A Statistical Analysis of Firm Size, Employment, Revenue, and Wage Relationships

McKara Street

Benson School of Business, Southern Wesleyan University

STAT 3123: Applied Statistics

Professor Laura Timmerman

December 1, 2025

A Statistical Analysis of Firm Size, Employment, Revenue, and Wage Relationships

The dataset from the United States Census Bureau [USCB] (2025) analyzed in this study represents U.S. firms categorized by size, total employment, payroll, employee wages, and revenue. This dataset provides insight into labor market dynamics and firm-level economic activity and demonstrates how characteristics of an organization influence workforce and compensation outcomes. The purpose of this analysis is to assess the relationships between firm size, total employment, total annual payroll, employee wages, and revenue to provide key insights into broader economic patterns and labor market structures. The findings will quantify how larger firms contribute to total employment and payroll in the U.S. and how characteristics of an organization affects employee compensation (USCB, 2025). Previous research supports these findings and demonstrates that larger and more productive firms typically pay higher wages and employ more workers (Arellano-Bover, 2024; National Bureau of Economic Research [NBER], 2024).

Firm Size, Employment, and Payroll Relationships

Correlation Analysis

Two correlations were chosen for their strong linear relationships and ability to clearly define how firm size relates to employment and payroll (Larson, 2023; USCB, 2025). The two chosen correlations are the correlation between the midpoint of firm size and total employment and the correlation between total employment and total annual payroll. The correlation between firm size and total employment is an of "r" 0.9711 indicating a very strong positive linear relationship between the midpoint of firm size and total employment. As the midpoint of firm size increases, total employment across the category also increases. This almost perfect correlation suggests that larger firms consistently employ more workers which aligns with

findings from Arellano-Bover (2024) who demonstrated that employment at larger firms is associated with higher wages and better career outcomes. Additionally, the correlation between total employment and total annual payroll is an "r" of 0.9973 indicating a very strong positive linear relationship between total employment and the total annual payroll for category indicating that as employment increases, the total annual payroll also increases. This correlation also suggests that larger firms pay higher total annual payrolls supported by NBER (2024) which shows that firm-level productivity and structure drive payroll increases as workforce size grows (Larson, 2023; USCB, 2025).

Regression Lines and Predictions

Regression equations were identified between each of the two correlations to quantify the linear relationships (Larson, 2023; USCB, 2025). The regression line derived from the correlation of 0.9711 represents total employment as a function of the midpoint firm size. The regression equation demonstrates that total employment is 2,237.01 times the firm size in addition to 2,770,873.29 as shown in *Appendix A*, along with its scatter plot. This regression indicates that as firm size increases, total employment increases. The slope of 2,237.01 employees represents the average increase in total employment for each additional unit increase in firm size. Equally important, the intercept of 2,770,873.29 employees represents the baseline total employment when a firm size is zero. Using this regression, predicted values are used to demonstrate the scaling effect of firm size on total employment. If a firm has one hundred employees, one can expect the total employment for the category to be 2.99 million employees. If a firm has one thousand employees, one can expect the total employment for the category to be 5.01 million employees. Finally, if a firm has ten thousand employees, one can expect the total employment for the category to be 25.14 million employees. As the firm size increases from one

hundred employees to ten thousand employees, the prediction of total employment for the category increases from 2.99 million employees to 25.14 million employees, further indicating that the larger the firm's size, the more people are employed (Larson, 2023; USCB, 2025).

As for the total employment for the category and total annual payroll for the category, total annual payroll is 75.66 times the total employment minus 56,781,343.46 as shown in *Appendix B* (Larson, 2023; USCB, 2025). The slope of 75.66 indicates that each additional employee contributes approximately $75.66 thousand to total payroll. The intercept of negative 56,781,343.46 represents the adjustment in the regression; however, the overall trend remains strongly positive. This regression equation indicates that as total employment increases, total annual payroll increases. The predicted values show that as total employment increases from three million employees to 40 million employees, one can expect the total annual payroll to increase from 170 billion employees to 2.97 trillion employees. The results prove that payroll increases proportionally with employment which is consistent with the findings of NBER (2024). NBER (2024) demonstrated that within-firm productivity and organizational structure contribute to higher payroll expenditures as workforce size increases (Larson, 2023; USCB, 2025).

Hypothesis Testing

For both hypothesis tests, the null hypothesis is that no significant correlation exists, and the alternative hypothesis is that a significant correlation exists (Larson, 2023; USCB, 2025). The claim lies in the alternative hypothesis giving the ability to prove that the two variables have significant correlations. In hypothesis testing for the correlation and regression between midpoint of firm size and total employment with an alpha level of 0.05, the test statistic found is 18.66. The test statistic leads to a rejection of the null hypothesis supporting the claim that there is a

significant correlation between the midpoint of firm size and total employment (Larson, 2023; USCB, 2025).

In hypothesis testing for the total employment and total annual payroll for the category with an alpha level of 0.05, the test statistic found is 62.19 (Larson, 2023; USCB, 2025). The test statistics lead to a rejection of the null hypothesis meaning that there is enough evidence to support the claim that there is a significant correlation between total employment and total annual payroll. The results of the hypothesis tests indicate that the identified correlations are statistically significant (Larson, 2023; USCB, 2025).

Multiple Regression of Revenue, Firm Size, and Wages

A multiple regression analysis was performed to identify the effect of firm size and mean revenue on mean salary per employee (Larson, 2023; USCB, 2025). The mean salary per employee is 53,791.61 minus 0.00012 times the mean revenue per firm in a category plus 55.62 times the midpoint of firm size. The coefficient of the midpoint of 55.62 indicates that each additional employee at the firm level increases mean salary per employee by $55.62 thousand. The coefficient for mean revenue is negative 0.00012 indicating that firm size has a stronger effect on employee wages than revenue. One can predict based on the regression equation that as revenue and firm size increase, the average employee salary increases. As mean revenue goes from 5 million to 100 million and a firm's midpoint size goes from two hundred employees to fifteen hundred employees, the mean pay per employee increases from $64,383.03 to $126,558.79 (Larson, 2023; USCB, 2025).

The result of the multiple regression illustrates that larger firms employ more workers, pay higher total payrolls annually, and offer higher average salaries per employee (Larson, 2023; USCB, 2025). This finding aligns with Arellano-Bover's (2024) research, which shows that

larger firms provide higher wages and better career outcomes. Equally important, NBER (2024) demonstrates that firm-level characteristics affect salary and payroll differences among firms. The collective findings highlight the structural importance of firm size in determining employee compensation (Larson, 2023; USCB, 2025).

Biblical Application

Biblical principles provide a foundation for understanding wages, work-ethic, and the treatment of employees. Scripture consistently emphasizes that workers deserve fair compensation as stated in Timothy 5:18 (King James Version, n.d.), "For the scripture saith, thou shalt not muzzle the ox that treadeth out the corn. And, The labourer is worthy of his reward." Timothy 5:18 indicates that paying employees fairly reflects the justice that God uses. Furthermore, Colossians 3:23 commands Christians to have a healthy work-ethic as unto the Lord instead of men. This work-ethic extends to employers instructing how they should demonstrate integrity and care in all business operations. Finally, when a lawyer asked Jesus "And who is my neighbour?" Jesus replied with the story of the Good Samaritan (King James Version, n.d., Luke 10:29). The story proved that the Samaritan was "neighbour" to the man who fell among thieves giving a portrayal to employers that all employees should be treated with compassion and care. Caring for employees through fair wages, a healthy work-ethic, and compassionate treatment fulfills ethical standards and gives glory to God (King James Version, n.d.).

Conclusion

Through a statistical analysis using correlations, regressions, predictions, and hypotheses, multiple strong conclusions are drawn about labor market dynamics (Larson, 2023). The findings of this study confirm strong linear correlations between firm size and total employment and total

annual payroll and total employment (Larson, 2023; USCB, 2025). Furthermore, larger firms employ more workers, pay higher total annual payrolls, and offer higher average salaries per employee. Overall, the statistical findings are supported by empirical research provided by Arellano-Bover (2024) and the NBER (2024) which allow a quantitative foundation for understanding how firm-level characteristics influence workforce outcomes (Larson, 2023; USCB, 2025).

References

Arellano-Bover, J. (2024). *Career Consequences of Firm Heterogeneity for Young Workers: First Job and Firm Size.* Journal of Labor Economics, 42(2), 549–589.

King James Version. (n.d.). Bible Gateway. https://www.biblegateway.com/versions/King-James-Version-KJV-Bible/

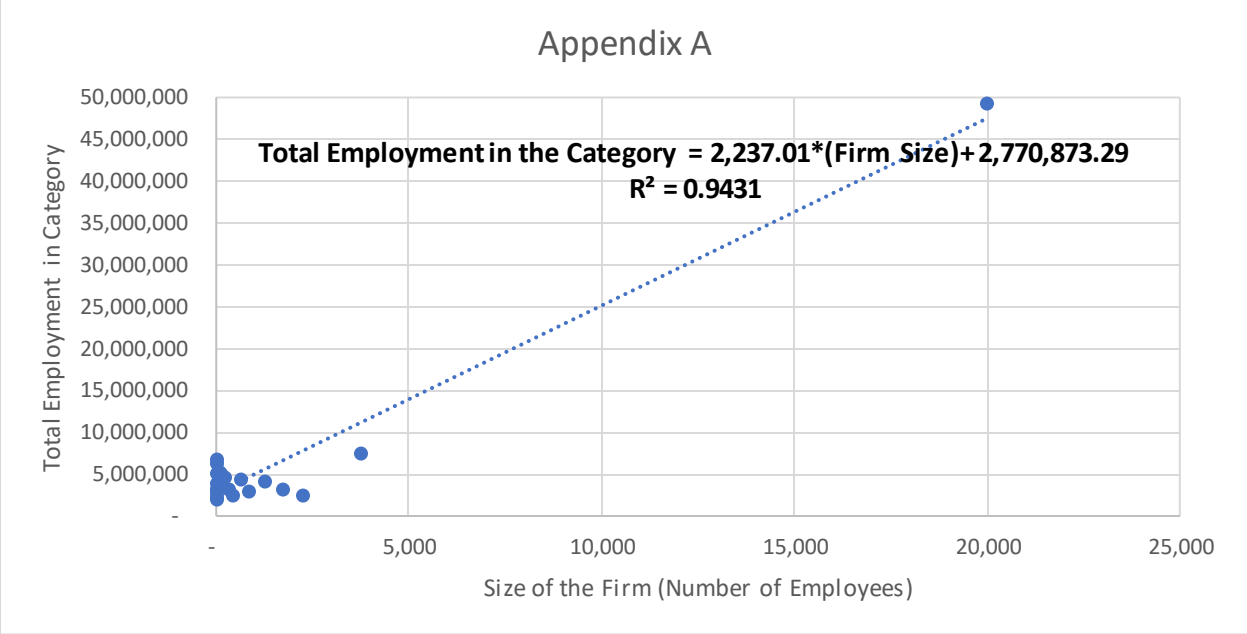
Larson, R. (2023). *Elementary Statistics: Picturing the World* (8th ed.). Pearson Education Inc.

National Bureau of Economic Research. (2024). *Within-Firm Pay Inequality and Productivity* (Working Paper No. 32240). https://www.nber.org/papers/w32240

United States Census Bureau. (July 22, 2025). *2022 SUSB annual data tables by Establishment Industry*. Census.gov. https://www.census.gov/data/tables/2022/econ/susb/2022-susb-annual.html

Appendix A

Appendix A presents the scatter plot demonstrating the relationship between firm size and total employment. The plot shows a clear upward trend, indicating that as firm size increases, total employment increases. Additionally, the data points closely follow the regression line, supporting a strong correlation.



Appendix B

Appendix B displays the scatter plot demonstrating the relationship between total employment and total annual payroll. The plot presents an upward trend, indicating that as total

employment increases, total annual payroll also increases. Additionally, the data points closely follow the regression line, supporting a strong correlation.