CONTEXTUAL FACTORS OF THE EXTERNAL EFFECTIVENESS OF THE UNIVERSITY EDUCATION: A MULTILEVEL APPROACH

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Abstract. *This paper aims at measuring the external effectiveness of the degree programmes of Italian universities taking into account both the characteristics of graduates and some context factors that differently affect the Italian regional labour markets. The analysis is performed via a multilevel logistic model using the Istat survey on Italian graduates of year 2004. Considering job placement one year after graduation, the regional youth unemployment rate affects the occupational chances, but this effect is moderate especially for degree programmes yielding high occupational chances. Even after controlling for the youth unemployment rate, the probability of getting job for graduates in the same subject area is markedly different across universities.*

Keywords: *Contextual effects, Effectiveness, Graduates, Job placement, Random effects.*

1. INTRODUCTION

The high unemployment rates of young graduates observed in many European countries call for detailed analyses of the transition from university to work. An important aspect of this phenomenon is verifying if the degree acquired from university matches the needs of the labour market. Thus, it is crucial to study the effectiveness of the university educational process with respect to the labour market outcomes of graduates, which is a kind of external effectiveness (Hanushek, 1986; Gori and Vittadini, 1999). This concept can be measured through several indicators, such as the success in getting a job, or getting a job in conformity with the education supplied by the degree programme, or a job with an adequate wage, or the time spent to get the first job (Biggeri *et al.*, 2001).

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This study deals with having a job one year after graduation. Any analysis on the effectiveness of the university educational process should take into account the factors, out of the control of the institution, that affect the effectiveness indicators: features of the graduates, features of the universities (such as indices of financial resources, number of students per degree programme), and external context factors represented by socio-economic features of the region where the university is located and where most of its graduates go and search for a job. Several studies dealing with this issue in Italy, like the surveys on job opportunities conducted by AlmaLaurea (Consorzio Interuniversitario AlmaLaurea, 2010, 2011) and by the Italian National Statistical Institute (Istat, 2008, 2010; Tivoli *et al.*, 2011), as well as the analysis carried out by Bini (1999), revealed markedly different results from North to South. This means that the chances to get a job are related to the economic and social differences among regions where universities are located, in addition to individual characteristics and university effectiveness. Therefore, a fair comparative effectiveness analysis should include observable variables measuring the relevant social and economic features of territories.

This paper aims at measuring the external effectiveness of the degree programmes of the universities considering both the characteristics of individuals and context factors that differently affect the regional job markets, in order to make *ceteris paribus* comparisons. This kind of analysis could help the government and policy makers to implement strategies for improving the tertiary education and allocate resources. Our analysis exploits the survey on job opportunities of the Italian graduates in 2004, conducted by Istat in 2007 (Istat, 2008). Currently, this is the most recent data set released by Istat (as a matter of fact the subsequent edition, the one about graduates in year 2007, has already been carried out in 2011).

Several context indicators can be used in the analysis (Barbieri *et al.*, 2008): (*i*) macroeconomic measures, like the Gross Domestic Product per inhabitant, or the productivity of labour; (*ii*) job market measures, like the (youth) unemployment rate, or the quota of irregular labour; (*iii*) measures of production structures, like the number of firms per inhabitant and the average number of employees per firm; (*iv*) innovation and technology measures, like the quota of innovative firms; (*v*) measures of the degree of culture, like the quota of family expenses for cultural entertainments; (*vi*) quality of life measures, like the poverty rate. In this work we exploit the indicators observed in 2004.

The Italian degree programmes are classified in 42 disciplinary classes, according to the Ministerial decree law of 8th August 2000 (MIUR, 2000b).

The analysis is based on a multilevel logistic model that takes into account the hierarchical two level structure of the data, where the clusters (or level 2 units) are

defined by the intersection of the university and the disciplinary class, for example a graduate in Economics at Florence University belongs to a different cluster from a graduate in Economics at Bologna University. These clusters will be called *class/university* from now on.

2. DATA

The Istat data set used in the analysis is made up by two distinct stratified samples for males and females, where the strata of each sample were defined as intersections between degree programmes and universities. The whole number of interviews is 47300, which is about 18% of the population of the 260070 graduates of year 2004. Note that the reform of degree programmes based on the decree law 509/99 (MIUR, 2000a) started in the academic year 2001/2002. In the Istat sample, the post-reform graduates from three-year programmes are 20730, while the remaining come from pre-reform programmes. We focus on post-reform graduates from three-year programmes: even if some of them enrolled in a pre-reform programme and then moved to a new programme (about 35%), most of them enrolled in a post-reform programme. The new degree programmes were designed to improve the performance of universities in terms of capacity to prepare young people for the job market.

The available covariates for the graduates include demographic variables (age, gender, place of residence during the studies, father and mother education and occupation), career variables (kind of high school attended, occupational condition during the studies, degree programme changes, kind of degree), and after degree information (involvement in other studies or training jobs after the degree). The characteristics of the job market are defined by several variables coming from external data sources (Barbieri *et al*., 2008) and measured at regional level.

The university name is missing for small universities (less than 750 graduates) due to data disclosure constraints. Therefore, for our purposes, the data set reduces from 20730 to 18760 graduates.

In order to estimate the probability of employment, we select the graduates by applying a set of conditions described in the following. We eliminate graduates who at the date of the interview: (*i*) did have the same job as before the degree (4109 out of 18760, 21.9%), (*ii*) were enrolled in a second-level degree at university (*laurea specialistica*) or were unemployed and not interested in searching for a job (9399, 50.1%). Moreover, we consider only graduates enrolled in a university located in the region of residence, thus excluding further 1156 graduates for whom it would be questionable to assume that they are searching job mainly in the region of the

university. Immarino and Marinelli (2012) investigate the issue of interregional mobility of graduates using the same Istat survey.

Given the previous selection criteria, the analysis is based on 3677 graduates (after excluding other 419 graduates with missing values on key variables).

The great reduction of the sample size is mainly due to the fact that many graduates do not actually search for a job, mostly because they keep on studying.

The selected graduates are clustered in 381 class/university groups. The median number of graduates within class/university groups is 4 (with a minimum of 1 and a maximum of 145). The overall percentage of employed graduates is 78%, with great variability among class/university groups.

In the following we will analyse the probability of employment one year after the degree through a two-level model, considering covariates at graduate and class/university level.

3. THE TWO-LEVEL LOGISTIC MODEL

Multilevel modelling is a methodology suitable for effectiveness evaluation (Grilli and Rampichini, 2009). In our application, the data have a hierarchical structure with two levels, represented by graduates (level 1 units) and by groups of degree programmes combined with universities (class/university: level 2 units). The observed response y_{ij} is a binary indicator equal to 1 if the graduate is employed one year after the degree, and zero otherwise. A two-level logistic model for graduate i of class/university j, with binomial variation at level 1, can be defined as follows (Rabe-Hesketh and Skrondal, 2008; Snijders and Bosker, 2011):

$$\text{logit}(\pi_{ij}) = \eta_{ij} = \alpha + \sum_h \beta_h x_{hij} + \sum_l \gamma_l z_{lj} + u_j \qquad u_j \overset{iid}{\sim} N(0, \sigma_u^2) \tag{1}$$

where x_{hij} is the h-th covariate of graduate i of class/university j, z_{lj} is the l-th macro-economic covariate of class/university j, and u_j is the random effect at level 2 which is intended to collect the unobserved factors at the class/university level affecting the outcome of the graduates.

Conditional on the random effects the probability to get job π_{ij} is

$$\pi_{ij} = \frac{1}{1 + \exp\left(-\eta_{ij}\right)} \tag{2}$$

The model includes individual-level covariates selected from the Istat questionnaire and macro-economic variables measured at regional level, derived from official statistics.

4. MODEL SELECTION

The multilevel logistic model defined in the previous section has been fitted by means of the `xtmelogit` procedure of Stata (Stata, 2009). Tab. 1 shows the results of the analysis.

The model selection process started with the model without covariates (Null model of Tab. 1). The variance at the class/university level is highly significant: the predicted probability to have a job one year after degree is 0.74 for an average class/university (i.e. u_j=0). This probability decreases to 0.29 for a class/university at the 2.5th percentile (u_j=-1.96), and it increases to 0.95 for a class/university at the 97.5th percentile (u_j=1.96).

The next step is the selection of significant graduate-level covariates, using a 5% threshold. Only few of them are significant (Model A of Tab. 1): gender (*female*, sample proportion 63%), age at graduation greater or equal to 30 (*age30*, sample proportion 10%), graduation within institutional time (*grad_in_time*, sample proportion 76%).

Table 1: Estimates of two-level logistic models

	Null model	***Model A Graduate covariates***	***Contextual covariates***	
			Model B Youth unempl.	***Model C GDP***
Model parameters				
constant	1.0480***	1.1230***	1.6055***	-0.2118
female		-0.2474*	-0.2550*	-0.2517*
age30		-1.1519***	-1.1340***	-1.1322***
grad_in_time		0.2783*	0.3038**	0.2978**
gdp04				0.0501**
y_unem04			-0.0270**	
level 2 s.d.	0.9945***	1.0099***	0.9906***	0.9939***
Statistics				
log-likelihood	-1776.50	-1741.99	1736.79	-1737.39
n. of parameters	2	5	6	6

** p<0.05; ** p<0.01; *** p<0.001*

Model estimates show that to be older and female reduces the probability to get a job, while graduation in time increases this probability. The largest effect is that of age: for example, the predicted probability for a male graduated beyond

institutional time is 0.75 if aged less than 30 years, and 0.49 if aged 30 years or more.

In the last step of the model selection process, the macro-economic variables measured in 2004 at regional level are added. The values of the contextual variables refer to the region where the university is located, so we implicitly assume that graduates search for a job in the region where they have got their degree. We inserted as regressors all the indicators listed in Section 1. Only two of them turned out to be significant: the youth unemployment rate (*y_unem04*) and the Gross Domestic Product per inhabitant (*gdp04*), whose descriptive statistics are reported in Tab. 2. These two variables are typical indices representing the degree of economic and job market development of a territory.

Table 2: Contextual variables (selected sample – 381 class/university groups)

Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
y_unem04 (percentage)	18.7	9.4	10.6	43.0
gdp04 (per capita´1000 euro)	26.3	4.8	15.5	31.1

The youth unemployment rate (*y_unem04*) and the Gross Domestic Product per inhabitant (*gdp04*) are significant only if they are entered one at the time (Models B and C of Table 1). As expected, these two macro-economic indicators have an opposite effect, positive for GDP and negative for youth unemployment: the predicted probability to get a job is higher for graduates resident in regions with higher GDP and lower youth unemployment rate. If the two macro-variables are added jointly, none of them is statistically significant due to their high correlation (-0.79).

Comparing Model A with Models B and C, it is evident that the contextual macro-economic variables are statistically significant, even if the reduction of the level 2 residual variance is small: for Model B, the reduction is $(0.9906^2-1.0099^2)/1.0099^2=0.037$, i.e about 4%.

The two alternative specifications with only one of the macro-variables have similar fit, though the model with youth unemployment (Model B) fits slightly better. Model B is preferable also from a theoretical point of view, given that the youth unemployment rate is closely related to the occupational chances of graduates. Thus, in the following, we will discuss the results of Model B.

5. RESULTS

Let us illustrate the results of Model B of Tab. 1, namely the model for the probability of getting job including the youth unemployment rate as contextual

variable. Tab. 3 shows Model B estimates with more details. The individual-level covariates are binary, thus the corresponding odds ratios compare two groups (e.g. males and females), other things being equal. On the contrary, the unemployment rate is a continuous variable, expressed as a percentage, so the odds ratio compares the outcomes of two subjects with the same covariates but graduated in regions differing by 1% in the unemployment rate.

Table 3: Odds Ratios and confidence intervals for model B of Table 1

Covariate	*Odds Ratio*	*Std. Err.*	*p-value*	*95% Conf. Interval*	
female	0.775	0.078	0.011	0.636	0.944
age30	0.322	0.047	0.000	0.241	0.429
grad_in_time	1.355	0.150	0.006	1.091	1.683
y_unem04	0.973	0.008	0.001	0.958	0.989

The model can be used to predict the probability to be employed one year after graduation according to formula (2). For instance, a baseline graduate (male, less than 30 years old at graduation, graduated beyond institutional time) in a hypothetical class/university with a mean level 2 residual (i.e. u_j=0), located in a region with a mean youth unemployment rate (namely 18%) has a probability of being employed of about 75%.

In order to evaluate the effect of unobserved characteristics at the class/university level, we consider 5 levels of effectiveness. Since the random effect u_j is normally distributed with an estimated standard deviation of σ_u=0.99, these 5 levels of effectiveness are defined as follows: 'very good' if u_j=2σ_u, 'good' if u_j= σ_u, 'mean' if u_j=0, 'bad' if u_j=-σ_u, and 'very bad' if u_j=-2σ_u.

Tab. 4 reports, for the 5 effectiveness categories defined above, the probabilities to be employed for a baseline graduate in a university located in a region with a mean youth unemployment rate.

Table 4: Probability to be employed for a baseline graduate by class/university effectiveness

Class/university effectiveness	*Random effect value*	*Employment probability*
Very good	+2σ_u	95.7%
Good	+σ_u	89.2%
Mean	0	75.4%
Bad	-σ_u	53.2%
Very bad	-2σ_u	29.7%

Baseline graduate: male, less than 30 years old, graduated beyond institutional time. University located in a region with youth unemployment rate at 18%.

The high variability of the predicted probabilities (ranging from about 30% to 96%) is likely related to university organization and quality of teaching, different employability of degree subjects, as well as local labour market factors other than the regional youth unemployment rate.

Fig. 1 shows the probability to be employed as a function of the regional youth unemployment rate, distinguishing three effectiveness categories. The probability to be employed for the baseline graduate in a mean class/university reduces of about 1% for each 2% increase in the unemployment rate (e.g. from 75.4% to 74.4% if the unemployment rate raises from the average value of 18% to 20%). The effect of the unemployment rate is higher for very bad class/universities, while it is negligible for very good ones.

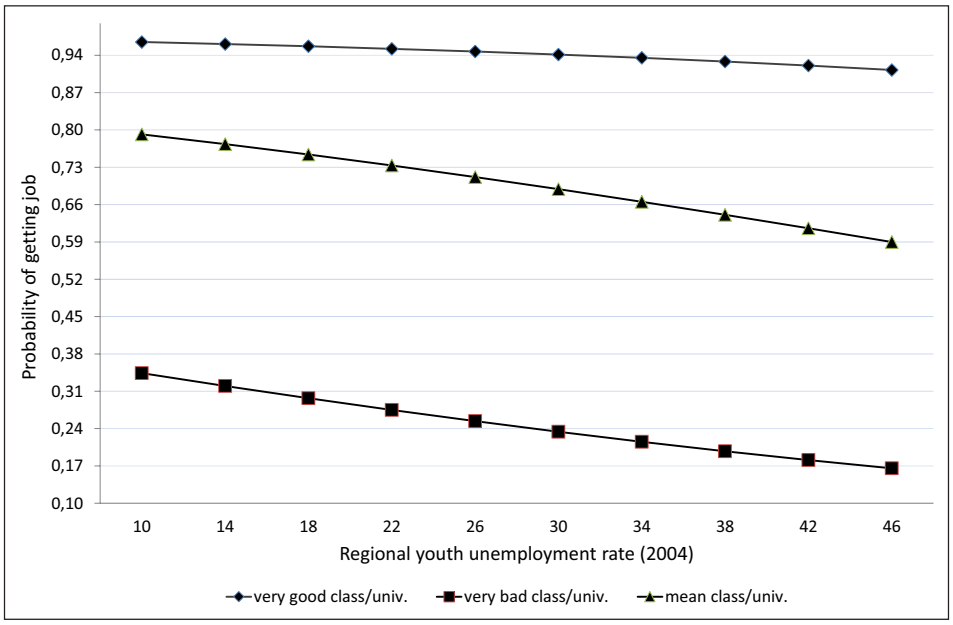

Figure 1: Predicted probability to be employed for a baseline graduate by regional unemployment rate.

The unemployment rate varies greatly between regions. To illustrate its effect, Table 5 reports the predicted probabilities for a baseline graduate in some of the Italian regions: Lombardia, Toscana, Campania and Sicilia, using the corresponding values of the youth unemployment rate, and plugging in the values of the random effect as defined in Tab. 4.

Table 5: Probability to be employed for a baseline graduate by class/university effectiveness and region

Class/university effectiveness	*Region (youth unemployment rate)*			
	Lombardia (12.74)	*Toscana (16.05)*	*Campania (37.66)*	*Sicilia (42.94)*
Very good	0.96	0.96	0.93	0.92
Good	0.90	0.90	0.83	0.81
Mean	0.78	0.76	0.64	0.61
Bad	0.57	0.55	0.40	0.37
Very bad	0.33	0.31	0.20	0.18

The results show that the spread between very bad and very good class/university groups is greater in regions with an unfavourable economic context, such as Sicilia. Moreover for very good class/university groups the differences across regions are negligible, while for very bad class/university groups the probability to be employed ranges for 33% in Lombardia to 18% in Sicilia. Thus, especially for degree courses with low employability, the comparison should take into account the factors that characterise regions and affect external outcomes of the universities.

In order to disentangle the effect of the class (degree subject) from the effect of the university, we collapse the classes into the 16 subject groups defined by the Ministry of Education (MIUR).

Table 6 reports the number of degree programmes in the analysed data set by subject group and geographical area. Note that we considered only first level degree programmes (3 years), so excluding the typical degree programmes in Law, Architecture and Medical sciences, lasting 5 or 6 years. Moreover, the analysed data set contains only graduates from degree programmes started in 2001 with the new regulation, which represent only a fraction of degree programmes active in 2001.

About 60% of the considered degree programmes belong to 4 groups: Medical sciences (mainly nursery), Socio-political sciences, Engineering and Economics. Some of the groups are under-represented in the Centre (Geo-biology and Chemistry-Pharmacy) or in the South of Italy (Foreign languages and Humanities). The presented results are referred to the transitory situation at the beginning of the reform, and thus they cannot be generalised to the whole Italian university system.

In order to evaluate the effectiveness of the subjects and their variability across universities, we compute the level 2 residuals (EB, Empirical Bayes residuals). Considering only the subject groups with at least 10 degree programmes in the data set, Fig. 2 reports the box-plots of the class/university EB residuals by subject.

Table 6: Number of degree programmes in the analysed data set by subject group and geographical area

Subject groups	*Geographical area*			*All*	
	North	*Centre*	*South*		
Medical sciences	39	20	21	80	21.0%
Socio-political	31	10	13	54	14.2%
Engineering	28	16	6	50	13.1%
Economics	24	11	5	40	10.5%
Foreign languages	15	6	2	23	6.0%
Science	14	4	4	22	5.8%
Humanities	10	8	1	19	5.0%
Geo-biology	12	1	2	15	3.9%
Education	7	4	3	14	3.7%
Chemistry-Pharmacy	10	1	2	13	3.4%
Sport	7	3	3	13	3.4%
Architecture	8	4	0	12	3.1%
Law	6	3	1	10	2.6%
Agricultural	6	3	0	9	2.4%
Psychology	3	2	1	6	1.6%
Defence	0	1	0	1	0.3%
All	*220*	*97*	*64*	*381*	*100.0%*

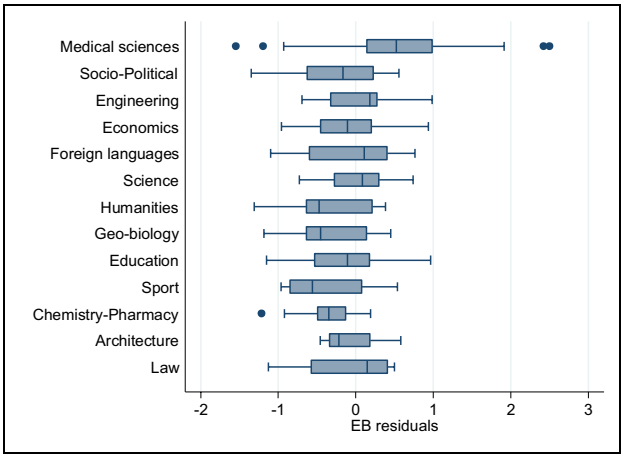

Figure 2: EB level 2 (class/university) residuals by subject group

The box-plots show a great variability within subject groups. This variability can be ascribed to the specific features of the degree programmes, to the local labour market or to the university organisation. The best group is Medical sciences, where more than 75% of courses have a residual larger than zero. Another group with a median above zero, is Engineering. On the contrary, the groups with a very low (negative) median are: Sport science, Humanities, Geo-biology and Chemistry-Pharmacy.

Fig. 3 reports the average of the EB residuals by geographical area (North, Centre and South of Italy) and subject groups. The residual analysis shows that the degree programmes in Humanities, Socio-political sciences, Chemistry-Pharmacy and Sport, yield lower chances of getting a job independently from the geographical area; while Medical sciences (mainly nursery) yield higher chances in all the geographical areas.

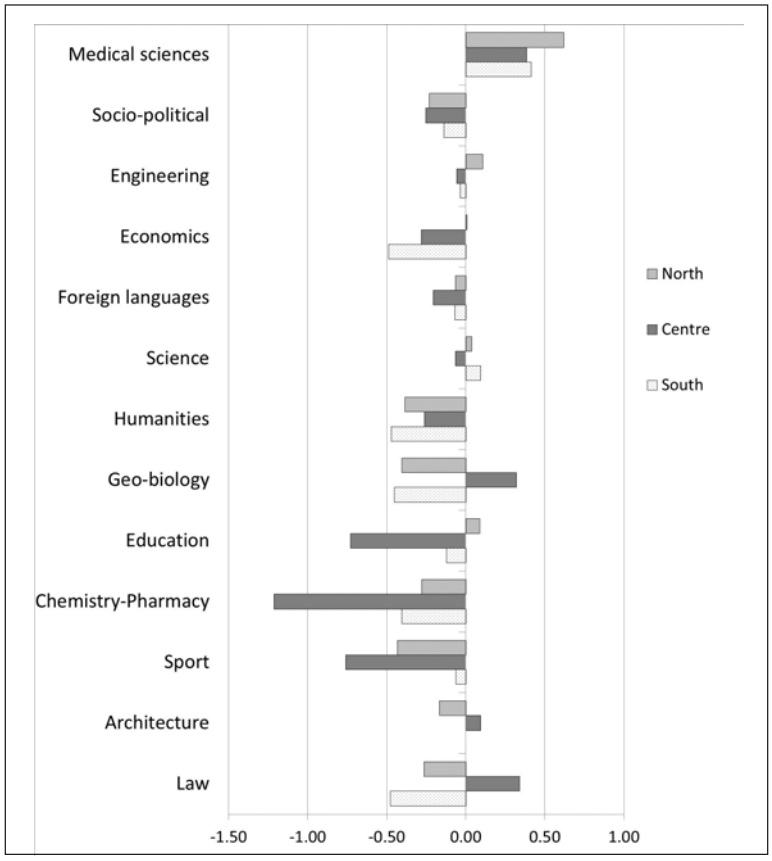

Figure 3: Average EB level 2 residuals by subject group and geographical area

In general, the residuals vary greatly across geographical areas. This means that differences in university organization and local labour market could affect some disciplines, so that comparisons among universities should be done with caution. In the model we control for the overall youth unemployment rate, while the job placement is influenced by other factors, such as the economic sectors of the firms in the regions.

In order to evaluate the consequences of adjusting for youth unemployment rate, we compare the average level 2 residuals by region from Model A and Model B, considering the class of Business Economics, which is present in most of the considered universities (Table 7).

Table 7: Comparison between EB level 2 residuals of Model A and Model B: Regional average of Business Economics programmes (class 17)

Region	*n. of*	*Model A*		*Model B*	
	class/univ	*Mean res.*	*Rank*	*Mean res.*	*Rank*
Friuli Venezia Giulia	1	0.47	1	0.41	1
Toscana	3	0.24	2	0.20	2
Lombardia	6	0.24	3	0.17	3
Emilia Romagna	2	0.10	4	-0.01	5
Umbria	1	0.00	5	-0.04	6
Sardegna	1	-0.10	6	0.15	4
Piemonte	2	-0.16	7	-0.20	7
Veneto	3	-0.31	8	-0.43	9
Marche	1	-0.33	9	-0.33	8
Liguria	1	-0.57	10	-0.52	10
Abruzzo	2	-0.65	11	-0.59	12
Calabria	1	-0.69	12	-0.55	11
Lazio	3	-0.70	13	-0.60	13

The adjustment for the youth unemployment rate in Model B produces small changes in the ranking of the degree programmes by region, though it attenuates the differences across regions: the range of the regional averages of the EB residuals is 1.17 in Model A and 1.01 in Model B.

6. CONCLUDING REMARKS

This study has considered the external effectiveness of universities in terms of probability for their graduates to get a job one year after degree. A measure of external effectiveness is obtained via a multilevel approach. The estimated model

allows us to evaluate the contribution of subject classes and universities to employability, adjusting not only for characteristics of graduates, but also for contextual factors of the regional economic systems. The resulting effectiveness measure is thus more appropriate to perform comparisons among universities or among degree programmes on the same subject at different universities.

We considered several contextual factors. The youth unemployment rate turns out to significantly affect the probability to get a job. Such effect is negligible for degree programmes with high employability, but it is relevant for graduates from degree programmes with low occupational chances. However, most of the variability of the employment probability is due to unobserved factors at the cluster level, where a cluster is defined by a given subject class in a given university. The spread between very bad and very good clusters is greater in regions with an unfavourable economic context, where the unemployment rate is higher. The high variability of the predicted probabilities is likely related to university organisation and quality of teaching, but also it depends on different local labour market factors other than different regional youth unemployment rate.

The analysis of the second level residuals showed a large variability within subject groups across universities which can be ascribed to specific features of the degree programmes, the university organisation and the local labour market. This means that comparisons among universities should be done with caution. Here, the model controls for the overall youth unemployment rate, but probably other factors, such as the economic sectors of the firms in the regions affect the job placement chances.

In terms of geographical areas (North, Centre and South), the analysis showed that some subject groups have a good or bad performance in all Italy, in particular Medical Sciences (mainly Nursery) is clearly outstanding. On the other hand, subject groups like Geo-biology and Law have quite different performances in the geographical areas.

The results of our analysis can be exploited by policy makers to compare the external effectiveness of degree programmes and universities, in particular to locate outlying cases with extremely bad or good performances. The results can also help students, especially freshmen, to compare the occupational chances yielded by degree programmes and universities.

The estimated model, and consequently the evaluation of universities effectiveness in terms of employability, can be improved in many ways. First of all, some of the universities are located in different provinces of the same region, while the macro-economic variables are measured at regional level. The availability of contextual variables measured at provincial level would allow to better characterise

the local job market. Moreover, the model does not include any information on characteristics of the institutions (internal context), which are difficult to obtain for all universities since at present none of the official surveys detects them.

Finally, the peculiarities of the presented results are referred to the transitory situation at the beginning of the university reform, so that they cannot be generalised to the whole Italian university system. This suggests to carry out a new analysis on graduates of more recent cohorts as soon as data are available.

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REFERENCES

Barbieri, A.G., Cruciani, S. and Ferrara, A. (2008). *100 Statistiche per il Paese. Indicatori per conoscere e valutare*. Istat, Stampa CSR.

Biggeri, L., Bini, M. and Grilli, L. (2001). The transition from university to work. A multilevel approach to the analysis of the time to obtain the first job, *Journal of the Royal Statistical Society A*, (164): 293-305.

Bini, M. (1999). Valutazione della Efficacia dell'Istruzione Universitaria rispetto al Mercato del Lavoro. In: *Research Report n. 3/99, Osservatorio per la Valutazione del Sistema Universitario*, MIUR, Roma: 1-100.

Consorzio Interuniversitario AlmaLaurea (2010). *XII Rapporto sulla condizione occupazionale dei laureati. Occupazione e occupabilità dei laureati. Investimenti in capitale umano nel futuro di Italia ed Europa.* Il Mulino, Bologna.

Consorzio Interuniversitario AlmaLaurea (2011). *XII Profilo dei laureati italiani. L'istruzione universitaria nell'ultimo decennio. All'esordio della European Higher Education Area,* Il Mulino, Bologna.

Gori, E. and Vittadini, G. (1999). *Qualità e valutazione nei servizi di pubblica utilità*. ETAS Libri, Milano.

Grilli, L. and Rampichini, C. (2009). Multilevel models for the evaluation of educational institutions: A review. In: Bini M., Monari P., Piccolo D. and Salmaso L. (Eds.), *Statistical methods for the evaluation of educational services and quality of products*. Physica-Verlag, Berlin Heidelberg: 61-80.

Hanushek, E.A. (1986). The Economics of schooling: Production and efficiency in public schools, *Journal of Economic Literature*, (49): 1141-1177.

Immarino, S. and Marinelli, E. (2012). Education-job (mis)matching and interregional migration: Italian university graduates' transition to work. *CIMR Research Working Paper Series* No.8.

Istat (2008). *Inserimento professionale dei laureati. Indagine 2007*. Istat, Roma.

Istat (2010). *I laureati e il mercato del lavoro. Inserimento professionale dei laureati. Indagine 2007*. Informazioni, 3. Istat, Roma.

MIUR (2000a). Decreto Ministeriale 3 novembre 1999, n.509, *Gazzetta Ufficiale della Repubblica Italiana*, 4 gennaio 2000 n.2. Istituto Poligrafico e Zecca dello Stato, Roma.

MIUR (2000b). Decreto Ministeriale 4 agosto 2000, *Gazzetta Ufficiale della Repubblica Italiana, 19 ottobre 2000 n. 245*, supplemento ordinario n. 170. Istituto Poligrafico e Zecca dello Stato, Roma.

Rabe-Hesketh, S. and Skrondal, A. (2008). *Multilevel and Longitudinal Modeling using Stata*, 2nd Edition. Stata Press, College Station, TX.

Snijders, T.A.B. and Bosker, R.J. (2011). *Multilevel Analysis. An introduction to basic and advanced multilevel modelling*. 2nd Edition, Sage, London.

Stata (2009). *Longitudinal/Panel-Data Reference Manual Release 11*. Stata Press.

Tivoli, A., Strozza, M. and Rottino, F.M. (2011). Studiare... e poi? Oggettività e percezione della qualità del lavoro. *Istat Working Papers*. 17/2011.