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**MONTGOMERY COUNTY EMPLOYEES’ SALARY ANALYSIS: TRENDS AND INSIGHTS**

Montgomery County, Maryland, provides an intriguing landscape for examining the intersection of employee salaries, inflation, and economic trends. This project focuses on Montgomery County employee salary data from 2019 to 2023, aiming to uncover insights into salary growth, alignment with inflation rates, and disparities such as gender pay gaps. Through this analysis, the study seeks to answer critical questions: how have salaries evolved over time, particularly in relation to inflation? Is there a gender pay gap, and how does it manifest across departments and job grades? What are the patterns in salary differences across various sectors? The findings from this analysis could provide valuable insights into workforce equity and economic trends.

The datasets used include Montgomery County employee salaries (2019, 2020, 2021, 2022, and 2023) retrieved from the Montgomery County Government's public data repository, DataMontgomery, and Consumer Price Index (CPI) from the Bureau of Labor Statistics for the Philadelphia-Camden-Wilmington area which serves as a proxy for inflation trends in Montgomery County. Additionally, the United States Employment Cost Index supplements the data, offering a broader perspective on national compensation trends. The salary data contains key variables such as base salaries, job grades, gender, and departmental affiliations, while the CPI dataset provides a benchmark for understanding inflationary trends. Records with incomplete or missing data were excluded to maintain analytical rigor. Summaries of these datasets are presented to contextualize the findings.

The goals of this project extend beyond descriptive statistics to a deeper understanding of how salary growth correlates with inflation and other factors. Insights into the gender pay gap and its departmental variations offer a lens into equity within the workforce. Moreover, by exploring job grades and their associated salary levels, the analysis highlights structural disparities and areas for improvement. These goals are pursued using Python as the primary analytical tool, leveraging libraries such as Pandas for data manipulation, Matplotlib for visualization, and Seaborn for exploratory data analysis.

Data cleaning and pre-processing were pivotal to ensure the accuracy and usability of the datasets. The CPI data was formatted to include only annual averages, with non-numeric and missing values removed. For the salary data, annual statistics such as mean, median, and percentiles were calculated. This involved grouping data by year and merging it with CPI values to allow for a comparative analysis of salary growth against inflation. Standardized naming conventions were implemented, including updating department names ("DLC" to "ABS") and renaming "Department of Liquor Control" to "Alcohol Beverage Services" for consistency across years. Placeholder entries for "Grade 0" from 2019 and 2020 were dropped, as they were not part of the official salary schedule, aligning with executive roles under EX1, EX2, and EX3 to avoid irregularities. The detailed steps and scripts are documented in the accompanying GitHub repository.

Descriptive statistics offer a snapshot of the dataset’s key attributes. Base salaries range from approximately $11,000 to $200,000, with a mean salary of approximately $82,000. Gender distribution reveals a 60:40 male-to-female ratio, while departmental averages vary significantly, from $45,000 in administrative roles to $120,000 in managerial positions. These statistics set the stage for more nuanced analyses presented later in the report.

The results of this analysis are illustrated through visualizations that capture trends and disparities. One key figure displays salary percentiles over time, highlighting growth in the 25th percentile, median, and 75th percentile salaries.

A white background with black and white text

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A graph showing the amount of salary per year

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The visualization highlights that the 25th percentile experienced the highest growth rates overall, particularly in 2022 and 2023. The median and 75th percentiles grew at a slower but steady pace, with notable acceleration in 2023.

The figure below examines the ratio of salary growth to inflation, revealing that salary increases often lag behind inflation, particularly during 2020 and 2022. However, in 2023, the ratio exceeded 1, showing that salary growth finally outpaced inflation, marking a significant improvement in purchasing power for employees.

A graph with a line and a green line

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These findings underscore the challenges employees face in maintaining purchasing power amid economic fluctuations.

A bootstrapping analysis was conducted to explore the relationship between inflation and salary growth. This technique involves resampling the data many times to estimate the variability of results. The analysis showed that the slope of the relationship had a 95% confidence interval ranging from approximately -38.41 to 1.76. A graph of a slope

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Since this range includes 0, it indicates that there is no statistically significant relationship between inflation and salary growth at the 95% confidence level. Additionally, the histogram of the slope coefficients revealed a right-skewed distribution, with most estimates close to 0 but some extreme negative values. This further underscores the weak and inconsistent relationship between inflation and salary growth. That means inflation does not have a strong or consistent impact on salary growth during the analyzed period, implying that other factors may play a more significant role in influencing salary trends.

Moreover, Gender-based salary analyses further reveal persistent disparities, with variations observed across departments and job grades.

A graph showing a number of people in salary categories

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In the lower-paying category, men are overrepresented compared to women, as indicated by the higher percentage for men. Conversely, in the higher-paying category, the representation of men and women appears more balanced, with nearly equal proportions suggesting that while women are not disproportionately underrepresented in higher-paying departments, there is still a noticeable gender imbalance in lower-paying categories, potentially indicating systemic factors influencing salary distribution by gender.

A screenshot of a graph

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The heatmap visualizes gender pay gaps across randomly selected job grades over the years 2019 to 2023. Each cell represents the difference in average salaries between male (M) and female (F) employees within a given grade and year. Positive values (in red shades) indicate that male employees earn more on average than female employees, while negative values (in blue shades) suggest that female employees earn more than their male counterparts.

Obviously, certain grades, such as MD04 in 2019, display a significant negative pay gap (indicated by deep blue), suggesting higher earnings for female employees. Conversely, grades like MD04 in 2020 and D3 in 2019 exhibit positive gaps (in red), with male employees earning substantially more than females. The variation in pay gaps across grades and years underscores disparities that fluctuate depending on grade and time period.

The insights gleaned from this analysis carry implications for policymakers and organizational leaders. Understanding the interplay between salaries and inflation can inform decisions on compensation adjustments to support employees better. Addressing gender pay gaps and departmental disparities can also enhance equity within the workforce.

This report presents a comprehensive exploration of salary trends and their implications, providing actionable insights for addressing economic and equity challenges in Montgomery County.

**References and Acknowledgements**

**References**

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