

Earnings Differentials by Industry: Testing the Theory of Compensating Wage Differentials

John Lauermann

Faculty Sponsor: Donna Anderson, Department of Economics

ABSTRACT

Previous research indicated that the relative attractiveness of a job affects the wages paid for that job. The theory of Compensating Wage Differentials argues that non-wage job benefits and detriments determine the disutility incurred working in various industries; this creates the need for a compensating wage differential. Thus it was hypothesized that there is an inverse relationship between the relative attractiveness of an industry of employment and the wages offered in those industries. A regression of earnings and industry of employment data from the 2002 "National Study of the Changing Workforce" was performed. It was found that the industry in which one works significantly affects earnings.

INTRODUCTION

Background

Many undesirable jobs offer comparatively high wages, given the level of skill needed to perform them. For example, workers in timber felling occupations (the most dangerous employment field in the USA, with an occupational fatality rate of 118 per 100,000) earn an average of \$60,000 in a nine month work-year (Christie, 2003). Fishermen in the Alaskan shellfish industry (which has an average of 400 deaths per 100,000 per year) earn over \$1,000 each day during the peak fishing season (Christie, 2003). Considering the low level of education needed to work in these occupations, these jobs offer extremely high salaries. This phenomenon is not uncommon. In fact, most dangerous, stressful, degrading, and repulsive occupations offer relatively high wages.

One explanation for the existence of high wages in undesirable work fields is offered by the theory of Compensating Wage Differentials. This theory argues that non-wage aspects of undesirable occupations decrease the supply of labor for those jobs. This decrease in labor supply increases the equilibrium wage in unattractive occupations, forcing employers to offer higher wages to attract a sufficient number of workers. This paper is an attempt to test the theory of Compensating Wage Differentials. The research detailed in this paper tests the relationship between the relative disutility associated with working in various industries, and the wages offered for working in those industries.

Theoretical Framework

The economic theory of Compensating Wage Differentials argues that the non-wage aspects of a job affect the wages that job offers, because those intangible aspects affect the supply of labor for that job. Negative job aspects will increase the relative disutility of working and decrease the number of people willing to perform that job, decreasing the supply of labor for that type of work. Employers offering unattractive jobs face a higher equilibrium wage in their particular labor market due to a decreased supply of labor. It is important to note that the higher wages these employers pay do not attract more people to an undesirable job market, which would increase the supply of labor. The higher wages are simply the equilibrium wage given the supply of labor in that industry: wages are high enough to offset the additional disutility workers must incur when working in the industry, but are not high enough to affect the supply of labor itself.

The theory also argues that jobs with positive intangible aspects will offer lower wages. Positive facets of an occupation will increase the number of people willing to supply their labor to that occupation; satisfying jobs will have a labor supply and a correspondingly low equilibrium wage. In that particular labor market, workers must pay a compensating wage differential, through lower wages, in order to work in an attractive job.

According to the Compensating Wages theory, there are several non-wage job aspects that affect labor supply, thus necessitating compensating wages. These include:

- 1) The risk of injury on a job: industries that are more dangerous must pay compensating wages to attract workers.
- 2) The fringe benefits of a job: the presence of benefits offered by employers, like health insurance and pension plans, will increase the supply of labor for that job and decrease wages. Conversely, employers that do not offer fringe benefits may face a smaller labor supply and the need to pay compensating wages.
- 3) The location of a job: jobs that are located in unattractive locations, like remote logging or mining camps, need to offer compensating wages; whereas jobs in attractive locations will offer lower wages.
- 4) Job security: insecure occupations with irregular work schedules, like real estate sales, are unattractive to many workers, so higher wages must be paid; in contrast, secure jobs attract workers, which allows employers to pay lower wages.
- 5) The prospect of wage advancement: low advancement potential will force employers to offer higher starting wages, while greater future earning potential will convince workers to accept low starting wages.
- 6) Extent of control over work: employees who have rigid schedules, like factory workers, are often paid a compensating wage, while other workers pay for job flexibility through lower wages.

This paper examines the compensating wage differentials associated with different industries of employment. Higher wages paid in some industries, like manufacturing, mining, and transportation, are probably the result of a compensating wage paid because jobs in these industries are often dangerous, located in unattractive areas, and offer little control over work pace and schedule. Lower wages paid in some industries, like services, trade, or agriculture might be due to compensating lower wages, since these industries offer a high level of flexibility to the worker, and are often located in more attractive areas.

Literature Review

Overall, the literature reviewed for this study supports the Compensating Wage Differentials theory, but some studies found that other factors sometimes outweigh the compensating wage effect. In her recent study, McCrate (2005) tests whether flexibility at work actually decreases earnings, and whether this is why women earn less than men. Using data from the 1991 Comparative Project in Class Analysis, a survey of work place authority and autonomy conducted by a team of US and Russian sociologists, she found that workplace flexibility does decrease earnings, but this is not why women earn less, since fewer women have flexible job schedules than men. McCrate's research suggests that there is a compensating wage effect, but it is often outweighed by other factors, like discrimination or human capital differentials.

In their 1983 study, Duncan and Holmlund tested whether on-the-job stress would create the need for a compensating wage. After analyzing data from the 1968 and 1974 Swedish Level of Living Survey, a survey of 1200 Swedish workers, they found that stressful jobs do offer significantly higher wages. In fact, they found that working in a hectic and stressful environment increased wages by 3.3%. Both reviewed studies support the Compensating Wage Differentials theory by demonstrating that the negative aspects of work increase wages while positive aspects decrease wages, probably due to a compensating wage differential.

RESEARCH PURPOSE

This paper tests the theory of Compensating Wage Differentials by examining the relationship between individuals' annual earnings and their industry of employment. Specifically, I hypothesize that there is an inverse relationship between the relative attractiveness of an industry of employment and the wages offered in those industries. This study is significant in its pertinence to the issue of labor exploitation. If the Compensating Wage theory is correct, then logically, all unattractive jobs should offer relatively high wages, given the level of skill needed to perform the job. Unfortunately, some monopsonist employers are able to pay workers low wages for highly undesirable work. For example, a sales-clerk position at Wal-Mart has many negative intangible aspects: employees must work long and irregularly scheduled shifts, work in a constantly hectic environment, and deal with numerous irate and abusive customers. If Wal-Mart was not setting wages, it would have to pay its clerks more than clerks employed at less stressful locations (like high-end department stores). However, the median hourly wage of a Wal-Mart clerk is \$8.50 (Noah, 2005). Working full time at that wage, a person with a household of four earns \$2300 below the federal poverty threshold of \$20,000 per year (US Health and Human Services, 2006). Though the significance of Wal-Mart as a wage setter is beyond the scope of this paper, the exceptionally low wages it pays suggests that it is exploiting workers in the extreme. In a competitive labor market, Wal-Mart employees would be paid a reasonable equilibrium wage, presumably one that keeps them out of poverty, since individuals in a competitive labor market would refuse to work for below-subsistence level wages, and a compensating wage.

RESEARCH DESIGN

Description of Data

The data used in this study is obtained from the 2002 “National Study of the Changing Workforce” (NSCW) (Bond, et al, 2002). This data is collected every five years by the Families and Work Institute, a non-profit organization that monitors American workforce, family, and community trends. This is a survey of over 2500 people working in the American workforce. It covers over 600 fields related to workers, their jobs, and their earnings, as well as data related to their family life.

For this research, the hypothesis is tested using multivariate regression on a sample of 2491 US workers. The dependent variable of the regression is the log of annual personal earnings. The independent variables include: the respondent’s level of education, measured with the discrete values of 1.00=no high school education, 2.00=high school degree, 3.00=some college education, 4.00=associates degree, 5.00=bachelor’s degree, and 6.00=graduate degree; the total years spent in the labor force since the respondent was 18 years old; the respondent’s experience squared; and the respondent’s gender, coded as 0=female and 1=male. These variables are included as controls because past research has show that education, experience, and gender affect earnings.

The other independent variables of the regression are the respondents’ industry of employment. These industries are defined by the US Census as:

- 1) Agriculture, forestry, fishing, and mining
- 2) Manufacturing: this includes all types of goods assembly occupations.
- 3) Construction
- 4) Transportation, communication, and public utilities: this industry includes all occupations related to the transportation of goods, the provision of communication services (like telecommunications), and the maintenance of public utilities.
- 5) Trade: this industry encompasses both retail and wholesale trade.
- 6) Finance, insurance, and real estate
- 7) Services: this category of industry includes all occupations related to the provision of professional, technical, educational, and medical services.
- 8) Public administration: this industry includes all government employed occupations

Since it is the largest industry of employment, the service industry is the omitted benchmark variable in the regression to which all other industries are compared.

Descriptive Statistics

The descriptive statistics, as shown in Table 1, reveal the following trends for the data fields. First, the mean of the respondents’ earnings is \$45,332. The respondents have spent an average of 21.13 years in the labor force. The education variable reveals that the respondents have a mean education level of 3.22; this corresponds to some college education without a degree. The descriptive statistics also reveal that 51.32% of the respondents are female and 48.68% are male.

Table 1: Descriptive Statistics
 Note: for variables 7-14 0=No and 1=Yes

Variable	Sample	
	Valid % or Mean	Std. Dev.
Yearly Earnings	\$45,332.43	75430.93
Education Level	3.2253	1.5433
Years in Labor Force	21.13	12.441
Respondent Gender		
Male	48.68	-
Female	51.32	-
Industry of Employment		
Agriculture, Forestry, Fishing, Mining	2.47	-
Construction	7.40	-
Manufacturing	13.20	-
Transportation, Communications, and Utilities	8.68	-
Wholesale and Retail Trade	18.56	-
Finance, Insurance, and Real Estate	5.46	-
Services	39.41	-
Public Administration	4.82	-
N	2491	

As the Table 1 reveals and Figure 1 displays graphically, the respondents' fields of employment are highly oriented towards tertiary sector industries: the service industry, the largest industry of employment, employs 39.41% of the respondents while trade industries employ 18.56%; transportation, communication, and utility industries employ 8.68%; finance, insurance, and real estate industries employ 5.46%. The mining, forestry, fishing, and agricultural industries employ 2.47% of the respondents. Finally, 13.2% of the respondents work in the manufacturing sector.

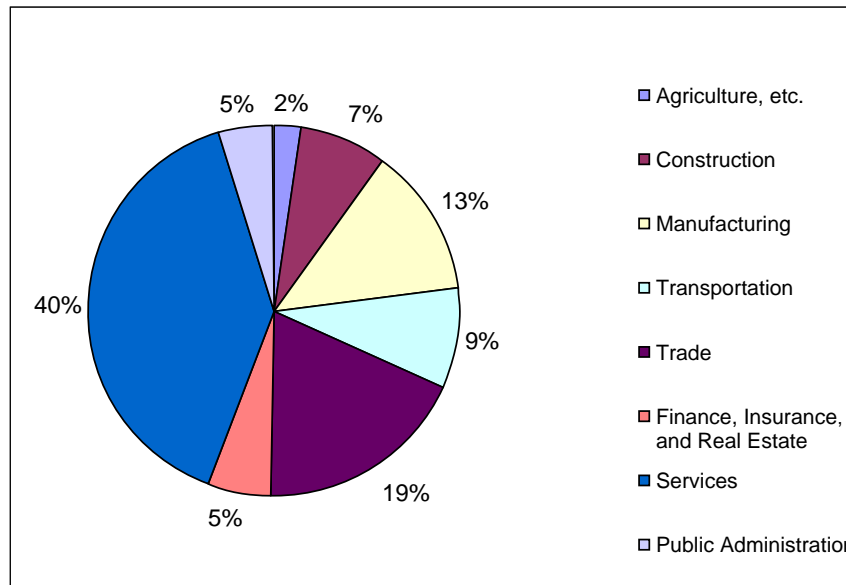
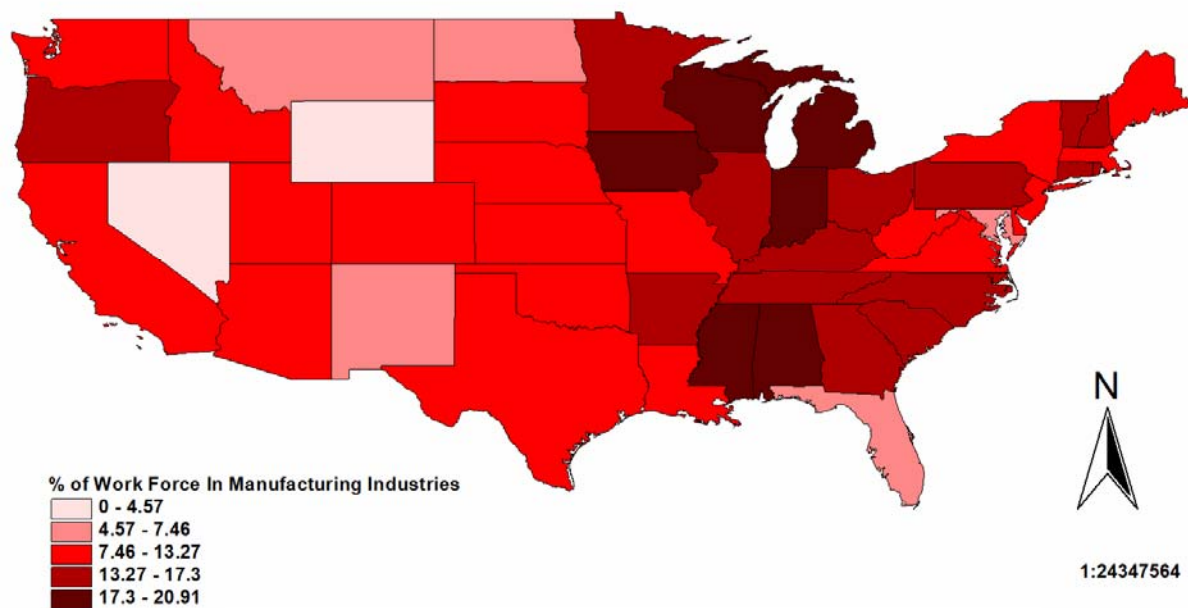


Figure 1: Respondent Employment by Industry

While it is not the largest source of US jobs, the manufacturing sector is an important employment base: over one in eight American workers are employed in manufacturing related jobs. An analysis of US Bureau of Labor Statistics data reveals that the significance of manufacturing as an employer varies geographically. As Figure 2 shows, manufacturing is most significant as a source of employment to the residents of the central Midwest and central South. In the states of Indiana, Iowa, Michigan, and Wisconsin, 17-21% of the labor force relies on manufacturing for employment; a similar proportion of the work force in Alabama and Mississippi rely on secondary sector jobs. Of particular interest is the fact that Wisconsin is one of the most significant states in the nation in terms of workforce dependency on manufacturing: 20.7% of the state's workers are employed in manufacturing.



**Figure 2: Employment in Manufacturing
By US State, 2002**

Source: *Geographic Profile of Employment and Unemployment, 2002*
US Bureau of Labor Statistics

The map of workforce dependency on manufacturing also reveals that manufacturing industries are not important fields of employment in the West and in some states of the South. Throughout the sparsely populated states of the Great Plains less than 10% of the workforce is employed in manufacturing; this is not surprising, since most of these states have no large populations to support manufacturing activities. In the recently developed states of California, Florida, and Texas (having experienced most growth after 1900) no more than 13% of the labor force works in manufacturing, a legacy of these states' late development, after manufacturing had begun to decline as a source of employment in the USA.

RESULTS AND ANALYSIS

Table 2 displays the results of the regression. As expected, all of the control variables of the study are significantly related to earnings. There is enough evidence to conclude the following: a year of experience increases earnings by 5.9%; each year of experience different from the mean experience different from the mean experience level of 21.13 years (measured by experience squared) decreases earnings by 0.2%; an additional level of education increases earnings by 18.5%; and finally, being a woman decreases earnings by 41.2%.

Table 2: Regression Results
Dependent Variable: Log of Annual Earnings, 2002
Benchmark Variable: Services

Independent Variable	Coefficient (P-value)
CONSTANT	9.153 (.000)
EDUCATION LEVEL	.185 (.000)
YEARS IN LABOR FORCE	.059 (.000)
YEARS IN LABOR FORCE ²	-.001 (.000)
GENDER	-.412 (.000)
AGRICULTURE, FORESTRY, FISHING, AND MINING	-.005 (.961)
CONSTRUCTION	.221 (.001)
MANUFACTURING	.240 (.000)
TRANSPORTATION, COMMUNICATION, UTILITIES	.176 (.003)
WHOLESALE & RETAIL TRADE	-.094 (.043)
FINANCE, INSURANCE, REAL ESTATE	.271 (.000)
PUBLIC ADMINISTRATION	.261 (.000)

Table 2 also displays the results of the test of relationship between earnings and the industry of employment. All but one of these variables are significantly related to earnings: the p-values of the relationship between earnings and employment in the manufacturing, agriculture, transportation, finance, and public sector industries are less than 5%, allowing me to conclude that working in these industries does affect earnings. In fact, compared to working in services, people working in manufacturing earn 24% more, those employed in finance earn 27% more, workers in transportation earn 17.6% more, construction workers earn 22% more, workers employed in trade earn 9.4% less, and workers in the public sector earn 26% more.

According to the Compensating Wage Differentials theory, these earnings differences might exist because:

- Manufacturing, construction, and transportation jobs offer higher wages because they are more dangerous and stressful, and less flexible than service jobs.
- Finance, insurance, real estate, and public sector jobs are less flexible and less stable than services, increasing wages, but differentials might also exist due to the higher amount of human capital needed to work in finance and government.
- Trade industry jobs are more flexible than service jobs, thus these jobs offer lower wages.

Finally, given the high p-values of the relationships between earnings and employment in mining, forestry, fishing, and trade, there is not enough evidence to conclude that working in these industries affects earnings.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The theory of Compensating Wage Differentials tries to explain earnings differentials by arguing that the non-wage aspects of jobs affect the supply of labor for those jobs. This in turn determines the wages that are paid to workers for performing those jobs. This study has found that working in some industries affects earnings. Workers in the manufacturing, transportation, finance, and public sector industries earn more, while retail and wholesale trade workers earn less, compared to workers in the service industry. These findings support the theory of Compensating Wages, since one reason for wage differentials in these industries may be the presence of compensating wages.

Recommendations

Based on the findings of this study, one may conclude that there are negative aspects to working in industries that offer compensating wages. Working in these industries is dangerous, degrading, inconvenient, or in some other way unattractive to workers. As a society, we can eliminate the factors creating the need for compensating wages by improving technology and changing some of our unnecessary preferences. For example, manufacturing jobs could be much safer if stricter workplace safety laws were implemented and technologies were improved. Transportation jobs would not have to pay a compensating wage if roads were safer and if drivers did not need to work constantly to meet our demands for readily available goods. (For example, food distributors need to make deliveries on holidays so stores can remain open). Finally, the trade industry is an anomaly in that it offers relatively low wages, despite the many negative aspects of the work: e.g. long irregular work schedules and a hectic working environment. This may be explained by monopsonist elements in the trade labor market, or by the low human capital requirements for working in trade (especially in retail). Future policies could increase wages in this industry by correcting any monopsonist elements and by increasing the productivity of trade workers through education and training.

Limitations of the Study

First, the study only applies to the people like the 2800 people surveyed in the source data: US salaried and wage workers. All others, like non-Americans or people who are self employed, are not studied. The statistical research specific to this paper also is limited in that it does not factor in a number of independent variables which might affect earnings, such as race, individual abilities, quality of education, and factors that might affect the relative value of human capital, like geographic location. For example, a degree in Spanish is worth relatively less in Alaska than in Texas. Finally the study does not analyze the effect of the cost-of-living on earnings. Some industries pay more because they are located in areas that have a higher cost of living. Future studies could eradicate this shortcoming by analyzing real earnings instead of gross earnings.

REFERENCES

- Bond, J., Galinsky, E., and Swanberg, J., *The National Study of the Changing Workforce*. New York, NY: The Families and Work Institute, 2002.
- Christie, Les. "America's Most Dangerous Jobs." *CNNMoney.com*. 13 Oct. 2003. 12 Dec. 2005. <<http://money.cnn.com/2003/10/13/pf/dangerousjobs/>>
- Duncan, Greg, Bertil Holmlund. "Was Adam Smith Right After All? Another Test of the Theory of Compensating Wage Differentials." *Journal of Labor Economics* 1.4 (1983): 366-379
- McCrate, Elaine. "Flexible Hours, Workplace Authority, and Compensating Wage Differentials in the US." *Feminist Economics*, March 2005: 11-39
- Noah, Timothy. "The Wal-Mart Manifesto." *Slate.com*. 24 Feb.2005. 12 Dec.2005 <<http://www.slate.com/id/2113954/>>
- U.S. Bureau of Labor Statistics. "Table 16. States: Employment status of the experienced civilian labor force by industry, 2002 annual averages." *Geographic Profile of Employment and Unemployment, 2002*. 2004. 12 Dec. 2005. <http://www.bls.gov/opub/gp/pdf/gp02_16.pdf>
- U.S. Department of Health and Human Services, "The 2006 HHS Poverty Guidelines." 24 Jan.2006. 20 April 2006. <<http://aspe.hhs.gov/poverty/06poverty.shtml>>