AI Adoption and Layoffs

Group 10

November 8, 2025

Research Question and Model Definition

- Does a higher level of AI adoption in firms correlate with a higher number of layoffs?
- We build a simple cross-sectional linear regression with synthetic data using the following model:

$$\text{Layoffs}_i = \beta_0 + \beta_1 \, \text{AI\_Adoption}_i + \varepsilon_i$$

- **AI_Adoption**$_i$: represents the degree of AI integration within firm i (e.g., automation of processes, use of machine learning tools, or AI-driven decision systems), expressed as a percentage
- **Layoffs**$_i$: number of employees laid off by firm i during the year
- Simulated dataset: 100 firms

OLS Estimation Code

In the following slides, we show selected Python code snippets to illustrate the main steps of our regression analysis.

```
# Add a constant term to include the intercept in the model
# and define the dependent variable (layoffs)
X = sm.add_constant(df["AI_Adoption"])
y = df["Layoffs"]

# Fit the OLS regression model
# Dand display the regression summary
model = sm.OLS(y, X).fit()
print(model.summary())
```

The complete and reproducible code is available at:

github.com/matteogiorgi/regression-timeseries/.../layoff.ipynb

OLS Model Output

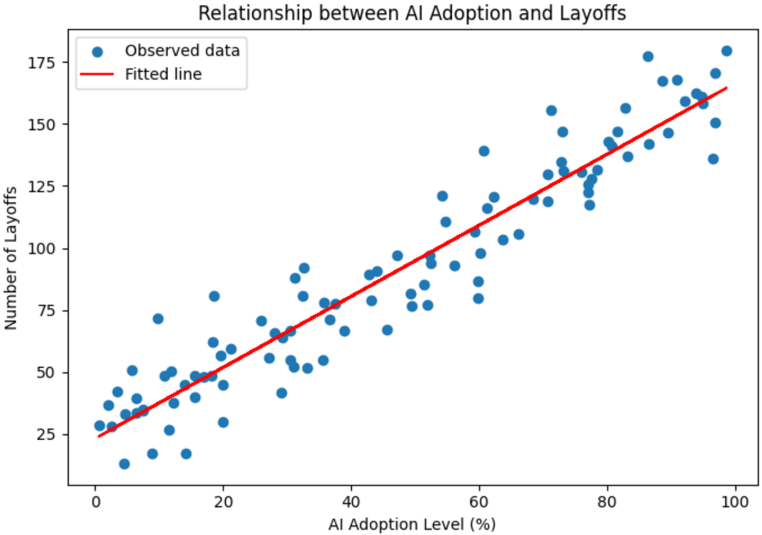
```
                            OLS Regression Results
==============================================================================
Dep. Variable:               Layoffs   R-squared:                       0.908
Model:                           OLS   Adj. R-squared:                  0.907
Method:                Least Squares   F-statistic:                     968.9
Date:               Fri, 07 Nov 2025   Prob (F-statistic):           1.31e-52
Time:                       11:59:07   Log-Likelihood:                -401.95
No. Observations:                100   AIC:                             807.9
Df Residuals:                     98   BIC:                             813.1
Df Model:                          1
Covariance Type:           nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         23.2264      2.554      9.093      0.000      18.158      28.295
AI_Adoption    1.4310      0.046     31.127      0.000       1.340       1.522
==============================================================================
Omnibus:                       0.900   Durbin-Watson:                   2.285
Prob(Omnibus):                 0.638   Jarque-Bera (JB):                0.808
Skew:                          0.217   Prob(JB):                        0.668
Kurtosis:                      2.929   Cond. No.                         104.
==============================================================================
```

Plot Fitted Model

```python
# Predict fitted values based on the estimated model
y_pred = model.predict(X)

# Create scatter plot (observed data)
# and add regression line (predicted values)
plt.figure(figsize=(7, 5))
plt.scatter(
    df["AI_Adoption"],
    df["Layoffs"],
    label="Observed data"
)
plt.plot(
    df["AI_Adoption"],
    y_pred,
    color="red",
    label="Fitted line"
)
plt.xlabel("AI Adoption Level (%)")
plt.ylabel("Number of Layoffs")
plt.title("Relationship between AI Adoption and Layoffs")
plt.legend()
plt.tight_layout()
plt.show()
```

Scatter Plot and Fitted Line



Interpretation of the Regression Results

- The estimated coefficient for **AI_Adoption** is **1.43**, statistically significant at the 1% level ($p < 0.001$).
- Interpretation: for each one-point percentage increase in the AI adoption index, the number of layoffs increases on average by about 1.43 employees.
- The intercept ($\beta_0 \approx 23.2$) indicates the expected number of layoffs for firms with no AI adoption at all.
- The $R^2 = 0.91$ shows that roughly **91% of the variation in layoffs** across firms is explained by differences in AI adoption levels.
- These results suggest a strong positive association between automation intensity and workforce reduction — consistent with the hypothesis that higher AI adoption may substitute part of human labor.

Our use of LLM

- We employed *ChatGPT* from *OpenAI* as AI peer-wise support tool during the preparation of this work
- Specifically, the model was asked to:
  - generate a set of **synthetic yet realistic data** for 100 firms, including a measure of AI adoption (`AI_Adoption`) and the corresponding number of layoffs (`Layoffs`)
  - propose and explain a **linear regression model** where:
    - the independent variable is the degree of AI adoption
    - the dependent variable is the number of layoffs per firm
- All results were than independently reviewed and verified by our group, together with the interpretations provided

Discussion and Takeaways

- The model highlights how AI-driven automation could lead to higher layoffs, at least in the short run.
- However, this synthetic example only captures a simplified linear relationship:
  - Real-world dynamics may depend on sector, firm size, and type of AI integration.
  - In some industries, AI adoption may create new roles (data analysis, system maintenance) rather than destroy jobs.
- Future empirical work should:
  - use panel data or time-series evidence to distinguish correlation from causality;
  - include control variables (e.g., productivity, profitability, R&D intensity);
  - test for nonlinear or threshold effects in AI adoption.
- Overall, the analysis illustrates how regression methods can be used to quantify economic effects of technological innovation.

This work was conceived and developed by:

Mattia Zanin, Matteo Giorgi, Enrico Zanello, Klea Kule, Luca Lo Buono

University of Padova
2025/2026