

AI Adoption and Layoffs

Group 10

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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  
# and 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](https://github.com/matteogiorgi/regression-timeseries/blob/master/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
=====
```

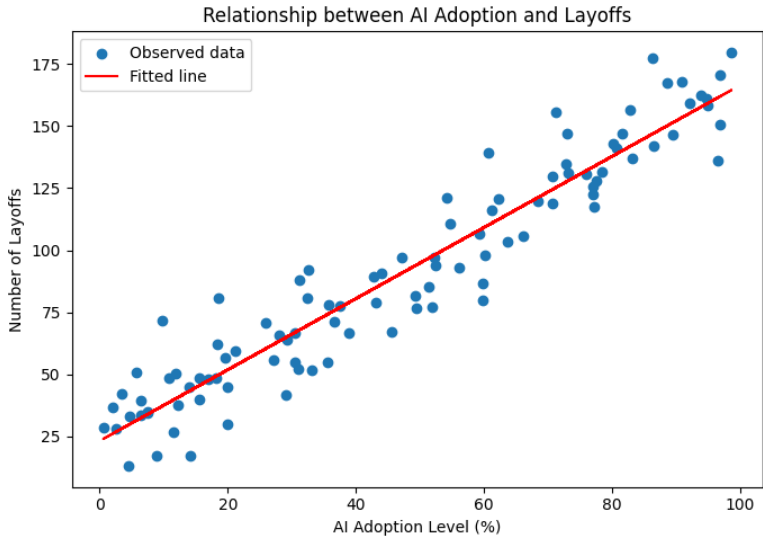
```
=====
Omnibus:                0.900      Durbin-Watson:           2.285
Prob(Omnibus):          0.638      Jarque-Bera (JB):         0.808
Skew:                   0.217      Prob(JB):                 0.668
Kurtosis:               2.929      Cond. No.                 104.
=====
```

Plot Fitted Model

```
# 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.

- 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
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