



Contribution ID: 93

Type: **not specified**

## Heterogeneity in STEM Graduate Wages Across Italian Universities: A Weighted Mixed-Effects Analysis

This study examines wage outcomes at the cohort level among STEM graduates in Italy, using data from the AlmaLaurea surveys covering 60 institutions over the period 2008-2023. The unit of analysis is a graduate cohort sharing the same university, degree level, and disciplinary category, observed one, three, or five years after completing their studies. Given the nested structure of the data and the heteroscedasticity arising from differences in cohort size, estimation relies on a weighted linear mixed-effects model incorporating random intercepts for both institution and survey year.

The findings reveal significant predictors of mean cohort remuneration. Geographic relocation for work is positively linked to earnings, whereas a greater share of women within a programme is negatively associated with cohort-average wages, capturing a composition effect at the programme level. Graduates holding a master's degree and those specialising in Computer Science and ICT or Industrial and Information Engineering command higher wages, while cohorts in Architecture and Civil Engineering earn considerably less relative to the Scientific baseline. Time since graduation emerges as one of the strongest predictors, with average wages rising markedly across survey intervals. A clear territorial divide is apparent, with cohorts based in the North earning substantially more than their Southern counterparts.

The cohort-level perspective treats average wages as synthetic indicators of the labour market returns associated with specific educational paths. Goodness of fit is evaluated via the correlation between fitted and observed cohort means and a size-weighted root mean squared error. The core findings hold across four robustness checks.

### Special/ Invited session

ISBIS

### Classification

Mainly application

### Keywords

Returns to Education, STEM, Wages, Mixed-Effects Models, Italy, regression

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