

## Abstract

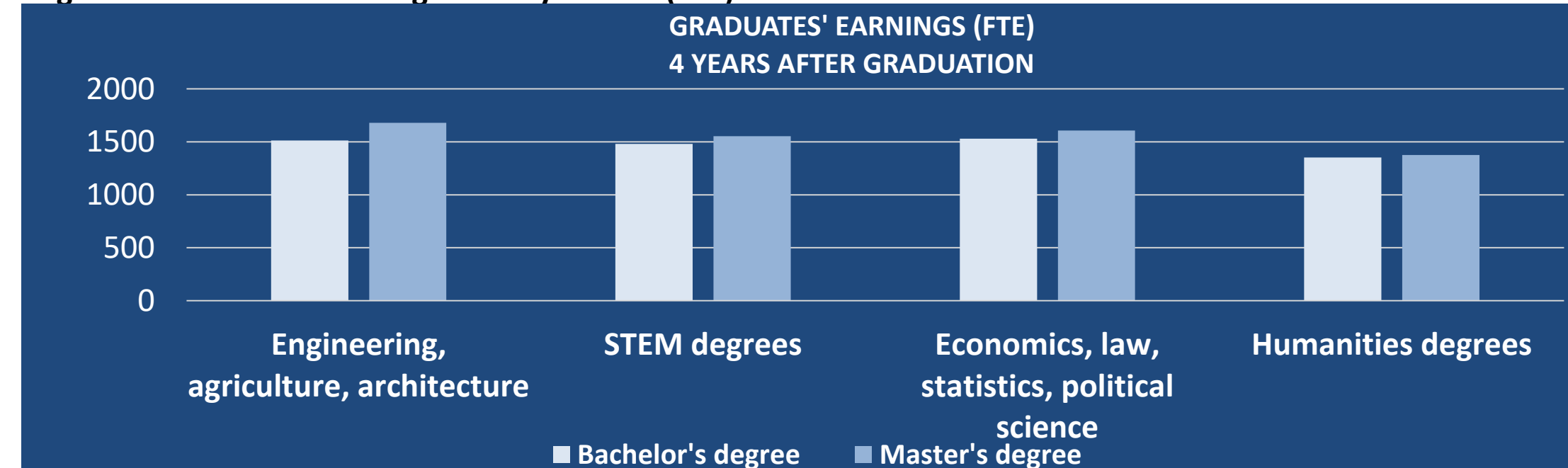
The present study provides new evidence on Italian graduates' earnings in their early career comparing wages for workers who had a master's degree with those for workers who had a bachelor's degree four years after graduation. The data used in this article come from the Italian National Institute of Statistics (ISTAT). In order to mitigate a potential selection bias into treatment (master degrees), we conducted a propensity score matching (PSM) analysis and we estimate the effect of master's degree on monthly net wage of graduates. Further we perform a sensitivity analysis based on the simulation with calibrated confounders (Ichino et al., 2008).

## Literature reviews

In human capital theory, first developed by Becker (1964), Schultz (1961) and Mincer (1974), education is an investment in exchange for future returns. In this framework, schooling is an optimizing investment decision based on future earnings and current costs. The graduates who opt to continue into master's degree programs expect to receive higher salaries than those with a bachelor's degree. Stark (2007) finds at the aggregate level that the returns to pursuing a master's degree in Canada are 4.1 per cent for men vs. 8.6 per cent for women. Torpey and Terrell (2015) compare the median wages between individuals with master's degrees and bachelor's degrees. They find that wage premium for workers in commodities, sales, and other financial services occupations with a master's degree was 89% higher than workers with just a 4-year degree (Torpey and Terrell, 2015).

Titus (2007) argues that endogeneity and self-selection bias are key problems for research in the field of higher education. The results of their study reveal that substantial self-selection bias is undetected when using OLS regression techniques, instead propensity score matching allows for estimates of the ATE, ATT, ATU on student outcomes such as wage earnings. In order to strengthen causal inferences, Desjardins, McCall, Ahlburg, and Moye (2002) highlight the need to account for issues of endogeneity when examining the effects of college, or specific programs, on an array of student outcomes. To our knowledge, this is the first study to evaluate the impact of the master's degree on Italian graduates' earnings. Following Ichino et al (2008) we introduce a potential confounder to assess the robustness of the estimated treatment effects. In our study U measures some unobservable component of ability and mimic the distribution of important covariates.

Figure 1. Graduates' Earnings in early career (FTE).



Note: Authors' elaboration based on the surveys of graduates conducted by the Italian National Institute of Statistics.

## Methods and Materials

The data stem from surveys of graduates conducted by the Italian National Institute of Statistics (2015). ISTAT carries out the sample survey on graduates who attained the university degree four years before the survey (2011). The first section presents the results of mynecrian equation by taking into account bachelor/masters, tenure, demographic variables, socio-economic background, field of studies. Standard ordinary least squares (OLS) estimation will give biased estimates, therefore we estimate the Heckman two-step procedure to control for selection bias, including covariates that could affect the probability to be employed.

$$y = \beta_0 + \beta_1 \text{ Master/Bachelor} + \beta_2 U + \beta_3 F + \beta_4 S + \beta_5 D + \beta_6 L + \varepsilon \quad (1)$$

The second section aims to estimate the effects of bachelor-master systems in Italy on wages of graduates in their early career. In order to mitigate a potential selection bias into treatment (master degrees), we compute the probability of participating in treatment conditional to pre-treatment control variables (PSM). Then, by comparing treated and untreated with the same propensity score in the common support region, we estimate the ATT (2).

$$E(\delta | T = 1) = E(Y^1 - Y^0 | T = 1) = E(Y^1 | T = 1) - E(Y^0 | T = 1) \quad (2)$$

Further we perform a sensitivity analysis based on the simulation (Ichino et al., 2008) with calibrated confounders. In every iteration, we compute the effect of U, that measures some unobservable component of ability.

## Results – OLS and Heckman selection model

Master's degree is correlated with a 5% wage increase compared to graduates with a bachelor's degree (Tab.1), using Heckman selection model, the estimates show an increase of 4.5%. For what concerns the field of studies, the largest decrease of earnings regards graduates in humanities: -11.6%. With Heckman correction the coefficient is -5.1%.

Table 1. Graduates' earnings FTE and Heckman selection model

Variable	(Ln)Graduates' Earnings Full Time Equivalent	(Ln)Graduates' Earnings FTE (Heckman two step)
Master's degree	0,050*	0,045*
	[0,020]	[0,021]
Chemistry, pharmacy, agriculture	-0,011	0,100***
	[0,013]	[0,015]
Economics. Law. political, social science	-0,018	0,026
	[0,012]	[0,013]
Humanities	-0,116***	-0,051**
	[0,015]	[0,017]
Tenure_month	0,004***	0,003***
	[0,000]	[0,000]
Female	-0,099***	-0,084***
	[0,009]	[0,010]

Note: Authors' elaboration based on the surveys of graduates conducted by the Italian National Institute of Statistics. Other controls: socio-economic background, demographic characteristics, high school characteristics, sector, type of contract, geographic area. Robust standard errors in parentheses: \* 0,05 \*\* 0,01 \*\*\* 0,001.

## Results - ATT and sensitivity analysis

The results of ATT show that earnings increase by 6.1% for master's graduates (Tab.2). In the case of the confounder (as ability) behaving like the dummy "general high school", the ATT differs by 0.9 p.p. from the neutral estimate. By estimating a logit model of  $\Pr(Y=1|T=0, U, W)$  in every iteration, we compute the effect of U on the relative probability to have a positive outcome in case of no treatment ("outcome effect" of the simulated U). The selection effect represents the probability to be assigned to the treatment  $T=1$ . We observe that outcome and selection effect are greater than one for the variables that indicate individuals with at least one employed or graduated parent.

Moreover, the selection effect is highest for degrees in Literature and psychology (2.558). If unobserved component U simulates distribution of dummy general high school, we observe a greater selection effect. Students graduated from high school have a very high probability of obtaining a master's degree. As expected, the selection effect is high for individuals with at least one parent graduate.

Table 2. ATT and sensitivity test with calibrated confounder (y=ln earnings)

	ATT	Std. Err.	Outcome effect	Selection effect
Base-No confounder	0,061	0,011	-	-
Neutral	0,059	0,013	1	1
Female	0,059	0,013	0,545	1,020
Bachelor's degree - North	0,062	0,013	0,898	0,855
High school _general	0,067	0,014	0,876	2,109
At least one employed parent	0,063	0,012	1,035	1,338
At least one parent graduate	0,061	0,013	1,080	1,966
Bachelor's degree - Chemistry, pharmacy, agr.	0,061	0,012	0,894	0,765
Bachelor's degree - Geology, biology, nat science	0,063	0,012	0,958	1,305
Bachelor's degree - Political, social science	0,064	0,013	1,104	0,446
Bachelor's degree - Physical education	0,061	0,012	0,768	0,341
Bachelor's degree - Law	0,063	0,013	1,081	0,335
Bachelor's degree - Science of education and training	0,061	0,012	0,711	0,275
Bachelor's degree - Foreign languages	0,062	0,012	0,710	0,999
Bachelor's degree - Literature, psychology	0,064	0,013	0,750	2,558

Note: Authors' elaboration based on the surveys of graduates conducted by the Italian National Institute of Statistics

## Conclusions

In this study we provide an update of the empirical evidence on the returns to education in Italy focusing on graduates with master's degree compared to graduates with lower educational attainment. First we show that master's degree increases wages of graduates. The results of regression analysis of earnings highlight that Italian graduates' earnings for workers who had a master's degree increase by 5/4.5%. We estimate average treatment effects on the graduates with master's degree by using propensity-score matching and we find that the wages increase by 6.1%. The study conducted suggests that the master's degree makes graduates more competitive. There is a variation in returns across fields of studies. The returns to pursuing a master's degree in Italy are lower for women than for men.

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