The Inverted Job Ladder in Skilled Professions

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Abstract

How do workers initially match with firms, and how do these matches improve over time? An influential perspective is known as the job ladder. In the job ladder, poached workers tend to move to better firms, while displaced workers who are shocked into unemployment tend to reemploy into worse firms. This paper combines theory and evidence to suggest an alternative hypothesis for reallocation in the skilled professions. I use historical data on lawyers to document an inverted job ladder. Lawyers switching from surviving firms move to worse firms, while lawyers switching from dissolved firms move to better firms. I complement this with evidence that (1) law firms specialize in different degrees of talent, and (2) law firms privately learn how talented their lawyers are. I combine these two features into a model that predicts an inverted job ladder. In the model, private learning creates a lemons problem where job switching workers are adversely selected. Firms that are willing to poach lemons from their rivals tend to be lower on the ladder, and thus more specialized in lemons. Meanwhile, workers who are retained up until the time of firm dissolution are revealed ex post to have been above average talent, and thus reemploy with better firms. The model's incorporation of firm heterogeneity and infinite horizon Markov dynamics allows it to more realistically portray market efficiency compared to the previous generation of private learning models. I structurally estimate the model in order to quantify misallocation due to private learning.

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1 Introduction

Within skilled professions, the better firms tend to work on bigger and more complex projects. DeSimone engineers skyscrapers, Cravath advises Fortune 500 mergers, and Goldman Sachs underwrites initial public offerings. The high stakes of their projects cause the top firms to have a low tolerance for failure, and to specialize in acquiring top talent. This specialization is most obvious in how the top firms recruit from the top schools. However, because initial credentials are imperfect signals of talent, true specialization demands continued learning about workers' talents, and subsequent reallocation.

How is talent reallocated in the skilled professions? The dominant perspective on labor reallocation is known as the job ladder. In a standard job ladder, economic surplus is always enhanced by moving workers up the ladder to higher ranked firms. Search frictions prevent such reallocations from occurring immediately. A worker gradually climbs the ladder through job-to-job moves as the opportunities to do so randomly arrive. When a worker is displaced into unemployment by a shock, she will tend to reemploy lower on the ladder.

The job ladder's predictions have been probed and verified through extensive empirical work, giving it a well-deserved influence on how economists view the labor market. It nonetheless has some empirical shortcomings. First, a job ladder is typically not able to explain why a large fraction of job-to-job mobility appears to be downward directed—except by appealing to idiosyncratic shocks.[1] Second, the evidence of upward directed job-to-job mobility appears to be weak when we focus on white-collar workers, rather than the entire economy ((Haltiwanger et al., 2018)). My paper will offer one explanation for these facts, which is that a large segment of the white-collar workforce is operating on a different type of job ladder. The relevant professions will be those where the quality of a person's work is privately observed by her firm (e.g., law, consulting, finance, marketing, engineering).[2] These professions are important because they hire a large share of society's best trained individuals. For example, more than a third of Harvard's undergraduate alumni accept jobs in finance or consulting alone ((Franck, 2017)).

I call this alternative framework the *inverted job ladder*. In an inverted job ladder, surplus is maximized when the best workers are placed at the top of the ladder, and the

[1]These shocks are sometimes called Godfather shocks because the poaching firm makes the worker an offer that she cannot refuse. Sorkin (2018)'s model provides an alternative explanation for apparent downward directed mobility, by essentially positing that unobserved firm-specific amenities cause some firms to be more highly ranked than they appear. However, the type of downward directed mobility that his model can explain seems to be quite different from that considered here.

[2]Some important counterexamples would be academics, who publish their papers, and inventors, who publish their patents.

worst workers are placed at the bottom. Instead of search frictions, the inverted job ladder features informational frictions, where employers privately learn how talented their workers are. Instead of workers opportunistically moving to better firms via job-to-job moves, it is the incumbent firms that opportunistically use their private information in order to retain their best workers, while allowing their worst workers (or lemons) to be poached. Poached workers tend to move to firms that are lower on the ladder (and more specialized in lemons). Meanwhile, workers who are retained up until the time of firm dissolution are revealed ex post to have been above average talent, and thus reemploy with better firms. These two predictions are the inverse of the standard job ladder. The market gradually learns how talented workers are through strategic inference. Efficiency depends on how rapidly workers move towards efficient matches, and requires dispersion of workers both up and down the ladder.

In order to better understand how talent is reallocated in the skilled professions, I take a three step approach that combines reduced form evidence, theory, and a structural estimation framework. The first step uses historical data on lawyers to document basic facts in favor of the inverted job ladder in law. Closely guided by these facts, the second step presents a dynamic theory of the labor market where heterogeneous firms are specialized in distinct levels of talent and privately learn their workers' talents. The third step shows how the model can be estimated by combining data on wealth, ability, and turnover, and uses these estimates in order to quantify labor misallocation caused by private learning.

I developed the data used in the first step by linking together annual editions of the *Martindale-Hubbell* professional directories of lawyers. The data are a comprehensive panel of all US lawyers from 1931 to 1963. Law is a particularly useful industry for exploring the inverted job ladder, and its implications, because firms can be straightforwardly ranked based on the quality of the schools that they recruit from. Law also happens to be one of the more prominent and well studied skilled professions.

I exploit some unique features of my data in order to establish three facts that are central to how lawyers match with and reallocate across firms. First, I show that firms specialize in different levels of worker talent, by showing that a firm's size and existing stock of employee talent is highly predictive of the law school quality of their new hires. Second, ranking firms by their propensity to recruit from good law schools, I study how lawyers' firms change when they are poached versus when they are displaced by shocks and forced to reemploy. This is in keeping with the empirical literature on the job ladder, which has also distinguished between poaching and displacement. Whereas that literature tries to distinguish between poaching and displacement based on whether there was an intervening spell of unemployment, I distinguish between the two cases based on whether the individual's original firm dissolved—a common occurrence in my empirical setting. I find the inverse of the standard job ladder finding: poached lawyers move to worse firms, while displaced lawyers reemploy into better firms. Third, in order to shed some light on why poached lawyers move to worse firms, I show evidence that poached lawyers are negatively selected on unobserved talent. To do this, I leverage a unique feature of my data and setting. Lawyers with more than ten years of experience would be reviewed by Martindale Hubbell for a prestigious legal ability rating, which was eventually obtained by about a quarter of the lawyers in each geographical market. Using their future rating outcome as a latent indicator of talent, I document that retained workers are positively selected on unobserved talent.

In the second step, I develop a model of the inverted job ladder whose main ingredients are inspired by the above facts. Firms are ranked by the difficulty of their projects, and each firm has a comparative advantage in employing talent commensurate with its rank. If workers' talents were immediately known, then the model would feature immediate sorting by comparative advantage. However, workers enter the labor market with some degree of uncertainty about how talented they are. An employer will privately learn a worker's true talent after hiring her, and will use that information to selectively match outside offers. Offer matching by superior informed incumbent firms leads to a classic adverse selection or lemons problem ((Akerlof, 1970)) where workers can only be poached when they are of below average quality. Thus, firms find that poaching below their own rank is always misaligned with their own comparative advantage, while poaching sufficiently above their own rank is well aligned.

Incumbent firms' private information is reflected in their public retention decisions. The market accumulates information through dynamic Bayesian updating. This explains why displacement leads to upward mobility. Having survived one or more rounds of retention, a worker's profile is better than when she began the employment spell. Displacement temporarily removes the burden of adverse selection. Because the worker's profile has improved, she tends to find it attractive to match with a higher ranking firm than before. Compared to the job ladder, the inverted job ladder paints a very different picture for the dynamics of worker reallocation. In a job ladder, individuals start from the bottom and gradually work their way up. In an inverted job ladder, young workers place high, and their best hope is to keep their spot on the ladder by meeting the increasingly high standards of their firm.

In addition to explaining the inverted job ladder, the model will provide the basis for a tractable quantitative framework to evaluate the efficiency costs of private employer learning and to assess potential labor market reforms. In step three, I structurally estimate and simulate the model. I estimate that the market is 90% as efficient as the ideal full information benchmark, and 28% more efficient than a setting where all learning is shut down. Thus, the market's dynamic accumulation of information via strategic inference appears to be very important to overall efficiency, and my model is the first to properly incorporate this in a long time horizon. I structurally decompose the 10% efficiency shortfall into an informational and non-informational component. The non-informational component calculates the increase in efficiency if, at each point in a representative worker's career, a social planner equipped with the same information as the market was allowed to optimally reallocate her. The remaining efficiency gap is informational, because it reflects the cost to the social planner of imprecise information about the worker's true talent. I find that more than two-thirds of the efficiency gap is non-informational.

I then conduct a counterfactual policy analysis that explores the social value of a labor market reform that uses competition within the educational system to create stronger signals about talent. This analysis is intended to shed light on the downsides of recent trends where internships during school are becoming increasingly essential in getting jobs. These internships often promise jobs to top students before they have completed their schooling, which disincentivizes their continued effort in school and thus undermines the signaling content of academic competition. Academic competition generates public signals, while internships generate private signals, suggesting a potential efficiency cost to these trends. I imagine a ban on such internships, which I model as simply delaying by one year the worker's entry into the labor market, in exchange for the opportunity compete in a school-wide competition. This competition is equally as informative of talent as the foregone labor market experience would have been. The cost of this competition is that, unlike labor market experience, it produces no output. The benefit is that at the end of the competition, the worker is unrestricted by the adverse selection problem. I find that the policy is welfare-enhancing.

Having summarized the main results of my paper, I will end the introduction with a review of the related literature. The rest of the paper will be divided into five parts. Section 2 describes the data. Section 3 presents the reduced form evidence on the inverted job ladder. Section 4 presents the theoretical model of the inverted job ladder. Section 5 shows how I identify and estimate the model. Section 6 performs the counterfactual analysis. The final section concludes with some remarks on areas for future research. Proofs and technical details are in the appendix.

1.1 Related literature

Patterns in worker reallocation. This paper is related to the literature on the on-the-job reallocation of workers across ranked firms, especially the branch studying what has become known as the job ladder. Although the term "job ladder" was originally just a generic name for a hierarchical ranking of jobs, the term is now used to describe a set of stylized patterns that frequently recur in economic models of on the job search with heterogeneous firms, dating back at least to Burdett and Mortensen (1998). In a standard job ladder model, firms are ranked by how desirable they are as potential employers, and in equilibrium. A worker tends to enter towards at the bottom of the ladder from unemployment, and gradually moves up through job-to-job transitions. Exogenous shocks occasionally destroy her job, forcing her to start at the bottom again when seeking reemployment. See Moscarini and Postel-Vinay (2013) for one of the latest iterations.

Job ladder models usually assume on-the-job search in the presence of frictions, where vacant firms always want to match with an encountered worker and thus only the workers' preferences matter for determining who matches with whom. Workers tend to begin their careers at the bottom of the ladder, conduct on-the-job search, and move up the ladder through poaching when opportunities arise. Occasionally, workers are displaced into unemployment and take their first opportunity to reemploy, which leads to mean reversion towards firms with lower ranks on average. Thus, the main features of a job ladder are that poaching tends to lead up the ranks, that lower ranking firms experience higher rates of poaching, and that displacement leads down the ranks (after reemployment).

There is fairly abundant empirical evidence for the job ladder based on studying the transitions of poached and displaced workers using matched worker-firm data. Some recent examples of empirical evidence for the job ladder are Haltiwanger et al. (2018) using data from the Longitudinal Employer Household Dynamics (LEHD) and Moscarini and Postel-Vinay (2017) using data from the Survey of Income and Program Participation (SIPP).[3] The main factor differentiating my dataset from the datasets that have contributed to the job ladder findings is that my data come from a single, insulated, high-skill industry.

This paper is, to the best of my knowledge, the first to provide evidence of an inverted job ladder.[4]

[3] The first paper ranks firms according to size, wages, or productivity, and studies net poaching outflows and inflows by rank quintile to verify that poaching is more prominent for firms at the bottom of the ladder. The second approach shows that job changers obtain relatively faster wage growth than job-stayers.

[4] Groes et al. (2014) finds a combination of upward and downward moves but their focus is on reallocation across occupations, not firms.

Learning about talent. I build on the private employer learning literature. The idea that asymmetric information between employers distorts mobility and impedes the efficient assignment of workers to firms comes from a long literature dating back to Waldman (1984), Greenwald (1986), and Gibbons and Katz (1991). The main goal of this literature has been to explain empirical patterns in wages and promotions, and it has therefore emphasized heterogeneity in the tasks within firms. Some examples include Bernhardt (1995), Waldman (1984), and Waldman (2016). My goal is to instead explain empirical patterns in interfirm mobility, so I focus on heterogeneity across firms. My contribution is to essentially formalize the idea that some firms are more selective than others, and thus confer different degrees of status when their names appear on resumés.[5,6]

There appears to be only one other paper that has theoretically investigated firm heterogeneity in the context of asymmetric learning: the working paper of Ferreira and Nikolowa (2019). Both of our models resolve the apparent "why do firms chase lemons" (p. 2) puzzle—i.e., explain why we observe poaching in spite of private learning. However, their model delivers the standard job ladder prediction of upward directed poaching. The most important difference in our models is the production function. According to their production function, higher ranking firms are uniformly more productive with all types of workers.

Because my model features dynamic Bayesian updating about workers' talents, it also relates to the literature on the speed of employer learning. It presents an alternative benchmark model to the symmetric learning framework of Farber and Gibbons (1996) that appears to have previously been missing from the literature.

> An alternative benchmark would be "private learning," where only the worker and the current employer observe performance outcomes, but other market participants draw appropriate inferences from the observed actions of the worker and the current employer. Because the game-theoretic issues associated with such strategic information transmission can be complex, most analyses of the private-learning case have been in two period settings with special assumptions about functional forms and probability distributions. (Farber and Gibbons, 1996, p. 1008)

[5]Consistent with this idea, Bidwell et al. (2015) analyze survey data from investment bankers to show that higher status firms attract more talented employees without paying them more due to better signaling opportunities, which they dub the "I used to work at Goldman Sachs" effect.

[6]I choose to abstract from task heterogeneity despite the distinction between partners and associates at large firms. During the sample period of my data, only about 4% of lawyers in law firms were identified as associates. Thus, it seems reasonable to abstract from the strategic information transmission created by different job titles when using data from this period. However, it should be feasible to add this feature to my model.

A rich literature following Farber and Gibbons (1996) has sought to test hypotheses about the nature of employer learning. Meanwhile, a large and more recent body of work has found evidence of asymmetric learning, where employers learn relatively more about their workers' talents than rival firms.[7] For example, Kahn (2013) estimates a model where the relative speeds of incumbent versus outside firm learning are captured by the relative variances in individual pay changes, and finds that "in one period, outside firms reduce the average expectation error over worker ability by roughly a third of the reduction made by incumbent firms." My paper takes a complementary, stylized approach by assuming that incumbent firms learn immediately, and that outside firms learn via strategic updating. I also present new evidence of asymmetric learning by studying the relationship between retention and future ability ratings.

One of the key contributions from this literature, starting with Altonji and Pierret (2001), has been to use the estimated speed of employer learning to indirectly assess the potential justification for schooling as a means of obtaining pre-job market signals. However, in a private learning framework, there still may exist a nuanced justification for pre-job market signaling even when the rate of public learning (via signaling) is fast, due to the persistence in initial placements. I find that pre-job market signaling, in the form of a job market simulation, is valuable because of the *fresh start* it affords workers when they enter the market, compared to workers obtaining the same sequence of signals but remaining beholden to an incumbent firm with superior information.[8]

2 Data and Background

My main data consist of linked entries in the annual *Martindale-Hubbell* professional directories covering US lawyers for all years between 1931 and 1963. I also match these data to deanonymized 1940 Census microdata, which I mainly use to for its information on housing expenditures. *Martindale-Hubbell* (hereafter MH) is an information services company whose predecessor firms, *Martindale's* and *Hubbell's*, were founded in the mid-1800s and then merged in 1931. MH's principal products are biographical information on lawyers and legal digests.[9] Data from the MH directories have been used in several previ-

[7] Examples include Kahn (2013), Kahn and Lange (2014), Schonberg (2007), and Braga (2018).

[8] Waldman (2016) also finds that asymmetric learning appears to enhance the rationale for signaling, but in his case the benefits are entirely due to the increased speed of public learning.

[9] Prior to the merger, *Martindale's* had the superior biographical information, and *Hubbell's* the superior digest.

ous studies in economics, and many in the empirical legal studies literature.[10] Although in the modern era MH is somewhat less important, it was without a doubt the primary method for lawyers to advertise their services during the period of study.[11]

I am aware of only one study that has attempted to transform the MH data into a comprehensive panel of individual lawyers' careers: Baker and Parkin (2006). Their paper mainly describes the process of collecting and cleaning MH's directories from 1998 to 2004, and then uses the data to describe certain new developments in the organization of law firms. Unfortunately, no additional developments appear to have come from this dataset.[12]

Each annual MH directory has a *Biographical* section, ordered by geographical markets (city/town and state), containing one or two lines of basic detail about every lawyer who responded to a questionnaire sent by MH's offices. Every person registered with the state or local bar association received a questionnaire. Professional directories (also called law lists) were the only legal method by which lawyers at this time could advertise their services, MH was the preeminent such directory, and inclusion in the directory was free. Thus, the response rate to the questionnaires was close to 100%.

The main purpose of the MH directory was to aid businesses that needed to find trustworthy lawyers in locations outside their place of business. In the early days, a large fraction of MH's customers appear to have been merchants seeking to collect on outstanding trade credit. An excerpt from the 1902 *Martindale's* directory reads:

> The merchant would investigate with the most scrupulous care the standing of a customer before selling him a small bill of goods, but would without hesitation send a large claim for collection to a lawyer in some far-away [S]tate, of whose responsibility and trustworthiness he knew absolutely nothing; often taking a name from some one of the numerous so-called lists of "Reliable Lawyers," published for the purpose of advertising such lawyers, and not for the benefit of the merchant, and circulated gratis, or at a mere nominal price. Whilst this may have been excusable then, for want of other resources, it is gross carelessness now. This is the want which this work fills. It is not published in the interest of any collection agency or association, nor to advertise any special attorney or list of attorneys, but treats them all impartially, rating them as they deserve to be rated, regardless of their wishes, and is published in the interest of, and seeks its patronage from those who have business to

[10] Some notable examples include Garicano and Hubbard (2005), Spurr (1990), and Galanter and Palay (1993).

[11] Law lists such as MH were in fact the only legal form of advertisement for lawyers.

[12] MH seems to have become less cooperative over time in giving researchers access to their modern, computerized data.

> place in their hands, thus making the very object of its existence diametrically opposite to those of any other so-called directory.

The biographical data that I use include each lawyer's birth year, location, name, law school, the name of their law firm (if they work for one) and an indicator of whether they're an associate, quality ratings, and estimates of net worth. I scraped every lawyer's entry in the MH biographical sections and then constructed a thirty-three year panel by merging individual lawyers' entries over time on the basis of their name, college, law school, and birth year. After implementing several techniques to correct for digitization errors, I was able to match about 93% of lawyers from one year to the next. To assess how much of the 7% attrition may have been caused by remaining errors, I took a random sample of 200 lawyers, aged 40-50, and manually searched for them in the directories. About 15% or 30 of the 200 cases were confirmed to be erroneous attrition caused by digitization errors that could not have been corrected by an automated procedure.[13] Thus, of the 7% attrition rate, at least 2 percentage points are caused by digitization errors. For lawyers in law firms, a bracketed abbreviated firm name would appear beside their entry, possibly with a symbol indicating their position as an associate. The directory also contained a *Firm card* section in which firms could pay a nominal sum to advertise more details, such as who their notable clients were, the fraternal orders to which their partners belonged, and so forth. I do not use this information, except to rectify a small number of firm classifications that were missing from the biographical data due to digitization errors.

1940 de-anonymized Census microdata. I match the MH data to the 100% Complete Count 1940 Census data from IPUMS in order to use expenditures on housing as a measure of wealth in my analysis. To perform the matching, I extracted all the individuals from the Census who appeared to have a high probability of being a lawyer, and then used fuzzy matching on name, location, and age to match them to the MH data. I successfully matched about half of the individuals in the MH data. However, this percentage is significantly higher (about 80%) for individuals spending the majority of their careers in law firms, which is the main sample of interest. One large obstacle in matching every MH lawyer to someone in the Census was that many lawyers spelled their names differently and reported slightly different birth years in the two datasets, and the resulting variations

[13] I used the panel structure of the data to try to painstakingly correct for as many of these errors as possible, and I was frequently able to correct digitization errors in year t when similar information was available in years $t-1$ and $t+1$. Unfortunately, certain individuals' names are systematically more prone to digitization error, which means that the chances of errors in two consecutive years are larger than what one might ordinarily expect.

were often not sufficiently unique to still be able to verify automatically that the data belonged to the same individual. Another factor in not matching all of the MH lawyers is that some of them may not have been recorded as lawyers by the Census. If lawyers work for law firms are more strongly attached to law compared to sole practitioners, then this could explain why the match rate is so much higher for that group. Thus, to the extent that the sample of matched lawyers is selected, I would suspect that they are positively selected on attachment to law, and possibly income, as well.

If the individuals I failed to match are "unmatched at random," then dropping them from the parts of the analysis that use the Census data will not bias the results. But incorrectly matching individuals across the two datasets will bias the results, even if they are mismatched completely randomly. Because of this, I opted to leave ambiguous cases unmatched.

Background on sample setting. The sample period is one of relatively modest and stable growth in the legal services industry, where most lawyers worked in law firms with relatively simple transactional arrangements, leading some to dub it ((Galanter and Palay, 1993)) the Golden Age of Law.[14] Unlike in modern law firms, which typically feature four positions—associates, non-equity partners, equity partners, and permanent counsel—most private practice lawyers in the 1950s were identified simply as "members," or "partners."[15] There is almost no data on the compensation agreements made in these firms, and I do not have data on annual earnings. But the historical literature has suggested that most compensation agreements involved a combination of profit-sharing, base salary, and adjustments for seniority.

Summary statistics on the main variables used in the analysis are included in Table 1. The sample consists of lawyer-year observations where the lawyer belongs to a private practice law firm with greater than 2 lawyers, are below the age of 65, and entered the market after the year 1931 (to ensure that I can see their entire career history).[16] The meanings of the "transitions" variables are described below.

Measuring mobility. Because my main interest is ranking firms and studying mobility through the ranks, I keep track of who is working with whom at each point in time, and develop a taxonomy of transitions: leaving the data (attrition), exit to sole practice,

[14] This name is intended to contrast with the subsequent period of explosive growth of large law firms, beginning in the 1970s, which coincided with a greater prevalence of associates.

[15] About four percent of lawyer-year observations in the Martindale-Hubbell data are associates.

[16] Lawyers who work alone, even if they share space and other resources with other lawyers, are sole practitioners. Using the "Class of worker" variable in the 1940 Census data, I calculated that about two-thirds of lawyers not listed in firms are truly working alone. The rest are working for the government or firms outside of private practice law.

Table 1: Summary statistics by lawyer-year

	Mean	Std.dev.	*p*.05	*p*.95
Age	41.06	7.81	29	54
Exper	10.63	7.23	1	24
A rated	0.26	0.44	0	1
Mkt. size	5519.20	7606.29	31	23231
Firm size	16.15	50.96	4	44
	Classified transitions			
Attrit.	0.03	0.17		
Poached	0.05	0.23		
Displaced	0.03	0.17		
Retained	0.83	0.38		
Exit	0.08	0.29		
Obs.	539,342			

Sample: Lawyers currently in law firms of three or more lawyers
Mkt. size reflects number of lawyers working in local town or city

displacement, poaching, and retention. To keep track of who is working with whom, I simply group together all of the lawyers in a given year who are listed in the same city or town, and who have the same abbreviated firm-name adjacent to their name. I refer to this group as a *colleague set*. Firm names are too inconsistent over time to be useful for dynamic measurements. For example, in the famous biography of one of the oldest and most prestigious law firms, known colloquially as Cravath, it is documented that the firm held six unique names in the period between 1906 and 1944 ((Swaine, 1948)). Therefore, for the purposes of classifying firm dissolution and interfirm mobility, I construct a measure of firm similarity based on the identities of the employed lawyers. Suppose that lawyer i belongs to the set of colleagues $\mathbf{c}_{i,t}$ in year t and the set $\mathbf{c}_{i,t+1}$ in the next year.[17] I will define two measures of similarity between colleague sets. Let C_t denote the set of *all* time t lawyers. The first measure is

$$d^1_{i,t} = \frac{||\mathbf{c}_{i,t} \cap \mathbf{c}_{i,t+1}||}{||\mathbf{c}_{i,t} \cap C_{t+1}||} = \frac{\text{Consecutive colleagues}}{\text{Time } t \text{ colleagues who stayed in the market}}.$$

The second measure is

[17] If the lawyer has no colleagues in either year, the point is moot.

$$d^2_{i,t} = \frac{||\mathbf{c}_{i,t} \cap \mathbf{c}_{i,t+1}||}{||C_t \cap \mathbf{c}_{i,t+1}||} = \frac{\text{Consecutive colleagues}}{\text{Time } t+1 \text{ colleagues previously in market}}.$$

In both cases, I count only the individuals who are in the sample during both time periods—otherwise, influxes of new lawyers or retirements of several older partners at once could have large effects on the results. When both of these measures are close to 1, it seems uncontroversial to assume that the firms are the same, but not when only one measure is close to one.[18] When the first measure is low, it indicates that the lawyer's old team does not constitute a large fraction of her new team, and it is thus likely that her team was absorbed by a larger firm. When the second measure is low, it suggests that the lawyer's old team split up.[19]

I define three non-exclusive indicators for time t worker mobility, conditional on remaining in the sample: *exit to sole practice*, *job-changing*, and *dissolution*. A lawyer exits to sole practice if she is not observed in a law firm for the next two years, but remains in the sample. A lawyer changes jobs if either distance measure is below 0.5 (weakly).[20] A lawyer experiences dissolution if all of her colleagues have either changed jobs, exited sole practice, or exited the sample. In order to be somewhat consistent with the rest of the labor literature, I will describe job-changers whose firms did not dissolve as *poached*, and job-changers whose firms dissolved as *reemployed*. Lawyers who did not change jobs or exit were *retained*. Using these data and associated measures, I will now rank firms and study the dynamics of firm rank under the different types of mobility.

3 Empirical Evidence

This section presents empirical evidence on how lawyers are initially matched and reallocated in law. My objective is to establish three factual claims that will motivate the theory of the inverted job ladder. The first fact is that firms specialize in distinct levels of talent. The evidence for this is that a firm's current size and the law school quality of its existing employees are highly predictive of the law school quality of future recruits. This suggests ranking firms by their size, stock of employees, or their overall propensity to recruit from better schools. Using this ranking, the second fact is that poached lawyers tend to move

[18] Given that law firms' main product is their talent, it would be unlikely for a law firm to re-brand while maintaining an almost identical set of employees.

[19] Despite the modest sizes of law firms during the sample period, mergers and fragmentations were somewhat common occurrences based on my readings of a large number of law firm biographies.

[20] The majority of cases are very clear-cut. A stricter or more liberal threshold would not change any of the results. However, the 0.5 threshold is preferred because it is the smallest threshold that mathematically precludes two time t colleagues who are *not* time $t+1$ colleagues from ever being counted as retained.

to worse firms, while displaced lawyers tend to move to better firms. This seems to be opposite to the usual job ladder evidence if we consider firm dissolution to be a form of worker displacement. The final fact is that poached workers are adversely selected on hidden information. The evidence comes from showing that lawyers who were retained tend to receive better future legal ability ratings than initially similar lawyers who were poached. To establish these facts, I first must create a measure of law school quality.

Law school quality. By measuring law school quality, my intention is to capture a proxy for a lawyer's perceived competence at the beginning of her career. Competence could mean analytical skills, willingness to work long hours, attention to detail, or even factors that reflect taste-based discrimination.[21] Moreover, I am only concerned with the signaling content of law school pedigree, inclusive but not exclusive to causal effects.

I construct my own continuous measure of school quality, LSQ, based on a comparison of how each school's alumni fared in three outcomes during the sample period: housing expenditure from the Census, estimated net worth scores from MH, and legal ability ratings from MH. I statistically decompose each outcome into a set of law school fixed effects after controlling for location, experience, and age. I compute each school's LSQ as the simple average of these three fixed effects, after normalizing each of them into a Z-score.[22] To corroborate the measure, I compare it to a set of ordinal law school rankings by Arewa et al. (2014).

This begs the question as to why I did not simply use the ordinal rankings directly. The problems are two-fold. First, if LSQ only had ordinal meaning, then I would be extremely limited in the types of analyses I could perform. The discussion in Section 5 will provide a theoretical foundation for using both A ratings and wealth in order to make *cardinal* comparisons across schools. Second, Arewa et al. (2014) is the most relevant ranking I have found, but even their ranking applies too much weight to recent years to be completely appropriate for my setting. It tends to overstate the quality of newer law schools, especially in the West Coast, that were still up-and-coming during my sample period.

Many lawyers did not attend law school early in the sample period. However, I do not have law school data for lawyers who exited the sample prior to 1939—about 17% of lawyers in the sample. For everyone else, an omitted law school should indicate that

[21] Taste-based discrimination was extremely important in 1950s corporate law firms. Corporate clients tended to be White Anglo-Saxon men listed on social registers, who preferred to work alongside lawyers from a similar background, and law firms took this into account when making hires ((Swaine, 1948)).

[22] I experimented with using factor analysis to choose suitable weights for the effects and found them to be very close to a simple average. The creation of the LSQ measure is more carefully described in the appendix.

they did not attend. I treat failure to attend law school and missing law school as two separate school categories with unique LSQ measures. Most of the analysis will not use individuals with potentially missing law schools.

Fact 1: Firms Specialize in Talent. I will now show that larger firms whose existing stock of employees were trained at better schools have a propensity to recruit other employees who were also trained at better schools. To do this, I simply regress a lawyer's own LSQ measure on her firm's characteristics (taking care to do leave-out calculations where appropriate). I find that the propensity of firms to hire from better schools is strongly increasing in the law school quality of their existing lawyers, the share of their lawyers that have obtained A ratings, and their size. Although larger markets do in fact attract lawyers from better schools, there appears to be no residual association with market size after controlling for the aforementioned firm characteristics.

Table 2: Own Law School Quality versus Colleagues' Characteristics

Dependant variable	**LSQ**	
	All obs	New hires only
Avg LSQ	0.566***	0.591***
	(0.001)	(0.005)
Share A-rated	0.080***	0.086***
	(0.001)	(0.006)
Log firm size	0.050***	0.050***
	(0.001)	(0.002)
Log mkt. size	0.002***	-0.005***
	(0.000)	(0.001)
N	1,512,679	88,825
R^2	0.245	0.261

Controls for mkt. size and current age
Sample of age 40+ lawyers matched to 1940 Census
Std. errors clustered on law school (in parens)
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This type of sorting is difficult to rationalize without a theory where firms are comparatively advantaged in distinct levels of worker talent. Comparative advantage can arise either because of truly innate differences between firms, or because of differences in the stocks of employees those firms happen to have accumulated. It can arise directly from the production function, or from differences in opportunity costs. For example, a firm wi

that is non-monotonic in firm type, or from a production function where better firms have an absolute advantage in production, *but* also experience a higher opportunity cost from hiring a given worker. In the standard job ladder literature, better firms have an absolute advantage. They are absolutely more productive across all workers, and experience no opportunity cost from making a new hire.

Readers who are familiar with professional services will most likely not require empirical evidence in order to be convinced that the top firms will typically not compete to hire the worst workers. However, the same is not true for other industries, like manufacturing, and evidence of sorting in such industries is quite limited. Theoretically, the assumption of absolute advantage in industries like manufacturing and unskilled services seem quite plausible. The incentive for firms to specialize in distinct levels of talent may be a unique feature of the skilled professions, and help explain why there is an inverted job ladder in law, but not in most of the labor market.

Fact 2: Poaching leads down the ladder, displacement leads up the ladder. I will use the three measures (average LSQ, share A rated, and firm size) that I found to be highly predictive of a lawyer's own LSQ in order to rank firms and study how poached and displaced workers move through the ranks. In addition to showing the average raw changes in these variables, I will also construct a summary measure that accounts for all of them simultaneously. Specifically, I will use the regression described in Table 2 to generate a predicted value of LSQ, $L\hat{S}Q_{i,t}$, for each lawyer i-year t observation.[23] I will then compute each lawyer's percentile rank in a particular year based on her $L\hat{S}Q_{i,t}$, denoting the percentile rank as $r_{i,t}$. Thus, changes in $r_{i,t}$ capture the fraction of the population that the lawyer surpasses or falls behind.

In Table 3, I have computed average year-to-year changes in the different measures of firm quality, for workers who are poached, displaced, and retained. The sample excludes exit and attrition. Poached lawyers lose an average of 5 percentage points in rank, moving to firms with 7 fewer lawyers and with an average colleague LS that is 0.035 standard deviations lower (recall that LSQ is a standardized measure). Meanwhile, displaced lawyers experience gains that are of similar magnitude for all three measures. Lawyers who are retained experience relatively negligible changes—except for firm size, which grows modestly throughout the sample period. Because displacement and poaching are equally common, they tend to cancel each other out and the overall direction of mobility is essentially flat. Thus, lawyers who are poached tend to move down, whereas lawyers who seek new employment following their firm's exit tend to move up. These findings are opposite to the standard job ladder literature, where job-switching workers move to better firms, and displaced workers reemploy into worse firms.

I now analyze growth in rank conditional on current rank:

[23] To generate a more precise estimate of $L\hat{S}Q_{i,t}$, I use a fully interacted third-order polynomial in all of the variables contained in Table 2. The estimated average changes in firm quality are not sensitive to using this rather than a first-order polynomial, but there appears to be greater dispersion in these changes when using the first-order polynomial, which seems to be expected when there is greater measurement error in the underlying firm quality that these measures are intended to proxy.

Table 3: Dynamics of firm rank by type of transition

Change in...	**Job leavers**		**Job stayers**
	Poached	Displaced	Retained
	Mean/SE	Mean/SE	Mean/SE
Mean colleague *LSQ* (z-score)	-0.035	0.027	-0.001
	(0.002)	(0.002)	(0.000)
Firm size	-6.933	6.127	0.146
	(0.079)	(0.055)	(0.002)
Share colleagues A-rated	-0.024	-0.020	0.003
	(0.002)	(0.002)	(0.000)
Firm rank (p.p.)	-0.058	0.046	-0.001
	(0.001)	(0.001)	(0.000)
Share of total	0.0274	0.0912	0.8189
Obs.	40,112	133,726	1,200,682

Sample: Lawyers remaining in private-practice law

$$\Delta_{i,t} = \Delta(r_{i,t}) + e_{i,t}, \mathbb{E}[e_{i,t}|r_{i,t}] = 0.$$

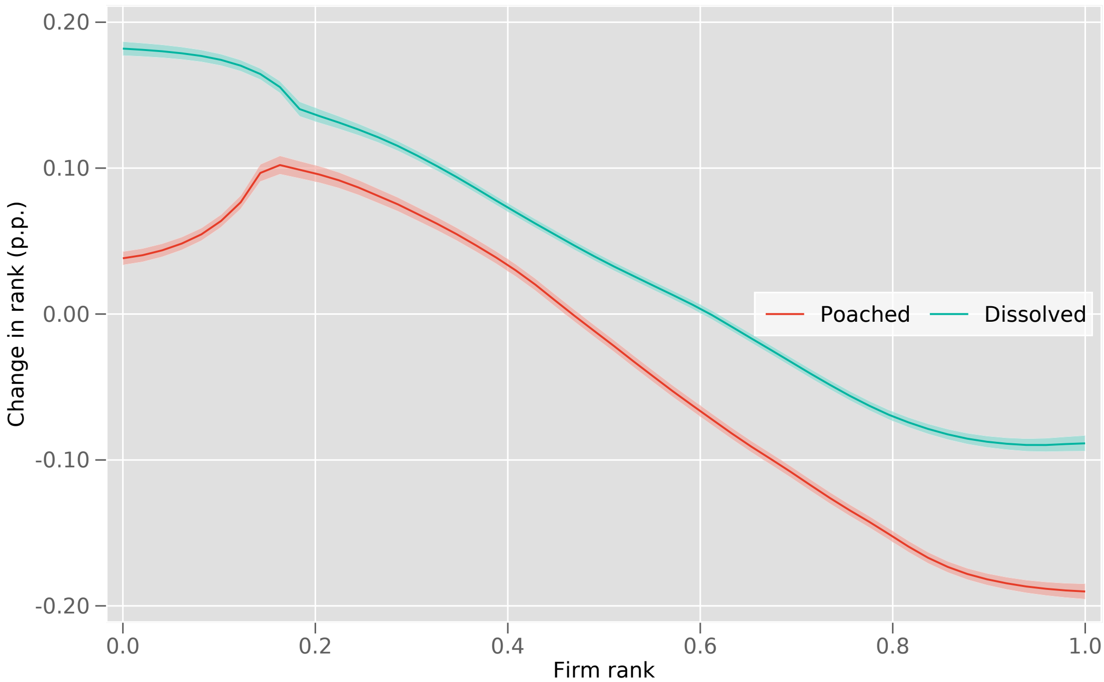
I estimate $\Delta(\cdot)$ with a non-parametric kernel estimator, separately for poached, displaced, and retained lawyers. For these estimates, I use the adjusted firm-rank measure.[24] The kernel estimate is plotted in Figure 1.

The estimates show that poached workers at high-ranking firms experience large drops in rank, while workers at low-ranking firms experience weak gains in rank. Job-changers departing dissolved firms obtain better average changes in rank for all levels of current rank.[25] If poaching occurred uniformly across the firm ranks, then the average poached worker would lose three percentage points in rank, while the average dissolved worker would gain about three percentage points in rank. But the inverted job ladder patterns are magnified by the fact that that poaching occurs disproportionately at the top ranks, and dissolution at the bottom ranks. In Figure 1, I plot non-parametric estimates of the share of turnover caused by each type of job change, poaching and dissolution, across the firm ranks.

[24] Otherwise, it would be difficult to study the transitions of workers at the bottom ranks, because such a large fraction of their transitions are to firms where none of the colleagues reported a law school.

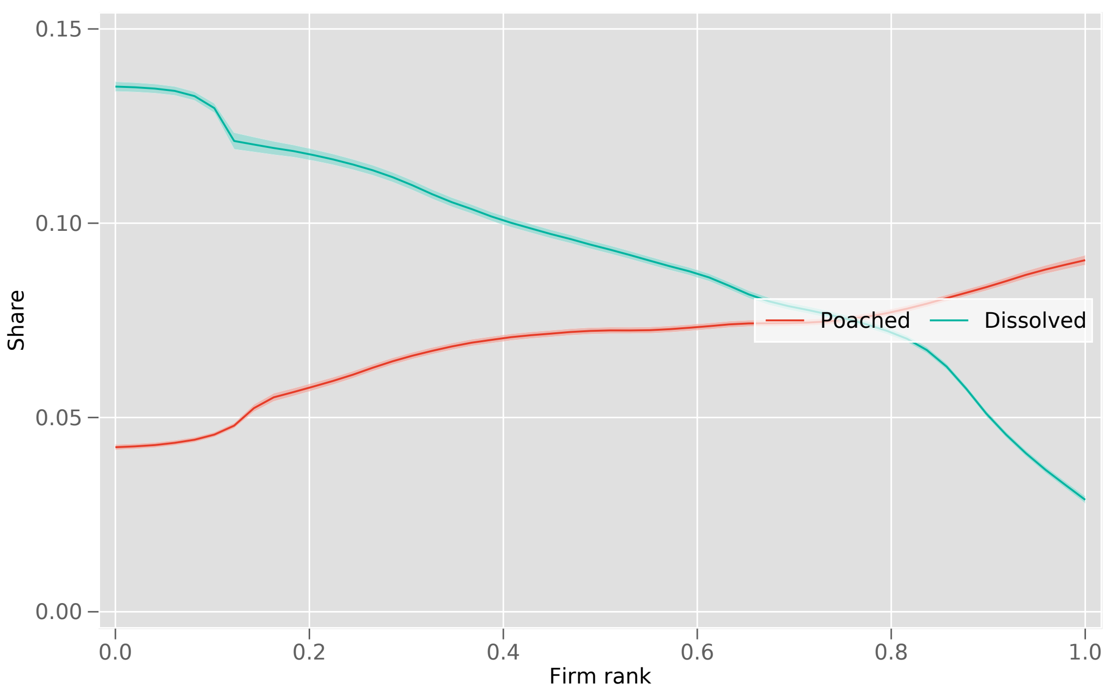
[25] A possible issue with interpreting these results is that firm dissolution, conditional on current rank, might not be exogenous. If dissolution were endogenous, then dissolving firms would most likely be of lower quality than what I measure, biasing down the estimated change in firm rank when their lawyers seek employment elsewhere. Thus, the result that job-changers from dissolved firms tend to move up the ranks seems robust to endogenous exit.

Figure 1: Dynamics of firm rank, conditional on current rank



Kernel density estimates with 95% CI

Figure 2: Rates of poaching and dissolution



Kernel density estimates with 95% CI

It is not surprising that top-ranking firms have lower rates of dissolution. However, the fact that high-ranking firms lose relatively more of their workforce to poaching, that poached workers lose rank, and that dissolved workers gain rank, are all contrary to what we would expect from the job ladder literature.

These figures drop lawyers who leave the private practice industry to work alone as sole practitioners. If one were to rank sole practice in order to compare it with law firms, it should almost certainly go at the bottom. In this case, including departures to sole practice would cause poaching to appear much more downward directed for the lower ranked firms.

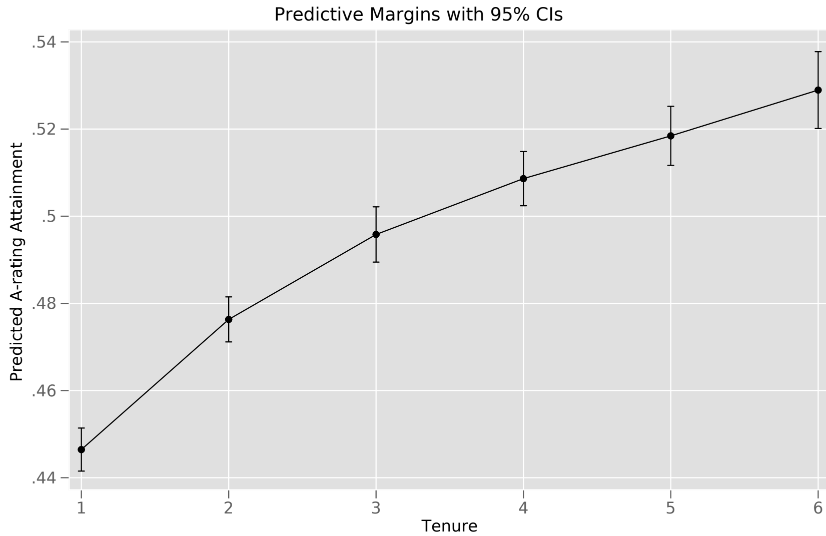
Fact 3: Poached workers are adversely selected. Why do poached workers move to worse firms? I will argue that it is because they are adversely selected from the batch of lawyers who initially joined the incumbent firm. When combined with the assumption that firms specialize in distinct levels of talent, it makes sense the poaching firm will be more specialized in lemons, and thus lower ranked than the incumbent firm.

My data are uniquely well suited to test for evidence of adverse selection because of the availability of legal ability ratings. Because lawyers do not qualify to receive an A rating until they have 10 or more years of experience, we can think of the future A rating attainment as a latent measure of an individual's talent. I will assume that when a lawyer has between 1 and 6 years of experience, the market at this point in time does not know whether she will receive an A rating in the future. However, as the econometrician that scraped and analyzed these data more than fifty years later, I *do* know if she will receive the A rating. Thus, if poached workers have lower odds of receiving the A rating in the future, we can conclude that they are adversely selected on hidden information.

The latent-variable approach is a canonical method for testing whether firms privately learn about their employees' talents. Several papers starting with Gibbons and Katz (1991) have found evidence that workers who separated under plant closings obtained better future reemployment wages than workers who were laid off, although the adverse selection interpretation has been challenged by Krashinsky (2002), who showed that plant closings disproportionately affect small firms, and thus job-leavers could simply be leaving bigger firms, and losing a size-wage premium. Some of the more recent literature tests for asymmetric learning by studying the correlation between earnings and hidden variables like, in the case of Schonberg (2007), scores on the Armed Forces Qualifying Test (AFQT).[26] Unlike AFQT scores, A ratings have not been determined at the time of the separations I consider in my test. Because A ratings are direct measures of talent, they

[26]Two recent alternative tests of asymmetric learning are Kahn (2009) and Pinkston (2009).

Figure 3: Future A ratings attainment by current tenure, $r_{i,t} > 0.75$



are also not susceptible to the wage determination critique of Krashinsky (2002).

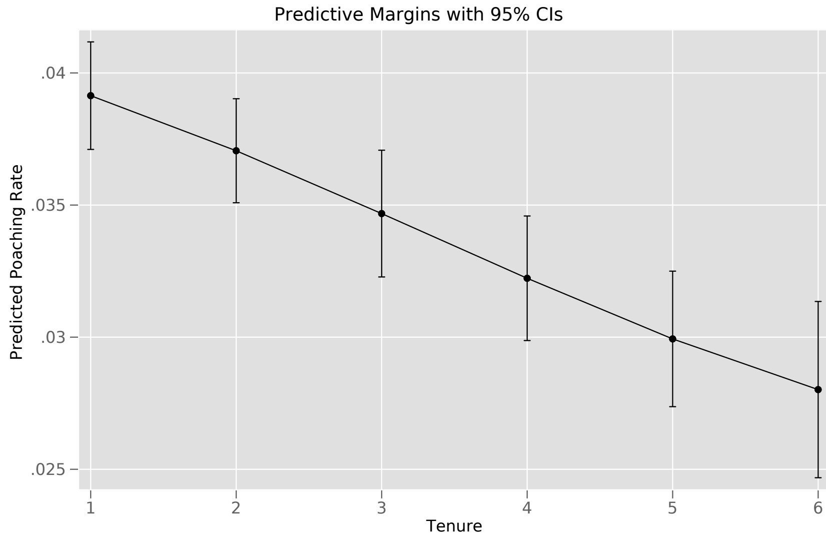
I will calculate the shares of lawyers receiving A ratings as a function of their firm's rank and their history of separation. The unit of observation is a lawyer-year, and the sample consists of lawyers who *currently* have six or fewer years of experience, and are known to remain in the sample for at least eight years.[27] In Figure 3 and Figure 4, I have plotted A ratings attainment and poaching rates by current tenure (i.e., the consecutive periods in which a worker has been retained by her original firm) for workers in the top quartile of firm rank. The results are very similar for the other three quartiles, and are included in the appendix.

4 The Model

I now present a model of the labor market where heterogeneous firms acquire private information about workers' talents. Private learning, combined with the opportunity to match outside offers, creates a familiar adverse selection or lemons problem ((Akerlof, 1970)). As with the Akerlof model, incumbent firms will use cutoff rules based on private information when deciding whether or not to retain a given worker. Adding dynamics

[27]The first selection ensures that the A rating outcome is many years ahead, so that any shocks that are directly responsible for poaching are unlikely to directly affect the A ratings outcome. The second selection ensures that the effects of tenure are not simply picking up random exits from the data that simultaneously reduce tenure and eliminate the chance to be observed obtaining an A rating. The evidence appeared somewhat stronger without these modifications

Figure 4: Poaching rates by current tenure, $r_{i,t} > 0.75$



to this process implies that market beliefs will evolve as a randomly truncating interval. Lower ranked firms with a technological specialization in less talented workers will rationally poach the worst workers of higher ranked rival firms, who are poorly specialized in such workers. Workers who are displaced in their first year will tend to reemploy at similar firms. Workers who are displaced in latter years will have become positively selected during the employment spell, and will tend to reemploy at better firms. I will now describe the basic elements of the game theoretic model: the objectives of firms and workers, the timing of actions, the information structure, and the production technology.

Setup. Time $t = 1, ..., T$ is discrete and possibly infinite. There is a continuum of firms with public types $\theta \in \mathcal{R}^+$, and a single worker with initially unknown talent z that is uniformly distributed over some initial interval $[z_1, z_2]$.[28,29] When a type z worker is employed by a type θ firm, they produce output $y(\theta, z)$.[30]

Agents have no time preference, but with probability $1 - \delta$ the worker exogenously exits the market and the game ends. The worker enters the game in one of two initial statuses: unattached, or attached to an incumbent firm of type θ. If the worker is initially attached, the incumbent firm privately knows her talent, z. The other firms (poachers)

[28]The assumption of one worker is equivalent to assuming that the game is separable across workers and is standard in dynamic models. The assumption of a one-dimensional, time-invariant talent or "individual competency" ((Postel–Vinay and Robin, 2002)) parameter is also fairly standard.

[29]Any continuous distribution can be made uniform via the inverse cumulative distribution transformation, so think of z as being the worker's percentile within the raw distribution of talent.

[30]The price of a unit of output is exogenously set to 1, and general equilibrium changes in prices are ruled out.

simultaneously make public spot-wage offers. If the worker is attached, the incumbent privately makes a counteroffer to the worker.[31]

The counteroffer phase is as follows. The incumbent privately announces a *potential* wage counteroffer.[32] The worker decides if she wants to apply to be retained at this wage. If the worker applies, then the incumbent firm either accepts or rejects the application. If accepted, the worker receives the wage and works at the incumbent for the duration of the period, and the wage and retention become public. If rejected, the worker must accept an offer from a poaching firm. Rejections are private information between the incumbent firm and the worker, and a rejected worker can costlessly impersonate a worker who chose not to apply. Thus, rejection and failure to apply are observationally equivalent to the rest of the market.

When an offer is accepted, the worker produces output for the winning firm for a single period, and then with probability $1 - \lambda^D$ the firm becomes next period's incumbent. With probability λ^D, the worker is exogenously displaced, and enters next period unattached. Any time a firm loses the worker, whether to poaching or displacement, it exits the game.[33] However, if it is the final period $t = T$, the worker and the accepted firm produce for exactly one period, and then the game ends.

Assumption 1. $y(\theta, z)$ is twice continuously differentiable, increasing in z and strictly concave and eventually decreasing in θ. $y(\theta, z)$ is supermodular in θ and z. $y(\theta, z)$ is homogeneous of degree ϕ.

Thus, for a given firm θ, more talent is always more productive. However, for a given level of talent z, there is a uniquely optimal firm type $\theta^\star(z)$, which, because of supermodularity, is increasing in z. The homogeneity assumption is made for analytical tractability, and implies that $\theta^\star(z)$ is proportional to z. This implies that by dividing θ by the right constant, we can ensure the following normalization.

[31] The assumption that incumbents respond sequentially to poaching offers is a common modeling choice, but for an important exception, see Li (2013).

[32] By assuming that the counteroffer is private, the incumbent will have a dominant strategy to make the minimum counteroffer required to convince the worker to apply for retention. This circumvents an analysis of whether and how an incumbent firm might use the counteroffer as a device to signal the quality of a worker who it does not intend to retain. This initially seems plausible—ex post, the incumbent firm should be indifferent to sharing information about a worker who it doesn't not intend to keep, while ex ante, commitment to such signaling would raise expected surplus. However, upon closer inspection, it seems that this would make it even more profitable for a firm to commit ex ante to "cheating" by providing exaggerated signals in states of the world where it does not intend to retain a worker. In equilibrium, such signals should become uninformative, and thus, I do not think public counteroffers would qualitatively change the results.

[33] This assumption is similar to Assumption 9 in Bernhardt (1995), p. 319, and is made to ensure that the relevant history remains tractable.

Assumption 2. $\theta^\star(z) = z$.

Definition 1. Suppose that z is uniformly distributed over $[z_1, z_2]$.

1. $[z_1, z_2]$ is the worker's resumé.
2. $y(z, z)$ is the worker's *full information output*.
3. $y^{\text{FIM}}(z_1, z_2) = \frac{1}{z_2 - z_1} \int_{z_1}^{z_2} y(z, z) dz$ is the worker's *expected full information output*.
4. $\bar{y}(\theta, z_1, z_2) = \frac{1}{z_2 - z_1} \int_{z_1}^{z_2} y(\theta, z) dz$ is the *ex ante average output*.
5. $\bar{y}^{\max}(z_1, z_2) = \max_\theta \bar{y}(\theta, z_1, z_2)$ is the *optimal ex ante average output*
   (a) $\theta^{\max}(z_1, z_2)$, the maximizer associated with $\bar{y}^{\max}(z_1, z_2)$, is the *optimal ex ante placement*.
   (b) If θ is larger (smaller) than $\theta^{\max}(z_1, z_2)$, the worker is *over-(under-)placed*.

In general, the full information output will serve as an unattainable, first-best benchmark. If a social planner had knowledge of the resumé, but not of z, then at best she could obtain the optimal ex ante average output by allocating the worker to her optimal ex ante placement. As we shall see, the worker's resumé will evolve over time, and equilibrium placement will not coincide with the static decisions of a social planner. Private information prevents a currently attached worker from leaving her firm unless she turns out to be below average talent. This causes a worker who is repeatedly retained to become under-placed. To partially offset the costs of future under-placement, the worker is incentivized to initially over-place when matching with a new firm.

To summarize the timing, each period has three stages. In stage one, poachers make wage offers. Stage two features the counteroffer and application/rejection stage, if the worker is attached. If by stage three the worker is unattached, then she selects her preferred poaching offer. In order to build intuition, I will start with a one-period model and then append more periods. I will conclude with results for the infinite horizon Markov equilibrium, which is the main object of analysis.

Definition of an equilibrium. An equilibrium is a collection of (1) beliefs about the worker's talent as a function of the history of the game, (2) wage offer rules, and (3) job acceptance rules such that the beliefs are consistent with Bayes' rule (whenever it applies), and the wage offer and job acceptance rules are sequentially rational. I will now introduce a refinement on off-equilibrium-path beliefs, which is in the spirit of the Divinity Criterion of Banks and Sobel (1987).

Assumption 3 (Divinity)**.** Suppose that after some history of play, the market assigns minimum value z_1 and maximum value z_2 to the worker's set of possible talents. If, along the equilibrium path, the incumbent firm is expected to retain the worker with probability 1, but the worker is not retained, beliefs update to assigning full probability to $z = z_1$. If instead the incumbent firm was expected to retain the worker with probability zero, but she is subsequently observed to be retained, beliefs update by assigning full probability to $z = z_2$.

This assumption is intuitive in the sense that, among the set of possible levels of talent consistent with the previous beliefs, beliefs update to assign all probability to that level of talent that would make the observed off-path play *most* profitable. This assumption is also necessary to ensure continuity of beliefs with respect to the cutoff rules that will be used in equilibrium. Cutoff rules that approach zero or one-hundred percent poaching probabilities will generate beliefs that converge in probability to z_1 (or z_2), and it would seem unintuitive if beliefs did not equal these respective limits in the cases of exactly zero or one-hundred percent turnover.

An overview of the model. The two main implications of the model are that (1) poached workers move to firms that are lower ranked than their incumbent, and (2) displaced workers move to firms that are better ranked than their incumbent. The worker's talent will be uniformly distributed within her resumé $[z_{1,0}, z_{2,0}]$ when she initially enters the market and joins her first firm. Poachings will truncate the resumé down, retentions will truncate the resumé up, and displacements will have no effect on the resumé. Once employed at an incumbent firm, a worker is always made a counteroffer that makes her no better off than being poached (and perceived to be below the firm's cutoff). For this reason, and somewhat surprisingly, displacements are *always* payoff enhancing from the perspective of the worker, because they allow her to escape the possible stigma of being poached—a possibility that gives leverage to the incumbent and which allows it to extract rents at the expense of both the worker and social efficiency.[34]

The one-period model. Let us quickly explore what happens in a one-period version of the model, when $t = T$. Using backward induction, we know that in stage three the worker will choose the highest wage offer. In stage two, having observed the highest poaching offer, the incumbent firm's dominant strategy is to announce a potential counteroffer that matches it. The worker's dominant strategy is to apply for the counteroffer.[35] The incum-

[34]Firms would profit by being able to commit against this inefficient rent seeking behavior, for example by promising to reveal all of their private information. The model assumes that firms cannot commit.

[35]As is often the case, in equilibrium the worker must behave as if she prefers the incumbent in cases of

bent then decides whether or not it is worthwhile to retain the worker at the previously announced counteroffer.

Lemma 1 (Retention follows a cutoff rule)**.** Let $[z_{1,T}, z_{2,T}]$ denote the resumé, θ_T the incumbent firm, z_T the worker's true talent that is privately observed by θ, and w_T^R the counteroffer wage at which the worker will potentially be retained. The incumbent retains the worker if and only if

$$z_T > \zeta_T(\theta_T, w_T^R),$$

where $\zeta_T(\theta_T, w_T^R)$ is the unique level of worker talent such that $y(\theta, \zeta_T) = w_T^R$.

Now let us consider the poaching offers made in stage 1. Each poacher knows that if its wage offer is pivotal, it will determine the counteroffer w_T^R, and therefore the cutoff rule, to be used by the incumbent in stage 2.

Lemma 2 (The time-T cutoff)**.** Recall that $\bar{y}^{\max}(z_1, z_2)$ is the maximized expected output of a worker with resumé $[z_1, z_2]$. The equilibrium cutoff must satisfy

$$y(\theta, z) - \bar{y}^{\max}(z_1, \zeta) < 0 \text{ if and only if } z < \zeta. \tag{1}$$

The equilibrium cutoff, $\zeta_T(\theta, z_1, z_2)$ is the maximum value within $[z_1, z_2]$ satisfying Equation 1.

See proof on page 49.

Equation 1 explains that along the equilibrium path the marginally retained worker's output must be equal to the average poached worker's output. However, this is merely a necessary condition, not a sufficient one. It is tempting to imagine a locus of wage-cutoff rule equilibria satisfying this necessary condition, some with endogenously low poaching, and others with high poaching, in the spirit of Acemoglu and Pischke (1998). The difference here is that poaching firms have a first-mover advantage, and will always force coordination on the highest level of poaching satisfying Equation 1.

Lemma 3. Suppose that $z_{1,T} \leq \zeta_T(\theta_T, z_{1,T}, z_{2,T}) < \theta_T < z_{2,T}$. Then the equilibrium poaching firm is of lower type than the incumbent firm.

See proof on page 50.

Poached workers are lemons, and tend to join firms that are more specialized in lemons. These will tend to be firms that are lower on the ladder than the incumbent was. The possible exception is that if the marginally retained worker were much higher than θ (the

ties, because were this not the case, then the incumbent could always pay an infinitesimally small premium to break the tie.

worker type for whom the incumbent is uniquely optimal), then the lemons of the incumbent might actually be suited for a better firm. This condition will be justified by adding periods and modeling the choice of the incumbent firm.

The model with two or more periods. Now let us append more periods to the game. The worker starts the game at period $T-1$ with resumé $[z_{1,T-1},, z_{2,T-1}]$, either unattached, or attached to a firm of type θ_{T-1}. In stage 1, firms make poaching offers. In stage 2, the incumbent posts a retention wage, the worker chooses whether to apply, and if she applies, the incumbent reveals if she is retained, and thus above some talent-specific cutoff ζ_{T-1}, or rejected, and below this cutoff. In stage 3, the worker chooses a poaching offer in the event that she is not attached.

The structure of the subgame beginning in period T will be identical to the one-period model: the worker is attached to an incumbent firm, and her talent is uniformly distributed along an interval (the resumé). Of course, the values of the time-T incumbent firm and resumé depend on what occured in period $T-1$. By backward induction, any T period model can be recast into the exact same structure: poachers make outside offers, the incumbent makes a counteroffer, the worker matches with a firm of type θ^P, and then the players enter a continuation game that was previously solved. For the two-period model, I have depicted a graphical rendition of the game in Figure 5.

I will now define the core functions that allow me to solve for the unique equilibrium. For the sake of clarity, I will allow the game to start at different possible times, $t=-\infty, ..., T$. Thus, $t=T$ corresponds to the one-period model, $t=T-1$ the two period model, and so forth. Conditional on the worker's attachment status, resumé, and identity of incumbent firm, it is irrelevant whether a game literally started in period K, or is merely a continuation of a game that started earlier.

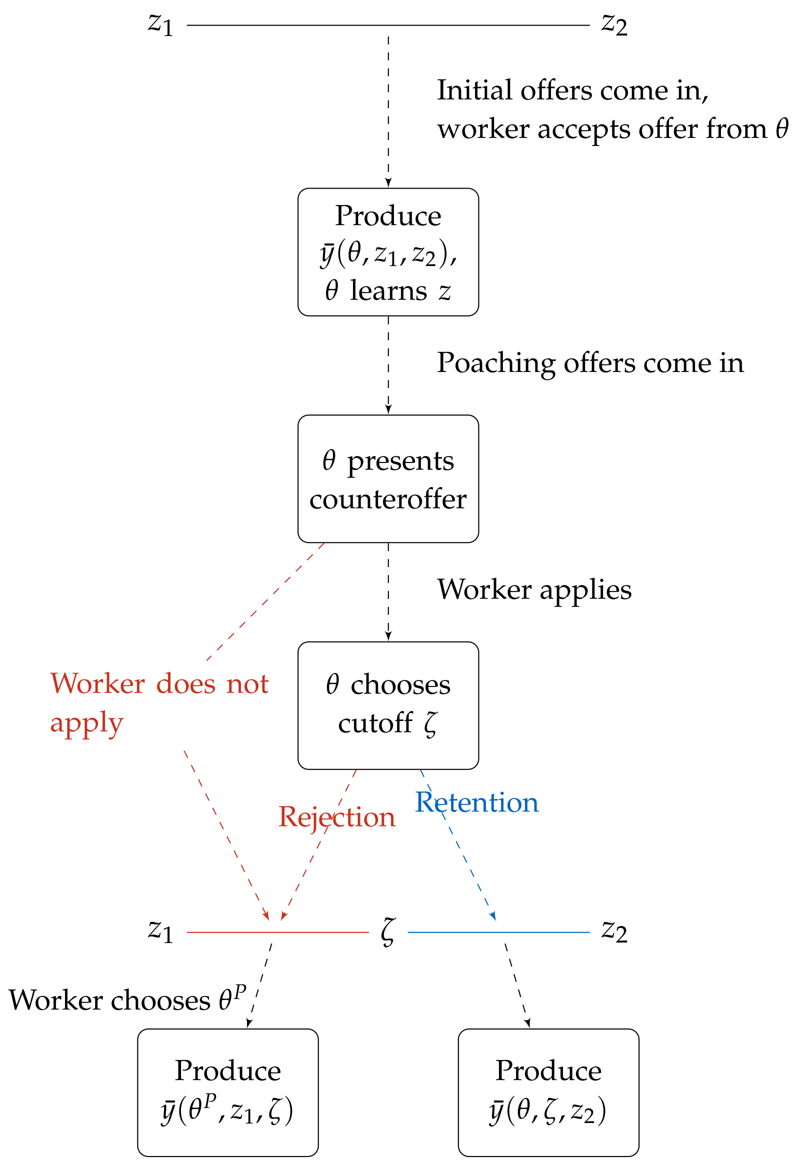
Definition 2. The *indirect poaching utility function*, $V_t^P(\theta, z_1, z_2)$, is the expected net present earnings of the worker who begins the game in period t unattached and with resumé $[z_1, z_2]$.

Definition 3. The *value function* is $V_T(z_1, z_2) = \max_\theta V_T^P(\theta, z_1, z_2)$.

Definition 4. The *cutoff rule function*, $\zeta(\theta, z_1, z_2)$, is the equilibrium cutoff rule used when the worker begins the game in period t with resumé $[z_1, z_2]$ attached to incumbent firm θ.

If the worker chose not to apply for retention, then as depicted in Figure 5, the market would incorrectly believe that she had been rejected, and her beliefs would diverge from her resumé. The next lemma states that a worker'(potentially divergent) beliefs are irrel-

Figure 5: Graphical rendition of two period game



evant to all future payoffs, conditional on her resumé, attachment status, and incumbent firm.[36]

Lemma 4. Conditional on the resumé, attachment status, and incumbent firm, the worker's own beliefs do not affect her payoffs, and it is a dominant strategy to apply for retention.

See proof on page 50.

The firm will pick a counteroffer makes the worker indifferent to applying and not applying. By Lemma 4, this is equivalent to making the worker indifferent between retention and rejection. It will be useful to imagine what this wage would be across different hypothetical cutoffs (which may or may not be equilibrium choices).

Definition 5. The *hypothetical retention wage function*, $w_t^R(\theta, z_1, z_2, \zeta)$, is the retention wage that makes the worker entering the game at time t with resumé $[z_1, z_2]$ attached to incumbent θ indifferent to being rejected and obtaining $V_t(z_1, \zeta)$ in the current period, and being accepted.

Lemma 5.

$$w_t^R(\theta, z_1, z_2, \zeta) = V(z_1, \zeta) - \delta \left((1 - \lambda^D) V(\zeta, \zeta(\theta, \zeta, z_2)) + \lambda^D V(\zeta, z_2) \right).$$

See proof on page 51.

The equilibrium cutoff must equate the output of the marginally retained worker to the hypothetical retention wage. It is the largest possible cutoff satisfying this condition.

Proposition 1. The *equilibrium cutoff rule* is

$$\zeta_t(\theta, z_1, z_2) = \sup_{\zeta \in [z_1, z_2]} \left\{ y(\theta, \zeta) - w_t^R(\theta, z_1, z_2, \zeta) > 0, \forall z > \zeta \right\}.$$

See proof on page 51.

Definition 6. The *retention wage function*, $w_t^R(\theta, z_1, z_2)$, is equal to $w_t^R(\theta, z_1, z_2, \zeta_t(\theta, z_1, z_2))$.

The output of the marginally retained worker must be weakly higher than the retention wage, and strictly so for any level of talent above the cutoff. After hiring the worker and producing output, the successful poaching firm will, except in the event of displacement, become next period's incumbent and learn the worker's talent.

[36]By extension, Lemma 4 implies that my analysis is robust to assuming that the worker knows her true talent.

Definition 7. The *ex ante incumbent profit function*, $\Pi_t^I(\theta, z_1, z_2)$, is the expected net present profits of an incumbent firm of type θ, given that the worker's true type z is uniformly distributed between z_1 and z_2.

The profits of becoming the incumbent are weakly positive because of the outside option of rejecting the worker, exiting the game, and obtaining a zero payoff. If the incumbent privately discovers that the worker is highly talented, then it may earn strictly positive profits, ex post. Thus, the ex ante profit function captures the expectation that the firm makes when it only knows the worker's resumé and has not yet acquired its private information. This expectation must account for the fact that, if worker's resumé is $[z_{1,t}, z_{2,t}]$ and the incumbent's cutoff rule is ζ_t, then the worker's resumé conditional on being retained will be $[\zeta_t, z_{2,t}]$, and the probability of retention will be $\frac{z_{2,t}-\zeta_t}{z_{2,t}-z_{1,t}}$.

To induce the worker to apply for retention, the incumbent will announce a retention wage, w_t^R, that makes the worker indifferent between retention and rejection. If the worker is retained, then with probability λ^D she will be displaced, and with probability $1-\lambda^D$ she will remain at the incumbent firm where she will again be made indifferent to retention and rejection. The next lemma uses this insight to solve for the retention wage.

Proposition 2. The retention wage function is given by

$$\begin{aligned} w_t^R(\theta, z_1, z_2) =& V(z_1, \zeta_t(\theta, z_1, z_2)) \\ & - \delta\left(\lambda^D V(\zeta_t(\theta, z_1, z_2), z_2) + (1-\lambda^D) V(\zeta_t(\theta, z_1, z_2), \zeta_{t+1}(\theta, \zeta_t(\theta, z_1, z_2)))\right). \end{aligned}$$

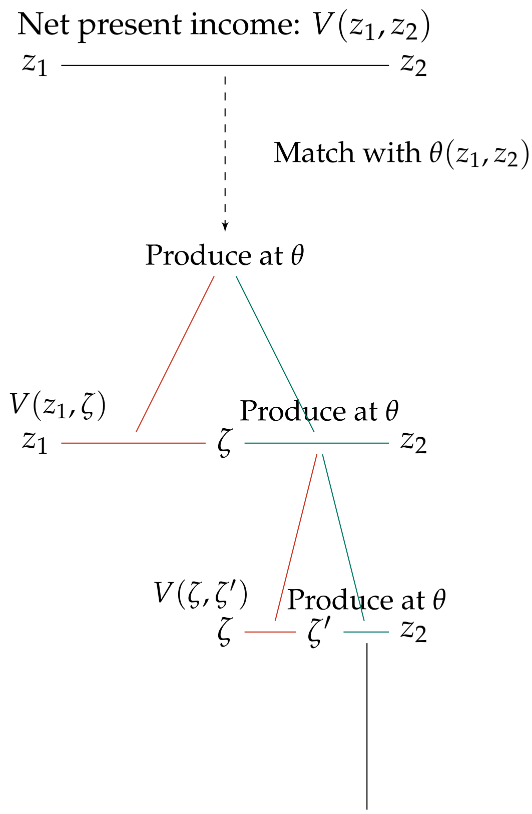
The profit conditional on retaining the worker is therefore expected output in the current period, minus the retention wage, plus the future incumbent profits (appropriately discounted by the probabilities of exit and displacement). The ex-ante incumbent profit function is characterized recursively below.

Proposition 3. For all $t > T$, $\Pi_t^I(\theta, z_1, z_2) = 0$. For all $t \leq T$,

$$\begin{aligned} \Pi_t^I(\theta, z_1, z_2) =& \frac{z_2-\zeta_t}{z_2-z_1}\left(\bar{y}(\theta, z_1, \zeta) + \delta(1-\lambda^D)\Pi_{t+1}^I(\theta, \zeta, z_2) - w_t^R\right), \\ & \text{subject to } \zeta_t = \zeta_t(\theta, z_1, z_2), \\ & \qquad \text{and } w_t^R = w_t^R(\theta, z_1, z_2). \end{aligned}$$

To complete the characterization of the model, I solve the indirect poaching utility. The indirect utility has three components: (1) the current wage, equaling expected output plus future ex-post incumbent profits, (2) the continuation value if the worker is not displaced, and (3) the continuation value if the worker is displaced.

Figure 6: Graphical rendition of infinite horizon game



Proposition 4.

$$
\begin{aligned}
V_t^P(\theta, z_1, z_2) = & \underbrace{\bar{y}(\theta, z_1, z_2) + \delta(1-\lambda^D)\Pi_{t+1}^I(\theta^P, z_1, z_2)}_{\text{wage}} \\
& + \underbrace{\delta(1-\lambda^D)V_{t+1}(z_1, \zeta_{t+1}(\theta, z_1, z_2))}_{\text{Continuation value of adversely selected worker}} \\
& + \underbrace{\delta\lambda^D V_{t+1}(z_1, z_2).}_{\text{Continuation value of displaced worker}}
\end{aligned}
$$

Analysis of the infinite horizon Markov equilibrium. As T goes to infinity, all of the equilibrium objects defined so far converge to stationary functions, and we can drop t subscripts. In Figure 6, I have illustrated the infinite horizon Markov equilibrium. For simplicity, I have ignored the possibility of displacement. When displacement occurs, the worker's continuation value is $V(z_1, z_2)$ instead of $V(z_1, \zeta)$, and her poaching firm is $\theta(z_1, z_2)$ instead of $\theta(z_1, \zeta)$.

For the remainder of this section, I will focus on deriving the two key features of the inverted job ladder: that poaching is downward directed, and that displacement is upward directed. First, I will show that the cumulative amount of information that can be acquired through poaching, within any particular employment spell, is bounded.

Proposition 5. For every possible (z_1, z_2, θ), there is some $\bar{\delta}$ such that, if and only if $\delta > \bar{\delta}$, the incumbent's cutoff rule is z_1. $\bar{\delta}$ is decreasing in $\frac{z_1}{z_2}$.

See proof on page 51.

This proposition helps guarantee that the marginally retained worker is always below the comparative advantage of the incumbent firm. However, this would be trivially satisfied if there were no poaching at all, so the next corollary establishes no poaching is not the only case where Proposition 5 applies.

Corollary 1. There exists a range of values for δ for which there is strictly positive poach when $\frac{z_1}{z_2}$ is sufficiently small, but where $\zeta(\theta, z_1, z_2) < \theta$ at all points along the equilibrium path.

Thus, as long as the discount factor is sufficiently high, we can ensure an arbitrarily small bound on the degree to which the worker's resumé can improve throughout the employment spell. The basic intuition is that, as workers become sufficiently patient, the *stigma* cost of being revealed below the incumbent firm's cutoff becomes arbitrarily high, relative to any contemporaneous difference in wage offers. The desire to protect her resumé causes the worker to accept relatively low wages in order to remain at the incumbent firm. It may seem pointless to protect one's resumé if doing so requires remaining at a firm that is paying very low wages. But recall that there is always some probability of becoming exogenously displaced in the future, at which point wage offers will become competitive.

This means that if δ is sufficiently large, any particular employment spell beginning at (z_1, z_2, θ) has a cap on the degree to which z_1 can increment up through market updating.

Assumption 4. Assume that δ is sufficiently low to guarantee some degree of poaching, but sufficiently high to ensure that cutoff rules are below the incumbent's type at all points along the equilibrium path.

The next two theorems are the main results.

Theorem 1. Assume that $\theta(z_1, z_2)$ is increasing in z_1 and z_2. Along every equilibrium path with poaching, the poaching firm is of lower type than the incumbent firm.

Proof. By the previous assumption, $\zeta < \theta$. In this case, the optimal firm $\theta(z_1, \zeta)$ is below $\theta(\zeta, \zeta)$, and since $\zeta < \theta$, this is below $\theta(\theta, \theta)$, which is, trivially, equal to θ. $\square$

Theorem 2. Assume that $\theta(z_1, z_2)$ is increasing in z_1 and z_2. Along every equilibrium path with displacement, the worker reemploys with a new firm that is of higher type than her previous firm. If, in the previous employment spell, the worker was retained during one or more periods with non-zero poaching probabilities, then the new firm is of strictly higher type.

Proof. Throughout an employment spell, the lower bound of the worker's resumé weakly improves. If the worker is retained after a period with a non-zero poaching probability, it strictly improves. Therefore, upon being displaced, the worker's resumé is better (strictly) than it was when she chose to match with the firm. Because the endogenous choice of firm, $\theta(z_1, z_2)$, is increasing in the resumé, the worker will choose to match with a (strictly) higher ranked firm. $\square$

5 Model Estimation

I will solve and simulate the infinite horizon Markov model in order to quantitatively assess the efficiency of talent discovery and reallocation in the market for lawyers, and to understand the value of potential labor market reforms. To do so, I must pick realistic model parameters. Thus, I prove that these parameters are identified from the observable data, and construct closely related estimators.

5.1 Identification

Overview of identification. I will calibrate δ to 92%, because I estimate that the true rate at which lawyers either exit the market or transition into sole practice is 8%.[37] I will identify λ^D by the degree to which retention positively signals future A ratings attainment.

To identify the two other model features—the production function and the initial distribution of worker resumés—I make additional restrictions. The production function is characterized by the returns to scale, ϕ, and a parameter governing complementarity, α. Initial resumés are characterized by a single parameter, γ, capturing the degree of initial uncertainty in worker's talents. The parameters ϕ and γ are jointly identified from a

[37] In choosing this number, I assume that the 3% sample attrition is mismeasured, rather than exit from the market. This seems reasonable given that I have restricted the sample to individuals between 22 and 60. In general, δ is a difficult parameter to choose because, if we also wanted to capture time-preferences (which are ignored in the theory section), we would alter δ. Initially one might think that time preferences should result in an even lower value for δ. However, if we wanted to model secular trend increases in the profitability of legal services over time, that might instead suggest a higher value for δ.

closed form relationship between the shares of law school alumni that are A rated, and the amount of wealth they are predicted to accumulate. I then identify α from turnover rates. The estimation methodology will closely resemble the identification methodology.

Main Assumptions. The main assumptions for identification are as follows.

Assumption 5. Let $(z_{1,0}, z_{2,0})$ denote the initial resumé. Then $z_{2,0} = \gamma z_{1,0}$, for some fixed constant γ. There exists an observed variable, $\mathbf{x}$, such that

$$\ln z_{2,0} = g(\mathbf{x}) + \epsilon, \epsilon \text{ is independent of } \mathbf{x}.$$

Assumption 6. A lawyer achieves an A rating if and only if her talent is above a fixed threshold z_A.

Assumption 7. $y(\theta, z) = (\alpha + \beta)\theta^{\alpha} z^{\beta} - \alpha\theta^{\alpha+\beta}$

The first part of Assumption 5 requires that all initial heterogeneity in workers' resumés take the form of proportional shifts (holding fixed the initial ratio of z_2 to z_1). The second part requires an instrument for this proportional heterogeneity. This assumption, combined with Assumption 6, provides me with the structure necessary to identify a mapping between A ratings attainment and accumulated wealth.

Assumption 7 is a functional form restriction. The first term in the production function can be interpreted as revenue, and the second term as an operating cost (exclusive of wage payments to the worker). Higher ranked firms and more talented workers are more productive, and more so when matched with each other. However, higher ranked firms are costlier to run, which puts them at a comparative disadvantage in employing less talented workers. Finally, and most importantly, the operating cost need not be an accounting cost. It could be an opportunity cost reflecting, for example, that firms have scarce slots which are more valuable at higher type firms.[38]

Assumption 7 now satisfies all of the properties of the production function described in Section 4. The exponents α and β sum to the production function's degree of homogeneity, ϕ. The choice of coefficients on the revenue and opportunity cost terms, $(\alpha + \beta)$ and β, is arbitrary. Because these coefficients are generically not separately identified from linear transformations of θ and z, I have chosen the parametrization respecting the normalization in Assumption 2 that $\theta^{\max}(z) = z$. With this production function in hand, it is

[38]One potential extension of my model would be to derive these opportunity costs in general equilibrium. Allowing cyclical shocks to endogenously change firms' opportunity costs would probably be the most fruitful avenue for connecting the model to the business cycle, which has been a major emphasis of the standard job ladder literature.

possible to analytically derive the objects that I defined in Definition 1 capturing output optimization under various degrees of certainty about the worker's talent.[39]

This choice of production function features a particularly convenient parameterization of the costs of over- or under-placement.

Lemma 6.

$$\frac{\partial^2 \ln y(\theta, z)}{\partial \ln \theta^2} \,|_{\theta=z} = -\alpha\phi.$$

Thus, $\alpha\phi = \alpha(\alpha + \beta)$ governs the percentage loss in efficiency as θ departs from z. Given an initial estimate of ϕ, attributing a larger part of ϕ to α will intuitively raise the costs of a given degree of over- or under-placement. For this reason, we should also expect that raising α to increase turnover, vis-a-vis the poaching of lemons by lower ranked firms. The effects on efficiency (expected output as a fraction of full information output) are not as intuitive. On the one hand, a higher value of α will certainly imply lower efficiency at the beginning of a worker's career. However, by increasing turnover and speeding up the pace of market inference, a higher value of α could also result in greater efficiency towards the end of a worker's career. Markets with a a low α will be efficient and markets with a high α will be inefficient, but it is not completely clear whether the efficiency consequences of private learning depend monotonically on α.

Proposition 6 (Identification of λ^D)**.** Consider a lawyer in year t with a given history. Let λ^D denote the rate of exogenous displacement, let τ_t denote the turnover rate, let $P_{A,t}$ denote the unconditional probability that the lawyer receives an A rating, and let $p_{A,r,t}$ denote the same probability conditional on the lawyer being retained by the incumbent firm after her first year. Assume that all of these quantities, except for λ^D, $z_{1,t}$, and $z_{2,t}$, are known. Assume that $1 > p_{A,t} > 0$, $0 < \tau_t < 1$, and $p_{A,r,t} < 1$. Then λ^D is identified by

$$\lambda^D = 1 - (1 - \tau_t)\frac{P_{A,r,t}}{P_{A,t}}.$$

See proof on page 52.

Intuitively, some degree of turnover is informative (poaching), and some degree of turnover is uninformative (displacement). The more positively selected are the retained employees, the larger is the portion of turnover that was informative, and the smaller must be λ^D.

Proposition 7 (Identification of $\phi = \alpha + \beta$ and γ)**.** Let $\phi = \alpha + \beta$, and let $\mathbf{x}$ denote the instrument (such as LSQ) described in Assumption 5. Suppose there exists an interval

[39] For interested readers, these are all derived in Appendix A.

of values for $\mathbf{x}$ where the probability of A ratings attainment conditional on $\mathbf{x}$ is strictly between 0 and 1. Let $\tilde{v}(\mathbf{x}) = \mathbb{E}[\ln V|\mathbf{x}]$, and let $p_A(\mathbf{x})$ denote the probability of becoming A rated conditional on $\mathbf{x}$. Let $\tilde{\gamma} = \frac{\gamma-1}{\gamma}$. Because $\tilde{v}(x)$ and $p_A(\mathbf{x})$ are both increasing, there exists a one-to-one relationship $\tilde{v}(p_A)$. Moreover, ϕ and γ are identified by

$$\phi = \left(\frac{\partial \tilde{v}}{\partial p_A}\right)^2 / \frac{\partial^2 \tilde{v}}{\partial p_A^2},$$

and

$$\tilde{\gamma} = \frac{1}{\frac{\partial \tilde{v}}{\partial p_A} / \frac{\partial^2 \tilde{v}}{\partial p_A^2} + p_A}$$

See proof on page 53.

Thus, ϕ and γ are identified from two distinct measures of curvature in the relationship between $\tilde{v}$ and p. This identification result leverages an important and unique aspect of my data. Without A ratings, there would be no way to anchor differences in ex ante characteristics, such as LSQ, into cardinal differences in talent. It would therefore be impossible to say whether a given return to LSQ was driven by large *differences* in talent between schools, or a large *return* to talent. The difference is crucial for correctly quantifying market efficiency.

Finally, I identify α from turnover.

Proposition 8. The first-year turnover rate is monotonically increasing in α, holding ϕ fixed.

See proof on page 54.

Estimation of λ^D. To estimate λ^D, I use the previous result stating that $\lambda^D = 1 - (1 - \tau_1)\frac{p_{A,r,1}}{p_{A_1}}$, where τ_1 is the first-year turnover rate, p_A is the A ratings attainment rate of the worker, and $p_{A,r,1}$ is the worker's A ratings attainment rate conditional on having just been retained.[40]

Because there appear to be different rates of turnover at different levels of firm rank—something I have chosen to abstract from in the model—it is important to use individuals who are relatively homogeneous at the beginning of their career when estimating the turnover rate and A ratings probabilities needed to estimate λ^D. Thus, I compute estimates separately for the four different firm rank quartiles and average them together. The resulting estimate for λ^D is 0.082.

[40]The result is for an arbitrary period t, but I target the first year only because this is the year with the highest poaching rate.

Estimation of ϕ and γ. I estimate ϕ and γ using the result in Proposition 7. Letting $\tilde{v}_i$ denote expected log permanent income conditional on $\mathbf{x}_i$ and $p_{A,i}$ denote the probability of A ratings attainment conditional on $\mathbf{x}$, Proposition 7 says

$$\tilde{v}_i = \tilde{v}_0 - \phi \ln \left(1 - \tilde{\gamma} p_{A,i}\right).$$

I will use a vector of law school dummy variables as the instrument $\mathbf{x}_i$. I assume that log housing expenditure equals log permanent income, plus idiosyncratic noise u_i that is independent of an individual's law school.[41] This assumption requires that the choice to spend more or less than the average fraction of one's permanent income on housing is exogenous to law school attendance. It is even fine for individuals to have attended their chosen school on the basis of their desire to consume more housing, so long as this choice did not on average translate into spending a larger *share* of income on housing.[42] My measure of housing wealth will contain recorded monthly rental payments for renters, and imputed monthly user-costs of housing for home-owners. The user-cost imputation follows the strategy of Albouy and Zabek (2016), who used the same Census dataset.[43] One could imagine using other instruments–the important thing is that the instrument(s) influence the individual's talent prior to labor market entry and are uncorrelated with idiosyncratic housing preferences.

Thus, $\tilde{h}_i = \ln H_i = \tilde{v}_i + u_i$, and

$$\tilde{h}_i = \tilde{v}_0 - \phi \ln \left(1 - \tilde{\gamma} p_{A,i}\right) + u_i. \tag{2}$$

To provide some intuition for the above equation, suppose that $\tilde{\gamma}$ equals one. In this case, ϕ measures the elasticity of housing wealth with respect to the percentile of the school's marginal alum who is expected to get the A rating, $1 - p_A(LSQ_i)$. Suppose that the marginally A rated lawyer would be a median alum from Harvard, but a 90th percentile alum from a relatively unknown local law school. In this case, we can conclude that the average Harvard alumni earns $\frac{0.9}{0.5}\phi = 1.8\phi$ log points more net present income than the average alum from the unknown school.

A challenge in estimating Equation 2 is that it requires knowledge of $p_{A,i}$. Because the equation is non-linear in this term, and $\tilde{\gamma}$ is identified off of curvature, estimation error in $p_{A,i}$ could bias estimates of $\tilde{\gamma}$ that treat these estimates as data. To get around this

[41]This implicit unit-income elasticity is in line with estimated elasticities for the sample period, which are reviewed in Wilkinson (1973).

[42]For example, individuals could defer in their preference for leisure as opposed to consumption, but behave identically with respect to the share of consumption expenditure allocated to housing.

[43]Specifically, I multiply home values by 0.0789 to get an annual imputed rent, and then divide by 12.

challenge, I will invert Equation 2 to get $p_{A,i}$ on the left-hand-side.

$$p_{A,i} = \frac{1}{\tilde{\gamma}} \left(1 - e^{\frac{1}{\phi}\left(\tilde{v}_0 - \left(\tilde{h}_i + u_i\right)\right)}\right).$$

Take an expectation over $\mathbf{x}_i$, let $\bar{h} = \mathbb{E}[\tilde{h}_i]$ (the unconditional expectation), and let $k = \mathbb{E}[e^{\frac{1}{\phi}(\tilde{v}_0 - u_i - \bar{h})}|\mathbf{x}_i]$. k is constant by independence of u_i to $\mathbf{x}_i$. This yields

$$p_{A,i} = \frac{1}{\tilde{\gamma}} \left(1 - ke^{-\frac{\tilde{h}_i - \bar{h}}{\phi}}\right). \tag{3}$$

Note that $\tilde{h}_i$ is a law school-conditional expectation that has to be estimated. Because log housing wealth varies continuously in the population, this term will be much easier to estimate than $p_{A,i}$ would have been. Take a second-order Taylor expansion of Equation 3 with respect to $\tilde{h}_i$ around $\bar{h}$, to get

$$p_{A,i} \approx \underbrace{\frac{1-k}{\tilde{\gamma}}}_{b_0} + \underbrace{\frac{k}{\tilde{\gamma}}\phi}_{b_1} \left(\tilde{h}_i - \bar{h}\right) + \underbrace{\frac{k}{2\tilde{\gamma}}\phi^2}_{b_2} \left(\tilde{h}_i - \bar{h}\right)^2. \tag{4}$$

By estimating the above equation via Ordinary Least Squares (OLS) , an estimate of ϕ can be inferred via $\phi = 2\frac{b_2}{b_1}$, and an estimate of $\tilde{\gamma}$ can inferred via $\tilde{\gamma} = \frac{1}{b_0 + \frac{b_1^2}{2b_2}}$.

A potential problem with estimating Equation 4 is that different locations may have had different standards for the assignment of A ratings. It is tempting to deal with this possible issue by simply including additive location fixed effects into the equation. However, the theory from which I derived this equation, which is in the proof for Proposition 7, says that changes in the talent threshold required to get an A rating will cause changes in both k and p^0. Thus, in order to account for differences across geographical markets (indexed by m), the equation should become

$$p_{A,i,m} = b_{0,m} + b_{1,m} \left(\tilde{h}_i - \bar{h}_m\right) + b_{2,m} \left(\tilde{h}_i - \bar{h}_m\right)^2. \tag{5}$$

I first estimate the equation pooling across counties. Next, I cut the sample into three market-size categories. Finally, I estimate the equation for just the cities of Chicago and New York. In each case, the de-meaning is performed within the level of market classification.

The estimates of ϕ and γ are presented in Table 4. The results are mostly plausible across specifications, except that the estimate of ϕ in the pooled specification is much larger—implausibly so—than in the others. This arises from a high estimated b_2 and a low estimated b_1 in Equation 4. As anticipated above, the apparent problem here is that

Table 4: Estimation of ϕ and γ

Sample	Estimate (std. err.) ϕ	γ	Observations
Split by Market Size Categories			
>500 lawyers	2.16 (0.38)	6.03 (0.35)	74,212
$100-500$ lawyers	2.08 (1.63)	5.24 (0.627)	20,413
<100 lawyers	3.67 (6.60)	5.59 (0.263)	38,721
Split by Individual Market			
New York City	2.58 (0.88)	7.42 (0.84)	14,285
Chicago	3.44 (0.31)	4.58 (0.38)	8,116
Pooled			
	7.29 (1.91)	6.77 (0.09)	133,346

Controls for mkt. size and current age
Sample of lawyers in 15th year
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

lawyers from better law-schools self-select into locations where, in an absolute sense, it is harder to qualify for an A rating. The lawyers from the best schools tend to all be in cities where the standards for A ratings are comparable, so the "good" variation in A ratings attainment is between lawyers with relatively high $\tilde{h}_i$, and this potentially explains why b_2 (the second-order term) is estimated to be relatively large in the pooled regression. Also, ϕ is estimated very imprecisely for markets with less than 100 lawyers. The lawyers in these small markets tend to have all gone to relatively low quality law schools, so there is insufficient variation in $\tilde{h}_i$ to estimate anything in the small markets.

The larger markets (with more than 500 lawyers) are the main focus of the analysis, because they contain most of the law firms. Thus, my preferred estimates are $\hat{\phi} = 2.16$, and $\gamma = 6.03$.

Having estimated γ, $\phi = \alpha + \beta$, and λ^D, I will now estimate the final parameter α using the simulated method of moments (SMM, see McFadden (1989)). As suggested by the identification proof, I will choose the value that minimizes differences between empirical gross turnover rates and those predicted by the model. Gross turnover will include both poaching and displacement transitions, following the terminology of Section 3. However, because the exogenous displacement rate λ^D was already estimated, the only free margin along which the simulated model can match gross turnover is through poaching.

I will simulate $t = 1, ..., T$ years of labor market experience for $s = 1, ..., S$ individuals by choosing random values of innate talent $z = z_1, ..., z_S$ and random sequences of displacement shocks $d = \{d_{1,1}, ..., d_{1,T}\}, ..., \{d_{S,1}, ..., d_{S,T}\}$. Fixing these simulated elements, a given guess of α will translate into a deterministic sequence of poaching outcomes. Let

$q_{s,t}(\alpha)$ be a binary indicator for whether, in the tth year of labor market experience, the simulated individual experiences turnover. Meanwhile, let i denote an actual individual in the data and let $q_{i,t}$ denote whether or not they experience turnover in year t. The simulated time t turnover rate is

$$\tau_t^S(\alpha) = \frac{1}{S}\sum_{s=1}^{S}\tau_{s,t}.$$

The model error for observation i, t is

$$\varepsilon_{i,t}(\alpha) = q_{i,t} - \tau_t^S(\alpha).$$

The tth moment is $e_t(\alpha) = \frac{1}{N}\sum_{i=1}^{N}\varepsilon_{i,t}(\alpha)$. Let $e(\alpha) = \Big(e_1(\alpha), ..., e_T(\alpha)\Big)^T$. Fixing the simulated elements, the SMM estimator of α is

$$\hat{\alpha} = \arg\min_{\alpha} Q(\alpha), Q(\alpha) = e(\alpha)^T W e(\alpha),$$

where W is a positive definite weight matrix. To choose the weight matrix and estimate the asymptotic covariance matrix of the estimates, I use the general indirect inference procedure described in Gourieroux et al. (1993), p.S92. Accordingly, the optimal weight matrix, $W^\star$, is the inverse of the variance-covariance matrix of the moments (evaluated at the true parameter).[44]

Solving the Model. I will now explain how I computationally solve the model, which is necessary to produce the simulated moments above. To solve the model analytically, one would compute the equilibrium objects described in the one-period model, and then apply backward recursion using the propositions in Section 4 to calculate the equilibrium cutoff rule $\zeta_t(\theta, z_1, z_2)$, the ex ante incumbent profit function $\Pi_t^I(\theta, z_1, z_2)$, and the promised value function $V_t(z_1, z_2)$. Because these functions lose analytical tractability after a few iterations, it is essential to use numerical methods.

Thus, I solve for these functions along discrete grid-points and use interpolation when the recursive procedure demands knowledge of an off-grid value. One particularly useful feature of the model is that every equilibrium object features homogeneity. Thus, I only need to explicitly solve the equilibrium functions in the case where $z_2 = 1$. To evaluate functions in cases where $z_2 \neq 1$, and simply apply homogeneity. For example, $V(z_1, z_2) = z_2^\phi V(\frac{z_1}{z_2}, 1)$.

[44]The covariance matrix is estimated via bootstrapped estimation of the entire set of experience-dependent turnover rates. The bootstrap is blocked on individual to account for within-individual clustering of turnover, which is implied by the model.

The Markov equilibrium can be approximated arbitrarily well by setting the number of periods and grid-points to be sufficiently large. I repeatedly solve the finite horizon model backwards until firm cutoff rules and worker offer-acceptance rules converge to stationary functions.[45]

5.2 Estimation Results

All parameter estimates (or calibrated values) and standard errors are listed in Table 5. Note that the parameter β is implicitly estimated as $\phi - \alpha$. The first standard error listed for α does not account for estimation error in the other parameters. To get a conservative upper bound on the correct standard error, I drew from the upper and lower bounds of the 95% confidence intervals for λ^D, ϕ, and γ, and estimated α separately for all 8 possible combinations. I divided the difference between the largest and smallest estimate by 1.96 to get a "rule of thumb" adjusted standard error.[46]

Table 5: Model Estimates

Parameter	**Estimate** (std. error)	**Description**
δ	0.920	1 - Exit rate
λ^D	0.082 (0.023)	Displacement rate
ϕ	2.165 (0.383)	Gross return to talent in production
γ	6.031 (0.352)	Initial value of $\frac{z_2}{z_1}$
α	1.900 (0.017) | (0.1014*)	Firm quality production parameter

*Adj. standard error using rule of thumb to account for first-stage estimation error.

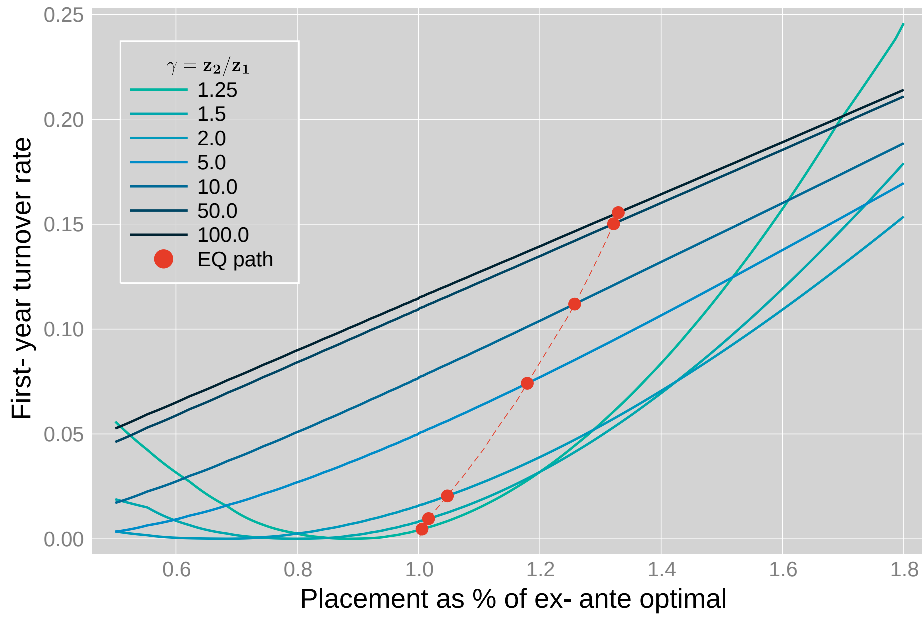
Comparison of model versus empirical career dynamics. To illustrate the initial over-placement phenomenon, in Figure 7 I have plotted the first-year turnover rate that would arise from different possible degrees of over-placement, and for different levels of $\frac{z_2}{z_1}$. Over-placement is measured as the ratio $\frac{\theta}{\theta^\star}$, where $\theta^\star$ is the firm type that maximizes ex ante expected output, while θ is the firm to which the individual actually matches. Essentially, the more a worker over-places, the higher the turnover-rate is,[47] but the less productive she is. Turnover is valuable, especially for young workers whose $\frac{z_2}{z_1}$ is large, because it

[45]Keep in mind that I will allow the discount factor to be relatively small. Thus, the important difference between a finite horizon and an infinite horizon is not that a career lasts forever—it is simply that the worker does not know *when* their career will end.

[46]I opted for this rule of thumb to save significantly on computing time. However, standard errors for all parameters would ideally be computed by bootstrapping the entire procedure from start to finish, blocking on law school (since that is where much of the important variation used to estimate ϕ and γ lies).

[47]The relationships are similar but less pronounced for second-year, third-year, and all future years' turnover.

Figure 7: First-year turnover rates, on and off the equilibrium path, for different resumés and degrees of over-placement



creates information and leads to better future match efficiency. The red points illustrate that the degree of over-placement, and the turnover rate, both vanish as z_1 converges to z_2.

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6 Normative Analysis and Counterfactual Simulations

With the estimated model in hand, I use it to answer some normative questions:

- How much less efficient is the market compared to a full information benchmark?
- How much inefficiency can be attributed to the speed at which the market identifies talent, relative to mismatched assignments that are known to be inefficient based on the information that the market currently has?
- What kinds of policies can enhance efficiency?

Benchmarking efficiency. To benchmark the industry's efficiency, it is useful to compare it to two extreme cases: a fully efficient industry where a worker's talents are immediately revealed to all agents, and a myopic industry where learning is shut down. In both cases, the initial assignment is permanent. Ex ante net present output in the two benchmark cases is easy to derive. We simply assign a worker to her optimal firm type based on the available information, and take an ex ante expectation. The periodic output in the two benchmark cases is constant over time. In the simulated industry, output gradually increases over time due to learning. At some point, learning comes to a halt, because mismatch between workers and firms can no longer overcome the adverse selection problem.

In the myopic case, market efficiency is estimated at 60%, while in the model equilibrium, it is estimated to be 85%. Thus, the market's ability to dynamically accumulate information over time through strategic inference has a quantitatively large effect on overall efficiency. Nonetheless, the 15% efficiency shortfall is still quite large, so in the remainder of this section I will evaluate the causes and possible policy solutions to this inefficiency.

Where is the 15% shortfall coming from? I structurally decompose it into an informational component and a residual non-informational component. To compute the informational component, I take the endogenous stochastic process of the resumé along the equilibrium path, and make it exogenous. I hand control of allocations over to a benevolent social planner who simply assigns the worker to her ex ante optimal firm based on the information available in each period.[48] Thus, at any point in time, the planner's failure to reach full efficiency simply reflects the absence of information. This thought experiment essentially transforms the information structure into a public learning environment a la Farber and Gibbons (1996).

I calculate that the social planner in this scenario would achieve 95% efficiency. Thus, the majority of market inefficiency is non-informational. Workers eventually become under-placed at incumbent firms because the adverse selection problem prevents them from moving up the ladder. To compensate for this, they initially over-place. These distortions explain ten percentage points of the overall fifteen percentage point efficiency gap.

The social value of pre-job market signaling. I will now perform a policy counterfactual to study the value of using competition in the educational system as a means of producing better information about workers before they go on the job market. My analysis is intended to shed light on recent trends in skilled professions, where internships appear to be supplanting academic competition as an entryway into top jobs. I will explain the internship trend for lawyers, but similar trends are occurring among MBA students and undergraduates going into finance.

Law school grades have typically been very important determinants of post-law school placements in the US, and schools have traditionally ranked their students academically.

[48]By the first welfare theorem, a competitive market would reach the same static optimization outcomes.

However, in recent years, grades in years two and three of law school have become far less consequential for placement. This decline appears related to a rising prevalence of the "2L summer associate-ships," which is essentially an internship occuring in the summer after the second year of law school. A prestigious summer associateship is close to a necessary and sufficient condition for getting a prestigious job after law school. Students apply for these positions in the fall of their second year of law school and thus have only two semesters worth of grades to use in the application. For the remaining four semesters of school, the top students have already been accepted as summer associates and have much lower incentives to compete academically. Thus, second- and third-year grades in law school are not considered to be very informative, at least compared to grades in the first year.

Internships allow firms to acquire private information about workers. In the case of lawyers, this appears to have recently come at the cost of public information, by reducing the signaling quality of second- and third-year grades. Should we consider banning such internships? To assess this within the framework of my model, I will consider a policy that forces the worker to delay her labor market entry for duration D in order to compete academically. The signal generated by academic competition is the same binary cutoff signal that would have been generated in the first year of the labor market. The benefit of academic competition is that, having received her signal, the worker leaves school unattached and unimpeded by the adverse selection problem that would have limited her ability to efficiently match to a new firm. The cost is the D units of foregone productive time (I will need to assume a discount rate for this calculation). The objective is to calculate how small D needs to be in order to make the extended academic competition worthwhile.

I assume that the representative worker's resumé is $[1, \gamma]$ (the results will be scale-invariant to the resumé), and I use the estimated model to compute her equilibrium expected earnings $V_0 = V(1, \gamma)$ and the cutoff that will be used in her first period of tenure at the incumbent firm, $\zeta_1 = \zeta(\theta(1, \gamma), 1, \gamma)$. Thus, the academic competition is assumed to reveal whether the worker is above or below ζ_1. The value of academic competition is

$$V_A = e^{-rD} \frac{\gamma - \zeta_1}{\gamma - 1} \underbrace{V(\zeta_1, \gamma)}_{} \text{Value if wins competition} + \frac{\zeta_1 - 1}{\gamma - 1} \underbrace{V(1, \zeta_1)}_{} \text{Value if loses competition.}$$

I find that $V_A = 1.122 V_0$. Assuming an interest rate of $r = 0.05$, this means that the maximum duration D at which academic competition is worthwhile is 2.3 years. Even if the worker had to pay a tuition cost to participate in the competition equaling five percent of her lifetime earnings, she would still be wiling to participate for a duration of more than one year. These results suggests that, for workers entering the skilled professions, the social returns to education can easily be justified on the basis of signaling alone. The results further suggest that internship trends in law and related professions are not necessarily a good thing, even if they may be privately attractive to the firms that offer them.

7 Conclusion

This paper presented evidence of an inverted job ladder for lawyers, where poaching is directed up the ranks, displacement is directed down the ranks, and high-ranking firms are subject to relatively more poaching. I developed a new *inverted job ladder* theory of how talent is discovered and reallocated. The theory has two key features that pertain to high-skilled professions: firms privately learn talent, and are specialized in hiring different levels of talent based on the difficulty of their work. I then validated the private learning assumption of the model by showing evidence that retained workers are positively selected, relative to workers who are poached.

By structurally estimating and solving the model, I found that the market for lawyers is about 85% as efficient as the full-information optimum. The majority of this inefficiency is not informational, and would be eliminated in a public learning information structure with the same amount of information about talent. I found that one possible solution to these inefficiencies is to improve the informativeness of academic competition prior to placement in the job market–a finding that is timely in light of recent trends where internships appear to be supplanting academic competition in the skilled professions.

Appendices

.1 More evidence of adverse selection for the bottom three quartiles of firm-rank

The below figures plot A ratings attainment and poaching rates against current tenure for the bottom three quartiles of firm-rank.

Figure 8: Future A ratings attainment by current tenure, $0.5 < r_{i,t} \leq 0.75$

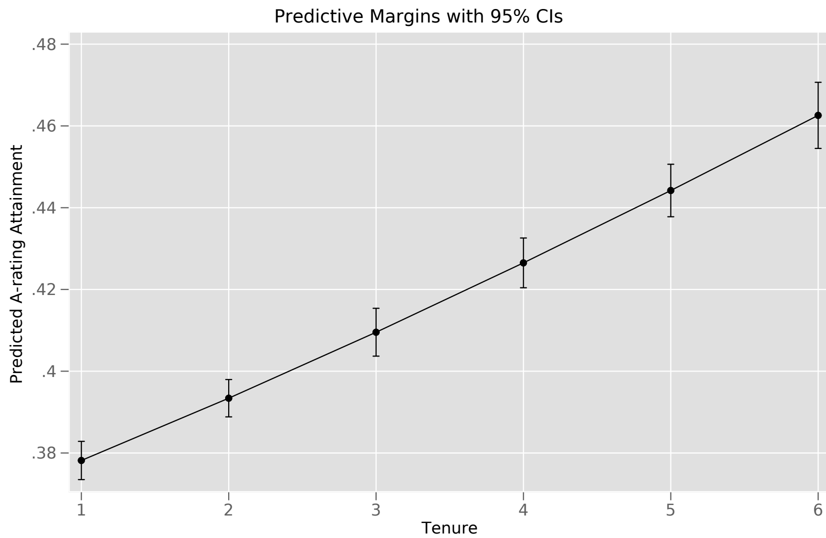


Figure 9: Poaching rates by current tenure, $0.5 < r_{i,t} \leq 0.75$

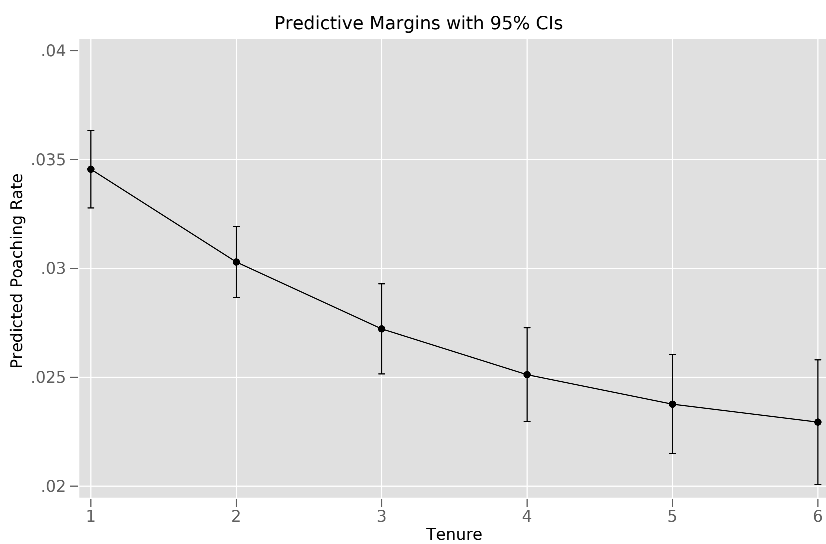


Figure 10: Future A ratings attainment by current tenure, $0.25 < r_{i,t} \leq 0.5$

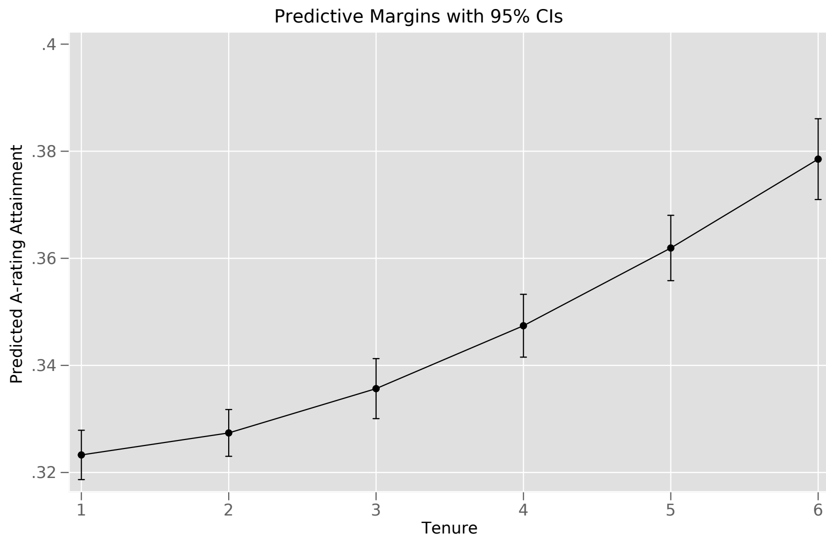


Figure 11: Poaching rates by current tenure, $0.25 < r_{i,t} \leq 0.5$

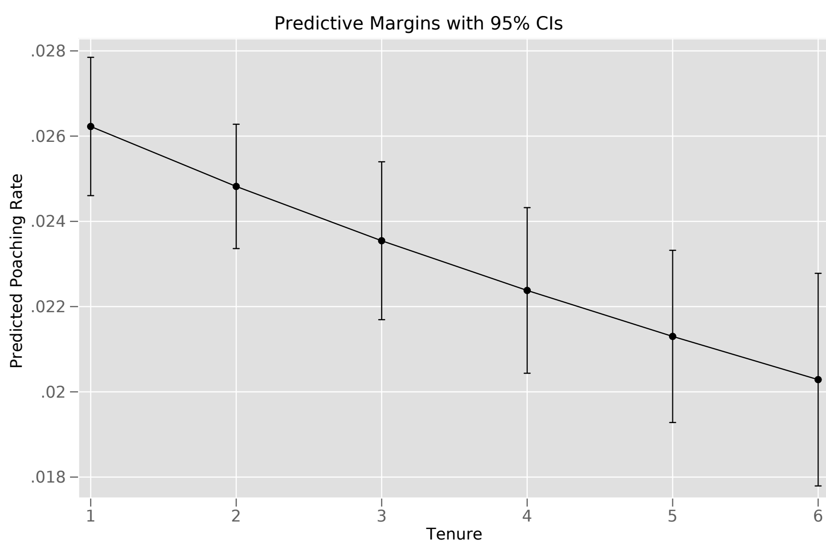


Figure 12: Future A ratings attainment by current tenure, $r_{i,t} \leq 0.25$

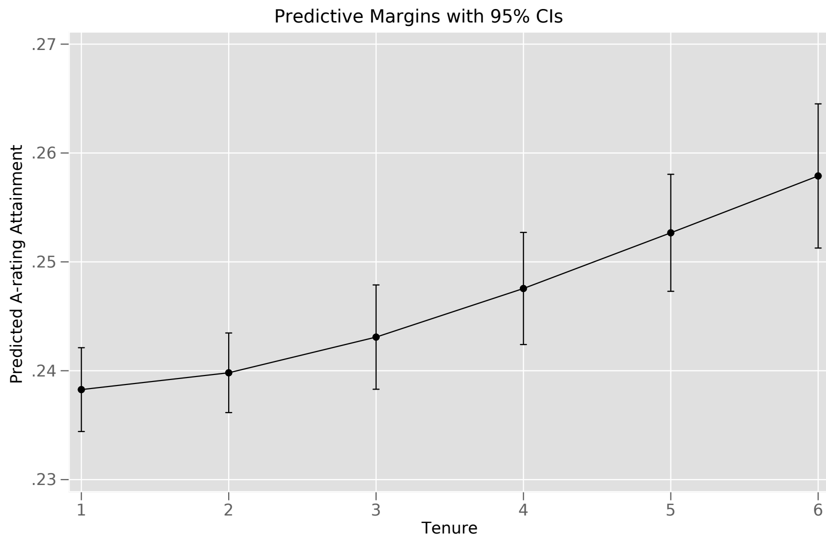
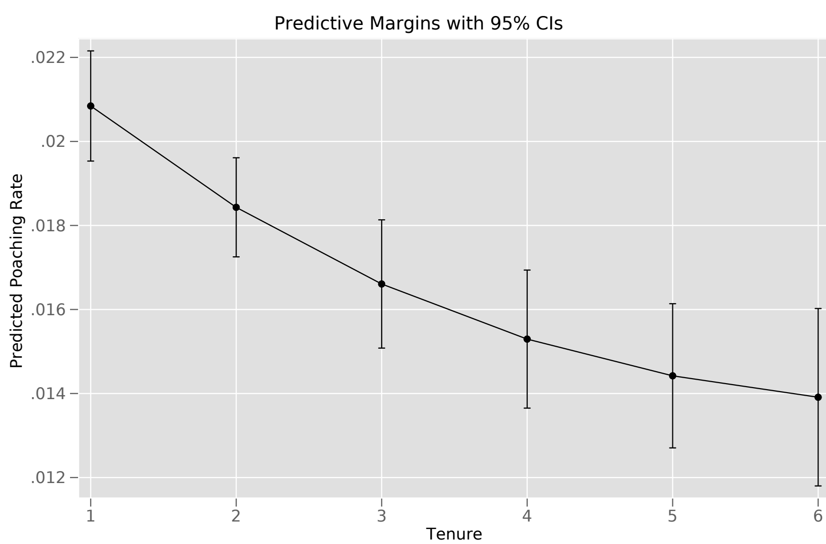


Figure 13: Poaching rates by current tenure, $r_{i,t} \leq 0.25$



Appendix A Analytical derivations of the objects in Definition 1

Using the assumed functional form in Assumption 7, here I analytically derive optimal output under various degrees of information about the worker's talent, defined in **??**.

The full information output is

$$\begin{aligned} \bar{y}^{FIM}[z_1, z_2] = \mathbb{E}_{z|z_1 \le z \le z_2} y(z, z) = \beta \mathbb{E}_{z|z_1 \le z \le z_2} \left[z^{\alpha+\beta} \right] \\ = \beta \frac{z_2^{\alpha+\beta+1} - z_1^{\alpha+\beta+1}}{(z_2 - z_1)\,(1 + \alpha + \beta)}. \end{aligned} \tag{6}$$

Again, the last line imposes the uniform distributional assumption. The shortfall of optimal expected output under incomplete information, as compared to expected output under full information, is increasing in the difference $z_2 - z_1$.

$$\begin{aligned} \theta^\star[z_1, z_2] &= \arg\max_\theta \mathbb{E}_{z|z_1 \le z \le z_2} y(\theta, z) \\ &= \left(\mathbb{E}_{z|z_1 \le z \le z_2} z^\beta \right)^{\frac{1}{\beta}} \\ &= \left(\frac{z_2^{1+\beta} - z_1^{1+\beta}}{(z_2 - z_1)(1 + \beta)} \right)^{\frac{1}{\beta}}, \end{aligned}$$

where the last line imposes the uniform distributional assumption. The ex ante optimal output is

$$\begin{aligned} \mathbb{E}_{z|z_1 \le z \le z_2} y(\theta^\star, z) &= \beta \left(\mathbb{E}_{z|z_1 \le z \le z_2} z^\beta \right)^{\frac{\alpha+\beta}{\beta}} \\ &= \beta \left(\frac{z_2^{1+\beta} - z_1^{1+\beta}}{(z_2 - z_1)(1 + \beta)} \right)^{\frac{\alpha+\beta}{\beta}}. \end{aligned} \tag{7}$$

A.1 Omitted Proofs

Lemma 2 (The time-T cutoff)**.** Recall that $\bar{y}^{\max}(z_1, z_2)$ is the maximized expected output of a worker with resumé $[z_1, z_2]$. The equilibrium cutoff must satisfy

$$y(\theta, z) - \bar{y}^{\max}(z_1, \zeta) < 0 \text{ if and only if } z < \zeta. \tag{1}$$

The equilibrium cutoff, $\zeta_T(\theta, z_1, z_2)$ is the maximum value within $[z_1, z_2]$ satisfying Equation 1.

Proof of Lemma 2. $\bar{y}^{\max}(z_1, \zeta)$ will be the value of the poaching wage when poaching firms correctly anticipate that the cutoff rule ζ is going to be used. Given that it matches this poaching wage, the marginally retained worker produces $y(\theta, \zeta)$. Thus, as long as $\zeta \in (z_1, z_2)$, the incumbent will be indifferent to retaining the marginally retained worker, and thus $y(\theta, \zeta) = \bar{y}^{\max}(z_1, \zeta)$, $y(\theta, z) > \bar{y}^{\max}(z_1, \zeta) \forall z > \zeta$, and $y(\theta, z) < \bar{y}^{\max}(z_1, \zeta) \forall z < \zeta$. It may also be possible to have $\zeta = z_1$, in which case the incumbent may strictly prefer to retain all worker types, or $\zeta = z_2$, in which case the incumbent strictly prefers to reject all worker types.

Existence of at least one value of ζ satisfying $y(\theta, \zeta) - \bar{y}^{\max}(z_1, \zeta) < 0 \forall z < \zeta$ is trivial. Because this function is continuous, it either lies uniformly above 0 (so $\zeta = z_2$ works), uniformly below 0 (so $\zeta = z_1$ works), or crosses 0 at some point (by the intermediate value theorem).

To understand why the equilibrium cutoff must be the supremum of all cutoffs, ζ, ensuring that the incumbent is indifferent to retaining the marginal worker type, we need to think about the incentives of the poaching firms. There is always some poaching firm that can trigger ζ to be used by offering $\bar{y}^{\max}(z_1, \zeta)$—in this case, the poaching firm would be $\theta^\star(z_1, \zeta)$.

Now suppose that in equilibrium, this pivotal offer were not being made. I will prove that there would then have to be some firm slightly below $\theta^\star(z_1, \zeta)$ that could generate strictly positive profits by triggering a cutoff slightly below ζ. Since ζ is, by assumption, the largest value satisfying Equation 1, it must be the case that either $\zeta_t = z_2$ and $y(\theta_t, \zeta_t) - \bar{y}^{\max}(z_{1,t}, \zeta_t) > 0$, or that $y(\theta_t, \zeta_t) - \bar{y}^{\max}(z_{1,t}, \zeta_t)$ is equal to 0 and is increasing in ζ_t (otherwise ζ_t could not be the largest value satisfying Equation 1). If we are in the first case, this means that a poaching firm could profitably offer strictly less than $\bar{y}^{\max}(z_{1,t}, \zeta_t)$ and still induce the incumbent to use the same cutoff (since no one else was already offering a pivotal wage this high). In the second case, this means that a poaching firm could profitably offer $\bar{y}^{\max}(z_{1,t}, \tilde{\zeta}_t)$, for some $\tilde{\zeta}_t$ that was slightly below ζ_t, and cause the incumbent to use a cutoff slightly below ζ_t. We know this would be profitable because $y(\theta_t, \zeta_t) - \bar{y}^{\max}(z_{1,t}, \zeta_t)$ is increasing in ζ_t. □

Lemma 3. Suppose that $z_{1,T} \leq \zeta_T(\theta_T, z_{1,T}, z_{2,T}) < \theta_T < z_{2,T}$. Then the equilibrium poaching firm is of lower type than the incumbent firm.

Proof of Lemma 3. The worker's talent is below ζ with probability one. Thus, the ex post optimal match, $\theta^\star(z)$, is below ζ with probability 1. Because output is concave in firm type, the ex ante optimal firm, $\theta^{\max}(z_1, \zeta)$, must be the ex post optimal firm for some $z \in [z_1, \zeta]$. If θ were higher or lower than this, then output could be improved with probability 1 by decreasing or increasing θ. □

Lemma 4. Conditional on the resumé, attachment status, and incumbent firm, the worker's own beliefs do not affect her payoffs, and it is a dominant strategy to apply for retention.

Proof of Lemma 4. Let the market's beliefs at any time and stage of the game be described by the resumé $[z_{1,t}, \zeta_t]$, and now allow this to differ from the worker's beliefs. The proof will be inductive. First, suppose we are in period $T-1$. In this case, the set of potential poaching offers available to the worker are completely independent of her beliefs. Her best strategy is to take the highest offer, and thus her own beliefs have no impact on her equilibrium earnings in the $T-1$ period subgame.

Now, suppose that we know that in all subgames with t or fewer remaining periods, the worker's payoff will be unaffected by her own beliefs, given her resumé, attachment status, and incumbent firm. Because future payoffs are not influenced by beliefs, the only way that beliefs can affect *current* expected payoffs is by causing a change in the joint distribution of next period's incumbent firm, resumé, and attachment status. This cannot occur if the worker is currently unattached because her resumé and the set of poaching offers will remain unchanged next period. Thus, the only possibility is for a currently attached worker to realize a different distribution of future resumés and attachment status in the next period.

Regardless of what her current beliefs are, there are only three possible outcomes: be displaced and obtain resumé $[z_{1,t}, z_{2,t}]$, remain at the incumbent firm, θ_t, and obtain a resumé $[\zeta_t, z_{2,t}]$, or leave the incumbent firm (without displacement) and obtain resumé $[z_{1,t}, \zeta_t]$. Displacement is exogenous, so the worker's private information can only serve to assign more or less weight to the latter two outcomes.

And now we come to the crux of the proof. Both outcomes deliver the exact same payoff to the worker. Thus, even though the probabilities of the two outcomes can change depending on the worker's private information, the worker's expected payoff cannot.[49]

Given that the worker's payoff is unaffected by her own information, it is a weakly dominant strategy for her to always apply. If there is a positive probability of retention,

[49]Notice that because of Assumption 3, even if the worker knew she was more talented than $z_{2,t}$, she would never be able to prove this to the market. The market would at best assume that she is of talent $z_{2,t}$.

conditional on applying, then the firm must anticipate strictly positive profit with probability 1 (the knife-edge case is when the worker's talent equals the cutoff, which happens with probability zero). Thus, with probability 1, the incumbent firm would always be willing to pay ϵ more than the worker's otuside option in order to convince her to apply, and thus the worker must always apply in equilibrium. □

Lemma 5.

$$w_t^R(\theta, z_1, z_2, \zeta) = V(z_1, \zeta) - \delta\left((1-\lambda^D)V(\zeta, \zeta(\theta, \zeta, z_2)) + \lambda^D V(\zeta, z_2)\right).$$

Proof of Lemma 5. If the worker is accepted, next period with probability λ^D she will remain attached to firm θ with resumé $[\zeta, z_2]$. The incumbent will then ensure that regardless of whether she is retained or not, she will receive value $V_{t+1}(\zeta, \zeta(\theta, \zeta, z_2))$. Meanwhile, if she is displaced, her resumé will remain at $[\zeta, z_2]$ and she will earn value $V(\zeta, z_2)$. □

Proposition 1. The *equilibrium cutoff rule* is

$$\zeta_t(\theta, z_1, z_2) = \sup_{\zeta \in [z_1, z_2]} \left\{y(\theta, \zeta) - w_t^R(\theta, z_1, z_2, \zeta) > 0, \forall z > \zeta\right\}.$$

Proof of Proposition 1. □

Proposition 5. For every possible (z_1, z_2, θ), there is some $\bar{\delta}$ such that, if and only if $\delta > \bar{\delta}$, the incumbent's cutoff rule is z_1. $\bar{\delta}$ is decreasing in $\frac{z_1}{z_2}$.

Proof of Proposition 5. Consider the cutoff inequality:

$$\zeta(\theta, z_1, z_2) = \sup_{\zeta \in [z_1, z_2]} \{G(z) < 0, \forall z < \zeta, z \in [z_1, z_2]\},$$

where

$$G(\zeta; \theta, z_2) = y(\theta, \zeta) + \delta\left((1-\lambda^D)V^I(\zeta, z_2) + \lambda^D V(z_1, z_2)\right) - V(z_1, \zeta).$$

As we make δ arbitrarily high, the expression becomes dominated by the difference in continuation values. The continuation value at the incumbent firm is strictly higher. Thus, there exists some critical value of the discount factor, $\bar{\delta}$, which guarantees that $G(\zeta; \theta, z_2)$ will be uniformly greater than 0 for all $\zeta > z_1$.

As we decrease z_1, we simply expand the interval over which we are considering $G(\zeta;\theta,z_2)$, so the critical $\bar{\delta}$ must be weakly higher than before. $\square$

Corollary 1. There exists a range of values for δ for which there is strictly positive poach when $\frac{z_1}{z_2}$ is sufficiently small, but where $\zeta(\theta,z_1,z_2) < \theta$ at all points along the equilibrium path.

Lemma 6.

$$\frac{\partial^2 \ln y(\theta,z)}{\partial \ln \theta^2}\,|_{\theta=z} = -\alpha\phi.$$

Proposition 6 (Identification of λ^D)**.** Consider a lawyer in year t with a given history. Let λ^D denote the rate of exogenous displacement, let τ_t denote the turnover rate, let $P_{A,t}$ denote the unconditional probability that the lawyer receives an A rating, and let $p_{A,r,t}$ denote the same probability conditional on the lawyer being retained by the incumbent firm after her first year. Assume that all of these quantities, except for $\lambda^D, z_{1,t}$, and $z_{2,t}$, are known. Assume that $1 > p_{A,t} > 0$, $0 < \tau_t < 1$, and $p_{A,r,t} < 1$. Then λ^D is identified by

$$\lambda^D = 1 - (1-\tau_t)\frac{P_{A,r,t}}{P_{A,t}}.$$

Proof of Proposition 6. Let the incumbent firm's cutoff rule be ζ_t. The turnover rate must satisfy

$$\tau_t = \lambda^D + (1-\lambda^D)\frac{\zeta_t - z_{1,t}}{z_{2,t} - z_{1,t}}.$$

Solving for ζ_t, we find

$$\zeta_t = z_{1,t}\frac{(\tau_t - \lambda^D)\gamma + 1 - \tau_t}{1-\lambda^D}.$$

By assumption, $p_{A,t} \in (0,1)$. This implies that the threshold for obtaining an A rating, z^A, must be in the interior of $[z_{1,t}, z_{2,t}]$. By the additional assumption that $p_{A,r,t} < 1$, we can infer that the incumbent's cutoff rule ζ_t was below z^A. Keep in mind that this implies that any worker who was truly poached should never receive an A rating!

The probability of getting an A rating prior to retention is $p_{A,t} = \frac{z_{2,t}-z^A}{z_{2,t}-z_{1,t}}$. The probability conditional on having been retained—and thus being revealed above ζ_t, is $p_{A,r,t} = \frac{z_{2,t}-z^A}{z_{2,t}-\zeta_t}$. The ratio of the two probabilities is

$$\frac{p_{A,r,t}}{p_A} = \frac{z_{2,t}-z_{1,t}}{z_{2,t}-\zeta_t} = \frac{z_{2,t}-z_{1,t}}{z_{2,t}-z_{1,t}\left(\frac{(\tau_t-\lambda^D)\gamma+1-\tau_t}{1-\lambda^D}\right)} = \frac{\gamma-1}{\gamma-\left(\frac{(\tau_t-\lambda^D)\gamma+1-\tau_t}{1-\lambda^D}\right)}$$

$$= \frac{\gamma - 1}{\frac{\gamma(1-\lambda^D)-(\tau_t-\lambda^D)\gamma+1-\tau_t}{1-\lambda^D}} = \frac{\gamma - 1}{\frac{\gamma(1-\tau_t)+1-\tau_t}{1-\lambda^D}} = \frac{1-\lambda^D}{1-\tau_t},$$

which implies

$$\lambda^D = 1 - (1-\tau_t)\frac{p_{A,r,t}}{p_{A,t}}.$$

□

Proposition 7 (Identification of $\phi = \alpha + \beta$ and γ)**.** Let $\phi = \alpha + \beta$, and let $\mathbf{x}$ denote the instrument (such as LSQ) described in Assumption 5. Suppose there exists an interval of values for $\mathbf{x}$ where the probability of A ratings attainment conditional on $\mathbf{x}$ is strictly between 0 and 1. Let $\tilde{v}(\mathbf{x}) = \mathbb{E}[\ln V|\mathbf{x}]$, and let $p_A(\mathbf{x})$ denote the probability of becoming A rated conditional on $\mathbf{x}$. Let $\tilde{\gamma} = \frac{\gamma-1}{\gamma}$. Because $\tilde{v}(x)$ and $p_A(\mathbf{x})$ are both increasing, there exists a one-to-one relationship $\tilde{v}(p_A)$. Moreover, ϕ and γ are identified by

$$\phi = \left(\frac{\partial \tilde{v}}{\partial p_A}\right)^2 / \frac{\partial^2 \tilde{v}}{\partial p_A^2},$$

and

$$\tilde{\gamma} = \frac{1}{\frac{\partial \tilde{v}}{\partial p_A} / \frac{\partial^2 \tilde{v}}{\partial p_A^2} + p_A}$$

Proof of Proposition 7. Consider net present earnings for a new worker, $V = V(z_1, z_2)$. By the previous homogeneity results, we know that $V = z_2^{\phi} V(\frac{z_1}{z_2}, 1) = z_2^{\phi} V(\gamma, 1)$, where the initial value of z_2 is a random variable. Taking logs, letting $k_1 = \ln V(\gamma, 1)$, and applying Assumption 5, we have

$$\ln V = k_1 + \phi \ln z_2 = k + \phi\left(g(\mathbf{x}) + \epsilon\right).$$

Taking expectations yields

$$\tilde{v}(\mathbf{x}) = \tilde{v}_0 + \phi g(\mathbf{x}). \tag{8}$$

Now I will show how to map $\mathbf{E}[\ln z_2|\mathbf{x}]$ into the $p_A(\mathbf{x})$. Assuming that a lawyer obtains an A rating if and only if her talent is above some constant threshold Z_A, then according to Assumption 5, and assuming that z_A is inside of $[z_1, z_2]$ with probability 1, the probability of receiving an A rating conditional on $\mathbf{x}$ is given by

$$
\begin{aligned}
p_A(\mathbf{x}) = Pr(z > z_A|\mathbf{x}) = \mathbb{E}_{z_1,z_2}\left[\frac{z_2 - z_A}{z_2 - z_1}|\mathbf{x}\right] &= \mathbb{E}_{z_1,z_2}\left[\frac{\gamma z_2 - \gamma z_A}{(\gamma-1)z_2}|\mathbf{x}\right] \\
&= \mathbb{E}_{z_1,z_2}\left[\frac{\gamma \exp\left(g(\mathbf{x})+\epsilon\right) - \gamma z_A}{(\gamma-1)\exp\left(g(\mathbf{x}_j)+\epsilon\right)}|\mathbf{x}\right] \\
&= \frac{\gamma}{\gamma-1}\frac{e^{g(\mathbf{x})} - z_A \mathbb{E}_{z_1,z_2}\left[e^{-\epsilon}|\mathbf{x}\right]}{e^{g(\mathbf{x})}} \\
&= \frac{\gamma}{\gamma-1}\left(1 - k_2 e^{-g(\mathbf{x})}\right),
\end{aligned} \tag{9}
$$

where the constant k_2 equals $z_A \mathbb{E}\left[e^{-\epsilon}\right]$. Solving for $g(\mathbf{x})$, we have

$$
g(\mathbf{x}) = \ln k_2 - \ln\left(1 - \frac{\gamma-1}{\gamma}p_A(\mathbf{x})\right).
$$

Plugging this in to Equation 10, and letting the constant $\tilde{v}_0$ equal $k_1 + \phi \ln k_2$, we have

$$
\tilde{v}(\mathbf{x}) = \tilde{v}_0 - \phi \ln\left(1 - \frac{\gamma-1}{\gamma}p_A(\mathbf{x})\right). \tag{10}
$$

Let $\tilde{\gamma} = \frac{\gamma-1}{\gamma}$. Taking derivatives of $\tilde{v}(\mathbf{x})$ yields

$$
\frac{\partial \tilde{v}}{\partial p_A} = \phi \frac{\tilde{\gamma}}{1 - \tilde{\gamma} p_A(\mathbf{x})},
$$

and

$$
\frac{\partial^2 \tilde{v}}{\partial p_A^2} = \phi \frac{\tilde{\gamma}^2}{(1 - \tilde{\gamma} p_A(\mathbf{x}))^2}.
$$

It is now clear how the algebraic manipulations in Equation 10 identify ϕ and γ.

□

Proof of Proposition 8. First, take the current incumbent firm and resumé of a first-year worker exogenous. In this case, the poaching rate is clearly increasing in α, because the mismatch between the marginally retained worker and the incumbent firm becomes relatively more expensive. Given the increased poaching rate, the worker's resumé, conditional on being retained, will improve by a higher margin than before, widening the difference between the incumbent firm, and the firm that she would optimally choose to match with if unattached with the same resumé.

Thus, if the worker's initial placement stayed the same, she would become relatively more under-placed in all future states of the world where she was still at her initial employer. Hence, the increase in α favors higher initial placement, which also causes turnover to increase. $\square$

A.2 Scoring schools and ranking firms

In order to study the mobility of workers through the ranks, I must rank firms. I rank firms according to a simple principal: higher-ranking firms hire better-credentialed lawyers, and better-credentialed lawyers tend to have gone to better law schools. Thus, enodogenous sorting patterns reveal exogenous technological differences. My procedure has two steps: (1) construct a cardinal measure of law school quality, and (2) rank individuals based on the law school quality of their colleagues. A Harvard graduate surrounded by alumni from no-name schools is assumed to probably be at a low-ranking firm, and a no-name alum surrounded by Harvard graduates is assumed to be at a high-ranking firm. Thus, graduates of bad schools can work at good firms, but they are assumed to be the exception rather than the rule.

Things that I do not control for, but could, include the individual's entire career history and legal ability ratings. Things that I cannot control for include an individual's performance in law school and public case outcomes. These things are no doubt important—in fact, a somewhat obscure Wisconsin Survey of lawyers conducted in 1932 matched the tax returns to the within-cohort academic ranks of 600 graduates of the University of Wisconsin Law School (graduating in years 1914-1932). The study found that higher academic rank was highly predictive of eventual income.[50]

Scoring schools. The first step of the procedure scores law schools based on two measures of the success of their alumni. I use two cardinal outcomes. The first measure is the share of alumni obtaining the (highest possible) A MH rating. The second measure is the average alum's MH net worth estimate.[51]

For both A ratings and rent, I need to adjust for differences in location and age. More populated areas are more competitive for ratings, have higher priced real estate, and could disproportionately attract certain law school alumni. Older individuals have had a longer time to build the credentials required for an A rating, may have different demand for housing based on family structure, and may come disproportionately from older law schools. Thus, the A ratings and rent-based measures are constructed as law school fixed effects in a statistical decomposition of each outcome after controlling for a polynomial

[50]See Lloyd K. Garrison (1938), pages 55-56.

[51]I also considered using expenditures on rent and housing using 1940 Census data. Average expenditure was mostly proportional to average net worth. In cases when it was not, it appeared likely to be driven by certain law schools disproportionately feeding into more or less expensive housing markets.

in age and market size. Since these observations all come from 1940, there is no need to account for temporal differences. For net worth, I need to adjust for secular increases in incomes across the sample period, and for the fact that older individuals have had more time to accumulate wealth.

Thus, I statistically decompose each outcome into a law school fixed effect after controlling for the aforementioned factors. To control for secular trends, I include a quadratic polynomial in calendar year. To control for market size, I include a quadratic polynomial in the log number of locally practicing lawyers. To control for age, I include a quadratic polynomial in age.

The net worth measure is based on a set of eight nominal intervals (see Figure 15 for an example and note that the intervals expand with inflation). I take the midpoint of the interval, deflate using the annual consumer price index, and apply a log transformation.

The sample used to construct each measure is every lawyer-year observation for lawyers currently aged 45-55.[52] The age restriction is designed to prevent newer schools with younger alumni from being unduly penalized.

In addition to these two cardinal measures, I obtained ordinal tiers of law schools from Arewa et al. (2014) in order to provide some external validation. The authors' goal is to establish a classification of school *eliteness* that captures persistent differences in schools with a focus on the middle of the 20th century. They provide seven categories on page 68, and I have added two more categories: one for schools that were too small to be listed in their study, and one for lawyers who reported no school in the MH data.[53] Figure 14 plots log net worth against A ratings, color-coded by the 9 external tiers. The measures are both highly consistent with the external rankings, and seem to complement each other quite well.[54]

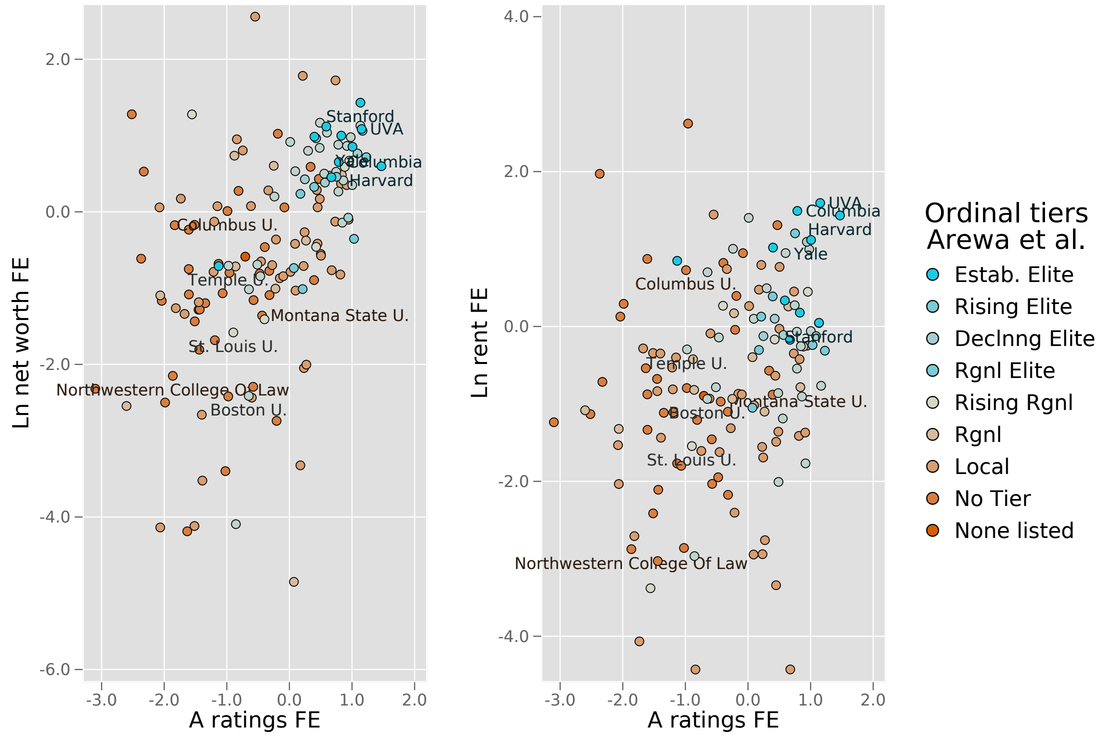
Net worth ratings do a very good job of separating the lower half of schools. However, net worths are topcoded and only available for lawyers in smaller cities and towns, so it unsurprisingly does a poor job of separating the top half of schools from each other. Where this measure fails, A ratings succeed. Only about a fifth of lawyers receive an A-rating, so the share of A-ratings essentially captures how many stars a school produces. This is where top schools like Harvard outperform good schools like the University of

[52]As opposed to having one observation per career, this sampling frame allows the *speed* at which lawyers obtain A ratings, which varies considerably, to also influence a school's score.

[53]By the 1930s, firms would seldom consider hiring lawyers who had not attended law school, despite the fact that their own senior partners had often not gone to law school themselves, because it had not been considered essential at the time that they began practicing.

[54]The main exception to this is New York University (NYU), a school with average scores on both measures that Arewa et al. (2014) put in their top tier. They explicitly mention NYU as being a unique case whose placement in the top tier is based more on its recent performance (see footnote 331 on page 68)

Figure 14: Cardinal measures of law school quality



Minnesota. I produce a final score for law school quality, *LSQ*, by normalizing each measure into a *Z*-score and taking a simple average.

Ranking firms. With the *LSQ* measure in hand, the second step of the procedure forms an index of colleagues' characteristics based on how they predict an individual's own *LSQ*. The *LSQ* of a lawyer's colleagues is a very strong predictor of their own *LSQ*, having a raw correlation of about 0.665, so an obvious starting place is to condition on this variable. My goal is to estimate an equation of the following form.

$$\tilde{\theta}_{i,f,t} = E[LSQ_i|\mathbf{x}_{i,f,t}] = f(\mathbf{x}_{i,f,t})$$

The index $f(\mathbf{x}_{i,f,t})$ is the basis for ranking firms. The simplest possible method would be to assume that $f(\mathbf{x}_{i,f,t})$ is simply an affine function of colleagues' mean *LSQ*. At the other end of the spectrum, I could incorporate an arbitrary set of characteristics in $\mathbf{x}_{i,f,t}$ and estimate this function non-parametrically. I view this latter method as ideal, but for now I simply choose a relatively small set of characteristics and estimate $f(\cdot)$ as a fully-interacted second-order polynomial. The characteristics $\mathbf{x}_{i,f,t}$ include the number of colleagues, their average law school quality, their average tenure within the firm, their average experience, the share that are A rated, and the population size of the location.[55] Each lawyer's raw index is then transformed into a ranking among all other lawyers working at firms in the same year.

Estimated firm ranks are powerful predictors of career success. I consider three outcomes: log rent, log net worth, and whether a lawyer ever obtains an A rating. All three outcomes are strongly predicted by firm rank, conditional on a lawyer's own LSQ, as shown in Table 6.

Table 6: Career success vs. firm rank

	Ln 1940 rent	Receives A-rating	Ln net worth
Firm rank	0.347***	0.224***	0.319***
	(0.0154)	(0.00825)	(0.0128)
LSQ	0.107***	0.119***	0.243***
	(0.00648)	(0.00350)	(0.00510)
Mean dep. var.	3.884	.359	12.752
Mkt. size ctrls.	YES	YES	YES
Age ctrls.	YES	YES	YES
Time ctrls.	N/A	YES	YES
N	29,383	45,164	90,417
R^2	0.187	0.083	0.122

Mkt. size, age, and year controls each contain quadratic polynom.
Robust std. errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

$$r_{i,f,t} = \frac{1}{N_f} \sum_{j=1}^{N_t} \mathbf{1} \left(L\hat{S}Q_{j,f,t} < L\hat{S}Q_{i,f,t} \right) \tag{11}$$

Because individuals in the same firm technically have different colleagues, they will often be measured as having different ranks. Although mildly counterintuitive, this is a small price to pay in order to avoid the mechanical biases that would arise from including an individual's *own* information in the measurement of their firm's rank.

The estimated firm ranks appear to correlate meaningfully with measures of success other than law school. Conditional on your own law school, working at a higher-ranking firm has large positive effects on predicted home-values, net worth estimates, ability ratings, and predicted wages (conditional on being a wage earner). My interpretation of these facts is not that being at a higher ranked firm *causes* you to succeed, but rather that

[55] I must be careful with using locational characteristics for ranking firms because in a latter section I will compare mobility across locations. In that section, I will work with location-specific ranks, but in this section, I allow some locations to be "better" than others, ceteris paribus.

higher-ranking firms select on other correlates of talent besides law school, which are ultimately reflected in these outcomes.

A.3 MH Confidential Key

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Figure 15: Martindale-Hubbell's confidential key (1931 edition)

CONFIDENTIAL KEY

to

The Martindale-Hubbell Law Directory

Numerals immediately following name indicate years of birth and admission.

Estimate of Legal Ability

NOTE—No arbitrary rule for determining legal ability can be formulated. Ratings are based upon the standard of ability for the place where the lawyer practices. Age, practical experience, class of practice, with other necessary qualifications are considered; reports are obtained through various channels and we endeavor to reflect the consensus of reliable opinion.

To qualify for "a", lawyers must be reported "very high" and have been practicing not less than ten years. To qualify for "b", lawyers must be reported "high" and have been practicing not less than five years. A lawyer reported "very high" and in practice more than five years but not long enough to qualify for "a" is rated "b".

"a", very high; "b", high; "c", fair.

Recommendations

NOTE—Nothing derogatory should be inferred from absence of rating. "v", very high.

Estimated Worth

NOTE—It is often difficult to get reliable estimates, therefore the ratings given must be considered as approximations only.

1 estimated over $100,000				5	estimated	from	$10,000 to	$20,000
2 "	from	50,000 to	$100,000	6	"	"	5,000 to	10,000
3 "	"	30,000 to	50,000	7	"	"	2,000 to	5,000
4 "	"	20,000 to	30,000	8	"	"	1,000 to	2,000

9, estimated less than $1,000

Rating for Promptness in Paying Bills

"g", good; "f", fair; "m", medium.

An asterisk (*) following the name of place indicates a County Seat.

"§" does not want collections.

"‡" not in general practice. This includes those engaged chiefly in other occupations than that of law, those retired, and those not in active practice.

"⊙" This character indicates that the lawyer after whose name it appears is listed at more than one point.

NOTE—Absence of rating characters (whether indicated by blank space or dash "—") should not in any case be construed as derogatory to anyone. This may mean that sufficient information was not obtainable up to time of going to press. Also, in some places we do not publish complete ratings or rate all who are worthy.

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