

The Effects of Individual and Employer Characteristics on  
Hourly Employee Retention: an Empirical Study

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Robert Allen Cobb

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## **Abstract**

This paper argues that employee tenure length is a function of not only firm specific characteristics and policies, but also individual characteristics, which can be identified and used in the pre-employment selection process. The information learned from this study can help hiring managers in identifying potentially high-production workers, by looking at several key factors that can be measured in a pre-employment application. This paper quantifies how the tenure length of employees can be influenced by not only the characteristics of the applicant, but also by decisions made by the employer. Some of these decisions include the starting wage, the number of scheduled hours given, and the job duties assigned to the individual once they are hired.

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## 1. Introduction

Workplace turnover is the result of employees quitting or being fired. When workers move across a defined set of jobs in the workforce, the rate of movement between those jobs at a specific location is the turnover<sup>1</sup> associated with that particular location. The annual job reallocation rate is around 20 percent, and the quarterly reallocation rate is over 40 percent. This means that about one out of every five jobs is either destroyed or created every year (Lane, 2000). In addition, 2 million Americans voluntarily quit their job every month (Bureau of Labor Statistics, 2013). There is, however, much variation in the turnover rate across positions and industries. Turnover is especially high in the retail industry, where self-termination is more prominent than being fired. On average, the annual part-time retail employee's turnover rate is 124 percent (The Economist, 2000).

There are many reasons why firms should care about employee retention. This of course includes saving money on employee hiring and training, but there are indirect benefits as well. When an individual terminates from an employer, there is a higher likelihood that the individual will go to work for a direct competitor. This action would then allow the former employee to take all of the procedures learned from the former employer to the new one (Management Study Guide). Prior to termination, workers can further be disengaged. For instance, there exists a 'quit and stay' phenomenon whereby the employee mentally quits their job, and ceases to put forth an effort that would yield in productive behavior (Maylett, 2013). During this time of disengagement, the employee is usually searching for other jobs.

Effective retention also helps with attraction of new talent. The attraction of low quality talent directly maps to poor execution of business plans, and can cause declines in worker productivity (Nwokocha & Iheriohanma, 2012). Potential employees are more likely to show interest in a company that fosters an environment that is beneficial to the employee. This characteristic of employers increases the number of applicants, and thus hiring managers have a larger sample of potential employees to choose from. Tied to this, the 'O-Ring Theory' of Kremer (1993) suggests that high skilled workers (who make few mistakes) will be matched with one another in equilibrium (i.e., high skill workers will instinctually want to work together), dramatically increasing output. The logic continues to hold for lower skilled workers, although the rate of output will not rise as fast as that of high skilled workers<sup>2</sup>. Higher retention

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<sup>1</sup> Turnover is defined, for a given time interval, as the ratio of total departures at a firm to the average number of employees.

<sup>2</sup> Specifically, the Starbucks franchise has chosen to offer a relatively high wage, low-turnover strategy, in hopes of attracting higher skilled workers with higher productivity rates; and ultimately higher tenure rates.

rates also lead to individual employees becoming more familiar with company policies and procedures, thus making them much more efficient when under time constraints of work.

A deep understanding over the drivers of retention is thus fundamental to firms. In competitive labor markets, a large driver of self-termination is financial. Job movement accounts for one-third of all real wage increases for individual workers, during the first ten years of employment (Lane, *The Low-Wage Labor Market: Challenges and Opportunities for Economic Self-Sufficiency*, 2000). However, the effect on low-skill workers as compared to high-skill workers is dramatically different. The marginal benefit from a job change for low skill workers is typically much less, with respect to wage and benefit differentials. Low-skill workers also suffer from turnover by the fact that lost work time is being compounded by time lost not gaining new skills.

It has been shown that younger workers turnover at a faster rate than older workers, especially for high school and college-aged individuals. Moreover, married workers are much more likely to have higher tenure rates than unmarried workers (Lane, *The Low-Wage Labor Market: Challenges and Opportunities for Economic Self-Sufficiency*, 2000). There will be much more turnover in times of economic expansion, especially in low skill jobs, and lower during times of recession (Nickell & Layard, 1999).

There exists an optimal level of turnover for the firm, at each position, at each skill level (Lane, Stevens, & Burgess, *Worker and Job Flows*, 1996). If a firm can control its level of turnover, then the firm then can control the consequences from having turnover at suboptimal levels. For example, if a firm pays below market value for a specific job, then they can expect a higher rate of turnover within that specific job. This higher rate of turnover can be offset by the fact that information exchange inside the job function is non-essential, thus training costs for an additional, new worker, is low. Conversely, if there exists job-specific information that is exchanged at an expensive rate within the firm, the firm may pay a premium to retain specific workers in these roles.

This paper develops models that describe the tenure rate based on information from a pre-employment application. Indeed, employers often collect important information in such applications and thus I investigate whether this information is useful for understanding employment spells. The models are applied to panel data on hourly, line-level positions at Pilot Flying J (PFJ), the largest operator of travel centers and travel plazas in North America.<sup>3</sup> The model takes pre-employment data, which include answers to a standard pre-employment

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<sup>3</sup> Line-level positions refer to positions where employees that interact with customers on a regular basis.

application and a personality test<sup>4</sup> that maps 77 personality-specific questions to 13 unique dimensions. These dimensions will be discussed later in this paper.<sup>5</sup>

The analytical techniques employed include standard OLS regression, logistic regression, and quantile regression. The responses to the general application and the personality test are mapped to the length of tenure of each individual. Unobserved factors related to location (e.g. hiring preferences of managers) and to macroeconomic conditions are controlled for through the inclusion of location and time fixed effects. Of note is that the analysis investigates whether factors deemed unlawful by the Equal Employment Opportunity Commission (EEOC) are important in explaining retention. These variables include age, race, marital status, and sex. The model also includes variables that are not observable until after a hiring decision has been made, such as the differential between requested and actual wages, and differences between desired and actual work schedules. This paper explores the heterogeneity in the relationship between employment duration and individual and job characteristics using quantile regression.

The purpose of the model is not necessarily to predict tenure rate, rather to help identify statistically significant key features of individuals, thus to help hiring managers identify specific traits of individuals that will correlate with higher tenure rates. These recommendations are not necessarily tied to the specific company to which the data came from, as the application is similar to most retail employment applications. Thus, the results from this paper may be applied to a wide range of companies in the retail industry.

In this paper, I show that the conceptual steps when making a data-driven hiring decision are to: (1) Identify key characteristics that will influence an individual's tenure length; (2) use those historical characteristics to help hiring managers identify potential candidates with traits that map to higher tenure rates. Relevant for tenure length, the analysis further supports notions that, once hired, firms must retain the employees with incentive structures that keep the employee engaged and loyal.

Findings show that individual characteristics, such as race, age, and marital status play a statistically significant role in the length of tenure. Moving forward, this paper is also able to show that the decisions made by the firm after an employee is hired play the largest role in maximizing the expected tenure of employees. These decisions are in the realm of employee scheduling, job duties and how quickly an individual is promoted/given a raise. Beyond the scope of this paper, this project will be used in building a new Employee Application System

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<sup>4</sup> The personality test used was developed by John Lounsbury, a Professor of Psychology at the University of Tennessee.

<sup>5</sup> The preliminary findings of this study were presented February 12-16 at the Pilot Flying J General Managers Meeting (GMM) in San Antonio Texas. The GMM gathers about 2,000 employees, which includes all of the retail general managers and about 400 employees from the corporate office.

that will 'score' potential candidates based on the input set of answers to the application and personality test. Machine learning techniques will be used in this portion, specifically Random Forest Ensemble Decision Trees<sup>6</sup>. The estimated completion date for this complete project is December 2015.

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<sup>6</sup> One of the projects currently assigned to the Business Intelligence department is to create a new employee screening system, which takes into consideration the convex combination of answers to the pre-employment application and personality test. This new system will hopefully allow PFJ to identify and retain quality employees, based on personal characteristics not previously explored.

## 2. Literature Review

### 2.1 Previous relevant research

Managing the retention of high-producing workers is considered one of the necessary steps of achieving a competitive advantage among competing firms (Walker, 2001). How employees perceive their workplace environment is an important aspect of retention. Factors that influence this perception include, compensation, benefits, their colleagues, their boss, the upward mobility that is available to them, and the fit (or customization) of the specific job at hand (Cappelli, 2000).

From December 2008 until March 2010, the rate at which people were laid off was higher than the rate at which people quit; from March 2010 to current times, the rate at which people are quitting has outpaced the rate at which they are laid off (Bureau of Labor Statistics, 2015). This is demonstrated graphically with data from the Bureau of Labor Statistics in Figure 1.

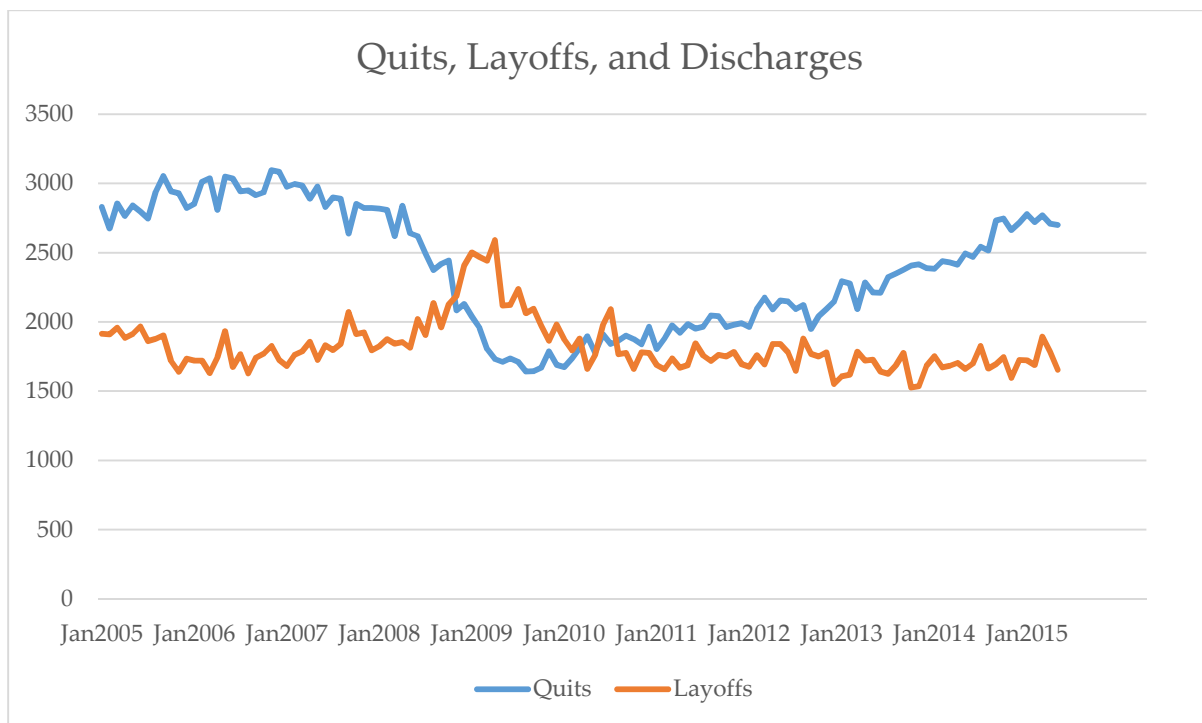


Figure 1: Quits, Layoffs, and Discharges in 000's

After 2010, the primary reason workers quit was the attainment of a higher paying job (Ehrenberg & Smith, 2015). Economic expansion will allow workers to have bargaining power in the workplace, as there is less friction moving from job to job (Batt, 2002). Other reasons for

quitting include poor working environment, excessive work pressure, excessive supervision, and small scope of growth and development (Islam & Alam, 2015).

## 2.2 Industrial wage theory

*“In the free market, employers have an incentive to lower costs by driving wages down, which is bad for workers. Since driving down wages is what efficiency requires, it follows that efficiency is bad for workers.” - (Ikeda, 2014)*

Employers incentivize their workers with wages (as well as with other factors). If the performance of an employee is not up to standard, the firm will have an incentive to pay the employee a higher wage (Akerlof & Yellen, 1986). However, wages are not growing quickly, as real wages (mean, adjusted for inflation) have gone from \$20.40 in December 2008, to only \$20.80 in January 2015 (Johnson, 2015).

There are multiple controllable costs in retail environments, but the largest is labor. Retail industry wide, the convention is that if a company wants to operate at a low cost, they must reduce controllable costs. Labor dollars are often interpreted as a cost driver rather than a revenue driver (Ton, 2012). Similar to the Phillip’s curve philosophy, common retail theory (albeit analytically wrong (Heskett, Jones, Loveman, Sasser, & Schlesinger, 1994)) states there exists an inverse relationship between customer service and profit margins. Customer service is a function of the type of person firms hire, and the person hired is a direct function of the wage being offered.<sup>7</sup> Thus, classic retail thought says that the higher your wages, the better your customer service, but the lower your profit margins. This thought assumes that high skill workers and low skill workers generate the same amount of marginal revenue, which Ton (2012) shows is incorrect.

The positive relationship between customer service and profit margins is demonstrated in real world retail chains. Specifically; Costco, Trader Joe’s, and one of PFJ’s direct competitors Quik-Trip; all pay well above the mean for their respective positions and have a healthy bottom line and phenomenal customer service, when compared to their competitors (Ton, 2012). These stores invest heavily in human capital, not only with regards to higher starting and mid-career wages, but also with in-depth training programs and professional development seminars. In the short run, cutting employee hours and wages creates immediate and quantifiable monetary benefits<sup>8</sup>. The long run effects of this practice are much harder to measure, however it can be

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<sup>7</sup> A much more detailed analysis of this is available in the appendix. I demonstrate how individual firms are buyers of labor from a market, and that the quality of labor obtained from the market is a direct function of the wage that is paid.

<sup>8</sup> A habit PFJ is guilty of is evaluating (and giving to) store General Managers based on the revenue dollar to labor dollar ratio, and the maximization of that number. Thus, when sales dollars are down for a given

shown that an increase in the real wage correlates with an increase in labor productivity (Anderson, 2007).

In 2000, Home Depot decreased the number of full-time employees and increased the number of part-time employees, in order to keep labor dollars down. This act almost instantaneously decreased Home Depot's customer service rating (as administered by a third party "Secret Shopper" service), and as a result year over year sales growth by store began to dip, and even turn negative in some cases. This paper will show that *ceteris paribus*, full-time employees stay much longer than part-time employees.

### *2.3 Retention as a function of firm characteristics*

At any skill level, high employee retention rates correlate strongly with customer service and customer satisfaction (Heskett, Jones, Loveman, Sasser, & Schlesinger, 1994). It has been shown that the retention of quality employees is a fundamental way of achieving a competitive advantage inside a particular market (Walker, 2001).

The attraction and retention of these employees is a function of many things, including: advancement opportunities, work environment and culture, work/leisure balance, and the outward image of the company (Cappelli, 2000). Other research suggests that site-specific HR management plays a large role in the retention rate of individual stores (Aguenza & Mat Som, 2012). Site-specific practices in compensation and bonuses, job security, training, supervisory attitude and culture, and work environment all play significant roles in the retention of employees (Ramlall, 2004).

This notion of site-specific characteristics of individual retail environments is also bolstered by the idea that if an individual or group of individuals all within the same location identify as part of a group, the tenure rate and employee production increases (Van Knippenberg, 2000). This group can be identified as part of the 'core' group of an individual location<sup>9</sup>. The definition of being part of the 'core' is subjective, however it is usually comprised of seasoned employees who are highly efficient<sup>10</sup> with regards to work flow and day-to-day activities (Lopez-Cabrales, Valle Ramon, & Herrero, 2006).

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month, PFJ immediately cuts labor hours to preserve the ratio. This practice is common among retail environments.

<sup>9</sup> The term 'core' is used in the academic literature, and within PFJ. The internal definition of 'core' is subjective within the organization.

<sup>10</sup> Are they in the core because they were effective first, or are they effective because they have long tenure? This is a 'chicken and the egg' scenario.

## 2.4 Wage

Compensation plays a large role in the attraction of potential employees, especially those with unique skillsets, and the initial wage paid by an employer is a part of the initial employer perception of the employee (O'Malley, 2000).<sup>11</sup> For employees in the retail segment, higher wages may signal a culture of excellence (Lawler, 1990), which can then be leveraged by the managers when making hiring decisions. Although higher starting wages are necessary to attract talent at every level of employment, it is not a driving factor of substantial tenure length (Smith, 2001). Money plays a secondary role to overall happiness while inside of the job (Wright & Bonett, 2007) (Duncan, 1976).

A positive relationship has been shown between initial starting wage (relative to peers in the same position) and tenure length (Sheridan, 1992). Intuitively, one would expect that individuals with higher relative education and experience as compared to their peers, will have longer tenure rates (Altonji & Blank, 1999). This paper will also show that the differential between desired starting wage and the received starting wage, has a large effect, holding all else constant.

## 2.5 Low-wage turnover

Low-wage workers have shorter tenure lengths on average than higher wage workers. This is due to the disparity between poor and non-poor low-wage workers. Poor, low-wage workers work on average the same number of hours per week as non-poor low-wage workers, but are employed 20 percent fewer weeks per year (Lane, 2000). Less educated workers are also less likely to voluntarily quit, and are more likely to be terminated (Cotton & Tuttle, 1986).

Low-wage turnover is also more susceptible to job reallocation. In low-wage positions, job creation and destruction is much more common than in higher wage positions. In the past, the Economic Cooperation and Development (OECD) has used this job reallocation rate as an index for the strength of a particular labor market. This reallocation comes with a cost, both to the firm and to the individual whose job has been reallocated. Longer tenured individuals are most adversely affected by job destruction, both on a monetary and emotional level (Maertz, Griffeth, Campbell, & Allen, 2007).

These findings ring especially true for line-level retail employees. Internal research at Pilot Flying J shows that there is an economic cost of about \$2,152 to hire, train, and get an

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<sup>11</sup> It can be argued in the sense of PFJ, skillsets needed to succeed at the hourly, line-level position are minimal

employee to a skill-level that they can function properly inside of a retail location. Not only is this cost incurred when an employee has to be replaced, the employer is also losing the customers who were socially attached to that employee, the knowledge of day-to-day activities, and workflow efficiency. For Pilot Flying J, many of the customers (professional drivers) drive redundant routes year over year, and they develop deep personal relationships with particular employees at the retail locations. Some proprietary survey data shows that on more than one occasion, drivers quit shopping with specific PFJ locations due to the termination of one specific employee.

Previous studies also show that the degree in which an employee 'matches' the job that they are designated to do plays a large role in the tenure length and productivity (Hersch, 1991). Employee match is a function of proper interviewing and making sure, pre-employment, that the potential employee has the aptitude and social skills to be successful in these types of positions.

## *2.6 Effects of turnover on the employee*

In the labor market, individuals will quit if doing so gets them to a higher level of utility. This especially holds true for younger workers in high skill jobs (Fallick, Fleischmann, & Rebitzer, 2005). Job movement accounts for one-third of all real wage increases for individual workers during the first ten years of employment, as the movement across these jobs allows the employee to move to a higher income level faster (Lane, 2000). However, the effect on low-skill workers as compared to high-skill workers is dramatically different. Low-skill (defined by low-education) workers also suffer from turnover by the fact that lost work time is being exponentiated by time lost not gaining new skills (Andersson, Holzer, & Lane, 2003).

Low-skill individuals who are fired have a lower probability of obtaining equivalent employment (as compared to the job they were just laid off from) again (directly as a function of low-skill), a higher probability of the subsequent job they take is of lesser value than their previous job (with regards to wage and benefits). These implications have higher relative costs for low-skilled individuals, as compared to individuals with more ability (higher educational levels). Low skill workers who have been laid off also have been given the reputation of being a 'lemon' (A derivative of Akerlof's lemon problem), due to their relatively low productivity levels, as demonstrated by their performance for the firm which laid them off (Gibbons & Katz, 1991).

## *2.7 Findings from other analysis*

The environment in which an employee works plays an important role in the attraction and retention of productive employees. 35 percent of American workers will quit their job within the first 6 months of being hired (Branham, 2005). The main reason of this voluntary turnover is the workplace was not what they expected it to be. Many workers (especially in low-skill, hourly positions) have unrealistic expectations of the job that they were hired to do. Of all new hires, 60 percent experienced some sort of initial shock during the transition to their new job (Branham, 2005).

Another major influencer for turnover is the work-life balance that low-skill workers incur. Usually, low-skill workers are at one time or another, scheduled to work off hour shifts<sup>12</sup>. (Golden, 1996) The work life balance that these employees incur is much less attractive than that of a high-skill worker, who would usually work during normal business hours.

These types of findings are not bounded by hourly retail and low-skill jobs. Evidence from the U.S. Navy<sup>13</sup> has shown that employee retention can be increased by having a commander (or some sort of leader) that made an effort to get to know employees personally. (Abrashoff, 2002)

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<sup>12</sup> This is especially true for this particular study, as Pilot Flying J has a history of scheduling workers during shifts they explicitly said they could not work.

<sup>13</sup> Explicitly, the USS Benfold had a retention rate of 28%. Captain Michael Abrashoff generated a retention rate of 100% by getting to know his crew on a persona level.

### **3. Pilot Flying J**

#### *3.1 Outline of the company*

In 2010, Pilot Travel Centers merged with Flying J to form Pilot Flying J (PFJ). PFJ is the 7<sup>th</sup> largest privately held company in the United States (Forbes, 2014), and is currently worth \$6 billion, and total revenue in 2014 being \$32 billion (\$22 billion being diesel fuel). One-third of all diesel fuel gallons in the United States are sold by PFJ. At any given time, PFJ employs around 24,000 people nationwide, of which around 17,000 are hourly, low-skill, line-level employees. These hourly employees serve as the liaison between Professional Drivers and their on-road necessities. These necessities include showers, ATM's, internet access kiosks and WI-FI hotspots in parking lots, laundry services, CAT Scales, workout facilities, medical care, religious services, and of course diesel fuel and food.

In 2014, Pilot Flying J hired over 22,000 new employees, to fill roughly 14,000 hourly, line-level positions, thus resulting in a turnover rate of over 158%. According to an internal audit, PFJ spent roughly \$51 million dollars in realized costs to hire and train these new employees in 2014 alone. This number includes the first month's (training period) pay, uniform, tax filings, and training programs. Not accounted for here are the economic costs that are associated with hiring these people, including the lost marginal revenue from each individual employee, or the opportunity cost of either a fellow hourly employee or manager taking the time out to train "on the fly" while the new employee is on a register or dealing with a customer

#### *3.2 Positions and job duties*

The line-level positions that are included in this study engage employees in repetitive tasks. The tasks that are a part of the daily duties have 'by the book' guidelines on how the tasks must be completed, thus allowing for little or no creative thinking when completing day to day activities. The positions included in this study include the titles "Hourly Team Member", "C-Store Team Member", "Coffee Host", "Deli Production", and "Hourly Restaurant". "Hourly Team Members" serve mainly as cashiers, and as needed will perform light maintenance duty. "C-Store Team Members" are the same as "Hourly Team Members", except that they are employed in PFJ's gas stations, rather than the Travel Centers. "Coffee Hosts" are delegated to only serve coffee. "Deli Production" workers are responsible for cooking and preparing the meals in the deli cases. "Hourly Restaurant" workers are cashiers and cooks for the fast-food restaurants attached to the Travel Centers.

These positions are usually heavily supervised. The level of supervision and micro-management has shown to have an inverse relationship with the length of tenure, at all levels of employment (Grant, 2010). This has shown to have an inverse relationship with the length of tenure, at all levels of employment (Grant, 2010).

There exists a large amount of utility that is gained from having a purpose at work. This supports the notion that people do not just work for the monetary rewards, but also for the intellectual rewards that are associated with a job, at any level (including hourly line-level jobs like PFJ offers). The lack of creative freedom in the workforce has shown to have negative impacts on the length of tenure, at any job level (Pfeffer, 1998).

Highly capable employees with more freedom to inject personal creativity were shown to have higher rates of job satisfaction and higher rates of tenure length, when compared to their non-skilled peers (Glynn, 1996). This also leads to the finding that highly-skilled employees who are unengaged or underutilized will self-terminate quickly. This means that PFJ must identify top talent quickly, and do what it can to retain them (higher pay, more responsibility). If the people in leadership positions are of high skill, it will create a trickle-down effect at the store level, to which other highly skilled people will be attracted to, thus recruiting new talent with higher skill levels, and fostering an environment with higher skills for current employees to learn from. This effect, will in turn require a wage to attract and retain top talent. This again supports the notion that a higher relative wage (relative to positions that require similar skillsets), will attract the top of the distribution with regards to talent (recall that higher talent also correlates with higher tenure).<sup>14</sup>

### 3.3 Scheduling

Although the wage rate has the biggest impact on initial tenure rates for employees, other factors also play major roles in determining how long an employee will stay employed. When an employee initially applies for a position at PFJ, the digital application has a section in which the company explicitly asks the candidate to fill out their desired weekly schedule. This is used for fitting a candidate to a specific job (if the job requires odd hours), and the candidate has the option to put 'open availability', which means they are available at any time, any day. Currently, if open availability is selected, the potential employee is given the 'green check-mark' in the scheduling column during application evaluation, and they are evaluated on the

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<sup>14</sup> The following question then arises: "Do we attract top talent by giving a higher starting wage to everyone, or do we pay low starting wages, identify top talent, and then promote them quickly?" (Classic 'chicken or the egg' problem) PFJ does neither of these things.

next criteria. I will show later in the paper that this is actually a negative signal when the candidate indicates that they have open availability.<sup>15</sup>

With regard to assigned scheduling, PFJ has created some common practices that show to decrease tenure length. Unpredictable work schedules, short shifts, and shifts that do not match the desired schedule are all factors that lead to early termination within the PFJ culture. The average age for employees that are in the data is about 30, leading to the fact that a large portion of the sample have families, thus other obligations that need attention outside of work. According to internal surveys done on departing employees, one of the biggest reasons employees quit their position with PFJ is their needs were not accommodated with regards to scheduling. Over 90% of employees in the training dataset had at least once been scheduled for a shift that they had previously explicitly said they could not work.

### *3.4 Turnover at Pilot Flying J*

As mentioned in section 2.6, firms can sometimes offset the cost of turnover by accounting for the relatively low cost of information exchange within the firm. Pilot Flying J does not have this luxury. Although the positions that are analyzed in this paper, the complexity of the duties are not something that can typically be picked up by the average applicant (thus also raising the argument that the marginal benefit of the wage employees receive does not exceed the marginal cost for coming to work, thus implicitly contributing to a higher turnover rate).

### *3.5 Analytics at Pilot Flying J*

Analytics at PFJ is a budding field. PFJ has traditionally been an ‘off-the-cuff’ decision making institution, as decisions historically have had to be made in an extremely timely fashion. This has shown to be successful in the past. However due to the exponential growth that PFJ has seen over the past 5 years (Pilot merged with a major competitor Flying J in July 2010, and has opened on average 25 stores per year since), it is becoming harder and harder for humans to factor all information before making a decision on a particular issue (not only with regards to employee retention).

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<sup>15</sup> It is worth noting, that if an individual puts ‘open availability’ on their application, it may be a function of them “fishing” for a job, out of being desperate. These people historically have left when another job is offered that pays marginally more. They also sometimes quit when the majority of their shifts are night shifts (General Managers take ‘open availability’ literally and schedule new employees 100% night shifts).

This is especially true within the Human Resources department, due to the large number of people that are employed at PFJ at any given time. Until now, even the most elementary predictive modeling techniques were not being used when determining (pre-employment) what a prospective employee's performance would be. This 'low hanging fruit' is something that this paper attempts to quantify, with the hopes of improving PFJ's hiring practices going forward.

### *3.6 Application of predictive modeling to Human Resource Departments*

In the current corporate culture, HR departments are starting to rely on analytics to gain foresight into who to hire, at every pay grade. The world of reporting in Excel spreadsheets has morphed into one that requires heavy analytics to predict future events. Predictive modeling helps bolster corporate objectives, by quantifying the bottom line dollar value of what it costs to hire, train, and terminate a given employee.

Including PFJ, one-fifth of American workers have 'bad' jobs. (Ton, 2012). These people have low wages (The average starting wage for cashiers at PFJ is \$8.63 per hour, the nationwide average starting wage for cashiers is \$9.52). PFJ culture has engrained multiple business practices that this paper shows to be detrimental to not only tenure rate, but work productivity. These practices include, but are not limited to: (i) paying minimum wage when possible, (ii) not adhering to employees requested shifts, and (iii) not giving the requested amount of hours per week. 'Bad jobs' translate to employees not being loyal to their respective employer, and thus leaving earlier had they been in a job which met the specific needs of the individual.

By forecasting an individual's human capital (with regards to their productivity and tenure length when employed at PFJ), we are able to select the most promising candidates from a specified applicant pool.

Industry wide, the ability to analyze 'big data'<sup>16</sup> is starting to empower firms to maximize revenues by better grasping the relationship of biodata<sup>17</sup> and worker productivity. Firms have slowly begun to model how workforce training programs drive sales and overall productivity, however only 44 percent of firms use any kind of analytics to make hiring decisions (Fallaw & Kantrowitz, 2011). Firms are also investing heavily in formally trained Industrial Organization

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<sup>16</sup> Relative term

<sup>17</sup> Biodata is the generalized term in Organizational Psychology that refers to biographical data. The most popular applications of biodata include analysis that attempt to quantify future behavior, as a function of past behavior.

Psychologists and formally trained Data Scientists to address questions that stem from Human Resource departments<sup>18</sup>.

### *3.7 Hiring process at PFJ*

To become an employee at PFJ, an individual must have completed the entire pre-employment application, obtained all prerequisites with regard to any certifications (if applicable for maintenance and technicians), and agreed to work (as indicated by a letter of intent to begin work on a certain day). The individual must also have passed both a background check, and a pre-employment drug screening. The applicant must also have agreed to be willing to submit to random drug tests at any time during their tenure at PFJ.<sup>19</sup> From the date an applicant applies, that individual's application stays current for 365 days.<sup>20</sup>

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<sup>18</sup> Pilot Flying J recently hired Dr. Craig BeVier, an IO Psychologist as Director of Talent Management. General Motors recently hired Dr. Michael Arena, a PhD in Organizational Dynamics to lead their talent acquisition department.

<sup>19</sup> Both drug tests and pre-employment background checks are administered through a third party, not affiliated with PFJ.

<sup>20</sup> Recall that general managers inside of the stores have no way of differentiating applicants, and the applicants are ranked from most recently applied to oldest. Thus, when selecting candidates to come in for interviews, general managers will usually select the individual at the top of the list, and work their way down until an applicant agrees to come in for an interview. One of the benefits of this project for PFJ, is that it will be able to provide a way to force rank individuals inside the ATS (applicant tracker system).

## 4. Data

### 4.1 Collection of data

Along with other factors, this study makes use of personality measures based on a test developed by Dr. John Lounsbury's group at the University of Tennessee, Knoxville, specifically for PFJ. The test questions are proprietary, and the 7 "dimension" scores used in this study were directly calculated by Lounsbury's group. The test was never intended to directly measure predictors of tenure but may be useful in this regard. This test has been altered over the years to emphasize different personality traits. From 2011-2013 the test was specifically designed to identify candidates with strong customer service skills. On March 14, 2014 the test shifted its purpose to identifying candidates that had particularly strong sales ability. Beginning in March 2014, the dimensions being calculated are defined as Helpfulness, Enthusiasm, Work Drive, General Reasoning, Ethical Behavior, Service Urgency and Comfort with Procedures.

As these personality measures have changed over time, this constrains the time frame over which analysis can be undertaken. As a compromise, I analyze two overlapping data sets. The first dataset, which includes persons hired between March 14, 2014 and December 31, 2014, includes Lounsbury results, EEOC sensitive variables, and standard application questions (15,731 observations).<sup>21</sup> The second data set is over a larger time horizon, spanning hires between January 1, 2011 and December 31, 2014, but excludes personality measures from the Lounsbury test (71,213 observations). The removal of the Lounsbury-based personality measures, as demonstrated later, has very little influence on the effect of other variables included.

Although more recent applicant data is available, to minimize issues associated with non-observability of tenure length, the data is limited to those who were hired as of December 31, 2014. For this analysis, data on tenure length are incorporated as of August 11th, 2015. Overall, the data includes 5,772 employees that are still employed with PFJ. The other 65,752 observations correspond with employees that have quit or have been terminated. Each row of this dataset represents an individual person that was hired at PFJ.

However, other characteristics of individuals that are consistent across both datasets can be used in both populations (age, sex, race, and answers to general application questions)<sup>22</sup>. The purpose of analyzing both of these datasets is to define a parsimonious model, which

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<sup>21</sup> Note that in this time frame of less than 10 months, PFJ hired almost 16,000 people across hourly, non-leadership positions.

<sup>22</sup> Again, for defining a model that can be implemented into PFJ's Applicant Tracker System (ATS), we cannot use these EEOC sensitive variables.

includes variables that are only statistically significant with regards to identifying what traits map to higher tenure rates, and maximize the sample size.

The data consists of hourly, non-leadership employees at any Travel Center across PFJ's entire network. With the exception of a few EEOC variables, application input data was required for all new employees in these positions. Omission of EEOC data was around 4 percent of total observations for each data set, and incomplete rows were dropped.

#### *4.2 Applicant pool and current employees*

The typical applicant at PFJ is a low skill worker. They possess little education beyond the high school level, and average 29 years of age. These applicants usually have been employed in similar positions at other retail locations, and they rarely possess the skills to move up in management<sup>23</sup>. The upward mobility within the positions analyzed in this paper is limited. About 5% of individuals in these hourly, line-level positions are eventually promoted to hourly management (These individuals remain in the dataset when they are promoted, as we wish to identify the key characteristics of those individuals who were able to be promoted). These positions, which are sometimes hired externally, are not included in this study, as the turnover issue with PFJ is largely centered upon these front-facing positions, not management.

About 10% of currently employed PFJ employees are convicted felons, and about 15% of total applicants are felons. PFJ has no strict rule on not hiring felons, with only a few exceptions<sup>24</sup>. Once hired, individual workers may move about different job titles within the store. All of these forward facing positions require the same level of credentials, and are of the same skill requirements. The only position that has a different set of requirements is the Maintenance positions. This position does not require any additional training, however Maintenance does not interact with customers. Every other position in the store interacts directly with customers and is responsible for keeping the shelves stocked. The main difference between is the department in which they perform their daily duties. For example, a Retail Cashier and a Restaurant Cashier perform the same duties and operate a register that is very similar, but they are just in different departments.

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<sup>23</sup> Travel Center General Managers usually possess at minimum a bachelor's degree, and were never formally employed as an hourly, line-level employee. The Regional Managers (one step above Travel Center General Managers) usually possess some sort of advanced degree, or at minimum a bachelor's degree and several years of experience as a General Manager.

<sup>24</sup> PFJ will not hire a convicted felon if the crime committed was in the realms of theft or sexual misconduct.

When a new applicant is entered into the system, they are given 10 unique choices to select for their desired first position, if hired by PFJ. This indication is only used to select individuals who have a desire to fit the opening at hand. Once hired, the individual is classified as one of 5 different positions. These positions are described in Table 1. It is observed that all of these hourly, line-level positions behave similarly with regard to tenure length.

#### 4.3 Descriptive statistics

The data is a mix of continuous and dummy variables<sup>25</sup>. The data is a mix of variables taken directly from the raw employment application, and data that has been transformed to represent a variable that was not directly captured by the application. An example of this type of variable is ‘Test Length’, which is the time (in minutes) that an applicant took to finish the application. This was extracted by finding the starting timestamp and ending timestamp in the associated applicant’s application file<sup>26</sup>. Descriptive statistics are displayed in Table 1:

Table 1: Descriptive Statistics

| <i>Variable</i>            | <i>Description</i>                             | <i>Mean Dataset_1(SD)</i> | <i>Mean Dataset_2(SD)</i> |
|----------------------------|------------------------------------------------|---------------------------|---------------------------|
| Days employed              | Number of days employed (Dependent Variable)   | 118.44(103.54)            | 151.07(201.92)            |
| Age                        | Applicant’s age in years                       | 28.11(10.48)              | 29.36(10.4)               |
| Caucasian                  | = 1 if applicant is Caucasian                  | .6188(.48)                | .6414(.47)                |
| African American           | = 1 if applicant is African American           | .1938(.39)                | .1872(.39)                |
| American Indian or Alaskan | = 1 if applicant is American Indian or Alaskan | .0189(.13)                | .0184(.13)                |
| Asian                      | = 1 if applicant is Asian                      | .0038(.06)                | .0046(.06)                |
| Hispanic                   | = 1 if applicant is Hispanic                   | .1259(.33)                | .1102(.31)                |
| Multi-Racial               | = 1 if applicant is multi-racial               | .0322(.17)                | .0298(.17)                |
| Hawaiian                   | = 1 if applicant is Hawaiian                   | .0023(.04)                | .0024(.04)                |
| Available Sunday           | = 1 if applicant can work anytime on Sunday    | 0.72(0.45)                | 0.75(0.43)                |
| Available Monday           | = 1 if applicant can work anytime on Monday    | 0.71(0.45)                | 0.73(0.44)                |
| Available Tuesday          | = 1 if applicant can work anytime on Tuesday   | 0.71(0.45)                | 0.73(0.44)                |
| Available Wednesday        | = 1 if applicant can work anytime on Wednesday | 0.71(0.45)                | 0.73(0.44)                |
| Available Thursday         | = 1 if applicant can work anytime on Thursday  | 0.71(0.45)                | 0.73(0.44)                |
| Available Friday           | = 1 if applicant can work anytime on Friday    | 0.72(0.45)                | 0.75(0.44)                |

<sup>25</sup> Some of the dummy variables included in this regression were created from ‘factor’ variables that were taken from the raw application data. These variables were answered by employees via ‘drop down’ boxes, where the applicant could choose from a set of responses to a particular question.

<sup>26</sup> Although some of the questions on the application were not required to be answered (some sensitive, personal information such as age, race, gender, or marital status), around 98% of applicants who were hired, willfully gave this information when applying for a job. The individuals who were hired and did not disclose this information were omitted from the analysis when estimating the model.

Table 1: Descriptive Statistics Continued

| <i>Variable</i>                  | <i>Description</i>                                | <i>Mean Dataset_1(SD)</i> | <i>Mean Dataset_2(SD)</i> |
|----------------------------------|---------------------------------------------------|---------------------------|---------------------------|
| Available Saturday               | = 1 if applicant can work anytime on Saturday     | 0.76(0.43)                | 0.79(0.4)                 |
| Hire Date January                | = 1 if applicant was hired in January             | .055(.22)                 | NA                        |
| Hire Date February               | = 1 if applicant was hired in February            | .064(.24)                 | NA                        |
| Hire Date March                  | = 1 if applicant was hired in March               | .099(.29)                 | .027(.16)                 |
| Hire Date April                  | = 1 if applicant was hired in April               | .088(.28)                 | .099(.29)                 |
| Hire Date May                    | = 1 if applicant was hired in May                 | .100(.30)                 | .114(.31)                 |
| Hire Date June                   | = 1 if applicant was hired in June                | .105(.30)                 | .130(.33)                 |
| Hire Date July                   | = 1 if applicant was hired in July                | .097(.29)                 | .127(.33)                 |
| Hire Date August                 | = 1 if applicant was hired in August              | .089(.28)                 | .114(.31)                 |
| Hire Date September              | = 1 if applicant was hired in September           | .073(.25)                 | .101(.30)                 |
| Hire Date October                | = 1 if applicant was hired in October             | .083(.27)                 | .111(.31)                 |
| Hire Date November               | = 1 if applicant was hired in November            | .075(.26)                 | .092(.28)                 |
| Hire Date December               | = 1 if applicant was hired in December            | .067(.25)                 | .081(.27)                 |
| Marital status Divorced          | = 1 if applicant's marital status is divorced     | .05(.22)                  | .05(.22)                  |
| Marital status Separated         | = 1 if applicant's marital status is separated    | .01(.11)                  | .01(.11)                  |
| Marital status Married           | = 1 if applicant's marital status is married      | .15(.36)                  | .16(.36)                  |
| Marital status Single            | = 1 if applicant's marital status is single       | .76(.42)                  | .76(.42)                  |
| Marital status Widowed           | = 1 if applicant's marital status is widowed      | .01(.07)                  | .01(.07)                  |
| Education None                   | = 1 if highest education indicated is None        | .20(.40)                  | .19(.39)                  |
| Education Associates             | = 1 if highest education indicated is Associates  | .10(.30)                  | .10(.30)                  |
| Education Bachelors              | = 1 if highest education indicated is Bachelors   | .05(.21)                  | .05(.22)                  |
| Education GED                    | = 1 if highest education indicated is GED         | .07(.26)                  | .07(.26)                  |
| Education High School            | = 1 if highest education indicated is High School | .47(.49)                  | .46(.49)                  |
| Education Masters                | = 1 if highest education indicated is Masters     | .002(.054)                | .003(.05)                 |
| Education PhD                    | = 1 if highest education indicated is PhD         | .001(.024)                | .001(.024)                |
| DIMENSIONSCORE.1022              | Lounsbury score: Helpfulness                      | 11.41(3.56)               | OMITTED                   |
| DIMENSIONSCORE.1023              | Lounsbury score: Service Urgency                  | 10.85(3.26)               | OMITTED                   |
| DIMENSIONSCORE.1024              | Lounsbury score: Comfort with Procedures          | 10.31(2.33)               | OMITTED                   |
| DIMENSIONSCORE.1025              | Lounsbury score: Enthusiasm                       | 8.96(3.66)                | OMITTED                   |
| DIMENSIONSCORE.1026              | Lounsbury score: Work Drive                       | 13.58(2)                  | OMITTED                   |
| DIMENSIONSCORE.1027              | Lounsbury score: Ethical Behavior                 | 10.1(3.17)                | OMITTED                   |
| DIMENSIONSCORE.1031              | Lounsbury score: General Reasoning                | 4.03(1.09)                | OMITTED                   |
| Can begin immediately            | = 1 if applicant can begin immediately            | 0.94(0.23)                | 0.95(0.22)                |
| Convicted Felon                  | = 1 if applicant is a convicted felon             | .08(.27)                  | .07(.26)                  |
| Desired wage difference          | Wage requested minus wage received, in dollars    | 0.2(1)                    | 0.1(1.04)                 |
| Wage negotiable                  | = 1 if starting wage is negotiable                | .89(.30)                  | .91(.27)                  |
| Starting wage                    | Actual starting wage of employee                  | 8.71(1.22)                | 8.38(1.09)                |
| Desired position Coffee Host     | = 1 if desired first position is Coffee Host      | .03(.17)                  | .03(.19)                  |
| Desired position Diesel Service  | = 1 if desired first position is Diesel Service   | .002(.05)                 | .001(.02)                 |
| Desired position Deli Supervisor | = 1 if desired first position is Deli Supervisor  | .009(.09)                 | .01(.07)                  |
| Desired position Deli Team       | = 1 if desired first position is Deli Team Member | .06(.24)                  | .03(.19)                  |
| Desired position Maintenance     | = 1 if desired first position is Maintenance      | .18(.38)                  | .18(.38)                  |
| Desired position Prep Cook       | = 1 if desired first position is Prep Cook        | .14(.34)                  | .14(.35)                  |

Table 1: Descriptive Statistics Continued

| <i>Variable</i>                    | <i>Description</i>                                            | <i>Mean Dataset_1(SD)</i> | <i>Mean Dataset_2(SD)</i> |
|------------------------------------|---------------------------------------------------------------|---------------------------|---------------------------|
| Desired position Rest. Cashier     | = 1 if desired first position is Restaurant Cashier           | .12(.32)                  | .12(.33)                  |
| Desired position Rest. Supervisor  | = 1 if desired first position is Restaurant Supervisor        | .01(.12)                  | .01(.13)                  |
| Desired position Retail Cashier    | = 1 if desired first position is Retail Cashier               | .39(.48)                  | .40(.49)                  |
| Desired position Retail Supervisor | = 1 if desired first position is Retail Supervisor            | .03(.17)                  | .03(.18)                  |
| Desired classification PT          | = 1 if desired classification is Part-Time                    | .16(.36)                  | .15(.36)                  |
| Desired Classification FT          | = 1 if desired classification is Full-Time                    | .44(.49)                  | .42(.49)                  |
| Fulltime classification            | = 1 if employee was assigned full-time                        | 0.39(0.49)                | 0.35(0.48)                |
| Convenience store worker           | = 1 if the employee's job title is in a C-Store <sup>27</sup> | .01(.10)                  | .01(.08)                  |
| Coffee host                        | = 1 if the employee's job title is Coffee Host                | .02(.15)                  | .02(.14)                  |
| Deli Production worker             | = 1 if the employee's job is Deli Production                  | .13(.34)                  | .09(.29)                  |
| Restaurant hourly worker           | = 1 if the employee's job is Hourly Restaurant labor          | .33(.47)                  | .35(.47)                  |
| Hourly team member                 | = 1 if the employee's job is Hourly Retail labor              | .48(.49)                  | .51(.49)                  |
| Preferred Hours per week           | Applicant's requested number of hours                         | 36.34(6.58)               | 36.45(7.03)               |
| Hour differential                  | Hours requested minus average hours per week                  | -8.89(9.91)               | -8.02(9.99)               |
| Average hours per week             | Average hours per week applicant worked                       | 27.55(8.9)                | 28.17(8.88)               |
| Male                               | = 1 if employee is a male                                     | 0.39(0.49)                | 0.4(0.49)                 |
| Moving next year                   | = 1 if the applicant intends on moving in the next year       | .02(.16)                  | .03(.15)                  |
| Open                               | =1 if applicant indicated open availability                   | 0.59(0.49)                | 0.62(0.49)                |
| Presently employed                 | =1 if the applicant is currently employed                     | 0.26(0.44)                | 0.25(0.43)                |
| Prior Pilot employee               | =1 if the applicant has worked for PFJ before                 | 0.1(0.3)                  | 0.09(0.29)                |
| Relative of Pilot employee         | =1 if the applicant is related to a current PFJ employee      | 0.08(0.27)                | 0.07(0.26)                |
| Terminated                         | =1 if the applicant has been terminated before                | .12(.34)                  | .12(.33)                  |
| Test length                        | Minutes applicant took to complete application                | 36.83(20.6)               | 36.26(19.15)              |
| Total Experience                   | Previous work experience, in months                           | 39.56(276.87)             | 44.67(297.64)             |

<sup>27</sup> C-Store is short for convenience store. Convenience stores are much smaller than full scale travel centers.

## 5. Linear Regression Analysis

### 5.1 Model background

The dependent variable in the model is the log of the variable ‘Days Employed’, which is the numeric count of days employed at PFJ. For employees that changed to a similar position or were promoted during their employment, the total time in all positions is considered.<sup>28</sup>

Coefficient estimates will be obtained using OLS, accounting for fixed effects associated with individual stores, as well as time fixed effects (this is accomplished by including time indicators associated with the month individuals were hired). A more granular level of fixed effects could have been introduced by controlling for the General Manager that hired an individual, however introducing this set of variables would cause almost perfect multicollinearity with the individual stores, as most General Managers at PFJ have extremely long tenure rates at each individual store. Models are estimated with heteroscedasticity-robust standard errors.

Given the log-linear specification, coefficients are interpretable as semi-elasticities, in terms of percentage changes in days employed with respect to unit changes in the explanatory variable. Let  $\beta_j$  denote the estimated coefficient associated with the explanatory variable  $x_j$ . For a continuous explanatory variable, a one-unit increase in the explanatory variable gives rise to an estimated  $\beta_j \cdot 100\%$  change in days employed, *ceteris paribus*. For an indicator variable,  $100 \cdot (\exp(\beta_j) - 1)$  is the percentage difference in days employed for a worker with  $x_j = 1$  and a worker with  $x_j = 0$ , *ceteris paribus*. Noting that average tenure is 151 in the large dataset, one can multiply the percentage change by 151 to get a clearer picture about the magnitude of the change; e.g., a 5% increase change evaluated at the mean of the data is approximately 7.5 days.

### 5.2 Linear regression

Diagnostics of the linear regression are as follows in Figure 2:

|                                |                             |
|--------------------------------|-----------------------------|
| <i>Observations</i>            | 70,867                      |
| <i>R</i> <sup>2</sup>          | 0.3499                      |
| <i>Adjusted R</i> <sup>2</sup> | 0.3439                      |
| <i>Residual Std. Error</i>     | .9851 (df = 67,258)         |
| <i>F Statistic</i>             | 58.76*** (df = 616; 67,258) |

Figure 2: Linear Regression Summary

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<sup>28</sup> Given the average tenure length of line-level employees is short, internal promotions at PFJ are quite rare. PFJ attempts to identify “talented” employees quickly, and advance them through the ranks; however the talent within these line-level positions is low. For the analysis, the title that was given when the employee was initially hired is used.

Looking at the adjusted  $R^2$ , the preliminary conclusion is that the model does not provide much predictive power, being that only 34% of the variation in the log number of days employed is being explained by the model. However, related studies on this topic report similar goodness-of-fit measures (Saleem & Affandi, 2014).

This information can be used to help hiring managers select the best possible candidates, by identifying the factors that increase or decrease tenure length in meaningful ways.<sup>29</sup> Although the predictive power of the model as a whole is low, the overall model is indeed significant when showing what factors affect tenure length (as indicated by the F-statistic).<sup>30</sup> Although there are other possible variables one may include, the model was intentionally kept relatively parsimonious with regards to the number of explanatory variables that were included<sup>31</sup>. Indeed, if the model's job was to predict tenure rate, it would be poor, however that is not the case.<sup>32</sup>

*The following table contains a complete regression output. The remainder of the chapter will dissect the model section-by-section.*

*Table 2: Regression Output-Dependent Variable 'Number of Days Employed'*

| <i>Variable</i>            | <i>Estimate(Sig)</i> | <i>Std. Error</i> | <i>t value</i> |
|----------------------------|----------------------|-------------------|----------------|
| Intercept                  | 2.164***             | 0.113             | 19.135         |
| Age                        | -0.0007              | 0.0004            | -1.728         |
| African American           | 0.1285***            | 0.0125            | 10.229         |
| American Indian or Alaskan | -0.0434              | 0.0311            | -1.394         |
| Asian                      | 0.1161*              | 0.0565            | 2.054          |
| Hispanic                   | 0.0271               | 0.0153            | 1.767          |
| Multi-racial               | -0.0068              | 0.0227            | -0.301         |
| Hawaiian                   | 0.0354               | 0.0777            | 0.456          |

<sup>29</sup> As of current, PFJ hiring managers have no analytics going into the evaluation of potential application, thus presumably any direction would be welcomed.

<sup>30</sup> Recall that the null hypothesis for the F-statistic is that all of the regression coefficients are equal to zero.

<sup>31</sup> The human element of the hiring process is not meant to be replaced, only bolstered from the findings of this study.

<sup>32</sup> With regards to predictive modeling, deep learning (machine learning) techniques have proven to be quite efficient with regards to this data. As stated earlier in the paper, Ensemble Decision Trees (Random Forest), Support Vector Machine (SVM) and Neural Network methods are all being employed with regards to the productionalized version of the predictive analytics for this PFJ study. An initial test was implemented on 8/7/2015.

Table 2: Regression Output-Dependent Variable 'Number of Days Employed' Continued

| <i>Variable</i>                       | <i>Estimate(Sig)</i> | <i>Std. Error</i> | <i>t value</i> |
|---------------------------------------|----------------------|-------------------|----------------|
| Available Sunday                      | 0.0522***            | 0.0152            | 3.418          |
| Available Monday                      | -0.01428             | 0.0286            | -0.498         |
| Available Tuesday                     | -0.06943*            | 0.0305            | -2.272         |
| Available Wednesday                   | -0.1122***           | 0.0285            | -3.932         |
| Available Thursday                    | 0.033                | 0.0307            | 1.075          |
| Available Friday                      | -0.05049             | 0.0289            | -1.743         |
| Available Saturday                    | 0.02662              | 0.0196            | 1.352          |
| Hired in February                     | -0.0548*             | 0.0220            | -2.49          |
| Hired in March                        | -0.0624**            | 0.0202            | -3.086         |
| Hired in April                        | -0.0364              | 0.0206            | -1.767         |
| Hired in May                          | -0.0142              | 0.0202            | -0.705         |
| Hired in June                         | -0.0352              | 0.02              | -1.761         |
| Hired in July                         | -0.0468*             | 0.0203            | -2.305         |
| Hired in August                       | 0.03209              | 0.0206            | 1.556          |
| Hired in September                    | 0.06874**            | 0.0215            | 3.188          |
| Hired in October                      | 0.0524*              | 0.0209            | 2.506          |
| Hired in November                     | 0.03428              | 0.0214            | 1.602          |
| Hired in December                     | 0.0557*              | 0.0220            | 2.524          |
| Marital status unknown                | -0.0479              | 0.0545            | -0.878         |
| Marital status divorced               | -0.0731***           | 0.0186            | -3.926         |
| Marital status separated              | -0.1433***           | 0.0326            | -4.396         |
| Marital status married                | -0.0640***           | 0.0114            | -5.596         |
| Marital status widowed                | -0.0198              | 0.0540            | -0.366         |
| Maximum education GED                 | -0.0599***           | 0.0155            | -3.851         |
| Maximum education HS Diploma          | 0.0306***            | 0.0090            | 3.379          |
| Maximum education Associates          | -0.0177              | 0.0139            | -1.278         |
| Maximum education Bachelors           | 0.0676***            | 0.0181            | 3.732          |
| Maximum education Masters             | 0.2024**             | 0.0702            | 2.88           |
| Maximum education PhD                 | 0.191                | 0.1515            | 1.26           |
| Can begin immediately                 | -0.12***             | 0.0185            | -6.515         |
| Convicted felon                       | 0.0079               | 0.0146            | 0.544          |
| Desired Wage differential             | 0.0813***            | 0.0043            | 18.628         |
| Desired wage negotiable               | 0.0172               | 0.0138            | 1.246          |
| Starting wage                         | 0.1163***            | 0.0061            | 18.793         |
| Desired first position Coffee Host    | 0.0515*              | 0.0209            | 2.458          |
| Desired first position Diesel Service | 0.0386               | 0.1501            | 0.257          |

Table 2: Regression Output-Dependent Variable 'Number of Days Employed' Continued

| <i>Variable</i>                              | <i>Estimate(Sig)</i> | <i>Std. Error</i> | <i>t value</i> |
|----------------------------------------------|----------------------|-------------------|----------------|
| Desired first position Deli Supervisor       | -0.0371              | 0.0519            | -0.715         |
| Desired first position Deli Team Member      | -0.0035              | 0.0219            | -0.161         |
| Desired first position Prep Cook             | 0.096***             | 0.0148            | 6.459          |
| Desired first position Restaurant Cashier    | 0.1766***            | 0.0154            | 11.45          |
| Desired first position Restaurant Supervisor | -0.1069***           | 0.0296            | -3.601         |
| Desired first position Retail Supervisor     | -0.0871***           | 0.0223            | -3.905         |
| Desired Part-Time                            | 0.392***             | 0.0139            | 28.133         |
| Desired Full-Time                            | -0.0316***           | 0.00886           | -3.599         |
| Fulltime classification (once hired)         | 0.1626***            | 0.0096            | 16.856         |
| Convenience store worker                     | -0.0924              | 0.3417            | -0.271         |
| Coffee host                                  | 0.112***             | 0.0276            | 4.076          |
| Deli production worker                       | -0.0952***           | 0.0148            | -6.411         |
| Hourly restaurant worker                     | -0.0375**            | 0.0130            | -2.868         |
| Preferred hours per week                     | -0.0185***           | 0.0027            | -6.645         |
| Hour Differential                            | -0.0053*             | 0.003             | -2.111         |
| Average hours per week given (once hired)    | 0.079***             | 0.0026            | 30.311         |
| Male                                         | -0.0221*             | 0.0093            | -2.359         |
| Moving in the next year                      | 0.0417               | 0.0242            | 1.721          |
| Open availability indicated on application   | -0.1713***           | 0.0097            | -17.656        |
| Presently employed                           | 0.0674***            | 0.0093            | 7.245          |
| Prior Pilot employee                         | -0.0227              | 0.0134            | -1.682         |
| Relative to a Pilot Employee                 | 0.1688***            | 0.0151            | 11.147         |
| Terminated                                   | 0.1153***            | 0.0115            | 9.973          |
| Total experience in months                   | 0.0001               | 0.00002           | 0.705          |
| Application length in minutes                | 0.0006**             | 0.0002            | 3.216          |
| *** indicates significance at <.01           |                      |                   |                |
| ** indicates significance at <=.05           |                      |                   |                |
| * indicates significance at <=.1             |                      |                   |                |

### 5.3 Unobservability in the dependent variable

One issue that is worth noting, is that although the dataset only includes individuals who were hired on or before December 31<sup>st</sup>, 2014, there exists some unobservability with regard to the people who are still working (as they have not been terminated yet). One circumvention to check to see if this is a legitimate problem is to omit all individuals who are still employed with PFJ, and compare the results of the new model with modified data, to the original model.

The count of individuals who are still employed at the time of this paper is 2,269. After removing these individuals from the data and re-running the model, the signs and significance of coefficients remain the same, with the exception of “Desired position Restaurant Supervisor” becoming significant at the 10% level (and remaining negative). This minor change in the model does not warrant the permanent omission of these individuals, as some of these long tenured individuals have specific characteristics that influence long tenure rates, that we wish to measure. Intuitively, we would be omitting the individuals who possess the characteristics that we wish to explicitly measure.

#### *5.4 Race and gender*

The regression includes several controls for race. The omitted race category is Caucasian and as such coefficients on the race indicators measure tenure differences relative to this omitted category. We see a large, significant increase in tenure for African Americans relative to Caucasians. Previous studies have shown that alternative employment options for African American individuals is smaller than those for Caucasian individuals. Thus, the opportunity cost of leaving a job that has already been attained is greater for African American individuals (Weisskopf, 2013).

The findings in this study are in line with another study produced by the BLS, which showed that the mean and median duration (in weeks) of Caucasian workers compared to African American workers was 37.7 vs 44.9 and 17.6 vs 24.7 respectively, for low-skill positions (Bureau of Labor Statistics, 2012).

There is a statistical difference between males and females; if the employee is a male, we can expect a 2.2% reduction in tenure length. This is contradictory to the findings by the BLS, in which the results were men stay on average 2.5% longer in their jobs at all job levels: hourly line-level to upper management (Bureau of Labor Statistics, 2012).

#### *5.5 Age*

Note the negative, significant coefficient associated with the variable ‘Age’ (albeit the coefficient is arbitrarily close to 0). The findings are inconsistent with a study conducted by the Bureau of Labor Statistics from 2004-2014, that showed that average tenure length increased with age (Bureau of Labor Statistics, 2014).<sup>33</sup> Other research has shown that the marginal utility

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<sup>33</sup> The study that was conducted by the BLS examined hourly positions across all types of work, not just hourly retail.

associated with switching to a new job with a higher wage diminishes with age.<sup>34</sup> Internal research at PFJ has indicated that older individuals treat hourly line-level positions as ‘stepping stone’ or ‘time-filler’ jobs, while in search of other, higher paying employment (Bosley, 2004).

Loess (locally weighted scatterplot smoothing) regression lines are useful for visualizing scatterplot data, as it indicates a weighted slope at each individual data point within a given support. This can be visualized using the PFJ data from this study: The red line is a standard linear regression line, with slope  $-.0007^{***}$ , and the blue line is a standard loess<sup>35</sup> regression line. Note that the loess regression line and the standard OLS regression line are very close.

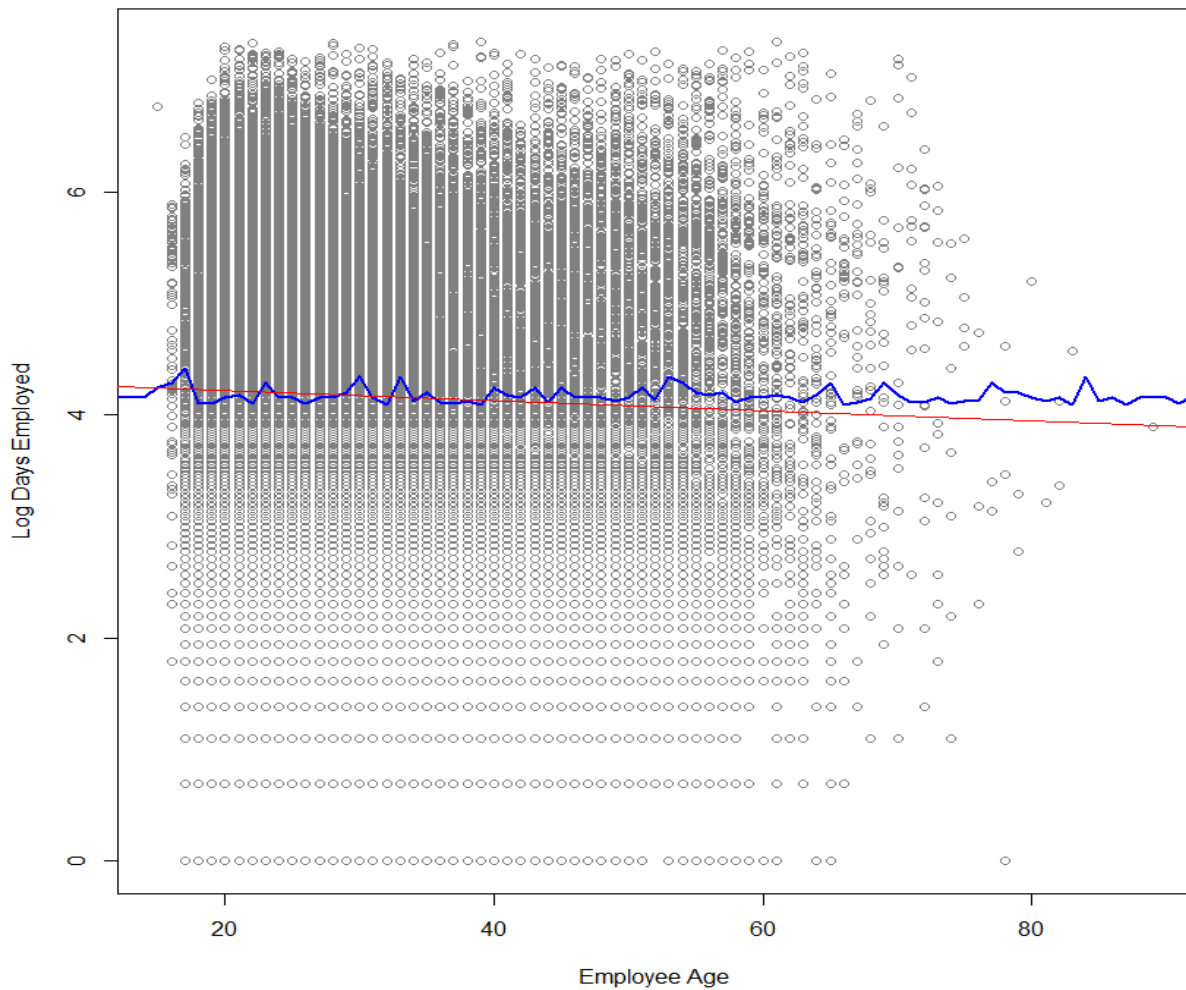


Figure 3: Log Days Employed vs Employee Age

<sup>34</sup> More on this specific variable will be discussed in the Quantile Regression section.

<sup>35</sup> Note that loess regression differs from lowess regression, in the sense that lowess regression uses a first degree polynomial to graphically show  $\frac{\partial y}{\partial x}$ .

## 5.6 Wage

Starting wage is determined, at least in part, by PFJ. For all of the positions included in this study, the starting wage is dictated by the corporate office for each individual store, for each position. Two of variables reported here include the starting wage granted, and the differential starting wage and the desired wage indicated on the application. The estimated coefficient on 'Desired Wage Differential' is 0.08, and is statistically significant. The interpretation is that for every dollar we pay an applicant above what they asked for, we can expect an increase in tenure of 8%, all else equal. This is consistent with all research discussed previously in this paper. At hourly, line level positions, starting wage is one of the biggest influences on tenure length, at the beginning of a new employee's job tenure.

One of the recommendations (discussed in the conclusion of this paper) will be to reevaluate the dictated starting wages, as traditionally PFJ's dictated wage for each of these positions is minimum wage, as compared to similar positions in PFJ competitors which pay on average 20% more. The other included variable in this section lists if the employee stated if their starting desired wage was negotiable or not. The model shows that if an individual states that their desired starting wage is not negotiable, this is a negative signal.

## 5.7 Scheduling

Pre-employment, applicants reveal their desired schedules, with regards to hours, if they want part-time or full-time, and if they are able to begin immediately. Recall that applicants can request part-time, full-time, or either. If an applicant says they want part-time classification, this is a good signal, as compared to someone responding 'either'.

More importantly, the biggest impact a function of how PFJ assigns the new employee. If PFJ classifies a new employee as full-time (thus giving them benefits), we can expect a tenure rate that is 16% longer than if we classified them as part-time.<sup>36</sup> This is controlling for the seasonal part-time employees that PFJ hires during peak summer months. Note that contrast in the signs for the coefficients for 'desired classification' and 'actual classification'. This may be due to the fact that once someone is hired and classified as full-time, the employee and the employee's family becomes eligible to receive benefits from PFJ. Once an individual has received benefits, they are more likely to feel 'in the family' with their employer, and have an

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<sup>36</sup> This could also be a function of PFJ's policy to hire employees and assign part-time classification, and then promote to full-time once the individual has established their intent to stay employed for a long time. This practice is something that is being addressed, but for our purposes, could cause some self-selection bias.

increased level of loyalty to their employer. This increased level of loyalty would directly lead to a longer expected tenure length.

The preferred hours per week is a variable that is negative, significant. This is the requested number of hours per week that an employee put on their initial application. Visualization of the data would create the argument that there does not exist an optimal number of requested hours, and the significance assigned to this parameter is incorrect. As before, the red line is the standard linear regression line with slope close to  $-.01$ .

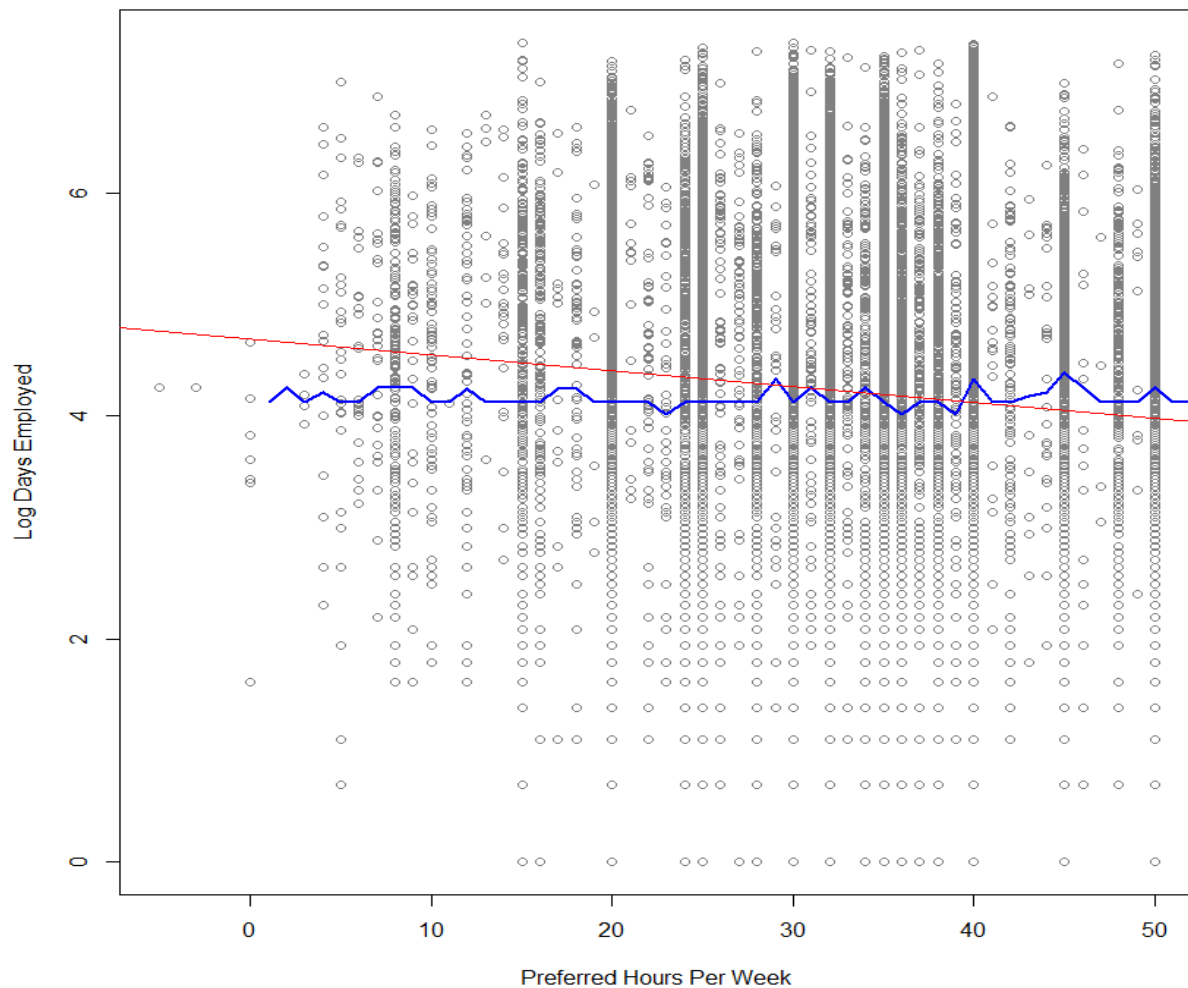


Figure 4: *Log Days Employed vs Preferred Hours per Week*

It is also worth noting that if an employee says that they can begin immediately, or that they have open availability (meaning that they responded that they can work anytime at any

day), these are both bad signals with regard to tenure length. This can be thought of as ‘fishing’ for a job, as most applicants that respond this way are unemployed at the time of application. Also, if an individual says they have open availability on their application, the scheduling manager for that particular store will schedule the majority of that individual’s hours on the night shift.<sup>37</sup> The majority of an individual’s shifts being at night tend to push them out more quickly. (Traditionally, PFJ looks for individuals with open availability who can begin work immediately. The data shows that this trait is not a positive signal.) If an individual states that they can begin immediately, we can expect a 12% reduction in expected tenure, all else equal. Similarly, if an individual says they have open availability, we can expect a 17% reduction in expected tenure length.

### 5.8 Criminal history and ethical behavior

There is no statistical difference between individuals who reported they had not been convicted of a felony, and those who have not. This data is completely contradictory to PFJ’s policy to blackball an individual who self-reported themselves as a felon.<sup>38</sup> The data would argue that if someone openly admits that they are a felon, this is not necessarily a bad signal to tenure length.

‘Honesty’ is a topic is something that could possibly be addressed more diligently in future pre-employment personality testing. (*Previous Lounsbury tests correlate work ethic and honesty*)<sup>39</sup>. The discovery of an individual’s honesty is something that is difficult to quantify<sup>40</sup>. In his book, Sarkar shows the correlation between honesty and work ethic, both at an economy wide scale and an individual scale (Sarkar, 2007).

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<sup>37</sup> Employee scheduling is a topic that PFJ does not put much thought in to. With regard to weekly scheduling, PFJ follows a ‘paint by numbers’ approach to scheduling. This is something that the Business Intelligence department has been tasked with: creating an optimal scheduling tool that maximizes labor dollars at peak times of the day.

<sup>38</sup> PFJ receives a large number of applicants from individuals who have been convicted of felonies. There also exists an unknown number of applicants who do not self-report themselves as felons, but whose criminal record shows up on the background check. If an individual fails to report themselves as a felon (within the time limits of the law), and their background check shows them as a convicted felon, then their application is dismissed immediately. This policy will not change, as the individual has subsequently lied to PFJ’s hiring manager about their criminal history.

<sup>39</sup> The recommendation is NOT, however, to hire all convicts. A pre-employment background check is still a necessity.

<sup>40</sup> PFJ will continue to ask applicant-specific interview questions that will allow the hiring manger to discover how honest a potential employee is. Again, higher honesty correlates with work ethic.

## 5.9 Education

With regard to education, the maximum level of education attained was used for the model, as a dummy variable (the omitted variable from the model was 'NONE', which corresponds to individuals who did not report any education on their application). The most important observation to make here was the comparison between people who obtained a GED vs those who obtained a high school diploma the traditional way (people with max education equal to a GED or high school diploma make up 54% of PFJ's total hourly workforce). Individuals who indicated that their maximum level of education was a high school diploma stay 3% longer than individuals who did not report any education.<sup>41</sup> Individuals who reported that their maximum level of education was a GED (obtained not in the traditional high school setting) can be expected to have a tenure that is 6% shorter than those who did not report an education level.

Previous experience plays a very small, positive insignificant effect on tenure rate. This is intuitive, as the hourly line-level jobs at PFJ do not require much specific training or experience. Hiring managers within PFJ are explicitly told to heavily weight previous experience in similar positions when making a hiring decision, which the data show to be bad hiring practices.

## 5.10 EEOC compliant variables

With regard to the behavioral differences of individual applicant candidates, there does exist a measureable difference with regards to race. Although these findings cannot be used in the implementation of any new hiring practices, for the purpose of this study it is interesting to point out that African America applicants have the highest rates of tenure of all. Recall that there was a statistical difference between males and females.<sup>42</sup>

Upon exclusion of these EEOC sensitive variables, there is not a large difference in the regression coefficients of the new estimated model. The coefficients attached to the variables

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<sup>41</sup> Internal research at PFJ has also shown that those with GED's vs those with traditional high school educations have much poorer performance with regard to customer service and sales capacity.

<sup>42</sup> This information is illegal to use in hiring decisions. These conclusions should not be invoked when making a hiring decision.

that remained in the model remained consistent with regard to sign and significant, most likely due to the large sample size<sup>43</sup>.

#### 5.11 *Month of hire*

It is interesting to note that individuals who are hired in the month of September have the greatest expected tenure. This follows intuition that employees who are working these low-level hourly jobs could possibly be individuals who are going back to school in the fall (during the months of either August or September), and thus the people that are willing to take a job in September do not have these specific obligations.

In general, individuals who are hired in the fall and winter months, have a larger expected tenure than those who are hired in the spring months. Again, this may explicitly due to the individuals who are hired in the spring months may have some sort of academic obligation in the fall, thus are unable to continue working into those months<sup>44</sup>.

#### 5.12 *Personality traits*

It is interesting to report the effects of the Lounsbury dimensions on tenure rate, albeit we have eliminated them from estimation of the original model. The left hand side variable is the log number of days employed, which is continuous. Recall removing the Lounsbury variables from the set do not cause much of a difference in the estimates of the other variables included in the model. Thus, we will only analyze the effects of these 7 dimension scores<sup>45</sup>.

The modeling methodology for this section was to build a model that included the Lounsbury variables, build a second model that does not include the Lounsbury variables; then compare the two model's explanatory power.

The following table compares the model that includes the Lounsbury results to that which excludes them. As noted by the Adjusted  $R^2$ , including the Lounsbury variables does not provide much with regard to explanatory power. However, these variables are interesting to look at with regard to the effect's sign and significance.

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<sup>43</sup> It is also noteworthy that the legal counsel at PFJ has been informed by the EEOC that the variable "experience" may become illegal to use, as it can be used as in instrument for age, thus there is a possibility that it may have to be removed from the application sometime in the future.

<sup>44</sup> Something worth noting, PFJ does not capture if someone is currently enrolled in school.

<sup>45</sup> The slight change in variable effect size was due to the reduction in sample size, not bias introduced by including these variables.

|                               | <i>Model with Lounsbury</i> | <i>Model without Lounsbury</i> |
|-------------------------------|-----------------------------|--------------------------------|
| <i>Observations</i>           | 15,414                      | 15,414                         |
| <i>R<sup>2</sup></i>          | 0.4081                      | 0.4045                         |
| <i>Adjusted R<sup>2</sup></i> | 0.3835                      | 0.3801                         |
| <i>Residual Std. Error</i>    | .9499(df = 14,757)          | .9526(df = 14,764)             |
| <i>F Statistic</i>            | 16.6***(df = 613;14,757)    | 16.55***(df = 606;14,764)      |

*Figure 5: Lounsbury Model Comparison*

Table 3 is an excerpt from the entire regression output, but is only the report of the Lounsbury variables<sup>46</sup>. As with the regression reported earlier, the dependent variable is the log of days employed.

Note that individually, some of these coefficients are statistically significant. Although the effect sizes are rather small in this output for each of these dimensions, the signs of the coefficients are the interesting pieces. Each one of these dimensions was a continuous number, over the support[0,15].

*Table 3: Personality Traits*

| <i>Variable</i>                              | <i>Estimate(Sig)</i> | <i>Std. Error</i> | <i>t value</i> |
|----------------------------------------------|----------------------|-------------------|----------------|
| DIMENSIONSCORE.1023(Service Urgency)         | -0.0112**            | 0.0039            | -2.849         |
| DIMENSIONSCORE.1031(General Reasoning)       | 0.0421***            | 0.0074            | 5.676          |
| DIMENSIONSCORE.1026(Work Drive)              | -0.0135*             | 0.0063            | -2.139         |
| DIMENSIONSCORE.1025(Enthusiasm)              | -0.0057*             | 0.0029            | -2.023         |
| DIMENSIONSCORE.1027(Ethical Behavior)        | -0.0100**            | 0.0031            | -3.274         |
| DIMENSIONSCORE.1022(Helpfulness)             | 0.0080*              | 0.0033            | 2.452          |
| DIMENSIONSCORE.1024(Comfort with Procedures) | 0.0149**             | 0.0050            | 2.994          |

\*\*\* indicates significance at <.01  
\*\* indicates significance at <=.05  
\* indicates significance at <=.1

Particularly, DIMENSIONSCORE.1031<sup>47</sup> is a measure of mathematical reasoning, as measured by a set of high school level math problems that potential candidates take at the end

<sup>46</sup> Recall that these variables are only valid for the dates March, 2014 to current

of the application process. Note that the positive (significant) sign attached to this variable. This follows suit with previous literature that higher tenure rate correlates with mental aptitude. Internal PFJ studies have also shown that mental aptitude highly correlates with quality of work, and quality of work correlates with tenure rate as well (thus creating a 'chicken and the egg' scenario).

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<sup>47</sup> For DIMENSIONSCORE.1031, a one point increase in the score obtained will cause a 4% increase in the number of days employed, all else equal.

## 6. Quantile and Logistic Regression

### 6.1 *Background for quantile regression*

Recall that the full linear model only had an adjusted  $R^2$  of .3499. It can be inferred that because this number is low, there must be individual (worker) characteristics that are not observable (for example, an individual may have a personality that does not do well with the faced paced environment of PFJ, or someone who is predisposed to bounce jobs quickly). Because of this, we can ask the question: “If an individual is has a predisposition to work a certain number of days (determined exogenously), and this characteristic is not quantifiable, how can we measure the statistical impact on these individuals, by changing variables that are controllable?” These relationships can be modeled using quantile regression<sup>48</sup>. In our case, quantile regression models the relationship between a set of independent variables and specific quantiles of tenure length. In other words, we seek to answer the question: “do the independent variables effect the length of tenure of those with lower predisposed tenure rates differently than those with higher predisposed tenure rates?” In the linear regression model, we are only estimating the effects of predictor variables at the mean. Due to the large disparity of the data, quantile regression will allow us to identify, more specifically, how different types of individuals react to certain conditions.

The variables of the most interest will be the ones that are determined by PFJ once an individual is hired, and the ones that are decided at time of hiring (such as ‘wage differential’, ‘hour differential’, ‘full-time’, etc...). We are most concerned with these variables, as the identification of the effects of these variables in each quantile will allow hiring managers to look to see what variables consistently have either a positive or negative effect, across all quantiles of individuals (again, assuming that the individual has a predisposed number of days employed, that cannot be accurately measured with the data at hand). Identifying variables that have the same effect (with regards to sign and significance) across all quantiles is information that can be used in the hiring process.

The benefit from answering these questions, is to maximize the ‘fringe’ tenure, which an individual was not predisposed to have. This stresses the fact that PFJ must be able to accurately identify talent during the interview process<sup>49</sup>, and that the processes once an employee is hired are beneficial to the employee. With the following results, we are most concerned with sign and significance, as effect sizes will be implicitly biased due to

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<sup>48</sup> This falls under the assumption that the number of days employed by an individual is known by that individual before beginning employment, therefore I seek to maximize the ‘fringe’ number of days employed.

<sup>49</sup> This is something that is at the top of PFJ’s priority list. Once this talent is identified (empirically and during the interview process), maximizing the ‘fringe’ tenure is what becomes of interest.

characteristics which cannot be measured. The following tables will show the comparison of the 10<sup>th</sup> percentile, 50<sup>th</sup> percentile, and the 90<sup>th</sup> percentile. Note that in the quantile regression models, we are dealing with the continuous number, the log of ‘days employed’. In our output, the intercept does not match (nor is close to) the quantile value. This is because the intercept is a non-increasing function of  $\tau$ , thus the quantile function is non-monotone. This is called crossing quantiles (when quantile curves are estimated individually, the quantile curves can sometimes cross). We can still interpret other coefficients in the standard way (Bondell, Reich, & Wang, 2010).<sup>50</sup> The quantile cutoffs for the data are 11 days, 71 days, and 315 days, for the 10<sup>th</sup>, 50<sup>th</sup>, and 90<sup>th</sup> percentiles, respectively.

The dependent variable in this regression is also the log of the continuous number of days employed. This technique is valid because the log of the continuous number is a monotonic transformation, thus the coefficients can be interpreted as any other log-linear regression.

Table 4: Quantile Regression

| <i>Variable</i>            | <i>Estimate(S.E.) <math>\tau = .1</math></i> | <i>Estimate(S.E.) <math>\tau = .5</math></i> | <i>Estimate(S.E.) <math>\tau = .9</math></i> |
|----------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|
| Intercept                  | 1.6332*** (0.1153)                           | 2.7777*** (0.0868)                           | 3.8971*** (0.0778)                           |
| Age                        | -0.0043*** (0.0008)                          | 0.0019*** (0.0006)                           | 0.0112*** (0.0006)                           |
| African American           | 0.1695*** (0.0171)                           | 0.2258*** (0.0128)                           | 0.2024*** (0.0123)                           |
| American Indian or Alaskan | -0.1609*** (0.0608)                          | -0.186*** (0.0341)                           | -0.0945*** (0.0468)                          |
| Asian                      | 0.2966*** (0.0810)                           | 0.2230*** (0.0626)                           | 0.1441*** (0.0252)                           |
| Hispanic                   | -0.044* (0.0234)                             | 0.0080*** (0.0161)                           | 0.0435*** (0.0165)                           |
| Multi-racial               | -0.0700** (0.0331)                           | 0.0410 (0.0264)                              | 0.0028 (0.0422)                              |
| Hawaiian                   | 0.0287 (0.1560)                              | -0.022 (0.1486)                              | -0.0476 (0.0325)                             |
| Marriage status unknown    | -0.1354 (0.0849)                             | -0.135** (0.0678)                            | -0.2391*8* (0.0601)                          |
| Marriage status divorce    | -0.0644* (0.0364)                            | -0.0993*** (0.0216)                          | -0.0921*** (0.0251)                          |
| Marriage status separated  | -0.0710 (0.06709)                            | -0.2072*** (0.0314)                          | -0.2325*** (0.0385)                          |
| Marriage status married    | -0.0634*** (0.01882)                         | -0.0689*** (0.0143)                          | -0.0486*** (0.015)                           |
| Marriage status widowed    | 0.0530 (0.1564)                              | -0.077 (0.0667)                              | -0.045 (0.1037)                              |
| Available Sunday           | 0.0435 (0.02883)                             | 0.0759*** (0.0195)                           | 0.0757*** (0.0198)                           |
| Available Monday           | -0.0338 (0.04998)                            | 0.0086 (0.0402)                              | 0.0677* (0.0373)                             |
| Available Tuesday          | -0.0483 (0.0521)                             | -0.0706** (0.035)                            | -0.0548* (0.0287)                            |
| Available Wednesday        | -0.0857* (0.04559)                           | -0.1153*** (0.0401)                          | -0.1425*** (0.0264)                          |
| Available Thursday         | -0.0235 (0.0365)                             | 0.0215 (0.0385)                              | 0.0638** (0.03228)                           |
| Available Friday           | 0.0190 (0.0512)                              | -0.0758* (0.0393)                            | -0.0181 (0.0279)                             |
| Available Saturday         | 0.0385 (0.0331)                              | 0.0427* (0.0248)                             | 0.0469** (0.0205)                            |

<sup>50</sup> It must also be noted that for the intercept of a quantile regression to be interpreted, the covariates must be centered so that the intercept can be interpreted as the conditional quantile. “Never estimate intercepts, always estimate ‘centercepts’” - (Koenker & Hallock, 2001).

Table 4: Quantile Regression Continued

| <i>Variable</i>                             | <i>Estimate (S.E.) <math>\tau = .1</math></i> | <i>Estimate (S.E.) <math>\tau = .5</math></i> | <i>Estimate (S.E.) <math>\tau = .9</math></i> |
|---------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Hired in February                           | -.0078 (.0245)                                | -.02667 (.02623)                              | .01095 (.0311)                                |
| Hired in March                              | -0.1144*** (0.0323)                           | -0.0133 (0.0249)                              | 0.02058 (0.031)                               |
| Hired in April                              | -0.0686** (0.033)                             | -0.0196 (0.0238)                              | -0.02641 (0.0298)                             |
| Hired in May                                | -0.0828** (0.030)                             | 0.0074 (0.0228)                               | 0.06408** (0.0283)                            |
| Hired in June                               | -0.0725** (0.029)                             | -0.0197 (0.023)                               | 0.06522** (0.0286)                            |
| Hired in July                               | -0.1313*** (0.032)                            | -0.0088 (0.0243)                              | 0.06615** (0.0292)                            |
| Hired in August                             | -0.0776** (0.0328)                            | 0.04921* (0.025)                              | 0.02996 (0.0308)                              |
| Hired in September                          | -0.0028 (0.0365)                              | 0.07882*** (0.0257)                           | 0.02512 (0.0360)                              |
| Hired in October                            | -0.0087 (0.0374)                              | 0.0919*** (0.0252)                            | -0.01383 (0.0326)                             |
| Hired in November                           | -0.0656* (0.0353)                             | 0.0705*** (0.0258)                            | -0.05489* (0.029)                             |
| Hired in December                           | -0.1329*** (0.0402)                           | 0.0472*** (0.025)                             | 0.0026 (0.0314)                               |
| Education level GED                         | -0.0486* (0.0255)                             | -0.0768 (0.0149)                              | -0.12639*** (0.029)                           |
| Education level HIGH SCHOOL                 | 0.0475*** (0.0157)                            | 0.0499* * * (0.0113)                          | 0.06252*** (0.0122)                           |
| Education level ASSOCIATES                  | 0.0669*** (0.024)                             | 0.0216 (0.018)                                | 0.0167 (0.0152)                               |
| Education level BACHELORS                   | 0.0638** (0.0305)                             | 0.1024* * * (0.0233)                          | 0.0966*** (0.0219)                            |
| Education level MASTERS                     | 0.3071*** (0.06315)                           | 0.0573 (0.0732)                               | 0.2624*** (0.0804)                            |
| Education level PHD                         | 0.2397*** (0.0715)                            | 0.1279 (0.1570)                               | 0.0817 (1.59928)                              |
| Desired first position Coffee Host          | 0.0161 (0.0356)                               | 0.0576* (0.0313)                              | 0.11816*** (0.0335)                           |
| Desired first position Diesel Service       | 0.3620 (0.3578)                               | 0.2501 (0.3915)                               | -0.08806*** (0.0322)                          |
| Desired first position Deli Supervisor      | 0.0546 (0.0843)                               | -0.0265 (0.0572)                              | -0.1407*** (0.0285)                           |
| Desired first position Deli Team Member     | 0.0126 (0.0304)                               | 0.0249 (0.0260)                               | -0.0644** (0.0307)                            |
| Desired first position Maintenance          | 0.0276 (0.0226)                               | 0.0421*** (0.0155)                            | 0.0135 (0.01742)                              |
| Desired first position Prep Cook            | 0.0765*** (0.0252)                            | 0.1623*** (0.0188)                            | 0.1458*** (0.0179)                            |
| Desired first position Restaurant Cashier   | 0.2107*** (0.0230)                            | 0.2404*** (0.0190)                            | 0.1675*** (0.01916)                           |
| Desired first position Restaurant Supervis. | -0.0301 (0.0568)                              | -0.0178 (0.0353)                              | -0.0930*** (0.0358)                           |
| Desired first position Retail Supervisor    | -0.0725* (0.0431)                             | -0.0027 (0.0307)                              | 0.0284*** (0.03042)                           |
| Convenience store worker                    | -0.0678** (0.0281)                            | -0.0338 (0.0623)                              | 0.1549*** (0.0588)                            |
| Coffee host                                 | 0.1908*** (0.0486)                            | 0.28084*** (0.0339)                           | 0.0887*** (0.0230)                            |
| Deli Production worker                      | 8-0.1418*** (0.0244)                          | -0.1635*** (0.0188)                           | -0.13267*** (0.0190)                          |
| Restaurant hourly worker                    | -0.0726*** (0.0195)                           | -0.0466*** (0.0159)                           | 0.02186 (0.0160)                              |
| Total experience in months                  | 0.0000* (0)                                   | 0.0000 (0.0000)                               | 0.0003*** (0.00001)                           |
| Presently employed                          | 0.1082*** (0.0153)                            | 0.1042*** (0.0116)                            | 0.0252** (0.0105)                             |
| Terminated                                  | 0.1524*** (0.0200)                            | 0.1282*** (0.0142)                            | 0.1209*** (0.0149)                            |
| *****Convicted felon                        | -0.0074 (0.024)                               | -0.0016 (0.0195)                              | -0.0638*** (0.0171)                           |
| Prior Pilot employee                        | -0.0987*** (0.0285)                           | 0.0550*** (0.0172)                            | 0.081*** (0.01893)                            |
| Relative to a Pilot Employee                | 0.1353*** (0.0215)                            | 0.1768*** (0.0220)                            | 0.2007*** (0.0130)                            |
| Moving in the next year                     | 0.0669*** (0.0177)                            | -0.0142 (0.0327)                              | 0.0343** (0.0151)                             |
| Desired wage negotiable                     | 0.0263 (0.0288)                               | 0.0113 (0.0171)                               | 0.0763*** (0.0156)                            |
| Desired Wage differential                   | 0.0770*** (0.00691)                           | 0.1488*** (0.0046)                            | 0.1698*** (0.0047)                            |
| Starting wage                               | -0.0085 (0.0068)                              | 0.0141*** (0.0048)                            | 0.0814*** (0.0046)                            |
| Can begin immediately                       | -0.074*** (0.0232)                            | -0.1556*** (0.0263)                           | -0.1312*** (0.0192)                           |
| Desired Part-Time                           | 0.2402*** (0.0249)                            | 0.4324*** (0.0182)                            | 0.3655*** (0.01706)                           |
| sired Full-Time                             | -0.0627*** (0.0148)                           | -0.0809*** (0.0107)                           | -0.0885*** (0.0117)                           |
| Preferred hours per week                    | -0.0027 (0.0094)                              | -0.0242*** (0.0042)                           | -0.02871*** (0.0023)                          |

Table 4: Quantile Regression Continued

| <i>Variable</i>                            | <i>Estimate (S.E.) <math>\tau = .1</math></i> | <i>Estimate (S.E.) <math>\tau = .5</math></i> | <i>Estimate (S.E.) <math>\tau = .9</math></i> |
|--------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Hour Differential                          | 0.0075 (0.0093)                               | -0.0073* (0.0039)                             | -0.0081*** (0.0019)                           |
| Fulltime classification (once hired)       | -0.0161 (0.0161)                              | 0.1976*** (0.011)                             | 0.2616*** (0.0103)                            |
| Male                                       | -0.0146 (0.0151)                              | -0.0391*** (0.011)                            | -0.0199* (0.0114)                             |
| Open availability indicated on application | -0.1029*** (0.0163)                           | -0.1494*** (0.0121)                           | -0.1353*** (0.0116)                           |
| Average hours per week given (once hired)  | 0.0695*** (0.0093)                            | 0.0838*** (0.0039)                            | 0.0588*** (0.0020)                            |
| Application length in minutes              | 0.0011*** (0.0004)                            | 0.0017*** (0.0002)                            | 0.0007*** (0.0002)                            |
| *** indicates significance at 1%           | <i>pseudo-R<sup>2</sup>=.7862</i>             | <i>pseudo-R<sup>2</sup>=.8244</i>             | <i>pseudo-R<sup>2</sup>.8923</i>              |
| ** indicates significance at 5%            |                                               |                                               |                                               |
| * indicates significance at 10%            |                                               |                                               |                                               |

## 6.2 Quantile regression results

We measure the goodness of fit for quantile regression using a pseudo- $R^2$  (Koenker & Machado, 1999). With regard to personal characteristics, it is interesting to point out which variables are significant vs. insignificant, when comparing the 10<sup>th</sup>, 50<sup>th</sup>, and 90<sup>th</sup> percentiles. For example, note that being married has no statistical impact on those who are in the bottom 10%, however for those in the 90<sup>th</sup> percentile, it does make a positive difference. Also, note that for individuals whose maximum education level attained is a high school diploma (as compared to someone with no education level reported at all), the expected tenure is increasing in all percentiles. To show the significance of these findings consider a hiring manager was presented with two candidates which had identical applications, except for one had a high school diploma, and the other did not report any formal education on their application. The manager would maximize the potential tenure length by selecting the individual with the high school education, as at all quantiles, having a high school diploma has an effect statistically significant effect, when comparing to someone with no reported education, at all quantiles. The same type of inference can be made with the dummy variable “Terminated”, which indicates if the individual has been fired from a previous job before. If someone indicates that they have been fired before, their expected tenure is increasing in all quantiles<sup>51</sup>. This could be a function of how ‘honest’ an individual is. Previous research has shown, that being an honest individual has correlated with higher tenure lengths, in multiple types of jobs (Jones, 1991).

It is interesting to note some of the coefficients that differ from the OLS regression previously discussed. For example, age has a different effect across different quantiles. As an

<sup>51</sup> Note that an individual does not have to tell the truth on their employment application with regard to being fired before. Thus, it can be speculated that if an individual is willing to tell us that they have been fired before, they might be a more honest individual.

individual becomes older, the likelihood that they are willing to bounce jobs decreases, and are more likely to stay at one employer for a longer period of time. This is in agreement of previous literature that shows that the length of tenure increases as individuals become older, and married (Mumford & Smith, 2004). In fact, the coefficient attached to the 10<sup>th</sup> percentile with regards to age is negative, significant; indicating that for the individuals that are predisposed to work for shorter amounts of time, being older is a not a good signal. However, in the 90<sup>th</sup> percentile, the opposite is true, as the coefficient attached to age is positive, significant. This further bolsters the idea that the measurement of an individuals predisposed tenure length is vital (identifying what traits of an individual signal a higher length).

For employers, it is best to focus on the results from the output of the 90<sup>th</sup> percentile. This is because employers are most concerned with not pushing individuals with a higher predisposed tenure length to quit earlier than they otherwise would have, if the employer had not engaged in detrimental behavior. For example, it is important that PFJ looks for individuals whose desired wage is negotiable, as this dummy variable is significant only for the 90<sup>th</sup> percentile. Thus, if the applicant's predisposed tenure is unknown, the hiring manager will maximize the expected tenure by hiring an individual who is willing to negotiate their starting wage (following intuition that if an individual is not 'fishing for a job', they will be willing to bargain with their employer, to an extent). This also agrees with the OLS regressing results, which show that if the desired wage is negotiable, the individual will have an expected tenure length which is 1.7% longer than an individual who indicates that their desired wage is negotiable. The argument still must be made that if an individual says that they will negotiate their starting wage, the employer must do everything in their power to match or exceed the desired wage, as the desired wage differential is positive, significant across all quantiles.

### *6.3 Logistic regression background*

PFJ executives have internally decided that the tenure length 'goal' for new, hourly employees is 120 days<sup>52</sup>. The following logistic regression output provides a 'robustness check', to see if variables that are significant with regard to a continuous left hand side variable of days employed, are also significant to a dichotomous left hand side variable that takes on the value 1 if the individual had a tenure length of over 120 days. Reported in the table below are the parameter estimates from the logistic regression, the odds ratios derived from those parameter estimates, and upper and lower confidence bounds.

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<sup>52</sup> This number was arbitrarily chosen, however PFJ upper management and executives have conducted low-level analysis, and determined 120 days was the 'breakeven' point at which the revenue generated by the worker is equal to their labor cost (MR=MC if you will)

Table 5: Logistic Regression

| <i>Variable</i>             | <i>Parameter(S.E.)</i> | <i>Odds Ratio</i> | <i>2.5% CI</i> | <i>97.5% CI</i> | <i>Pr(&gt; z )</i> |
|-----------------------------|------------------------|-------------------|----------------|-----------------|--------------------|
| Intercept                   | -2.625*** (0.1517)     | 0.0724            | 0.0538         | 0.0975          | < 2e-16            |
| Age                         | 0.0029** (0.001047)    | 1.0029            | 1.0008         | 1.0049          | 0.0050             |
| African American            | 0.2961*** (0.02354)    | 1.3446            | 1.2839         | 1.4080          | < 2e-16            |
| American Indian or Alaskan  | -0.167 (0.06638)       | 0.8461            | 0.7429         | 0.9638          | 0.0118             |
| Asian                       | 0.2699** (0.1264)      | 1.3098            | 1.0224         | 1.6781          | 0.0327             |
| Hispanic                    | -0.020 (0.02921)       | 0.9801            | 0.9256         | 1.0379          | 0.4924             |
| Multi-racial                | 0.0085 (0.05228)       | 1.0085            | 0.9103         | 1.1174          | 0.8700             |
| Hawaiian                    | -0.053 (0.1808)        | 0.9480            | 0.6651         | 1.3513          | 0.7682             |
| Marriage status unknown     | -0.355* (0.1285)       | 0.7011            | 0.5451         | 0.9019          | 0.0057             |
| Marriage status divorce     | -0.122** (0.04328)     | 0.8848            | 0.8129         | 0.9632          | 0.0047             |
| Marriage status separated   | -0.306*** (0.07817)    | 0.7360            | 0.6314         | 0.8578          | 0.0000             |
| Marriage status married     | -0.068*** (0.02631)    | 0.9339            | 0.8870         | 0.9834          | 0.0094             |
| Marriage status widowed     | -0.101 (0.1261)        | 0.9034            | 0.7056         | 1.1567          | 0.4207             |
| Available Sunday            | 0.1218*** (0.03476)    | 1.1295            | 1.0551         | 1.2091          | 0.0004             |
| Available Monday            | 0.0733 (0.06403)       | 1.0760            | 0.9491         | 1.2199          | 0.2523             |
| Available Tuesday           | -0.0751 (0.06797)      | 0.9274            | 0.8117         | 1.0596          | 0.2678             |
| Available Wednesday         | -0.207*** (0.0634)     | 0.8124            | 0.7174         | 0.9199          | 0.0010             |
| Available Thursday          | -0.0011 (0.06843)      | 0.9984            | 0.8731         | 1.1417          | 0.9822             |
| Available Friday            | 0.0012 (0.06467)       | 1.0012            | 0.8820         | 1.1365          | 0.9841             |
| Available Saturday          | 0.1215*** (0.04489)    | 1.1291            | 1.0340         | 1.2330          | 0.0067             |
| Hired in February           | -0.0641 (0.05017)      | 0.9378            | 0.8500         | 1.0347          | 0.2011             |
| Hired in March              | -0.0267 (0.04621)      | 0.9736            | 0.8892         | 1.0659          | 0.5626             |
| Hired in April              | -0.0754 (0.04741)      | 0.9273            | 0.8450         | 1.0175          | 0.1113             |
| Hired in May                | -0.0521 (0.04616)      | 0.9491            | 0.8670         | 1.0390          | 0.2586             |
| Hired in June               | -0.1143 (0.04585)      | 0.8919            | 0.8153         | 0.9758          | 0.0126             |
| Hired in July               | -0.0715 (0.04662)      | 0.9309            | 0.8496         | 1.0200          | 0.1249             |
| Hired in August             | 0.1473*** (0.0471)     | 1.1587            | 1.0565         | 1.2707          | 0.0017             |
| Hired in September          | 0.2339*** (0.0489)     | 1.2635            | 1.1480         | 1.3905          | 0.0000             |
| Hired in October            | 0.2106*** (0.0475)     | 1.2344            | 1.1246         | 1.3548          | 0.0000             |
| Hired in November           | 0.1671*** (0.04843)    | 1.1818            | 1.0748         | 1.2996          | 0.0005             |
| Hired in December           | 0.1255 (0.05019)       | 1.1337            | 1.0274         | 1.2509          | 0.0124             |
| Education level GED         | -0.1603*** (0.0365)    | 0.8518            | 0.7929         | 0.9151          | 0.0000             |
| Education level HIGH SCHOOL | 0.0967*** (0.0207)     | 1.1015            | 1.0575         | 1.1473          | 0.0000             |

Table 5: Logistic Regression Continued

| <i>Variable</i>                              | <i>Parameter(S.E.)</i> | <i>Odds Ratio</i> | <i>2.5% CI</i> | <i>97.5% CI</i> | <i>Pr(&gt; z )</i> |
|----------------------------------------------|------------------------|-------------------|----------------|-----------------|--------------------|
| Education level ASSOCIATES                   | 0.0433 (0.03192)       | 1.0443            | 0.9809         | 1.1117          | 0.1743             |
| Education level BACHELORS                    | 0.188*** (0.04066)     | 1.2068            | 1.1144         | 1.3069          | 0.0000             |
| Education level MASTERS                      | 0.4528*** (0.1593)     | 1.5727            | 1.1508         | 2.1491          | 0.0044             |
| Education level PHD                          | 0.0439 (0.3353)        | 1.0449            | 0.5415         | 2.0162          | 0.8957             |
| Desired first position Coffee Host           | 0.1521*** (0.0478)     | 1.1642            | 1.0601         | 1.2785          | 0.0014             |
| Desired first position Diesel Service        | 0.4227 (0.3316)        | 1.5260            | 0.7967         | 2.9231          | 0.2024             |
| Desired first position Deli Supervisor       | 0.0737 (0.1184)        | 1.0765            | 0.8535         | 1.3576          | 0.5334             |
| Desired first position Deli Team Member      | -0.013 (0.0503)        | 0.9862            | 0.8936         | 1.0884          | 0.7837             |
| Desired first position Maintenance           | 0.0582** (0.02898)     | 1.0600            | 1.0015         | 1.1219          | 0.0442             |
| Desired first position Prep Cook             | 0.2395*** (0.0342)     | 1.2706            | 1.1882         | 1.3586          | 2.5E-12            |
| Desired first position Restaurant Cashier    | 0.3973*** (0.03519)    | 1.4878            | 1.3886         | 1.5941          | < 2e-16            |
| Desired first position Restaurant Supervisor | -0.0265 (0.0707)       | 0.9737            | 0.8476         | 1.1187          | 0.7076             |
| Desired first position Retail Supervisor     | 0.0322 (0.0517)        | 1.0327            | 0.9331         | 1.1429          | 0.5332             |
| Total experience in months                   | 0.0000 (0.0000)        | 1.0000            | 0.9999         | 1.0001          | 0.2683             |
| Presently employed                           | 0.1515*** (0.02109)    | 1.1635            | 1.1164         | 1.2126          | 6.7E-13            |
| Terminated                                   | 0.2181*** (0.02607)    | 1.2437            | 1.1817         | 1.3088          | < 2e-16            |
| Convicted felon                              | 0.0037 (0.03317)       | 1.0037            | 0.9405         | 1.0711          | 0.9109             |
| Prior Pilot employee                         | 0.0659 (0.02935)       | 1.0681            | 1.0084         | 1.1313          | 0.0246             |
| Relative to a Pilot Employee                 | 0.31*** (0.03344)      | 1.3634            | 1.2769         | 1.4557          | < 2e-16            |
| Moving in the next year                      | -0.113** (0.0553)      | 0.8927            | 0.8008         | 0.9950          | 0.0404             |
| Desired wage negotiable                      | 0.0179 (0.0314)        | 1.0180            | 0.9571         | 1.0828          | 0.5694             |
| Convenience store worker                     | 0.0018 (0.0976)        | 1.0018            | 0.8273         | 1.2132          | 0.9847             |
| Coffee host                                  | 0.3203*** (0.0604)     | 1.3775            | 1.2235         | 1.5508          | 1.19E-07           |
| Deli Production worker                       | -0.2715*** (0.0329)    | 0.7622            | 0.7145         | 0.8131          | < 2e-16            |
| Restaurant hourly worker                     | -0.1564*** (0.0287)    | 0.8552            | 0.8084         | 0.9047          | 5.09E-08           |
| Can begin immediately                        | -0.199*** (0.04157)    | 0.8195            | 0.7554         | 0.8891          | 0.0000             |
| Desired Part-Time                            | 0.5925*** (0.0315)     | 1.8085            | 1.7002         | 1.9236          | < 2e-16            |
| Desired Full-Time                            | -0.1251*** (0.0202)    | 0.8824            | 0.8480         | 0.9182          | 7.08E-10           |
| Starting wage                                | 0.0176** (0.00955)     | 1.0178            | 0.9989         | 1.0370          | 0.0644             |
| Desired Wage differential                    | 0.2106*** (0.0101)     | 1.2344            | 1.2100         | 1.2592          | < 2e-16            |
| Fulltime classification (once hired)         | 0.4939*** (0.0203)     | 1.6386            | 1.5747         | 1.7052          | < 2e-16            |
| Open availability indicated on application   | -0.257*** (0.0220)     | 0.7733            | 0.7407         | 0.8075          | < 2e-16            |
| Preferred hours per week                     | -0.036*** (0.0065)     | 0.9639            | 0.9516         | 0.9763          | 2.07E-08           |

Table 5: Logistic Regression Continued

| Variable                                  | Parameter(S.E.)     | Odds Ratio | 2.5% CI | 97.5% CI | Pr (> z ) |
|-------------------------------------------|---------------------|------------|---------|----------|-----------|
| Hour Differential                         | -0.0095 (0.0060)    | 0.9905     | 0.9789  | 1.0022   | 0.1134    |
| Average hours per week given (once hired) | 0.1028*** (0.00617) | 1.1082     | 1.0949  | 1.12177  | < 2e-16   |
| Male                                      | -0.0441** (0.021)   | 0.9568     | 0.9177  | 0.9975   | 0.0380    |
| Application length in minutes             | 0.00148** (0.00047) | 1.0014     | 1.0005  | 1.0024   | 0.0016    |
| *** indicates significance at 1%          |                     |            |         |          |           |
| ** indicates significance at 5%           |                     |            |         |          |           |
| * indicates significance at 10%           |                     |            |         |          |           |

|                           |                     |
|---------------------------|---------------------|
| Observations              | 67,874              |
| McFadden's R <sup>2</sup> | .1576               |
| Log-Likelihood            | -38435.08 (df = 70) |

Figure 6: Logistic Regression Summary

#### 6.4 Logistic regression results

As with the quantile regression output, the variables that are of most interest are the ones that PFJ has control over, either during the interview process or after. For example, the coefficient attached to desired wage differential is .2131. Exponentiation, this results in:  $e^{.2106} = 1.2344$ , which can be interpreted as a one dollar increase in the desired wage differential results in the odds of someone making it to 120 days increases by factor of 1.2344 ( a number greater than one), which agrees to the linear regression from the earlier section. Also agreeing with the linear regression, if the applicant is black, as compared to a white, the odds of the applicant making it to 120 days increases by a factor of 1.3446, all else constant. The logistic regression results tell a very similar story to the linear regression results, thus validating this model as a 'robustness check' for the linear model.

The logistic regression approach is one that is useful to PFJ, as a model can be built that yields will estimate an applicant's probability of staying at least 120 days (recall that this number is was the 'magic' number set by PFJ executives).

All significant variables that were either determined by PFJ at the time of interview or during the employee's tenure, kept the same sign and significance from the linear regression to the logistic regression.

## 7. Conclusions and future study

The purpose of this paper was to demonstrate how simple linear regression can help identify causes of premature employee termination. These conclusions allow us to answer the question, “How do hiring managers isolate specific characteristics of measurable, pre-employment information that map to higher rates of tenure?” With this information, hiring managers will have a better grasp on how to identify individuals that display these characteristics. This will also help hiring managers select interview questions that are more tailored to each potential employee. The models presented in this paper are not intended to replace traditional hiring practices, rather help hiring managers identify individuals who display characteristics that map to higher tenure rates.

The starting wage that an employee receives is important, however more important was the wage differential between the requested wage and the actual starting wage; which was highly significant, with a large effect. Currently, PFJ is in the middle of a controlled experiment where in 60 randomly selected stores, the starting wage is being perturbed, both with regard to the market wage in each individual area, and with regard to the requested wage on the individual employee’s application. The hypothesis from the reported model in this paper are that for every additional dollar we pay individuals above what they ask for on their application, we can expect an additional 15.4 days of tenure (if the regression is run with a logged dependent variable, an additional one dollar of pay above the applicant’s desired wage maps to a 8.1% increase in predicted tenure length), *ceteris paribus*. As stated before, because previous experience has no statistical impact on length of tenure, PFJ would be better off hiring an individual with no experience, and paying a wage above what was requested on the application, than hiring someone with experience and paying exactly what they asked for (under the assumption that the person with higher experience would command a higher starting wage). It is imperative that PFJ adheres to employee requests with respect to required scheduling and wages.

It would also be beneficial to PFJ to either remove entirely the dictated starting wage, or to have the dictated starting wage match that of the region’s market average wage for similar positions. PFJ has been notorious for paying on average 10 percent less than the market for any given hourly, line level position<sup>53</sup>. This act has attracted lower quality talent (thus stifling

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<sup>53</sup> A theoretical model is shown in the appendix that shows as the gap between the reservation wage and the actual paid wage grows, the labor quality of the applicant pool that an employer has to pick from diminishes. This is directly applicable to PFJ, as it is a single buyer of labor from a labor market, and PFJ has ‘dictated starting wages’ that will act as a wage ceiling for new hires. The gap between this dictated wage and the reservation wage of the applicant is what is of interest.

productivity), and has also driven higher quality talent out, as those individuals can command a higher wage elsewhere.

Full-time employees stay drastically longer than part-time employees. Previous research shows that this is a function of an individual getting a feeling of reliance on their employer, due to higher wages (on average) and health benefits. It is also shown that full-time employees have higher productivity rates than part-time employees. This was demonstrated by Home Depot in 2000.

Individuals who are not willing to begin work immediately (as they must give notice to another job) have higher tenure rates. If they are currently employed and are able to begin immediately, this is a very bad signal, as they are willing to quit their current employer immediately and will be willing to do the same to PFJ if another (better) opportunity comes along. If someone is not currently employed and can begin immediately, this is not a bad sign, as the individual has no work obligations.

Most importantly, during the interview process it is imperative to identify the applicant's needs. If these needs are not met, it creates a foul work environment, and the individual will be more at risk to quit earlier. The data tend to argue that the more an employer can satisfy the intangible needs of its employees, the higher the employee morale will be, thus leading to longer and more productive tenure rates.

Beyond the scope of this paper, machine learning techniques will be utilized in a production environment that map EEOC-approved variables to predicted tenure rates. This ranking system will then be used in 'grading' potential applicants when they apply. The 'grade' will be a 0-100 numeric score, which is calculated by the cumulative distribution function for all scores in all stores. Thus, for each individual store, the hiring manager will have a numeric ranking that allows them to filter for the highest possible predicted tenure length (under the assumption that the store manager is making an effort to maximize the expected tenure of their new employee).

As an internal check, PFJ's Business Intelligence department used out of sample estimation on all employees hired after January 1<sup>st</sup>, 2015 as a test group to check the estimation power of the model<sup>54</sup>. The model was trained on data dating from January 1<sup>st</sup>, 2011 to December 31<sup>st</sup>, 2014. PFJ has received over 220,000 applications for these hourly, line-level positions, of which about 12,000 have been hired (resulting in a 5.5% onboarding rate of applicants). If these applicants would have been 'scored' using the model that was created for

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<sup>54</sup> In this portion, Random Forest ensemble decision trees were used in the productionalized version of the model.

this project, the overlap of the top 5.5% of applicants from this pool (according to our internal score), and the individuals who were actually hired, is around 400 people. If the score function had been in place at the beginning of 2015, and taking the individual's predicted tenure as gospel, PFJ would have had to only hire about 10,000 people. This 2,000 worker reduction in hiring would, at \$2,152 in economic cost associated with each individual hired, would have resulted in a \$4,304,000 net savings for 2015 alone (under the assumption that the individuals hired would stay their entire predicted tenure length)<sup>55</sup>.

Looking back at the original model, there are several variables that would likely increase the explanatory power of the model, but are simply unobservable. Some of these factors include: how many children does the applicant have? It has been shown that individuals with children that are of age 4 and below have a higher tenure rate, and having children who are older than 4 in the house significantly lower tenure rates, especially in women (Mumford & Smith, 2004). This type of information is not something that PFJ directly collects on its employees, thus is not measurable in the set. Another factor that would be interesting to look at would be the implementation of a formal training session that took place off-site. Currently, one of PFJ's competitors Quik-Trip, offers a comprehensive 4 week training session that encompasses their expectations with regards to customer service and day to day operations<sup>56</sup>. Accommodating employee requests, with regard to scheduling, wages, and day-to-day operations will have an impact on the tenure, and subsequently productivity, of hourly employees at PFJ.

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<sup>55</sup> And most likely resulting in a raise for the author.

<sup>56</sup> PFJ is expected to introduce some sort of formal training in this regard by the end of 2016.

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## Appendix

## Dictated and reservation wages as applied to Pilot Flying J

Pilot Flying J is a single buyer of labor from a larger labor pool, thus, the quality of labor can be theorized using a model that maps labor quality to dictated wage and reservation for a particular employer, in this case PFJ. Continuing with the notion that individuals respond to incentives, individuals also intertemporally choose a reservation wage that is equal to exactly what they are willing to accept when choosing whether to take a job or not. PFJ dictates ‘required starting wages’. These required wages cannot be exceeded when extending a job offer to a potential employee.

For more than one reason, the reservation wage that an employee has, could circumstantially be broken, if the need for immediate employment outweighs the utility that would be attained by postponing and continuing the job search; this is explicitly demonstrated by a job offer acceptance rate of roughly 40 percent at PFJ. In these cases, the employee would continue to seek employment, and when a job is offered that brings the employee equal to or above their reservation wage, they take the job.<sup>57</sup> It is worth noting that higher reservation wages are held by individuals with higher levels of employment, experience, as well as other factors. The important point to consider here, is that reservation wages are directly correlated with an applicant’s labor quality, under the assumption that individuals can correctly identify their labor quality. Reservation wages solve the following equation:

$$w^r = b + \frac{\delta}{\rho} \int_{w^r}^{\infty} (w - w^r) dF(w) = b + \frac{\delta}{\rho} P(w > w^r) E(w - w^r | w > w^r)$$

Where  $b$  is the monetary value of present state of individual (their net worth),  $\delta$  is the constant probability that that an individual receives an job offer in each time period, the job offer comes with wage  $w$ , and follows a random distribution  $F(w)$ .  $\rho$  is a time discount factor, that gets larger as time goes on; meaning that the longer the individual goes without having a job, the lower the reservation wage becomes (van Ophem, Hartog, & Berkhout, 2011). If this equation holds, the optimal strategy is to accept a job offer if  $w \geq w^r$ . We can write the right hand side of the equation as:

$$b + \frac{\delta}{\rho} g(w^r, w)$$

$g(w^r, w)$  is the gap between the reservation wage and the market wage (In PFJ’s case, the dictated wage for each individual position). Comparing internal dictated wages to a study done

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<sup>57</sup> This paper will imply that the required wage needs to be omitted completely, as to let the market sort out what the fair market wage is for the required positions.

by the Economic Research Institute<sup>58</sup>, which measured the average starting wages for positions in which this paper was studying, PFJ pays on average only 90% of market value for starting wages in hourly, line-level positions. Thus, for virtually all cases,  $w^r \geq w^D$ . If the majority of individuals set reservation wages at market levels, PFJ will not attract labor talent with adequate quality.

Note, that if an individual has a lower monetary value  $b$ , the individual has a lower reservation wage. This is demonstrated well by applicants in low-skill positions, including those applying to line-level jobs at PFJ, as most of the people applying for these jobs are of low income. Thus this model fits well to PFJ's applicants.

Following intuition, the model is solved when the market (in our case, the PFJ dictated) wage is greater than or equal to the reservation wage of the individual. (van Ophem, Hartog, & Berkhout, 2011) This finding is supported also by the notion that ultra-high wages are not overbearingly important, but 'fair' wages are extremely important. Fair salaries is highly correlated with employee retention. Thus, as long as the compensation being given to any level of worker is fair, the expectation is that all else equal, that particular employee will have the intention to remain employed (Higginbotham, 1997).

Once this 'fair' wage has been reached, employees begin to shift their primary focus onto other things, such as work-life balance, vacation time, upward mobility, and supervisory support. It has also been shown that single acts of recognition by supervisors has been shown to not effect probability of turnover. Small, non-cash rewards that are given at a more frequent time were much more effective in reducing the probability of voluntary termination (Farris, 2000).

Continuing with the thought that wages should be set endogenously within the market directly supports the idea that a worker will not work unless the wage being offered is greater than or equal to the individual's reservation wage. Combining the reservation wage and the quality of labor demanded yields the Figure 7.

Note, in figure 7, there exists a  $w^*$  that satisfies the quality of labor demand/supply. As stated above, if  $w^* \geq w^r$  then the market clears and the quality of labor that is needed for the job is met. However, if a wage is dictated ( $w^D$ ), and below  $w^*$  (an act in which PFJ is very guilty of), there exists a labor quality shortage (LQS) equal to the shaded in triangle's area. Analytically:

$$LQS = \int_{QL^S}^{QL^*} LdQL + \int_{QL^*}^{QL^D} DdQL - ((QL^D - QL^S) * (W^D))$$

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<sup>58</sup> PFJ purchased wage data from the Economic Research Institute (ERI) specifically for this study.

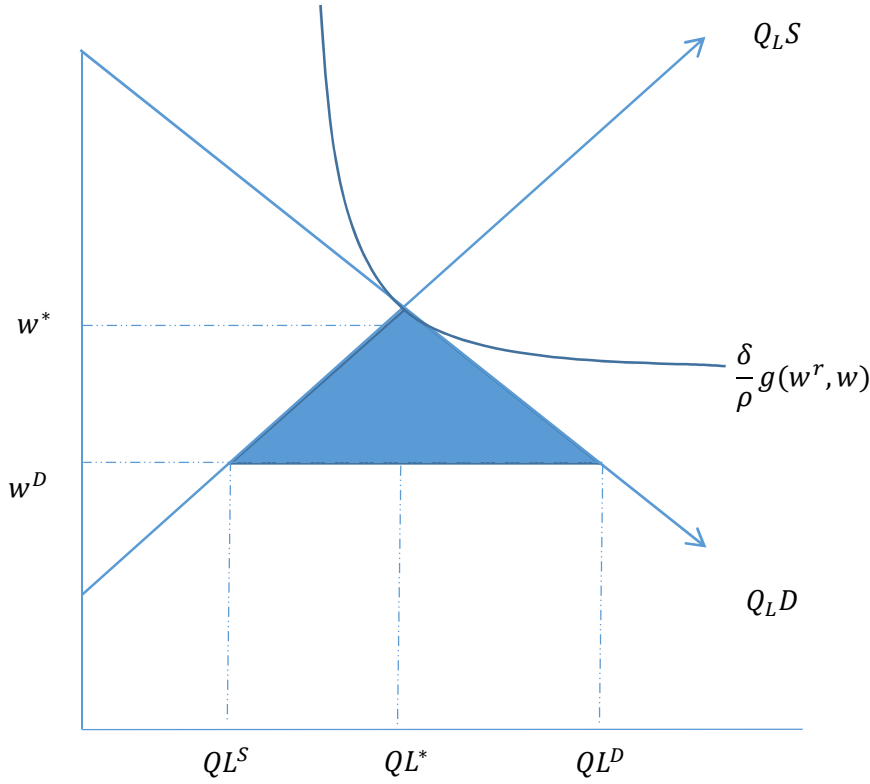


Figure 7: Firm Labor Quality and the Dictated Wage

This equation represents the quality shortage in the labor demanded to fill a specific job, given that a job attracts an individual with reservation wage  $w^*$ , but will only be paid  $w^D$ . This quality shortage will then lead to reduced tenure and poor performance on the job.<sup>59</sup> This theory is supported by PFJ's data, as there exists an inverse relationship between relative starting wages, and tenure length (shown later in this paper). This model is also analogous to the situation where an individual has a reservation wage that is lower than the dictated wage. The individual will work for a wage that is higher than their reservation wage, however the quality of labor lost due to the individual having skills that map to their correctly identified reservation wage will be equal to the quality of labor lost, as shown above (hiring someone that is not skilled enough for the job at hand, and them not being able to keep up with their duties). There are assumptions that must be made with this model. The first is that people know their worth,

<sup>59</sup> It is worth noting, that if  $w^D > w^*$ , then the dictated wage does not constrain the market-clearing wage, and thus the optimal quality of labor is attained through the market paying  $w^*$ .

and are able to correctly identify their own unique reservation wage.<sup>60</sup> The second assumption that must be made is that  $w$  is increasing in  $QL$ , thus:  $w'(QL) > 0$ .

Intuitively, lower starting wages attracts candidates with lower motivation, lower skillsets, less loyalty, and who are more likely to leave given another job offer with marginally better pay (again, under the assumption that an individual has correctly identified their reservation wage). Couple that with the demanding tasks that these positions require (cleaning restrooms/floor, dealing with Professional Drivers, working a complex cash register, working in fast food restaurants when necessary) and no health insurance (for part-time workers), the economic cost, more often than not, far outweighs the economic benefit from coming to work for a certain set of individuals at Pilot Flying J.

The correlation between labor (quality and quantity) and financial success is a positive one, which has decreasing marginal returns. The quick fix of cutting labor when financial stress is present is an incorrect response, as demonstrated by Robert Nardelli of Home Depot.

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<sup>60</sup> At  $w^*$  we are in steady state.

## Blank sample application from Pilot Flying J

This is the current application (at time of writing July 2015) that PFJ gives to potential employees. The average time needed to complete the application is 36 minutes.



### Thanks for your interest in our great job opportunities!

Pilot Travel Centers LLC is an Equal Opportunity Employer. Applicants for all job openings are welcomed and considered without regard to race, gender, age, national origin, religion, disability, military status, or any other basis protected by applicable federal, state, or local law. Smoking is prohibited in all indoor areas of Pilot Travel Centers LLC unless designated smoking areas have been established.

Flying J Canada, Inc. is a equal opportunity employer and provides equal employment opportunities to all employees and applicants for employment without regard to race; color; ancestry; sex; ethnic origin; pregnancy; place of origin; sexual orientation; civil, marital or family status; age; religion; political convictions; language; national origin; social condition; a handicap or use of any means to palliate a handicap; or any other grounds prohibited by law.

Click the "Next" button to begin.

Next >

Please select the position(s) you would like to apply for. Items marked with an "\*" are required.

First  
Choice\*

Second  
Choice  
(Optional)

- |                       |                       |                                                                                                                                                                          |
|-----------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="radio"/> | <input type="radio"/> | <b>Retail Cashier</b> - Maintains friendly customer relations at the combination desk.                                                                                   |
| <input type="radio"/> | <input type="radio"/> | <b>Maintenance / Housekeeping</b> - Follows maintenance, safety, and security policies to ensure a clean and safe facility for customers and employees.                  |
| <input type="radio"/> | <input type="radio"/> | <b>Coffee Host</b> - Maintains the coffee program and implements monthly promotional items or test market programs.                                                      |
| <input type="radio"/> | <input type="radio"/> | <b>Retail Shift Supervisor</b> - Supervises and provides direction and maintenance procedures to team members while maintaining customer service standards at all times. |
| <input type="radio"/> | <input type="radio"/> | <b>Restaurant Cashier</b> - Maintains fast food customer satisfaction by meeting food quality and service standards.                                                     |
| <input type="radio"/> | <input type="radio"/> | <b>Restaurant Shift Supervisor</b> - Supervises and assists food production line and cashier customer service performance.                                               |
| <input type="radio"/> | <input type="radio"/> | <b>Prep Cook / Line Cook / Sandwich Artist / Production</b> - Prepares fast food orders while maintaining food preparation line.                                         |

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Please enter the following information. Items marked with an "\*" are required.

|                                                |                                               |                                               |                                               |
|------------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Legal First Name*                              | <input type="text"/>                          | Address 1*                                    | <input type="text"/>                          |
| Name You Go By                                 | <input type="text"/>                          | Address 2                                     | <input type="text"/>                          |
| Legal Middle Name                              | <input type="text"/>                          | City*                                         | <input type="text"/>                          |
| Legal Last Name*                               | <input type="text"/>                          | State/Prov*                                   | <input type="text" value="Please Select..."/> |
| Suffix                                         | <input type="text" value="Please Select..."/> | County                                        | <input type="text"/>                          |
|                                                |                                               | Country*                                      | <input type="text" value="Please Select..."/> |
| Home Phone                                     | <input type="text" value="( ) -"/>            | Postal Code*                                  | <input type="text"/>                          |
| Best number to reach you at                    | <input type="text" value="( ) -"/>            | <input type="checkbox"/> Same as above        | Email <input type="text"/>                    |
| Best time to reach you                         | <input type="text" value="Please Select..."/> | <input type="text" value="Please Select..."/> |                                               |
| How did you hear about our job opportunities?* |                                               | <input type="text" value="Please Select..."/> |                                               |
| If referred, by whom?                          |                                               | <input type="text"/>                          |                                               |

Please enter the following information. Items marked with an "\*" are required.

Are you legally authorized to work in the United States?\*

☐ Yes ☐ No

Are you 16 years of age or older?\*

☐ Yes ☐ No

If you are offered employment, are you willing to submit to a drug screening test on your first day of employment?\*

☐ Yes ☐ No

Is there a possibility that you will be moving away from this area in the next 12 months?\*

☐ Yes ☐ No ☐ Maybe

In the following questions, please note that a "Yes" answer to any of the following questions will not necessarily disqualify you from employment. Factors such as the age and time of the offense, seriousness and nature of the violation, and rehabilitation will be considered when making any employment decisions. Do not include convictions that were sealed or expunged pursuant to a court order. **INSTRUCTIONS FOR ANSWERING CRIMINAL CONVICTION INQUIRY FOR CALIFORNIA APPLICANTS:** Do not identify convictions under California Health & Safety Code §§11357(b) or (c), 11360(b) (formerly subdivision (c) of section 11360), 11364, 11365, or 11550 related to marijuana offenses that occurred two or more years before the instant application. Also, do not identify any conviction for which the record has been judicially ordered sealed, expunged or statutorily eradicated, or any misdemeanor conviction for which probation has been successfully completed or otherwise discharged and the case has been judicially dismissed. **INSTRUCTIONS FOR ANSWERING CRIMINAL CONVICTION INQUIRY FOR CONNECTICUT APPLICANTS:** Applicants are not required to disclose the existence of any arrest, criminal charge, or conviction, the records of which have been erased pursuant to section 46b-146, 54-76o or 54-142a of the Connecticut General Statutes. Criminal records subject to erasure under these sections are records pertaining to a finding of delinquency or the fact that a child was a member of a family with service needs, an adjudication as a youthful offender, a criminal charge that has been dismissed or nolle (not prosecuted), a criminal charge for which the person was found not guilty, or a conviction for which the offender received an absolute pardon. Any person whose criminal records have been erased pursuant to these sections is deemed to have never been arrested within the meaning of the law as it applies to the particular proceedings that have been erased, and may so swear under oath. **INSTRUCTIONS FOR ANSWERING CRIMINAL CONVICTION INQUIRY FOR GEORGIA APPLICANTS:** Do not identify any guilty plea that was discharged by the court under Georgia's First Offender Act. **INSTRUCTIONS FOR ANSWERING CRIMINAL CONVICTION INQUIRY FOR MASSACHUSETTS APPLICANTS:** An applicant for employment with a sealed record on file with the Commissioner of Probation may answer "no record" with respect to an inquiry herein relative to prior arrests, criminal court appearances, or convictions. In addition, an applicant for employment may answer "no record" with respect to any inquiry relative to prior arrests, court appearances and adjudications in all cases of delinquency or as a child in need of services which did not result in a complaint transferred to the superior court for criminal prosecution. Massachusetts applicants should not disclose information regarding first-time misdemeanor convictions for drunkenness, simple assault, speeding, minor traffic violations, affray or disturbance of the peace. Finally, Massachusetts applicants should not disclose convictions for other misdemeanors where the date of conviction or the end of any period of incarceration was more than five years ago unless there have been subsequent convictions within those five years. **INSTRUCTIONS FOR ANSWERING CRIMINAL CONVICTION INQUIRY FOR WASHINGTON APPLICANTS:** Do not identify any conviction that is more than ten (10) years old at the time of making this application.

Within the last 7 years, have you been convicted of a crime involving violence, sex, stalking, minors, theft, property damage, fraud, robbery, or drugs?

☐ Yes ☐ No

If yes, please describe the circumstances, including the state and county of each conviction (1000 character limit).

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Please enter your Equal Employment Opportunity Employer (EEOE) information. Completion of these items is **voluntary** and your responses will not be viewed when employment decisions are made.

Gender

Race

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Please enter the following information. Items marked with an "\*" are required.

Can you begin work immediately? \* ☐ Yes ☐ No

If not, what date can you begin? (Please click on the date you can begin on the calendar to the right,)

Are you looking for a full time or part time position? \*

Please Select... ▼

How many hours would you prefer to work in a normal work week on average? \*  hours

Please select the times below that you are available to work "From" and "To" each day. (Please note that we are a 24 hour operation)

| Day        | Available to work? | From | To | Or check here for "anytime" |
|------------|--------------------|------|----|-----------------------------|
| Sunday*    | ▼                  | ▼    | ▼  | <input type="checkbox"/>    |
| Monday*    | ▼                  | ▼    | ▼  | <input type="checkbox"/>    |
| Tuesday*   | ▼                  | ▼    | ▼  | <input type="checkbox"/>    |
| Wednesday* | ▼                  | ▼    | ▼  | <input type="checkbox"/>    |
| Thursday*  | ▼                  | ▼    | ▼  | <input type="checkbox"/>    |
| Friday*    | ▼                  | ▼    | ▼  | <input type="checkbox"/>    |
| Saturday*  | ▼                  | ▼    | ▼  | <input type="checkbox"/>    |

Please enter any other notes regarding when you can or cannot work (1000 character limit):

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|            |            |            |            |            |            |            |  |   |
|------------|------------|------------|------------|------------|------------|------------|--|---|
| ≤          | June 2015  |            |            |            |            |            |  | ≥ |
| <b>Sun</b> | <b>Mon</b> | <b>Tue</b> | <b>Wed</b> | <b>Thu</b> | <b>Fri</b> | <b>Sat</b> |  |   |
| <u>31</u>  | <u>1</u>   | <u>2</u>   | <u>3</u>   | <u>4</u>   | <u>5</u>   | <u>6</u>   |  |   |
| <u>7</u>   | <u>8</u>   | <u>9</u>   | <u>10</u>  | <u>11</u>  | <u>12</u>  | <u>13</u>  |  |   |
| <u>14</u>  | <u>15</u>  | <u>16</u>  | <u>17</u>  | <u>18</u>  | <u>19</u>  | <u>20</u>  |  |   |
| <u>21</u>  | <u>22</u>  | <u>23</u>  | <u>24</u>  | <u>25</u>  | <u>26</u>  | <u>27</u>  |  |   |
| <u>28</u>  | <u>29</u>  | <u>30</u>  | <u>1</u>   | <u>2</u>   | <u>3</u>   | <u>4</u>   |  |   |
| <u>5</u>   | <u>6</u>   | <u>7</u>   | <u>8</u>   | <u>9</u>   | <u>10</u>  | <u>11</u>  |  |   |

Please enter the following information. Items marked with an "\*" are required.

Have you ever been employed by Pilot or Flying J before?\*

☐ Yes ☐ No

If yes,

Where?

Please Select... ▼

What position?

When did you depart?

Please Select... ▼

Do you have any relatives who currently work for Pilot or Flying J?

☐ Yes ☐ No

If yes,

Where?

Please Select... ▼

What position?

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Please enter the following information. Items marked with an "\*" are required.

Are you presently  
employed?\*

☐ Yes ☐ No

Have you ever been terminated  
or discharged from a position?\*

☐ Yes ☐ No

If you have, why? (1000 character limit)

Please enter some information regarding your previous employers:

|                   |                          |                                             |                    |                      |                    |                                                                       |
|-------------------|--------------------------|---------------------------------------------|--------------------|----------------------|--------------------|-----------------------------------------------------------------------|
| Employed From     | Please Select... ▼       | Please Select... ▼                          | To                 | Please Select... ▼   | Please Select... ▼ |                                                                       |
| Employer Name     | <input type="text"/>     |                                             | Employer City      | <input type="text"/> |                    | Employer State/Prov<br>Please Select... ▼                             |
| Employer Phone    | ( <input type="text"/> ) | <input type="text"/> - <input type="text"/> | Position Held      | <input type="text"/> |                    | Wage at Departure \$<br><input type="text"/>                          |
| Supervisor's Name | <input type="text"/>     |                                             | Reason for Leaving | <input type="text"/> |                    | May we contact?<br><input type="radio"/> Yes <input type="radio"/> No |

|                   |                          |                                             |                    |                      |                    |                                                                       |
|-------------------|--------------------------|---------------------------------------------|--------------------|----------------------|--------------------|-----------------------------------------------------------------------|
| Employed From     | Please Select... ▼       | Please Select... ▼                          | To                 | Please Select... ▼   | Please Select... ▼ |                                                                       |
| Employer Name     | <input type="text"/>     |                                             | Employer City      | <input type="text"/> |                    | Employer State/Prov<br>Please Select... ▼                             |
| Employer Phone    | ( <input type="text"/> ) | <input type="text"/> - <input type="text"/> | Position Held      | <input type="text"/> |                    | Wage at Departure \$<br><input type="text"/>                          |
| Supervisor's Name | <input type="text"/>     |                                             | Reason for Leaving | <input type="text"/> |                    | May we contact?<br><input type="radio"/> Yes <input type="radio"/> No |

|                   |                          |                                             |                    |                      |                    |                                                                       |
|-------------------|--------------------------|---------------------------------------------|--------------------|----------------------|--------------------|-----------------------------------------------------------------------|
| Employed From     | Please Select... ▼       | Please Select... ▼                          | To                 | Please Select... ▼   | Please Select... ▼ |                                                                       |
| Employer Name     | <input type="text"/>     |                                             | Employer City      | <input type="text"/> |                    | Employer State/Prov<br>Please Select... ▼                             |
| Employer Phone    | ( <input type="text"/> ) | <input type="text"/> - <input type="text"/> | Position Held      | <input type="text"/> |                    | Wage at Departure \$<br><input type="text"/>                          |
| Supervisor's Name | <input type="text"/>     |                                             | Reason for Leaving | <input type="text"/> |                    | May we contact?<br><input type="radio"/> Yes <input type="radio"/> No |

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Please enter some information regarding your education:

|               |                      |                       |                                                |
|---------------|----------------------|-----------------------|------------------------------------------------|
| School Name   | <input type="text"/> | Type of School/Degree | Please Select... ▼                             |
| School City   | <input type="text"/> | School State/Prov     | Please Select... ▼                             |
| Area of Study | <input type="text"/> | Years Completed       | <input type="text"/> Status Please Select... ▼ |

|               |                      |                       |                                                |
|---------------|----------------------|-----------------------|------------------------------------------------|
| School Name   | <input type="text"/> | Type of School/Degree | Please Select... ▼                             |
| School City   | <input type="text"/> | School State/Prov     | Please Select... ▼                             |
| Area of Study | <input type="text"/> | Years Completed       | <input type="text"/> Status Please Select... ▼ |

|               |                      |                       |                                                |
|---------------|----------------------|-----------------------|------------------------------------------------|
| School Name   | <input type="text"/> | Type of School/Degree | Please Select... ▼                             |
| School City   | <input type="text"/> | School State/Prov     | Please Select... ▼                             |
| Area of Study | <input type="text"/> | Years Completed       | <input type="text"/> Status Please Select... ▼ |

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Read each item and select the option below it that you feel is most accurate. Remember to answer each question **honestly**. All your answers will be kept confidential. Items marked with an "\*" are required.

I often use words like "great" or "outstanding" to describe my experiences.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

Our staff should make it a priority to reach out to make each customer feel welcome in our stores.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

Sometimes I have stretched the truth for my boss just to get him or her off my back.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

There is no reason I can think of to justify my taking something that did not belong to me. \*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I always try to create a very favorable first impression on customers.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I would prefer to know exactly how my customers feel about the quality of service I provided them.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

People coming into our stores should have a good time.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I have expectations for outstanding success in my future.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I put more effort into my job than most people.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

It really annoys me when people I work with do not follow procedures exactly.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

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Read each item and select the option below it that you feel is most accurate. Remember to answer each question **honestly**. All your answers will be kept confidential. Items marked with an "\*" are required.

I smile and speak to any customer who comes near me when I am working.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

In making a decision, I always go by what is right and proper.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I always tell people the truth even if they don't want to hear it.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I try to make direct eye contact when speaking with customers.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I always keep every single promise I make.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I would buy stolen merchandise if it would help out a person in need and I knew neither of us would be caught.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I like to make every customer feel that they are important to me.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

When following a process, I always go by the known procedure.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

If I see something that needs to be done, I go ahead and do it even if it is more than my normal job duties.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I am always dependable and reliable in everything I do.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

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Read each item and select the option below it that you feel is most accurate. Remember to answer each question **honestly**. All your answers will be kept confidential. Items marked with an "\*" are required.

When I pay cash and somebody gives me too much change, I always call it to their attention.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I really believe in the saying "Every cloud has a silver lining."\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I am more comfortable working when there are standard operating procedures.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

My supervisor would say I work extremely hard and use my time well at work.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I have a reputation for being helpful to other people.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I am basically an optimistic person.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I would rather work in a place which doesn't have too many rules and guidelines.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I think it is OK to make a copy for my own use at home of copyrighted software which was purchased by somebody else.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

If I get my assignments done at work, I always look for something else to do.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I feel more comfortable in a job with a lot of rules and policies because I know that I won't do anything wrong.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

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Read each item and select the option below it that you feel is most accurate. Remember to answer each question **honestly**. All your answers will be kept confidential. Items marked with an "\*" are required.

I prefer to strike up conversations with customers rather than wait to see if they talk to me.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I think it is important to regularly say "please" and "thank you" when dealing with customers.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I want our customers to feel that they are valued and appreciated.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I always keep things in their proper place so that I know where to find them.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

If I am not busy I look for something to do to stay productive.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I try to say or do things to make sure customers remember me.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I tend to agree more with the saying "The glass is half full." than with the one that says "The glass is half-empty."\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

No matter what I am paid, I try to be as useful and productive as possible, even if it means doing more than my assigned tasks.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

Sometimes people get annoyed with me for not getting back to them when I promised.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

If I see a coworker taking something that did not belong to him or her, I would just keep quiet about it.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

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Read each item and select the option below it that you feel is most accurate. Remember to answer each question **honestly**. All your answers will be kept confidential. Items marked with an "\*" are required.

It sometimes bothers me to have to follow every single health and safety standard at work. \*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I always encourage customers to come back again when they are leaving.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

Customers really like it if you talk to them and make them feel welcome and appreciated.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I am always looking for something to do to make myself useful at work.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

When I start a new job, I want to make sure I learn the rules and procedures first, so I don't do my task wrong.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I try to understand a customer's needs and desires before advocating a product or attempting to influence a buying decision.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

When something significant but unexpected happens in my life, it's usually something bad.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I would turn in anybody I knew was taking home company equipment or merchandise, even if the person was a friend of mine.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I might miss a day of work without really being sick.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

When there is an opportunity to take a breather at work, I use it.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

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Read each item and select the option below it that you feel is most accurate. Remember to answer each question **honestly**. All your answers will be kept confidential. Items marked with an "\*" are required.

I go the extra mile to ensure that my work is excellent in every way.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I always thank customers for something they said or did, even if they don't spend much.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I have really high hopes for myself.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

There is always more work to be done if you look for it.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I enjoy work where you have to follow standard procedures exactly.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

A person who steals out of necessity is less to blame than a person who steals for personal gain. \*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I would rather work with people who are easygoing and don't necessarily conform to every rule and regulation.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

It would be good for every single customer to be greeted as soon as they come into the store.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

We should be hiring employees who really like people and help make our store a friendly place.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

If I had a night shift job that was really boring, I would make sure I had enough to do to prevent myself from falling asleep.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

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Read each item and select the option below it that you feel is most accurate. Remember to answer each question **honestly**. All your answers will be kept confidential. Items marked with an "\*" are required.

I would have to be truly sick to miss a day of work.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I smile a lot when I am talking to customers.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

Ideally, one of our staff would approach every customer and ask how they could help them find what they need even if they don't seem to need any help.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I regularly compliment customers on something they say or the way they look.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I prefer to have procedures to follow in my work.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I enjoy making myself useful every minute of my day at work.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

When the future is uncertain, I tend to anticipate problems.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I try to perform every task assigned to me in a very thorough manner.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

When bad things happen, I tend to look on the bright side.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

If things are slow at work, I start thinking of things we could change to make things better.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

I would rather work for a company where there are clear rules and guidelines.\*

☐ I strongly disagree. ☐ I disagree. ☐ I'm in-between. ☐ I agree. ☐ I strongly agree.

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Read each item and **select** the option below it that you feel is most accurate. Remember to answer each question **honestly**. All your answers will be kept confidential. Items marked with an "\*" are required.

It should take 5.22 minutes to clean a shower. You have 5 showers that need to be cleaned. How many minutes should it take for you to clean all 5?\*

- ☐ 26.1 minutes    ☐ 25 minutes    ☐ 27.3 minutes    ☐ 26.5 minutes

You have been cleaning diesel dispensers for 35 minutes. You have completed 6 dispensers. How many minutes has it taken you to clean 1 dispenser?\*

- ☐ 6.83    ☐ 5.22    ☐ 5.83    ☐ 6.00

You are going to mix a gallon bucket of window cleaner. The instructions direct you to mix 1 part cleaner to 3 parts water. How much cleaning solution will you need to use?\*

- ☐ 1 ½ quarts    ☐ 1 pint    ☐ 2 quarts    ☐ 1 quart

You have 1 case of soap bars and there are 150 bars in a case. You use 300 bars of soap per day. How many cases do you need to order to have enough for 7 days?\*

- ☐ 11    ☐ 12    ☐ 13    ☐ 14

A customer buys 17.01 in gas and requests one five dollar [\$5] lottery ticket, two one dollar [\$1] lottery tickets, and one [\$3] lottery ticket. He gives you two winning tickets to be redeemed: one for (\$5) and the other for (\$2). How much change would he receive from a \$100 bill?\*

- ☐ \$20.01    ☐ \$72.01    ☐ \$74.99    ☐ \$79.99

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# Applicant Notification

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## Work Opportunity Tax Credit Program

This employer participates in the Work Opportunity Tax Credit (WOTC) program. This program is designed by the federal government to help companies hire more people into the workforce and to retain employees through federal incentives.

The statements below are for informational purposes only and require no action at this time. However, should you continue in the hiring process, you may be asked to provide feedback on the following:

---

- I am a member of a family that has received assistance from Temporary Assistance for Needy Families (TANF) for any 9 months during the past 18 months.
- I am a veteran and a member of a family that received Supplemental Nutrition Assistance Program (SNAP) benefits (food stamps) for at least a 3-month period during the past 15 months.
- I was referred here by a rehabilitation agency approved by the state, an employment network under the Ticket to Work program or the Department of Veteran Affairs.
- I am at least age 18 but not age 40 or older, and I am a member of a family that:
  - Received SNAP benefits (food stamps) for the past 6 months, or
  - Received SNAP benefits (food stamps) for at least 3 of the 5 months, but is no longer eligible to receive them.
- During the past year, I was convicted of a felony or released from prison for a felony.
- I received supplemental security income (SSI) benefits for any month ending during the past 60 days.
- I am a veteran and I was discharged or released from active duty in the U.S. Armed Forces during the past 5 years and, for at least 4 weeks during the past year, I received unemployment compensation.
- I am at least age 16 but not age 25 or older, and:
  - During the past 6 months, I have not attended a secondary, technical, or post-secondary school for more than an average of 10 hours per week, not counting periods during which the school was closed for scheduled vacations, and
  - During the past 6 months, if I was employed, during each consecutive 3-month period within the past 6 months, I earned less than I would have earned if I had worked for the applicable minimum wage 30 hours every week during the 3-month period, and
  - I do not have a certificate of graduation from a secondary school or a General Education Development (GED) certificate or I have a certificate that was awarded at least 6 months ago and I have not held a job (other than occasionally) or been admitted to a technical or post-secondary school since I received the certificate.
- I am a veteran entitled to compensation for a service-connected disability and, during the past year I was:
  - Discharged or released from active duty in the U.S. Armed Forces, or
  - Unemployed for a period or periods totaling at least 6 months.
- I am a member of a family that:
  - Received TANF payments for at least the past 18 months, or
  - Received TANF payments for any 18 months beginning after August 5, 1997, and the earliest 18-month period beginning after August 5, 1997, ended during the past 2 years, or
  - Stopped being eligible for TANF payments during the past 2 years because federal or state law limited the maximum time those payments could be made.

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Please enter the following information. Items marked with an "\*" are required.

I certify that all of the information furnished on this application and during the application process is true, complete and correct to the best of my knowledge. I understand that any misrepresentation or omission of facts may result in refusal to hire or, if hired, may result in my dismissal at any time regardless of when the false answer or omissions are discovered.

I recognize that this employment application is not an offer of employment. I agree that if I am hired by the Company, as allowable by law, **I will be an at-will employee**, meaning that either the Company or I may end the employment relationship at any time with or without cause or notice. I understand that no one at Pilot Travel Centers LLC or Maxum Petroleum Operating Company has authority to enter into any agreement for employment for any specified period of time, or to make any agreement contrary to the at-will employment relationship.

**I agree that if I am hired by the Company, my employment will be subject to and contingent upon the signing of a mandatory arbitration agreement presented to me and signed when I complete my new hire paperwork. If I have any questions related to the mandatory arbitration agreement, I may contact the Legal Department at 865-588-7488, Ext. 2219.**

I further understand and agree that, except for employment-at-will status, if hired, at anytime my wages, hours, working conditions, job assignment(s), and compensation rate(s) will be subject to change by Pilot Travel Centers LLC or Maxum Petroleum Operating Company.

I agree, as a requirement of my employment, I will be required to, and will, submit to legally permissible drug testing upon an offer of employment from Pilot Travel Centers LLC or Maxum Petroleum Operating Company, prior to starting work and during my term of employment.

Massachusetts Applicants: I understand that it is unlawful in Massachusetts to require or administer a lie detector test as a condition of employment or continued employment. An employer who violates this law shall be subject to criminal penalties and civil liability.

Massachusetts Applicants: I understand that it is unlawful in Massachusetts to require or administer a lie detector test as a condition of employment or continued employment. An employer who violates this law shall be subject to criminal penalties and civil liability.

Maryland Applicants: I understand that under Maryland law, an employer may not require or demand, as a condition of employment, prospective employment, or continued employment, that any individual submit to or take a lie detector or similar test. An employer who violates this law is guilty of a misdemeanor and subject to a fine not exceeding \$100.

☐ I understand and agree with the above statements.\*

Social Security Number\*  -  -

Confirm Social Security Number\*  -  -

**Use the "Back" button to review or correct any information that you believe may have been entered incorrectly or inaccurately, or use the "Finished" button to submit your application for consideration.**

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## Vita

Robert Allen Cobb Jr was born in Bowling Green, Kentucky. After graduating from Warren Central High School, he attended Western Kentucky University, double majoring in Economics and Computer Information Technology, and was a kicker on the WKU football team from 2006-2009. Upon completion of undergraduate work in 2011, he enrolled in WKU's M.A. in Applied Economics program, and graduated at the top of his class with a concentration in Econometrics. After completion of his M.A. in 2013, he enrolled in the University of Tennessee's PhD program in Economics. After completion of all required core coursework, he took a job at Pilot Flying J as a Business Intelligence Data Scientist, in Knoxville, Tennessee. This thesis fulfills the requirements for the M.A. in Economics from the University of Tennessee.