Birds of a Feather Flock Together: Two-Sided Incomplete Information and Human Capital Composition over the Firm Lifecycle

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Abstract

Based on the premise that there is incomplete information on the true quality of both young workers and young firms, we posit that human capital composition in a firm will vary over its lifecycle. When firms are new and young, we hypothesize that senior managers will be unwilling to hire younger workers, because the unknown quality of young workers may increase the risks associated with firm viability and short term needs to combat the liability of newness. This results in younger firms having more homogeneous work forces. As both worker and firm quality are revealed over time, we hypothesize that the heterogeneity in human capital composition will increase, given that the resolution of firm level uncertainty permits managers to seek benefits of complementarities between junior and senior workers. We find support for our hypotheses using employee-employer linked microdata from the legal services industry.

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ABSTRACT

Based on the premise that there is incomplete information on the true quality of both young workers and young firms, we posit that human capital composition in a firm will vary over its lifecycle. When firms are new and young, we hypothesize that senior managers will be unwilling to hire younger workers, because the unknown quality of young workers may increase the risks associated with firm viability and short term needs to combat the liability of newness. This results in younger firms having more homogeneous work forces. As both worker and firm quality are revealed over time, we hypothesize that the heterogeneity in human capital composition will increase, given that the resolution of firm level uncertainty permits managers to seek benefits of complementarities between junior and senior workers. We find support for our hypotheses using employee-employer linked microdata from the legal services industry.

INTRODUCTION

Incomplete information (Akerlof, 1970; Holmstrom, 1979), like Knightian uncertainty (1921), arises in dynamic environments where difficulty in predicting the future prevents any party from assigning probabilities to future economic developments (Alchian, 1950). Incomplete information plays an important role in the careers of young workers (Bidwell & Briscoe, 2010; Jovanovic, 1979) and the performance of young firms (Alvarez & Barney, 2005; Jovanovic, 1982). When young workers enter jobs there is incomplete information about their quality and thus their performance is difficult to forecast. Analogously, there is incomplete information about the quality of new firms and thus their future performance is uncertain.

Previous work has examined incomplete information about workers and firms in isolation. This dichotomy is surprising because the incomplete information about young firms partially stems from the fact that they often have few resources beyond the human capital possessed by their employees (Alvarez & Barney, 2005). As a consequence, information about the quality of workers is most important when incomplete information about the firm is highest. Building on this idea, we integrate across the previously isolated firm and individual levels of analysis by suggesting that incomplete information creates a problem of two-sided uncertainty in the labor market. On one side, firm managers are challenged by incomplete information on worker quality when identifying, hiring, and retaining the workers that will provide the best contribution to firm performance (Coff, 1997). On the other side, workers have incomplete information about the quality of potential employers, so workers are concerned with ability to appropriate rewards for their efforts.

We examine the link between incomplete information about firms and workers by connecting the reduction in uncertainty about firm quality to managers' willingness to bear more

uncertainty about the future contributions of the colleagues that they hire. To capture reduction in uncertainty about worker quality, we focus on the age of employees. Incomplete information prevents the firm from making accurate assessments about the future contributions of younger individuals (Jovanovic, 1979), but research indicates that succession advantages (Cannella & Lubatkin, 1993; Cannella and Shen, 2001) and complementarities between workers of different ages (Garicano & Hubbard, 2007, 2009; Lucas, 1978; Rosen, 1982) provide incentives for the firm to build a workforce with age heterogeneity. We suggest that firm managers will only pursue these returns to age complementarity when firm-side uncertainty is sufficiently low because managers are unwilling to assume the dual hazard of hiring colleagues of uncertain quality in a firm of uncertain quality.

Relying on rich individual level data on the legal services industry from the US Census Bureau, we hypothesize and show that firm-side uncertainty has a strong influence on the propensity of younger and older individuals to work together in the same organization. Specifically, we find that the variation in the age of a firm's employees increases with firm age and firm performance. We also find that the positive effect of firm performance on age heterogeneity is particularly important when the firm is new, and thus is of uncertain quality. The results suggest that "birds of a feather" flocking together to start-ups resulting in the homogeneity of workforces in new firms (Ruef, Aldrich & Carter, 2003) is partially driven by the role of incomplete information and that reduction in firm-side uncertainty allows organizations to unlock the returns to complementarities among younger and older workers which increases diversity in older and better performing organizations.

The paper makes several contributions to the literature concerned with firm evolution and the development of new organizations. To scholars interested in the role of incomplete

information in entrepreneurship (Alvarez & Barney, 2005; Dushnitsky, 2010), we provide the insight that incomplete information operates at the firm and individual levels of analysis simultaneously and there are important interactions between the two aspects of incomplete information. By linking the uncertain futures of firms with the uncertain futures of workers, we show how incomplete information may influence the assembly and development of human capital over the firm lifecycle.

We connect the literature on workforce complementarities (e.g. Lucas, 1978; Rosen, 1982) to the literature on firm evolution (Nelson & Winter, 1982), underscoring how underdeveloped routines and uncertainty about survival in young organizations can prevent them from realizing the benefits of heterogeneous human capital. While there is an active body of work that examines the connection of individual characteristics and entrepreneurial decisions (Campbell et al., 2010; Lazear, 2005; Nicolau et al., 2008; Robinson & Sexton, 1994), there is less research on understanding how individual characteristics of founders influence their choice of partners and their early hires. Our results suggest that older entrepreneurs may be unwilling to hire young workers because incomplete information about the quality of the firm itself reduces their willingness to employ workers of uncertain quality. However, as the firm matures and performance improves, the benefits of complementarities push the organization to develop a more heterogeneous workforce.

We also contribute to the strategic entrepreneurship literature by underscoring the conflict of short-term and long-term incentives in new firm creation. While training young workers may have a strong payoff in the future, senior founders may be unwilling to share scarce short-term rents with young workers whose quality is difficult to discern and who may wind up being little more than a drain on resources (Coff, 1999). We also suggest incomplete information

as a mechanism by which founders can appropriate rents over the firm lifecycle. By lowering uncertainty about the firm's chances for survival, better performance allows founders to hire younger workers, which in turn allows the firm to achieve better performance by unlocking short-term and long-term complementarities between older and younger workers. The capability to manage the transition from a homogenous workforce where internal workers are insulated from the risks of hiring colleagues of uncertain quality to a heterogeneous workforce where firms can extract value from complementarities is potentially a source of competitive advantage for entrepreneurial firms, especially given the challenges to overcoming inertia in the assembly of human capital (Hannan, Burton & Barron, 1996).

Incomplete Information about Workers

Firms evaluating a potential employee must forecast that employee's willingness and ability to contribute to the performance of the firm. Because the worker's contributions will take place in the future, information about these contributions is by definition incomplete: they are unknown to both the employee and the employer (Jovanovic, 1979). In order to reduce the incompleteness of the information about the worker's future contributions, a hiring manager must rely on the worker's past performance and as well as the manager's knowledge of the firm in order to forecast the worker's future performance.

Managers must overcome a number of challenges when making this forecast. The job candidate's past performance may contain a significant firm-specific component (Becker, 1962) that will be diminished if she exits her current firm. In such a situation, the firm must evaluate the quality of the worker's general and industry-specific skills (Neal, 1995) as well as her willingness and ability to develop firm-specific human capital (Morris, Alvarez, Barney & Molloy, 2011) in order to predict her ability to contribute to the performance of a different firm.

In order to evaluate the skills held by outside workers, firms usually rely on signals, such as personal recommendations (Granovetter, 1973) or past employment relationships (Spence, 1973). Information about whether or not the worker's skills will fit with the hiring firm is still incomplete (Jovanovic, 1979), but these signals can help reduce uncertainty.

Evaluating the ability and motivation of young workers will be particularly difficult, in part because they have fewer available signals. Young workers may be able to demonstrate general human capital in the form of education (Becker, 1975; Spence, 1973), but their lack of tenure in the workforce means that they have fewer industry-specific skills, recommendations, and prior employers for a potentially hiring firm to evaluate. Older workers, on the other hand, have revealed more information about their quality by virtue of their longer tenure in the workforce. Therefore, when a firm hires a young worker, it faces greater difficulty in developing an accurate forecast of his future contributions to the performance of the firm relative to hiring a more senior worker.

However, the uncertainty about a younger worker's quality is not necessarily a negative for the hiring firm. Just as financial investors may seek investments with greater variability in order to take advantage of prospects for growth at a discount due to risk, so too might firms prefer to hire young workers because of their potential to develop into productive employees in the future. Thus, hiring a young worker entails a short-term cost of training and evaluation with a possible long-term payoff as the worker reveals ability and motivation while simultaneously becoming embedded in her job (Lee et al., 2004) due to social relationships and firm-specific skills (Becker, 1962). By restricting the worker's perception of mobility, these developments can help the firm pay less than market rates for the worker's skills (Kryscynski, 2011) as she progresses in her career, resulting in a long-term benefit for the firm. Older workers, on the

other hand, are more a known quantity whose future contributions can be more accurately forecast by all firms in the market.

Incomplete Information about Firms

In the previous section, we focused on incomplete information about the quality of potential workers from the point of view of a firm's hiring managers. In this section, we take the perspective of workers both inside and outside of the firm, and focus on incomplete information about the quality of the firm itself. While incomplete information about worker quality involves the worker's ability and motivation to contribute to firm performance, incomplete information about firm quality from the perspective of a current or potential employee surrounds the way that the firm creates value and the way that the value is divided among its workers. Prior work indicates that the firm's routines for creation (Lippman & Rumelt, 1982) and apportionment (Blyler & Coff, 2003) of value are difficult even for insider employees to observe and understand.

Just as incomplete information inhibits the firm's ability to evaluate young workers, so too does incomplete information inhibit a worker's ability to evaluate the quality of a young firm. At a basic level, entrepreneurial firms often lack well-defined strategies (Dencker, Shah & Gruber, 2009) and crucial physical and financial resources (Stinchcombe, 1965). Also, though founders with prior experience may port routines from previous organizations (Phillips, 2002), firm routines for creating value require time to develop, so young firms also lack these essential organizational inputs as compared to older organizations (Nelson & Winter, 1982). In addition to the firm's routines for creating value, current and potential employees will also be concerned with the firm's routines for apportioning the value that is created (Castanias & Helfat, 1991; Coff, 1999). Even in an older firm, the organization's routines for dividing value are usually

difficult for employees to discern (Blyler & Coff, 2003), and this uncertainty will likely increase

in young organizations that do not have institutionalized employment procedures (Doeringer &

Piore, 1971).   Thus, as a consequence of resource and routine deficiencies, working for a young

firm requires an employee to shoulder more uncertainty about the firm's ability to create value

and his own ability to appropriate a satisfactory portion of the value that is created as compared

to employment in an older organization.

Two-Sided Uncertainty in New Firms

Combining the two previous sections illuminates a vexing two-sided problem of

incomplete information operating in labor markets. On the firm side, managers deciding whom

to hire and workers outside the firm deciding whether to join the organization may have

difficulty assessing whether and how the firm will create value as well as their own ability to

appropriate some of that value. On the worker side, hiring managers will have difficulty

assessing the future contributions of job candidates and workers outside the firm trying to decide

whether to join the organization will have difficulty predicting the future contributions of

potential colleagues. In this section, we suggest that the desire of workers to reduce the

combination of these uncertainties will have a distinct impact on the evolution of the age of the

firm's workforce over the firm lifecycle.

Previous research suggests that substantial benefits may flow to firms that are able to

compile a workforce of both young and old workers. These benefits have short-term and long-

term components. In the short term, young workers can provide complementarities to older

workers, helping them expand their productivity. By taking on tasks that require less specialized

knowledge, younger workers may represent important complementary assets to higher quality

workers (Groysberg et al., 2008) because they can allow older workers to apply their limited

time and energy to tasks with the highest returns to their human capital (Lucas, 1978; Rosen, 1982). Because much of a firm's performance may be attributable to a narrow group of its most talented workers (Zenger, 1992; Zucker, Darby & Brewer, 1998), increasing the productivity of older workers may increase short-term firm performance. With regard to long-term benefits, hiring young workers can increase firm performance because young workers eventually become older workers. By hiring workers when they first enter the industry, the firm can pay them relatively low wages while they develop industry and firm-specific human capital (Bidwell & Briscoe, 2010), thus providing the firm with a local stock of talent to replace older workers who may eventually depart the firm (e.g. Cannella & Shen, 2001). Promoting from a stock of internal talent rather than hiring from outside may be cheaper because the firm does not have to compensate outsiders for the loss of the human capital specific to their former employer (Becker, 1962; Harris & Helfat, 1998). Additionally, promoting internally may be more effective than bringing in outsiders in some cases because external hires may disrupt the performance of incumbent employees (Campbell & Saxton, 2010) while also experiencing a drop in performance themselves (Groysberg et al., 2008).

These analyses, however, do not take into account difficulties posed by the age of the firm. Internal division of labor presents many coordination challenges (Williamson, 1967) which firms normally solve through the implementation of routines (Nelson & Winter, 1982). Because young firms lack well developed routines, this coordination will be more difficult and the short-term returns to complementarities may be lower in young organizations. Furthermore, young firms may be created in order to exploit a very specific opportunity (Shane & Venkataraman, 2000) which does not require the complexity inherent in internal division of labor. These are

problems of short-term value creation that may provide a disincentive for older workers to hire younger workers inside of young firms.

Other issues may lie in the trade-off between long-term value creation and short-term value division that older workers must make when hiring young workers inside of young firms. Young workers are likely to provide their most significant contributions to the firm in the future as they develop industry- and firm-specific skills. However, incomplete resources place short-term pressures on the importance of each individual's marginal contribution to a new firm's growth and survival (Penrose, 1959). Accordingly, older workers may be unwilling to partner with younger workers who have yet to reveal their industry-specific talent and ability because they may have to subsidize the young worker's contributions in the short-term while being unsure whether the firm itself will survive long enough for the young workers to contribute. In short, working in a young firm with young workers requires older workers to shoulder two-sided uncertainty about both the firm and their colleagues.

Thus, because of the short-term pressures of working in a young firm, older workers employed by a young firm will likely prefer to reduce the uncertainty surrounding the quality of their colleagues by partnering with other older workers who have revealed the quality of their industry-specific skills. Similarly, older workers interested in joining a young firm may be less likely to join a firm that is mostly composed of younger workers. As a result, if young workers choose to work in a young firm, they may have to partner with other young workers, despite the fact that they may prefer to partner with older workers who may have more industry knowledge. However, as the firm ages, routines stabilize, and resources become less scarce, the firm may be better suited to exploit the complementarities between workers of different age groups. In addition, as the firm ages and the uncertainty as to whether it will survive in the future decreases,

older workers may be more willing to hire and train young workers because the older workers will be more likely to collect the long-term pay-off that occurs as the young workers grow older and reveal their quality. As a result, we have the following hypothesis:

Hypothesis 1: The variation in the age of the firm's workforce increase as the firm ages.

Reduction in Firm-Side Uncertainty

Our previous discussion has centered on how two-sided uncertainty in the quality of the firm and the quality of employees will reduce the incentives of older workers to join with younger workers when the organization is in its infancy. In this section, we discuss how, like firm age, firm performance can reduce firm-side uncertainty and increase the willingness of older workers to worker with younger employees. In essence, higher performing firms—like older firms— have increased likelihood of survival and more rents to share in the short-term, thus reducing concerns that older employees may have about waiting for the long-term payoff from joining with younger workers.

To begin, despite the previously discussed advantages of collaboration between older and younger workers, older workers may be unwilling to partner with younger workers when firm performance is low. As we suggested in the previous section, many of the benefits that older workers may receive from the collaboration are likely to be long-term as the young workers develop industry and firm-specific skills (Topel & Ward, 1992). However, given incomplete information about the quality of young workers (Jovanovic, 1979), it will be difficult to predict whether young workers will be able or willing to make these investments. Importantly, when the firm is not performing well, the survival of the firm will be more uncertain and there will be fewer rents available for appropriation by individual employees (Castanias & Helfat, 1991; Coff, 1999). As a result of this rent scarcity and long-term uncertainty, older workers may be

unwilling to join with younger workers. The younger worker's marginal contribution to the short-term productivity of the firm may be relatively low, and older workers may be unwilling to take a long-term view of investments in human capital when faced with short-term rent scarcity.

However, if the firm is performing well in the present, there will be more rents for employees to divide and the uncertainty about firm survival will be lower. In short, better firm performance leads to less incomplete information about firm quality. In this situation, older workers are more assured of capturing the future benefits of collaborating with younger workers, so older workers currently employed by the firm will be more likely to hire younger workers despite having incomplete information about their present quality. Similarly, older workers contemplating selecting a job at a firm with younger workers will be more likely to do so if that firm exhibits good performance. As a result, we expect that higher performing firms will be more heterogeneous in terms of employee age.

Hypothesis 2: Firm performance has a positive relationship with the variation in the age of the firm's workforce.

Firm Age and Firm Quality

In the previous section, we argued that higher performing firms would be better positioned to employ both older and younger workers because reduced firm-side uncertainty flowing from increased performance would allow older workers to accept the employee-side uncertainty of joining with young workers of ambiguous quality. In this section, we suggest that the reduction in firm-side uncertainty that comes from increased firm performance will be particularly important if the firm is young.

Better firm performance may encourage older workers to join with younger workers since higher performing firms have more rents to divide among employees and are more likely to

survive into the future, thus reducing concerns that older workers may have about making long-term investments in younger workers of uncertain quality. This positive signal about firm quality and subsequent reduction in firm-side uncertainty may be particularly salient in young organizations because young firms, owing to their age, suffer on average from a liability of newness due to scare resources and unstable routines (Nelson & Winter, 1982; Stinchcombe, 1965). When the firm is older, its survival may be less sensitive to short-term fluctuations in performance due to the slack created by existing stocks of resources. Because of the information about its quality that has been revealed by its ability to survive, better short-term performance may not change worker's perceptions of an older firm's prospects for survival. On the other hand, because of its short history and uncertain quality, good short-term performance may send a stronger signal about the quality and prospects for survival of a young firm. As a result of the relative lack of information about the quality of young firms versus old firms, we expect that better firm performance will be more important in convincing older workers to partner with younger workers inside of young organizations as compared to older organizations. As a result, we have the following hypothesis:

Hypothesis 3: Firm performance will be more positively related to the variation in the age of the firm's workforce when the firm is younger

DATA AND METHODS

Empirical setting

We tested our hypotheses in the U.S. legal services, an appropriate setting for several reasons. Professional services represent a large and growing sector of the US economy, constituting 46 percent of GDP in 2007[1]. However, few studies of firm evolution use professional services as an

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[1] Statistics on GDP by industry are from the Industry Economic Accounts Program at the Bureau of Economic Analysis. (http://www.bea.gov/industry/xls/GDPbyInd_VA_NAICS_1998-2008.xls).

empirical setting, increasing the novelty of our paper. In addition, due to the human capital intensity and low overhead costs, entrepreneurship is common in legal services (Teece, 2003), providing our data with the new entrants and young firms necessary to test our hypotheses. Human capital intensity also means that the quality of new attorneys can be difficult to discern because the motivation and ability of new lawyers to make these investments can be difficult to ascertain.   While law school students can distinguish themselves based on the school they attend and other activities such as participation in law reviews and judicial clerkships (Spence, 1973), primary signals such as bar passage can be relatively homogenous across individuals and academic success in law school does not necessarily predict an individual's ability to attract clients, and "rain-making" is typically a requirement to for success in the legal services industry (e.g. Galanter & Palay, 1991). Additionally, because many students enter law school either directly or one to two years after undergraduate studies (Parkin & Baker, 2006), individual age is a reasonable proxy for industry specific human capital in legal services, and we can exploit this fact in our analysis.

Prior work also suggests that despite the uncertain quality of young attorneys, firms have substantial incentive to hire them—both to leverage complementarities with older partners (Garicano & Hubbard, 2007, 2009) and to provide a local stock of human capital for partner succession (Galanter & Palay, 1991). Finally, prior studies of legal services have revealed substantial firm-level heterogeneity in the way in which law firms deal with the uncertain quality of young lawyers (Malos & Campion, 1995, 2000; Parkin & Baker, 2006). Some firms employ the well-known "up or out" tournament model, where associates get six or seven years to reveal their quality, at which point they are either promoted to partner or asked to leave the firm. On the other hand, some firms do not use the tournament model and instead hire partners from

outside, letting other firms serve as proving grounds for attorneys to reveal their quality (Malos & Campion, 2000). Thus, there are a variety of human capital strategies with regard to employee age that firms can choose to employ, and we can exploit this variation in our analyses.

Data

We analyze data from the Longitudinal Employer-Household Dynamics Project (LEHD) organized by the US Census Bureau[2]. These near universal, micro-level data are drawn from Unemployment Insurance records and include all employees of all firms who ever reported working in legal services in ten large states from 1990 to 2004. In addition to recording individual earnings for each worker, these data contain a variety of individual demographic variables and firm characteristics which we detail below. These data also provide stable individual and firm identifiers, allowing us to track the creation of new firms and reliably measure firm age.

Our level of analysis is the firm-year. We limited the sample to firms with at least 6 employees making at least $25,000 a year. We also eliminate firms that lost or gained more than 20 employees to an established firm or spinout in the previous year. These restrictions allow us to generate meaningful measures of compensation structure and avoid mergers, acquisitions, and administrative recoding of organizational identifiers. We also eliminate observations where the revenue is greater than $1M per worker, eliminating a handful of observations where revenues exhibited a dramatic temporary spike. Because these observations consisted of a few highly paid older individuals, they have flat compensation structures and low workforce age variation. Thus, their elimination results in a conservative test of our hypotheses.

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[2] See http://lehd.did.census.gov/led/library/tech_user_guides/overview_master_zero_obs_103008.pdf.

We also account for left-censoring in our data. Because of the importance of firm age in our theoretical arguments, we exclude left-censored firms until they have been in the data for at least 5 years. This allows us to ensure that these firms are "old" firms by our theoretical definition, which is important in the non-parametric measures of firm age that we employ below[3].

Estimation Methodology

We compute a series of fixed-effect linear regressions at the firm level of analysis. We estimate variation in workforce age as a function of firm age and a variety of controls for firm-level human capital. Fixed effects allow us to control for unobserved differences in firm quality and routines which may affect workforce variation and firm performance.

Dependent Variable

Variation in workforce age is measured using the firm's coefficient of variation, a well-known measure of diversity (Allison, 1978) commonly used in management research (Harrison et al., 1998; Klein, Conn, Smith, & Sorra, 2001; Simons, Pelled, & Smith, 1999; Wiersema & Bird, 1993). The coefficient of variation is calculated as the standard deviation of the ages of the firm's employees divided by the mean of the ages of the firm's employees.

Explanatory Variables

Firm age is a key explanatory variable in H1 and H3. In our primary specification, we measure firm age with two dummy variables. The first indicates whether the firm is a startup, which we identify as being a new firm in the data. The second indicates whether the firm is young, and we follow previous work (e.g. Elfenbein et al., 2010) by classifying young firms as those 1-4 years old. Our results are largely unchanged at different cut-off points for young firms.

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[3] The results that we present below are robust to including left-censored firms in the sample. The fixed effect nature of our analysis gives each firm its own intercept in the model, accounting for censoring.

Firm quality is a key explanatory variable in H2 and H3. We define firm quality as the natural log of the firm's total revenue. Because of the partnership model prevails in the legal services industry, we can assume that the firm's revenues are returned to employees as wages. Revenue is a common performance metric for studies using data from legal services (e.g. Campbell et al., 2010; Hitt et al., 2001; Somaya et al., 2008) and is widely used in trade publications and outsider ratings as a key indicator of firm quality (Malos & Campion, 1995). Theoretically, we use the log of this measure because the signal value of firm revenue may increase at a decreasing rate; empirically, we find that the logged measure provides superior model fit than the unlogged measure (likelihood ratio tests are significant at the 5% level).

Control Variables. We control for firm-specific, industry-specific, and general human capital by including, respectively, measures of average *tenure*, *age*, and *education* of the firm's workforce as well as the squares of these variables to account for nonlinear effects. Tenure records years since joining the firm and age measures years since birth, which in legal services is a reasonable proxy for industry experience (Gilson & Mnookin, 1985). Education is an individual level continuous variable imputed by the Census Bureau. We control for *firm size* by counting the number of employees in the firm each year. We also control for the firm's *wage structure*, which is measured by the coefficient of variation of the employee wages (e.g. Shaw et al., 2002). This important control removes variation in the dependent variable that is due to the firm hiring young workers that are also very low paid, such as legal secretaries. We also control for *race* and *gender* by including percentage of whites and males in the firm's workforce. We include a rough proxy for existing social relationships by including *prior relationships,* which takes the value of (1-turnover rate $_{t-1}$) for established firms. For startups, *prior relationships* measures the % of the startup who were coworkers in the startup's primary parent firm, defined as the

established firm which contributed the largest number of employees to the startup (e.g. Phillips, 2002). We include year dummies. Finally, we also include firm-level fixed effects to control for time-invariant, unobserved differences across firms.

RESULTS

Table 1 contains means and correlations of our variables. 6% of the firm-year observations are startup years, and 26% of the firm-year observations are for young firms between one and four years old. The *prior relationships* variable indicates that on average, firms retain 90% of their workforce from year to year. The average firm size in our data is 53 employees, but this variable has a long right tail, as reflected in its large standard deviation.

Table 2 contains results for our fixed effect regressions. Model 1 provides the tests of Hypotheses 1 and 2. Turning to Hypothesis 1, we see that the coefficient on the dummy for startup is negative and significant, as is the dummy for young firm. Furthermore, a Wald test for the equality of these coefficients indicates that the coefficient on startup is significantly more negative than the coefficient on young firm (p-value < .05). These results provide strong support for Hypothesis 1: as the firm gets older, the variation in the age of its workforce increases. We also note that this result is unchanged when we measure firm age continuously by including the number of years that the firm has been in the data along with the square of this variable. With regard to economic significance, holding other variables at their sample means, we see that startup firms have workforce age variation that is 2% less than firms that are older than four years.

Turning to H2, we see that log(revenue) is positive and highly statistically significant, supporting Hypothesis 2. With regard to economic significance, holding other variables at

sample means, we see that a standard deviation increase in log(revenue) results in a 1% increase in the variation of workforce age.

Model 3 provides the test of Hypothesis 3. We see that the interactions between our firm age dummies and the firm's log(revenue) are both positive and significant, indicating that log(revenue) has a stronger impact on the variation of the age of the firm's workforce when the firm is young. Furthermore, we note that a Wald test of the equality of the two interaction coefficients indicates that they are significantly different from each other at 10% level of significance. With regard to economic significance, holding other variables at sample means, we see that a one standard deviation increase in log(revenue) results in a 2% increase in workforce age variation for a startup but only a 1% bump for firms older than four years.

DISCUSSION AND CONCLUSION

This paper argues that labor markets experience a two-sided problem of incomplete information. On one side, the quality of young firms is uncertain. On the other side, the quality of young employees is uncertain. Our empirical results suggest that older workers who have revealed their quality will only want to deal with one side of this uncertainty at a time—they will generally avoid working in young firms with young colleagues. We find, however, that older workers can be persuaded to join with younger colleagues inside of a young firm when that firm exhibits exceptional performance. By reducing firm-side uncertainty stemming from a young firm's liability of newness, firm performance may convince older workers to make long-term investments in human capital by hiring younger workers.

Limitations and Future Research

There are several limitations to this research project which can serve as motivation for future research. First, our project potentially undervalues the role of social networks in the team

assembly process. While we attempt to control for prior relationships in the parent organization, an alternative explanation for our results is that founders rely on their social networks when determining founding partners and early hires (Sorenson & Audia, 2000). Consequently, if young firms consist only of groups of employee with social ties, then young firms would look homogenous regardless of the presence of incomplete information on worker quality. Then, as firms age and grow, the social network of their employees increases, leading to exposure to potential job candidates from different backgrounds which could increase the heterogeneity of the firm. Future research connecting founders' hiring decisions to their social network could address this alternative explanation.

There are several data constraints that potentially confound interpretation of our results. While age serves as a proxy for industry experience, this proxy introduces noise into the interpretation of our results to the extent that some workers enter legal services later than others. Future research that has better measures of employee experience could test a more refined model of how incomplete information on employee quality and the revelation of employee quality influences workforce design outcomes across the firm lifecycle. Symmetrically, future research that has more precise measures of job design and employee role, and thus workforce complementarities could refine the analysis of how job quality is revealed over time as startups age.

Finally, there are potentially generalizability issues with our research. Our research focuses only on the legal services industry which may not be representative of manufacturing industries, or even other services industries. Legal services is an industry where there is incomplete information on both employee and firm quality and there are complementarities across worker types (Garicano & Hubbard, 2007). While other industries face the same

information constraints and complementarities, the degree of these conditions may differ from the legal services industry. Future research that expands this analysis to other industries would allow the examination of the generalizability of our results outside the legal services context.

Contributions

Despite these limitations, our paper makes several contributions to the literatures concerned with human capital and the evolution of organizations. Prior work implicates incomplete information in the development of firms (Jovanovic, 1982) and workers (Jovanovic, 1979). We extend this work by pointing out that incomplete information about workers and firms operates simultaneously in the labor market and thus enters the calculus of hiring managers and workers contemplating the acceptance of a job offer. While prior work suggests that incomplete information will affect whether entrepreneurs can attract resources (Alvarez & Barney, 2005), we suggest that incomplete information will also alter the entrepreneur's decision set. Specifically, older entrepreneurs may be unwilling to join with young workers due to their uncertain quality.

In a similar vein, we contribute to the voluminous work that examines the liability of newness experienced by young organizations. Our results suggest that the liability of newness not only prevents other parties from partnering with young organizations (Hallen, 2008; Shane & Cable, 2002), it also affects the willingness of entrepreneurial managers to make long term investments in the human capital of their organizations. Thus, the liability of newness compresses new firms from without *and* from within.

Finally, research at the interface between sociology and entrepreneurship emphasizes the importance of social networks in new firm formation and success (e.g. Ruef et al., 2003). This

work suggests that homophily drives "birds of a feather" to flock to new firms together. We propose incomplete information about new firms and new workers as an important underlying mechanism for this type of behavior.

Table 1

Sample Statistics and Correlations of Variables

Variable	Obs	Mean	Std Dev	1	2	3	4	5	6	7	8	9	10	11
1 Coefficient Variation, Employee Ages	69138	0.24	0.07	1.00										
2 Dummy: Is the firm a startup?	69138	0.06	0.23	0.00	1.00									
3 Dummy: Is the firm 1-4 years old?	69138	0.26	0.44	-0.01	-0.15	1.00								
4 Log(Total Revenue)	69138	6.96	1.16	0.02	-0.06	-0.11	1.00							
5 Prior Relationships	69138	0.90	0.19	0.02	-0.07	-0.22	-0.18	1.00						
6 Coefficient Variation, Earnings	69138	0.68	0.40	0.03	-0.04	-0.05	0.39	-0.03	1.00					
7 # Employees	69138	53.40	470.87	0.02	0.00	0.01	0.33	-0.01	0.06	1.00				
8 Avg age, employees	69138	40.81	5.30	-0.01	-0.07	-0.13	-0.12	0.13	-0.01	-0.02	1.00			
9 Avg tenure, employees	69138	3.43	2.26	-0.04	-0.37	-0.53	0.00	0.27	0.05	-0.04	0.40	1.00		
10 Avg educ, employees	69138	14.47	1.02	-0.13	0.02	-0.01	-0.01	0.00	0.07	-0.04	0.28	0.13	1.00	
11 % male	69138	0.38	0.19	0.00	0.02	0.02	0.13	0.05	0.10	0.06	0.04	0.02	0.02	1.00

Table 2:

Fixed Effect OLS Regressions on the Variation in the Age of the Firm's Workforce

Dependent Variable		Model 1		Model 2	
Coefficient of Variation, Age of the Firm's Workforce		Coef.	Std. Err.	Coef.	Std. Err.
Explanatory Variables					
Dummy: Is the firm a startup?	H1	-0.010 ***	0.002	-0.024 **	0.007
Dummy: Is the firm 1-4 years old?	H1	-0.004 ***	0.001	-0.014 **	0.005
Log(Revenue)	H2	0.004 ***	0.001	0.004 ***	0.001
Log(Revenue)*Dummy: Is the firm a startup?	H3			0.002 *	0.001
Log(Revenue)*Dummy: Is the firm 1-4 years old?	H3			0.001 *	0.001
Control Variables					
Prior relationships		0.001	0.002	0.001	0.002
# Employees		0.000 ***	0.000	0.001	0.001
Coefficient Variation, Employee Earnings		0.001	0.001	0.000 ***	0.000
Avg age, employees		0.034 ***	0.002	0.034 ***	0.002
(Avg age, employees)^2		0.000 ***	0.000	0.000 ***	0.000
Avg tenure, employees		-0.008 ***	0.001	-0.008 ***	0.001
(Avg tenure, employees)^2		0.000 ***	0.000	0.000 ***	0.000
Avg educ, employees		-0.011 ***	0.001	-0.011 ***	0.001
% male		-0.005	0.004	-0.005	0.004
Constant		-0.236 ***	0.046	-0.231 ***	0.046
R-squared		0.0435		0.0434	
Number of observations		69,138		69,138	

Note: Models include firm fixed effects and year dummy variables. Models also include a variable measuring the percentage of the firm's employees who are white.

* Significant at the 5% level
** Significant at the 1% level
*** Significant at the .001% level