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), scaled between 0 and 100
- **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:

https://github.com/matteogiorgi/regression-timeseries

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

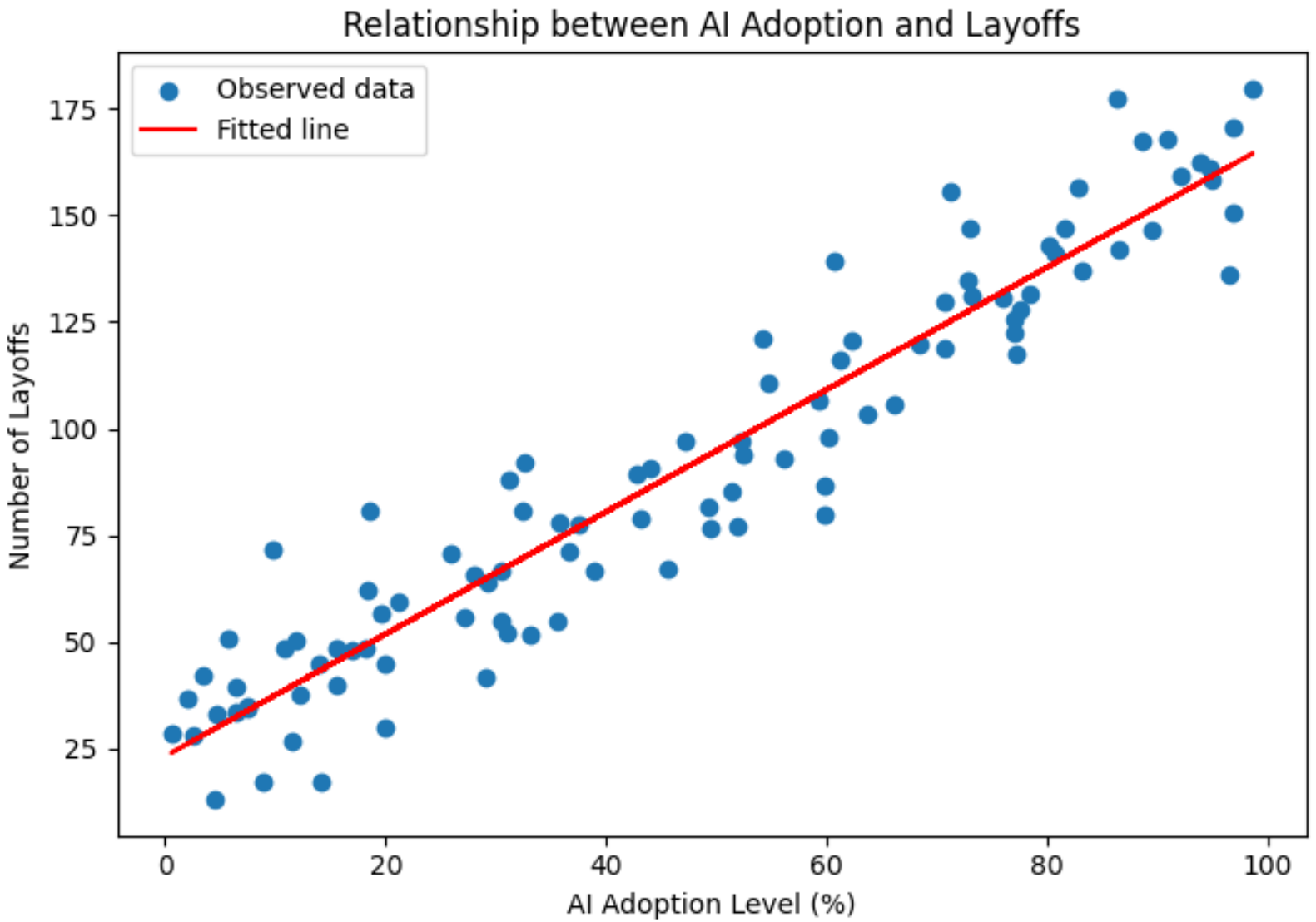
Omnibus:	0.900	Durbin-Watson:	2.285
Prob(Omnibus):	0.638	Jarque-Bera (JB):	0.808
Skew:	0.217	Prob(JB):	0.668
Kurtosis:	2.929	Cond. No.	104.

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 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.

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.