscript{13}The costs of entry imposed by government regulations vary widely from country to country, as documented by Djankov et al. (2002). Within the United States, fees such as for business licenses differ across localities, and local chambers of commerce vary in the efficiency with which they guide business start-ups through the legally required procedures. In addition special tax breaks may be offered, such as for locating in an enterprise zone.
or the kind of “finishing” that senior members of a firm sometimes add to the work of junior members in order to complete the service for a client. For example, a worker providing architectural services may know what designs will satisfy the client’s needs but must learn the procedures for obtaining approval from the appropriate regulatory agencies. A worker will find it easier to learn the functions of his former employer, the better is the match between the needs of the client and the worker’s knowledge and talents.

After the worker becomes an entrepreneur, he and the client negotiate over whether the latter will now become a client of the new firm, with disagreement leading to separation that yields zero for both parties. Finally, if the entrepreneur retains the client then he chooses his effort level and produces a value of customized services given by equation (1), which he and the client divide according to the bargaining weights $\lambda$ and $1 - \lambda$, respectively.

### B. Solution

We solve our model using the standard technique of sequential rationality combined with a bargaining solution.\(^{14}\) Where the parties make a joint decision, we apply the generalized Nash bargaining solution, where the client has a fixed bargaining weight of $1 - \lambda$ and, wherever the firm and worker are both in the negotiation, the relative bargaining weights of the worker and firm are $\alpha$ and $1 - \alpha$, respectively. Thus, where all three agents negotiate, the bargaining weights for the client, firm, and worker are, in order, $1 - \lambda$, $(1 - \alpha)\lambda$, and $\alpha\lambda$. Where the client negotiates

\(^{14}\)That is, we calculate a *negotiation equilibrium* (Watson 2002). This means that the worker maximizes his payoff when making his individual effort decisions and the outcomes of the negotiation phases are consistent with a bargaining solution, assuming that the players accurately anticipate the continuation values from various points in the game tree.
with the entrepreneur, the client’s bargaining weight is \(1 - \lambda\) and the entrepreneur’s is \(\lambda\).

At each bargaining phase in the game, the set of feasible payoff vectors has the “transferable utility” property, meaning that, by making monetary transfers, the parties can arbitrarily shift utility between themselves on a one-to-one basis. Because the game has transferable utility, the outcome of negotiation can be viewed in terms of the maximized surplus relative to the disagreement point, with each party obtaining his disagreement value plus his bargaining weight times the surplus. That is, the payoffs to the parties are computed by finding the total surplus relative to the disagreement point, dividing it among the parties according to their bargaining weights, and adding each party’s share of the surplus to his individual disagreement (threat) value.\(^{15}\) Any transfers between the parties implied by these payoffs are computed by subtracting their continuation values (their payoffs in the next phase of the game) from their current payoffs. The bargaining power of each party is therefore partly given by his endogenously determined disagreement value and partly given by his exogenous bargaining weight.

We calculate payoffs and transfers by backward induction. Our first result is that the effort \(e^S\) that the worker supplies when he separates from the firm and becomes an entrepreneur is greater than the effort \(e^T\) that the worker supplies when he stays together with the firm. This result provides the motivation for the client and worker to consider separation from the firm. It is easily shown that when the worker becomes an entrepreneur (which occurs with probability \(p_i\))

\(^{15}\)Technically, the generalized Nash solution solves \(\max \prod_{i \in I} (u_i - d_i)\xi_i\), where \(I\) is the set of players, \(u_i\) is player \(i\)’s utility, \(d_i\) is player \(i\)’s disagreement value, and \(\pi_i\) is player \(i\)’s bargaining weight. This simplifies to the surplus-division formula in settings of transferable utility. Bargaining weights are nonnegative and sum to one.
once the separation decision has been made), his payoff when he makes his effort decision is
\[ \lambda(f(e^S) + B) - (k_i(\eta) + e^S), \]
whereas when the worker stays together with the firm, his payoff when he makes his effort decision is
\[ \alpha \lambda(f(e^T) + B) - e^T \] (see the Appendix). Since the worker chooses the effort level that maximizes his anticipated payoff, \( e^S \) and \( e^T \) must respectively satisfy:
\[ \lambda f'(e^S) = 1 \text{ and } \alpha \lambda f'(e^T) = 1. \] (3)

Given \( f'' < 0 \), we have \( e^T < e^S \) provided \( \alpha < 1 \). The efficient level of effort, which we denote by \( \bar{e} \), must satisfy \( f'(\bar{e}) = 1 \). Even an entrepreneur, therefore, will supply less than the efficient level of effort.

For our next result we turn to the point in Figure 1 at which the client, firm, and worker renegotiate \( p_i \) to \( p_i' \). If the parties foresee that the client and worker will separate from the firm, clearly the surplus from separation will be maximized by choosing \( p_i^* = 1 \), so efficient bargaining will yield this outcome. Now the sum of the payoffs to the parties from separation is \( f(e^S) + B - e^S - k_i(\eta) \), compared to \( f(e^T) + B - e^T \) from staying together. Efficient bargaining then dictates that the worker becomes an entrepreneur (separation) with \( p_i^* = 1 \) when \( k_i(\eta) \leq f(e^S) - e^S - (f(e^T) - e^T) \) and he remains with the firm when \( k_i(\eta) > f(e^S) - e^S - (f(e^T) - e^T) \), regardless of the \( p_i \) to which the firm and worker initially agree. We have:

**Proposition 1:** Given the (suboptimal) effort levels \( e^T \) and \( e^S \), the parties select \( p_i' \) efficiently and they separate if and only if it is efficient to do so.

Note that we refer to “efficient” choices of \( p_i' \) and whether to separate, given the inefficient effort

\[ \text{For convenience, we are assuming here that } \lambda [f(e^S) - e^S] \geq c_i + \bar{\eta}, \text{ which means that, conditional on leaving the firm, the worker prefers to become an entrepreneur and serve the client rather than walk away altogether.} \]
levels that the worker provides. The key to achieving the Coasian result of Proposition 1 is the ability of all three parties to renegotiate $p_i$ together.

Let us denote by $\eta_i$ the value of the idiosyncratic component of the cost of establishing a new business below which workers will become entrepreneurs. We have:

$$\eta_i = f(e^S) - e^S - (f(e^T) - e^T) - c_i.$$  \hspace{1cm} (4)

We restrict attention to the interesting range of $c_i$ values that implies $\eta_i$ is in $[\underline{\eta}, \bar{\eta}]$; that is, $c_i \in [\underline{c}, \bar{c}]$, where $\underline{c} = f(e^S) - e^S - (f(e^T) - e^T) - \eta$ and $\bar{c} = f(e^S) - e^S - (f(e^T) - e^T) - \underline{\eta}$. Within this range we have the expected result that the probability that the worker becomes an entrepreneur varies inversely with the cost of entrepreneurship.\footnote{Technological progress in information technology and efforts by local governments to streamline regulations have probably reduced the cost of business service entrepreneurship substantially, thereby increasing the probability that a worker will become a client-based entrepreneur, all else equal. This could explain the apparent increase in employer interest in the use of non-compete and non-solicitation agreements noted in the Introduction.}

We can now solve for the $p_i$ to which the firm and worker agree when they are first matched. One might think that our Coasian result on the irrelevance of $p_i$ would make the firm and worker indifferent regarding its value, but this is incorrect. To see this, we first compute the expected total payoff to the client, firm, and worker from their relationship, denoted by $y_i$:

$$y_i = \gamma_i(f(e^S) + B - e^S - c_i) - \hat{\eta}_i + (1 - \gamma_i)(f(e^T) + B - e^T),$$  \hspace{1cm} (5)

where $\gamma_i$ is the probability that the client and worker separate from the firm in location $i$ and $\hat{\eta}_i = \int_{\underline{\eta}}^{\bar{\eta}} \eta \mu(\eta) \, d\eta$. This does not depend on $p_i$, but the expected payoff for the client, $y_{Ci}$, depends positively on $p_i$ because the bargaining power of the client increases with $p_i$. In the Appendix we show that

$$y_{Ci} = (1 - \lambda)[p_i(c_i + E\eta) + \gamma_i(f(e^S) + B - e^S - c_i) - \hat{\eta}_i + (1 - \gamma_i)(f(e^T) + B - e^T)],$$  \hspace{1cm} (6)
where $E\eta$ is the expected value of $\eta$. Since $y_{ci}$ is increasing in $p_i$ and $y_i$ is not a function of $p_i$, the sum of the payoffs to the firm and worker must be decreasing in $p_i$. It follows that the firm and worker will choose $p_i = p_i^\ast$. If the location will enforce any contract, then the firm and worker will choose $p_i = 0$ and the firm will compensate the worker for accepting this iron-clad restrictive employment clause with an immediate transfer or “signing bonus.”

**Proposition 2:** At the beginning of their relationship, the firm and the worker write a contract that sets $p_i = p_i^*$. If there are no legal constraints, they thus choose $p_i = 0$. Renegotiation of the restrictive covenant occurs whenever it is efficient for the firm and worker to separate.

The intuition for this result is that the client benefits from the ability of the worker to serve her as an entrepreneur, so the firm and worker can collectively capture some of the client’s surplus by restricting this ability.

Non-compete and non-solicitation clauses are the “stick” employers can use to discourage their employees from taking away clients. When local governments neutralize this stick by setting $p_i$ at a high level, we can expect employers to rely more heavily on the “carrot” of bribing employees to stay with their firms. Carnevale, Lockhart and Olosunde (1999) note that business service employers are indeed using discretionary deferred pay compensation schemes as a way to supplement non-compete agreements when their enforcement is uncertain. They state, for example, that “firms are beginning to require their employees to defer a portion of their annual bonuses over several years so that employees stand to lose a portion of their bonuses if they leave.” Does our model indeed predict that some workers will receive positive transfers from firms when they agree to stay together and $p_i$ is high? We expect this to be true only for workers for whom entrepreneurship is attractive ($k/\eta$ is low), but in this case the parties may just
The positive transfer from the firm to the worker who draws \( \eta \) just above \( \hat{\eta}_l \) must come out of the firm’s pocket as opposed to being entirely funded by the client: with \( p_i' = p_i = p_l \) but the surplus from agreement relative to separation is close to zero. The transfer the firm must pay to this worker is roughly equal to the difference between the worker’s expected income if he separates and his income if he stays with the firm. This difference is easily shown (see the Appendix) to be

\[
p_i \left[ \lambda (f(e^S) + B - e^S) - \alpha \lambda (f(e^T) + B) - e^T \right].
\]

Clearly this expression is increasing in \( p_i \) and must be positive when \( p_i = 1 \) and the worker’s bargaining weight vis-a-vis the firm \( \alpha \) is low but his bargaining weight as an entrepreneur vis-a-vis the client \( \lambda \) is high. We can therefore expect use of discretionary deferred compensation schemes by firms to be greater in states where non-compete and non-solicitation clauses are less enforced.\(^{18}\)

### III. Liquidity-Constrained Workers

Our model predicts that, when hired, if there are no legal constraints workers will agree to give up any rights to serve in their own businesses the clients of whom they acquire deep knowledge while working as employees. A worker who, nevertheless, becomes a client-based entrepreneur will therefore have to buy from the firm the right to continue to serve his client. In other words, in the phase of the game where the parties renegotiate the worker’s contract, the

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\(^{18}\)The positive transfer from the firm to the worker who draws \( \eta \) just above \( \hat{\eta}_l \) must come out of the firm’s pocket as opposed to being entirely funded by the client: with \( p_l = 1 \) and the surplus from staying together close to zero, the firm’s current payoff is roughly equal to its threat point (its payoff if separation occurs) which in turn equals zero, so the firm must lose roughly its entire continuation payoff \( (1 - \alpha) \lambda (f(e^T) + B) \) (see Table A1 in the Appendix).
transfer from the firm to the worker will be negative.\textsuperscript{19}

In reality, there are several barriers that limit the ability of the worker to make a monetary transfer to the firm. First, workers generally do not have the resources to internally (out of pocket) finance a large payment. Even if the firm paid the worker a “signing bonus” at the beginning of their relationship, little of it may be left to transfer back to the firm. Furthermore, if $\alpha$ is close to zero then, in the benchmark model, the signing bonus is very small relative to the amount that the worker transfers to the firm during renegotiation of his contract. Second, external financing generally is limited due to informational asymmetries between the worker and outside lending institutions. If future returns from the client are unverifiable, the entrepreneur/worker can hide his income and declare that his new firm has failed. If banks cannot easily distinguish between the workers in our model and other, high-risk agents, then the banks will not be willing to lend the worker the money required to buy out his non-compete agreement.\textsuperscript{20}

In this section, we propose an extension of our model to investigate the real liquidity constraint that workers face. Because of the technical complexities involved, we do not offer a

\textsuperscript{19}This is easily verified by substituting $p_i = 0$ into the formula for $t_{F_{Wi}}^{(a2)}$ in Table A1 (in the Appendix). From this formula we can also see that, if the bargaining power $\alpha$ of the worker vis-a-vis the firm is small, then the worker will have to pay the firm almost the entire value of his business, $\lambda(f(e^5) + B - e^5) - k_i(\eta)$, to obtain the rights to serve his client as an entrepreneur.

\textsuperscript{20}Similar problems arise in loan arrangements with the client and firm. A loan from the client is subject to hold-up, whereby, after the effort decision, the worker refuses to consummate trade unless the loan is renegotiated. This implies that the entrepreneur’s and client’s continuation payoffs from the time that they contract are independent of the sunk loan amount, meaning that the client is merely making an immediate transfer to the firm through the worker. A loan from the firm requires the same verification of returns as would a loan from a bank; the worker could hide his returns from the firm and, anticipating that it cannot compel the worker to repay, the firm will not issue the loan.
full model of the constraints inherent in internal and external financing. Instead, to capture the worker’s liquidity constraint, we modify our benchmark model by making one additional assumption: that transfers to the worker must be nonnegative. That is, when the firm and worker first contract and when three parties renegotiate this contract and then decide whether to stay together, the worker cannot make a positive transfer to the other parties.\footnote{Specifically, we require that $t_{FWi}^{(a)} \geq 0$, $t_{FWi}^{(b)} \geq 0$ in Figures A1.1 and A1.2, and the transfer from the firm to the worker during their initial contract negotiation (which comes before the subgame described in the Appendix figures) is also nonnegative.}

Implicitly, we must also assume that the worker’s cost of effort $e^S$ or $e^T$ and cost of establishing a new business $c_i + \eta$ consist of time rather than money, so that they do not have to be financed. Regarding the cost $c_i$ imposed by government regulations, Djankov et al. (2002) find for the United States that the typical direct (out-of-pocket monetary) component is less than one-half of one percent of per capita GDP.

A. Assumptions and a note on the bargaining solution

To simplify the analysis and focus our attention on an interesting range of the parameter space, we make the following assumptions on the parameters of the model:

- \textbf{(A1)} $\lambda[f(e^S) - e^S] \geq c_i + \bar{\eta}$,
- \textbf{(A2)} $e^T \geq c_i + \bar{\eta} + B\alpha\lambda/(1 - \alpha\lambda)$, and
- \textbf{(A3)} $\lambda B \geq (1 - \lambda)[f(e^S) - e^S]$.

Assumption A1 was made in the benchmark model. Assumption A2 simplifies the analysis by implying that the worker’s liquidity constraint does not bind in the negotiation over whether the three parties stay together or separate. Assumption A3 yields the interesting case in which the
worker’s liquidity constraint always binds in the negotiation of $p_i'$. By starting with a specification of $f$ for which $e^T \geq c_i + \tilde{\pi} + f(e^S) - e^S$, we can find a number $B$ to satisfy A2 and A3.

The worker’s liquidity constraint makes applying the Nash bargaining solution a bit more complicated than is the case in the benchmark model, because the set of payoff vectors over which the parties negotiate does not necessarily exhibit transferable utility. In other words, the outcome of negotiation cannot always be put in terms of a maximized surplus (relative to the disagreement point) that is divided between the players according to bargaining weights. Thus, we have to employ the general form of the Nash bargaining solution, as described in footnote 15 on page 14. However, in some of the bargaining problems in our model, the outcome of negotiation one obtains by ignoring the liquidity constraint is feasible even with the liquidity constraint. In this case, the liquidity constraint is not binding and so it does not affect the negotiation.

**B. Solution**

To solve the model with liquidity constrained workers, we use the same backward induction procedure that we used to analyze our benchmark model. In fact, much of the analysis is the same as that in the benchmark model. To start, note that the liquidity constraint does not bind in the negotiation phases between the entrepreneur and the client, nor does it bind in the negotiation between the client, firm, and worker after the three have decided to stay together. This can be verified by confirming that, in these negotiation phases, the unconstrained Nash bargaining solution specifies a nonnegative transfer to the worker/entrepreneur (see the Appendix). We show in the Appendix that the same is true for the negotiation between the
client, firm, and worker over whether to stay together, given Assumption A2.

Our analysis continues with the evaluation of the parties’ negotiation over \( p_i' \). Here, the liquidity constraint has an interesting effect and leads to different outcomes than occur in the benchmark model. We show in the Appendix that under Assumption A3, the sum of the firm’s and client’s continuation payoffs is decreasing in \( p_i' \) even when total surplus is increasing in \( p_i' \).

Because the worker is liquidity constrained, the outcome of negotiation is the disagreement point of \( p_i' = p_i \) with no immediate transfers.

We thus have the following Proposition, proved in the Appendix:

**Proposition 3:** When the worker is liquidity constrained, his original contract is not renegotiated (so \( p_i' = p_i \)) and the parties stay together if and only if it is efficient to do so given \( p_i \) — that is, if and only if

\[
\pi \left[ f(e^s) - e^s - c_i - \eta \right] \leq f(e^T) - e^T.
\]

The intuition behind Proposition 3 is simple. Much of the gain of increasing \( p_i' \) goes to the worker by way of his anticipated value of dealing directly with the client. Without an immediate transfer from the worker, the firm loses when \( p_i' \) is increased. Furthermore, the firm’s loss is significant given that \( B \) is large (by assumption). Thus, the worker gains in future value, whereas the client and firm jointly lose. Although the total value increases, it is value that will be realized only in the future. Because of the liquidity constraint, the worker cannot compensate the firm for its loss.

Proposition 3 has some important observable consequences. First, when clients and workers separate from firms there will be disputes that will be handled by the courts. This clearly inefficient outcome contrasts sharply with the benchmark model result (Proposition 1) in which separation is always accompanied by the complete release of the worker from any non-
compete or non-solicitation covenants. Second, the rate of entrepreneurship will be increasing in \( p_i \), again a sharp contrast with the benchmark model in which the rate of entrepreneurship is unaffected by the degree of restrictiveness of the contracts made between firms and workers regarding the ability of the latter to serve clients after leaving their firms. In particular, the cutoff value of \( \eta \) below which workers will become entrepreneurs is now given by

\[
\hat{\eta}_i = \max \{ f(e^S) - e^S - c_i - [f(e^T) - e^T]/p_i, \eta \}. \tag{7}
\]

Equation (7) shows that, provided there is any entrepreneurship in equilibrium, \( \hat{\eta}_i \) varies directly with \( p_i \). Comparing equation (7) to equation (4), we see that the difference comes from the fact that the parties are no longer able to renegotiate \( p_i \) to \( p_i' = 1 \).

Recall that the decision not to renegotiate even when it is efficient to do so hinges on \( B \), the value of the customized service to the client without effort by the worker, being large enough to satisfy Assumption A3. A restrictive covenant allows the firm to retain the client in the event of separation from the worker. To renegotiate a release of the restrictive covenant, the firm requires compensation that a liquidity-constrained worker cannot deliver. If \( B \) is small, however, the client would be willing to sufficiently compensate the firm. Thus, for a given contract \( p_i \), a reduction of \( B \) implies a greater propensity to renegotiate the contract. We therefore expect to see more disputes handled by the courts and less client-based entrepreneurship in industries with high values of \( B \), all else (including contracts) equal. For example, we might expect more disputes in financial services, where the firm may be able to quickly analyze the client’s portfolio after the worker’s departure, than in engineering consulting, where the worker may have mastered intricate technical details of the client’s project through site visits.

We conclude our analysis of the liquidity-constrained setting by evaluating the firm and
worker’s optimal choice of $p_i$ in their initial contract. Integrating over the random variable $\eta$, we write the expected payoffs of the client, firm, and worker as a function of the contract parameter $p_i$. The client’s expected payoff is

$$y_{Ci} = p_i(1 - \lambda)[f(e^S) - e^S] + (1 - \lambda)B + \int_{\eta_i} \tilde{\eta}(1 - \lambda)[f(e^T - e^T - p_i(e^S) - e^S - k_i(\eta))]\mu(\eta)d\eta. \quad (8)$$

The firm’s expected payoff is

$$y_{Fi} = (1 - p_i)\lambda B + \int_{\eta_i} \tilde{\eta}(1 - \alpha)\lambda[f(e^T) - e^T - p_i(f(e^S) - e^S - k_i(\eta))]\mu(\eta)d\eta$$

and the worker’s expected payoff is

$$y_{Wi} = p_i\lambda[f(e^S) + B - e^S] - p_i(c_i + e\eta) + \int_{\eta_i} \tilde{\eta}\alpha\lambda[f(e^T) - e^T - p_i(f(e^S) - e^S - k_i(\eta))]\mu(\eta)d\eta.$$ 

To interpret these payoffs, note that each party obtains the value of separation, plus his share of the surplus of staying together (integrated over those values of $\eta$ for which the parties stay together).

The following lemma is proved in the Appendix.

**Lemma 1:** The client’s value $y_{Ci}$ is strictly increasing in $p_i$, whereas the firm’s value $y_{Fi}$ is strictly decreasing in $p_i$. The total value of the parties, $y_{Ci} + y_{Fi} + y_{Wi}$, is increasing in $p_i$. The sum of the worker’s and firm’s values, $y_{Fi} + y_{Wi}$, is convex in $p_i$.

In other words, the client prefers higher values of $p_i$, the firm prefers lower values of $p_i$, and any $p_i < 1$ is inefficient. Given the inability of the parties to renegotiate $p_i$ to $p_i' = 1$, only $p_i = 1$ yields the same, efficient result as does the benchmark model.

At the beginning of their relationship, the firm and worker select $p_i$ and can make a positive transfer from the firm to the worker (but not the other way around). Thus, applying the Nash bargaining solution, the firm and worker select $p_i$ and a transfer $t$ to solve
\[
\max \{ y_{Fi}(p_i) - t \}^{1-\alpha} \{ y_{Wi}(p_i) + t \}^\alpha,
\]
subject to \( p_i \in [0, 1] \) and \( t \geq 0 \). The disagreement point is zero for both parties. Figure 2 illustrates the bargaining set for two different cases of the parameter values and for the full (unrestricted) range of \( p_i \). The worker’s payoff, graphed on the x-axis, is \( y_{Wi}(p_i) + t \); the firm’s payoff, on the y-axis, is \( y_{Fi}(p_i) - t \). In the pictures, the dashed line indicates the payoff vectors that are feasible for different values of \( p_i \), holding \( t = 0 \); that is, the dashed line is the set of points \( \{ y_{Wi}(p_i), y_{Fi}(p_i) \} \) for \( p_i \in [0, 1] \). The bargaining set includes each of these points as well as all of the points that can be reached by increasing \( t \) from zero (moving the payoff vector down and to the right, in the direction of a line with a slope of –1). The solid line delineates the frontier of the bargaining set, on which the solution will lie.

The solution to the firm and worker’s initial bargaining problem is difficult to characterize in general, but clearly there are three possibilities when \( p_i = 0 \): a corner solution at \( p_i = 0 \), a corner solution at \( p_i = 1 \), and an interior solution with \( p_i \in (0, 1) \). Furthermore, the solution will specify \( p_i = 0 \) if \( y_{Fi}(0) + y_{Wi}(0) \geq y_{Fi}(1) + y_{Wi}(1) \), which is the case shown in the right diagram of Figure 2. Algebra reveals that this inequality simplifies to

\[
\lambda(1-\gamma_i)[f(e^S) - e^S - (f(e^T) - e^T)] \leq c_i + E[H_i - \lambda(1-\gamma_i)E[c_i + H_i | \eta_i \geq f(e^S) - e^S - c_i - (f(e^T) - e^T)],
\]

(10)

where \( \gamma_i \) is the probability that separation will be efficient, i.e., that \( \eta_i \leq f(e^S) - e^S - c_i - (f(e^T) - e^T) \). The conditional expectation on the right side of this inequality is the expected set up cost for the entrepreneur, conditional on separation not being efficient. We have some simple sufficient conditions for \( p_i = 0 \) to be selected:
Proposition 4: Suppose there are no legal constraints on $p_i$. If $\lambda$ is sufficiently close to zero and/or $\gamma_i$ is sufficiently close to one relative to the other parameters, then the firm and worker will select $p_i = 0$.

Proposition 4 tells us that when inequality (10) is satisfied, the firm and worker set $p_i = p_i = 0$. It follows that as $p_i$ rises above zero so must $p_i$, thereby reducing entrepreneurship by equation (7). For $p_i >> 0$, however, we can only establish a weaker claim, whether or not inequality (10) is satisfied. The following Proposition is proved in the Appendix:

Proposition 5: As $p_i$ rises, the firm and worker’s optimal choice of $p_i$ weakly increases.

Summarizing, as we increase $p_i$ from zero, provided that inequality (10) is satisfied we initially have $p_i = p_i$ in the model with liquidity-constrained workers, just as in the benchmark model. At some point, however, in the model with liquidity-constrained workers increases in $p_i$ may cause $p_i$ to jump above $p_i$, after which further increases in $p_i$ may leave $p_i$ unchanged, and so on. Thus increases in $p_i$ only weakly increase entrepreneurship for $p_i >> 0$. If inequality (10) fails, we can only say that the firm and worker face an interesting trade-off in their selection of $p_i$. By lowering $p_i$ from one, they expropriate value from the client, just as in the benchmark model. However, they also reduce the total value of the three parties by creating an environment in which they later stay together when it is efficient for them to separate (with $p_i' = 1$).

IV. Choice of Locations by Clients

In this section we analyze how the interaction between client-firm-worker relationships and the local government policies that determine $p_i$ and $c_i$ determines the number of clients $Q_i$ in each location. We assume that at the beginning of the period of interaction that we analyze, a
fixed measure (quantity) of clients $Q$ is allocated over a fixed number $n$ of locations indexed by $i$. We let $N_i$ denote the mass of firms in location $i$, which we take as fixed in this section but determine endogenously in the next. Each client inelastically demands one unit of commercial space. Commercial rent in a given region is increasing in the quantity of clients located there:

$$r_i = r(Q_i), \ r' > 0.$$  \hfill (11)

The producer surplus associated with this upward-sloping supply curve is part of local income. Each client chooses the location that maximizes her expected net income $y_{C_i} - r_i$. In equilibrium, therefore, it must be that

$$y_{C_j} - r(Q_j) = y_{C_i} - r(Q_i), \ j \neq i; \quad \sum_{i=1}^{n} Q_i = Q.$$  \hfill (12)

Once the $y_{C_i}$ are determined we can use equations (12) to solve for the $Q_i$.

After the clients have arrived, in each location $i$ the $N_i$ firms hire workers in anticipation of serving clients, with exactly one worker needed to serve each client. To maintain the simplicity of the bargaining problem between any firm and worker, we assume that each firm correctly anticipates serving $q_i = Q_i / N_i$ clients and interviews $q_i$ workers, without either firms or workers having a second chance to match.\(^{22}\) As before, the firm negotiates a contract with each worker that specifies $p_r$, and the firm and worker can make an immediate monetary transfer as they reach an agreement. After completing its hiring, each firm accepts $q_i$ clients. Every client-firm-worker relationship then unfolds as in section II or section III, depending on whether workers are liquidity-constrained.

\(^{22}\)We assume away integer problems.
In the benchmark model we showed in Proposition 2 that firms and workers will set $p_i = p$. We substitute this result into equation (6) to obtain the solution for $y_{Ci}$ in the benchmark model:

$$y_{Ci} = (1 - \lambda)[B + p(c_i + E\eta) - \bar{\eta}_i + \gamma_i(f(e^\delta) - e^\delta - c_i) + (1 - \gamma_i)(f(e^T) - e^T)].$$

(6')

In the model with liquidity constrained workers we showed in Proposition 4 that firms and workers will again set $p_i = p$ if $p$ is sufficiently close to zero and if $\lambda$ is sufficiently close to zero and/or $\gamma_i$ is sufficiently close to one relative to the other parameters. We substitute this result into equation (8) and simplify to obtain the solution for $y_{Ci}$ in the model with liquidity constrained workers:

$$y_{Ci} = (1 - \lambda)[B + p(c_i + E\eta - \bar{\eta}_i) + \gamma_i f(e^\delta) - e^\delta + (1 - \gamma_i)(f(e^T) - e^T + \omega c_i)],$$

(8')

where $\gamma_i$ is the probability that a liquidity-constrained worker will become an entrepreneur given $p$. If we allow for the possibility that some workers turn out to be liquidity-constrained and some do not, then if this characteristic is independent of $\eta$ the expected payoff for clients is simply a weighted average of the payoffs given by equations (6') and (8'), with the weights determined by the probability that a worker turns out to be liquidity constrained.

Using either equation (6') or equation (8'), we see that if $p_i = p_j$ and $c_i = c_j$, then $y_{Ci} = y_{Cj}$, implying $Q_i = Q_j$ from equation (12). We also see using either equation that if $p_i > p_j$ and $c_i = c_j$, then $y_{Ci} > y_{Cj}$. This yields

**Proposition 6:** Comparing locations with equal values of $c_i$, if the local governments differ in their enforcement of non-compete and non-solicitation agreements, the number of clients will be higher where these agreements are less enforced (that is, where $p$ is higher). A characteristic of
this equilibrium is that locations with more entrepreneurial activity will have more clients.23

It follows that, holding $c_i$ constant, locations with higher $p_i$ that are therefore (weakly) more entrepreneurial will have greater employment in business services and greater total output of business services.

To analyze the impact on the number of clients of differences in $c_i$ across locations, we first note that in the benchmark model the relationship between the expected client payoff $y_{ci}$ and $c_i$ depends on the choice of $p_i$ (hence $p_i$):  

**Lemma 2:** There is a decreasing function $x$ with $x(0) = \bar{c}$ and $x(1) = c$, such that $y_{ci}$ is increasing in $c_i$ for $c_i > x(p_i)$ and $y_{ci}$ is decreasing in $c_i$ for $c_i < x(p_i)$.24

The intuition here is that, when $p_i$ is low, the client’s payoff is sensitive to $c_i$ only in the event that the parties renegotiate the worker’s contract to set $p_i' = 1$ in anticipation of separating, in which case lowering $c_i$ raises the negotiation surplus without changing the client’s disagreement value; hence, the client is better off with a lower $c_i$. On the other hand, when $p_i$ is high, the client’s payoff is sensitive to $c_i$ only in the event that staying together is efficient; in this case, raising $c_i$ causes the worker’s disagreement value to decrease, which favors the client. Lemma 2 and equations (6’) and (8’) then imply

**Proposition 7:** In the absence of legal constraints on $p_i$, so that $p_i = 0$ in all locations, $c_i < c_j$ weakly implies $Q_i > Q_j$; that is, locations with lower costs of entrepreneurship will have more clients if workers are not liquidity-constrained and the number of clients will be equal if workers

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23Note that in the benchmark model, locations with equal values of $c_i$ cannot differ in their rates of entrepreneurship.

24Lemma 2 is proved in the Appendix.
are liquidity-constrained. A characteristic of this equilibrium is that locations with more entrepreneurial activity will have more clients.\(^{25}\)

We conclude this section with the implications of our analysis so far for government policy. We have seen that the constrained socially efficient rates of entrepreneurship and expected payoffs from client relationships are achieved for any \(p_i\) in our benchmark model and for \(p_i = 1\) in the model with liquidity constrained workers. We can now also consider the optimal allocation of clients across locations. It is easily shown that, given the constrained socially efficient payoffs \(y_i\), total expected income from all client relationships plus total producer surplus of all landlords that rent to clients is maximized when

\[
y_j - r(Q_j) = y_i - r(Q_i), \quad \forall j \neq i.
\]

This differs from the equilibrium condition (12), the intuition being that clients do not internalize all of the benefits of the decision to locate in a particular region, because this includes benefits to firms and workers who, in our model, do not contract with clients until location choices are made. However, in the special case \(c_j = c_i, \forall j \neq i\), it is easy to see that both (12) and (13) yield \(Q_j = Q_i, \forall j \neq i\) (hence \(Q_i = Q/n\)) when \(p_j = p_i, \forall j \neq i\). We thus have

**Proposition 8.** In the case where \(c_i\) is identical across all locations, the optimal policy is for each location not to enforce non-compete and non-solicitation contracts, setting \(p_i = 1\) for every location. This policy achieves the constrained socially efficient rates of entrepreneurship and expected payoffs from client relationships and the optimal allocation of clients across locations.

When \(c_i\) differs across locations, it is easily shown that in general too few clients will choose the low-cost locations. National welfare can therefore be increased by, for example,

\(^{25}\)Note that in the model with liquidity constrained workers, locations with \(p_i = 0\) will have no entrepreneurial activity.
We do not analyze policy regarding \( c_i \) as given because \( c_i \) presumably affects all entrepreneurship, not only client-based entrepreneurship, and is therefore too blunt an instrument.

In the benchmark model, the invariance of \( y_i \) to \( p_i \) frees government enforcement of non-compete and non-solicitation clauses to be used as a (second-best) policy instrument to influence the allocation of clients across locations. Suppose, for some locations \( i \) and \( j \), intrinsic cost differences imply \( c_i < c_j \). Then, because of the externality inherent in the clients’ location choice, fewer clients will locate in region \( i \) than is socially optimal. Setting \( p_i < p_j \) helps to internalize the externality and enhance welfare.\(^{26}\)

V. Endogenous Determination of the Number of Firms

We can determine the number of firms in each location by embedding our model of the previous section in an overlapping generations framework. In order to maintain tractability we will have to make an admittedly artificial simplifying assumption. This will allow us to generate a number of empirically testable predictions.

We now assume that agents in our model live for two periods. Clients are active in the first period of their lives and retire in the second period. Workers either remain employees or become entrepreneurs in the first period of their lives. In the second period of their lives they can

\(^{26}\)We do not analyze policy regarding \( c_i \) taking \( p_i \) as given because \( c_i \) presumably affects all entrepreneurship, not only client-based entrepreneurship, and is therefore too blunt an instrument.
We assume that workers receive a benefit $R$, financed by lump-sum taxation, or they can run business service firms. Workers who became entrepreneurs in the first period of their lives can expand their existing firms by hiring workers from the new generation to serve the new generation of clients, whereas workers who remained employees must invest $c_i$ if they wish to run similar firms. Our key simplifying assumption is that $R$ is sufficiently high that if all previously established firms stay in business, profits per firm will be driven below $R$. In this case no new firms will be established by workers in the second period of their lives. Some previously established firms will “mature” into larger firms, and the rest will “fail” in the sense that their entrepreneurs will choose to retire. This assumption insures that a worker’s choice whether to become an entrepreneur in the first period of his life has no impact on his income in the second period of his life, which in equilibrium is always $R$.27

Determination of the number of “mature” or large firms in each location is now straightforward. Our model is always in a steady state. The expected firm payoff $y_{Fi}$ gives the profit an entrepreneur can expect from each client he accepts in the second period of his life. Since his cost of entry has already been sunk, his total expected profits from running his firm in the second period of his life are $q_i y_{Fi}$. The equilibrium number of large firms (employers) is then determined by

$$q_i y_{Fi} = R \quad \text{or} \quad N_i = Q_i y_{Fi} / R.$$  

The equilibrium size of mature firms $q_i$ therefore varies inversely with the profitability of client relationships, and the equilibrium number of mature firms $N_i$ varies directly with the profitability

---

27 We assume that workers receive $R$ even if they are unemployed in the first period of their lives, so that expectation of this retirement benefit has no impact on bargaining between firms and workers over their initial contracts.
of client relationships given the number of clients in the location. Another observable characteristic of locations is the ratio of mature to new firms, given by $N_i/y_i Q_i = y_{Fi}/y_i R_i$. Note that the number of mature firms has no aggregate welfare consequences because, in the equilibria we consider, all costs of entry have already been sunk and all retirement benefits are funded by lump-sum transfers.

It is easily shown that, in both our benchmark model and our model with liquidity-constrained workers, expected payoffs for firms are decreasing in $p_i$. Moreover, $p_i$ increases strictly with $p_i$ in the former model and at least weakly with $p_i$ in the latter model (by Proposition 5). We can therefore state:

**Proposition 9:** The size of mature firms is larger and the average age of firms (ratio of mature to new firms) is lower in locations with higher $p_i$.

The effect of higher $p_i$ on the average age of firms can be greater in the model with liquidity-constrained workers because not only does $y_{Fi}$ fall but $\gamma_i$ (the rate of entrepreneurship) can increase. The effect of higher $p_i$ on the number of mature firms in a location is ambiguous, however, because in both the benchmark model and model with liquidity-constrained workers the number of clients $Q_i$ increases, offsetting the fall of $y_{Fi}$ in equation (14).

Unlike $p_i$, a lower cost of entrepreneurship $c_i$ does not affect expected firm payoffs in the same direction in the benchmark and liquidity-constrained models. We are therefore unable to use equation (14) to make predictions regarding the impact of differences in $c_i$. 
V. Conclusions and Directions for Further Research

We analyzed a model of business service production in which clients can choose between locations that differ in costs of firm entry and enforcement of restrictive employment covenants for firm workers. Workers develop relationships with clients that allow them to provide high value customized services. In a given relationship, production relies on the worker exerting effort, but effort is unverifiable and therefore difficult to motivate. The worker’s incentive to exert effort is greater when the worker starts his own firm to serve the client, but to do so he must pay an entry cost. Pairs of firms and workers negotiate their initial employment contracts, including any covenants restricting the ability of workers to serve clients as entrepreneurs, prior to matching and contracting with their clients. However, clients, firms, and workers have the opportunity to renegotiate the terms of their relationships. If workers face liquidity constraints that keep them from borrowing money on the basis of expected future returns, the outcome of negotiation will be affected.

A surprising number of our results are robust to whether or not workers are liquidity-constrained. First, firms and workers will agree to make non-compete or non-solicitation clauses as strict as they can. Second, workers with attractive entrepreneurial options who choose to stay with their employers will receive transfers from them, which we can interpret as discretionary deferred compensation schemes. Third, weaker enforcement of restrictive employment clauses attracts clients to locations, generating greater employment and output in their business service sectors. In addition, the size of mature firms will be larger and the ratio of mature to new firms will be lower. Fourth, if the cost of entry is equal across locations \((c_i = c_j \forall i)\), unambiguous assignment of property rights in clients to workers in all locations \((p_i = 1 \forall i)\) yields the
constrained socially efficient outcome.

There are, however, two important differences between the results of our benchmark model and our model with liquidity-constrained workers. In the benchmark model, the decision by a worker and a client to separate from a firm was always accompanied by renegotiation of the worker’s contract to assign property rights in the client to him, whereas when the worker is liquidity-constrained and the value of the customized service to the client without the worker’s effort is large enough, renegotiation fails and the firm takes the worker to court to try to stop him from serving the client as an entrepreneur. The failure of renegotiation leads to the second important difference, which is that by limiting enforcement of restrictive employment clauses, local governments can generate more entrepreneurship and increase the total value generated by each client-firm-worker relationship in the liquidity-constrained model but not in the benchmark model.

Our paper yields an unambiguous answer to its title question: there are not too many client-based entrepreneurs. This is a stronger conclusion than we expected. Employers might object that we have treated the productivity of the worker in serving the client as the result of on-the-job training that is independent of any action by the employer. In reality, a firm might be able to influence this productivity by, for example, manipulating the extent to which it covers the expense to the worker of visits to the client. If the firm is limited in its ability to restrict the worker from leaving with the client, it may not have the correct incentive to provide an input that is needed to make the client-worker relationship more productive. Might this argument reverse the positive effects of limiting enforcement of non-compete and non-solicitation clauses when workers are liquidity-constrained? In general, it may, but this depends on whether the input in
question actually must be provided by the firm, when it must be provided, and whether it can be verified and contracted upon.

For example, suppose the input is a verifiable investment (and so can be enforced) that either the firm or worker can finance. In this case, standard intuition (Becker 1964; Mincer 1974) suggests that the appropriate incentives will be given by having the worker make the general investments and having the firm make the investments that are relation-specific. If the worker cannot finance an investment, or if the firm must make an unverifiable investment choice, then the firm’s incentive to make a general investment will be enhanced by the use of an enforceable restrictive covenant of the type we have studied here. In our model, this would strengthen the force to lower $p_i$ and it would provide a welfare-based reason to set lower values of $p_i$. However, the worker and firm will still want $p_i$ to be lower than is efficient, so some bound on the enforcement of restrictive covenants is still in order. In general, the literature on general versus specific investment in workers, it seems, would benefit from more analysis of contractual arrangements that affect post-severance activity.

\[\text{Note that, if the firm’s investment decision is verifiable, then it can be directly specified in the parties’ contract and enforced. Renegotiation between the firm and the client over this investment will ensure financing from the client when the parties choose to separate. This incentive for investment in workers is analogous to that given to firms by monopsony power over workers in the model of Acemoglu and Pischke (1998).}\]
Appendix

This Appendix contains details of the analysis that are not presented in the text. Figures A1.1 and A1.2 contain the extensive-form diagram of the game, from the point at which $p_i$ has been chosen and the number $\eta$ has been drawn. The circled nodes in the picture are joint-decision nodes; each models a phase in which two or three of the players negotiate. At both individual- and joint-decision nodes, the branches are labeled with the actions that must be taken. At joint-decision nodes, a disagreement point is also indicated, which describes what happens if the players do not reach an agreement. Each party can unilaterally compel disagreement.

Note that Phase (a) in Figure A1.1 is where the firm, worker, and client negotiate over $p_i$. Here, an immediate transfer from the client to the firm is denoted $t_{CFi}^{(a)}$, an immediate transfer from the firm to the worker is denoted $t_{FWi}^{(a)}$, and disagreement means $p_i' = p_i$, $t_{CFi}^{(a)} = 0$, and $t_{FWi}^{(a)} = 0$. At Phase (b) the parties negotiate over whether to stay together; here, the possible transfers are denoted with a “(b)” superscript and the disagreement point is separation with no immediate transfers. Figure A1.2 shows the subgame from the point at which the worker and client separate from the firm. This subgame begins with a random event — the move of “nature” that determines whether the worker is allowed to serve the client.

The payoff of each player in the game is simply the player’s total monetary gains, which the player is assumed to maximize.

A. Benchmark Model

In this subsection, we give the details of how the equilibrium transfers and continuation payoffs are determined in the benchmark model with no liquidity constraints. Table A1 summarizes the calculations. In the table, $y$ denotes a player’s continuation value from a given phase of the game; superscripts denote the phase of the game and subscripts denote the player.

Our calculations proceed by backward induction. We begin with the subgame from the point at which separation occurs (starting at Phase (a) in Figure A1.2). With probability $p_i$ this subgame ends with the client receiving a customized service of value $f(e^S) + B$, where $e^S$ is the effort supplied by the entrepreneur (worker) when he and the client separate from the firm. With probability $1 - p_i$ this branch ends with the client receiving a customized service of value $B$. We will work through the solution to Phase (b), in which the entrepreneur chooses his effort level and the client and entrepreneur divide the value of the customized service. Solving for the payoffs and transfers in the rest of the separation branch is straightforward.

After the worker has invested $k_i(\eta)$ to become an entrepreneur and has supplied $e^S$, his disagreement value in the event of a breakdown in bargaining with his client is $- (k_i(\eta) + e^S)$. The client’s disagreement value is zero. The gross surplus from proceeding with production of the customized service is therefore $f(e^S) + B - (k_i(\eta) + e^S)$, leaving a net surplus relative to the disagreement point of $f(e^S) + B$. Dividing this according to the bargaining weights of the client and entrepreneur and adding the disagreement points yields the payoffs $y_{CI}^{S(b')} = (1 - \lambda)(f(e^S) + B)$ and $y_{EI}^{S(b')} = \lambda(f(e^S) + B) - (k_i(\eta) + e^S)$ shown in Table A1. Comparing these payoffs to the (end-
of-game) continuation values \( f(e^i) + B \) for the client and \(- (k(\eta) + e^i)\) for the entrepreneur implies a transfer of \( t_{CEi}^{(b)} = \lambda(f(e^i) + B) \) from the client to the entrepreneur, also shown in Table A1. The entrepreneur chooses the effort level that maximizes his anticipated payoff \( \lambda(f(e^i) + B) - (k(\eta) + e^i)\), so \( e^i \) must satisfy \( \lambda f'(e^i) = 1 \) as noted in expression (3) in the text.

Working backwards to phase (a'), we see that the entrepreneur picks up a transfer \( t_{CEi}^{(a')} = (1 - \lambda)e^i \) from the client, yielding client and worker payoffs \((1 - \lambda)(f(e^i) + B - e^i)\) and \(\lambda(f(e^i) + B - e^i) - k(\eta)\), respectively, that are received with probability \( p_i' \). With probability \( 1 - p_i' \), on the other hand, the firm is able to prevent the worker from serving the client and the worker gets zero, leaving the client and the firm to divide the surplus \( B \). The expected payoffs from separation for the client, firm, and worker are therefore given by:

\[
\begin{align*}
\hat{y}_{Ci}^c &= p_i'(1 - \lambda)(f(e^i) + B - e^i) + (1 - p_i')(1 - \lambda)B \\
\hat{y}_{Fi}^c &= (1 - p_i')\lambda B \\
\hat{y}_{Wi}^c &= p_i'[\lambda(f(e^i) + B - e^i) - k(\eta)] \\
\end{align*}
\]

(15)

We now turn to Figure A1.1 and work backward from phase (c) to solve the “stay together” subgame. After the worker has supplied \( e^T \), his disagreement value in the event of a breakdown in bargaining between himself, the client and the firm is \(- e^T\). The disagreement values of the client and firm are zero. The gross surplus from proceeding with production of the customized service is \( f(e^T) + B - e^T \), leaving a net surplus relative to the disagreement point of \( f(e^T) + B \). Dividing this according to the bargaining weights of the client, firm, and worker and adding the disagreement point yields the payoffs \( \hat{y}_{Ci}^{(c)} = (1 - \lambda)(f(e^T) + B) \), \( \hat{y}_{Fi}^{(c)} = (1 - \alpha)\lambda(f(e^T) + B) \), and \( \hat{y}_{Wi}^{(c)} = \alpha\lambda(f(e^T) + B) - e^T \) shown in Table A1. Comparing these payoffs to the (end-of-game) continuation values \( f(e^T) + B \) for the client, zero for the firm and \(- e^T\) for the worker implies payments of \( t_{CFi}^{(c)} = \lambda(f(e^T) + B) \) from the client to the firm and \( t_{FWi}^{(c)} = \alpha\lambda(f(e^T) + B) \) from the firm to the worker, also shown in Table A1. The worker chooses the effort level that maximizes his anticipated payoff \( \alpha\lambda(f(e^T) + B) - e^T \), so \( e^T \) must satisfy \( \alpha\lambda f'(e^T) = 1 \) as noted in expression (3) in the text.

Given these payoffs in phase (c), in phase (b) the gross surplus to the parties from agreeing to stay together is \( f(e^T) + B - e^T \). This must be compared to the total value of disagreement (separation of client and worker from firm), which can be seen from equations (15) to equal \( p_i'(f(e^\delta) + B - e^\delta - k(\eta)) + (1 - p_i')B \). Given efficient bargaining, disagreement will occur when this latter value is at least as large as the former value, in which case all parties receive the payoffs in equations (15). If, on the other hand, the former value is greater, then the net surplus from agreement \( f(e^T) - e^T - p_i'(f(e^\delta) - e^\delta - k(\eta)) \) will be divided among the parties. Adding the parties’ shares of this surplus to their disagreement points from equations (15) yields the payoffs \( \hat{y}_{Ci}^{(b)} \), \( \hat{y}_{Fi}^{(b)} \), and \( \hat{y}_{Wi}^{(b)} \) shown in Table A1. The transfers from the client to the firm and from the firm to the worker are then given by \( \hat{y}_{Ci}^{(c)} - \hat{y}_{Ci}^{(b)} \) and \( \hat{y}_{Wi}^{(c)} - \hat{y}_{Wi}^{(b)} \), respectively.30

In Phase (a) of the game (at the beginning of Figure A1.1), the parties renegotiate \( p_i \). If

30For the disagreement point described in the text to always be appropriate, we make the following assumption throughout: \( \lambda(f(e^\delta) - e^\delta) \geq c_i + \tilde{\eta} \). This ensures that the worker wants to become an entrepreneur whenever separation occurs.
they foresee that the client and worker will separate from the firm, clearly the surplus from separation will be maximized by choosing $p_i' = 1$, so efficient bargaining will yield this outcome. We must consider three cases:

**Case (a1):** $p_i(f(e^S) - e^S - k_i(\eta)) \geq f(e^T) - e^T$. Separation is efficient\(^{31}\) even at the existing $p_i$, so the disagreement points are the separation payoffs with $p_i' = p_i$ and the surplus from agreement on $p_i' = 1$ is $(1 - p_i)(f(e^S) - e^S - k_i(\eta))$. This gives us the information needed to compute the payoffs shown in Table A1, and the transfers are computed by subtracting from these payoffs the separation payoffs with $p_i' = 1$, which are the continuation values in this case.

**Case (a2):** $p_i(f(e^S) - e^S - k_i(\eta)) < f(e^T) - e^T$, but $f(e^S) - e^S - k_i(\eta) \geq f(e^T) - e^T$. Staying together is efficient at the existing $p_i$, but separation is efficient with $p_i' = 1$. The disagreement points are $y_{Ci}^{(b)}$, $y_{Fi}^{(b)}$, and $y_{Wi}^{(b)}$ evaluated at $p_i' = p_i$ and the surplus from agreement on $p_i' = 1$ is $f(e^S) - e^S - k_i(\eta) - (f(e^T) - e^T)$. The continuation values are the same as in case (a1).

**Case (a3):** $f(e^S) - e^S - k_i(\eta) < f(e^T) - e^T$. Nothing is to be gained from renegotiating $p_i$. The parties’ payoffs equal their disagreement points $y_{Ci}^{(b)}$, $y_{Fi}^{(b)}$, and $y_{Wi}^{(b)}$ evaluated at $p_i' = p_i$, and there are no transfers.

We can now compute the expected client payoff $y_{Ci}$ by summing the client payoffs in phase (a) using the density $\mu$ and noting that Case (a3) applies when $\eta > \bar{\eta}_i$ and that Cases (a1) and (a2) yield the same payoffs when $\eta \leq \bar{\eta}_i$. We have:

$$y_{Ci} = \int_{\mathbb{A}} (1 - \lambda)[f(e^S) + B - e^S - (1 - p_i)k_i(\eta)]\mu(\eta) d\eta + \int_{\bar{\eta}_i} (1 - \gamma_i)(f(e^T) + B - e^T + p_i k_i(\eta))\mu(\eta) d\eta$$

$$= (1 - \lambda)[p_i(c_i + E\eta) + \gamma_i(f(e^S) + B - e^S - c_i) - \bar{\eta}_i + (1 - \gamma_i)(f(e^T) + B - e^T)],$$

where $\gamma_i$ is the probability that the client and worker separate from the firm in location $i$, $E\eta$ is the expected value of $\eta$, and $\bar{\eta}_i = \int_{\mathbb{A}} \eta \mu(\eta) d\eta$. This is equation (6) in the text. Similar computations yield the expected total payoff for the client, firm, and worker from one client relationship, denoted by $y_i$:

$$y_i = \gamma_i(f(e^S) + B - e^S - c_i) - \bar{\eta}_i + (1 - \gamma_i)(f(e^T) + B - e^T).$$

This is equation (5) in the text.

**B. The Model with Liquidity Constraints**

Note that the liquidity constraint does not bind in the negotiation phases shown in Figure

\(^{31}\)“Efficiency” used here is defined with respect to the separation/stay together decision. For example, we say that separation is efficient given $p_i'$ if it yields a higher joint payoff than does staying together.
A1.2 (between the entrepreneur and the client), nor does it bind in the negotiation at Phase (c) in Figure A1.1. This can be verified by confirming that, in these negotiation phases, the unconstrained Nash bargaining solution specifies a nonnegative transfer to the worker/entrepreneur; note that \( t_{FWi}^{(c)}, t_{CEi}^{(a)}, \) and \( t_{CEi}^{(b)} \) in table A1 are all nonnegative. Thus, the values \( y_{Ci}^{S}, y_{Fi}^{S}, y_{Wi}^{S}, y_{Ci}^{T}(c), y_{Fi}^{T}(c), \) and \( y_{Wi}^{T}(c) \) are the same as they were in the benchmark model. For these values, recall expression (4) and the following paragraph in Section II.B (or refer to Table A1).

Next consider the negotiation at Phase (b) in Figure A1.1, where, given \( p_i \), the parties jointly decide whether to stay together. The disagreement point is separation with no transfers, which yields the continuation values \( y_{Ci}^{S}, y_{Fi}^{S}, \) and \( y_{Wi}^{S} \) for the client, firm, and worker, respectively. As we noted in the analysis of the benchmark model, the joint value of separating (the sum of the players’ continuation values) is 
\[
\pi \left[ f(e_S) + B - e_S - k(\eta) \right] + (1 - \pi)B,
\]
whereas the joint value of staying together is 
\[
f(e_T) + B - e_T.
\]
If the former exceeds the latter then separation is the solution to the bargaining problem, just as in the benchmark model. If the joint value of staying together exceeds the value of separating, then efficiency dictates staying together. However, we must check to see whether the worker’s liquidity constraint interferes with this outcome. Ignoring the liquidity constraint for a moment, we recall that, in the Nash solution of the benchmark model, the parties stay together and the worker gets an immediate transfer of 
\[
t_{FWi}^{(b)} = y_{Wi}^{T(b)} - y_{Wi}^{T(c)},
\]
as defined in Table A1. We have:

**Lemma A1:** Under the assumptions of Section III, the worker’s transfer \( t_{FWi}^{(b)} \) from the benchmark model is nonnegative when 
\[
f(e_T) + B - e_T \geq \pi \left[ f(e_S) + B - e_S - k(\eta) \right] + (1 - \pi)B.
\]

**Proof:** From Table A1, we see that 
\[
t_{FWi}^{(b)} = \lambda(p_i' - \alpha)B + (1 - \alpha\lambda)e_T + \lambda p_i'(1 - \alpha)(f(e_S) - e_S) - p_i'(1 - \alpha\lambda)k(\eta),
\]
which is clearly greater than or equal to 
\[
- \alpha\lambda B + (1 - \alpha\lambda)e_T - (1 - \alpha\lambda)k(\eta).
\]
This expression has the same sign as does 
\[
e_T - \alpha\lambda B/(1 - \alpha\lambda) - k(\eta),
\]
which is nonnegative by Assumption A2. 

This result implies that the worker’s liquidity constraint does not bind in the solution to the bargaining problem in Phase (b) of Figure A1.1. In other words, given \( p_i' \), the outcome of negotiation over whether to stay together is exactly the same as that computed for the benchmark model. Thus, the values \( y_{Ci}^{T(b)}, y_{Fi}^{T(b)}, \) and \( y_{Wi}^{T(b)} \) in the model with the liquidity constraint are the same as those derived for the benchmark model (shown in Table A1).

Our analysis continues with the evaluation of the parties’ negotiation over \( p_i' \) (Phase (a) in Figure A1.1). Here, the liquidity constraint has an interesting effect and leads to different outcomes than occur in the benchmark model. Let us consider Cases (a1)-(a3) paralleling the analysis of the benchmark model.

**Case (a1):** \( p_i(f(e_S) - e_S - k(\eta)) \geq f(e_T) - e_T \). Separation would occur even at the existing \( p_i \). It is efficient to set \( p_i' = 1 \). However, an increase in \( p_i' \) causes the firm’s continuation payoff \( y_{Fi}^{T(b)} \) to drop at the rate of \( \lambda B \) and the client’s continuation payoff \( y_{Ci}^{T(b)} \) to rise at the rate of \( 1 - \)
Taking the derivative of $y_C T_i (b) + y_F T_i (b)$ with respect to $\pi N$ yields $-8B + (1 - 8)\left[f(e^S) - e^S\right]$ where $\pi N$ would yield separation. By Assumption A3, this is nonpositive. In the range of $\pi N$ in which the parties will stay together, the derivative is $-8B + 8(1 - 8)\left[f(e^S) - e^S\right]$ + $(1 - 8)\left[f(e^T) - e^T\right]$, which, given the presumption of Case (a2), does not exceed $-8B + (1 - 8)\left[f(e^S) - e^S\right] - (1 - 8)\left[f(e^T) - e^T\right]$. Again, this is nonpositive.

Case (a2): $p(f(e^S) - e^S - k(\eta)) < f(e^T) - e^T$, but $f(e^S) - e^S - k(\eta) \geq f(e^T) - e^T$. Staying together is efficient at the existing $\pi$, but separation is efficient with $\pi'_i = 1$. It is easy to verify that, as in Case (a1), the sum of the firm’s and client’s continuation payoffs, $y_{Fi}^{T(b)} + y_{Ci}^{T(b)}$, is decreasing in $\pi'_i$.32 (This depends on Assumption A3.) Thus, the firm will not agree to set $\pi'_i$ above $\pi_i$ without an immediate transfer from the worker. Because the worker is liquidity constrained, the outcome of negotiation is the disagreement point of $\pi'_i = \pi_i$ with no immediate transfers.

Case (a3): $f(e^S) - e^S - k(\eta) < f(e^T) - e^T$. Nothing is to be gained from renegotiating $p_i$. The parties’ payoffs equal their disagreement points $y_{Ci}^{T(b)}$, $y_{Fi}^{T(b)}$, and $y_{Wi}^{T(b)}$ evaluated at $\pi'_i = \pi_i$, and there are no transfers.

In summary, we have shown that the worker’s original contract is not renegotiated (so $\pi'_i = \pi_i$) and the parties stay together if and only if it is efficient to do so given $\pi_i$ — that is, if and only if $\pi_i[f(e^S) - e^S - c_i - \eta] \leq f(e^T) - e^T$. The equilibrium payoffs from Phase (a) in Figure A1.1 satisfy $y_{Ci}^{T(a)} = y_{Ci}^{T(b)}$, $y_{Fi}^{T(a)} = y_{Fi}^{T(b)}$, and $y_{Wi}^{T(a)} = y_{Wi}^{T(b)}$, for the values of $y_{Ci}^{T(b)}$, $y_{Fi}^{T(b)}$, and $y_{Wi}^{T(b)}$ shown in Table A1 and evaluated at $\pi'_i = \pi_i$. This proves Proposition 3 in the text.

C. Proofs Not in the Text

Proof of Lemma 1: Calculating the derivative of $y_{Ci}$, we obtain

$$\frac{\partial y_{Ci}}{\partial \pi_i} = (1 - \lambda)[f(e^S) - e^S] - \int_{\eta_i}^{\pi_i}(1 - \lambda)[f(e^S) - e^S - k(\eta)]\mu(\eta) d\eta,$$

which is positive because $\int_{\eta_i}^{\pi_i}\mu(\eta) d\eta \leq 1$. In the derivative calculation, note that the term with $\partial \eta_i / \partial \pi_i$ disappears because, by the definition of $\eta_i$, we have

$$f(e^T) - e^T - \pi_i[f(e^S) - e^S - k(\eta_i)] = 0$$

where $\eta_i > \eta$ and we have $\partial \eta_i / \partial \pi_i = 0$ otherwise. Likewise, the derivative of $y_{Fi}$ is

$$\frac{\partial y_{Fi}}{\partial \pi_i} = -\lambda B - \int_{\eta_i}^{\pi_i}(1 - \alpha)\lambda[f(e^S) - e^S - k(\eta)]\mu(\eta) d\eta.$$
which is negative because the bracketed term in the integral is positive by Assumption A1.

Similarly, the derivative of the agents’ total value with respect to \( p_i \) is easily calculated and seen to be positive.

Regarding the convexity of the sum of the worker’s and firm’s values, calculations along the lines of those above yields

\[
\frac{\partial y_{Fi}}{\partial p_i} + \frac{\partial y_{Wi}}{\partial p_i} = \lambda [f(e^S) - e^S] \int_{\eta_i}^{\hat{\eta}_i} \mu(\eta) d\eta + \lambda \int_{\eta_i}^{\hat{\eta}_i} (c_i + \eta) \mu(\eta) d\eta - (c_i + E\eta)
\]  

(16)

where \( \hat{\eta}_i > \eta_i \), and

\[
\frac{\partial y_{Fi}}{\partial p_i} + \frac{\partial y_{Wi}}{\partial p_i} = -(1 - \lambda)[c_i + E\eta]
\]

(17)

where \( \hat{\eta}_i = \eta_i \). Note that \( p_i \) does not enter expression (17), so the second derivative is zero where \( p_i \) is low enough so that \( \hat{\eta}_i = \eta_i \). In expression (16), \( p_i \) enters only through \( \hat{\eta}_i \). Note that, here, the derivative \( \partial y_{Fi}/\partial p_i + \partial y_{Wi}/\partial p_i \) is increasing in \( \hat{\eta}_i \), because \( f(e^S) - e^S - k(\hat{\eta}_i) > 0 \) (by Assumption A1). Also, from the definition of \( \hat{\eta}_i \), we note that \( \hat{\eta}_i \) is increasing in \( p_i \). Thus, we have that, at every value of \( p_i \), the derivative \( \partial y_{Fi}/\partial p_i + \partial y_{Wi}/\partial p_i \) is increasing in \( p_i \). This proves that \( y_{Fi} + y_{Wi} \) is convex in \( p_i \).

**Proof of Proposition 5:** Consider the effect of raising \( p_i \) to, say, \( p_i + \epsilon \). Let \( p_i^* \) be the optimal choice of \( p_i \) for the worker and the firm in the case with constraint \( p_i \) and let \( p_i^{**} \) be the optimal selection for the case with constraint \( p_i + \epsilon \). If \( p_i^* < p_i + \epsilon \), then, clearly, we know that \( p_i^{**} > p_i^* \) because the former must weakly exceed \( p_i + \epsilon \). If \( p_i^* > p_i + \epsilon \), then \( p_i^{**} = p_i^* \) follows from the “independence of irrelevant alternatives” property of the worker and firm’s maximization problem (9). To see this, note that the set of feasible payoff vectors for the worker and firm in problem (9) with constraint \( p_i > p_i + \epsilon \) is a subset of the set of feasible payoff vectors in the problem with the tighter constraint \( p_i > p_i \). Because \( p_i^* \) solves the problem with the looser constraint, and since \( p_i^* \) is feasible with the tighter constraint, we conclude that \( p_i^* \) also solves the latter problem. Thus, the optimal choice of \( p_i \) is weakly increasing in \( p_i \).33

**Proof of Lemma 2:** Calculating the derivative from the first line of expression (6), we obtain

\[
\frac{\partial y_{Ci}}{\partial c_i} = \int_{\eta_i}^{\hat{\eta}_i} (1 - \lambda)(1 - p_i) \mu(\eta) d\eta + \frac{\partial \hat{\eta}_i}{\partial c_i} \int_{\eta_i}^{\hat{\eta}_i} (1 - \lambda) [f(e^S) + B - e^S - k(\hat{\eta}_i) + p_i k(\hat{\eta}_i)]
\]

\[
+ \int_{\hat{\eta}_i}^{\eta_i} (1 - \lambda) p_i \mu(\eta) d\eta - \frac{\partial \hat{\eta}_i}{\partial c_i} \int_{\eta_i}^{\hat{\eta}_i} (1 - \lambda) [f(e^T) + B - e^T + p_i k(\hat{\eta}_i)]
\]

Note that, by the definition of \( \hat{\eta}_i \), we have \( f(e^S) - e^S - k(\hat{\eta}_i) = f(e^T) - e^T \), which implies that the second and fourth terms in the above expression cancel. Simplifying the remaining two terms, the derivative is

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33Because the bargaining set is generally not convex here, it is possible that there are multiple solutions to the maximization problem (11). In this case, our monotonicity result still holds for the sets of solutions.
\[ \frac{\partial y_{ci}}{\partial c_i} = -\int_{\eta_i}^{\eta}(1-\lambda)\mu(\eta)d\eta + \int_{\eta_i}^{\eta}(1-\lambda)p_\eta(\eta)d\eta. \]

Noting that \( \eta_i \) is decreasing in \( c_i \), and that it equals \( \eta \) when \( c_i = \bar{c} \) and \( \eta \) when \( c_i = \xi \), the conclusion follows. \( \blacksquare \)
References


The worker and firm contract on probability $p$, that the worker will be allowed to serve a client if he and the client separate from the firm.

Each worker serves one client (as an employee). Each worker draws $\eta$, the idiosyncratic component of his cost of establishing his own firm to provide a customized service to the client.

$\eta$ becomes common knowledge to the firm, worker, and client. The client, firm, and worker renegotiate $p$ to $p'$, or disagree (in which case $p' = p$).

The client, firm, and worker negotiate over whether the three parties stay together (in which case the worker provides the customized service to the client as an employee) or separate (in which case the client and worker both separate from the firm).

Together ($T$)  
Separate ($S$), disagreement point

The worker chooses effort level $e^\tau$ and the value of output is $f(e^\tau) + B$. The client, firm, and worker divide the surplus $f(e^\tau) + B$.

Uncertainty over whether the entrepreneur can serve the client is resolved.

$1 - p'_{ik}$  
$p'_{ik}$

The worker invests $k/(\eta)$ to establish his own firm.

The firm retains the client, but without the worker. The value of output is $B$. The client and firm divide surplus $B$.

The worker (now entrepreneur) and client negotiate over whether to work together or separate, where separation yields zero for both.

The entrepreneur chooses effort level $e^\xi$ and the value of output is $f(e^\xi) + B$. The client and entrepreneur divide the surplus $f(e^\xi) + B$.

Figure 1: Timing.
Figure 2: The Bargaining Set for the Firm and Worker’s Initial Contract Negotiation.
Phase (a)  Phase (b)  Worker’s effort choice  Phase (c)

Disagreement point: $p_i^e = p_i^r$  
$t_{CFi}^{(a)} = t_{FWi}^{(a)} = 0$

Stay/separate,  
$t_{CFi}^{(b)}$, $t_{FWi}^{(b)}$

Disagreement point:  
separation with $t_{CFi}^{(b)} = t_{FWi}^{(b)} = 0$;  
continuation values: $y_{CFi}^e$, $y_{FWi}^e$, $y_{FWi}^w$  
(from the continuation to Figure 2.2)

Disagreement point:  
separation with $t_{CFi}^{(c)} = t_{FWi}^{(c)} = 0$;  
payoffs are  
C: $-t_{CFi}^{(a)} - t_{CFi}^{(b)}$  
F: $-t_{CFi}^{(a)} - t_{CFi}^{(b)} - t_{FWi}^{(a)} - t_{FWi}^{(b)}$  
W: $-t_{FWi}^{(a)} - t_{FWi}^{(b)} - e^T$

Payoffs are  
C: $f(e^T) + B - t_{CFi}^{(a)} - t_{CFi}^{(b)} - t_{CFi}^{(c)}$  
F: $t_{CFi}^{(a)} + t_{CFi}^{(b)} + t_{CFi}^{(c)} - t_{FWi}^{(a)} - t_{FWi}^{(b)} - t_{FWi}^{(c)}$  
W: $t_{FWi}^{(a)} + t_{FWi}^{(b)} + t_{FWi}^{(c)} - e^T$

C = Client  The payoffs reported are  
F = Firm  continuation payoffs from the  
W = Worker  time $\eta$ is observed, given $p_i$.

Figure A1.1: The Subgame From the Time $\eta$ is Observed, Given $p_i$. 
Disagreement point: production opportunity lost, with \( t_{CEi}^{(a)} = 0 \); payoffs are
\[
\begin{align*}
  &C: - t_{CFi}^{(a)} \\
  &F: t_{CFi}^{(a)} - t_{FWi}^{(a)} \\
  &E: t_{FWi}^{(a)} - k(\eta)
\end{align*}
\]

Disagreement point: production opportunity lost, with \( t_{CEi}^{(b')} = 0 \); payoffs are
\[
\begin{align*}
  &C: - t_{CFi}^{(a)} - t_{CEi}^{(a')} \\
  &F: t_{CFi}^{(a)} - t_{FWi}^{(a)} \\
  &E: t_{FWi}^{(a)} + t_{CEi}^{(a')} - \epsilon^S - k(\eta)
\end{align*}
\]

Disagreement point: production opportunity lost, with \( t_{CFi}^{(b')} = 0 \); payoffs are
\[
\begin{align*}
  &C: B - t_{CFi}^{(a)} - t_{CFi}^{(b')} \\
  &F: t_{CFi}^{(a)} - t_{FWi}^{(a)} + t_{CFi}^{(b')} \\
  &W: t_{FWi}^{(a)}
\end{align*}
\]

The payoffs reported are continuation payoffs from the time \( \eta \) is observed, given \( p_i \).

**Figure A1.2:** The Subgame Following Separation of the Client, Firm, and Worker at Phase (b) in Figure 2.1.
Continuation payoffs and transfers for Figure A1.1

If \( f(e^S) - e^S - k_1(\eta) \geq f(e^T) - e^T \):

\[
\begin{align*}
\gamma_{G_i}^{(a)} &= (1 - \lambda)(f(e^S) + B - e^S - (1 - p_i)k_1(\eta)) \\
\gamma_{F_i}^{(a)} &= \lambda(1 - p_i)(B + (1 - \alpha)(f(e^S) - e^S - k_1(\eta)) \\
\gamma_{W_i}^{(a)} &= \lambda p_i B + \lambda[p_i + \alpha(1 - p_i)](f(e^S) - e^S) - [p_i + \alpha\lambda(1 - p_i)]k_1(\eta) \\
t_{CF_i}^{(a)} &= (1 - \lambda)(1 - p_i)k_1(\eta) \\
t_{FW_i}^{(a)} &= - (1 - p_i)[\lambda[B + (1 - \alpha)(f(e^S) - e^S)] - (1 - \alpha\lambda)k_1(\eta)]
\end{align*}
\]

If \( f(e^S) - e^S - k_1(\eta) < f(e^T) - e^T \):

\[
\begin{align*}
\gamma_{G_i}^{(b)} &= (1 - \lambda)(f(e^T) + B - e^T + p_i k_1(\eta)) \\
\gamma_{F_i}^{(b)} &= \lambda[(1 - p_i)B + (1 - \alpha)[f(e^T) - e^T - p_i (f(e^S) - e^S - k_1(\eta))] \\
\gamma_{W_i}^{(b)} &= \lambda p_i B + \alpha\lambda f(e^T) - e^T + \lambda p_i (1 - \alpha)(f(e^S) - e^S - p_i (1 - \alpha\lambda)k_1(\eta) \\
t_{CF_i}^{(b)} &= (1 - \lambda)(e^T - p_i k_1(\eta)) \\
t_{FW_i}^{(b)} &= \lambda(p_i B - (1 - \alpha\lambda)e^T + \lambda p_i (1 - \alpha)(f(e^S) - e^S - p_i (1 - \alpha\lambda)k_1(\eta)
\end{align*}
\]

\[
\begin{align*}
\gamma_{G_i}^{(c)} &= (1 - \lambda)(f(e^T) + B) \\
\gamma_{F_i}^{(c)} &= (1 - \alpha)\lambda f(e^T) + B) \\
\gamma_{W_i}^{(c)} &= \alpha\lambda f(e^T) + B - e^T \\
t_{CF_i}^{(c)} &= \lambda f(e^T) + B \\
t_{FW_i}^{(c)} &= \alpha\lambda f(e^T) + B
\end{align*}
\]

Continuation payoffs and transfers for Figure A1.2

\[
\begin{align*}
\gamma_{G_i}^{(S)} &= p_i (1 - \lambda)(f(e^S) + B - e^S) + (1 - p_i)(1 - \lambda)B \\
\gamma_{F_i}^{(S)} &= (1 - p_i)\lambda B \\
\gamma_{W_i}^{(S)} &= p_i[\lambda f(e^S) + B - e^S - k_1(\eta)] \\
\gamma_{G_i}^{(a')} &= (1 - \lambda)(f(e^S) + B - e^S) \\
\gamma_{E_i}^{(a')} &= \lambda(f(e^S) + B - e^S - k_1(\eta) \\
t_{CE_i}^{(a')} &= (1 - \lambda)e^S
\end{align*}
\]

\[
\begin{align*}
\gamma_{G_i}^{(b')} &= (1 - \lambda)(f(e^S) + B) \\
\gamma_{E_i}^{(b')} &= \lambda f(e^S) + B - (k_1(\eta) + e^S) \\
t_{CE_i}^{(b')} &= \lambda f(e^S) + B \\
\gamma_{G_i}^{(c')} &= (1 - \lambda)B \\
\gamma_{E_i}^{(c')} &= \lambda B \\
\gamma_{W_i}^{(c')} &= 0
\end{align*}
\]