Data Visualization of College Major Economic Outcomes: Career Prospects and Gender Equity Analysis

Educational ROI and Workforce Analytics

Problem Statement

Prospective college students face critical decisions about their academic majors with limited data on long-term economic outcomes. While anecdotal advice abounds, systematic analysis of employment rates, median earnings, gender diversity, and career trajectories across majors is scarce. This project addresses the information gap by analyzing and visualizing comprehensive data on 173 college majors, enabling evidence-based educational planning and workforce policy decisions.

Research Objectives

Investigate key questions about college major economics: Which majors offer the highest earning potential? How do employment rates vary across fields? What is the relationship between gender diversity and median salaries? Which major categories provide the best return on education investment? Results inform student major selection, university curriculum planning, and policy discussions about STEM education and gender equity.

Methodology

Dataset: American Community Survey data (2010-2012 graduates) curated by FiveThirtyEight, covering 173 specific majors across 16 major categories. Variables include total graduates, gender breakdown, employment metrics, and salary statistics. Sample size ranges from 36 graduates (Petroleum Engineering) to 393,735 (Psychology), ensuring statistical reliability across major categories.

Data Cleaning and Preparation:

- Removed rows with missing values (1 major dropped: 172 remaining)
- Validated data consistency: gender totals match overall totals, employment percentages sum correctly
- Created derived features: unemployment rate, full-time employment rate, women's share percentage
- Normalized salary data to 2012 dollars for temporal consistency

Visualization Techniques Employed:

1. Scatter Plots (Bivariate Relationships)

- Sample size vs median salary: identifying statistical reliability patterns
- Women's share vs median salary: investigating gender pay equity across majors
- Employment rate vs median salary: correlation between job availability and compensation
- Men vs women counts: visualizing gender distribution across fields

2. Histograms (Distribution Analysis)

- Median salary distribution: identifying typical earnings ranges and outliers
- Sample size distribution: understanding major popularity and data reliability

- Women's share distribution: assessing gender balance across higher education
- Employment rate distribution: market demand signals for different fields

3. Bar Plots (Categorical Comparisons)

- Top 10 and bottom 10 majors by median earnings
- Major categories ranked by average salary and employment rate
- Gender diversity comparisons across STEM vs non-STEM fields
- Unemployment rates by major category

4. Box Plots (Statistical Summaries)

- Salary distributions within major categories (quartiles, outliers)
- Employment variability across categories (spread and median)
- Gender representation consistency within categories

Results

Earnings Analysis:

- Highest paying major: Petroleum Engineering ($110,000 median salary)
- Top 10 majors: dominated by engineering and actuarial science (8 of 10)
- Lowest paying major: Library Science ($22,000 median salary)
- Engineering majors earn 2.5-4x more than arts/humanities majors on average
- Salary distribution: median $36,000, mean $40,151 (right-skewed due to high earners)

Employment Outcomes:

- Overall employment rate: 87.3% across all majors (strong job market for college graduates)
- Highest employment: Healthcare majors (93.4% average) and engineering (91.2%)
- Lowest employment: Arts majors (78.5% average) reflecting portfolio career patterns
- Unemployment rate negatively correlated with median salary (r = -0.42)

Gender Diversity Insights:

- Most gender-balanced major: Social Work (88% women) - gender imbalance in caregiving fields
- Most male-dominated: Military Technologies (96% men)
- Female-majority majors: Education (77% women), Psychology (72% women), Health (85% women)
- Male-majority majors: Engineering (81% men), Computer Science (74% men)
- Negative correlation between women's share and median salary (r = -0.28), suggesting persistent gender pay gaps linked to major choice

Major Category Rankings (by median earnings):

- 1. Engineering: $57,000 average across 29 specific majors

- 2. Computers & Mathematics: $53,000 (strong tech sector demand)
- 3. Physical Sciences: $41,000
- 4. Business: $37,000 (variable based on specialization)
- 5. Health: $36,000
- Bottom tier: Education ($32,000), Psychology & Social Work ($30,000), Arts ($29,000)

Key Findings:

- STEM majors consistently outperform in both earnings and employment metrics
- Major selection has 3-5x impact on lifetime earnings (engineering vs arts degree)
- Gender segregation across majors contributes significantly to aggregate gender pay gap
- High-earning majors tend to have lower total graduate numbers (scarcity premium)
- Full-time employment rates vary 60-95% across majors, indicating different work-life patterns

Practical Recommendations:

- For earnings maximization: Engineering, Computer Science, Actuarial Science
- For job security: Healthcare, Education (high employment rates)
- For work-life balance consideration: Psychology, Biology (higher part-time rates indicate flexibility)
- Gender equity interventions: Encourage women in high-paying STEM fields, men in caregiving professions

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This comprehensive visualization project transforms complex educational data into actionable insights, supporting evidence-based career planning and workforce development policy.