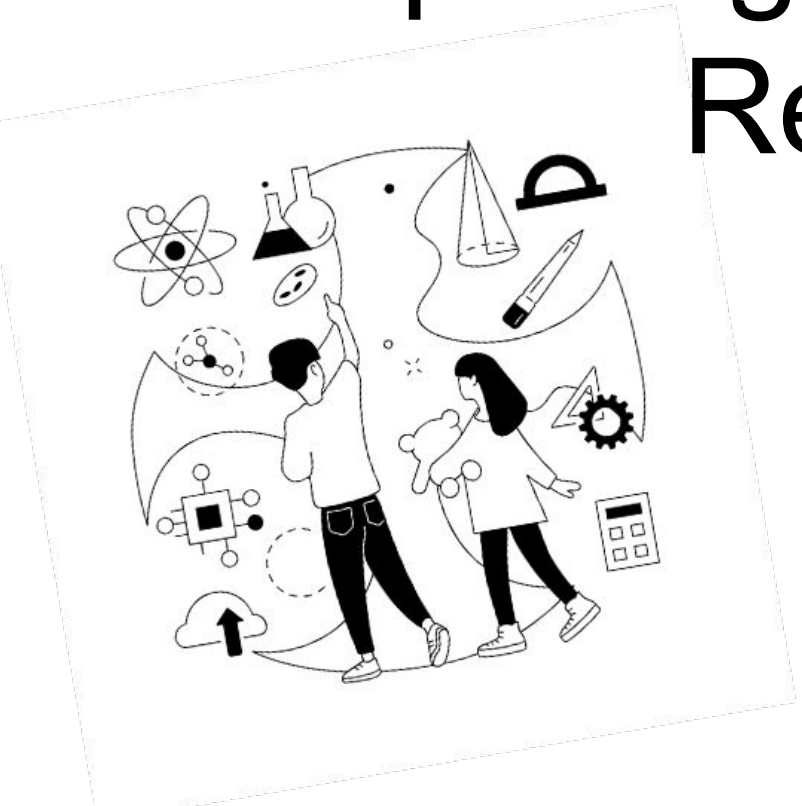
STEM vs. Non-STEM Degrees: Exploring Patterns in Age & Real Income



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Introduction

Motivation:

I wanted to evaluate the belief that STEM degrees lead to higher financial stability and explore whether age also affects this relationship.

Research Questions:

1. How is age related to real income among employed workers?
2. Is there an income difference among STEM vs non-STEM degree holding workers?

Methods

Data Collection:

- Sampling unit – Individual workers in the US who hold a degree and are employed either full-time or part-time.
- Sample size – 248 individuals

Measures:

1. Numeric explanatory variable – Age
   Measured in years
2. Binary categorical explanatory variable – Degree Type
   - "STEM" – highest degree earned in a science, technology, engineering, or mathematics field
   - "Non-STEM" – highest degrees earned outside STEM fields

Analysis Method:

Descriptive statistical method was used to examine income patterns by age and degree type. Histograms, box plots, bar charts, and scatterplots were used to visually explore distributions and relationships. These analyses were run in R Studio.

Descriptives

Table 1 – Descriptive Statistics

	Center	Spread
Real Income ($)	Mean = $58,147.19	SD = $46,211.44
	Center	**Spread**
Age (years)	Mean = 43.96 years	SD = 13.46 years
	Non-STEM Count	**STEM Count**
Degree Type	155	93

Results

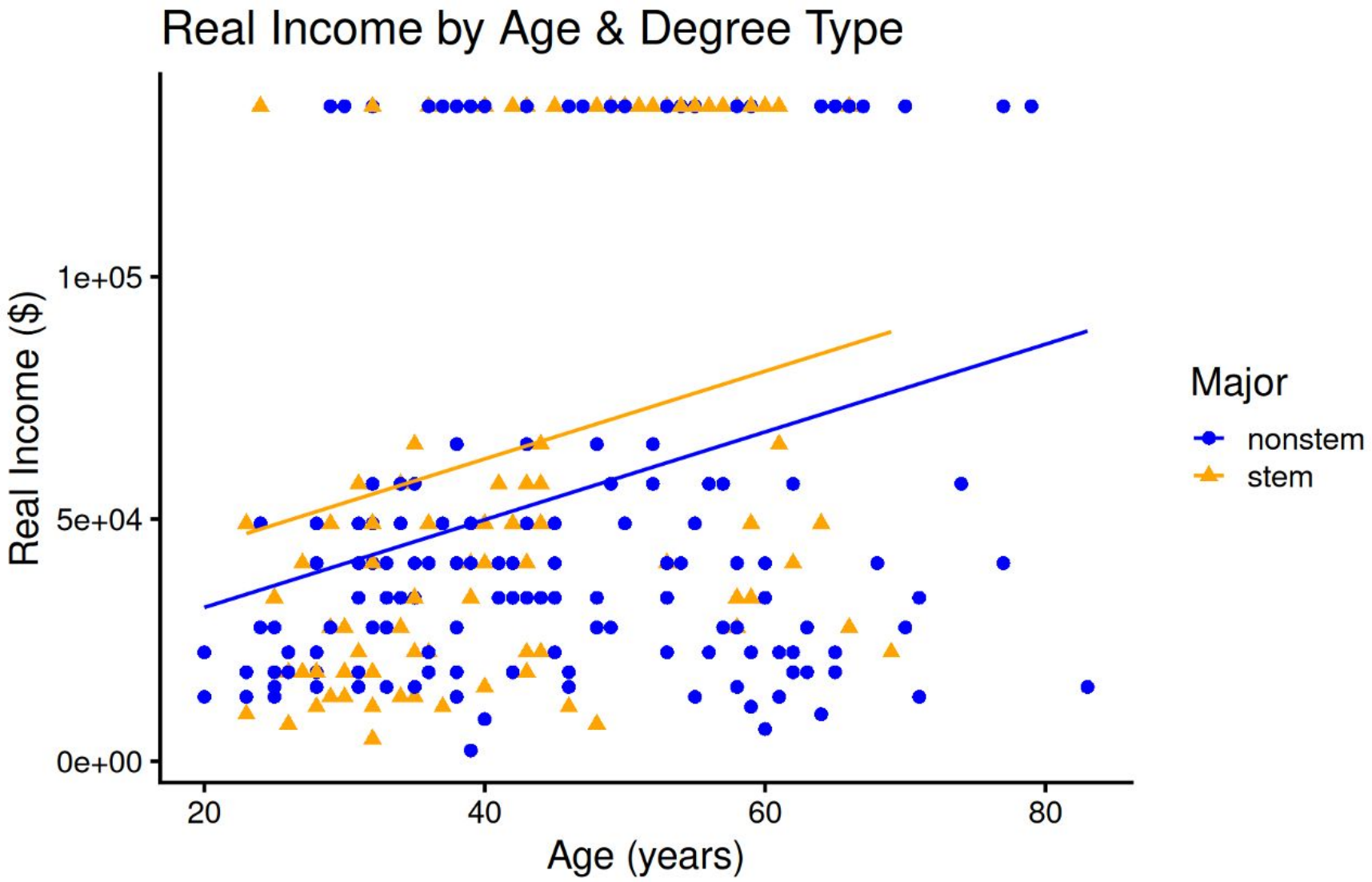
Table 2 – Model Results

	Estimate	t-stat	S.E.	p-value
Intercept	13650	1.35	10080	0.177
Age	905	4.29	210.9	2.53 x 10^(-5)
Major (STEM)	12540	2.14	5848	0.0330

Model df: 248 – 2 – 1 = 245

Adjusted model fit statistic (R^2): 0.074

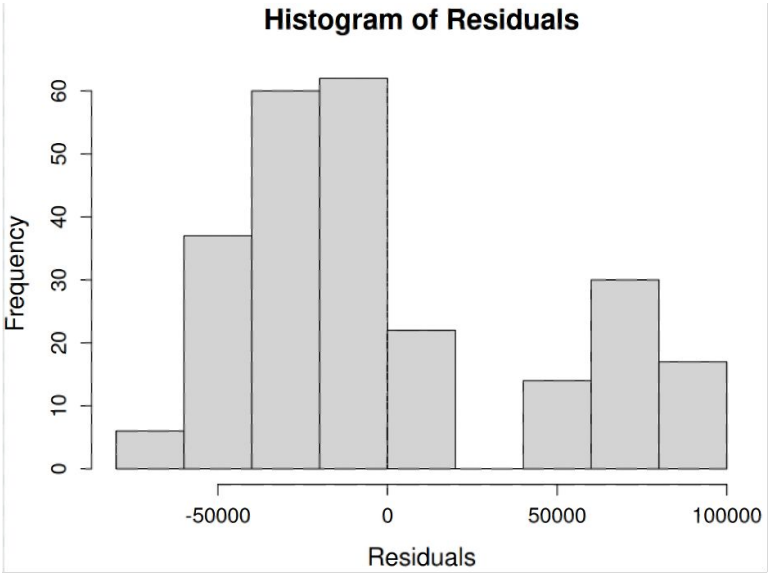
Multivariate Plot

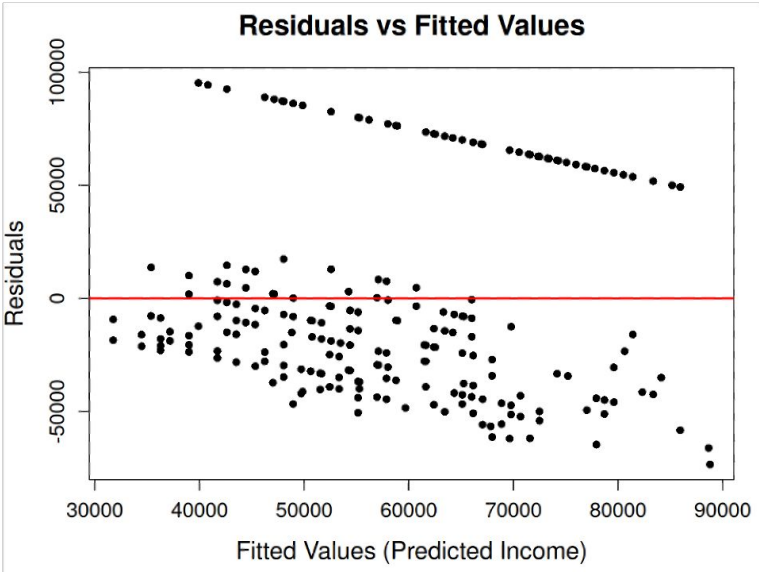


Assumptions

Assumptions:

1. Random sample
   - Randomly sampled from filtered GSS dataset.
2. Independent Observations
   - Each observation = a unique survey respondent
   - No duplicates found
3. Linearity: Age predictor is linearly related to real income
   - Residuals centered around zero (red line)
   - No strong curve pattern
   - Presence of two distinct clusters not perfectly linear
4. Normality of Residuals
   - Centered at zero
   - Right-skewed due to high-income outliers
5. Equal Variance of Residuals
   - Funnel shape in residual plot
   - Larger spread at higher fitted values





Discussion

Interpretation:

- Significance of Age on Income
  - For each additional year of age, expected real income increased by approximately $905, holding the degree type constant. This effect is statistically significant meaning that age is a meaningful predictor of real income in this sample. ($t=4.29$, $df=245$, $p<0.05$)
- Significance of Degree Type on Income
  - Workers with a STEM degree earn approximately $12,540 more than workers with non-STEM degrees, controlling for age. This effect is statistically significant, supporting the idea that STEM degrees are associated with higher earnings. ($t=2.14$, $df=245$, $p<0.05$)
- The adjusted $R^2 = 0.074$ indicates that this model explains only 7.4% of the variation in income, meaning that most of the variation is due to other factors that are not included in this model, such as occupation, work experience, location, etc.

Limitations:

- **Weak model fit** – most of income variation is explained by other variables that are not included in the model
- **Assumptions not being fully met**
  - Right-skewed residual histogram caused by high-income outliers
    → normality assumption partially met
  - Funnel shaped residual scatter plot → equal variance assumption is not fully met

Implications:

The research outcome suggests that both age and having obtained a STEM degree are associated with higher real income, but the most income differences are affected by other factors that were not covered in this model.

Future Research:

If I were to repeat the study, I would include additional key predictors, such as, work experience, occupation, location, industry, to better explain the real income and more accurately assess whether STEM degree holders truly earn more than non-STEM workers.

References:

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