Group10 - Multiple Linear Regression

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1 AI Adoption and Layoffs: new model

In this notebook, we extend our previous analysis regarding the relationship between AI adoption and layoffs adding more variables to our regression model in order to control for potential new factors that could influence layoffs. As the previous simple linear regression model states:

$$\text{Layoffs}_i = \beta_0 + \beta_1 \text{AIAdoption}_i + \epsilon_i$$

Characteristics such as revenue growth, merger, market capitalization, taxes, foreign direct investments, R&D expences, average age of employees, unionization rate of the firm and concession of public incentives to adopt the AI will be included in the analysis. The goal is to identify which factors are statistically significant and assess the robustness of the relationship between AI adoption and layoffs.

1.1 Full Multiple linear regression

The new variables we decided to include are:

- **Revenue growth** in one year X_2: this it to account for the fact that a decrease in revenue might imply less resources available and therefore possible layoffs. An increase in X_2 has a negative effect on Layoffs.
- **Merger** X_3: a variable =1 if the firm has been acquired by another firm in the last year and zero otherwise. This is to account for the fact that mergers and acquisition often imply a dismissal of many employers of the acquired company, who are substituted by staff selected by the acquiring company. If $X_3 = 1$, Layoffs increases.
- **Market capitalization** X_4: a variable that describes the total value of outstanding shares of a firm. We believe that less capitalized firms might have less employees and therefore they could be less inclined to fire them. An increase in X_4 has a positive effect on Layoffs.
- **Taxes**: the amount of taxes X_5: paid in the last year. Higher level of taxes might reduce legal reserves of a company or, more generally, reduce the resources that can be invested for priority projects. Therefore, higher layoffs are more likely to occur to compensate the higher taxes. An increase in X_5 has a positive effect on Layoffs.
- **Foreign direct investments** X_6: investments in another country to acquire a significant influence on a foreign firm or to establish a new subsidiary. FDIs can imply investments in new production facilities, maybe less expensive than the ones in home country, which might be closed. An increase in X_6 has a positive effect on Layoffs.
- **R&D expenses** X_7: firms with higher R&D expenses might tend to reskill employees and adapt their competences to make them compatible with AI tools, rather than firing them. An increase in X_7 has a negative effect on Layoffs.

- **Average age of employees** X_8: we believe that employees with higher average age might be less likely to gladly accept to attend training courses in order to be reskilled. An increase in X_8 has a positive effect on Layoffs.
- **Unionization rate of the firm** X_9: with a higher level of unionization , layoffs would be likely lower. An increase in X_9 has a negative effect on Layoffs.
- **Concession of public incentives to adopt the AI** (binary variable) X_{10}: if a firm receives incentives in order to adopt AI tools, then this process might accelerate the process of AI adoption and increase the number of layoffs. If $X_{10} = 1$, Layoffs increases.

The dependent variable Layoffs is simulated as a linear function of these predictors plus a random noise term. We then estimate a multiple linear regression model using the ordinary least squares (OLS) method with Layoffs as the dependent variable:

$$\text{Layoffs}_i = \beta_0 + \beta_1 \text{AIAdoption}_i + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i}$$
$$+ \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + \beta_{10} X_{10i} + \epsilon_i$$

1.2   Restricted model

Now the regression contains a relatively high number of variables, we believe that, by running a regression output sono betas might be statistically non-different from zero and therefore some variables can be eliminated, so that we can consider a third linear regression model. According to us, the variable in question are:

- **Foreign direct investments** X_6: as a matter of fact, they can be used simply to expand the presence of the firm in another country and it does not necessarily imply shutdown of production plans.
- **Taxes** X_5: we believe that the reason we proposed before to include it in the model is appropriate, but in most cases higher level of taxes in one year might not be sufficient do determine a significant increase in the number of layoffs. Moreover, taxes can increase due to an increase in revenues, and if revenues increase , firing workforce should not be necessary.
- **Concession of public incentives to adopt AI** X_{10}: incentives can accelerate AI adoption and workforce might be fired. However, if a firm does not directly pay for AI tools then cutting cost could be non- necessary, at least in the short term. Therfore workforce and AI tools might be complementary and the number of layoffs will not increase.
- **Average age of employees** X_8: we believe that it is true that old workers might be less willing to adapt to AI, but in practice firms generally tend to fire young workers, rather than old employees.

$$\text{Layoffs}_i = \beta_0 + \beta_1 \text{AIAdoption}_i + \beta_2 X_{1i} + \beta_3 X_{2i} + \beta_4 X_{3i} + \beta_7 X_{7i} + \beta_9 X_{9i} + \epsilon_i$$

1.3   Conclusions

We prefer the restricted model, as it is more parsimonious and easier to interpret. It is more complete than the single linear regression model done in the first work, as it includes more variables that might influence layoffs, but at the same time it avoids including variables that are not significant in contrast to the full model.