Exploration for Human Capital: Theory and Evidence from the MBA Labor Market*

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Abstract

Drawing on insights from corporate finance and personnel economics, we show that firms consider potential employees using a real options approach, much as they do when making other types of capital investment decisions. Theoretically we find that firms' hiring decisions are influenced by the uncertainty in workers' productivity, competition in the labor market, adjustment costs, and redeployability concerns. Firms value probationary employment arrangements that provide the option to learn about the productivity of potential hires before permanent investment occurs. Higher uncertainty and adjustment costs hinder permanent investment and increase the value of the option to learn. Greater competition for workers speeds up firm investment and increases the value of probationary employment. Higher worker redeployability leads to more investment, if firms face low competition. We test and confirm these predictions empirically using a novel dataset with detailed recruiting information from the labor market for MBA graduates.

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1 Introduction

As the value of skill has risen in the developed economy over time, many firms rely on finding and developing the right people to remain competitively viable. But how do firms invest in human capital? In many ways, the decision to invest in people is similar to the decision to invest in physical assets.[1] Uncertainty about the profit generated by the investment, as well as competition, adjustment costs, and redeployability concerns are likely to influence which workers firms hire. All of these factors are important for the firms' decision to make investments in physical capital, due to their real options features (e.g., delay, expand, or abandon), as shown by a large literature in corporate finance and macroeconomics (Dixit and Pindyck (1994), Trigeorgis (1996)). The goal of this paper is to investigate the effects of uncertainty, competition, adjustment costs, and redeployability in the context of human capital investments, and to compare these effects to those documented in the realm of physical capital investments.[2]

The novel contribution of our paper is to combine insights from the finance literature on real options and from the labor and personnel economics literature on employer-employee matching and job search to provide a theoretical and empirical analysis of the process by which firms select employees.[3] We derive a model of how firms value probationary or contingent employment arrangements which provide the "option to learn" about the productivity of potential hires. We model how a firm's willingness to take a chance on a worker responds to features previously studied in the context of real options of physical capital – uncertainty about productivity, turnover costs (the labor market equivalent of adjustment costs), redeployability across employers, and the competitiveness of the labor market faced by the firm.

[1] The term "Human Capital", coined by Schultz (1961), captures this idea and suggests that firms' choice of employees, as well as employee skills and knowledge, are the result of deliberate investment.

[2] While some attention has been paid to the real option of hiring workers in managerial practitioner papers (e.g., Foote and Folta (2002)), only a few economic papers have studied this issue (Lazear (1998) and Hendricks, DeBrock and Koenker (2003)).

[3] See Oyer and Schaefer (2011) for details about the successes and limitations of the economics literature on employer/employee matching. For empirical evidence on firm/worker matching focused on senior executives, see Bandiera, Guiso, Prat and Sadun (2010) and Graham, Harvey and Puri (2010). They show that firms that offer stronger incentives employ managers who are more risk tolerant and more talented, and that managerial characteristics such as risk aversion match these firms' project types. Kaplan, Klebanov and Sorensen (forthcoming) document that personality characteristics influence firms' choice of executives and correlate with performance.

We then test the model using a novel data from the market for fresh MBA graduates.[4]

We first show theoretically that firms value probationary employment arrangements that provide the option to learn about the productivity of potential hires before permanent investment occurs. Higher uncertainty and adjustment costs hinder permanent investment and increase the value of the option to learn. More competition for workers speeds up firm investment and increases the value of probationary employment, while greater worker redeployability leads to more investment if firms face low competition.

We then test these predictions empirically using a novel dataset with detailed recruiting information from the labor market for MBA graduates, and find general support for the model. Not surprisingly, we find that all firms prefer to hire students with high general ability and experience in their industry. We also show that a large fraction of job applicants have unknown industry fit, which creates uncertainty regarding their future productivity. We document that employers highly value the option to learn information about candidates lacking industry experience by making significant use of cheap probationary employment – namely, summer intern positions after the students' first year in the MBA program. The interest in exploring workers with unknown fit is significantly higher at the internship recruiting stage, relative to the full-time recruiting stage which occurs in the students' second year of MBA study. This is particularly true for firms characterized by high turnover costs, such as small companies. Higher competition increases the number of job offers that firms make at the internship stage relative to the full-time stage, increasing the importance of probationary employment as a channel for investment in human capital. Finally, we document that firms facing less competition for workers, such as prestigious corporations, are more likely to invest in more redeployable workers. Specifically, these firms focus more on applicants with high general ability as measured by their GPA for both probationary and permanent jobs.

The model and our empirical results highlight important similarities between options to invest in human and physical capital, as well as critical differences. Both people and physical capital are inputs into the firms' production function, and are associated with generating revenues and incurring expenses. It is therefore natural to expect that for both types of

[4]Data on MBA graduates has recently been used in other finance research. For example, Shue (2011) finds that networking through MBA education leads executives to exhibit commonalities in firm policies. Sapienza, Maestripieri and Zingales (2009) show that MBA students low in risk aversion are more likely to work in higher risk finance jobs after graduation, while Kaniel, Massey and Robinson (2010) find that optimistic MBA students receive job offers faster than their peers.

assets, uncertainty about the cash flows they will produce, the costs of changing strategies upon the revelation of new information about productivity, and the competitiveness of the market in which the firm operates will be critical determinants for the decision to invest. Theoretical work regarding physical capital investment decisions proves that it is valuable for firms to wait and learn more about future product market conditions before starting or abandoning a project (Brennan and Schwartz (1985), Titman (1985) and McDonald and Siegel (1986)). The option to wait for the resolution of uncertainty is more valuable for investments with a higher degree of irreversibility, which may come from higher capital adjustment costs or a lower degree of asset redeployability, and for firms operating in less competitive markets (Caballero (1991), Williams (1993), Grenadier (2002)). These predictions have been verified empirically in the context of real estate valuation and development (Quigg (1993), Cunningham (2007), Bulan, Mayer and Somerville (2009)), offshore petroleum lease acquisitions (Paddock, Siegel and Smith (1988)), mining operations (Moel and Tufano (2002)), and manufacturing (Guiso and Parigi (1999)).

However, human and physical capital differ in important ways that call into question the relevance of the results documented regarding physical investments when trying to understand the firms' decision to invest in human capital. First, the nature of uncertainty in the two contexts is different. Typically, the source of uncertainty about physical capital investments comes from future demand in the product market. For example, an oil exploration firm is concerned with whether future oil prices will be high or low, and may want to wait for less uncertain times before incurring the exploration costs. Therefore, variability in such settings has an intertemporal nature.

In human capital investments, concerns about uncertainty regarding product market demand may be of lesser importance relative to concerns about the inherent heterogeneity of human capital. No potential employee has a perfect substitute and each employee's scale is limited, so firms cannot buy more of the same human capital input or know for sure what they are. This leads us to focus more on the "option to learn" as the firm determines the value of the asset (that is, employee) over time rather than on the "option to wait" for information revelation in the product market.[5] Lazear (1998) also considers the option to

[5]Kahn and Lange (2011) point out another part of employee heterogeneity that is more analogous to the "option to wait" in real option models of physical capital by considering the fact that workers' productivity is constantly changing and that these changes differ across people. This suggests that firms might value both the "option to learn" and the "option to wait" on employees as they do other assets (see Grenadier

learn in a labor market context, stating conditions under which hiring risky workers can be a profit-maximizing strategy for firms. Given the institutional context we study empirically, our approach differs from Lazear (1998) in a few key ways. We allow for more flexible industry-specific and firm-specific productivity, and, in our model, wages do not vary across firms. Our data and these refinements to the model allow us to address the comment by Oyer and Schaefer (2011) that there is scarce work examining across-firm variation in propensity to hire risky workers, or whether the observed variation fits with Lazear's theory.

Second, the nature of competition may be different. The real options literature concerning physical capital has focused mostly on competition for output in the product market (e.g., Grenadier (2002)) and its implication for the timing of investment in the face of uncertainty. A notable exception is Abel, Dixit, Eberly and Pindyck (1996), who suggest that variation in the market value of the inputs deployed in production should also be a determinant of the timing and size of corporate investment. Arguably, in the case of human capital investment, considerations regarding the competition for inputs (i.e., the workers themselves) are critical.

Third, the nature of the asset's redeployability is different in the two contexts. For physical capital investments, higher asset redeployability lessens the irreversibility of the investment and the importance of resolving uncertainty for the timing of projects, as the loss incurred when the capital stock is sold or adjusted is lower (e.g., Guiso and Parigi (1999)). In the context of human capital investments, high redeployability (or lower specificity) of a potential worker is equivalent to this individual having more generally applicable skills, which can be deployed elsewhere without any compensation (or recouping of investment costs) for the current employer. Hence firms in competitive environments characterized by some uncertainty in the profit function and capital adjustment costs may delay investing in workers characterized by high redeployability, and at the same time may speed up investing in highly redeployable physical assets.

Finally, capital adjustment costs are likely to influence physical and human capital investment decisions in similar ways, as in both settings they capture the idea that it is costly to scale up and scale down the capital stock (or hire and fire people) because of frictions in asset or labor markets. Therefore, high capital adjustment costs, which are typically referred to as turnover costs in the case of human capital, may slow down investment in the presence

and Malenko (2010)), so that they can see how a given worker's productivity develops. However, because our empirical analysis focuses on the initial firm/worker match, we cannot analyze this form of option value.

of uncertainty.

These similarities and differences in real options considerations regarding physical and human assets are captured by our model and empirical findings. In line with results from the physical investments literature, we show that uncertainty and adjustment costs hinder permanent investment and increase the value of the option to learn about worker productivity. Different from implications from the physical investments literature, we find that higher competition for human capital increases the value of probationary employment arrangements as a channel for hiring. Higher redeployability of human capital leads to more investment only if firms face low competition for workers.

Probationary or temporary employment arrangements similar to the summer interships we consider are widespread and continue to gain importance. This type of employment has been shown to be a stepping stone to permanent employment, accounting for a significant percentage of jobs across the world: for example, 10% in the U.K. (Booth, Francesconi and Frank (2002)) and 35% in Spain (Guell and Petrongolo (2007)). Using U.S. survey data, Houseman (2001) reports that temporary and part-time workers are employed by 46% and 72% of business establishments, respectively. While providing firms with flexibility to weather changes in the economic environment (Segan and Sullivan (1997), Levin (2002)) (i.e., providing the "option to wait"), temporary and contract employment is also valued for offering firms the option to learn about the quality of workers. In the U.S. survey sample constructed by Houseman (2001), 21% of employers using temporary workers from agencies and 15% using part-time workers cited screening as an important reason for using these types of work arrangements. Also illustrating the value of the firms' option to learn about worker productivity, Guell and Petrongolo (2007) find that Spanish workers with better outside options are better at converting temporary work arrangements into permanent positions.

Getting a better understanding of the matching process in high-skill environments such as the one studied here is important, given the increasing prevalence of graduate degrees and the significant role of high-skill and professional labor markets in the economy. The process of matching firms and employees early in their career is also particularly interesting to study, in light of the strong impact of these initial matches on long-term employment and productivity (Oyer (2008)). Given the anecdotal suggestions of a recent renewal of the "War for Talent", our model and empirical results provide some guidance on what employers are searching for in at least one high-talent market.[6]

Our paper builds on and contributes to work in other areas of labor economics and finance. For example, we build on the matching model of Jovanovic (1979), as we allow idiosyncratic fit to affect the efficient matching of firms to workers. The positive assortative matching between firms and workers that we obtain here is in the spirit of predictions in Gabaix and Landier (2008) and Tervio (2008), who model the matching of CEOs to firms and its implications for output and wages. In our setting, where wages are assumed to be standardized, this result is driven by the fact that more prestigious firms have better odds of having their offers accepted by high ability job candidates, and not because these firms offer higher wages to more productive workers. The specifics of the labor market learning process we consider during summer internships has many of the features of the learning model in Farber and Gibbons (1996). However, in our context, wages do not adjust to match expected productivity so we cannot make predictions about the relationship between wages and other variables. Like Farber and Gibbons (1996), all learning in our model is public information. Firms choose employees based partially on their match-specific productivity (or preferences). This gives incumbent firms some of the advantages enjoyed by firms with an informational advantage in models such as Waldman (1984) and Greenwald (1986). It also leads to an "unraveling" effect where the average quality of available employees is higher in the summer internship phase than in the permanent hiring phase.

Our paper also complements the emerging finance literature regarding the role of workers on corporate decisions and outcomes. For example, the firms' workforce characteristics have been shown to influence capital structure choices, theoretically and empirically (e.g., Berk, Stanton and Zechner (2010), Agrawal and Matsa (2011)), as well as the cost of capital (Eisfeldt and Papanikolaou (forthcoming)). The acquisition of productive labor, not just physical assets, is an important driver of M&A decisions (Ouimet and Zarutskie (2011)).

We present a simple model of hiring in the MBA labor market in the next section of the paper. We describe the dataset in Section 3. Section 4 contains the empirical analysis, as well as a discussion of its limitations. Section 5 concludes.

[6]The business press and blogs are full of talk of a reviving war for talent as we write this. According to the PricewaterhouseCoopers' 2011 Annual Global CEO survey, "Talent tops the CEO agenda for 2011, across all regions." (http://www.pwc.com/gx/en/ceo-survey/talent-search.jhtml). Numerous recent articles have detailed hiring battles for new graduates between Facebook, Google, and other technology companies. See, for example, "Google Battles to Keep Talent," by Amir Efrati and Pui-Wing Tam, *Wall Street Journal*, November 11, 2010.

2 A Stylized Model of Hiring

2.1 Setup

In this section, we develop a simple model of hiring. The model captures many of the general hiring and matching challenges firms face, but is adapted to the MBA context which we will study empirically.

We assume that productivity is a function of three factors – an individual's general ability (skills that are equally useful to multiple employers), industry-specific skills, and a match quality idiosyncratic to a given firm/worker pair. Our model focuses on a single firm's actions, at each of two stages of the hiring process: a try-out (i.e., internship recruiting) stage and a permanent employment (i.e., full-time recruiting) stage.

Each person has either high general ability ($H = 1$) or low general ability ($H = 0$). This is public information (known to potential employers of MBA students through grades, GMAT scores, etc.) For a given firm, the fraction of applicants with $H = 1$ in the initial stage applicant pool is given by $\phi_{a,1}$.

Each potential new hire is either a good match for the firm's industry ($M = 1$) or a bad match ($M = 0$).[7] M is not known until the person works in the industry but it becomes publicly known with certainty once he works there. Let ϕ_b represent the fraction of a given firm's applicant pool, conditional on not having previous experience in the firm's industry, with $M = 1$. We assume that all applicants who do have industry experience have $M = 1$. That is, if a person is a bad match for an industry, she will never apply to work there (either because she understands it is not her best option or because she knows firms will not make her an offer.) This insures that, even if a person is an excellent fit for a specific firm, she will not want to work for that firm if she is a bad fit for the firm's industry.

Before hiring (from the interviewing and reference processes), the firm learns each potential worker's match-specific productivity, ϵ, which is distributed uniformly from $-\sigma$ to σ with distribution $f(\epsilon) = \frac{1}{2\sigma}$ and CDF $F(\epsilon) = \frac{\epsilon+\sigma}{2\sigma}$. Modeling in detail the process by which the employer learns about match productivity is not particularly interesting in our case because

[7] We focus on the value of the match between a worker and an industry early in a career. However, this could also be interpreted as industry-specific human capital that builds very quickly. While most of the prior work on worker/industry matching has focused on specific human capital built up throughout longer careers (see, for example, Neal (1995) and Parent (2000)), see Oyer (2008) for evidence consistent with workers such as the ones we study accumulating industry-specific capital rapidly.

it takes place before the firm or worker make a commitment. While this match value is an important determinant of where the person ultimately works, the option value in our model derives from the fact that a new worker may or may not turn out to be a good fit for the industry as a whole.

Productivity Y is an additive function of these three factors. Specifically, $Y = \alpha I_{\{H=1\}} + \beta I_{\{M=1\}} + \varepsilon$. We make two assumptions that are critical to our results and not necessarily intuitive. We will justify both empirically. First, each firm offers a single wage to all new hires. Second, low ability candidates ($H = 0$) accept job offers with probability 1, while high ability candidates accept offers with probability $p < 1$. The first assumption implies that firms only have to be concerned about maximizing "Y". This is a strong assumption in that it precludes the labor market clearing through wage competition. We can justify this assumption in our context, however, because employers of MBAs generally offer the same wage to all new MBA hires. As we show below, in our data there is no relationship between starting wages and any measures of individual ability (grades, test scores, age, etc.) once we control for employer and job fixed effects. The second assumption captures the idea that high ability candidates have better (and more) opportunities than low ability ones, and hence are less likely to accept a particular offer.

Let s_1 represent the fraction of first year applicants who have experience in the industry and s_2 represent the fraction of second year applicants who have experience in the industry. Let $\phi_{a,2}$ represent the fraction of second year applicants with $H = 1$. We will solve for $\phi_{a,2}$ based on the expected outcomes after the first period. Note that ϕ_b (i.e., the probability that a person without industry experience will be revealed to have good industry fit, that is, $M = 1$) does not vary across the two periods because it is a probability that is constant across all workers.

The model plays out according to the following timeline:

- The firm screens one summer intern candidate at random from among applicants.
- After the interview, the firm makes the person an offer at a fixed cost of δ or chooses not to. If the person is made an offer, he/she accepts if $H = 0$ and accepts with probability p if $H = 1$.
- If the person is offered the job and accepts, the firm learns the value of M (if the person has no industry experience) over the course of the summer and then either

offers a permanent job or doesn't. If the person is made an offer at the end of the summer, he/she accepts.

- If the firm does not make a permanent offer to a summer intern, it can screen one second year applicant.

- After the interview, the firm makes the person an offer at a fixed cost of λ or chooses not to.

- If the person is offered the job, he accepts if $H = 0$ and accepts with probability p if $H = 1$.

- If the person is found to have $M = 0$ after being hired for the full-time position, he quits and/or is fired, leading to a replacement cost of η.

- If the firm ends up hiring no worker for the full-time position, its profits are zero.

2.2 Real Options

In our model firms value general ability H and industry fit M, as well as idiosyncratic fit ε. Firms also have the option to explore an asset (i.e., candidate) at little cost, learn about industry fit, and later "abandon" the asset if it proves to be less valuable than other available candidates.

In fact, in our setup firms are provided with real options twice. First, during internship recruiting, a firm is given (at a cost of δ) the option to explore a worker during temporary employment, and keep him in a permanent position only if his contribution to firm output turns out to be better than what the firm can expect to get by hiring somebody else at that point in time (which we will define and refer to as $\overline{Y}$ below). The firm can exercise the option to abandon at no cost, as firing an intern is free.

Second, during full-time recruiting, the firm is given (at a cost of λ) the option to offer a full-time job to a candidate, but only keep him in that position if his contribution to the firm's output is above some threshold (given by the firing cost η), which we assume only happens if $M = 1$. To exercise the option to abandon (i.e., to fire a candidate with a low enough value), the firm must pay a cost $\eta > 0$. Firing a full-time employee is costlier, or more time and resource consuming, than firing an intern.

Both of these options have payoffs similar to those of a call option. Specifically, the firm benefits from the upside (i.e., if the candidate's value turns out to be high), but is protected on the downside (i.e., if the candidate's value turns out to be low, which happens if the industry fit M is revealed to be zero).

For both of these options, the underlying asset is the candidate's contribution to the firm's output, namely $Y = \alpha I_{\{H=1\}} + \beta I_{\{M=1\}} + \varepsilon$, of which H and ε are known ex-ante. The uncertainty in the value of the underlying asset is therefore only given by the uncertainty in M. For industry stayers, this uncertainty is zero, since we assume $M = 1$ for these individuals. For industry switchers, the uncertainty in M depends on $\phi_b = Prob\{M = 1|industry\ switcher\}$ and is given by $var(M|industryswitcher) = \phi_b(1-\phi_b)$.

From basic option theory we know that the value of a call option increases with the current value and variance of the underlying asset and that it decreases with the strike price. Hence, in our setting, the value of having the option to explore and later abandon a particular candidate increases (all else equal) with the firm's current expectation of this candidate's Y (e.g., it increases in the person's H and ε) and with $var(M|industryswitcher) = \phi_b(1-\phi_b)$. It decreases in $\overline{Y}$ for internship recruiting and in η for full-time recruiting.

Notably, in this setting the strike price for the internship stage option, i.e. $\overline{Y}$, is endogenous since it depends on how firms make internship offers in the first place, which will influence the composition and quality of the pool of candidates available at the full-time recruiting stage. Furthermore, $\overline{Y}$ also depends on how good candidates turn out to be in terms of industry fit by the end of the internship, which is determined by ϕ_b. Hence, in this model, the parameter ϕ_b influences two things: the uncertainty in the underlying asset considered by a firm (i.e., the candidate the firm is thinking of making an internship offer to), and the value of the alternative action, which is to hire at the full-time stage (i.e., the value of $\overline{Y}$). Therefore, the effect of ϕ_b on the value of the option to "explore and abandon" at the internship stage is not straightforward, since ϕ_b has effects on this option's strike price and on the variance of the underlying asset.

Note here that the costs of acquiring these real options of exploring workers (i.e., δ for internship hiring, and λ for full-time hiring) are not "market prices" of these call options. They are just fixed costs that firms need to pay to be able to explore (and later perhaps abandon) investment opportunities in the realm of human capital.

2.3 Implications

The fact that termination is costly at the full-time recruiting stage, but costless at the internship stage leads to the following result:

Implication I. *Firms value probationary employment arrangements that provide the option to learn about the productivity of potential hires before permanent investment occurs.*

To understand the drivers of the value of this option to learn and the patterns in investment decisions it generates, we need to determine the firm's strategy. We do so through backwards induction and start by considering the firm's choices when hiring for full-time positions. The applicant can be any of four types – a high ability switcher, a low ability switcher, a high ability stayer, or a low ability stayer. The firm will hire the applicant if $E[Y] > 0$. So it hires workers of each type as follows:

- If the applicant is a high ability switcher, make an offer to him/her if: $p\phi_b(\alpha+\beta+\varepsilon) - \lambda - p(1-\phi_b)\eta > 0$. This condition will hold with probability $\frac{1}{2\sigma}(\sigma+\alpha+\beta-\frac{\lambda+p(1-\phi_b)\eta}{p\phi_b})$.
- If applicant is a low ability switcher, make an offer if: $\phi_b(\beta+\varepsilon) - \lambda - (1-\phi_b)\eta > 0$. This condition will hold with probability $\frac{1}{2\sigma}(\sigma+\beta-\frac{\lambda+(1-\phi_b)\eta}{\phi_b})$.
- If high ability stayer, make an offer if: $p(\alpha+\beta+\varepsilon) - \lambda > 0$. This condition will hold with probability $\frac{1}{2\sigma}(\sigma+\alpha+\beta-\frac{\lambda}{p})$.
- If low ability stayer, make an offer if: $\beta+\varepsilon-\lambda > 0$. This condition will hold with probability $\frac{1}{2\sigma}(\sigma+\beta-\lambda)$.

The probability of getting an offer is higher for a random high ability stayer than a random high ability switcher because, for a given ϵ, the high ability stayer has higher expected productivity. Similarly, the probability of getting an offer is greater for low ability stayers than low ability switchers. Together, these two comparisons suggest, not surprisingly, that the probability of getting an offer will be higher for candidates with industry experience (for whom we assume $M = 1$ with certainty).

The firm could actually be more likely to hire a random low ability stayer than a random high ability stayer if high ability workers' acceptance rates are sufficiently low. Specifically, the probability that a random high ability stayer gets an offer is greater than the probability that a low ability stayer gets an offer if $p > \frac{\lambda}{\lambda+\alpha}$. The probability of an offer to a high ability switcher will be greater than that for a low ability switcher if $p > \frac{\lambda}{\lambda+\alpha\phi_b}$. So, as long as p is high enough, the probability of getting an offer will be increasing in H. Therefore, during full-time recruiting, firms will be more likely to make offers to candidates who are proven industry fits (i.e., industry stayers, for whom $M = 1$) and, as long as their acceptance rate p is high enough, to candidates of high general ability ($H = 1$).

Now consider how the preference for stayers relative to switchers is affected by the other parameters. Specifically, manipulating the four conditions above, we find that:

$Prob$(High ability stayer gets full-time offer) - $Prob$(High ability switcher gets full-time offer)$=\frac{1}{2\sigma}(\frac{1}{\phi_b} - 1)(\eta + \frac{\lambda}{p})$ and

$Prob$(Low ability stayer gets full-time offer) - $Prob$(Low ability switcher gets full-time offer)$=\frac{1}{2\sigma}(\frac{1}{\phi_b} - 1)(\eta + \lambda)$.

Both of these differences are decreasing in ϕ_b and increasing in η, while the high ability difference is decreasing in p. Therefore, at the full-time recruiting stage, firms'preference for industry stayers relative to switchers decreases with the probability that switchers have good industry fit ϕ_b and, if $\lambda > 0$ and $H = 1$, with firm prestige p, and increases with the turnover cost η. We therefore obtain the following:

Implication II. *Higher uncertainty (i.e., lower ϕ_b) and adjustment costs (η) hinder permanent investment and increase the value of the option to learn.*

Similarly, we can look at how the preference for high ability workers relative to low ability workers is affected by the same parameters. This preference is captured by the following equations:

$Prob$(High ability stayer gets full-time offer) - $Prob$(Low ability stayer gets full-time offer)$=\frac{1}{2\sigma}[\lambda(1 - \frac{1}{p}) + \alpha]$.

$Prob$(High ability switcher gets full-time offer) - $Prob$(Low ability switcher gets full-time offer)$=\frac{1}{2\sigma}[\frac{\lambda}{\phi_b}(1 - \frac{1}{p}) + \alpha]$.

Both of these differences are increasing with firm prestige p, if $\lambda > 0$, and productivity of general skill α. The switcher difference is decreasing in ϕ_b, if $\lambda > 0$.[8] Therefore, at the full-

[8]Note that the model has predictions about the effect of parameters p, ϕ_b, and η regarding two different quantities: how likely it is that an industry switcher gets an offer, and how much **more likely** it is that a switcher, relative to a stayer, gets an offer. This is an important distinction. For example (as will be clear below), at the Internship stage the **relative** likelihood of an offer to a switcher (compared to a stayer) increases in ϕ_b. However, the effect of ϕ_b on the likelihood that a switcher gets an offer is ambiguous because a high ϕ_b makes that particular switcher more appealing, but it also makes potential hires at the full-time stage ($\overline{Y}$) more appealing. This distinction between direct and relative effects on offer likelihood will have

time recruiting stage, firms' relative preference for high general ability candidates relative to low general ability candidates increases with the acceptance probability p if $\lambda > 0$, and with the productivity of general skill α. This relative preference decreases for industry switchers with the probability ϕ_b that an outsider will be a good fit, if $\lambda > 0$.

One other possible trade-off the firm could face is between the extra productivity brought by a high ability switcher and the assurance of a good industry match provided by a low ability stayer. The firm will make offers to more of the high ability switcher distribution than the low ability stayer distribution if $p > \frac{\lambda}{\phi_b(\lambda+\alpha+\eta)-\eta}$.

Also note that, because firms with higher p and α are more likely to focus on high ability candidates (and are at least as likely to get them to accept their offers), high ability candidates will disproportionately end up at these firms. This leads to positive assortative matching between firms and workers. But high ability candidates can end up at lower prestige firms (those with low p) if the idiosyncratic match (ε) is high enough.

Therefore, there will be positive assortative matching. High general ability workers will be relatively more likely to work for high prestige (p) or high productivity (α) firms. However, this matching will be imperfect, with some low general ability workers at high prestige and high productivity firms due to idiosyncratic matching (ε).

We can now model the firm's behavior when it hires summer interns. First, define $\overline{Y}$ to be the minimum $E[Y]$ to make an offer to the summer intern. This will be the expected value of a new hire from the second year pool less the costs of hiring the summer intern. If the expected value of the summer intern is not at least this high, the firm is better off waiting for a full-time applicant. $\overline{Y}$ is the average of each type of worker's value, weighted by the probability that the applicant will be each type, which is $Prob$(Applicant is low ability stayer) $* \, Prob(E[Y] > 0|$low ability stayer) $* \, E[Y|$low ability stayer with $E[Y] > 0] + Prob$(Applicant is low ability switcher) $* \, Prob(E[Y] > 0|$low ability switcher) $* \, E[Y|$low ability switcher with $E[Y] > 0] + Prob$(Applicant is high ability stayer) $* \, Prob(E[Y] > 0|$high ability stayer) $* \, E[Y|$high ability stayer with $E[Y] > 0] + Prob$(Applicant is high ability switcher) $* \, Prob(E[Y] > 0|$high ability switcher) $* \, E[Y|$high ability switcher with $E[Y] > 0]$. We can write this as:

$$\overline{Y} = \frac{(1-\phi_{a,2})}{4\sigma}\{s_2(\sigma+\beta-\lambda)^2 + (1-s_2)[\phi_b\sigma + \phi_b\beta - \lambda - (1-\phi_b)\eta]^2\}$$

important implications for what regressions we run to test each prediction.

$$+\frac{\phi_{a,2}}{4\sigma}\{s_2[p(\sigma+\alpha+\beta)-\lambda]^2+(1-s_2)[p\phi_b(\sigma+\alpha+\beta)-\lambda-p(1-\phi_b)\eta]^2\} \quad (1)$$

$\overline{Y}$ is increasing (that is, the firm will hold summer interns to a higher standard) in α, β, p, $\phi_{a,2}$, and ϕ_b and it is decreasing in λ and η.[9] The threshold is ambiguously affected by variance of idiosyncratic match quality ε in the applicant pool: $\overline{Y}$ can be increasing or decreasing in σ^2. Increased variance always increases the expected value of the reservation candidate conditional on the candidate being someone the firm prefers to not hiring at all (that is, $E[Y] > 0$). However, increased variance can either increase (if most candidates are worse than not hiring at all) or decrease (if most candidates are preferable to not hiring) the probability of the new applicant in the second year being better than not hiring at all.

As with full-time hiring, the firm must choose whether or not to hire each type of applicant. It will choose as follows:

- Hire an applicant who is a high ability switcher if: $p\phi_b(\alpha+\beta+\varepsilon)-\delta > p\phi_b\overline{Y}$. For a randomly drawn candidate, this condition will hold with probability $\frac{1}{2\sigma}(\sigma+\alpha+\beta-\overline{Y}-\frac{\delta}{p\phi_b})$.
- Hire a low ability switcher if: $\phi_b(\beta+\varepsilon)-\delta > \phi_b\overline{Y}$. This condition will hold with probability $\frac{1}{2\sigma}(\sigma+\beta-\overline{Y}-\frac{\delta}{\phi_b})$.
- Hire a high ability stayer if: $p(\alpha+\beta+\varepsilon)-\delta > p\overline{Y}$. This condition will hold with probability $\frac{1}{2\sigma}(\sigma+\alpha+\beta-\overline{Y}-\frac{\delta}{p})$.
- Hire a low ability stayer if: $\beta+\varepsilon-\delta > \overline{Y}$. This condition will hold with probability $\frac{1}{2\sigma}(\sigma+\beta-\overline{Y}-\delta)$.

The expected productivity of the candidate net of the costs of making an offer (that is, the left-hand sides of the four inequalities) only differ from those for full-time candidates by the difference in turnover and offer costs at the two stages. The right-hand side of the

[9] In addition to a direct positive effect of ϕ_b on $\overline{Y}$, ϕ_b also has an indirect positive effect on $\overline{Y}$ because it increases s_2. Intuitively, if more outsiders would be a good fit for a particular job, this will increase the fraction of switchers that leave the market after the summer internship and raise the fraction of the pool of full-time applicants that are industry stayers. This, in turn, makes the expected value of a random draw from the full-time pool higher, increasing the value of waiting until the second stage to hire.

four inequalities captures the opportunity cost of making an offer and, unlike for full-time offers, this varies across the four types of candidates when considering a summer internship. Consider an offer to a low ability stayer. That person always accepts the offer and (conditional on meriting a summer internship offer) always gets and accepts a full-time offer at the end of the summer. But if the firm makes an offer to a high ability switcher, there is a $1 - p\phi_b$ probability that the candidate will either not accept the summer offer or, because he is revealed over the summer to have $M = 0$, not get a full-time offer. In these cases, the firm gets a fresh draw from the students available in the full-time market. This creates some option value in that, while the firm's expected payoff from that new draw is bounded from below by zero (the firm can decide not to make an offer), there is a chance that the summer candidate turning them down or turning out to be a bad fit will lead them to recruit a superb candidate at the full-time stage.

The differences in the firm's hiring decisions between the summer and full-time recruiting, then, focus on two key areas – differences in opportunity costs and turnover costs across the four types of candidates. This leads to some differences in the preferences among the four types of workers at the two stages. However, it is still the case that high ability stayers are the firm's first choice and low ability switchers are its least favored category, as long as $p > \frac{\delta}{\delta + \alpha\phi_b}$. If this condition holds, firms prefer high ability to low ability (for switchers and possibly for stayers) because the acceptance rate of high ability applicants is high enough for them to be worthwhile. This is a similar result to that obtained in the case of full-time recruiting, and therefore we obtain:

Implication III. *Higher worker redeployability (i.e., higher α) leads to higher investment if firms face low competition (high enough p). Corollary: There exists imperfect positive assortative matching, as high ability workers are more likely to work for high prestige (p) or high productivity (α) firms.*

During summer internship recruiting, firms will be more likely to make offers to students who are proven industry fits (i.e., industry stayers, for whom $M = 1$) and, as long as their acceptance rate (p) is high enough, to students of high general ability ($H = 1$).

The firm will prefer high ability switchers to low ability stayers if $p > \frac{\delta}{\phi_b(\delta+\alpha)}$. Remember that, when making full-time offers, the firm will prefer high ability switchers to low ability stayers if $p > \frac{\lambda}{\phi_b(\lambda+\alpha+\eta)-\eta}$. Note that, if the costs of making offers in the two periods are the same (that is, if $\delta = \lambda$), the conditions for first and second year hiring are the same except the turnover cost η is not relevant for summer hiring. This implies that (as long as the costs of making a summer offer are not substantially higher than the costs of making a full-time offer), the firm will be more likely to make an offer to a high ability switcher rather than to a low ability stayer when making first year hires relative to when making second year hires.

Therefore, all else equal, firms will hire more industry switchers for summer internships than for full time jobs. This is particularly true for high η firms. In other words, exploration is more valuable early on, and more so if late-stage failure cost is high.

Regardless of how much it prefers stayers to switchers before the summer, note that our model assumes the firm only learns about switchers during the summer. All stayers receive and accept full-time offers at the end of the internship while some switchers are revealed to be bad fits and do not receive full-time offers. Therefore, industry stayers will be more likely to get offers at the end of a summer internship than industry switchers.

Some of the relationships between the likelihood of getting an offer and some of the parameters of the model are different for summer hiring than for full time hiring. For example, consider the effect of the fraction of switchers that will turn out to be good industry fits (ϕ_b). If this goes up, the summer internship offer probability for stayers goes down because the value of waiting $\overline{Y}$ until the full-time stage to hire goes up. But the effect on the summer offer probability to switchers is ambiguous because an increase in ϕ_b increases both the value of waiting $\overline{Y}$ and the value of hiring a given switcher summer candidate. However, the interactions between ϕ_b and both H and M are similar in the summer and full-time markets. Consider the relative preference for stayers over switchers in the summer:

Prob{High ability stayer gets internship offer} - Prob {High ability switcher gets internship offer}=$\frac{1}{2\sigma}\frac{\delta}{p}(\frac{1}{\phi_b}-1)$ and

Prob{Low ability stayer gets internship offer} - Prob {Low ability switcher gets internship offer}=$\frac{1}{2\sigma}\delta(\frac{1}{\phi_b}-1)$.

The main difference between these equations in the summer and full-time hiring stages is that turnover costs (η) are no longer relevant. Therefore, at the internship recruiting stage, firms'preference for industry stayers relative to switchers decreases if $\delta > 0$ with ϕ_b and, for $H = 1$ candidates, with p, but does not depend on turnover cost η.

We again find some similarities to full-time hiring when we look at the relative preference for high ability candidates compared to low ability candidates:

$Prob$(High ability stayer gets internship offer) - $Prob$(Low ability stayer gets internship offer)$=\frac{1}{2\sigma}[\delta(1-\frac{1}{p})+\alpha]$ and

$Prob$(High ability switcher gets internship offer) - $Prob$(Low ability switcher gets internship offer)$=\frac{1}{2\sigma}[\frac{\delta}{\phi_b}(1-\frac{1}{p})+\alpha]$.

Therefore, at the internship recruiting stage, firms' preference for high relative to low general ability candidates increases with the acceptance probability p if $\delta > 0$ and the productivity of general skill α, and for industry switchers it decreases with the probability ϕ_b that a switcher will be a good fit, if $\delta > 0$.

We can now determine how the applicant pool differs at the two stages. That is, we can consider $\phi_{a,2}$. Solving for $\phi_{a,2}$ explicitly can be done but is excessively complicated algebraically so we focus on comparing the second stage applicant pool to the corresponding first-period pool. To determine how the applicant pool changes between the two stages, we need to determine the probability that each type of worker will leave the market before the second stage. That is, we determine what fraction of high ability switchers, high ability stayers, low ability switchers, and low ability stayers get summer internship offers and, at the end of the internship, an offer of a permanent job. For each type, this is the probability the person is offered a job by the firm that screens her for a summer internship times the probability she accepts times the probability she gets a permanent offer at the end of the summer. This logic leads to the following:

- $Prob$(high ability switcher leaves market) $= \frac{1}{2\sigma}[p\phi_b(\sigma+\alpha+\beta-\overline{Y})-\delta]$
- $Prob$(high ability stayer leaves market) $= \frac{1}{2\sigma}[p(\sigma+\alpha+\beta-\overline{Y})-\delta]$
- $Prob$(low ability switcher leaves market) $= \frac{1}{2\sigma}[\phi_b(\sigma+\beta-\overline{Y})-\delta]$
- $Prob$(low ability stayer leaves market) $= \frac{1}{2\sigma}(\sigma+\beta-\overline{Y}-\delta)$

From these conditions we can see that high ability workers are more likely to leave the market if $p > \frac{\sigma+\beta-\overline{Y}}{\sigma+\alpha+\beta-\overline{Y}}$. A sufficient but not necessary condition for this to be true is that, conditional on ϵ and switcher/stayer status, the firm prefers a high ability candidate to a low ability candidate when making a full-time hire. That is, when the firm would always prefer a high ability switcher (stayer) candidate with idiosyncratic productivity ϵ' to a low ability switcher (stayer) with idiosyncratic productivity ϵ', it will also be the case that high ability candidates are more likely to leave the market before full-time recruiting. Further, it seems likely that the high ability workers that turn down an offer are at least as likely as low ability workers to get a full-time offer at the alternative employer where they accept offers. As a result, it must be the case that the fraction of high ability workers that leave the market will be greater than the fraction of low ability workers that leave the market, and hence $\phi_{a,1} > \phi_{a,2}$. Firms that wait until the full-time hiring phase to begin hiring will face an adverse selection problem in that there will be fewer high ability workers available after summer internships.[10]

We have been treating the decision about which job to apply for as random for the applicants in the interest of not introducing the complexity required to properly model a two-sided matching process (see Kuhnen (2011) for a model and empirical evidence regarding the applicants' job search process.) That is a reasonable assumption to the extent that we think of all students as potential applicants to all firms and we assume that no firm would ever have chosen an applicant that did not apply to their firm. Under the assumptions we have been using, summer internship "stayers" are always more likely to get a full-time offer than switchers. This means that there will be more stayers accepting jobs immediately after summer internships than switchers. As a result, the pool of available stayers will be smaller for full-time jobs, implying $s_2 < s_1$. This requires that we define stayers and switchers based on pre-MBA jobs only (practically, though, summer internships may expand the potential pool of stayers by generating industry experience for summer internship switchers).

Therefore we obtain the following:

Implication IV. *Greater competition for workers (i.e., lower p) speeds up firm investment and increases the value of probationary employment. Corollary: There exists adverse selection at the permanent investment stage.*

3 Data

We test the model's predictions using a novel dataset describing detailed aspects of the recruiting process conducted by a large number of globally-known firms at a top business school in the U.S. The data span three MBA cohorts during 2007-2009, encompassing 1,482

[10] This suggests some degree of "unraveling" in the MBA market, but not the chronic levels seen in other markets such as certain medical specialties (Niederle and Roth (2003)) and law clerkships (Avery, Jolls, Posner and Roth (2001)). Li and Rosen (1998) develop a model of unraveling in a labor market with one key feature of our model (uncertainty about applicant ability) and without another (probationary hiring, though firms can buy their way out of contracts). They show that unraveling is more dramatic when the applicant pool is smaller, more applicants are relatively talented, and talent is more heterogeneous among applicants.

job applicants and 383 firms, covering both internship and full-time on-campus recruiting. It provides details regarding the firms' identity and industry, job openings posted, as well as the candidates' personal and work background, training while in business school, applications sent during both recruiting stages, and offers received. See Kuhnen (2011) for more details regarding the dataset. Table 1 provides basic summary statistics of these 1,482 students.

We describe firms using various measures of industry, prestige and size. We use a coarse breakdown of industry, putting firms into one of six categories – consulting, finance, general corporations, technology, government/non-profit and other services (mainly law firms), as well as a fine classification scheme, based on the 60-industry breakdown used by the business school providing the data. We define a firm as prestigious (and therefore likely to have high offer acceptance rate p, and potentially low turnover costs η) if the firm is listed in the Fortune MBA 100 annual rankings during 2007-2009. If in a given sample year a firm is ranked in the top 100 according to these surveys, then we refer to it as a prestigious employer.[11] This appears to be a valid way to capture firm desirability, given that in our sample, offers made by firms on the *Fortune* list have a significantly higher chance to be accepted than offers made by other firms: 52% versus 40% in the case of internships, and 61% versus 44% in the case of full-time jobs (these differences are significant at $p < 0.01$).

To capture the firm turnover cost η we use firm size, as smaller firms are likely to face higher costs if they need to fire and replace employees. For example, this may happen because smaller firms may not have a dedicated human resources department. They may be less able to redeploy workers in different divisions, relative to more complex firms, as documented empirically by Tate and Yang (2011), or they may be more financially constrained and thus more likely to fire workers following changes in project choices (Giroud and Mueller (2012)). We measure size based on three dimensions: annual revenues, number of employees, and years since founded. The latter is particularly useful in the case of privately held companies, for which the sales and employees figures are not always available. These figures are collected from Compustat in the case of publicly-traded firms, and from databases compiled by Hoovers, Manta.com and Vault.com in the case of private firms. We assign the firms in the sample to deciles with respect to each of these size proxies, and also construct an overall size proxy as the average of the firm's standing (in terms of decile) across these three size measures.

[11] The rankings are available at: http://money.cnn.com/magazines/fortune/mba100/2009/full_list/.

The recruiting process at the business school providing the data for this study is well structured. For both internships and full-time jobs, students can apply to obtain an interview slot during on-campus recruiting in two stages. In the first stage, referred to as "closed", they can submit resumes to companies that will offer on-campus recruiting. Employers then select whom to invite for interviews based on the students' resumes. This process is costless to students. In a second stage, called the "open" or "bidding" system, students can bid a limited number of points (out of an annual endowment of 800 points) to obtain an interview slot. Therefore, in this second stage obtaining an interview with a desired employer is costly to the student (in terms of bid points). The data set contains all the bids that each student placed for interview slots for either internships or full-time jobs, as well as information about whether or not the bids were successful (i.e., higher or equal to the clearing bid for that contest). On-campus recruiting for full-time positions occurs at the beginning of the students' second year in the MBA program, between September and December. On-campus recruiting for summer internships occurs during the January-March period of the students' first year in the MBA program.

4 Empirical Results

We start by presenting evidence regarding some of the key assumptions of the model, and then move on to test the four main theoretical implications regarding human capital investment decisions.

4.1 Evidence Regarding Model Assumptions

Each firm offers a single wage wage to all new hires. This assumption implies that wages offered for jobs taken upon finishing school do not depend on individuals' ability or industry experience. An institutional detail supporting this assumption is that employers that recruit on campus are required to post details such as the job title, location, and salary at the very beginning of the recruiting season (and before seeing any candidates). As shown in the regression model in Table 2, the data confirms that starting salaries (i.e., those characterizing the first year of employment after graduate school) are specific to the position available, and do not depend on characteristics of the person who receives the employment offer.[12] Specifically, controlling for class, industry, job source, job location, and company-job title fixed effects, we find no evidence that the GPA, quality of undergraduate institution attended, industry experience, age, gender, or international student status of the person receiving the full-time offer are related to the offered wage (either in logs or levels). Furthermore, in the data only 10.8% of starting full-time wages are renegotiated (the corresponding figure for internships is 1.72%). Not surprisingly, the wage renegotiation frequency is 3.7% higher in the case of male candidates, in line with the finding in Babcock and Laschever (2003) that men are better than women at asking for higher pay.[13] While in general rare, renegotiations of starting wages are more frequent for cohorts graduating during good economic times, compared to those graduating during recessions. Specifically, the frequency of renegotiations is 13.01% for the class of 2007, and 8.27% for the class of 2009 (the difference is statistically significant at $p < 0.05$). The renegotiation frequency for the class of 2008 (graduating several months before the beginning of the financial crisis in September 2008) is 10.02%.

Low general ability candidates ($H = 0$) accept job offers with probability 1, while high ability candidates accept offers with probability $p < 1$. While a literal interpretation of this assumption is not valid (in the sense that in reality low ability students do not always accept a particular offer), the key empirical relevance of the assumption is that, for our model to be valid, it must be the case that high ability (i.e., $H = 1$) candidates accept offers for internships or full-time jobs with a lower probability than low ability (i.e., $H = 0$) candidates. In other words, Assumption 2 can be restated as $1 - p > 0$. Table 3 confirms this assumption, showing that high ability candidates (defined as those with above average GPA) receive more offers than low ability candidates. Based on the number of offers received, we estimate that the offer acceptance rate of high ability candidates is lower than that of low ability candidates by 12% in the case of internships, and by 10% in the case of full-time offers. These differences can be interpreted as measuring the value of $1 - p$ in the data.

[12] We only have data concerning starting salaries. It is likely that after working for a company for a while, an employee will be compensated based on proven performance.

[13] In a different sample of MBA students, Bertrand, Goldin and Katz (2010) document a rising gap in earnings between men and women after graduation, caused by gender differences with respect to training during business school, career interruptions, and weekly hours worked.

A large fraction of job applicants have unknown industry fit, which creates uncertainty regarding their future productivity. Among all applications sent for jobs, the fraction that come from industry switchers is 89% in the case of internships, and 86% in the case of full-time jobs. This illustrates the fact that for the majority of potential candidates, firms face uncertainty regarding the industry specific skills of these individuals.

All else equal, firms prefer to hire students with high general ability and experience in their industry. Table 4 shows the results of probits at each stage of the recruiting process – summer hiring, general full-time hiring, and full-time offers made to summer interns. For each applicant/firm pair, we define the applicant to be an industry stayer if the applicant worked in the firm's industry (using either the fine or the coarse industry classification schemes) before entering business school (and so that this measure will be comparable across the two recruiting seasons, we do not change the definition based on the summer internship experience). We define applicants to be of high ability ($H = 1$) if the person's total two-year GPA during the MBA program is above the school average.

Columns 1 and 2 of Table 4 show probits of job offer probability for summer internships and full-time jobs, respectively. As we would expect, offers of both type are more likely as general ability H or industry fit M increase. With respect to general ability, we find that increasing the GPA by 1 point (using a 4-point scale) increases the probability of an internship application resulting in an offer by 6%. This is a large effect, given the overall application-to-offer conversion rate for internships is 5.6%. Similarly, increasing the GPA by 1 point increases the probability of a full-time application resulting in an offer by 3%, a large effect given that the application-to-offer conversion rate at the full-time recruiting stage is 3.4%. With respect to industry fit, we document that applications from industry stayers are 3% more likely to result in offers at both recruiting stages. These effects are economically large and statistically significant ($p < 0.01$). Column 3 of Table 4 indicates that industry stayers will be more likely to get offers at the end of a summer internship than industry switchers. The table shows that, relative to industry switchers, industry stayers have a 19% higher probability of converting an internship into full-time employment ($p < 0.01$).[14]

[14]Note, however, that our model does not capture all the effects of general ability H. In the model, firms only learn about industry fit over the summer, so general ability (which is publicly known at all times) does not affect the probability of a summer intern getting a full-time offer (conditional on the person getting a summer internship offer in the first place). However, the table shows that high GPA students are substantially

4.2 Evidence Regarding Model Predictions

Implication I. *Employers highly value the option to learn about candidates lacking industry experience, by making significant use of cheap probationary employment – namely, summer intern positions after the students' first year in the MBA program.*

Indeed, we find that probationary employment is valuable. Forty-four percent of candidates who receive probationary employment convert that into full-time job offers, and in 68% of these cases, the offer is accepted.

Implication II. *The interest in exploring workers with unknown fit is significantly higher at the internship recruiting stage, relative to the full-time recruiting stage which occurs in the students' second year of MBA study, particularly for firms characterized by high turnover costs, such as small companies.*

We find that industry switchers receive 63% of offers for internships compared to 52% of offers for full-time jobs. This difference is significant at $p < 0.01$. Also, the multivariate probit models in columns 1 and 2 of Table 4 show that the impact of being an industry stayer on the likelihood of receiving an offer is stronger at the full-time stage than at the internship stage. The coefficients are similar for the two groups but, given the underlying difference in the offer probability (5.6% for internship applications vs. 3.4% for full-time job applications), the effect is much greater at the full-time recruiting stage. Industry experience roughly doubles the success probability of full-time applicants, while only increasing the internship applicants' success rate by half. These results provide strong evidence that firms are more willing to explore during the summer internship phase than when they make a longer-term commitment to the employee.

Implication II also states that the summer preference for industry switchers will be stronger when turnover costs (η) are higher. The evidence in Table 5 is consistent with this prediction. The table displays simple comparisons across high and low η firms of the fraction of offers made to industry switchers at the internship and full-time stages. We use both the coarse (first two columns) and the fine (columns three and four) industry classification scheme to define whether an applicant is a switcher or a stayer. In the top panel we measure η based on the firm's overall size decile (i.e., the aggregate size measure based

more likely to get offers at the end of an internship than low GPA students.

on sales, number of employees and years since founded), since larger firms are likely to have processes in place that can speed up the firing and replacement of workers. As a robustness check, in the bottom panel of Table 5 we use firm prestige as an alternative measure of turnover costs on the assumption that high prestige firms can more easily fill openings. As before, we find that offers to industry outsiders are more common at the summer phase for all types of firms. Moreover, the drop in interest in industry switching applicants between the internship and the full-time recruiting stage is greater for higher η firms, whether we measure η based on firm size or firm prestige. We find that high η firms are between 11% and 13% less likely to make offers to industry outsiders at the full-time stage, relative to the internship stage. In the case of low η firms, the corresponding drop in interest in switchers is only 6% to 9%, depending on the η proxy and on whether we use the coarse or the fine industry classification scheme. The data therefore show that exploration is indeed more valuable early on, and suggest this relationship is stronger if the cost of late-stage failure (i.e., turnover due to industry misfit) is high.

We now focus on the relationship between full-time hiring decisions, industry experience, and turnover costs suggested by the model: at the full-time recruiting stage, firms' preference for industry stayers relative to switchers increases with turnover costs η. We now employ the approach of running probit regressions where an observation is a full-time offer and the dependent variable equals one if that offer is made to an industry switcher. This approach can be tied directly to the theory. The model predicts that, at the full-time stage, the relative preference for switchers compared to stayers is given by: $Prob$(randomly drawn switcher gets offer) - $Prob$(randomly drawn stayer gets offer), and this quantity increases with ϕ_b and decreases with η. This implies that the ratio of switchers to stayers who get offers should increase with ϕ_b and decrease with η.

In the first three regression specifications displayed in Table 6, we use various measures of firm size as proxies for turnover cost η, based on firm sales, number of employees, or a composite of these and the age of the firm. For all three measures we find a positive relationship between making the offer to an outsider and firm size. These relationships are significant and economically meaningful in that an increase of one size decile increases the probability of the offer going to a switcher by two to three percentage points. To put this effect in perspective, the base probability of an offer going to an industry switcher is 52%.

In the regression specification in the fourth column of Table 6 we test another model prediction – that, when doing full-time hiring, firms' preference for industry stayers relative to switchers will decrease with the probability ϕ_b that switchers have good industry fit. We generated a proxy for the likelihood ϕ_b of an outsider being a good fit for each of the six broad industry classifications by determining what fraction of industry outsider summer interns receive full-time offers. We define high ϕ_b industries to be those where it is more likely that an internship offered to a switcher will result in a full-time offer. The "high ϕ_b" broad industry areas are Consulting (ϕ_b=50%) and Finance (ϕ_b=48%). Low ϕ_b industry areas include General Corporations (ϕ_b=36%) and Technology(ϕ_b=40%). Because ϕ_b is defined at the industry level, we can no longer include industry fixed-effects in our probit models predicting whether an offer will go to an industry switcher or a stayer. Note that the effect of the turnover cost η in the probit model in the fourth column of Table 6 is similar to those documented in the first three columns. As predicted, we find that the probability ϕ_b of an outsider being a good fit is positively and significantly related to the likelihood that the offer will be made to an outsider. Changing from a lower ϕ_b industry area such as General Corporations to a higher ϕ_b industry area such as Consulting is associated with an increase of approximately 10% percentage points in the probability of an offer going to an outsider.

In the probit model in the last column in Table 6 we focus on a final part of Implication II, namely, that for offers going to high general ability ($H = 1$) candidates, firm prestige p reduces the preference for stayers if the cost λ of making an offer is strictly positive. We find that there is not a significant relationship between firm prestige and the probability that a stayer is preferred to the switcher, which can mean that either the model does not describe the data accurately, or that the cost of writing up an offer (λ) is trivial.

We now turn to internship recruiting, for which the model predicts that firms' preference for industry stayer interns relative to switchers will be unrelated to turnover cost η. As we showed above, turnover costs are related to preference for stayers at the full-time stage so this internship implication captures one of the key ideas of the option value of exploration (i.e., the option to abandon the asset at the try-out stage without incurring turnover costs). The first three columns in Table 7 show results of probit models similar to those we performed for full-time hiring in Table 6, using various proxies for η based on measures of firm size. The results show no evidence of a relationship between turnover costs and firms' propensity to focus offers on industry stayers. Therefore, as predicted, turnover costs have a strong relationship to firms' taste for industry experience in the full-time stage but not in the internship phase. The fourth column in Table 7 looks at a related facet of the model – the prediction that firms' preference for industry stayer interns relative to switchers decreases with ϕ_b. As before, we use industry-level success at converting summer internships into full-time offers as our measure of ϕ_b. The table shows that there is no empirical relationship between our proxy for ϕ_b and the propensity to make offers to outsiders. We therefore find no relationship between the degree to which industry switchers have proven successful in a given industry and the degree to which that industry is willing to make internship offers to outsiders. One possible explanation for this is that the relationship between summer offers to outsiders and ϕ_b is reliant on δ, the cost of making a summer offer, being substantial. If δ is negligible then the model would predict the patterns we find. That is, we would expect ϕ_b to be associated with a decrease in the preference to hire industry stayers for full-time positions but there should not be a significant relationship between ϕ_b and firms' relative preference for stayers when making internship offers. In the last column of Table 7 we test whether for high ability candidates, the relative preference for industry stayers versus switchers decreases with firm prestige p if $\delta > 0$. We do not find a significant relationship between p and the relative preference for stayers vs. switchers, which as above, could happen if the cost δ of extending an internship offer is trivial.

Implication III. *Firms facing low competition, such as prestigious corporations, are more likely to invest in more redeployable workers, namely those with high general ability as measured by their GPA, relative to less redeployable ones, for both probationary and permanent jobs. As a result, there will be imperfect positive assortative matching, as high ability workers are more likely to work for high prestige or high productivity firms.*

The model predicts that firms will value high ability candidates relatively more as the acceptance probability p (e.g., firm prestige) and the productivity of general skill α increase, and, in the case of industry switching candidates, as the probability ϕ_b that an outsider will be a good fit decreases (assuming $\lambda > 0$). We test these predictions in the probit models in Table 8 using data from the full-time recruiting stage. In general, we find support for the implication that high p and high α firms, namely, those deemed as prestigious are more likely to value high general ability relative to low general ability candidates. However, when we focus on the sample of offers made to industry switchers, we do not observe a significant negative relationship between ϕ_b and the probability that an offer will go to a high ability individual, which may mean the model is not accurate, or, as before, that $\lambda = 0$ (that is, the cost of writing up an offer letter is trivial in the setting considered here.)

Similar to the full-time recruiting stage, the model predicts that firms' preference for high ability intern candidates relative to those with lower ability will be increasing with the acceptance probability p (e.g., firm prestige) and the productivity of general skill (α) and, for switcher candidates, it decreases with the probability ϕ_b that a switcher will be a good fit if $\delta > 0$. We test these predictions in the probit models in Table 9. We find some support for the implication that prestigious firms prefer high ability candidates relative to low ability ones at the internship stage, but not for the implication concerning the influence of the ϕ_b parameter.

Finally, the data show that indeed better people tend to work at better firms. Specifically, we find that 60% of those accepting full-time offers at "high prestige" firms have high GPAs compared to 47% of those joining firms that are not prestigious.

Implication IV. *Higher competition increases the number of job offers that firms make at the internship stage relative to the full-time stage, increasing the importance of probationary employment as a channel for investment in human capital. As a result, the quality of the candidate pool is lower at the permanent recruiting stage relative to the internship stage.*

Table 10 shows that this prediction is consistent with the data. The overall GPA of 307 candidates who choose not to participate in on campus full-time recruiting is 3.50, whereas the GPA of the 1100 who participate is 3.44 (the difference is significant at $p < 0.001$). This indicates that, at least along this dimension of general ability, the full-time recruiting pool is of lower quality than the pool of candidates who are no longer seeking jobs at that time. While this may not seem like a large difference, grade dispersion is not all that great at this school. The 0.06 GPA difference is roughly a quarter of one standard deviation. To understand whether there is also a worsening of the candidate pool at the full-time recruiting stage in terms of industry experience, we calculate the percentage of candidates who participate in the on campus full-time recruiting process, conditional on being an industry switcher at the internship stage. Of those who choose not to apply for full-time jobs in their second year of the MBA program (21% of candidates), 80% had interned for companies in an industry (using the school's 60 industry categorization scheme) different from that where they worked before business school, and therefore were industry switchers in the first recruiting stage. For the remaining candidates, who did apply to jobs during the on-campus recruiting process, 85% were industry switchers at the internship stage (the difference is significant at $p < 0.03$). Among all candidates recruiting at the internship stage, 84% were industry switchers. Therefore, the pool of candidates actively seeking jobs at the full-time recruiting stage is of lower quality, in terms of industry experience, than the pool of candidates who have completed the job seeking process after the summer internship stage. These results indicate that there exists some unraveling in terms of general ability and industry expertise during the two recruiting stages, which leads those firms recruiting in the full-time stage to face adverse selection in the candidate pool.

4.3 Caveats and Limitations

Not surprisingly, our model does not match the data perfectly. In addition to the possibility that there may be flaws in our logic or assumptions, there are at least two likely reasons for the observed discrepancies. First, there are limits and oversimplifications that we made to keep the model tractable. Second, there are important limits to our data such as the fact that our proxies for the various forms of heterogeneity among firms are less than ideal for capturing the differences in recruiting strategies identified by the model.

One example of an oversimplication in the model is that we assumed that reservation profits (0 in the full-time stage and $\overline{Y}$ for the internship stage) are identical across firms. Presumably "better" firms (in terms of p or α, for example) would be able to hold out for better workers given they would have better applicants from other sources (other business schools, for example). Also, there are likely to be other forms of heterogeneity across firms (such as the number of positions available or the number of people available to interview) that are not captured by parameters p, α, β, η and ϕ_b. For example, in the data the likelihood that an application for a full-time job results in a job offer may not just depend on the firm's probability p of having its offer accepted, but may also depend on how many applications were sent to the firm per available full-time position. Unfortunately, we do not know how many positions were available at a given firm. Suppose that prestigious firms are those that receive more applications per job opening (thus lowering the application success probability), and also are characterized by high values of p (i.e., high probability of offer acceptance). Then, in a regression where we try to predict the probability of an offer being made to a candidate using the firm's prestige, the effect of the prestige variable is a combination of the off-setting effects of high p and a high number of applicants per job opening at the firm. We were able to get around these issues, to some degree, by carefully using the dataset containing information about all applications sent to firms, and also by limiting our analysis to the dataset containing information about the offers received by candidates.

Another oversimplification in the model exposed by the empirical work is our assumption that the students' general ability (as proxied by GPA, for example) is known when candidates are first seen. In reality, however, as firms spend more time with a candidate (e.g., during the summer internship), they get to learn this general ability more precisely. In the data, we in fact observe that a high GPA increases the likelihood that a summer internship is converted into a full-time job (see Table 4), which the model would not predict.

The data have limitations that lead to some important caveats about both the internal and external validity of our analysis. One limit of the data is that the offers are self-reported by students. The career office at the school that provided the data works very hard to encourage students to provide details of their offers. However, there are surely a few students who do not report their market outcomes at all and others that report with some error (such as not listing all offers). Also, a substantial amount of the job search by students at this school is done through channels other than on-campus recruiting. In these cases, we do not have any information about firms' preferences because we do not observe who applies to these firms. While we do not think that these issues with the data bias our results substantially (if anything, the measurement error would imply any relationships in the data are likely to be stronger than our analysis suggests), we do not know for sure.

While we expect that our results are likely to be similar to what we would find at other top business and professional schools, the external validity of our analysis is certainly limited by the fact that we study only one school. We do not know whether the firms we see show the same tendencies when they recruit from other schools or when they recruit from non-MBA pools of workers, much less whether other firms conform to our model. Also, students at the school we analyze disclose their grades to potential employers, whereas several other similar business schools have a non-disclosure of grades policy. It would be interesting to see if employers recruiting at those schools exhibit similar preferences to the firms we analyze.

5 Conclusion

We develop and test a model of hiring strategies when firms can hire workers on a probationary basis and value both general skill and industry experience. Firms consider workers as real options and have the incentive to explore candidates with potential upside but who are also likely to be bad industry fits. The model generates several empirical predictions concerning the effects of uncertainty, adjustment costs, competition, and asset redeployability on decisions to invest in human capital. We test these predictions using a unique dataset covering recruiting activity at a top U.S. business school. We show that firms recruiting at this school always value ability and industry experience and that, when hiring summer interns, they place a relatively high value on general ability, given the option to sever ties with bad matches, in terms of industry fit, at the end of the summer. We also show that firms that wait until the second year of the two-year program to start recruiting face an adverse selection problem. When the cost of exercising the real option of firing employees with bad match value are higher, we observe less of a tendency to explore risky workers (i.e., industry switchers), and a stronger preference for safer candidates (i.e., industry stayers).

Our paper has two main contributions. Theoretically, we bring together ideas from the real options literature in corporate finance and from the personnel and labor economics literature, to understand the process by which firms make human capital investment decisions. Empirically, we add to the limited literature concerning the drivers of firms' hiring strategies and firm-worker matching. Our evidence indicates that firms think of potential employees as real options, much as they do when considering making other capital investment decisions. Hence, combining insights from corporate finance and personnel economics can shed more light on the role of human capital in firm outcomes.

References

Abel, A. B., Dixit, A. K., Eberly, J. C. and Pindyck, R. S.: 1996, Options, the value of capital, and investment, *Quarterly Journal of Economics* **111**(3), 753–777.

Agrawal, A. K. and Matsa, D. A.: 2011, Labor unemployment risk and corporate financing decisions, *Working paper* .

Avery, C., Jolls, C., Posner, R. A. and Roth, A. E.: 2001, The market for federal judicial law clerks, *The University of Chicago Law Review* **2001**, 793–902.

Babcock, L. and Laschever, S.: 2003, *Women don't ask: Negotiation and the gender divide*, Princeton University Press.

Bandiera, O., Guiso, L., Prat, A. and Sadun, R.: 2010, Matching firms, managers, and incentives, *Working paper* .

Berk, J. B., Stanton, R. and Zechner, J.: 2010, Human capital, bankruptcy and capital structure, *Journal of Finance* **65**, 891–926.

Bertrand, M., Goldin, C. and Katz, L. F.: 2010, Dynamics of the gender gap for young professionals in the financial and corporate sectors, *American Economic Journal: Applied Economics* **2**(3), 228–255.

Booth, A. L., Francesconi, M. and Frank, J.: 2002, Temporary jobs: Sepping stones or dead ends?, *The Economic Journal* **112**, F189âĂŞF213.

Brennan, M. J. and Schwartz, E. S.: 1985, Evaluating natural resource investments, *Journal of Business* **58**(2), 135–157.

Bulan, L., Mayer, C. and Somerville, C. T.: 2009, Irreversible investment, real options, and competition: Evidence from real estate development, *Journal of Urban Economics* **65**, 237–251.

Caballero, R. J.: 1991, On the sign of the investment-uncertainty relationship, *American Economic Review* **81**(1), 279–288.

Cunningham, C. R.: 2007, Growth controls, real options and land development, *Review of Economics and Statistics* **89**(2), 343–358.

Dixit, A. K. and Pindyck, R.: 1994, *Investment Under Uncertainty*, Princeton University Press.

Eisfeldt, A. L. and Papanikolaou, D.: forthcoming, Organization capital and the cross-section of expected returns, *Journal of Finance* .

Farber, H. S. and Gibbons, R.: 1996, Learning and wage dynamics, *Quarterly Journal of Economics* **111**, 1007–1047.

Foote, D. A. and Folta, T. B.: 2002, Temporary workers as real options, *Human Resource Management Review* **12**, 579–597.

Gabaix, X. and Landier, A.: 2008, Why has CEO pay increased so much?, *Quarterly Journal of Economics* **123**(1), 49–100.

Giroud, X. and Mueller, H. M.: 2012, Capital and labor reallocation inside firms, *Working paper* .

Graham, J., Harvey, C. R. and Puri, M.: 2010, Managerial attitudes and corporate actions, *Working paper* .

Greenwald, B. C.: 1986, Adverse selection in the labor market, *Review of Economic Studies* **53**, 325–347.

Grenadier, S. and Malenko, A.: 2010, A bayesian approach to real options: The case of distinguishing between temporary and permanent shocks, *Journal of Finance* **65**(5), 1949–1986.

Grenadier, S. R.: 2002, Option exercise games: An application to the equilibrium investment strategies of firms, *Review of Financial Studies* **15**(3), 691–721.

Guell, M. and Petrongolo, B.: 2007, How binding are legal limits? Transitions from temporary to permanent work in spain, *Labour Economics* **14**, 153–183.

Guiso, L. and Parigi, G.: 1999, Investment and demand uncertainty, *Quarterly Journal of Economics* **114**(1), 185–227.

Hendricks, W., DeBrock, L. and Koenker, R.: 2003, Uncertainty, hiring, and subsequent performance: The NFL draft, *Journal of Labor Economics* **21**, 857–886.

Houseman, S. N.: 2001, Why employers use flexible staffing arrangements: Evidence from an establishment survey, *Industrial and Labor Relations Review* **55**(1), 149–170.

Jovanovic, B.: 1979, Job matching and the theory of turnover, *Journal of Political Economy* **87**, 972–990.

Kahn, L. B. and Lange, F.: 2011, Employer learning, productivity, and the earnings distribution: Evidence from performance measures, *Working paper* .

Kaniel, R., Massey, C. and Robinson, D. T.: 2010, The importance of being an optimist: Evidence from labor markets, *NBER Working paper 16328* .

Kaplan, S., Klebanov, M. M. and Sorensen, M.: forthcoming, Which CEO characteristics and abilities matter?, *Journal of Finance* .

Kuhnen, C. M.: 2011, Searching for jobs: Evidence from MBA graduates. Northwestern University.

Lazear, E. P.: 1998, Hiring risky workers, *in* I. Ohashi and T. Tachibanaki (eds), *Internal Labour Markets, Incentives, and Employment*, St. Martin's Press, New York.

Levin, J.: 2002, Multilateral contracting and the employment relationship, *Quarterly Journal of Economics* **117**(3), 1075–1103.

Li, H. and Rosen, S.: 1998, Unraveling in matching markets, *American Economic Review* **88**(3), 371–387.

McDonald, R. and Siegel, D.: 1986, The value of waiting to invest, *Quarterly Journal of Economics* **101**, 707–727.

Moel, A. and Tufano, P.: 2002, When are real options exercised? an empirical study of mine closings, *Review of Financial Studies* **15**(1), 35–64.

Neal, D.: 1995, Industry-specific human capital: Evidence from displaced workers, *Journal of Labor Economics* **13**, 653–677.

Niederle, M. and Roth, A. E.: 2003, Unraveling reduces mobility in a labor market: Gastroenterology with and without a centralized match, *Journal of Political Economy* **111**, 1342–1352.

Ouimet, P. and Zarutskie, R.: 2011, Acquiring labor, *Working paper* .

Oyer, P.: 2008, The making of an investment banker: Stock market shocks, career choice, and lifetime income, *Journal of Finance* **63**, 2601–2628.

Oyer, P. and Schaefer, S.: 2011, Personnel economics: Hiring and incentives, *in* O. Ashenfelter and D. Card (eds), *The Handbook of Labor Economics*, Vol. 4b, North-Holland, Great Britain.

Paddock, J. L., Siegel, D. R. and Smith, J. L.: 1988, Option valuation of claims on real assets: The case of offshore petroleum leases, *Quarterly Journal of Economics* **103**, 479–508.

Parent, D.: 2000, Industry-specific capital and the wage profile: Evidence from the national longitudinal survey of youth and the panel study of income dynamics, *Journal of Labor Economics* **18**, 306–323.

Quigg, L.: 1993, Empirical testing of real option-pricing models, *Journal of Finance* **48**, 621–640.

Sapienza, P., Maestripieri, D. and Zingales, L.: 2009, Gender differences in financial risk aversion and career choices are affected by testosterone, *Proceedings of the National Academy of Sciences* **106**(36), 15268âĂŞ15273.

Schultz, T. W.: 1961, Investment in human capital, *American Economic Review* **51**, 1–17.

Segan, L. M. and Sullivan, D. G.: 1997, The growth of temporary services work, *Journal of Economic Perspectives* **11**(2), 117–136.

Shue, K.: 2011, Executive networks and firm policies: Evidence from the random assignment of mba peers, *Working paper* .

Tate, G. and Yang, L.: 2011, The bright side of corporate diversification: Evidence from internal labor markets, *Working paper* .

Tervio, M.: 2008, The difference that CEOs make: An assignment model approach, *American Economic Review* **98**(3), 642–668.

Titman, S.: 1985, Urban land prices under uncertainty, *American Economic Review* **75**(3), 505–514.

Trigeorgis, L.: 1996, *Real Options*, MIT Press.

Waldman, M.: 1984, Job assignments, signaling, and efficiency, *RAND Journal of Economics* **15**, 255–267.

Williams, J. T.: 1993, Equilibrium and options on real assets, *Review of Financial Studies* **6**(4), 825–850.

Table 1: Summary Statistics.

	$Mean$	$St.Dev.$
GPA_i	3.45	0.28
$Top100Undergrad_i$	0.48	0.50
Age_i (years)	30.11	2.19
$Male_i$	0.66	0.47
$InternationalStudent_i$	0.39	0.49
N	1482	

Table 2: Keeping the company and job characteristics fixed, salaries for full-time job offers do not depend on the ability of the person receiving the offer.

	$Wage_i$	$Ln(Wage)_i$
GPA_i^{MBA}	–1011.57	–0.01
	(–1.01)	(–1.04)
$Top100Undergrad_i$	332.39	0.00
	(0.73)	(0.53)
$IndustryStayer_i$	–201.90	–0.01
	(–0.38)	(–0.92)
$InternationalStudent_i$	–293.09	–0.00
	(–0.54)	(–0.40)
$Male_i$	522.53	0.01
	(1.03)	(1.02)
Age_i	–30.89	–0.00
	(–0.24)	(–0.40)
$Constant$	93878.65	11.45
	(9.28)***	(98.05)***
Class FEs	Yes	Yes
Industry FEs	Yes	Yes
Job Source FEs	Yes	Yes
Job Location FEs	Yes	Yes
Company-Job title FEs	Yes	Yes
R^2	0.48	0.40
Observations	1676	1676

Table 3: High ability candidates have a lower offer acceptance probability than low ability candidates.

	Number of internship offers and acceptance probability	Number of full-time offers and acceptance probability (if in full-time recruiting)
High ability candidates	1.98	1.48
(GPA above average)	N=784 people	N=568 people
Low ability candidates	1.60	1.29
(GPA below average)	N=698 people	N=532 people
Δ Offers High vs. Low Ability	$0.38^{***}(p < 0.01)$	$0.19^{***}(p < 0.01)$
Δ Probability Offer Acceptance	$\frac{1}{1.98} - \frac{1}{1.60}$	$\frac{1}{1.48} - \frac{1}{1.29}$
High vs. Low Ability		
Estimate for $(1 - p)$	12%	10%

Table 4: Who gets offers? Probit models, marginal effects are reported. The dependent variable is equal to one for applications that resulted in an offer. Standard errors are robust to heteroskedasticity and clustered by job. Clustering by student yields results of similar statistical significance. Linear probability models yield similar results.

	Internships	Full-time Jobs	FT jobs through internship
GPA_i	0.06	0.03	0.31
	$(8.87)^{***}$	$(5.13)^{***}$	$(5.61)^{***}$
$IndustryStayer_i$	0.03	0.03	0.19
	$(5.41)^{***}$	$(4.83)^{***}$	$(4.64)^{***}$
$Male_i$	–0.02	–0.01	–0.06
	$(-4.86)^{***}$	$(-3.97)^{***}$	$(-1.70)^{*}$
$InternationalStudent_i$	–0.02	–0.02	–0.06
	$(-8.09)^{***}$	$(-6.96)^{***}$	$(-1.88)^{*}$
Age_i	–0.00	–0.00	0.01
	(–0.92)	(–0.32)	(0.79)
Class FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes
Pseudo R^2	0.03	0.08	0.08
Observations	23800	10654	1296
Observed application success frequency	5.6%	3.4%	44%

Table 5: Switchers are more attractive as summer interns than as full-time hires when turnover costs are higher. In the top panel we use firm size as a proxy for turnover cost η. Observations are split based on whether the firm's overall size decile is above the mean (i.e., indicating a low η) or below the mean (i.e., indicating a high η). As a robustness check, in the bottom panel we use firm prestige as an alternative proxy for turnover costs (i.e., prestigious firms are likely to have low η, while the others have high η).

% offers made to industry switchers	Low η firms (High Size)	High η firms (Low Size)	Low η firms (High Size)	High η firms (Low Size)
	Broad industry classification		Fine industry classification	
Internships	62%	60%	86%	80%
Full-time Jobs	55%	49%	77%	69%
Difference	7%**	11%***	9%***	11%***

% offers made to industry switchers	Low η firms (Prestigious)	High η firms (Non-prestigious)	Low η firms (Prestigious)	High η firms (Non-prestigious)
	Broad industry classification		Fine industry classification	
Internships	60%	63%	81%	86%
Full-time Jobs	54%	50%	72%	73%
Difference	6%**	13%***	9%***	13%***

Table 6: Turnover cost η, likelihood of switcher success ϕ_b, and firm prestige p, and the relative preference for stayers vs. switchers during on-campus full-time recruiting. Dependent variable is equal to 1 if offer recipient is an industry switcher (using five broad industry categories). Probit models, marginal effects reported. Robust standard errors clustered by firm. ϕ_b is defined at the broad industry level, and measures the percentage of summer internships that resulted in full-time jobs, for interns who were industry switchers. Offers included are those for class of 2007, 2008 and 2009 two-year MBA students.

Dependent variable	Indicator equal to 1 if offer recipient is industry switcher				
	Offers to all candidates				Offers to $H = 1$ candidates
Sales Decile	0.03				
(*low* η)	(3.01)***				
Employees Decile		0.02			
(*low* η)		(1.97)**			
Overall Size Decile			0.03	0.02	0.04
(*low* η)			(2.58)***	(2.25)**	(1.91)*
ϕ_b				0.88	1.49
				(2.03)**	(2.28)**
Prestigious					–0.03
(*high* p)					(–0.43)
Class FEs	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	No	No
R^2	0.04	0.04	0.04	0.02	0.02
Observations	513	535	543	535	288

Table 7: Turnover cost η, likelihood of switcher success ϕ_b, and firm prestige p, and the relative preference for stayers vs. switchers during on-campus internship recruiting. Dependent variable is equal to 1 if offer recipient is an industry switcher (using five broad industry categories). Probit models, marginal effects reported. Robust standard errors clustered by firm. ϕ_b is defined at the broad industry level, and measures the percentage of summer internships that resulted in full-time jobs, for interns who were industry switchers. Offers included are those for class of 2007, 2008 and 2009 two-year MBA students.

Dependent variable	Indicator equal to 1 if offer recipient is industry switcher				
	Offers to all candidates				Offers to $H=1$ candidates
Sales Decile	0.01				
(low η)	(1.13)				
Employees Decile		0.01			
(low η)		(1.49)			
Overall Size Decile			0.01	0.01	0.02
(low η)			(1.08)	(0.90)	(1.68)*
ϕ_b				–0.26	–0.51
				(–0.77)	(–1.37)
Prestigious					–0.05
(high p)					(–1.05)
Class FEs	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	No	No
R^2	0.02	0.02	0.02	0.01	0.04
Observations	1506	1515	1576	1576	970

Table 8: Turnover cost η, likelihood of switcher success ϕ_b, and firm prestige p, and the relative preference for high vs. low ability candidates during on-campus full-time recruiting. Dependent variable is equal to 1 if offer recipient is a a high general ability ($H = 1$) candidate, defined based on GPA in the first three columns, and based on the number of open (bid-determined) full-time applications in the last three columns. Probit models, marginal effects reported. Robust standard errors clustered by firm. ϕ_b is defined at the broad industry level, and measures the percentage of summer internships that resulted in full-time jobs, for interns who were industry switchers. Offers included are those for class of 2007, 2008 and 2009 two-year MBA students.

Dependent variable	Indicator equal to 1 if offer recipient is high ability candidate					
	Ability based on GPA			Ability based on # open full-time applications		
	Offers to all candidates		Offers to industry switchers	Offers to all candidates		Offers to industry switchers
Prestigious	0.07	0.15	0.09	0.10	0.14	0.21
(*high* p)	(1.63)	(2.54)**	(1.11)	(2.12)**	(2.09)**	(2.30)**
Overall Size Decile		–0.03	–0.01		–0.02	–0.03
(*low* η)		(–2.20)**	(–0.48)		(–1.59)	(–1.28)
ϕ_b			0.59			–1.00
			(0.81)			(–1.51)
Class FEs	Yes	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	No	Yes	Yes	No
R^2	0.04	0.04	0.04	0.02	0.02	0.05
Observations	629	550	277	627	548	277

Table 9: Turnover cost η, likelihood of switcher success ϕ_b, and firm prestige p, and the relative preference for high vs. low ability candidates during on-campus internship recruiting. Dependent variable is equal to 1 if offer recipient is a a high general ability ($H = 1$) candidate, defined based on GPA in the first three columns, and based on the number of open (bid-determined) internship applications in the last three columns. Probit models, marginal effects reported. Robust standard errors clustered by firm. ϕ_b is defined at the broad industry level, and measures the percentage of summer internships that resulted in full-time jobs, for interns who were industry switchers. Offers included are those for class of 2007, 2008 and 2009 two-year MBA students.

Dependent variable	Indicator equal to 1 if offer recipient is high ability candidate					
	Ability based on GPA			Ability based on # open full-time applications		
	Offers to all candidates		Offers to industry switchers	Offers to all candidates		Offers to industry switchers
Prestigious	–0.03	–0.03	–0.00	0.07	0.11	0.04
(high p)	(–1.00)	(–0.95)	(–0.06)	(2.21)**	(3.09)***	(0.97)
Overall Size Decile		0.00	–0.01		–0.02	–0.00
(low η)		(0.08)	(–0.54)		(–1.88)*	(–0.09)
ϕ_b			0.17			1.70
			(0.44)			(4.15)***
Class FEs	Yes	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	No	Yes	Yes	No
R^2	0.02	0.03	0.01	0.04	0.04	0.04
Observations	1737	1593	956	1728	1588	952

Table 10: Unraveling and adverse selection at the full-time recruiting stage. Participants in the on-campus recruiting process for full-time jobs have lower general ability and are more likely to be industry switchers relative to individuals who are done seeking employment after the internship stage.

	GPA	% who were switchers at internship stage
Participated in full-time recruiting on campus	3.44 (N=1100)	85%
Did not participate in full-time recruiting on campus	3.50 (N=307)	80%
Difference	-0.06***	5%**