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# Contextual factors of the external effectiveness of the university education: a multilevel approach

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## What is the effectiveness of university education?

The effectiveness of university education is a measure of the ability of the university system to achieve educational aims

- Occupational status after degree (1=Yes, 0=No)
- Duration of unemployment (time to first job)
- Wage or job satisfaction

### Aim of this research

Check the possibility of **measuring** the **external effectiveness** of universities (or course programs of all universities)

In order to make fair comparisons among different universities (or course programs) we take account of both

- the characteristics of the **individuals**
- and the **economic** and **social context** factors of the Italian regions

### To this aim we apply

**Multilevel (mixed, random effects) models**

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## Data set

From last survey on job opportunities of the Italian graduates in 2004, conducted by the Italian National Institute of Statistics in 2007 (Istat, 2008)

**Peculiarity:** two different groups of individuals with respect to the reform about teaching organization DM n.509/99 (decree law)

- ❑ 26570 graduates from degree programs before
- ❑ 20730 graduates from degree programs after

After the decree law DM n.509/99 the new teaching system should have affected the 'performance' of universities in terms of capacity to prepare young people to needs of job market and also changed the propensity of people to search for a job after the degree

**This study is accomplished using graduates from degree programs after this decree law**

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## Variables considered in the analysis

**Response variable** Occupational status at the interview (about three years after degree) (1=Yes, 0=No)

**Covariates** measured at **individual** level

- age
- gender
- marital status
- address (residence) during the studies
- kind of the degree
- final mark
- occupational condition during the studies
- other studies or training jobs after the degree
- course program changes
- military service
- social background
- kind of the high school attended

**Remark:** the only available information pertaining characteristics of course programs or universities, i.e. internal contextual variables, are the cluster means of individual level covariates

**External contextual covariates** measured at **regional** level (Istat, 2008)

**a) macroeconomic measures**

- Gross Domestic Product per inhabitant (*gdp*)
- productivity of labour (*prod\_lab*)

**b) job market measures**

- (youth) unemployment rate (*unempl*)
- quota of irregular labour (*q\_lab*)

**c) measure of production structures**

- number of firms per inhabitant (*n\_firms*)
- average number of employees per firm (*empl\_firm*)

**d) measure of innovation and technology**

- quota of innovative firms (*innov\_firms*)

**e) measures of the degree of culture**

- quota of family expenses for cultural entertainments (*q\_family*)

**f) measure of quality of life**

- the poverty rate (*q\_life*)

Aim of the research

➤ To estimate the probability to get a job

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the sample size was reduced to 13424 units by eliminating all graduates who at the date of the interview:

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▪ did have the same job before their degree

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▪ were unemployed but at the same time were not interested in searching for a job

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## Multilevel approach

➤ To evaluate how much the contextual covariates affect the probability to get a job

**Level 2** → course programs by universities (546 clusters)

**Level 1** → graduates (13424 graduates)

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## Two level Logit model

$$\text{logit}(\pi_{ij}) = \beta_0 + \sum_h \beta_h x_{hij} + \sum_l \delta_l z_{lj} + u_j$$

$$E(y_{ij} = 1 | x_{ij}, u_j) = \pi_{ij} = \frac{\exp(\beta_0 + \sum_h \beta_h x_{hij} + \sum_l \delta_l z_{lj} + u_j)}{1 + \exp(\beta_0 + \sum_h \beta_h x_{hij} + \sum_l \delta_l z_{lj} + u_j)}$$

probability to get job

$h$ -th covariate for the  $i$ -th graduate of the  $j$ -th cluster

$l$ -th macro-economic covariate for the  $j$ -th cluster

$u_j \stackrel{iid}{\sim} N(0, \sigma_u^2)$

2<sup>nd</sup> level random effect

Remark: all the 2<sup>nd</sup> level factors beyond observed characteristics are included in  $u_j$

## Model A without external contextual variables

### Model results 1

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level 1					
	age2_2		.3238295	.1220217	0.008
	age2_3		1.030602	.1650102	0.000
	age2_4		.5664397	.2385697	0.018
	graduate_in_time		.4763298	.1194794	0.000
	working_student		.2533406	.0943595	0.007
	graduate_father		-.1923589	.1107814	0.082
	after_degree		-.6314676	.0794733	0.000
	_cons		1.942942	.3150035	0.000

level 2					
	pctg_graduate_father		-.0176543	.004933	0.000
	sigma_u		1.171709	.0875581	

Labels:

- age of graduates (*age2*)
- graduation within institutional time (*graduate\_in\_time*, 1 if yes)
- occupational condition during the studies (*working\_student*, 1=if at work during the studies)
- educational level of father (*graduate\_father*)
- **cluster mean of graduate\_father** (proportion) (*pctg\_graduate\_father*)
- attended courses after getting the degree (*after\_degree*)

In the fit, we also added the mean of the  $h$ -th covariate of the  $j$ -th cluster

$$z_{hj}^*$$

#### Baseline graduate (when the model is null)

- less than 23 years old
- not graduated within institutional time
- never worked during the studies
- not graduated father
- not attended courses after degree

Model B with external contextual variables: *unempl\_2005*

## Model results 2

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	q2_1	Coef.	Std. Err.	P> z
level 1				
	age2_2	.3171903	.1206581	0.009
	age2_3	1.080437	.163419	0.000
	age2_4	.6364174	.2353766	0.007
	graduate_in_time	.4914841	.1189942	0.000
	working_student	.2023089	.094447	0.032
	graduate_father	-.1924619	.1106952	0.082
	after_degree	-.6274822	.0792874	0.000
	_cons	2.838565	.3464269	0.000
level 2				
	pctg_graduate_father	-.0201524	.0047053	0.000
	unempl_05	-.1372708	.0220267	0.000
	sigma_u	1.0432	.0839319	

As regards the macro-economic variables measured in the 2005 year at Regional level, only the unemployment rate (*unempl\_05*) is significant.



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## Regional unemployment rate effect

the probability to be employed for the baseline graduate (86.84%) **reduces** of about **6%** when the unemployment rate increases from 6% (average value) to 10%

the unexplained **cluster variability** is partly explained by the regional unemployment rate

$$I_{\Delta} = \left( \frac{\sigma_{u_j \text{ mod } B}^2 - \sigma_{u_j \text{ mod } A}^2}{\sigma_{u_j \text{ mod } A}^2} \right) * 100 = -20.9\%$$

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## Probabilities to get job for a baseline graduate in “bad” and “good” Universities: a classification

$$\pi_i = \exp(\eta_{ij} + u_j) / [1 + \exp(\eta_{ij} + u_j)]$$

- Very good univ.  $u_j = +2\sigma_u$
- Good univ.  $u_j = \sigma_u$
- Medium univ.  $u_j = 0$
- Bad univ.  $u_j = -\sigma_u$
- Very bad univ.  $u_j = -2\sigma_u$

### Baseline graduate

- less than 23 years old
- not graduated within institutional time
- never worked during the studies
- not graduated father
- not attended courses after degree

$$\eta_{ij} = \beta_0 + \sum_l \delta_l z_{lj}$$

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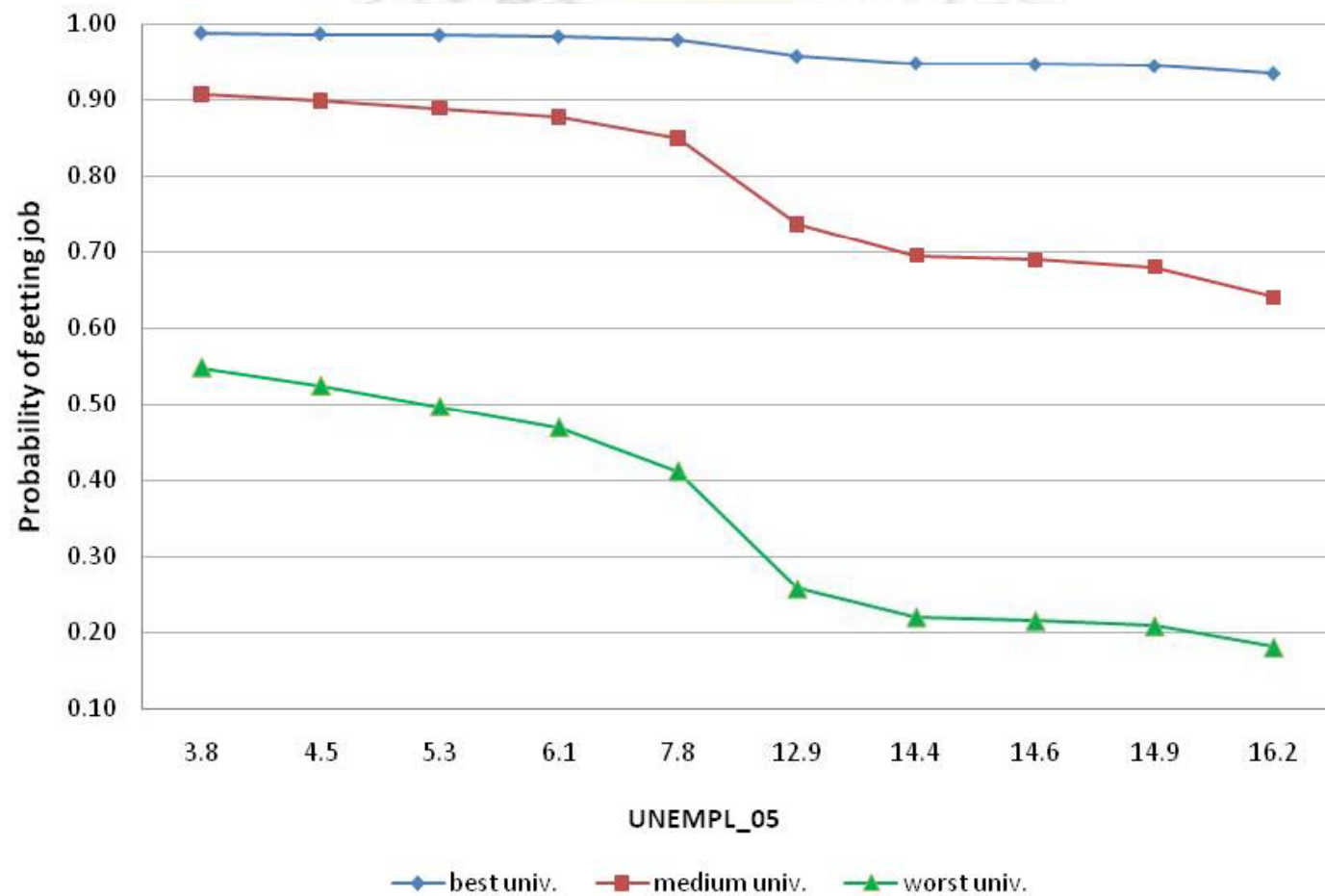
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## Unemployment rate effect



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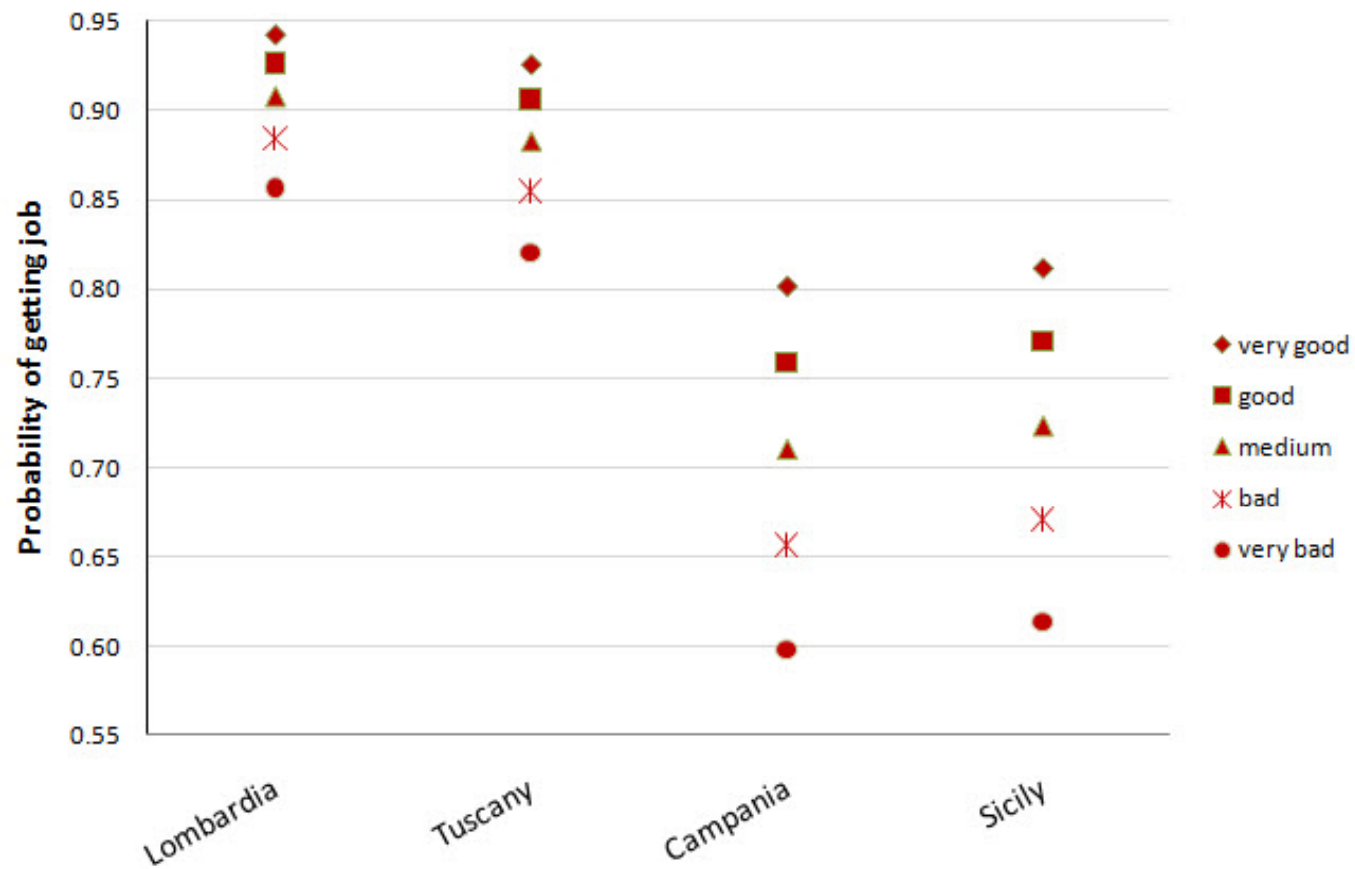
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# Unemployment rate effect: regional differences

## Probability plot for graduates in Economics



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## Concluding remarks

- ❑ The use of contextual characteristics improves the ranking of universities (or course programs)
- ❑ Need to improve this measure including
  - Internal contextual variables (characteristics of institutions)
- ❑ External contextual variables are observed only at regional level. Need to have information for “local” territories (counties)

## Work in progress

- ❑ Same analysis using the graduates before the decree law n.509/99



**THANK YOU FOR YOUR  
ATTENTION**

