Pay for Graduates of Different Levels of Higher Education

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***Abstract* –**

# I. Introduction

This project focuses on identifying the pay discrepancies between individuals with a bachelor's degree compared to people with a master's degree working the same position. This project also focuses on calculating the return on investment for getting a bachelor’s degree and comparing it with the ROI for a master’s degree. Finding out the ROI is important because a master’s degree is a big time and financial commitment, and one should know if it is worth it to them to get a master's degree, or if they should stay with their bachelor's degree.

# II. Datasets

## A. Source of Datasets

The main source of data used for this project came from payscale.com. PayScale is a reliable data source as it uses real-time data submitted by user’s and is used by both businesses and employees to find out if the pay for a certain position is adequate. Unfortunately, you cannot download a csv file directly so the desired job positions had to be manually imputed into a custom csv file that then could be used to create useful charts and diagrams.

## B. Character of Datasets

The data is ordered by Degree Type, followed by the Major, Average Pay and Profession type. The data has 62 entrees, including both bachelor's and master’s degrees. It is important to note that the currency used for Pay is in U.S. Dollars as that is what currency PayScale provided. The data was cleaned by only using specific Profession Types: Engineer, Developer, Analyst, Manager, and Administrator.

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Fig. 1. Example of Dataset

# III. Methodology

In this project, the primary language programming used was Python. Python was picked because of the libraries that can be used to generate charts and graphs to help visualize and analyze the data. Python was also used because calculations can be easily made in this language which proved to be useful when calculating averages and return on investment percentages.

## Numpy

Numpy is utilized in many ways for this project. One way that Numpy is used is to read the data from the csv file, which allows the use of data inside to create visualizations. Numpy also helps to sort the data in a way that makes it more useful for other parts of the program to do mathematical operations and to create custom charts.

## B. matplotlib.pyplot

This library is crucial to this project, and without it this project could not exist. Matplot is what creates all the visualizations. Some examples of how Matplot is being utilized is the plt.bar and plt.scatter functions. These functions are being used to create bar and scatter plots with the data provided from Numpy. With Matplot the following visualizations were created: ROI Comparison bar chart, Average Pay Comparison bar chart, Pay distribution by job title for Bachelors and Masters scatter plot and the Average pay by job type for Bachelors and Masters scatter plot.

## C. ROI Calculation

One important criterion for this project was the ROI (Return on Investment) calculation. The calculation was preformed using the same formula as PayScale [1] uses: ((Earnings after 20 years of work) – (total cost of education)) / (total cost of education). To get the total cost of education the cost of attending WIT was used. For a bachelor’s degree the cost came to $255,352 and for a master’s degree it came to $295,352. A screenshot of a computer code

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Fig. 2. ROI Calculation

# IV. Results

After all the data has been gathered, cleaned, organized, and made into useful graphs. Overall, the data shows us that on average staying with a bachelor’s degree makes more financial sense.

## A. ROI Comparison

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Fig. 3. ROI Bar Chart

When comparing the ROI percentages side by side, we can see that overall, a bachelor's degree has a significantly higher ROI than a master's degree with bachelor’s being 5.59% and master’s being 5.18% overall.

## B. Average Pay Comparison

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Fig. 4. Average Pay Comparison Bar Chart

On average someone with a bachelor’s degree earns $84,077 and someone with a master’s degree earns $91,260. The difference in annual salary between the two degree types is $7,183 with people that have a master's degree earning on average 8.55% more than people with a bachelor's degree.

## C. Average Pay by Job Type

Across the field, someone with a master’s degree makes more than someone with a bachelor's degree. Administrators make $4,200 more, analysts make $4,900 more, developers make $5,700 more, engineers make $7,300 more, and managers make $10,600 more. What this shows is that getting a master’s degree does not guarantee you a consistent salary increase as it varies significantly from each individual job type.

# V. Discussion

One shortcoming of this project is that the dataset is very limited. The data had to be manually selected and imported which led to less data that could be analyzed. One improvement to this project would be to find a different dataset that allows for mass export of data so that more accurate graphs could be created that can reflect more data and can reflect more types of job fields.

Another weakness of this project is that for the return-on-investment calculation, the WIT cost of attendance was taken. Wentworth has a higher-than-average cost of attendance, which can alienate a subset of the population reviewing the results of this project as the return on investment would not be applicable to them. Next time the ROI should be calculated using the national average for cost of attendance for both private and public universities.

# VI. Conclusion

In conclusion, this project showed that overall getting a master’s degree results in a lower return-on-investment over a 20-year period compared to obtaining a bachelor's degree. The project also showed us that the average pay for someone with a master's degree is 8.55% higher than an individual with a bachelor's degree, with the average wage of someone with a master's degree being $7,183 more than someone with a bachelor's degree. What the data also showed is that the difference in pay between the two degrees vary between job types with administrators gaining the least wage with a master's degree, and managers gaining the most.

# References

[1] Payscale’s College ROI Report methodology. College ROI Report (2024). Available at: https://www.payscale.com/college-roi/methodology. (Accessed: 5th December 2024)