

Wage Growth and Worker Observability

Paul C. Hallmann

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Djavad Salehi-Isfahani, Chair

Richard Ashley

Suqin Ge

Zhou Yang

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(ABSTRACT)

When hiring new entrants into the labor market, firms make their decisions based on limited information about worker ability. An estimation of ability must be gleaned from observable factors such as a worker's education level, GPA and interview performance. While some firms conduct further testing, it remains that an accurate evaluation of worker ability at the time of hiring is very difficult to achieve. Evidence suggests that much of a firm's evaluation of worker ability takes place after a worker has been hired. The purpose of this paper is to provide a thorough analysis of wage growth and a firm's ability to observe its workers' productivity.

I regress a Mincerian wage equation using data from the March 2009 Supplement of the Consumer Population Survey merged with additional industry data gathered from the Bureau of Labor Statistics. The coefficient of worker experience interacted with various measures of worker observability is used to provide an indication of the importance of worker observability in the growth of wages. I examine four potential measures of worker observability: firm size, occupation, industry, and worker-manager ratio. The results indicate a positive relationship between worker observability and wage growth when using firm size as a measure of observability.

Dedication

This dissertation is dedicated to the memory of my son, Lucas Clark Hallmann.

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Chapter 1

Introduction

When hiring new entrants into the labor market, firms make their decisions based on limited information about worker ability. An estimation of ability must be gleaned from observable factors such as a worker's education level, GPA and interview performance. While some firms conduct further testing, it remains that an accurate evaluation of worker ability at the time of hiring is very difficult to achieve. Evidence suggests that much of a firm's evaluation of worker productive ability takes place after a worker has been hired. The presence of employer learning has been illustrated by the fact that the variance of wages among a cohort of workers increases with worker experience. Studies have also shown that there exists an increasing correlation between wages and ability measures not observed by employers (i.e. standardized test scores) [Farber and Gibbons, 1996], [Altonji and Pierret, 2001]. Furthermore, a worker's productivity is likely to increase as he or she gains on-the-job experience.

One area in which the literature on wage growth is incomplete is the examination of the impact of worker observability on returns to experience. While research has shown the existence of a variation in employer learning across occupations [Mansour, 2012], differences in worker ob-

servability can only be partially explained by occupational differences. In this paper, firm size, occupation, industry and worker-manager ratio are used as correlates for worker observability.

The importance of worker observability in the determination of wages has been explained by efficiency wage theory. A larger firm with low worker observability might be willing to pay higher wages to ensure a higher quality pool of applicants, thus minimizing the instances of unobserved shirking by its workers or providing motivation to put forth greater effort [Shapiro and Stiglitz, 1984] [Esfahani and Salehi-Isfahani, 1989]. In cases of low worker observability, workers with high levels of responsibility might earn an even greater wage premium [Eaton and White, 1982].

Not only is the ability of an employer to observe shirking behavior lower in firms of larger size, but the ability to observe positive behavior is also lower. Therefore, the amount of time it takes for the ability of a worker to be revealed to his or her employer should be increasing with firm size. As this ability is revealed, we expect the worker's wage to be increased accordingly (or laid off if true ability is below the firm's expectation). Assuming this is an accurate description of reality, we would expect to see the effect of experience on wages to be increasing with firm size.

In general, a worker's wages increase with experience. This wage increase can be attributed to two factors: 1) The worker learns and becomes more productive with experience (The Learning by Doing or Human Capital Model) or 2) with experience, there are more opportunities for the employer to observe the worker's productivity and compensate them accordingly (The Employer Learning Model). The purpose of this paper is to provide a thorough analysis of wage growth and a firm's ability to observe its workers' productivity. Using firm size, occupation, industry, and worker-manager ratio as correlates of worker observability, estimation results provide evidence for the existence of a positive relationship between worker observability and wage growth.

Chapter 2

Literature Review

This section includes a brief summary of the methodologies and results from some of the more impactful studies in the employer learning literature. The focus of this review is restricted only to the results of each study that pertain to the objectives of this paper. As such, certain findings of the following papers have been left out intentionally.

2.1 Symmetric Employer Learning

2.1.1 Farber and Gibbons, 1996

Farber and Gibbons (FG) presents a dynamic benchmark model in which worker ability is signalled initially by characteristics observable at entry into the labor market (i.e. education), but also allows for employers to learn more about worker ability based on subsequent observations of worker productivity [Farber and Gibbons, 1996]. In this model, all worker characteristics and worker productivity information is observed by all market participants. Two additional assumptions are made: wages equal expected output at each date and the stochastic component of worker's output has a

time-invariant distribution (natural and learned ability are valued equally by employers).

In addition to the i th worker's innate ability, η_i , and schooling, s_i , the model contains three kinds of worker characteristics: X_i , those observed by employers and included in the data, Z_i , those observed by employers but not included in the data and, B_i , those included in the data but unobserved by employers.

Output for worker i in period t is denoted by y_{it} . Outputs are independent draws from $G(y_{it} \mid \eta_i, s_i, X_i, Z_i)$ (note: B_i is assumed to have no direct effect on output).

Employers' information is symmetric. The joint distribution $F(\eta_i, s_i, X_i, Z_i, B_i)$ and conditional distribution $G(y_{it} \mid \eta_i, s_i, X_i, Z_i)$ are both known to all employers. All employers observe schooling s_i , worker characteristics X_i and Z_i and the full sequence of outputs, $\{y_{i1}, \dots, y_{it}\}$.

The expected output per worker gives the wage paid to a worker in period t :

$$w_{it} = E(y_{it} \mid s_i, X_i, Z_i, y_{i1}, \dots, y_{it}) \quad (2.1)$$

Data from the National Longitudinal Survey of Youth (NLSY) is used for the empirical analysis. The selected sample consists of 4998 individuals surveyed from 1979 to 1988 for a total of 34,742 observations.

B_i can be viewed as some combination of innate ability, education and family background. Since these measures are certainly observable by employers, Farber and Gibbons construct an alternative by using aptitude test scores and data on family background. More specifically, Armed Forces Qualification Test (AFQT) scores and information on whether anyone in the home had a library card when the individual was age fourteen are used. A regression of B_i on X_i provides the residual (B_i^*) which can be viewed as worker attributes unobserved by employers.

$$B_i^* = B_i - X_i \hat{\gamma} \quad (2.2)$$

In order to achieve orthogonality of B_i^* and Z_i , the first observed wage of worker i (w_{i0}) is included in the construction:

$$B_i^* = B_i - X_i \hat{\gamma} - \hat{\delta} w_{i0} \quad (2.3)$$

To generate B_i^* , a sample was taken using only the first observation for each individual. Using this sample, the AFQT score was regressed on education, part-time status, the interaction of education and part-time status, race, sex, age, calendar year, and the real wage. The same was done using the library card indicator variable. The residuals from these two regressions were used as measures of ability that are not observed by the employers.

FG use the NLSY79 data set, a panel study of men and women who were aged 14-21 in 1978 and have been surveyed annually through 1991. The sample is restricted to only include individuals who make their first long term transition (3 consecutive years) from nonwork to work during the sample period. Those workers listed as being in the military were also excluded from the sample.

Regressions of the level of the real wage on a set of worker characteristics, education, experience, AFQT and the library card residuals provides no evidence that the relationship between wage and education varies with experience. Furthermore, the results indicate that measures of worker ability that are not observed by the market have an increasing relationship with wages as experience increases.

FG's study provides strong empirical evidence in support of their "learning model" in which a worker's education provides a signal to employers about their ability level upon entry into the labor

market. The employer compensates the worker based on this initial signal upon entry but future changes in compensation are not related to this initial signal. These future changes in compensation depend on what the employer learns about the true ability level of the worker. As the employer has the time to observe the worker's ability, they are able to more accurately compensate the worker.

2.1.2 Altonji and Pierret, 2001

Altonji and Pierret (AP) provides evidence of employer learning by showing how wage coefficients on easily observable and difficult to observe worker characteristics change with experience. They suggest that firms statistically discriminate among young workers on the basis of easily observable characteristics such as education, race and gender. As firms learn about the ability of workers, the coefficients on easily observed variables decrease and the coefficients on difficult to observe variables increase. This suggests that, as workers gain experience, their pay becomes more dependent on their productivity and less dependent on their easily observable characteristics (i.e. education).

$$y_{it} = r s_i + \alpha_1 q_i + \Lambda z_i + \eta_i + H(t_i)$$

where y_{it} is the log of labor market productivity of worker i with t_i years of experience; s_i represents variables that are observed by employer and econometrician; q_i includes variables that are observed by the employer but not by the econometrician; z_i consists of measures of productivity that are not observed by employers but are available to the econometrician; η_i is an index of all other determinants of productivity that are not observed by the employer or the econometrician; and $H(t_i)$ is the experience profile of productivity.

AP uses the 1992 release of NLSY79, a panel study of men and women who were aged 14-

21 in 1978 and have been surveyed annually since then (biennially since 1994). The sample is restricted to white or black men who have received at least 8 years of education and do not change education between successive years.

Whereas FG found a consistent relationship between education and wage as experience increased, AP finds evidence suggesting that the effect of education on wages declines with experience. Although the decline is minimal it is statistically different from zero. This tells us that employers appear to only use education as a measure of ability when a worker enters the labor market. As a worker becomes more experienced, the employer has the opportunity to observe more accurate measures of worker ability (i.e. productivity) so the reliance on education declines.

As expected, the results also show that wages become more dependent on productivity as experience increases. AP utilizes a number of measures of unobserved worker characteristics as correlates of worker productivity including AFQT scores, sibling wage, and father's education. The wage effects of all three variables increase with experience.

2.1.3 Lange, 2007

Other research has focused more specifically on the speed at which employers learn about employees. Following the basic employer learning model described in FG, [Lange, 2007] determines an estimate for the speed at which employers learn about workers.

Lange uses NLSY data from the years 1978-1998. The sample is restricted to include only nonblack respondents earning an hourly wage between \$1 to \$100. The total remaining sample size is 4,701 individuals with 48,930 observations.

Results indicate that employer learning takes place quickly. The employers' initial worker abil-

ity expectation errors decline by an average of 26% in the first year. After three years, the error will have declined by 51% and within 5 years it will have declined by 64%. Clearly, this suggests that the majority of employer learning takes place within the first few years of an employees entrance into the labor market. However, the expectation error remaining after these first few years of employment is enduring. On average, Lange finds that it takes 26 years to reduce expectation error to less than 10% of its initial value. Even if measured at the end of a worker's career, at 60 years of age or after 40 years of work, expectation error still averages about 6% of its initial value.

2.1.4 Mansour, 2010

Mansour extends the work done by AP by suggesting that employer learning varies across occupations. The hypothesis is that learning might differ across occupations as a result of some sorting of ability into occupations or because of the nature of the work required for each occupation which might affect the speed of employer learning.

Mansour's model is similar to that of AP and Lange. The primary difference is that AP and Lange assume that employer learning is independent of job assignment. Lange shows that the speed of employer learning depends on the variance of the initial expectation error of employers and the variance of the signal of output. Mansour allows for both of these to vary by initial occupational assignment.

The CPS Outgoing Rotation Group from 1984-2000 is used to calculate the occupation residual variance at each experience level in the first ten years of the worker's career and the growth rates of wage dispersion for workers of different experience levels. These estimates were merged with the occupations reported in the NLSY 1979. The growth rates in wage dispersion are compared

with the growth rates in the coefficient of AFQT.

The results indicate that occupations with high growth in the variance of residual wages are the same occupations that exhibit high growth in the coefficient of AFQT. As such, it is possible to categorize occupations as "high learning" and "low learning". Although the growth rates in wage dispersion and AFQT coefficient are low for these "low learning" occupations, they are not occupations where employers know little about the worker after 10 years of experience. In fact, the results indicate that employers actually possess a great deal of information about the worker at the time of hire and there is little further learning to be done.

2.2 Asymmetric Employer Learning

The following subsection highlights a branch of the literature that attempts to assess the symmetry of employer learning. That is, do all employers have the same information about a worker's productivity or does that worker's current employer have superior information? Although the public availability of productivity varies across occupations, it is likely that there is at least some level of information available to all employers in the market. For example, a law firm is likely to use the number of cases a lawyer has won and lost as a measure of productivity. The lawyer's current employer, however, is likely to be the only one with knowledge of how well the lawyer works in high pressure situations or as a part of a team.

2.2.1 Schönberg, 2007

Schönberg extends the learning model of FG and AP by allowing for asymmetric learning and by introducing mobility into the model. Using data from the NLSY79 Schönberg is able to test

for asymmetric learning in two ways. The first method is to estimate how ability measures affect the probability that workers will switch firms. This follows the finding that asymmetric learning results in a market in which workers who switch firms are less able than those who stay with their employer (Gibbons and Katz, 1991). The second test assumes that the effect of easily observable (education) and hard to observe worker characteristics (innate ability) on wage offers is the same for incumbent firms and outside firms if employer learning is symmetric. If learning is asymmetric, then incumbent firms are better informed about the worker's innate ability. As such, the effect of education should be smaller and the effect of ability should be greater for incumbent firms than for outside firms. Incumbent firms are able to use their accumulated knowledge of the worker's ability while outside firms only have easily observable characteristics, such as education, to use in evaluating the worker's productivity. This test is conducted using AFQT test scores as the measure for hard to observe worker characteristic and years of schooling as the easily observable worker characteristic.

The first test for asymmetry is conducted by estimating probit models with quarterly quit rate as the dependent variable. If asymmetry exists, then low-ability workers are more likely to leave the firm than are high-ability workers. The hypothesis test is whether the coefficient for AFQT score is zero or negative. A negative coefficient indicates asymmetric learning while a coefficient of zero indicates symmetric learning. The results of the test indicate the existence of asymmetric learning but the inclusion of industry and occupation dummies result in insignificant estimates. This suggests that sorting by ability into occupations and industries is important. Schönberg is only able to show that asymmetric learning exists, when including occupation and industry dummies, when testing by education level. The results indicate the existence of asymmetric learning for college graduates but not for high school graduates.

The second test for asymmetry involves a wage regression and analysis of how the coefficients of the AFQT score and schooling vary with experience and tenure. If learning is symmetric, incumbent firms should not have more accurate information about a worker's ability than outside firms so the coefficient on the interaction of AFQT and tenure should be zero. Asymmetric learning would be indicated by a positive coefficient. The results are similar to those found in test one. There is no evidence of asymmetric learning without distinguishing between education groups. Even when distinguishing between education groups, the results are mixed. There is some evidence suggesting that asymmetry exists among college educated workers but that asymmetry declines with tenure (although results are insignificant after the fifth year of tenure).

Overall, Schönberg concludes that learning is largely symmetric. There does appear to be some evidence of asymmetry within the group of college educated workers but these results are mixed.

2.2.2 Pinkston, 2009

Pinkston follows the public learning model from FG and AP while also including a nested public and private learning model. He finds evidence of employer learning over continuous spells of employment. He claims that this evidence is consistent with an asymmetric learning model in which an employer's private learning is reflected in the worker's wage and is also transmitted to subsequent employers whenever the worker makes a job transition. This would make it appear as public learning when in fact it is private learning being transmitted from one employer to the next.

One of the major contributions of this paper is the inclusion of the ability of outside employers to compete for workers in a way that produces wage growth without promotions or changes in publicly observed information. All of this is done by allowing firms to bid on workers. Even if not

all information is publicly available, bidding wars allow a firm that outbids the worker's previous employer to observe that employer's private information by observing its final bid.

In Pinkston's model, wages become more highly related to actual worker productivity as the length of the employment spell increases. This is because the wage converges to the employer's productivity expectation and because that expectation becomes more accurate as the employer collects more private information. As such, there should be an increasing correlation between wage and difficult to observe variables that measure productivity as well as a decreasing correlation between wage and easily observable productivity variables.

Pinkston uses data from NLSY79 with AFQT scores being the correlate for innate ability. The results indicate that AFQT scores have a greater impact on a worker's wage as the length of continuous employment increases. Specifically, a one standard-deviation increase in the adjusted AFQT score increased the hourly wage by 0.27 more after 5 years of continuous employment than at the beginning of an employment period. Alternatively, an additional five years of potential experience and the same change in AFQT score increased the hourly wage by only 0.15. This result clearly indicates that private learning has at least as much of an effect as does public learning.

Chapter 3

Model

In this section, I describe a dynamic model of public learning based on that developed in FG. Three different types of time-invariant worker characteristics are considered in the wage determination: variables observed by both the employer and the econometrician (years of schooling, experience), variables observed by the employer but not by the econometrician (some measures of productivity, quality of schooling), and other determinants of productivity not observed by the employer or the econometrician (innate ability).

Let S_i denote a vector of the i th worker's individual demographic characteristics such as age, gender, race and education. Let X_i denote a vector of time-invariant worker characteristics that are not observed by the employer and not included in the data such as innate ability or unobserved productivity. Let Z_i denote a vector of time-invariant worker characteristics that are observed by the employer but not included in the data such as quality of schooling, GPA, or quality of interview.

The output of worker i at time t is determined by all of the aforementioned worker characteristics:

$$y_{it} = \beta_t S_i + \gamma_t X_i + \lambda_t Z_i$$

The employer is able to observe some signal of worker productivity but is unable to directly observe y_{it} . Most occupations require the completion of myriad tasks, of which only some can be directly observed. This provides the employer with limited information regarding productivity. We assume that this observed productivity is included in Z_i while the remainder is captured in X_i . Therefore, the employer's knowledge about the information captured in X_i is limited. More specifically, it depends on the observability of worker i .

Let $\omega_i = [0, 1]$ be a normalized measure of worker observability. Assume $\omega_i = 0$ to represent an employer that has absolutely no capacity to observe worker i 's ability outside of what is represented in Z_i . Conversely, $\omega_i = 1$ represents an employer that has the capacity to perfectly observe the ability of worker i . Firm size, worker-manager ratio, firm industry, and worker occupation are all examined as potential correlates for worker observability in the empirical section of the paper.

The employer's wage offer for worker i is equal to the output they expect worker i to produce during a given time, t . The employer's expectations depend not only on S_i , X_i , and Z_i . We assume that the employer also uses knowledge of worker i 's output in previous production periods in its valuation.

$$E(y_{it} | S_i, X_i, Z_i, y_{i1}, \dots, y_{i,t-1}) = w_{it}$$

In defining w_{it} , we include ω_i to capture the variation in the employers' capacity to learn what

is captured in X_i . The estimation of the firm's initial wage offer for worker i 's is as follows:

$$w_i = \alpha + \beta S_i + \phi X_i + \gamma X_i \omega_i + \lambda Z_i + \epsilon_i$$

Therefore, the employer offers a wage based on the measures of productivity that it has the ability to observe and its expectation of innate ability. This expectation is based on how much the employer has been able to observe the worker in his or her current task.

Chapter 4

Data

The sample is taken from the March 2009 supplement of the Consumer Population Survey (CPS). The sample size is 88,285 and includes the employed male and female civilian population between the ages of 16 and 65. Additional four-digit industry level data has been merged with the standard CPS data in order to better characterize each industry. Industry level data includes the number of firms in each industry by firm size (there are four different categories of firm size), the total employment in each industry by firm size, total payrolls in each industry by firm size, two different measures of the wage distribution for each industry, capital-labor ratio, percentage of total production costs from labor, percentage of total production costs from capital, hourly labor output, production per dollar of labor, output per worker and hourly labor cost. The following individual identifying characteristics are used in all empirical analysis: education, experience, state, region, resides in a metro area, resides in a metro city center, veteran status, union status, marital status, gender, race, occupation and industry.

Chapter 5

Empirical Analysis

The empirical analysis section provides a systematic approach to determining the impact of worker observability on wage growth. A thorough analysis of the problem requires the inclusion of all potential correlates of worker observability. Firm size, occupation, industry and worker-manager ratio are used as potential measures of worker observability. The wage equation is as follows:

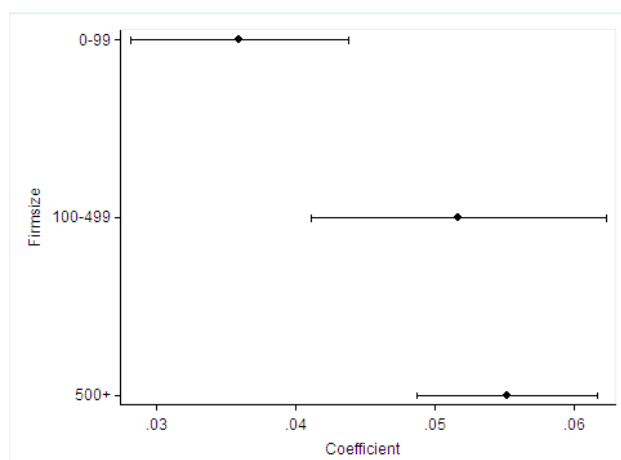
$$w_i = \alpha + \beta S_i + \gamma W_i X_i + \theta X_i X_i + \epsilon_i$$

Let S_i denote a vector of the i th worker's individual demographic characteristics which includes education, state, region, dummy for residing in a metro area, dummy for residing in a metro city center, veteran status, union status, marital status, gender, race, occupation, industry and other industry characteristics detailed above. $W_i * X_i$ is the interaction term of worker i 's observability and experience, respectively. The estimations of γ using all four measures of worker observability are provided and discussed in this section.

5.1 Firm size

To begin the analysis, firm size is used as the measure of worker observability, W_i . The estimation results presented in Figure 5.1 show that γ increases with firm size. The results could be interpreted as an indication of the importance of worker observability in the employer learning or learning by doing models. Considering the employer learning model, if worker observability decreases as firm size increases, it would take longer for the large employers to learn their worker's true ability and compensate them accordingly. As such, experience should be more important for those workers employed at large firms and we should see larger coefficients of the experience-firm size interaction term for larger firm sizes.

Figure 5.1: Estimated Coefficients: Experience-Firm size Interactions



The difference between the experience coefficient for firms with fewer than 100 employees and firms with 100-499 employees is over 2 times as large as the difference between the experience coefficient for firms with 100-499 employees and firms with 500+ employees. This indicates that worker observability decreases at an increasing rate as firm size increases. The true ability of a worker might be similarly obscured from the employer in a firm of 300 employees or 3,000 employees. Once a firm reaches a specific threshold, employer learning might become more difficult.

There is some research that supports this claim. A paper by Robin Dunbar [Dunbar, 1992] suggests that “the number of neocortical neurons limits an organism’s information-processing capacity and that this then limits the number of relationships that an individual can monitor simultaneously.” This suggestion ultimately led to what is now known as Dunbar’s Number; the maximum number of relationships that an individual can monitor simultaneously. Dunbar’s Number is actually a range of 100-230 relationships but is often cited as 150. A similar study [McCarty et al., 2001] suggests that the number is actually significantly higher. The Bernard-Killworth number is 290 relationships per person. While an interesting topic, it warrants further consideration as to whether it is actually relevant to worker observability. A story by [NPR, 2011] provides evidence that it is, in fact, quite relevant and important to employers:

GORE-TEX, the company that makes wetsuits, hiking boots and ponchos, is the subject of a famous anecdote in the world of sociology. It centers on the guy who founded the company, Bill Gore.

“When Bill Gore set the company up, he set it up in his backyard,” Robin Dunbar, a professor of evolutionary anthropology at the University of Oxford, tells NPR’s Rachel Martin.

From its modest beginnings, GORE-TEX grew and grew, Dunbar says, until Gore opened up a large factory. That, too, continued to grow.

Then one day, Dunbar says, Gore walked into his factory.

“And he simply didn’t know who everybody was.”

Gore wondered why this was. “It was his gut instinct,” Dunbar says, “that the bigger a company got, people working for the company were much less likely to work hard and help each other out.”

Gore did some counting, and realized that after putting about 150 people in the same building, things at GORE-TEX just did not run smoothly. People couldn’t keep track of each other. Any sense of community was gone.

So Gore made the decision to cap his factories at 150 employees.

“Whenever they needed to expand the company,” Dunbar says, “he would just build a new factory. Sometimes right on the parking lot next door.”

Things ran better this way, Gore realized. In smaller factories, Dunbar says, “everybody knew who was who. Who was the manager, who was the accountant, who made the sandwiches for lunch.”

Business was never better. One-hundred fifty, it seemed, was a magic number.

The relationship between worker observability and wage growth presented in Table 5.1 can also be explained by the learning by doing model. There is evidence that workers often change occupations throughout the course of their tenure [Kahn and Lange, 2010]. These internal movements of workers are associated with wage increases and larger firms provide more opportunities for such movements [Williams, 1991]. The positive association of wage growth and worker observability, measured by firm size, could be due to the greater prevalence of internal promotions for workers employed by larger firms. This would be considered a return to tenure. However, there is conflicting evidence regarding the relationship between experience, tenure and wages. Evidence suggests that tenure increases wages only after the first several years and that the accumulated effect of experience has a more substantial effect over a worker’s career [Williams, 1991]. Similarly, [Altonji and Shakotko, 1987] argues that returns to tenure only exist during the first year and additional years provide no returns. [Abraham and Farber, 1987] concludes that there is very little or no return to additional tenure. [Topel, 1991] provides completely different findings, suggesting that additional years of tenure yield significant wage increases. While the literature fails to provide a consensus conclusion, the public learning model does not differentiate between returns to tenure and returns to experience. The results present returns to experience which would encompass any returns to tenure that a worker might have received.

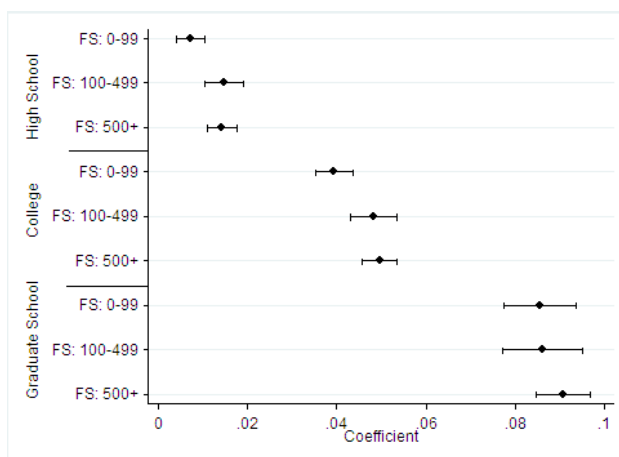
When hiring new entrants into the labor market, firms make their decisions based on limited

information about worker ability. Workers are able to send certain signals to their potential employers regarding their ability but firms' initial wage offers are often based off of some statistical discrimination [Altonji and Pierret, 2001]. Decomposing the experience coefficient by firm size and education provides some insight as to how much a workers education acts as a signal of true ability to the employer. Figure 5.2 shows that the experience coefficient increases with firm size regardless of education level. In addition, we again see that the largest difference in the coefficient is between firms with fewer than 100 employees and those with 100-499 employees. This holds true for all education levels. The difference is also much larger for college educated workers than it is for high school educated workers. The results for those attending graduate school are unclear. This implies that there is a lower variance in worker ability as the level of education increases and that there might be greater error in the firms evaluation of worker ability for less educated workers. A worker who has earned a graduate degree has more accurately signaled to potential employers that he or she is highly skilled. A worker with a high school diploma but no college education sends a more ambiguous signal and suffers from a higher level of statistical discrimination in his or her initial wage offer. This is consistent with the findings in [Arcidiacono et al., 2008] which suggest that worker ability is observed nearly perfectly for college graduates but much more gradually for high school graduates.

5.2 Occupation

While firm size might provide a more literal measure of worker observability, it is the ability of an employer to observe a worker's productivity that is paramount. As such, regardless of firm size or worker-manager ratio, the observability of worker productivity is likely to vary by occupation.

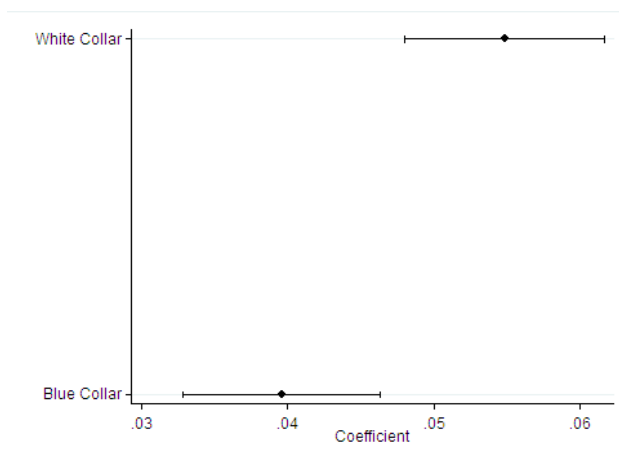
Figure 5.2: Estimated Coefficients: Experience-Firm size-Educational Attainment Interactions



Productivity is more likely to be observed in manufacturing or production where the output can be directly observed and quantified. Productivity is probably more difficult to observe in occupations such as management and administrative support where there is no physical output and production is difficult to quantify. Figure 5.3 shows the estimation of γ when experience is interacted with occupation type. Occupation types are either blue collar or white collar. Blue collar includes the precision production, craft, repair, operations, fabrication and labor occupations. White collar includes managerial, professional, technical, sales, and administrative support occupations. The coefficient of experience interacted with an indicator for white collar workers is significantly larger than that of experience interacted with an indicator for blue collar workers.

The relationship between wage growth and worker observability as measure by occupation type shown in Figure 5.3 can be explained by employer learning. Blue collar worker production is typically more easily observable than white collar production. For example, an employer can easily determine the output per hour of an assembly line worker but such a measure is much more ambiguous for an office secretary. The more observable nature of blue collar work allows firms to learn the productivity of their blue collar workers more quickly than that of their white collar

Figure 5.3: Estimated Coefficients: Experience-Occupation Type Interactions



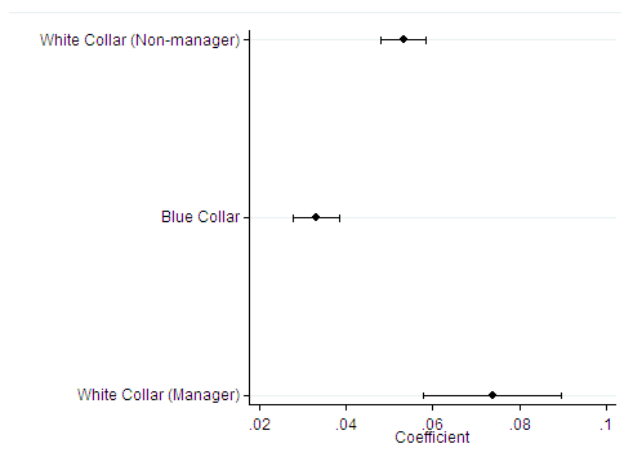
workers. As true productivity is learned, it can be appropriately compensated. For a white collar worker, it might take longer to receive a wage that accurately reflects their ability and production. This is illustrated by the larger experience coefficient.

There is considerable variation in the occupation types classified as white collar. In order to further determine the impact of occupation on wage growth, white collar is broken into managerial and non-managerial sub-classifications. The observability of managerial white collar workers is likely to differ from the observability of non-managerial white collar workers. The results of the estimation are provided in Figure 5.4 and can be similarly explained by employer learning.

The results can also be explained by learning by doing. The higher coefficient for the white collar workers indicates that white collar worker experience greater wage growth than blue collar worker wages. This could plausibly be explained by the existence of more opportunities for advancement in white collar occupations. White collar workers may become experts in their selected field upon entry to the labor market but that expertise may grow to include other skills and abilities, such as managerial ability, as one gains experience. This growth would most likely come with an increase in wage. The results in Figure 5.4 support this claim; managerial white collar workers

experience greater wage growth than their non-managerial counterparts. This could be viewed as learning by doing being rewarded by promotion to the managerial level. Blue collar workers would also experience an accumulation of skill and expertise but it might be more limited to a specific task. This limitation is likely to play a significant role in the limited wage growth compared to white collar workers.

Figure 5.4: Estimated Coefficients: Experience-Occupation Type (Managerial vs. Non-Managerial) Interactions



Further analysis provides an insight into the importance of occupation type and wage growth by firm size. Figure 5.5 provides the results of a regression on experience interacted with dummies for occupation type and firm size. As expected, the coefficient on the three-way interaction term increases with firm size. We also observe larger coefficients for white collar occupations when compared to blue collar occupations at each firm size.

To further analyze the importance of worker observability in wage growth, we regress experience interacted with occupation type and education. The results are given in Figure 5.7. There are a couple of noteworthy results. First, the experience coefficient appears to be increasing with education level for white collar workers and decreasing with education for blue collar workers. It should be noted that not all coefficients are significantly different from each other so we must be

Figure 5.5: Estimated Coefficients: Experience-Occupation Type-Firm size Interactions

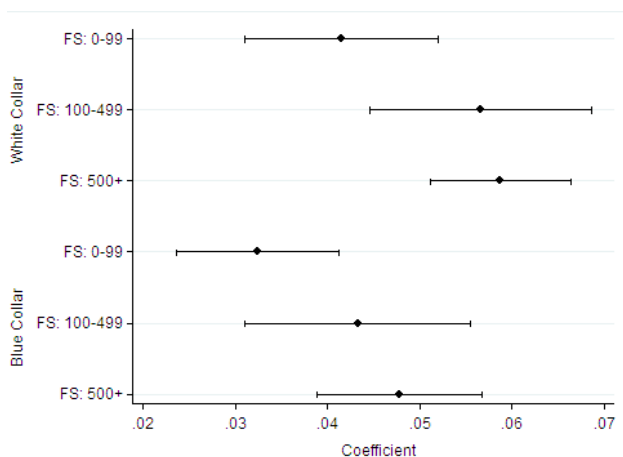
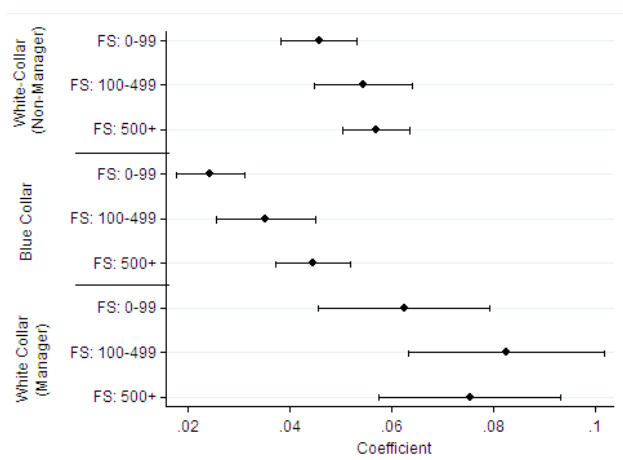


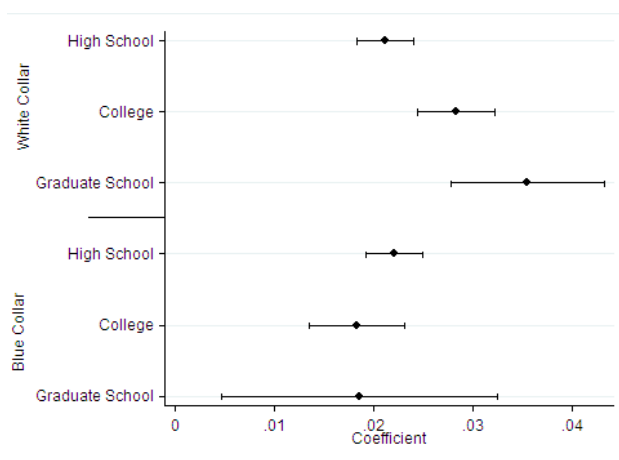
Figure 5.6: Estimated Coefficients: Experience-Occupation Type (Managerial vs. Non-Managerial)-Firm size Interactions



cautious in drawing any conclusions. That said, there are intuitive explanations for the relationships presented in Figure 5.7. If education provides an accurate measure of natural ability then we would expect workers of high ability, or high level of educational attainment, to increase their skill level as they gain work experience. An increase in wage should come with the increase in skill level. This explains the positive relationship between education and experience coefficient for white collar workers. Given that the difference between the coefficients for blue collar workers is not statistically significant, we cannot be sure that any difference exists at all. The only other

notable result is that the coefficient for college educated white collar workers is significantly larger than its blue collar counterpart. This might reflect the greater opportunities for wage increases found in white collar work.

Figure 5.7: Estimated Coefficients: Experience-Occupation Type-Educational Attainment Interactions



A comparison of white collar and blue collar occupations provides a broad look at worker observability at the occupational level but a more detailed analysis is necessary. The results provided in Table 5.1 come from a regression of experience interacted with twenty four different occupations. The regression analysis provides further support of the theory that blue collar occupations are more easily observed by employers than are white collar occupations. Occupations with the highest coefficients, indicating higher returns to experience, include management, financial specialists, computer and mathematical occupations, legal occupations and health care practitioners. Occupations with the lowest coefficients, indicating lower returns to experience, include transportation and material moving, building, grounds cleaning and maintenance, production, and construction. These results are consistent with those provided from the more general classification of occupation type. The workers with white collar occupations and lower worker observability, particularly managerial white collar, experience greater returns to experience than do their blue collar counterparts.

Table 5.1: Regression Results: Occupation-Experience Interactions

Occupation	Coefficient	CI 95
Management	0.0756***	0.0702, 0.0810
Business operations Specialists	0.0675***	0.0581, 0.0769
Financial Specialists	0.0737***	0.0648, 0.0825
Computer and Mathematical	0.0757***	0.0671, 0.0843
Architecture and Engineering	0.0735***	0.0636, 0.0834
Life, physical, and social science	0.0440***	0.0311, 0.0569
Community and social service	0.0595***	0.0494, 0.0695
Legal	0.0988***	0.0857, 0.1118
Education, training and library	0.0571***	0.0508, 0.0634
Arts, design, entertainment, sports and media	0.0611***	0.0507, 0.0715
Healthcare practitioners and technical	0.0951***	0.0887, 0.1016
Healthcare support	0.0469***	0.0389, 0.0549
Protective service	0.0400***	0.0312, 0.0488
Food Preparation and Serving	0.0481***	0.0418, 0.0543
Building and Grounds Cleaning and Maintenance	0.0234***	0.0163, 0.0306
Personal Care and Service	0.0352***	0.0276, 0.0427
Sales	0.0529***	0.0476, 0.0583
Office and Administrative Support	0.0385***	0.0337, 0.0433
Farming, fishing and forestry	0.0333	-0.0010, 0.0676
Construction	0.0348***	0.0282, 0.0414
Extraction workers	0.0619	-0.0610, 0.1847
Installation, maintenance and repair workers	0.0361***	0.0287, 0.0435
Production	0.0340***	0.0281, 0.0398
Transportation and material moving	0.0263***	0.0205, 0.0322

*** 95% Confidence

5.3 Industry

As occupation appears to have some impact on worker observability, there might also be some difference across industries. Assuming that the productivity of workers in the manufacturing industries is more easily observed than that of workers in the services industries, an estimate of the return to experience is determined for each sector. The results of a regression on the interaction of experience and industry type are given in Figure 5.8 and do not indicate any statistical difference between the manufacturing and services industries. Given the variation in the occupations within those industries classified as services industry, it might be beneficial to consider skill-intensive service industries as a sub-classification. Skill-intensive service industries include professional and tech-

nical, management, educational, health, finance and insurance services. Figure 5.9 provides the estimation results from dividing the services industries into two sub-classifications: skill-intensive and other. The inclusion of additional classifications fail to provide any statistically significant difference in returns to experience across industry types.

Figure 5.8: Estimated Coefficients: Experience-Industry Type Interactions

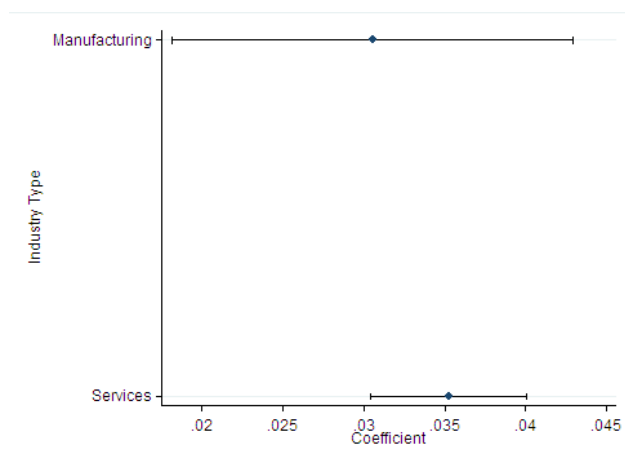
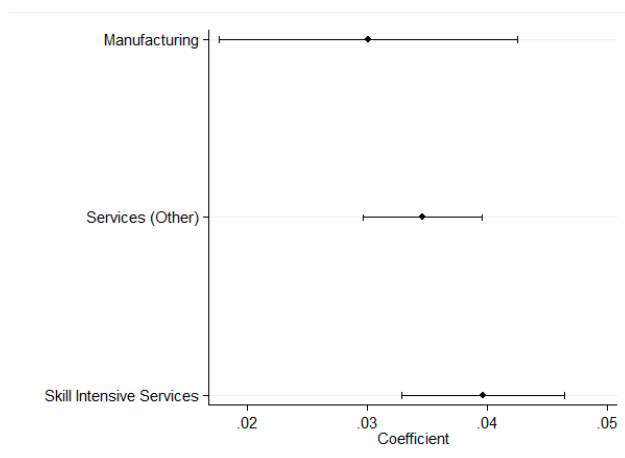


Figure 5.9: Estimated Coefficients: Experience-Industry Type Interactions



While worker observability might vary across industries, it is likely that this only occurs due to the differing distributions of occupations in each industry or other industry characteristics. For completeness, Table 5.3 provides the regression results using specific industries rather than broad industry type. While the coefficient varies across industries, there is no discernible pattern with

respect to any measure of worker observability. Table 5.4 compares some potentially significant characteristics from industries with the highest and lowest coefficients.

A possible explanation for the variation in returns to experience across industries could be differences in industry concentration. An industry dominated by few very large firms might exhibit much higher wage differences across firm size than a more balanced industry. Large firms benefiting from economies of scale might be able to offer higher wages to labor market entrants to ensure a higher quality pool of applicants. This could be misconstrued as an inability to quickly learn worker ability due to lower worker observability while it is actually indicative of a highly concentrated industry. Certain measures of industry concentration are given in Table 5.2. All three of the measures given below are positively correlated with the coefficient estimates given in Table 5.3 (Correlations are 0.46, 0.46, and 0.53). There is clearly a positive relationship between the industry-experience coefficient and industry concentration. The variation in returns to experience across industries might also be explained by worker sorting; where certain industries are able to pay higher wages and attract a more highly skilled pool of applicants [Bartel and Sicherman, 1997].

Table 5.2: Industry Concentration Measures

Industry	% Firms w/ 500+ Employees	% Employed in Firms w/ 500+ Employees	% of Total Pay- roll for Firms w/ 500+ Employees
Construction	0.14%	15.90%	21.07%
Food	4.21%	74.77%	74.07%
Beverage and Tobacco	1.97%	62.09%	69.40%
Textiles, Apparel	0.72%	22.77%	24.17%
Wood	1.93%	27.47%	31.02%
Paper and Printing	0.91%	36.31%	41.44%
Petroleum and Coal	15.69%	91.16%	93.49%
Chemical	8.63%	71.85%	78.48%
Plastic and Rubber	5.17%	50.82%	53.04%
Nonmetallic Minerals	2.92%	50.38%	53.98%
Primary and Fabricated Metals	2.20%	35.18%	39.34%
Machinery	4.60%	51.18%	54.36%
Computer and Electronics	5.49%	65.30%	72.20%
Electrical Equipment, Appli- cances and Components	6.32%	59.80%	61.69%
Transportation Equip	6.68%	74.38%	81.41%
Wholesale Trade	2.48%	45.46%	52.46%
Retail Trade	0.50%	70.38%	66.80%
Transportation and Warehous- ing	1.01%	55.65%	60.01%
Utilities	10.12%	91.20%	95.16%
Publishing	2.51%	65.54%	72.61%
Telecommunications	2.65%	90.34%	91.51%
Finance and Insurance	0.84%	69.94%	73.80%
Real Estate	0.33%	23.32%	29.14%
Professional, Scientific and Technical	0.49%	38.87%	45.36%
Management	26.52%	87.31%	90.55%
Administrative and Support, Waste Management and Remedi- ation Services	0.95%	63.69%	66.82%
Educational Services	2.32%	44.37%	48.48%
Health Care and Social Assis- tance	2.95%	77.85%	81.09%
Arts, Entertainment and Recre- ation	0.93%	38.88%	36.59%
Accommodation	1.21%	60.42%	69.78%
Food Services and Drinking Places	0.45%	38.76%	39.73%
Repair and Maintenance	0.25%	10.54%	12.58%
Personal and Laundry	6.09%	15.96%	28.52%
Religious, Grantmaking, Civic and Professional	0.18%	9.12%	13.32%
Average	3.83%	52.56%	56.57%

Table 5.3: Regression Results: Industry-Experience Interactions

Industry	Coefficient	CI 95
Construction	0.0101***	0.0094, 0.0108
Nonmetallic mineral products	0.0105***	0.0086, 0.0125
Primary metals and fabricated metal products	0.0114***	0.0103, 0.0125
Machinery	0.0111***	0.0099, 0.0124
Computers and electronic products	0.0109***	0.0096, 0.0121
Electrical equipment and appliances	0.0091***	0.0069, 0.0113
Transportation equipment	0.0128***	0.0117, 0.0138
Wood products	0.0091***	0.0071, 0.0110
Miscellaneous Mfg	0.0087***	0.0074, 0.0101
Food	0.0077***	0.0066, 0.0087
Beverage and tobacco products	0.0096***	0.0067, 0.0126
Textiles, apparel, and leather	0.0046***	0.0027, 0.0065
Paper Mfg and Printing	0.0108***	0.0095, 0.0122
Petroleum and coal	0.0186***	0.0152, 0.0219
Chemicals	0.0142***	0.0129, 0.0155
Plastics and rubber products	0.0106***	0.0086, 0.0126
Wholesale trade	0.0119***	0.0111, 0.0127
Retail trade	0.0029***	0.0024, 0.0034
Transportation and warehousing	0.0107***	0.0101, 0.0114
Utilities	0.0147***	0.0135, 0.0159
Publishing	0.0086***	0.0068, 0.0104
Motion picture and sound recording industries	0.0116***	0.0084, 0.0147
Telecommunications	0.0138***	0.0123, 0.0152
Other information services	0.0013	-0.0012, 0.0039
Finance	0.0125***	0.0117, 0.0133
Insurance	0.0122***	0.0112, 0.0131
Real Estate	0.0077***	0.0067, 0.0088
Rental and leasing services	0.0091***	0.0066, 0.0116
Professional and Technical Services	0.0120***	0.0113, 0.0126
Management of companies and enterprises	0.0111***	0.0057, 0.0165
Administrative and support services	0.0056***	0.0048, 0.0064
Waste management and remediation	0.0115***	0.0094, 0.0136
Educational services	0.0044***	0.0038, 0.0049
Health services	0.0066***	0.0060, 0.0072
Hospitals	0.0082***	0.0075, 0.0089
Social assistance	0.0011*	0.0001, 0.0021
Arts, entertainment, and recreation	0.0061***	0.0050, 0.0072
Accommodation	0.0056***	0.0044, 0.0068
Food services and drinking places	-0.0001	-0.0010, 0.0007
Repair and maintenance	0.0064***	0.0052, 0.0077
Personal and laundry services	0.0047***	0.0033, 0.0060
Membership associations and organizations	0.0034***	0.0024, 0.0045
Private Households	0.0052***	0.0035, 0.0070
Public Administration	0.0102***	0.0096, 0.0108

*** 95% Confidence

* 90% Confidence

Table 5.4: Industry Comparison

Industry	Coeff.	Avg. Wage	10th-90th %/Median	C/L Ratio	Hourly Labor Output	Hourly Labor Cost
High Coefficient						
Transportation equipment	0.0128	\$29.34	1.02	0.36	\$146.27	\$32.73
Chemicals	0.0142	\$32.53	1.63	2.43	\$279.90	\$35.79
Telecommunications	0.0138	\$28.78	1.34	—	\$190.66	\$46.09
Petroleum and Coal	0.0186	\$32.98	1.24	4.60	\$1,785.47	\$44.54
Low Coefficient						
Retail Trade	0.0029	\$17.21	1.05	—	\$145.80	\$19.44
Educational Services	0.0044	\$21.81	1.48	—	—	—
Administrative and Support Services	0.0056	\$19.03	1.19	—	\$34.98	\$17.39
Personal and Laundry Services	0.0047	\$15.99	0.53	—	\$33.11	\$17.15

5.4 Worker-Manager Ratio

The final measure of worker observability is worker-manager ratio (WMR). WMR is calculated at the industry level using the occupation classifications reported for each individual in the CPS data. If firm size is an important aspect of how a worker's wages grow with experience, then the worker's observability by management should also play some role. As such, one would expect a negative relationship between worker observability and worker-manager ratio. If a manager has fewer workers to supervise and evaluate, they should be able to more easily observe each of those workers' productivity. Using worker-manager ratio as a measure of such observability, Figure 5.10 provides the results from a regression on experience interacted with an indicator variable for industries with a worker-manager ratio greater than ten (High WMR) and an indicator variable for industries with a worker-manager ratio below five (Low WMR).

The regression results provide no evidence of any statistically significant difference in the ease of employer learning between firms with high or low worker-manager ratios. A clearer picture can be gleaned from the result of a regression on experience interacted with worker-manager ratio which yields a statistically significant coefficient estimate of 0.0003359. This result suggests that learning the true ability of a worker becomes more difficult as the worker-manager ratio increases. That is, as worker observability decreases, employers are unable to quickly identify and compensate for their workers' true productivity. To ensure that this result is truly capturing the effect of WMR, an additional estimation is conducted using manager-worker ratio (MWR) as the measure of worker observability. If the results from the first estimation are capturing the effect of WMR then the estimated γ using the interaction of MWR and experience should be negative. That is, returns to experience decreases as worker observability increases. The results using both WMR

Table 5.5: Regression Results: Manager-Worker Ratio

	Coefficient	t-ratio	95% CI
Manager-Worker Ratio	0.2665	19.68	0.2399, 0.2930
Worker-Manager Ratio	0.000336	7.16	0.000244, 0.000428

and MWR are given in table 5.5. The positive and statistically significant coefficient on the MWR-experience interaction indicates that there is actually no relationship between returns to experience and worker-manager ratio, as measured here.

The most likely explanation for the lack of any statistical relationship is the depth at which we are able to measure WMR. While firm size is measured at the individual level, WMR is measured at the industry level. There is certainly going to be an immense amount of variation in WMR within any given industry that is not being captured here. It is likely that firm level measures of WMR would provide more veracious results. A complete breakdown of worker-manager ratio by industry is available in Table 5.6.

Figure 5.10: Estimated Coefficients: Experience-Worker-Manager Ratio Interactions

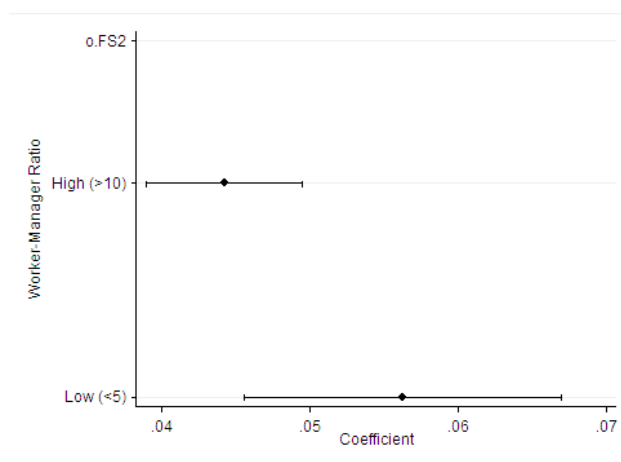


Table 5.6: Worker-Manager Ratio by Industry

Industry	Worker-Manager Ratio
Construction	5.21
Nonmetallic mineral products	7.37
Primary metals and fabricated metal products	6.68
Machinery	6.63
Computers and electronic products	4.25
Electrical equipment and appliances	5.58
Transportation equipment	6.68
Wood products	9.00
Miscellaneous Mfg	5.19
Food	12.47
Beverage and tobacco products	3.64
Textiles, apparel, and leather	7.64
Paper Mfg and Printing	8.44
Petroleum and coal	5.50
Chemicals	4.45
Plastics and rubber products	8.28
Wholesale trade	9.58
Retail trade	27.51
Transportation and warehousing	11.67
Utilities	7.38
Publishing	4.52
Motion picture and sound recording industries	4.07
Telecommunications	6.28
Other information services	12.53
Finance	3.07
Insurance	7.63
Real Estate	2.95
Rental and leasing services	10.77
Professional and Technical Services	5.74
Management of companies and enterprises	3.90
Administrative and support services	8.90
Waste management and remediation	6.33
Educational services	12.33
Health services	14.74
Hospitals	16.89
Social assistance	8.86
Arts, entertainment, and recreation	11.13
Accommodation	4.56
Food services and drinking places	6.41
Repair and maintenance	17.70
Personal and laundry services	19.25
Membership associations and organizations	4.29

Chapter 6

Conclusions

Using cross-sectional data in a study in which time and experience are so important creates some limitations to the robustness of the results. Being unable to track historical changes in wage, occupation or industry limits the ability to track the importance of job changes, layoffs, promotions and the like. Even in models of asymmetric employer learning it has been shown that job changes and layoffs disseminate important information to all employers in the market [Gibbons and Katz, 1991]. Additionally, evidence suggests most workers are assigned to different tasks throughout their careers and performance on past tasks does not always relate to performance on future tasks [Kahn and Lange, 2010]. This would suggest that much of what an employer learns about a worker in a specific task is lost when the worker moves on to another task.

Given that the data set fails to provide a measure of tenure for each worker, we are unable to determine how many years each individual has been employed by his or her current employer. Under the assumption of symmetric learning, the issue of tenure makes no difference. In a model of asymmetric learning, tenure could potentially play an important role. However, the significance is unclear. There is conflicting evidence regarding the relationship between experience, tenure and

wages. [Williams, 1991] found that tenure increases wages only after the first several years and that the accumulated effect of experience has a more substantial effect over a worker's career. Similarly, [Altonji and Shakotko, 1987] argue that returns to tenure only exist during the first year and additional years provide no returns. [Abraham and Farber, 1987] conclude that there is very little or no return to additional tenure. [Topel, 1991] provides completely different findings, suggesting that additional years of tenure yield significant wage increases.

As is standard practice in the literature, learning is assumed to be symmetric in this model. Although the literature is in support of this assumption [Schönberg, 2007] [Pinkston, 2009], additional industry level data on turnover and quit rates has been included to account for the possibility that learning is different while a worker accumulates general experience versus tenure. A summary of industry turnover is provide in table 6.1.

Table 6.1: Industry Turnover Statistics

Industry	Hire Rate	Quit Rate	Separation Rate
Construction	5.3	1.3	7.4
Manufacturing	1.5	0.9	3.9
Retail trade	3.7	2.3	4.3
Professional and Business Services	4.3	2.1	5.1
Health and Social Assistance	2.9	1.4	2.7
Arts, entertainment, and recreation	5.9	1.4	5.9
Accommodation & Food services	5.1	3.5	5.4

This paper provides a thorough analysis of the relationship between worker observability and wage growth. Using firm size, occupation, industry, and worker-manager ratio as correlates of worker observability, estimation results provide evidence for the existence of a positive relationship between worker observability and wage growth. It is shown that there is a significant relationship between firm size and returns to experience. More specifically, returns to experience increase with firm size. This relationship can be explained both by the learning by doing model, where worker productivity increases with experience, and the employer learning model, where employers are

only able to observe the actual productivity of a worker as they gain experience.

The results also indicate a great deal of variation in returns to experience across occupations. This variation can be explained by the varying levels of observability of the tasks associated with each occupation. As noted in [Mansour, 2012], there is strong evidence suggesting that this variation can largely be explained by employer learning. No discernible relationship was found between industry type and returns to experience. It is likely that any inter-industry variation is due to worker sorting. Additionally, using WMR as a measure of worker observability did not yield any conclusive results. This is most likely explained by the fact that WMR was measured at the industry level. A measure of WMR at the firm level would have been more useful but this level of detail was not included in the data set.

Chapter 7

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Appendix A

Industry Descriptions

A.1 Construction

NAICS Description: The Construction sector comprises establishments primarily engaged in the construction of buildings and other structures, heavy construction (except buildings), additions, alterations, reconstruction, installation, and maintenance and repairs. Establishments engaged in demolition or wrecking of buildings and other structures, clearing of building sites, and sale of materials from demolished structures are also included. The industries within this sector have been defined on the basis of their unique production processes. As with all industries, the production processes are distinguished by their use of specialized human resources and specialized physical capital.

This industry can be further divided into three sub-industries: (1) building construction and land subdivision and land development; (2) heavy construction (except buildings); and (3) construction activity by special trade contractors. For this study, I chose to use the more broad industry definition rather than include each sub-industry. The occupations and capital-labor ratios are

relatively similar across sub-industries.

Industry Details: The unemployment rate within the construction industry is a staggering 19.0%. Despite this rate, employment in the construction industry is projected to increase by 33% between 2010 and 2020. Union membership is fairly prominent within the industry. 14.5% of workers in the construction industry reported as being union members while 15% were represented by unions. The median weekly earnings of union represented and non union workers differ dramatically. Nonunion workers earn only 66% of their union represented counterparts. The wage differences between union members and union represented workers is minimal. Workplace safety is a major issue with 879 work-related fatalities in 2009.

Table A.1: Employment by Occupation: Construction

Occupation	Employment	Median Hourly Wage
Carpenters	476,300	\$19.24
Construction laborers	611,330	\$14.44
Construction Managers	156,260	\$40.12
Electricians	377,460	\$22.99
Operating engineers and other construction equipment operators	199,180	\$20.82

Table A.2: Summary statistics: Construction Industry

Variable	Mean
Age	39.699
Hourly Wage	\$22.813
Years of Education	13.387
Total Firms	700,831
Firms: < 20 Employees	647,353
Firms: 20-99 Employees	46,761
Firms: 100-499 Employees	5,723
Firms: 500+ Employees	994
Total Employment	5,967,128
Employment for Firms w/ < 20 Employees	2,297,191
Employment for Firms w/ 20-99 Employees	176,937
Employment for Firms w/ 100-499 Employees	959,143
Employment for Firms w/ 500+ Employees	948,857
Total Payroll	\$280,943,232
Payroll for Firms w/ < 20 Employees	\$85,687,448
Payroll for Firms w/ 20-99 Employees	\$84,572,008
Payroll for Firms w/ 100-499 Employees	\$51,476,312
Payroll for Firms w/ 500+ Employees	\$59,207,480
Wage Dispersion: 10th-90th Percentiles / Median	1.415
Wage Dispersion: 25th-75th Percentiles / Median	0.709
N	5102

A.2 Manufacturing

The Manufacturing sector comprises establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products. The assembling of component parts of manufactured products is considered manufacturing. The manufacturing industry can be broken down into many sub-industries. In the empirical part of this paper, the manufacturing industry is divided into the following fifteen sub-industries:

1. Food Manufacturing

NAICS Description: Industries in the Food Manufacturing sub-industry transform livestock and agricultural products into products for intermediate or final consumption. The industry groups are distinguished by the raw materials (generally of animal or vegetable origin) processed into food products.

The food products manufactured in these establishments are typically sold to wholesalers or retailers for distribution to consumers, but establishments primarily engaged in retailing bakery and candy products made on the premises not for immediate consumption are included.

Industry Details: The unemployment rate in the food manufacturing industry is 8.5%. Employment is projected to increase by a moderate 1.6% between 2010 and 2020. There is virtually no union presence in the food manufacturing industry. The majority of the occupations are low wage blue-collar jobs. Workplace safety is a concern with 48 work-related fatalities and a rate of 5.7 injuries per 100 full-time workers.

Table A.3: Employment by Occupation: Food Manufacturing:

Occupation	Employment	Median Hourly Wage
Bakers	49,460	\$11.59
First-line supervisors/managers of production and operating workers	45,190	\$23.22
Food batchmakers	83,300	\$12.51
Packaging and filling machine operators and tenders	115,420	\$12.95
Slaughterers and meat packers	77,310	\$11.33

Table A.4: Summary statistics: Food Manufacturing

Variable	Mean
Age	41.154
Hourly Wage	\$18.503
Years of Education	12.809
Total Firms	2,710.458
Firms: < 20 Employees	1,865.501
Firms: 20-99 Employees	482.398
Firms: 100-499 Employees	185.152
Firms: 500+ Employees	114.512
Total Employment	261,950.498
Employment for Firms w/ < 20 Employees	104,90.806
Employment for Firms w/ 20-99 Employees	19,757.94
Employment for Firms w/ 100-499 Employees	32,611.936
Employment for Firms w/ 500+ Employees	195,861.01
Total Payroll	\$8,966,910.174
Payroll for Firms w/ < 20 Employees	\$264,589.144
Payroll for Firms w/ 20-99 Employees	\$653,492.424
Payroll for Firms w/ 100-499 Employees	\$1,207,937.616
Payroll for Firms w/ 500+ Employees	\$6,641,708.095
Wage Dispersion: 10th-90th Percentiles / Median	1.013
Wage Dispersion: 25th-75th Percentiles / Median	0.464
Capital-Labor Ratio	1.878
Percentage of Total Production Costs from Labor	0.122
Percentage of Total Production Costs from Capital	0.229
Hourly Labor Output	\$165.7
Production Per Dollar of Labor	\$7.770
Output Per Worker	\$347,351.813
Hourly Labor Cost	\$21.32
N	1085

2. Beverage and Tobacco Manufacturing

NAICS Description: Industries in the Beverage and Tobacco Product Manufacturing subsector manufacture beverages and tobacco products. The industry group, Beverage Manufacturing, includes three types of establishments: (1) those that manufacture nonalcoholic beverages; (2) those that manufacture alcoholic beverages through the fermentation process; and (3) those that produce distilled alcoholic beverages. Ice manufacturing, while not a beverage, is included with nonalcoholic beverage manufacturing because it uses the same production process as water purification. The industry group, Tobacco Manufacturing, includes two types of establishments: (1) those engaged in redrying and stemming tobacco and (2) those that manufacture tobacco products.

Industry Details: The unemployment rate in the Beverage and Tobacco Product Manufacturing subsector is 9.8% with 78 mass layoff events reported during the year. Union presence is negligible in the industry. Employment in the industry is projected to decline by 1.0% between 2010 and 2020. While both beverage and tobacco manufacturing are projected to decrease, the projected 9.7% decline in employment in tobacco manufacturing account for the majority of the projected decline for the industry as a whole. Primary occupations include a mix of both blue-collar and white-collar jobs which exhibit a wide range in earnings. There were 13 reported work-related fatalities and a rate of 6.4 injuries or illnesses per 100 full-time workers in 2009.

Table A.5: Employment by Occupation: Beverage and Tobacco Manufacturing

Occupation	Employment	Median Hourly Wage
Driver/sales workers	7,9400	\$15.33
Industrial production managers	1,460	\$43.80
Laborers and freight, stock, and material movers, hand	10,920	\$12.48
Packaging and filling machine operators and tenders	21,200	\$15.84
Sales representatives, wholesale and manufacturing, except technical and scientific products	9,240	\$23.25
Separating, filtering, clarifying, precipitating, and still machine setters, operators, and tenders	9,450	\$18.88

Table A.6: Summary statistics: Beverage and Tobacco Manufacturing

Variable	Mean
Age	41.4
Hourly Wage	\$25.805
Years of Education	15.019
Total Firms	3,149.987
Firms: < 20 Employees	2,541.123
Firms: 20-99 Employees	439.839
Firms: 100-499 Employees	106.994
Firms: 500+ Employees	62.032
Total Employment	116,265.974
Employment for Firms w/ < 20 Employees	12,154.897
Employment for Firms w/ 20-99 Employees	16,751.316
Employment for Firms w/ 100-499 Employees	15,168.91
Employment for Firms w/ 500+ Employees	72,190.852
Total Payroll	\$5,623,104.484
Payroll for Firms w/ < 20 Employees	\$392,398.374
Payroll for Firms w/ 20-99 Employees	\$624,215.374
Payroll for Firms w/ 100-499 Employees	\$703,962.361
Payroll for Firms w/ 500+ Employees	\$3,902,528.374
Wage Dispersion: 10th-90th Percentiles / Median	1.32
Wage Dispersion: 25th-75th Percentiles / Median	0.653
Capital-Labor Ratio	6.022
Percentage of Total Production Costs from Labor	0.08
Percentage of Total Production Costs from Capital	0.485
Hourly Labor Output	\$327.11
Production Per Dollar of Labor	\$12.43
Output Per Worker	\$611,462.75
Hourly Labor Cost	\$26.32
N	155

3. Textiles, Apparel and Leathers

NAICS Description: Industries in the Textile Mills subsector group establishments that transform a basic fiber (natural or synthetic) into a product, such as yarn or fabric, that is further manufactured into usable items, such as apparel, sheets towels, and textile bags for individual or industrial consumption. The further manufacturing may be performed in the same establishment and classified in this subsector, or it may be performed at a separate establishment and be classified elsewhere in manufacturing.

Industries in the Apparel Manufacturing subsector group establishments with two distinct manufacturing processes: (1) cut and sew (i.e., purchasing fabric and cutting and sewing to make a garment) and (2) the manufacture of garments in establishments that first knit fabric and then cut and sew the fabric into a garment. The Apparel Manufacturing subsector includes a diverse range of establishments manufacturing full lines of ready-to-wear apparel and custom apparel: apparel contractors, performing cutting or sewing operations on materials owned by others; jobbers performing entrepreneurial functions involved in apparel manufacture; and tailors, manufacturing custom garments for individual clients are all included. Knitting, when done alone, is classified in the Textile Mills subsector, but when knitting is combined with the production of complete garments, the activity is classified in Apparel Manufacturing.

Establishments in the Leather Manufacturing subsector transform hides into leather by tanning or curing and fabricating the leather into products for final consumption. It also includes the manufacture of similar products from other materials, including products (except apparel) made from leather substitutes, such as rubber, plastics, or textiles. Rubber footwear,

textile luggage, and plastics purses or wallets are examples of leather substitute products included in this group. The products made from leather substitutes are included in this subsector because they are made in similar ways leather products are made (e.g., luggage). They are made in the same establishments, so it is not practical to separate them.

Industry Details: There is no unemployment data for this industry but there were 424 mass layoff events reported in 2009. The vast majority of these events came from the Textiles and Apparel Manufacturing subsectors. There is no union presence reported in this industry. Employment is projected to dramatically decline between 2010 and 2020. Specifically, a decline of 9.7% is projected for the Textiles subsector, a 58.1% decline is projected for the Apparel Manufacturing subsector, and a 54.3% decline is projected for the Leather Manufacturing subsector. Workplace safety is a minor issue with no work-related fatalities reported and an injury and illness rate of 2.9 per 100 full-time workers. The majority of the industry's workforce are blue-collar laborers with relatively low hourly wages. The industry is labor intensive with over 24% of costs going to labor and only 17.9% going to capital.

Table A.7: Employment by Occupation: Textiles, Apparel and Leathers

Occupation	Employment	Median Hourly Wage
First-line supervisors/managers of production and operating workers	11,660	\$20.98
Sewing machine operators	68,350	\$9.32
Inspectors, testers, sorters, samplers, and weighers	10,910	\$12.75
Textile bleaching and dyeing machine operators and tenders	9,16	\$11.02
Textile knitting and weaving machine setters, operators, and tenders	15,160	\$12.86
Textile winding, twisting, and drawing out machine setters, operators, and tenders	18,710	\$12.52

Table A.8: Summary statistics: Textiles, Apparel and Leather

Variable	Mean
Age	42.38
Hourly Wage	\$17.075
Years of Education	12.916
Total Firms	3,075.877
Firms: < 20 Employees	2,586.153
Firms: 20-99 Employees	387.269
Firms: 100-499 Employees	80.224
Firms: 500+ Employees	22.231
Total Employment	52,566.104
Employment for Firms w/ < 20 Employees	12,154.429
Employment for Firms w/ 20-99 Employees	14,941.273
Employment for Firms w/ 100-499 Employees	13,443.948
Employment for Firms w/ 500+ Employees	11,969.981
Total Payroll	\$1,280,831.334
Payroll for Firms w/ < 20 Employees	\$250,986.425
Payroll for Firms w/ 20-99 Employees	\$352,381.89
Payroll for Firms w/ 100-499 Employees	\$366,231.727
Payroll for Firms w/ 500+ Employees	\$309,528.636
Wage Dispersion: 10th-90th Percentiles / Median	1.481
Wage Dispersion: 25th-75th Percentiles / Median	0.592
Capital-Labor Ratio	0.729
Percentage of Total Production Costs from Labor	0.246
Percentage of Total Production Costs from Capital	0.179
Hourly Labor Output	\$58.29
Production Per Dollar of Labor	\$3.88
Output Per Worker	\$111,242.344
Hourly Labor Cost	\$15.01
N	308

4. Wood Products Manufacturing

NAICS Description: Industries in the Wood Product Manufacturing subsector manufacture wood products, such as lumber, plywood, veneers, wood containers, wood flooring, wood trusses, manufactured homes (i.e., mobile home), and prefabricated wood buildings. The production processes of the Wood Product Manufacturing subsector include sawing, planing, shaping, laminating, and assembling of wood products starting from logs that are cut into bolts, or lumber that then may be further cut, or shaped by lathes or other shaping tools.

Industry Details: The unemployment rate in the Wood Products Manufacturing industry is 14.7% with 553 mass layoff events reported. Employment in the industry is projected to increase by 24.2% between 2010 and 2020. Primary occupations comprise mostly of low wage skilled and unskilled craftsmen and machine operators. Workplace safety is a major issue in the industry with 21 work related fatalities and an injury and illness rate of 6.5 per 100 full-time workers reported in 2009. A capital-labor ratio of 0.101 is one of the lowest among manufacturing industries. Wood Products Manufacturing is labor intensive with only 2.8% of costs being capital expenditures.

Table A.9: Employment by Occupation: Wood Products Manufacturing

Occupation	Employment	Median Hourly Wage
Cabinetmakers and bench carpenters	10,060	\$13.73
Carpenters	9,070	\$14.73
First-line supervisors/managers of production and operating workers	13,070	\$22.14
Machine feeders and offbearers	10,870	\$12.04
Sawing machine setters, operators, and tenders, wood	27,140	\$12.53
Team assemblers	29,500	\$12.50
Woodworking machine setters, operators, and tenders, except sawing	35,960	\$12.71

Table A.10: Summary statistics: Wood Products Manufacturing

Variable	Mean
Age	40.686
Hourly Wage	\$19.126
Years of Education	13.052
Total Firms	1,973.173
Firms: < 20 Employees	1,483.088
Firms: 20-99 Employees	360.16
Firms: 100-499 Employees	91.748
Firms: 500+ Employees	38.176
Total Employment	46,413.84
Employment for Firms w/ < 20 Employees	8,408.764
Employment for Firms w/ 20-99 Employees	13,694.69
Employment for Firms w/ 100-499 Employees	11,561.337
Employment for Firms w/ 500+ Employees	12,749.049
Total Payroll	\$1,509,705.908
Payroll for Firms w/ < 20 Employees	\$224,951.683
Payroll for Firms w/ 20-99 Employees	\$423,464.441
Payroll for Firms w/ 100-499 Employees	\$392,987.765
Payroll for Firms w/ 500+ Employees	\$468,302.02
Capital-Labor Ratio	0.101
Percentage of Total Production Costs from Labor	0.277
Percentage of Total Production Costs from Capital	0.028
Hourly Labor Output	\$68.960
Production Per Dollar of Labor	\$3.38
Output Per Worker	\$133,999.563
Hourly Labor Cost	\$20.38
N	306

5. Paper Manufacturing and Printing Support Activities

NAICS Description: Industries in the Paper Manufacturing sub-industry make pulp, paper, or converted paper products. The manufacturing of these products is grouped together because they constitute a series of vertically connected processes. More than one is often carried out in a single establishment. There are essentially three activities. The manufacturing of pulp involves separating the cellulose fibers from other impurities in wood or used paper. The manufacturing of paper involves matting these fibers into a sheet. Converted paper products are made from paper and other materials by various cutting and shaping techniques and includes coating and laminating activities.

Industries in the Printing and Related Support Activities sub-industry print products, such as newspapers, books, periodicals, business forms, greeting cards, and other materials, and perform support activities, such as bookbinding, platemaking services, and data imaging. The support activities included here are an integral part of the printing industry, and a product (a printing plate, a bound book, or a computer disk or file) that is an integral part of the printing industry is almost always provided by these operations.

Processes used in printing include a variety of methods used to transfer an image from a plate, screen, or computer file to some medium, such as paper, plastics, metal, textile articles, or wood. The most prominent of these methods is to transfer the image from a plate or screen to the medium (lithographic, gravure, screen, and flexographic printing). A rapidly growing new technology uses a computer file to directly "drive" the printing mechanism to create the image and new electrostatic and other types of equipment (digital or nonimpact printing).

Industry Details: The paper manufacturing and printing support activities industries had

241 and 235 mass layoff events in 2009, respectively. Employment is projected to decrease by 7.7% in the paper manufacturing industry and 6.6% in the printing support activities industry between 2010 and 2020. There were a reported 22 work-related fatalities in 2009 with a reported rate of injury and illness of 2.95 per 100 full-time workers.

Table A.11: Employment by Occupation: Paper Manufacturing and Printing Support Activities

Occupation	Employment	Median Hourly Wage
Cutting and slicing machine setters, operators, and tenders	14,620	\$16.78
First-line supervisors/managers of production and operating workers	34,000	\$27.12
Industrial production managers	4,800	\$42.39
Industrial truck and tractor operators	14,420	\$16.21
Paper goods machine setters, operators, and tenders	78,400	\$16.86

Table A.12: Summary statistics: Paper Manufacturing and Printing Support Activities

Variable	Mean
Age	43.458
Hourly Wage	\$22.144
Years of Education	14.128
Total Firms	17,531.395
Firms: < 20 Employees	14,581.636
Firms: 20-99 Employees	2,305.254
Firms: 100-499 Employees	484.239
Firms: 500+ Employees	160.265
Total Employment	376,464.209
Employment for Firms w/ < 20 Employees	72,256.673
Employment for Firms w/ 20-99 Employees	92,512.563
Employment for Firms w/ 100-499 Employees	74,998.395
Employment for Firms w/ 500+ Employees	136,696.578
Total Payroll	\$15,347,695.16
Payroll for Firms w/ < 20 Employees	\$2,258,940.985
Payroll for Firms w/ 20-99 Employees	\$3,577,658.463
Payroll for Firms w/ 100-499 Employees	\$3,150,678.605
Payroll for Firms w/ 500+ Employees	\$6,360,417.107
Wage Dispersion: 10th-90th Percentiles / Median	1.019
Wage Dispersion: 25th-75th Percentiles / Median	0.487
Capital-Labor Ratio	0.862
Percentage of Total Production Costs from Labor	0.221
Percentage of Total Production Costs from Capital	0.19
Hourly Labor Output	\$105.73
Production Per Dollar of Labor	\$4.03
Output Per Worker	\$218,472.344
Hourly Labor Cost	\$26.23
N	618

6. Petroleum and Coal Products Manufacturing

NAICS Description: The Petroleum and Coal Products Manufacturing sub-industry is based on the transformation of crude petroleum and coal into usable products. The dominant process is petroleum refining that involves the separation of crude petroleum into component products through such techniques as cracking and distillation.

Industry Details: The average unemployment rate in the Petroleum and Coal Products Manufacturing industry in 2009 was 7.7%, significantly lower than the nation's average unemployment rate of 9.3%. As alternative energy sources become more viable, employment in the Petroleum and Coal Products Manufacturing industry is projected to decline by 12.3% between 2010 and 2020. There were 8 work-related fatalities reported in 2009 with a rate of 1.5 injury and illness cases per 100 full-time workers.

Table A.13: Employment by Occupation: Petroleum and Coal Products Manufacturing

Occupation	Employment	Median Hourly Wage
First-line supervisors/managers of production and operating workers	4,990	\$35.39
Mixing and blending machine setters, operators, and tenders	3,680	\$17.28
Petroleum pump system operators, refinery operators, and gaugers	19,890	\$31.04
Truck drivers, heavy and tractor-trailer	2,670	\$18.00

Table A.14: Summary statistics: Petroleum and Coal Products Manufacturing

Variable	Mean
Age	40.83
Hourly Wage	\$32.98
Years of Education	14.87
Total Firms	274.59
Firms: < 20 Employees	167.07
Firms: 20-99 Employees	35.38
Firms: 100-499 Employees	29.03
Firms: 500+ Employees	43.10
Total Employment	61,113.72
Employment for Firms w/ < 20 Employees	739.31
Employment for Firms w/ 20-99 Employees	1,298.90
Employment for Firms w/ 100-499 Employees	3,366.69
Employment for Firms w/ 500+ Employees	55,708.83
Total Payroll	\$5,741,503.03
Payroll for Firms w/ < 20 Employees	\$44,495.66
Payroll for Firms w/ 20-99 Employees	\$79,262.72
Payroll for Firms w/ 100-499 Employees	\$250,267.86
Payroll for Firms w/ 500+ Employees	\$5,367,476.79
Wage Dispersion: 10th-90th Percentiles / Median	1.24
Wage Dispersion: 25th-75th Percentiles / Median	0.59
Capital-Labor Ratio	4.60
Percentage of Total Production Costs from Labor	0.03
Percentage of Total Production Costs from Capital	0.12
Hourly Labor Output	\$1,785.47
Production Per Dollar of Labor	\$40.09
Output Per Worker	\$3,929,423.50
Hourly Labor Cost	\$44.54
N	116

7. Chemical Manufacturing

NAICS Description: The Chemical Manufacturing sub-industry is based on the transformation of organic and inorganic raw materials by a chemical process and the formulation of products. It distinguishes the production of basic chemicals that comprise the first industry group from the production of intermediate and end products produced by further processing of basic chemicals that make up the remaining industry groups.

Industry Details: The average unemployment rate in the Chemical manufacturing industry was 8.6% in 2009 with 193 mass layoff events reported. Employment is projected to decline by 7.1% between 2010 to 2020. There were 18 work-related fatalities reported in 2009 with a rate of 2.3 injury and illness cases per 100 full-time workers.

Table A.15: Employment by Occupation: Chemical Manufacturing

Occupation	Employment	Median Hourly Wage
Chemical equipment operators and tenders	38,350	\$22.03
Chemical technicians	18,700	\$21.99
Chemists	24,530	\$33.21
Mixing and blending machine setters, operators, and tenders	54,220	\$16.66
Packaging and filling machine operators and tenders	46,600	\$13.51

Table A.16: Summary statistics: Chemical Manufacturing

Variable	Mean
Age	43.26
Hourly Wage	\$32.53
Years of Education	15.40
Total Firms	1,611.60
Firms: < 20 Employees	990.73
Firms: 20-99 Employees	329.45
Firms: 100-499 Employees	152.33
Firms: 500+ Employees	139.09
Total Employment	144,862.84
Employment for Firms w/ < 20 Employees	5,564.42
Employment for Firms w/ 20-99 Employees	13,549.61
Employment for Firms w/ 100-499 Employees	21,661.47
Employment for Firms w/ 500+ Employees	104,087.33
Total Payroll	\$10,066,331.42
Payroll for Firms w/ < 20 Employees	\$272,352.41
Payroll for Firms w/ 20-99 Employees	\$681,690.05
Payroll for Firms w/ 100-499 Employees	\$1,211,810.00
Payroll for Firms w/ 500+ Employees	\$7,900,478.96
Wage Dispersion: 10th-90th Percentiles / Median	1.63
Wage Dispersion: 25th-75th Percentiles / Median	0.78
Capital-Labor Ratio	2.43
Percentage of Total Production Costs from Labor	0.12
Percentage of Total Production Costs from Capital	0.29
Hourly Labor Output	\$279.90
Production Per Dollar of Labor	\$7.82
Output Per Worker	\$609,673.44
Hourly Labor Cost	\$35.79
N	753

8. **Plastics and Rubber Manufacturing**

NAICS Description: Industries in the Plastics and Rubber Products Manufacturing industry make goods by processing plastics materials and raw rubber. The core technology employed by establishments in this industry is that of plastics or rubber product production. Plastics and rubber are combined in the same sub-industry because plastics are increasingly being used as a substitute for rubber; however the sub-industry is generally restricted to the production of products made of just one material, either solely plastics or rubber.

Many manufacturing activities use plastics or rubber, for example the manufacture of footwear, or furniture. Typically, the production process of these products involves more than one material. In these cases, technologies that allow disparate materials to be formed and combined are of central importance in describing the manufacturing activity. In NAICS, such activities (the footwear and furniture manufacturing) are not classified in the Plastics and Rubber Products Manufacturing subsector because the core technologies for these activities are diverse and involve multiple materials.

Industry Details: The average unemployment rate in the Plastics and Rubber Manufacturing industry was 14.1% in 2009 with 559 mass layoff events reported. The future employment outlook is positive with a 14.6% increase projected between 2010 and 2020. There were 19 work-related fatalities reported in 2009 with a rate of 4.8 injury and illness cases per 100 full-time workers.

Table A.17: Employment by Occupation: Plastics and Rubber Manufacturing

Occupation	Employment	Median Hourly Wage
Extruding and drawing machine setters, operators, and tenders, metal and plastic	31,570	\$14.52
First-line supervisors/managers of production and operating workers	28,270	\$23.88
Inspectors, testers, sorters, samplers, and weighers	23,460	\$14.62
Molding, coremaking, and casting machine setters, operators, and tenders, metal and plastic	52,210	\$12.22
Packers and packagers	26,290	\$10.71
Team assemblers	41,850	\$12.61

Table A.18: Summary statistics: Plastics and Rubber Manufacturing

Variable	Mean
Age	42.25
Hourly Wage	\$21.98
Years of Education	13.88
Total Firms	6,668.84
Firms: < 20 Employees	3,851.23
Firms: 20-99 Employees	1,792.84
Firms: 100-499 Employees	678.80
Firms: 500+ Employees	345.97
Total Employment	424,791.52
Employment for Firms w/ < 20 Employees	26,024.63
Employment for Firms w/ 20-99 Employees	77,120.07
Employment for Firms w/ 100-499 Employees	105,773.11
Employment for Firms w/ 500+ Employees	215,873.71
Total Payroll	\$16,734,131.72
Payroll for Firms w/ < 20 Employees	\$967,640.02
Payroll for Firms w/ 20-99 Employees	\$2,840,338.87
Payroll for Firms w/ 100-499 Employees	\$4,050,998.06
Payroll for Firms w/ 500+ Employees	\$8,875,154.78
Wage Dispersion: 10th-90th Percentiles / Median	1.21
Wage Dispersion: 25th-75th Percentiles / Median	0.55
Capital-Labor Ratio	0.73
Percentage of Total Production Costs from Labor	0.24
Percentage of Total Production Costs from Capital	0.17
Hourly Labor Output	\$117.11
Production Per Dollar of Labor	\$4.35
Output Per Worker	\$244,692.31
Hourly Labor Cost	\$26.92
N	293

9. Nonmetallic Mineral Product Manufacturing

NAICS Description: The Nonmetallic Mineral Product Manufacturing subsector transforms mined or quarried nonmetallic minerals, such as sand, gravel, stone, clay, and refractory materials, into products for intermediate or final consumption. Processes used include grinding, mixing, cutting, shaping, and honing. Heat often is used in the process and chemicals are frequently mixed to change the composition, purity, and chemical properties for the intended product. For example, glass is produced by heating silica sand to the melting point (sometimes combined with cullet or recycled glass) and then drawn, floated, or blow molded to the desired shape or thickness. Refractory materials are heated and then formed into bricks or other shapes for use in industrial applications.

The Nonmetallic Mineral Product Manufacturing subsector includes establishments that manufacture products, such as bricks, refractories, ceramic products, and glass and glass products, such as plate glass and containers. Also included are cement and concrete products, lime, gypsum and other nonmetallic mineral products including abrasive products, ceramic plumbing fixtures, statuary, cut stone products, and mineral wool. The products are used in a wide range of activities from construction and heavy and light manufacturing to articles for personal use.

Industry Details: The average unemployment rate in the Nonmetallic Mineral Product Manufacturing industry was 12.0% in 2009 with 400 mass layoff events reported. The future employment outlook is positive with a 16.1% increase projected between 2010 and 2020. There were 27 work-related fatalities reported in 2009 with a rate of 5.2 injury and illness cases per 100 full-time workers.

Table A.19: Employment by Occupation: Nonmetallic Mineral Product Manufacturing

Occupation	Employment	Median Hourly Wage
Extruding, forming, pressing, and compacting machine setters, operators, and tenders	15,050	\$15.43
First-line supervisors/managers of production and operating workers	12,620	\$25.76
Laborers and freight, stock, and material movers	11,120	\$12.83
Molders, shapers, and casters, except metal and plastic	18,810	\$14.05
Truck drivers, heavy and tractor-trailer	54,900	\$16.77

Table A.20: Summary statistics: Nonmetallic Mineral Product Manufacturing

Variable	Mean
Age	41.12
Hourly Wage	\$21.40
Years of Education	13.56
Total Firms	2,946.32
Firms: < 20 Employees	2,072.74
Firms: 20-99 Employees	639.44
Firms: 100-499 Employees	147.46
Firms: 500+ Employees	86.68
Total Employment	112,605.80
Employment for Firms w/ < 20 Employees	12,602.32
Employment for Firms w/ 20-99 Employees	24,003.49
Employment for Firms w/ 100-499 Employees	18,939.12
Employment for Firms w/ 500+ Employees	56,728.19
Total Payroll	\$4,859,728.14
Payroll for Firms w/ < 20 Employees	\$461,674.71
Payroll for Firms w/ 20-99 Employees	\$960,742.70
Payroll for Firms w/ 100-499 Employees	\$799,475.93
Payroll for Firms w/ 500+ Employees	\$2,623,150.64
Wage Dispersion: 10th-90th Percentiles / Median	1.14
Wage Dispersion: 25th-75th Percentiles / Median	0.51
Capital-Labor Ratio	0.78
Percentage of Total Production Costs from Labor	0.24
Percentage of Total Production Costs from Capital	0.19
Hourly Labor Output	\$90.01
Production Per Dollar of Labor	\$3.80
Output Per Worker	\$192,599.59
Hourly Labor Cost	\$23.66
N	323

10. Primary Metals and Fabricated Metal Product Manufacturing

NAICS Description: Industries in the Primary Metal Manufacturing subsector smelt and/or refine ferrous and nonferrous metals from ore, pig or scrap, using electro-metallurgical and other process metallurgical techniques. Establishments in this subsector also manufacture metal alloys and superalloys by introducing other chemical elements to pure metals. The output of smelting and refining, usually in ingot form, is used in rolling, drawing, and extruding operations to make sheet, strip, bar, rod, or wire, and in molten form to make castings and other basic metal products.

Industries in the Fabricated Metal Product Manufacturing subsector transform metal into intermediate or end products, other than machinery, computers and electronics, and metal furniture, or treat metals and metal formed products fabricated elsewhere. Important fabricated metal processes are forging, stamping, bending, forming, and machining, used to shape individual pieces of metal; and other processes, such as welding and assembling, used to join separate parts together. Establishments in this subsector may use one of these processes or a combination of these processes.

Industry Details: The average unemployment rate in the Primary Metals and Fabricated Metal Product Manufacturing industry was 13.2% in 2009 with 686 mass layoff events reported. The future employment outlook is positive with a 11.8% increase projected between 2010 and 2020. There were 16 work-related fatalities reported in 2009 with a rate of 6.2 injury and illness cases per 100 full-time workers.

Table A.21: Employment by Occupation: Primary Metals and Fabricated Metal Product Manufacturing

Occupation	Employment	Median Hourly Wage
Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	66,180	\$15.13
First-line supervisors/managers of production and operating workers	75,860	\$26.90
Machinists	121,950	\$18.08
Team assemblers	70,460	\$13.67
Welders, cutters, solderers, and brazers	79,450	\$16.56

Table A.22: Summary statistics: Primary Metals and Fabricated Metal Product Manufacturing

Variable	Mean
Age	42.54
Hourly Wage	\$22.78
Years of Education	13.77
Total Firms	9,505.88
Firms: < 20 Employees	7,024.06
Firms: 20-99 Employees	1,867.03
Firms: 100-499 Employees	405.39
Firms: 500+ Employees	209.39
Total Employment	260,999.04
Employment for Firms w/ < 20 Employees	41,299.25
Employment for Firms w/ 20-99 Employees	73,556.93
Employment for Firms w/ 100-499 Employees	53,892.90
Employment for Firms w/ 500+ Employees	91,808.19
Total Payroll	\$11,416,603.69
Payroll for Firms w/ < 20 Employees	\$1,516,327.60
Payroll for Firms w/ 20-99 Employees	\$3,093,330.33
Payroll for Firms w/ 100-499 Employees	\$2,295,514.83
Payroll for Firms w/ 500+ Employees	\$4,490,935.07
Wage Dispersion: 10th-90th Percentiles / Median	1.17
Wage Dispersion: 25th-75th Percentiles / Median	0.52
Capital-Labor Ratio	0.48
Percentage of Total Production Costs from Labor	0.25
Percentage of Total Production Costs from Capital	0.12
Hourly Labor Output	\$103.88
Production Per Dollar of Labor	\$3.74
Output Per Worker	\$215,571.83
Hourly Labor Cost	\$27.80
N	1005

11. Machinery Manufacturing

NAICS Description: Industries in the Machinery Manufacturing subsector create end products that apply mechanical force, for example, the application of gears and levers, to perform work. Some important processes for the manufacture of machinery are forging, stamping, bending, forming, and machining that are used to shape individual pieces of metal. Processes, such as welding and assembling are used to join separate parts together. Although these processes are similar to those used in metal fabricating establishments, machinery manufacturing is different because it typically employs multiple metal forming processes in manufacturing the various parts of the machine. Moreover, complex assembly operations are an inherent part of the production process.

Industry Details: The average unemployment rate in the Machinery Manufacturing industry was 11.5% in 2009 with 1,046 mass layoff events reported. The future employment outlook is not encouraging with a 1.5% decrease projected between 2010 and 2020. There were 22 work-related fatalities reported in 2009 with a rate of 4.3 injury and illness cases per 100 full-time workers.

Table A.23: Employment by Occupation: Machinery Manufacturing

Occupation	Employment	Median Hourly Wage
Computer-controlled machine tool operators, metal and plastic	25,920	\$18.21
Machinists	67,200	\$19.36
Mechanical engineers	32,0807	\$33.81
Team assemblers	108,970	\$14.83
Tool and die makers	21,310	\$21.36
Welders, cutters, solderers, and brazers	52,210	\$17.23

Table A.24: Summary statistics: Machinery Manufacturing

Variable	Mean
Age	42.931
Hourly Wage	\$25.615
Years of Education	14.514
Total Firms	6,438.128
Firms: < 20 Employees	4,180.232
Firms: 20-99 Employees	1,523.411
Firms: 100-499 Employees	438.274
Firms: 500+ Employees	296.211
Total Employment	302,788.148
Employment for Firms w/ < 20 Employees	26,157.351
Employment for Firms w/ 20-99 Employees	61,399.665
Employment for Firms w/ 100-499 Employees	60,250.871
Employment for Firms w/ 500+ Employees	154,980.263
Total Payroll	\$14,983,327.23
Payroll for Firms w/ < 20 Employees	\$1,118,966.167
Payroll for Firms w/ 20-99 Employees	\$2,824,693.472
Payroll for Firms w/ 100-499 Employees	\$2,894,520.863
Payroll for Firms w/ 500+ Employees	\$8,145,146.239
Wage Dispersion: 10th-90th Percentiles / Median	1.243
Wage Dispersion: 25th-75th Percentiles / Median	0.541
Capital-Labor Ratio	0.528
Percentage of Total Production Costs from Labor	0.243
Percentage of Total Production Costs from Capital	0.129
Hourly Labor Output	\$117.42
Production Per Dollar of Labor	\$4.02
Output Per Worker	\$247,668.281
Hourly Labor Cost	\$29.19
N	796

12. Computer and Electronic Product Manufacturing

NAICS Description: Industries in the Computer and Electronic Product Manufacturing subsector group establishments that manufacture computers, computer peripherals, communications equipment, and similar electronic products, and establishments that manufacture components for such products. The Computer and Electronic Product Manufacturing industries have been combined in the hierarchy of NAICS because of the economic significance they have attained. Their rapid growth suggests that they will become even more important to the economies of all three North American countries in the future, and in addition their manufacturing processes are fundamentally different from the manufacturing processes of other machinery and equipment. The design and use of integrated circuits and the application of highly specialized miniaturization technologies are common elements in the production technologies of the computer and electronic subsector.

Industry Details: The average unemployment rate in the Computer and Electronic Product Manufacturing industry was 10.8% in 2009 with 626 mass layoff events reported. The future employment outlook is not encouraging with a 14.3% decrease projected between 2010 and 2020. There were 8 work-related fatalities reported in 2009 with a rate of 1.6 injury and illness cases per 100 full-time workers.

Table A.25: Employment by Occupation: Computer and Electronic Product Manufacturing

Occupation	Employment	Median Hourly Wage
Computer hardware engineers	28,370	\$48.64
Electrical and electronic engineering technicians	37,050	\$24.64
Electrical and electronic equipment assemblers	98,100	\$13.91
Semiconductor processors	21,290	\$15.61

Table A.26: Summary statistics: Computer and Electronic Manufacturing

Variable	Mean
Age	43.26
Hourly Wage	\$33.19
Years of Education	15.84
Total Firms	3,463.25
Firms: < 20 Employees	2,162.28
Firms: 20-99 Employees	827.58
Firms: 100-499 Employees	283.25
Firms: 500+ Employees	190.13
Total Employment	260,494.42
Employment for Firms w/ < 20 Employees	12,451.23
Employment for Firms w/ 20-99 Employees	34,843.26
Employment for Firms w/ 100-499 Employees	43,097.69
Employment for Firms w/ 500+ Employees	170,102.24
Total Payroll	\$16,351,303.58
Payroll for Firms w/ < 20 Employees	\$606,677.43
Payroll for Firms w/ 20-99 Employees	\$1,669,010.16
Payroll for Firms w/ 100-499 Employees	\$2,269,570.36
Payroll for Firms w/ 500+ Employees	\$11,806,045.63
Wage Dispersion: 10th-90th Percentiles / Median	1.85
Wage Dispersion: 25th-75th Percentiles / Median	0.89
Capital-Labor Ratio	1.00
Percentage of Total Production Costs from Labor	0.27
Percentage of Total Production Costs from Capital	0.27
Hourly Labor Output	\$107.39
Production Per Dollar of Labor	\$3.60
Output Per Worker	\$233,087.80
Hourly Labor Cost	\$29.82
N	822

13. Electrical Equipment, Appliance, and Component Manufacturing

NAICS Description: Industries in the Electrical Equipment, Appliance, and Component Manufacturing subsector manufacture products that generate, distribute and use electrical power. Electric Lighting Equipment Manufacturing establishments produce electric lamp bulbs, lighting fixtures, and parts. Household Appliance Manufacturing establishments make both small and major electrical appliances and parts. Electrical Equipment Manufacturing establishments make goods, such as electric motors, generators, transformers, and switchgear apparatus. Other Electrical Equipment and Component Manufacturing establishments make devices for storing electrical power (e.g., batteries), for transmitting electricity (e.g., insulated wire), and wiring devices (e.g., electrical outlets, fuse boxes, and light switches).

Industry Details: The average unemployment rate in the Electrical Equipment, Appliance, and Component Manufacturing industry was 12.5% in 2009 with 397 mass layoff events reported. The future employment outlook is not encouraging with a 8.2% decrease projected between 2010 and 2020. There were 9 work-related fatalities reported in 2009 with a rate of 3.5 injury and illness cases per 100 full-time workers.

Table A.27: Employment by Occupation: Electrical Equipment, Appliance, and Component Manufacturing

Occupation	Employment	Median Hourly Wage
Coil winders, tapers, and finishers	6,290	\$14.90
Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	6,740	\$15.43
Electrical and electronic equipment assemblers	36,120	\$14.05
First-line supervisors/managers of production and operating workers	11,190	\$25.70
Inspectors, testers, sorters, samplers, and weighers	10,780	\$16.68
Team assemblers	47,840	\$14.71

Table A.28: Summary statistics: Electrical Equipment, Appliance, and Component Manufacturing

Variable	Mean
Age	43.65
Hourly Wage	\$25.50
Years of Education	14.80
Total Firms	4,162.67
Firms: < 20 Employees	2,568.67
Firms: 20-99 Employees	985.33
Firms: 100-499 Employees	345.00
Firms: 500+ Employees	263.67
Total Employment	270,218.33
Employment for Firms w/ < 20 Employees	15,290.17
Employment for Firms w/ 20-99 Employees	40,290.67
Employment for Firms w/ 100-499 Employees	53,054.17
Employment for Firms w/ 500+ Employees	161,583.33
Total Payroll	\$12,619,897.17
Payroll for Firms w/ < 20 Employees	\$667,089.67
Payroll for Firms w/ 20-99 Employees	\$1,789,651.67
Payroll for Firms w/ 100-499 Employees	\$2,378,218.67
Payroll for Firms w/ 500+ Employees	\$7,784,937.17
Wage Dispersion: 10th-90th Percentiles / Median	1.60
Wage Dispersion: 25th-75th Percentiles / Median	0.67
Capital-Labor Ratio	0.91
Percentage of Total Production Costs from Labor	0.22
Percentage of Total Production Costs from Capital	0.20
Hourly Labor Output	\$122.33
Production Per Dollar of Labor	\$4.47
Output Per Worker	\$254,175.98
Hourly Labor Cost	\$27.34
N	234

14. Transportation Equipment Manufacturing

NAICS Description: Industries in the Transportation Equipment Manufacturing subsector produce equipment for transporting people and goods. Transportation equipment is a type of machinery. An entire subsector is devoted to this activity because of the significance of its economic size in all three North American countries. Establishments in this subsector utilize production processes similar to those of other machinery manufacturing establishments - bending, forming, welding, machining, and assembling metal or plastic parts into components and finished products. However, the assembly of components and subassemblies and their further assembly into finished vehicles tends to be a more common production process in this subsector than in the Machinery Manufacturing subsector.

Industry Details: The average unemployment rate in the Transportation Equipment Manufacturing industry was 14.6% in 2009 with 1,827 mass layoff events reported. The future employment outlook is not encouraging with only a 0.2% increase projected between 2010 and 2020. There were 31 work-related fatalities reported in 2009 with a rate of 5.2 injury and illness cases per 100 full-time workers.

Table A.29: Employment by Occupation: Transportation Equipment Manufacturing

Occupation	Employment	Median Hourly Wage
Aerospace engineers	28,380	\$45.78
Machinists	50,200	\$20.37
Mechanical engineers	32,300	\$39.86
Team assemblers	176,040	\$16.20
Welders, cutters, solderers, and brazers	41,640	\$17.10

Table A.30: Summary statistics: Transportation Equipment Manufacturing

Variable	Mean
Age	43.44
Hourly Wage	\$29.34
Years of Education	15.00
Total Firms	3,459.88
Firms: < 20 Employees	2,142.08
Firms: 20-99 Employees	758.02
Firms: 100-499 Employees	327.89
Firms: 500+ Employees	231.89
Total Employment	400,894.27
Employment for Firms w/ < 20 Employees	12,398.43
Employment for Firms w/ 20-99 Employees	32,017.61
Employment for Firms w/ 100-499 Employees	58,273.41
Employment for Firms w/ 500+ Employees	298,187.22
Total Payroll	\$21,022,293.95
Payroll for Firms w/ < 20 Employees	\$2,042,300.51
Payroll for Firms w/ 20-99 Employees	\$2,761,169.35
Payroll for Firms w/ 100-499 Employees	\$2,216,573.07
Payroll for Firms w/ 500+ Employees	\$17,115,269.41
Wage Dispersion: 10th-90th Percentiles / Median	1.02
Wage Dispersion: 25th-75th Percentiles / Median	0.50
Capital-Labor Ratio	0.36
Percentage of Total Production Costs from Labor	0.20
Percentage of Total Production Costs from Capital	0.07
Hourly Labor Output	\$146.27
Production Per Dollar of Labor	\$4.47
Output Per Worker	\$318,692.53
Hourly Labor Cost	\$32.73
N	1190

A.3 Wholesale Trade

NAICS Description: The Wholesale Trade sector comprises establishments engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The merchandise described in this sector includes the outputs of agriculture, mining, manufacturing, and certain information industries, such as publishing.

The wholesaling process is an intermediate step in the distribution of merchandise. Wholesalers are organized to sell or arrange the purchase or sale of (a) goods for resale (i.e., goods sold to other wholesalers or retailers), (b) capital or durable nonconsumer goods, and (c) raw and intermediate materials and supplies used in production.

Wholesalers sell merchandise to other businesses and normally operate from a warehouse or office. These warehouses and offices are characterized by having little or no display of merchandise. In addition, neither the design nor the location of the premises is intended to solicit walk-in traffic. Wholesalers do not normally use advertising directed to the general public. Customers are generally reached initially via telephone, in-person marketing, or by specialized advertising that may include Internet and other electronic means. Follow-up orders are either vendor-initiated or client-initiated, generally based on previous sales, and typically exhibit strong ties between sellers and buyers. In fact, transactions are often conducted between wholesalers and clients that have long-standing business relationships.

Industry Details: The average unemployment rate in the Wholesale Trade industry was 7.2% in 2009 with 653 mass layoff events reported. The future employment outlook is positive with a 13.6% increase projected between 2010 and 2020. 4.9% of wage and salary workers were members of unions with 5.5% being represented by unions. Union members earned about 4.8% more on

average than did those not represented by unions. There were 190 work-related fatalities reported in 2009 with a rate of 3.3 injury and illness cases per 100 full-time workers.

Table A.31: Employment by Occupation: Wholesale Trade

Occupation	Employment	Median Hourly Wage
Laborers and freight, stock, and material movers	365,550	\$12.05
Sales representatives, wholesale and manufacturing, except technical and scientific products	921,740	\$25.42
Sales representatives, wholesale and manufacturing, technical and scientific products	223,920	\$35.68
Truck drivers, heavy and tractor-trailer	195,500	\$18.17
Wholesale and retail buyers, except farm products	43,190	\$24.53

Table A.32: Summary statistics: Wholesale Trade

Variable	Mean
Age	42.07
Hourly Wage	\$26.91
Years of Education	14.63
experience	27.44
Total Firms	19,186.76
Firms: < 20 Employees	15,626.15
Firms: 20-99 Employees	2,653.88
Firms: 100-499 Employees	620.81
Firms: 500+ Employees	476.59
Total Employment	437,518.90
Employment for Firms w/ < 20 Employees	73,200.22
Employment for Firms w/ 20-99 Employees	92,508.60
Employment for Firms w/ 100-499 Employees	74,856.13
Employment for Firms w/ 500+ Employees	198,904.78
Total Payroll	\$24,161,184.09
Payroll for Firms w/ < 20 Employees	\$3,302,719.90
Payroll for Firms w/ 20-99 Employees	\$4,490,364.34
Payroll for Firms w/ 100-499 Employees	\$3,790,927.31
Payroll for Firms w/ 500+ Employees	\$12,674,336.11
Wage Dispersion: 10th-90th Percentiles / Median	1.63
Wage Dispersion: 25th-75th Percentiles / Median	0.71
Capital-Labor Ratio	0.00
Percentage of Total Production Costs from Labor	0.00
Percentage of Total Production Costs from Capital	0.00
Hourly Labor Output	\$362.95
Production Per Dollar of Labor	\$10.19
Output Per Worker	\$719,755.44
Hourly Labor Cost	\$35.63
N	2293

A.4 Retail Trade

NAICS Description: The Retail Trade sector comprises establishments engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise.

The retailing process is the final step in the distribution of merchandise; retailers are, therefore, organized to sell merchandise in small quantities to the general public. This sector comprises two main types of retailers: store and nonstore retailers.

1. Store retailers operate fixed point-of-sale locations, located and designed to attract a high volume of walk-in customers. In general, retail stores have extensive displays of merchandise and use mass-media advertising to attract customers. They typically sell merchandise to the general public for personal or household consumption, but some also serve business and institutional clients. In addition to retailing merchandise, some types of store retailers are also engaged in the provision of after-sales services, such as repair and installation.

2. Nonstore retailers, like store retailers, are organized to serve the general public, but their retailing methods differ. The establishments of this subsector reach customers and market merchandise with methods, such as the broadcasting of "infomercials," the broadcasting and publishing of direct-response advertising, the publishing of paper and electronic catalogs, door-to-door solicitation, in-home demonstration, selling from portable stalls (street vendors, except food), and distribution through vending machines.

Industry Details: The average unemployment rate in the Retail Trade industry was 9.5% in 2009 with 1,965 mass layoff events reported. The future employment outlook is positive with a 12.3% increase projected between 2010 and 2020. 5.3% of wage and salary workers were members

of unions with 5.9% being represented by unions. Union members earned about 6.6% more on average than did those not represented by unions. There were 307 work-related fatalities reported in 2009 with a rate of 4.2 injury and illness cases per 100 full-time workers.

Table A.33: Employment by Occupation: Retail Trade

Occupation	Employment	Median Hourly Wage
Cashiers	2,712,630	\$9.06
Customer service representatives	266,950	\$11.60
First-line supervisors/managers of retail sales workers	1,083,340	\$17.46
Retail salespersons	3,982,5907	\$10.04
Stock clerks and order fillers	1,251,370	\$9.73

Table A.34: Summary statistics: Retail Trade

Variable	Mean
Age	37.42
Hourly Wage	\$17.21
Years of Education	14.17
experience	23.24
Total Firms	29,185.29
Firms: < 20 Employees	25,548.87
Firms: 20-99 Employees	2,978.63
Firms: 100-499 Employees	512.19
Firms: 500+ Employees	145.61
Total Employment	1,028,644.11
Employment for Firms w/ < 20 Employees	106,279.00
Employment for Firms w/ 20-99 Employees	115,653.30
Employment for Firms w/ 100-499 Employees	74,727.30
Employment for Firms w/ 500+ Employees	723,969.80
Total Payroll	\$23,480,423.94
Payroll for Firms w/ < 20 Employees	\$2,423,526.38
Payroll for Firms w/ 20-99 Employees	\$3,218,139.11
Payroll for Firms w/ 100-499 Employees	\$2,133,954.00
Payroll for Firms w/ 500+ Employees	\$15,685,150.22
Wage Dispersion: 10th-90th Percentiles / Median	1.05
Wage Dispersion: 25th-75th Percentiles / Median	0.46
Hourly Labor Output	\$145.80
Production Per Dollar of Labor	\$7.50
Output Per Worker	\$234,946.95
Hourly Labor Cost	\$19.44
N	9389

A.5 Transportation and Warehousing

NAICS Description: The Transportation and Warehousing sector includes industries providing transportation of passengers and cargo, warehousing and storage for goods, scenic and sightseeing transportation, and support activities related to modes of transportation. Establishments in these industries use transportation equipment or transportation related facilities as a productive asset. The type of equipment depends on the mode of transportation. The modes of transportation are air, rail, water, road, and pipeline.

Industry Details: The average unemployment rate in the Transportation and Warehousing industry was 9.7% in 2009 with 1,491 mass layoff events reported. The future employment outlook is positive with a 20.7% increase projected between 2010 and 2020. 21.3% of wage and salary workers were members of unions with 22.6% being represented by unions. Union members earned about 12.2% more on average than did those not represented by unions. There were 666 work-related fatalities reported in 2009 with a rate of 5.2 injury and illness cases per 100 full-time workers.

Table A.35: Employment by Occupation: Transportation and Warehousing

Occupation	Employment	Median Hourly Wage
Airline pilots, copilots, and flight engineers	64,120	\$52.03
Bus drivers, school	175,650	\$14.06
Railroad conductors and yardmasters	40,570	\$25.86
Sailors and marine oilers	23,040	\$17.14
Truck drivers, heavy and tractor-trailer	872,930	\$19.04

Table A.36: Summary statistics: Transportation and Warehousing

Variable	Mean
Age	42.84
Hourly Wage	\$22.02
Years of Education	14.21
experience	28.63
Total Firms	32,393.28
Firms: < 20 Employees	29,001.80
Firms: 20-99 Employees	2,498.23
Firms: 100-499 Employees	565.86
Firms: 500+ Employees	327.39
Total Employment	612,252.24
Employment for Firms w/ < 20 Employees	101,283.67
Employment for Firms w/ 20-99 Employees	92,497.67
Employment for Firms w/ 100-499 Employees	77,011.42
Employment for Firms w/ 500+ Employees	340,705.16
Total Payroll	\$23,771,911.83
Payroll for Firms w/ < 20 Employees	\$3,248,387.15
Payroll for Firms w/ 20-99 Employees	\$3,369,610.69
Payroll for Firms w/ 100-499 Employees	\$2,888,271.64
Payroll for Firms w/ 500+ Employees	\$14,265,642.72
Wage Dispersion: 10th-90th Percentiles / Median	1.07
Wage Dispersion: 25th-75th Percentiles / Median	0.54
Capital-Labor Ratio	0.00
Percentage of Total Production Costs from Labor	0.00
Percentage of Total Production Costs from Capital	0.00
Hourly Labor Output	\$64.24
Production Per Dollar of Labor	\$2.07
Output Per Worker	\$126,260.44
Hourly Labor Cost	\$31.01
N	3490

A.6 Utilities

NAICS Description: The Utilities sector comprises establishments engaged in the provision of the following utility services: electric power, natural gas, steam supply, water supply, and sewage removal. Within this sector, the specific activities associated with the utility services provided vary by utility: electric power includes generation, transmission, and distribution; natural gas includes distribution; steam supply includes provision and/or distribution; water supply includes treatment and distribution; and sewage removal includes collection, treatment, and disposal of waste through sewer systems and sewage treatment facilities.

Industry Details: The average unemployment rate in the Utilities industry was 4.8% in 2009 with 39 mass layoff events reported. The future employment outlook is not encouraging with a 6.5% decrease projected between 2010 and 2020. 26.1% of wage and salary workers were members of unions with 27.5% being represented by unions. Union members earned about 11.1% more on average than did those not represented by unions. There were 25 work-related fatalities reported in 2009 with a rate of 3.3 injury and illness cases per 100 full-time workers.

Table A.37: Employment by Occupation: Utilities

Occupation	Employment	Median Hourly Wage
Control and valve installers and repairers, except mechanical door	19,690	\$27.69
Electrical engineers	16,370	\$40.97
Electrical power-line installers and repairers	55,900	\$30.97
First-line supervisors/managers of mechanics, installers, and repairers	17,160	\$38.23
Meter readers, utilities	17,740	\$19.12

Table A.38: Summary statistics: Utilities

Variable	Mean
Age	43.77
Hourly Wage	\$29.88
Years of Education	14.85
experience	28.92
Total Firms	1,778.98
Firms: < 20 Employees	1,010.90
Firms: 20-99 Employees	490.96
Firms: 100-499 Employees	177.51
Firms: 500+ Employees	180.29
Total Employment	356,825.33
Employment for Firms w/ < 20 Employees	4,546.20
Employment for Firms w/ 20-99 Employees	23,103.91
Employment for Firms w/ 100-499 Employees	29,732.81
Employment for Firms w/ 500+ Employees	325,414.76
Total Payroll	\$31,325,971.75
Payroll for Firms w/ < 20 Employees	\$234,640.56
Payroll for Firms w/ 20-99 Employees	\$1,465,225.59
Payroll for Firms w/ 100-499 Employees	\$2,073,514.23
Payroll for Firms w/ 500+ Employees	\$29,808,591.64
Wage Dispersion: 10th-90th Percentiles / Median	0.95
Wage Dispersion: 25th-75th Percentiles / Median	0.48
N	816

A.7 Publishing

NAICS Description: Industries in the Publishing Industries (except Internet) subsector group establishments engaged in the publishing of newspapers, magazines, other periodicals, and books, as well as directory and mailing list and software publishing. In general, these establishments, which are known as publishers, issue copies of works for which they usually possess copyright. Works may be in one or more formats including traditional print form, CD-ROM, or proprietary electronic networks. Publishers may publish works originally created by others for which they have obtained the rights and/or works that they have created in-house. Software publishing is included here because the activity, creation of a copyrighted product and bringing it to market, is equivalent to the creation process for other types of intellectual products.

Industry Details: The average unemployment rate in the Publishing industry was 9.1% in 2009 with 196 mass layoff events reported. The future employment outlook is positive with a 4.0% increase projected between 2010 and 2020. 5.3% of wage and salary workers were members of unions with 6.5% being represented by unions. Union members earned about 31.4% more on average than did those not represented by unions. There were 12 work-related fatalities reported in 2009 with a rate of 1.5 injury and illness cases per 100 full-time workers.

Table A.39: Employment by Occupation: Publishing

Occupation	Employment	Median Hourly Wage
Advertising sales agents	46,180	\$18.41
Editors	58,110	\$24.62
Graphic designers	25,390	\$18.70
Reporters and correspondents	30,200	\$15.59

Table A.40: Summary statistics: Publishing

Variable	Mean
Age	42.13
Hourly Wage	\$26.43
Years of Education	15.64
experience	26.49
Total Firms	7,170.83
Firms: < 20 Employees	5,847.64
Firms: 20-99 Employees	885.48
Firms: 100-499 Employees	256.93
Firms: 500+ Employees	180.78
Total Employment	302,579.39
Employment for Firms w/ < 20 Employees	27,685.10
Employment for Firms w/ 20-99 Employees	34,323.52
Employment for Firms w/ 100-499 Employees	42,259.78
Employment for Firms w/ 500+ Employees	198,310.98
Total Payroll	\$17,158,476.12
Payroll for Firms w/ < 20 Employees	\$1,039,342.96
Payroll for Firms w/ 20-99 Employees	\$1,540,904.45
Payroll for Firms w/ 100-499 Employees	\$2,120,068.63
Payroll for Firms w/ 500+ Employees	\$12,458,159.60
Wage Dispersion: 10th-90th Percentiles / Median	1.05
Wage Dispersion: 25th-75th Percentiles / Median	0.49
Hourly Labor Output	\$167.80
Production Per Dollar of Labor	\$3.55
Output Per Worker	\$318,810.59
Hourly Labor Cost	\$47.22
N	415

A.8 Motion Picture and Sound Recording

NAICS Description: Industries in the Motion Picture and Sound Recording Industries subsector group establishments involved in the production and distribution of motion pictures and sound recordings. While producers and distributors of motion pictures and sound recordings issue works for sale as traditional publishers do, the processes are sufficiently different to warrant placing establishments engaged in these activities in a separate subsector. Production is typically a complex process that involves several distinct types of establishments that are engaged in activities, such as contracting with performers, creating the film or sound content, and providing technical postproduction services. Film distribution is often to exhibitors, such as theaters and broadcasters, rather than through the wholesale and retail distribution chain. When the product is in a mass-produced form, NAICS treats production and distribution as the major economic activity as it does in the Publishing Industries subsector, rather than as a subsidiary activity to the manufacture of such products.

Industry Details: The average unemployment rate in the Motion Picture and Sound Recording industry was 13.8% in 2009 with 291 mass layoff events reported. The future employment outlook is not encouraging with a 6.7% decrease projected between 2010 and 2020. 12.8% of wage and salary workers were members of unions with 13.0% being represented by unions. Union members earned about 47% more on average than did those not represented by unions. There were no work-related fatalities reported in 2009 with a rate of 3.6 injury and illness cases per 100 full-time workers.

Table A.41: Employment by Occupation: Motion Picture and Sound Recording

Occupation	Employment	Median Hourly Wage
Actors	25,350	\$23.14
Audio and video equipment technicians	6,890	\$20.21
Cashiers	19,050	\$8.98
Motion picture projectionists	8,270	\$9.73
Producers and directors	32,270	\$46.10

Table A.42: Summary statistics: Motion Picture and Sound Recording

Variable	Mean
Age	34.24
Hourly Wage	\$26.53
Years of Education	15.46
Total Firms	15,859.62
Firms: < 20 Employees	14,636.89
Firms: 20-99 Employees	951.92
Firms: 100-499 Employees	174.26
Firms: 500+ Employees	96.56
Total Employment	297,232.25
Employment for Firms w/ < 20 Employees	39,079.71
Employment for Firms w/ 20-99 Employees	34,802.48
Employment for Firms w/ 100-499 Employees	29,135.22
Employment for Firms w/ 500+ Employees	194,214.85
Total Payroll	\$13,153,695.96
Payroll for Firms w/ < 20 Employees	\$2,831,251.09
Payroll for Firms w/ 20-99 Employees	\$1,616,492.43
Payroll for Firms w/ 100-499 Employees	\$1,065,208.83
Payroll for Firms w/ 500+ Employees	\$7,640,743.60
Wage Dispersion: 10th-90th Percentiles / Median	3.03
Wage Dispersion: 25th-75th Percentiles / Median	1.42
N	229

A.9 Telecommunications

NAICS Description: Industries in the Telecommunications subsector group establishments that provide telecommunications and the services related to that activity (e.g., telephony, including Voice over Internet Protocol (VoIP); cable and satellite television distribution services; Internet access; telecommunications reselling services). The Telecommunications subsector is primarily engaged in operating, and/or providing access to facilities for the transmission of voice, data, text, sound, and video. Transmission facilities may be based on a single technology or a combination of technologies.

Industry Details: The average unemployment rate in the Telecommunications industry was 8.4% in 2009 with 168 mass layoff events reported. The future employment outlook is positive with a 8.2% increase projected between 2010 and 2020. 16.0% of wage and salary workers were members of unions with 17.7% being represented by unions. Union members earned about 18.5% more on average than did those not represented by unions. There were 19 work-related fatalities reported in 2009 with a rate of 2.4 injury and illness cases per 100 full-time workers.

Table A.43: Employment by Occupation: Telecommunications

Occupation	Employment	Median Hourly Wage
Customer service representatives	100,200	\$16.02
Electronics engineers, except computer	25,450	\$39.94
First-line supervisors/managers of office and administrative support workers	13,470	\$28.87
Telecommunications equipment installers and repairers, except line installers	137,410	\$27.07
Telecommunications line installers and repairers	85,860	\$28.94

Table A.44: Summary statistics: Telecommunications

Variable	Mean
Age	40.07
Hourly Wage	\$28.78
Years of Education	15.36
Total Firms	4,119.08
Firms: < 20 Employees	3,268.52
Firms: 20-99 Employees	576.97
Firms: 100-499 Employees	164.58
Firms: 500+ Employees	109.02
Total Employment	640,249.65
Employment for Firms w/ < 20 Employees	14,306.73
Employment for Firms w/ 20-99 Employees	22,781.35
Employment for Firms w/ 100-499 Employees	24,736.20
Employment for Firms w/ 500+ Employees	578,425.38
Total Payroll	\$42,455,885.31
Payroll for Firms w/ < 20 Employees	\$764,855.57
Payroll for Firms w/ 20-99 Employees	\$1,261,638.95
Payroll for Firms w/ 100-499 Employees	\$1,578,924.82
Payroll for Firms w/ 500+ Employees	\$38,850,465.22
Wage Dispersion: 10th-90th Percentiles / Median	1.34
Wage Dispersion: 25th-75th Percentiles / Median	0.64
Hourly Labor Output	\$190.66
Production Per Dollar of Labor	\$4.14
Output Per Worker	\$395,679.13
Hourly Labor Cost	\$46.09
N	726

A.10 Finance and Insurance

NAICS Description: The Finance and Insurance sector comprises establishments primarily engaged in financial transactions (transactions involving the creation, liquidation, or change in ownership of financial assets) and/or in facilitating financial transactions. Three principal types of activities are identified:

1. Raising funds by taking deposits and/or issuing securities and, in the process, incurring liabilities. Establishments engaged in this activity use raised funds to acquire financial assets by making loans and/or purchasing securities. Putting themselves at risk, they channel funds from lenders to borrowers and transform or repackage the funds with respect to maturity, scale, and risk. This activity is known as financial intermediation.

2. Pooling of risk by underwriting insurance and annuities. Establishments engaged in this activity collect fees, insurance premiums, or annuity considerations; build up reserves; invest those reserves; and make contractual payments. Fees are based on the expected incidence of the insured risk and the expected return on investment.

3. Providing specialized services facilitating or supporting financial intermediation, insurance, and employee benefit programs.

In addition, monetary authorities charged with monetary control are included in this sector.

Industry Details: The average unemployment rate in the Finance and Insurance industry was 5.8% in 2009 with 677 mass layoff events reported. The future employment outlook is positive with a 8.9% increase projected between 2010 and 2020. 1.4% of wage and salary workers were members of unions with 1.9% being represented by unions. Union members earned about 4.0% less on average than did those not represented by unions. There were 33 work-related fatalities

reported in 2009 with a rate of 0.8 injury and illness cases per 100 full-time workers.

Table A.45: Employment by Occupation: Finance and Insurance

Occupation	Employment	Median Hourly Wage
Accountants and auditors	95,830	\$31.55
Insurance sales agents	312,170	\$22.89
Loan officers	256,950	\$27.59
Securities, commodities, and financial services sales agents	293,700	\$34.29
Tellers	533,650	\$11.81

Table A.46: Summary statistics: Finance and Insurance

Variable	Mean
Age	40.76
Hourly Wage	\$30.80
Years of Education	15.87
Total Firms	64,588.09
Firms: < 20 Employees	59,553.34
Firms: 20-99 Employees	3,515.41
Firms: 100-499 Employees	1,022.82
Firms: 500+ Employees	541.78
Total Employment	1,593,691.82
Employment for Firms w/ < 20 Employees	190,741.09
Employment for Firms w/ 20-99 Employees	137,718.24
Employment for Firms w/ 100-499 Employees	158,529.32
Employment for Firms w/ 500+ Employees	1,114,689.67
Total Payroll	\$114,179,701.53
Payroll for Firms w/ < 20 Employees	\$9,367,163.19
Payroll for Firms w/ 20-99 Employees	\$9,522,719.41
Payroll for Firms w/ 100-499 Employees	\$11,340,758.54
Payroll for Firms w/ 500+ Employees	\$84,268,899.07
Wage Dispersion: 10th-90th Percentiles / Median	1.44
Wage Dispersion: 25th-75th Percentiles / Median	0.90
Hourly Labor Output	\$129.32
Production Per Dollar of Labor	\$2.20
Output Per Worker	\$252,719.77
Hourly Labor Cost	\$37.99
N	4252

A.11 Real Estate, Rental and Leasing

NAICS Description: The Real Estate, Rental and Leasing sector comprises establishments primarily engaged in renting, leasing, or otherwise allowing the use of tangible or intangible assets, and establishments providing related services. The major portion of this sector comprises establishments that rent, lease, or otherwise allow the use of their own assets by others. The assets may be tangible, as is the case of real estate and equipment, or intangible, as is the case with patents and trademarks.

This sector also includes establishments primarily engaged in managing real estate for others, selling, renting and/or buying real estate for others, and appraising real estate. These activities are closely related to this sector's main activity, and it was felt that from a production basis they would best be included here. In addition, a substantial proportion of property management is self-performed by lessors.

The main components of this sector are the real estate lessors industries (including equity real estate investment trusts (REITs)); equipment lessors industries (including motor vehicles, computers, and consumer goods); and lessors of nonfinancial intangible assets (except copyrighted works).

Industry Details: The average unemployment rate in the Real Estate, Rental and Leasing industry was 8.1% in 2009 with 165 mass layoff events reported. The future employment outlook is positive with a 14.2% increase projected between 2010 and 2020. 3.0% of wage and salary workers were members of unions with 3.6% being represented by unions. Union members earned about 17.3% more on average than did those not represented by unions. There were 76 work-related fatalities reported in 2009 with a rate of 3.3 injury and illness cases per 100 full-time

workers.

Table A.47: Employment by Occupation: Real Estate, Rental and Leasing

Occupation	Employment	Median Hourly Wage
Counter and rental clerks	192,680	\$11.29
Property, real estate, and community association managers	111,020	\$23.97
Real estate brokers	34,280	\$28.40
Real estate sales agents	131,360	\$18.05

Table A.48: Summary statistics: Real Estate, Rental and Leasing

Variable	Mean
Age	42.00
Hourly Wage	\$25.55
Years of Education	14.95
Total Firms	199,545.02
Firms: < 20 Employees	190,890.94
Firms: 20-99 Employees	6,432.31
Firms: 100-499 Employees	1,564.59
Firms: 500+ Employees	657.18
Total Employment	1,214,353.95
Employment for Firms w/ < 20 Employees	495,672.81
Employment for Firms w/ 20-99 Employees	231,312.17
Employment for Firms w/ 100-499 Employees	204,145.96
Employment for Firms w/ 500+ Employees	283,130.35
Total Payroll	\$49,306,080.90
Payroll for Firms w/ < 20 Employees	\$17,085,454.57
Payroll for Firms w/ 20-99 Employees	\$9,306,221.88
Payroll for Firms w/ 100-499 Employees	\$8,515,928.14
Payroll for Firms w/ 500+ Employees	\$14,368,904.40
Wage Dispersion: 10th-90th Percentiles / Median	1.63
Wage Dispersion: 25th-75th Percentiles / Median	0.71
Hourly Labor Output	\$21.63
Production Per Dollar of Labor	\$0.93
Output Per Worker	\$32,001.13
Hourly Labor Cost	\$4.15
N	1393

A.12 Professional, Scientific and Technical Services

NAICS Description: The Professional, Scientific, and Technical Services sector comprises establishments that specialize in performing professional, scientific, and technical activities for others. These activities require a high degree of expertise and training. The establishments in this sector specialize according to expertise and provide these services to clients in a variety of industries and, in some cases, to households. Activities performed include: legal advice and representation; accounting, bookkeeping, and payroll services; architectural, engineering, and specialized design services; computer services; consulting services; research services; advertising services; photographic services; translation and interpretation services; veterinary services; and other professional, scientific, and technical services.

Industry Details: The average unemployment rate in the Professional, Scientific and Technical Services industry was 6.7% in 2009 with 800 mass layoff events reported. The future employment outlook is positive with a 28.7% increase projected between 2010 and 2020. 1.1% of wage and salary workers were members of unions with 1.5% being represented by unions. Union members earned about the same wage as those not represented by unions. There were 87 work-related fatalities reported in 2009 with a rate of 1.2 injury and illness cases per 100 full-time workers.

Table A.49: Employment by Occupation: Professional, Scientific and Technical Services

Occupation	Employment	Median Hourly Wage
Accountants and auditors	366,350	\$31.13
Architectural and civil drafters	68,070	\$22.69
Lawyers	381,190	\$56.40
Management analysts	208,560	\$41.12

Table A.50: Summary statistics: Professional, Scientific and Technical Services

Variable	Mean
Age	40.77
Hourly Wage	\$34.85
Years of Education	16.93
Total Firms	104,016.92
Firms: < 20 Employees	97,225.70
Firms: 20-99 Employees	5,285.49
Firms: 100-499 Employees	991.82
Firms: 500+ Employees	513.91
Total Employment	1,069,394.84
Employment for Firms w/ < 20 Employees	299,432.57
Employment for Firms w/ 20-99 Employees	198,697.77
Employment for Firms w/ 100-499 Employees	153,625.14
Employment for Firms w/ 500+ Employees	415,679.97
Total Payroll	\$75,948,593.64
Payroll for Firms w/ < 20 Employees	\$16,163,857.72
Payroll for Firms w/ 20-99 Employees	\$13,886,512.08
Payroll for Firms w/ 100-499 Employees	\$11,421,688.58
Payroll for Firms w/ 500+ Employees	\$34,447,978.51
Wage Dispersion: 10th-90th Percentiles / Median	1.34
Wage Dispersion: 25th-75th Percentiles / Median	0.85
Hourly Labor Output	\$90.46
Production Per Dollar of Labor	\$2.08
Output Per Worker	\$172,987.63
Hourly Labor Cost	\$43.53
N	5027

A.13 Management of Companies and Enterprises

NAICS Description: The Management of Companies and Enterprises sector comprises (1) establishments that hold the securities of (or other equity interests in) companies and enterprises for the purpose of owning a controlling interest or influencing management decisions or (2) establishments (except government establishments) that administer, oversee, and manage establishments of the company or enterprise and that normally undertake the strategic or organizational planning and decision making role of the company or enterprise. Establishments that administer, oversee, and manage may hold the securities of the company or enterprise.

Establishments in this sector perform essential activities that are often undertaken, in-house, by establishments in many sectors of the economy. By consolidating the performance of these activities of the enterprise at one establishment, economies of scale are achieved.

Industry Details: The average unemployment rate in the Management of Companies and Enterprises industry was not reported in 2009 but there were 104 mass layoff events reported. The future employment outlook is positive with a 5.5% increase projected between 2010 and 2020. There were no work-related fatalities reported in 2009 with a rate of 1.7 injury and illness cases per 100 full-time workers.

Table A.51: Employment by Occupation: Management of Companies and Enterprises

Occupation	Employment	Median Hourly Wage
Accountants and auditors	78,040	\$30.67
Bookkeeping, accounting, and auditing clerks	76,910	\$17.16
Financial managers	51,120	\$58.48
First-line supervisors/managers of office and administrative support workers	44,700	\$26.87
General and operations managers	72,800	\$58.89

Table A.52: Summary statistics: Management of Companies and Enterprises

Variable	Mean
Age	40.88
Hourly Wage	\$25.17
Years of Education	16.02
Total Firms	27,517.00
Firms: < 20 Employees	5,282.00
Firms: 20-99 Employees	6,165.00
Firms: 100-499 Employees	8,772.00
Firms: 500+ Employees	7,298.00
Total Employment	2,853,450.00
Employment for Firms w/ < 20 Employees	15,549.00
Employment for Firms w/ 20-99 Employees	75,577.00
Employment for Firms w/ 100-499 Employees	271,058.00
Employment for Firms w/ 500+ Employees	2,491,266.00
Total Payroll	\$264,706,016.00
Payroll for Firms w/ < 20 Employees	\$1,709,268.00
Payroll for Firms w/ 20-99 Employees	\$4,845,584.00
Payroll for Firms w/ 100-499 Employees	\$18,449,048.00
Payroll for Firms w/ 500+ Employees	\$239,702,112.00
Wage Dispersion: 10th-90th Percentiles / Median	1.86
Wage Dispersion: 25th-75th Percentiles / Median	0.93
N	49

A.14 Administrative and Support, Waste Management and Remediation Services

The Administrative and Support, Waste Management and Remediation Services sector comprises establishments performing routine support activities for the day-to-day operations of other organizations. These essential activities are often undertaken in-house by establishments in many sectors of the economy. The establishments in this sector specialize in one or more of these support activities and provide these services to clients in a variety of industries and, in some cases, to households. Activities performed include: office administration, hiring and placing of personnel, document preparation and similar clerical services, solicitation, collection, security and surveillance services, cleaning, and waste disposal services.

Industry Details: The average unemployment rate in the Administrative, Support and Waste Management and Remediation Services industry was not reported in 2009 but 3,205 mass layoff events were reported. The future employment outlook is positive with a 21.3% increase projected between 2010 and 2020. 4.0% of wage and salary workers were members of unions with 4.7% being represented by unions. Union members earned about 19.0% more on average than did those not represented by unions. There were 346 work-related fatalities reported in 2009 with a rate of 2.9 injury and illness cases per 100 full-time workers.

Table A.53: Employment by Occupation: Administrative, Support and Waste Management and Remediation Services

Occupation	Employment	Median Hourly Wage
Janitors and cleaners, except maids and house-keeping cleaners	813,860	\$9.55
Laborers and freight, stock, and material movers, hand	391,130	\$9.60
Landscaping and groundskeeping workers	458,500	\$11.14
Office clerks, general	268,340	\$12.28
Security guards	635,360	\$10.89

Table A.54: Summary statistics: Administrative, Support and Waste Management and Remediation Services

Variable	Mean
Age	39.88
Hourly Wage	\$19.03
Years of Education	13.75
Total Firms	47,576.35
Firms: < 20 Employees	42,047.02
Firms: 20-99 Employees	3,996.64
Firms: 100-499 Employees	1,078.70
Firms: 500+ Employees	454.00
Total Employment	1,430,275.77
Employment for Firms w/ < 20 Employees	151,143.18
Employment for Firms w/ 20-99 Employees	162,907.61
Employment for Firms w/ 100-499 Employees	205,307.12
Employment for Firms w/ 500+ Employees	910,917.86
Total Payroll	\$41,520,379.72
Payroll for Firms w/ < 20 Employees	\$4,247,263.29
Payroll for Firms w/ 20-99 Employees	\$4,384,331.70
Payroll for Firms w/ 100-499 Employees	\$5,146,577.06
Payroll for Firms w/ 500+ Employees	\$27,742,208.41
Wage Dispersion: 10th-90th Percentiles / Median	1.19
Wage Dispersion: 25th-75th Percentiles / Median	0.52
Hourly Labor Output	\$34.98
Production Per Dollar of Labor	\$2.01
Output Per Worker	\$53,061.77
Hourly Labor Cost	\$17.39
N	2636

A.15 Educational Services

The Educational Services sector comprises establishments that provide instruction and training in a wide variety of subjects. This instruction and training is provided by specialized establishments, such as schools, colleges, universities, and training centers. These establishments may be privately owned and operated for profit or not for profit, or they may be publicly owned and operated. They may also offer food and/or accommodation services to their students.

Educational services are usually delivered by teachers or instructors that explain, tell, demonstrate, supervise, and direct learning. Instruction is imparted in diverse settings, such as educational institutions, the workplace, or the home, and through diverse means, such as correspondence, television, the Internet, or other electronic and distance-learning methods. The training provided by these establishments may include the use of simulators and simulation methods. It can be adapted to the particular needs of the students, for example sign language can replace verbal language for teaching students with hearing impairments. All industries in the sector share this commonality of process, namely, labor inputs of instructors with the requisite subject matter expertise and teaching ability.

Industry Details: The average unemployment rate in the Educational Services industry was 6.6% in 2009 with 149 mass layoff events reported. The future employment outlook is positive with a 13.6% increase projected between 2010 and 2020. 12.9% of wage and salary workers were members of unions with 15.2% being represented by unions. Union members earned about 11.4% more on average than did those not represented by unions. There were 74 work-related fatalities reported in 2009 with a rate of 2.4 injury and illness cases per 100 full-time workers.

Table A.55: Employment by Occupation: Educational Services

Occupation	Employment	Median Hourly Wage
Education administrators, elementary and secondary school	219,360	\$43.76
Elementary school teachers, except special education	1,405,560	\$26.44
Middle school teachers, except special and vocational education	639,670	\$26.57
Secondary school teachers, except special and vocational education	996,840	\$27.15
Teacher assistants	1,038,400	\$12.03

Table A.56: Summary statistics: Educational Services

Variable	Mean
Age	42.58
Hourly Wage	\$21.81
Years of Education	16.85
Total Firms	15,399.45
Firms: < 20 Employees	7,286.20
Firms: 20-99 Employees	6,147.02
Firms: 100-499 Employees	1,608.19
Firms: 500+ Employees	358.05
Total Employment	1,071,828.10
Employment for Firms w/ < 20 Employees	50,939.39
Employment for Firms w/ 20-99 Employees	273,645.62
Employment for Firms w/ 100-499 Employees	271,681.52
Employment for Firms w/ 500+ Employees	475,561.57
Total Payroll	\$35,176,007.13
Payroll for Firms w/ < 20 Employees	\$1,183,547.94
Payroll for Firms w/ 20-99 Employees	\$7,628,424.55
Payroll for Firms w/ 100-499 Employees	\$9,310,033.14
Payroll for Firms w/ 500+ Employees	\$17,054,002.98
Wage Dispersion: 10th-90th Percentiles / Median	1.48
Wage Dispersion: 25th-75th Percentiles / Median	0.76
N	8543

A.16 Health Care and Social Assistance

NAICS Description: The Health Care and Social Assistance sector comprises establishments providing health care and social assistance for individuals. The sector includes both health care and social assistance because it is sometimes difficult to distinguish between the boundaries of these two activities. The industries in this sector are arranged on a continuum starting with those establishments providing medical care exclusively, continuing with those providing health care and social assistance, and finally finishing with those providing only social assistance. The services provided by establishments in this sector are delivered by trained professionals. All industries in the sector share this commonality of process, namely, labor inputs of health practitioners or social workers with the requisite expertise. Many of the industries in the sector are defined based on the educational degree held by the practitioners included in the industry.

Industry Details: The average unemployment rate in the Health Care and Social Assistance industry was 4.9% in 2009 with 675 mass layoff events reported. The future employment outlook is positive with a 32.7% increase projected between 2010 and 2020. 7.5% of wage and salary workers were members of unions with 8.6% being represented by unions. Union members earned about 19.0% more on average than did those not represented by unions. There were 133 work-related fatalities reported in 2009 with a rate of 5.4 injury and illness cases per 100 full-time workers.

Table A.57: Employment by Occupation: Health Care and Social Assistance

Occupation	Employment	Median Hourly Wage
Home health aides	862,610	\$9.82
Licensed practical and licensed vocational nurses	619,000	\$19.68
Medical and health services managers	235,970	\$40.89
Nursing aides, orderlies, and attendants	1,349,220	\$11.53
Registered nurses	2,362,520	\$31.68

Table A.58: Summary statistics: Health Care and Social Assistance

Variable	Mean
Age	41.48
Hourly Wage	\$23.73
Years of Education	15.57
Total Firms	35,547.94
Firms: < 20 Employees	28,749.35
Firms: 20-99 Employees	3,972.90
Firms: 100-499 Employees	1,775.28
Firms: 500+ Employees	1,050.41
Total Employment	2,784,330.10
Employment for Firms w/ < 20 Employees	143,540.72
Employment for Firms w/ 20-99 Employees	159,550.25
Employment for Firms w/ 100-499 Employees	313,742.55
Employment for Firms w/ 500+ Employees	2,167,496.58
Total Payroll	\$134,419,056.30
Payroll for Firms w/ < 20 Employees	\$7,064,914.10
Payroll for Firms w/ 20-99 Employees	\$6,783,623.80
Payroll for Firms w/ 100-499 Employees	\$11,565,603.56
Payroll for Firms w/ 500+ Employees	\$109,004,914.57
Wage Dispersion: 10th-90th Percentiles / Median	1.34
Wage Dispersion: 25th-75th Percentiles / Median	0.76
N	11125

A.17 Arts, Entertainment and Recreation

NAICS Description: The Arts, Entertainment and Recreation sector includes a wide range of establishments that operate facilities or provide services to meet varied cultural, entertainment, and recreational interests of their patrons. This sector comprises (1) establishments that are involved in producing, promoting, or participating in live performances, events, or exhibits intended for public viewing; (2) establishments that preserve and exhibit objects and sites of historical, cultural, or educational interest; and (3) establishments that operate facilities or provide services that enable patrons to participate in recreational activities or pursue amusement, hobby, and leisure-time interests.

Industry Details: The average unemployment rate in the Arts, Entertainment and Recreation industry was 11.1% in 2009 with 389 mass layoff events reported. The future employment outlook is positive with a 17.8% increase projected between 2010 and 2020. 6.4% of wage and salary workers were members of unions with 7.1% being represented by unions. Union members earned about 13.5% more on average than did those not represented by unions. There were 87 work-related fatalities reported in 2009 with a rate of 4.9 injury and illness cases per 100 full-time workers.

Table A.59: Employment by Occupation: Arts, Entertainment and Recreation

Occupation	Employment	Median Hourly Wage
Actors	15,910	\$15.91
Amusement and recreation attendants	169,700	\$8.89
Fitness trainers and aerobics instructors	154,570	\$15.44
Gaming supervisors	5,850	\$21.46
Musicians and singers	29,590	\$25.45

Table A.60: Summary statistics: Arts, Entertainment and Recreation

Variable	Mean
Age	37.73
Hourly Wage	\$19.26
Years of Education	14.63
Total Firms	48,271.97
Firms: < 20 Employees	40,331.12
Firms: 20-99 Employees	6,159.50
Firms: 100-499 Employees	1,330.10
Firms: 500+ Employees	451.25
Total Employment	1,009,511.97
Employment for Firms w/ < 20 Employees	161,804.98
Employment for Firms w/ 20-99 Employees	249,085.06
Employment for Firms w/ 100-499 Employees	206,094.71
Employment for Firms w/ 500+ Employees	392,527.22
Total Payroll	\$22,911,401.48
Payroll for Firms w/ < 20 Employees	\$4,452,834.53
Payroll for Firms w/ 20-99 Employees	\$4,978,260.26
Payroll for Firms w/ 100-499 Employees	\$5,097,860.05
Payroll for Firms w/ 500+ Employees	\$8,382,446.13
Wage Dispersion: 10th-90th Percentiles / Median	1.63
Wage Dispersion: 25th-75th Percentiles / Median	0.73
Hourly Labor Output	\$51.26
Production Per Dollar of Labor	\$2.82
Output Per Worker	\$72,102.01
Hourly Labor Cost	\$18.17
N	1435

A.18 Accommodation

NAICS Description: Industries in the Accommodation subsector provide lodging or short-term accommodations for travelers, vacationers, and others. There is a wide range of establishments in these industries. Some provide lodging only; while others provide meals, laundry services, and recreational facilities, as well as lodging. Lodging establishments are classified in this subsector even if the provision of complementary services generates more revenue. The types of complementary services provided vary from establishment to establishment.

Industry Details: The average unemployment rate in the Accommodation industry was 12.5% in 2009 with 602 mass layoff events reported. The future employment outlook is positive with a 8.1% increase projected between 2010 and 2020. 7.8% of wage and salary workers were members of unions with 8.3% being represented by unions. Union members earned about 17.3% more on average than did those not represented by unions. There were 32 work-related fatalities reported in 2009 with a rate of 5.0 injury and illness cases per 100 full-time workers.

Table A.61: Employment by Occupation: Accommodation

Occupation	Employment	Median Hourly Wage
First-line supervisors/managers of housekeeping and janitorial workers	29,400	\$14.55
Hotel, motel, and resort desk clerks	214,930	\$9.64
Lodging managers	27,710	\$22.59
Maids and housekeeping cleaners	413,500	\$9.07
Waiters and waitresses	128,170	\$9.15

Table A.62: Summary statistics: Accommodation

Variable	Mean
Age	40.40
Hourly Wage	\$17.04
Years of Education	13.55
Total Firms	41,246.53
Firms: < 20 Employees	32,015.76
Firms: 20-99 Employees	7,495.80
Firms: 100-499 Employees	1,234.21
Firms: 500+ Employees	500.76
Total Employment	1,701,130.56
Employment for Firms w/ < 20 Employees	188,804.59
Employment for Firms w/ 20-99 Employees	264,853.71
Employment for Firms w/ 100-499 Employees	219,597.36
Employment for Firms w/ 500+ Employees	1,027,792.13
Total Payroll	\$41,381,874.13
Payroll for Firms w/ < 20 Employees	\$3,191,926.27
Payroll for Firms w/ 20-99 Employees	\$4,491,676.68
Payroll for Firms w/ 100-499 Employees	\$4,822,068.55
Payroll for Firms w/ 500+ Employees	\$28,875,401.89
Wage Dispersion: 10th-90th Percentiles / Median	1.29
Wage Dispersion: 25th-75th Percentiles / Median	0.59
Hourly Labor Output	\$54.57
Production Per Dollar of Labor	\$2.99
Output Per Worker	\$90,360.29
Hourly Labor Cost	\$18.25
N	917

A.19 Food Services and Drinking Places

Industries in the Food Services and Drinking Places subsector prepare meals, snacks, and beverages to customer order for immediate on-premises and off-premises consumption. There is a wide range of establishments in these industries. Some provide food and drink only; while others provide various combinations of seating space, waiter/waitress services and incidental amenities, such as limited entertainment. The industries in the subsector are grouped based on the type and level of services provided. The industry groups are full-service restaurants; limited-service eating places; special food services, such as food service contractors, caterers, and mobile food services; and drinking places.

Industry Details: The average unemployment rate in the Food Services and Drinking Places industry was 11.7% in 2009 with 1004 mass layoff events reported. The future employment outlook is positive with a 9.2% increase projected between 2010 and 2020. 1.3% of wage and salary workers were members of unions with 1.8% being represented by unions. The wage difference between union and non-union members was negligible. There were 119 work-related fatalities reported in 2009 with a rate of 3.4 injury and illness cases per 100 full-time workers.

Table A.63: Employment by Occupation: Food Services and Drinking Places

Occupation	Employment	Median Hourly Wage
Combined food preparation and serving workers, including fast food	2,334,020	\$8.69
Cooks, fast food	480,180	\$8.79
Cooks, restaurant	839,540	\$10.45
First-line supervisors/managers of food preparation and serving workers	602,070	\$13.75
Waiters and waitresses	1,996,830	\$8.90

Table A.64: Summary statistics: Food Services and Drinking Places

Variable	Mean
Age	31.32
Hourly Wage	\$12.95
Years of Education	13.29
Total Firms	372,085.76
Firms: < 20 Employees	293,394.11
Firms: 20-99 Employees	69,749.90
Firms: 100-499 Employees	7,274.50
Firms: 500+ Employees	1,667.25
Total Employment	9,013,531.73
Employment for Firms w/ < 20 Employees	1,698,234.40
Employment for Firms w/ 20-99 Employees	2,571,997.89
Employment for Firms w/ 100-499 Employees	1,249,435.20
Employment for Firms w/ 500+ Employees	3,493,864.24
Total Payroll	\$126,645,037.71
Payroll for Firms w/ < 20 Employees	\$23,649,655.22
Payroll for Firms w/ 20-99 Employees	\$35,856,601.99
Payroll for Firms w/ 100-499 Employees	\$16,822,541.08
Payroll for Firms w/ 500+ Employees	\$50,316,239.42
Wage Dispersion: 10th-90th Percentiles / Median	0.81
Wage Dispersion: 25th-75th Percentiles / Median	0.34
Hourly Labor Output	\$34.97
Production Per Dollar of Labor	\$2.67
Output Per Worker	\$46,892.19
Hourly Labor Cost	\$13.09
N	4830

A.20 Repair and Maintenance

Industries in the Repair and Maintenance subsector restore machinery, equipment, and other products to working order. These establishments also typically provide general or routine maintenance (i.e., servicing) on such products to ensure they work efficiently and to prevent breakdown and unnecessary repairs.

Industry Details: The average unemployment rate in the Repair and Maintenance industry was 9.8% in 2009 with 64 mass layoff events reported. The future employment outlook is positive with a 23.2% increase projected between 2010 and 2020. There were 112 work-related fatalities reported in 2009 with a rate of 3.8 injury and illness cases per 100 full-time workers.

Table A.65: Employment by Occupation: Repair and Maintenance

Occupation	Employment	Median Hourly Wage
Automotive body and related repairers	93,100	\$18.13
Automotive service technicians and mechanics	221,860	\$15.93
Cleaners of vehicles and equipment	117,240	\$9.01
First-line supervisors/managers of mechanics, installers, and repairers	48,380	\$26.03
Helpers—installation, maintenance, and repair workers	22,380	\$10.15
Painters, transportation equipment	22,910	\$18.95

Table A.66: Summary statistics: Repair and Maintenance

Variable	Mean
Age	38.61
Hourly Wage	\$17.54
Years of Education	13.51
Total Firms	88,843.37
Firms: < 20 Employees	85,722.38
Firms: 20-99 Employees	2,524.31
Firms: 100-499 Employees	372.88
Firms: 500+ Employees	223.80
Total Employment	474,145.42
Employment for Firms w/ < 20 Employees	320,550.55
Employment for Firms w/ 20-99 Employees	75,076.87
Employment for Firms w/ 100-499 Employees	28,505.31
Employment for Firms w/ 500+ Employees	49,992.65
Total Payroll	\$15,657,431.58
Payroll for Firms w/ < 20 Employees	\$9,967,193.29
Payroll for Firms w/ 20-99 Employees	\$2,712,504.31
Payroll for Firms w/ 100-499 Employees	\$1,006,669.23
Payroll for Firms w/ 500+ Employees	\$1,970,080.47
Wage Dispersion: 10th-90th Percentiles / Median	1.23
Wage Dispersion: 25th-75th Percentiles / Median	0.63
Hourly Labor Output	\$45.30
Production Per Dollar of Labor	\$2.33
Output Per Worker	\$85,263.95
Hourly Labor Cost	\$19.48
N	986

A.21 Personal and Laundry Services

Industries in the Personal and Laundry Services subsector group establishments that provide personal and laundry services to individuals, households, and businesses. Services performed include: personal care services; death care services; laundry and drycleaning services; and a wide range of other personal services, such as pet care (except veterinary) services, photofinishing services, temporary parking services, and dating services.

Industry Details: The average unemployment rate in the Personal and Laundry Services industry was 6.7% in 2009 with 68 mass layoff events reported. The future employment outlook is positive with a 6.4% increase projected between 2010 and 2020. There were 29 work-related fatalities reported in 2009 with a rate of 2.5 injury and illness cases per 100 full-time workers.

Table A.67: Employment by Occupation: Personal and Laundry Services

Occupation	Employment	Median Hourly Wage
Counter and rental clerks	58,490	\$9.04
First-line supervisors/managers of personal service workers	22,710	\$16.82
Hairdressers, hairstylists, and cosmetologists	318,020	\$10.92
Laundry and dry-cleaning workers	104,280	\$9.28
Pressers, textile, garment, and related materials	44,250	\$9.34

Table A.68: Summary statistics: Personal and Laundry Services

Variable	Mean
Age	38.14
Hourly Wage	\$15.99
Years of Education	13.84
Total Firms	41,955.35
Firms: < 20 Employees	39,758.64
Firms: 20-99 Employees	1,992.75
Firms: 100-499 Employees	154.64
Firms: 500+ Employees	2,557.72
Total Employment	315,768.80
Employment for Firms w/ < 20 Employees	151,720.88
Employment for Firms w/ 20-99 Employees	68,140.25
Employment for Firms w/ 100-499 Employees	24,092.65
Employment for Firms w/ 500+ Employees	50,384.29
Total Payroll	\$6,264,649.75
Payroll for Firms w/ < 20 Employees	\$2,634,073.49
Payroll for Firms w/ 20-99 Employees	\$1,450,103.40
Payroll for Firms w/ 100-499 Employees	\$528,796.81
Payroll for Firms w/ 500+ Employees	\$1,786,518.25
Wage Dispersion: 10th-90th Percentiles / Median	0.53
Wage Dispersion: 25th-75th Percentiles / Median	0.22
Hourly Labor Output	\$33.11
Production Per Dollar of Labor	\$1.93
Output Per Worker	\$50,872.77
Hourly Labor Cost	\$17.15
N	945

A.22 Religious, Grantmaking, Civic, Professional and Similar Organizations

Industries in the Religious, Grantmaking, Civic, Professional and Similar Organizations subsector group establishments that organize and promote religious activities; support various causes through grantmaking; advocate various social and political causes; and promote and defend the interests of their members.

Industry Details: The average unemployment rate in the Religious, Grantmaking, Civic, Professional and Similar Organizations industry was 4.9% in 2009 with 110 mass layoff events reported. The future employment outlook is positive with a 15.0% increase projected between 2010 and 2020. There were 29 work-related fatalities reported in 2009 with a rate of 2.4 injury and illness cases per 100 full-time workers.

Table A.69: Employment by Occupation: Religious, Grantmaking, Civic, Professional and Similar Organizations

Occupation	Employment	Median Hourly Wage
Clergy	22,610	\$19.55
Public relations specialists	36,530	\$23.92
Self-enrichment education teachers	19,130	\$15.63
Social and community service managers	15,520	\$28.57
Social and human service assistants	22,380	\$14.73

Table A.70: Summary statistics: Religious, Grantmaking, Civic, Professional and Similar Organizations

Variable	Mean
Age	44.30
Hourly Wage	\$21.27
Years of Education	16.37
Total Firms	117,784.43
Firms: < 20 Employees	106,560.71
Firms: 20-99 Employees	9,997.24
Firms: 100-499 Employees	1,014.05
Firms: 500+ Employees	212.43
Total Employment	1,112,167.82
Employment for Firms w/ < 20 Employees	483,681.18
Employment for Firms w/ 20-99 Employees	374,733.53
Employment for Firms w/ 100-499 Employees	152,131.15
Employment for Firms w/ 500+ Employees	101,476.99
Total Payroll	\$24,752,385.30
Payroll for Firms w/ < 20 Employees	\$9,118,655.41
Payroll for Firms w/ 20-99 Employees	\$8,074,076.71
Payroll for Firms w/ 100-499 Employees	\$4,261,559.64
Payroll for Firms w/ 500+ Employees	\$3,297,159.48
Wage Dispersion: 10th-90th Percentiles / Median	1.46
Wage Dispersion: 25th-75th Percentiles / Median	0.67
N	1161

Appendix B

Summary of Coefficient Estimates

Table B.1: Summary of Coefficient Estimates

Interaction Term	Coefficient	Interaction Term	Coefficient
Exp_FS1	0.0334***	Exp_WC_FS1	0.0457***
Exp_FS2	0.0465***	Exp_WC_FS2	0.0545***
Exp_FS3	0.0520***	Exp_WC_FS3	0.0570***
Exp_HS_FS1	0.00726***	Exp_BC_FS1	0.0245***
Exp_HS_FS2	0.0148***	Exp_BC_FS2	0.0354***
Exp_HS_FS3	.0142***	Exp_BC_FS3	0.0445***
Exp_C_FS1	.0394***	Exp_WCM_FS1	0.0625***
Exp_C_FS2	0.0483***	Exp_WCM_FS2	0.0825***
Exp_C_FS3	0.0496***	Exp_WCM_FS3	0.0754***
Exp_G_FS1	0.0855***	Exp_WC_HS	0.0265***
Exp_G_FS2	0.0862***	Exp_WC_C	0.0319***
Exp_G_FS3	0.0908***	Exp_WC_G	0.0336***
Exp_HS	0.0405***	Exp_BC_HS	0.0281***
Exp_C	0.0584***	Exp_BC_C	0.0261***
Exp_G	0.0623***	Exp_BC_G	0.0206***
Exp_WC	0.0533***	Exp_Mfg	0.0305***
Exp_BC	0.0331***	Exp_Svc	0.0352***
Exp_WCM	0.0738***	Exp_SISvc	0.0396***
Exp_Mfg_FS1	0.0175*	Exp_HWMR	0.0579***
Exp_Mfg_FS2	0.0322***	Exp_LWMR	0.0623***
Exp_Mfg_FS3	0.0449***	Exp_MWR	0.266***
Exp_Svc_FS1	0.00381***	Exp_WMR	0.000336***
Exp_Svc_FS2	0.00559***		
Exp_Svc_FS3	0.00680***		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Exp=Experience, FS1= Firm size 0-99, FS2=Firm size 100-499, FS3=Firm size 500+, HS=High School, C=College, G=Graduate School, WC=White Collar, BC=Blue Collar, WCM=Managerial White Collar, Mfg=Manufacturing, Svc=Services, SISvc=Skill-Intensive Services, HWMR=High Worker-Manager Ratio, LWMR=Low Worker-Manager Ratio, MWR=Manager-Worker Ratio, WMR=Worker-Manager Ratio