University of Florence

Demographic Models

Transition to first employment for postgraduated

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Author	*Student ID*
Noemi Benci	7006267
Martina Pacifici	7006254

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Background

Due to our status of Master Statistics Students and to some interesting articles, we wanted to see how long does it take for Italian postgraduate from different field of education to find their very first job, a socially significant point of change after the end of the studies.

Our country is in a situation of job uncertainty, almost for young people. We wanted to test the work situation for who decides to invest into his/her own "Human Capital" by joining the University.

In Italy the portion of the population under 25 enrolling in College is very small and under OCSE media. Most of all just a very little part of them gets a Scientific degree, and we expected it to be the field of education with the smallest timing of entry into first job.

Focusing on the gender we didn't expect any type of differences on the timing of entry into the work world, almost if we talk about graduate people.

Furthermore we wanted to test whether some control variables explaining the background of the individuals (diploma, social origin) and the prestige of the University (private/ public, nearer to areas where it's easier to find job) influence the timing of entry into the work world.

For these analyses Event History approach was the best choice, because in this way we could follow the biography and the different timing of any single individual.

With Event History Analysis we were able to study the interdependence between the timing of entry into the work world and the field of education of any subject, but even with their other characteristics.

In event history we often find the exit time of unemployment as one of the main analysis topic. It's certain that unemployment is a strong influencing factor for transition to the exit from parental house, marriage, first child and many other life-changing events, but the way it has been treated in event history (or not) studies is diversified. In particular the first employment has been often examined in terms of earnings; probably it's common to think that it's more interesting to know, before entering into the University world, how much you can potentially earn once you get a certain job or once you're postgraduate. It could be interesting but when does this time arrive? To answer this question we decided to do this analysis.

A paper written by Fabrizio Bernardi in 2001 named "Is it a Timing or a Probability Effect? Four Simulations and an Application of Transition Rate Models to the Analysis of Unemployment Exit" was very interesting for us to understand the main point of our analysis. Often in EHA, as it's said in this paper, it's not possible to distinguish whether the variables affect the response in terms of time or probability effects.

The model and the type of analysis we chose was suggested even by the idea we had at the very beginning: looking at the timing. We thought that a different field of education instead of another could, first of all, accelerate or decelerate the timing of entry into the job's world instead of increasing or decreasing its probability.

With the information we had from an ISTAT 2015 survey based on 2011 graduate we couldn't work with the type of the first job found after graduation (even if it would have been interesting) but we worked with the contract. We treated it as a competing risk model, considering the main event job finding possible with a fixed-term or a permanent contract.

We anticipated that in most of the cases the first contract would have been a fixed-term one but it's has been very interesting looking at the proportions diversified by the fields.

The ISTAT survey, which generated our database, allowed us to do a retrospective investigation of any postgraduate. It's clearly an advantage for us to know better what affects the timing of this transition most between all the main events a person lives. On the other hand sometimes (but in some very small cases) the memory of the questioned was not so reliable, especially when they were asked about their first contract.

Despite this small occurrence, we were fulfilled to use Event History analysis for its accuracy, dealing with the specific biographies and the background of any questioned.

1 Research Questions

Two are the main research questions we formulated.

First we asked ourselves if it's the timing of first job different looking at the field of education.

This means that we were keen on seeing what is the effect of the field of the degree on the timing of first job. There are not many answers in literature to our main research question, so it would have been interesting to see what we could find out analyzing the ISTAT dataset of 2011 postgraduate. For this task we focused on demographic models and, using the results, we tried to predict an expected time of wait for the first job. Before starting our analysis we thought that Scientific degrees lead to a faster job finding.

The second question was about the first type of contract one should expect as first one after the degree consignment.

We often hear on news that in Italy most young people are hired with fixed-term contract and once the job-giver can't renew the postgraduate with another fixed-term, because of the terms law gives, he or she gets fired. We didn't have many information about the first job continuation, but we asked ourselves if it's common for any postgraduate to get a fixed-term as first job. Once again we focused on the differences between field of education for the first type of contract. We used a competing risk model to answer this question; the competing risk were a fixed-term contract and a permanent one. We anticipated that fixed-term was the most common contract but it was very interesting to see the differences we met between the two answers for the fields of education.

2 Empirical Strategy

We focused our analysis on a sample from 2011 graduates who were questioned in 2015 by ISTAT about their job conditions after the degree. In particular the theoretical sample was composed by 73.825 people but the only respondents were 58.400 individuals. A section of this empirical sample was truncated (17.929 Doctors) because we found out that they accepted their first job before the month of their graduation and we didn't have any information about it.

We worked then on a risk set of 40.471 cases; for the first main research question (timing on job's entry) 6.110 graduates were censored because from their 2011 degree and at the moment of the end of the interview never had or accepted a job opportunity.

Our idea was to look at the timing of entry into the work world for this Italian 2011 graduates measured in months between their degree consignment and their first job.

At first we took a look at the survey and checked all the variables contained in the data set to clearly understand which ones we wanted to use and which type of information we could merge together. The variables ISTAT created based on the survey were 181. We decided to use the variable field of education, named "gruppo", as the first explanatory variable for our phenomenon. This is divided into 9 categories: Economic-Statistics (baseline category), Scientific (math, technology, chemistry, pharmacy), Biological (biology, geologic, agricultural), Medical, Engineering (engineering and architecture), Social-Sciences (social-sciences, security and defence, politic-sciences), Juridical, Literature (Italian literature and foreign languages) and Psycho-Pedagogical (psychology and pedagogy).

Then we created and selected some that we wanted to use as control variables in our model. This variables are i.e. the type of high school the subject concluded (scientific as baseline category), the "social origin" (the education level of the parents and their employment status) and the degree mark (a dummy variable which takes value 0 if the mark is less than 100, the baseline category, and 1 otherwise). Other variables refer to the geographical area of the achievement (North, Center, Islands-South Italy or telematics University).

We generated dummy variables referring to what the student did after the graduation, i.e. if they started another course (Master degree, PhD, etc...). This was very important almost to control who in 2011 got a bachelor's degree and went on with studies.

We considered the gender too, which took value 0 if the postgraduate is a man, 1 if female. We included this wishing not to find differences in job findings for postgraduate.

In our opinion, these information could moderate and combine the effect of field of education on the timing of first employment. Through the analysis some were excluded into the final model for lack of significance of their coefficients.

In the end we encoded the time (we used a variable created by ISTAT named "mesi i lavoro" which measures our analysis main point, months between 2011 graduation) and created the event (job finding) variables.

To answer the question about which type of contract we used of course the same data set of before but the risk set was a bit different; we had to drop 10.386 observations more (401 of them declared that never had/accepted a job opportunity but selected a type of first contract in the survey, while 9.985 declared that had/accepted a job opportunity but didn't select which type of contract were offered). So the risk set was composed by 30.085 observations with 5.709 censored cases.

To answer the question which contract is more probable to get as first job post degree we used field of education, described before, as main explanatory variable.

The competing risk (which is even the model we chose to deal with this question and risk set) describes clearly a risk effect, instead of a timing one. In fact, for this analysis we focused on the risk for any field of education to get a fixed-term or a permanent contract.

For the event we defined the two competing risk: first job with permanent contract (permanent or self employed) versus fixed-term contract (fixed-term, casual worker, occasional collaboration, research grant/bursary).

The control variables are the same used in the first question while some were cut off getting to the final model.

3 First analysis results

3.1 Descriptive Findings

Firstly we had to choice the model and to reach this goal we draw the smoothed plot of the hazard rate. As we can see in the Figure 1 the hazard is bimodal, in particular a lot of people find the first job before the 20th month and many others find it near the 40th month. To understand why we observed this phenomenon, we decided to plot the same hazard both by field of education and by type of degree. The plot in the center underlines that the bimodal issue found in the global hazard is present in every field except for the medical.

The third image explains the reason of this problem: the interviewed graduated in three different types of degree (the master's, the one-tier master's and the bachelor's degree). Those who graduated in the one-tier and in the master degree, found their first job in the first months after the graduation, but who finished the three-years degree found it near the 40th month. This explanation is very sensible due to the fact that many people decide to continue their studies after the bachelor's degree.

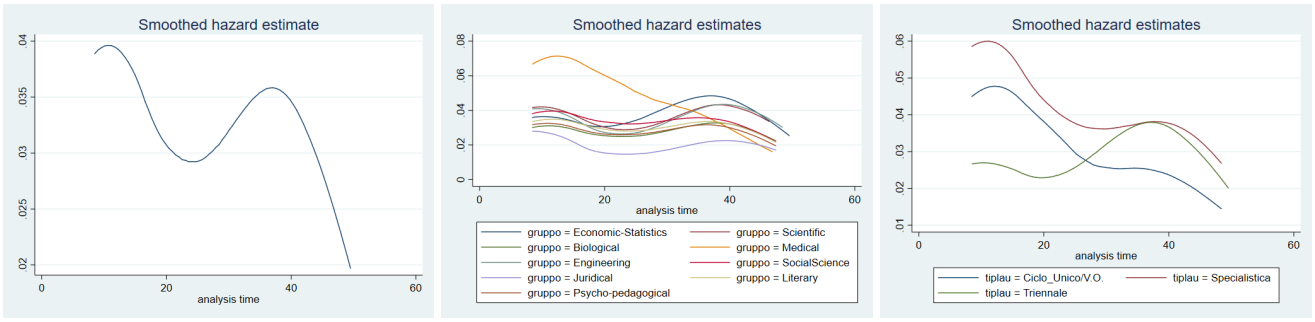

Figure 1: Smoothed Hazards of our sample, by field of education and by type of degree

Due to all this consideration we decided to use a Piecewise Constant Model, so that we could assume a flexible distribution of the hazard by including an interaction term between the time intervals and the type of degree.

3.2 Model Findings

At the beginning we fitted a Piecewise Constant Model without control covariates. We were interested in understanding the effect of the field of education, of time intervals and of the interaction between time and type of degree. We reported in Figure 2 on the left image the coefficients of field of education of this model, choosing as baseline the Economic-Statistics field. The effects are positive for Medical, negative for Biological, Juridical, Literary and Psycho-Pedagogical and non significant in relation with the baseline the Scientific, Engineering and Social Science fields. Who has a positive effect would presumably get the first job more quickly than Economic-Statistics postgraduates.

In Table 1 we reported the estimated hazard ratios for all the variables of the final model. Each value represent the multiplicative effect on the baseline hazard, without considering other variables. When the hazard ratio is greater than 1 the associated variable has a positive effect on the baseline hazard and therefore reduces the expected duration. They aren't all significant, such as parental education, which effect is mostly captured by parental occupation, and type of diploma (Scientific as baseline). The lack of significance could be explained by the fact that we used lot of control variables that mitigate the effect of the others.

Respect to the Bachelor's degree (baseline case) both the One-Tier Master's and the Master's hazard ratios are significant but with opposite effect; the first one influences negatively the hazard rate, probably due to the fact that Juridical, the worst field in job's finding, is typical a One-Tier Master's degree. In particular who graduates with a One-Tier degree has 14% risk less to get the first job in respect to who has a Bachelor, so the timing of this transition is slower. On the other hand who concludes a Master degree has 44% risk more than the baseline category.

The interactions between time intervals and type of degree are significant and allow to capture the bimodal shape of hazard function.

Having already described field of education's coefficients in Figure 2 it's now important to quantify their effect through hazard ratios.Using Economic-Statistics as baseline case we can see that Scientific behave in the same way (its hazard ratio is not significant). As we have already said Medical field has the biggest positive effect: they have 25% risk more than the baseline to experiment this transition. The smallest effect is represented by Juridical, which has circa 40% risk less than Economic-Statistics. The other fields risks range from 17% to 23% less than the baseline. The difference between Engineering and Economic-Statistics is significant only at 5%, with an hazard ratio a few greater than one.

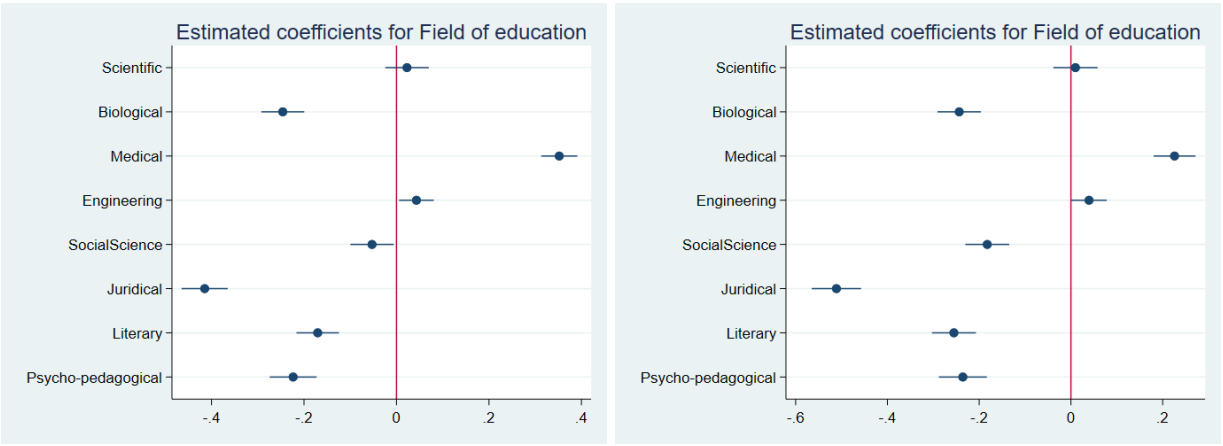

Figure 2: Coefficient plot model without control covariates (left) and with control variables (right)

In the right-hand figure the coefficients refer to the Piecewise Constant model with both main variables, time intervals (interacted with type of degree) and control variables. As we can see the coefficients for field of education follow the same trend as before, but the estimates are a little different; the Juridical field gets worse and the positive effect of Medicals gets lower.

variable	Haz. Ratio	pvalue
tiplau		
Ciclo Unico/V.O.	.8647724	0.000
Specialistica	1.442124	0.000
time int		
6	.8432316	0.000
12	.6050672	0.000
18	.5371131	0.000
24	.9675566	0.263
30	1.195492	0.000
36	1.598283	0.000
42	1.244729	0.000
48	.1446934	0.000
tiplau*time int		
Ciclo Unico/V.O. * 6	1.505362	0.000
Ciclo Unico/V.O. *12	2.217397	0.000
Ciclo Unico/V.O. *18	1.384813	0.000
Ciclo Unico/V.O. *24	.6311347	0.000
Ciclo Unico/V.O. *30	.5831101	0.000
Ciclo Unico/V.O. *36	.5071239	0.000
Ciclo Unico/V.O. *42	.5727962	0.000
Ciclo Unico/V.O. *48	.3933008	0.000
Specialistica * 6	1.062791	0.074
Specialistica *12	1.120657	0.008
Specialistica *18	1.028541	0.573
Specialistica *24	.4983054	0.000
Specialistica *30	.3690424	0.000
Specialistica *36	.4186605	0.000
Specialistica *42	.4950032	0.000
Specialistica *48	.9209534	0.483
gruppo		
Scientific	1.00989	0.689
Biological	.7838893	0.000
Medical	1.253412	0.000
Engineering	1.040264	0.045
SocialScience	.8333469	0.000
Juridical	.5998143	0.000
Literary	.7748889	0.000
Psycho-pedagogical	.7901182	0.000

variable	Haz. Ratio	pvalue
ita Nord ref.)		
Centro	.7562255	0.000
Sud	.5706721	0.000
Isole	.6091109	0.000
Telematica+Estero	.4503917	0.000
1.voto lau	1.120751	0.000
privata	.9940277	0.779
1.ciclo unic 2	.4711059	0.000
1.trienn 2	.5871292	0.000
1.magistr 2	.4379037	0.000
1.master i 2	1.005659	0.757
1.master ii 2	.831062	0.000
femmina	.9721673	0.016
tipo dipl		
Liceo Classico	.9209479	0.000
Liceo Linguistico	1.107449	0.000
Liceo Socio-Psico-Pedagogico	1.016113	0.530
Liceo Artistico/Istituto Arte	.9456023	0.233
Istituto Tecnico	1.003979	0.790
Istituto Professionale	.9373282	0.031
Scuola Straniera	.8960498	0.209
occ genitori		
almeno un dipendente	1.095268	0.000
almeno un autonomo	1.118499	0.000
istr genitori		
entrambi max medie	.9598203	0.014
almeno uno diploma	1.02818	0.080
almeno un laureato	.9853282	0.370
entrambi laureati	.9650749	0.059
cons	.0699752	0.000

Table 1: Table of Hazard Ratio

It's now important to talk about the control variables on the right side of the Table 1. The geographical area of consignment is divided into five categories: North (baseline case), Center, South, Islands and Telematics/ Foreign Universities. All the hazard ratios respect to the baseline are significant and smaller than 1; it confirms what we expected, Telematics/Foreign and South-Italy lead to a slower job finding.

The dummy of degree's mark has a significant (and positive) effect, while Private University has not.

Next we find that the 5 dummies we created to define the studies after 2011 degree are all significant, except the I level Master. They all bring to a slower timing of job finding, as we could expect. They help to keep under control the bimodal shape of hazard we talked before.

Gender has a significant and negative effect; as male is the baseline case, being female decreases of 3% the risk to find job.

Dealing with parental job conditions we took as baseline unemployed or retired parents; as we can see both the hazard ratios for the other two categories have a significant and positive impact. Having at least one self-employed parent has a stronger positive effect on job finding, maybe this is explained by the fact that self-employed can assure a job position to their sons.

After discussing the model results, we estimated the survival functions by field of education using our model, reported in Figure 3.

The red horizontal line represents the median; the interception between the median and any survival function shows the median time for job finding for any category; in particular we can see that Medical, in median, finds the first job at the 18th month post degree, while Juridical has a median time of job's entry of 36 months. We can divide the other fields in two main medians: 20 and 23 months.

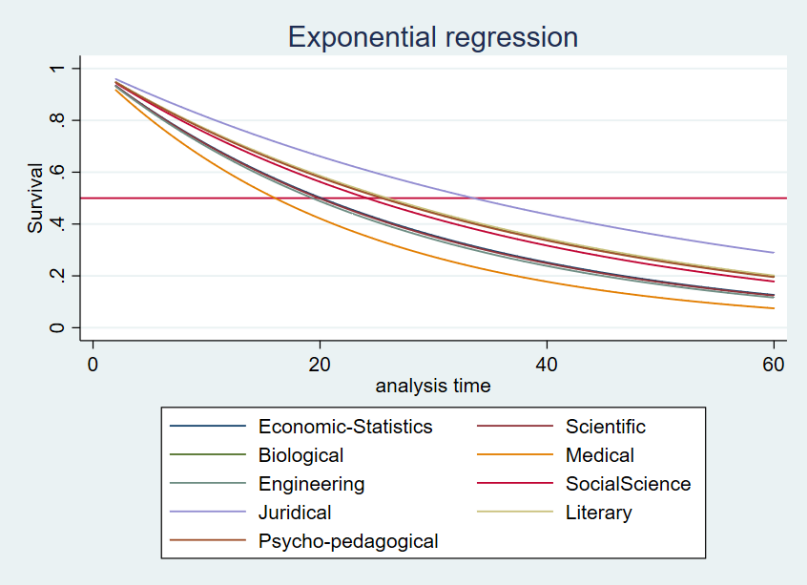

Figure 3: Estimated Survival functions by field of education

4 Competing Risks

The second analysis we developed focuses on the type of first contract, using a competing risk model. Due to the bimodal shape of hazard function we used the Piecewise Constant Model with the interactions between time-interval and type of degree; the control variables are the same of the previous model. In this analysis the definition of the event is different from before; we created this variable coding censored as 0, fixed-term contract as 1 and permanent contract as 2.

4.1 Descriptive Findings

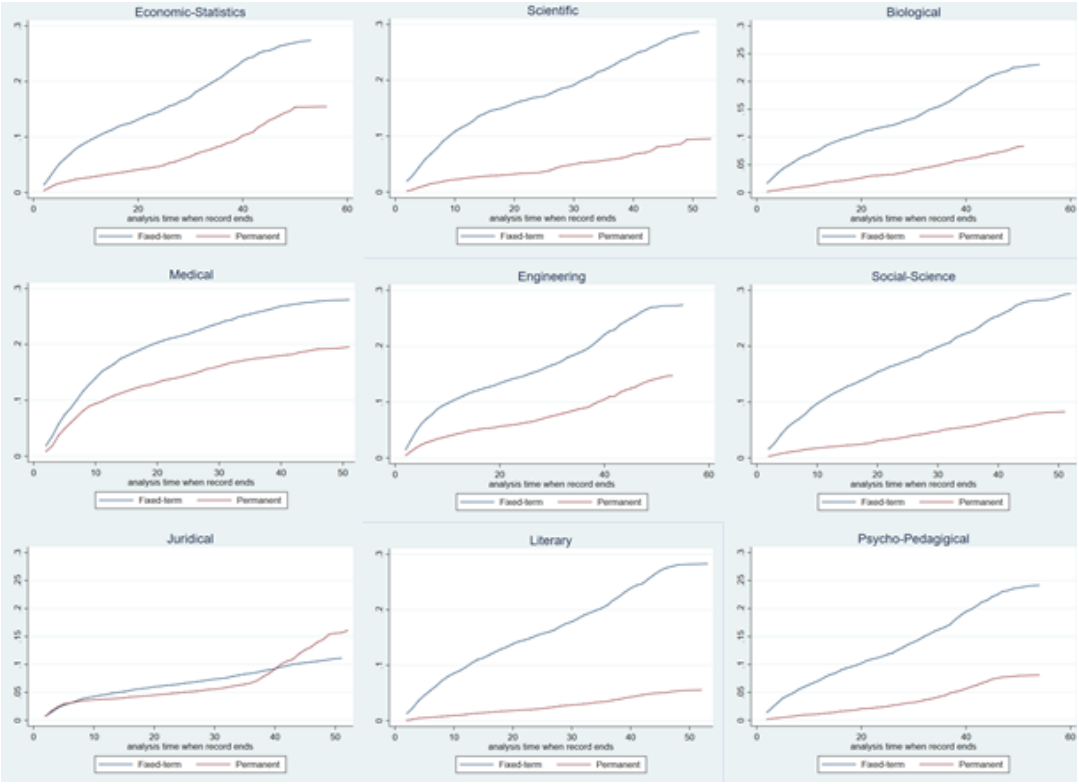

Figure 4: Hazard function for permanent and fixed term contract by field of education

Firstly reported the plot of cumulative incidence function of the two type of contract by field of education in Figure 4 in order to clearly see the differences.

They all quietly have the same hazard shape except for two cases: Juridical and Medical. In all the cases we can see that fixed term has an higher incidence function than permanent and the differences are pronounced.

Medical has a smaller difference in the two CIFs. Juridical has a completely different shape; the two functions seem to be the same until they reach the 40th month. From this time, as we can see from the Figure 4, the two hazards invert; it becomes more probable to get a permanent contract than a fixed-term. This is explained by how we defined the permanent contract (permanent and self employed are together); after Law Studies and the required internship many people do an exam that allow them to become lawyer and to start this job as self-employed.

4.2 Model Findings

In Table 2 we reported the estimated hazard ratios of all the variables we used in our model, which changes from the previous one by introducing the dummy of the type of first contract and its interaction term with field of education. We decided to insert this interaction term because we thought that the field of education influences the type of first contract. In this way we could take a look at the behaviour of each field separately.

variable	Haz. Ratio	Pvalue
permanent	.4033613	0.000
gruppo		
Scientific	1.162775	0.000
Biological	.8889626	0.000
Medical	1.102399	0.003
Engineering	1.019389	0.494
SocialSciences	.99509	0.879
Jiuridical	.4363534	0.000
Leterary	.9828545	0.586
Psycho-pedagogical	.8721038	0.000
permanent *gruppo		
permanent *Scientific	.6320822	0.000
permanent *Biological	.7234527	0.000
permanent *Medical	1.669576	0.000
permanent *Engineering	1.137685	0.011
permanent *SocialScience	.583876	0.000
permanent *Juridical	2.481597	0.000
permanent *Literary	.3995254	0.000
permanent *Psycho-pedagogical	.6330566	0.000
tiplau		
Ciclo Unico/V.O.	1.077992	0.026
Specialistica	1.42737	0.000
time int		
6	.8310095	0.000
12	.6345832	0.000
18	.5578523	0.000
24	.8195181	0.000
30	.9489006	0.149
36	1.004896	0.899
42	.6720877	0.000
48	.0462033	0.000
tiplau *time int		
Ciclo Unico/V.O. * 6	1.203569	0.000
Ciclo Unico/V.O. *12	1.135341	0.046
Ciclo Unico/V.O. *18	.8462244	0.035
Ciclo Unico/V.O. *24	.4513704	0.000
Ciclo Unico/V.O. *30	.4622521	0.000
Ciclo Unico/V.O. *36	.5632535	0.000
Ciclo Unico/V.O. *42	.5660398	0.000
Ciclo Unico/V.O. *48	.7707538	0.315

variable	Haz. Ratio	Pvalue
Specialistica * 6	1.04575	0.248
Specialistica *12	1.021979	0.654
Specialistica *18	.9499399	0.370
Specialistica *24	.5521378	0.000
Specialistica *30	.3750634	0.000
Specialistica *36	.5108925	0.000
Specialistica *42	.55613	0.000
Specialistica *48	1.23064	0.276
ita		
Centro	.7461782	0.000
Sud	.5400229	0.000
Isole	.5795767	0.000
Telematica Estero	.5078502	0.000
1.voto lau	1.13205	0.000
privata	.9916244	0.738
1.ciclo unic2	.4382571	0.000
1.trienn 2	.5911516	0.000
1.magistr 2	.4403641	0.000
1.master i 2	1.010018	0.634
1.master ii 2	.8683396	0.000
femmina	.9594286	0.003
tipo dipl		
Liceo Classico	.9190177	0.000
Liceo Linguistico	1.128151	0.000
Liceo Socio-Psico-Pedagogico	.9860917	0.644
Liceo Artistico/Istituto Arte	.9571454	0.397
Istituto Tecnico	1.003696	0.834
Istituto Professionale	.9333466	0.054
Scuola Straniera	.9423449	0.572
occ genitori		
almeno un dipendente	1.117205	0.000
almeno un autonomo	1.145834	0.000
istr genitori		
entrambi max medie	.9571493	0.045
almeno uno diploma	1.040827 .	0.056
entrambi diplomati	.9934255	0.736
entrambi laureati	.9672906 .	0.157
cons	.0527083	0.000

Table 2: Estimated Hazard Ratio of the Piecewise Constant model for competing risks

To evaluate the effect of the first type of contract we have to look at the hazard ratios corresponding to the following variables jointly: type of contract, fields of education and their interactions. In average individuals has the 60% less risk to get a first permanent contract instead of a fixed-term. The main effect of field of education variables can be

interpreted as the multiplicative effect on the hazard to get a fixed-term for the category we are looking at, in respect to Economic-Statistics. Engineering, Social-Sciences and Literary are not significantly different from the baseline, i.e. they have the same risk to get a fixed-term. In contrast with the others, Medical (+16%) and Scientific (+10%) have a major risk to get a fixed-term respect to the baseline Economic-Statistics. Juridical has the least risk to get the fixed-term; in respect to the baseline it is 57% smaller.

The hazard ratios of the interaction terms between permanent contract and field of education show how the risk to get a permanent first contract changes in respect to the baseline's one. We can see that even if they have the worst timing on job finding, Juridical postgraduates have the highest risk to get permanent as first contract; in fact they have 148% more risk to gain it than Economic-Statistics. Even Medical (+67%) and Engineering (+14%) degrees lead to a higher risk of permanent as first contract than the baseline. On the other hand Literary postgraduates have 60% less risk to gain an indefinite-period contract as first one than Economic-Statistics do.

We chose the same control variables as in the previous Piecewise Constant model for the timing of transition to first employment. The effects of the controls are reported in Table 2. They are quietly the same as in the previous model but the effects of gender and parental occupation become stronger.

Female's effect gets worse; not considering other features, a female has 5% lower risk to get a fixed-term contract than a man does.

Parental occupation seems to have a more important role on the first type of contract than on the timing to first job. In particular having at least one parent who is self-employed increases the risk of 14% to get a fixed-term contract for the first job, net of other covariates.

Conclusion

We are very satisfied with our analysis because both confirm some of our expectations and both add not trivial results.

Dealing with the timing of entry into work world we can say that field of education is a strong influencing factor. We were waiting for Scientific degrees to be the ones with the highest risk and so the shortest timing for this transition but we found out that Medicals and Engineering overcome this field of education. We are glad that our field is at the fourth place in speed of job finding.

The differences between Italian Universities are sadly strong, in particular in the North people find job more quickly. We cannot explain if this behaviour depends on the fact that in North Italy there is more job offer or if this depends on some particular features of the Colleges. We expected this effect but not as strong as it reveled from the analysis.

We did not expect any differences between males and females but there is a small gender effect; women point to a slower job finding than men do. We thought that at least in high qualified jobs there would not be any discrimination. We tried to explain this phenomenon by looking at the number of males and females composing the field of degrees. It's common to say that female are in percentage fewer than male in graduating in Scientific areas but looking at the sample composition we found that men and women were equally distributed between fields of degree. Unfortunately this differences are still rooted in our society (at least we could confirm this for 2011-2015).

It was presumable that the type of degree strongly influences our main research questions; a Master degree is said to better qualify the Student in his/her field than a Bachelor does. What we didn't expect is that One-Tier degrees decrease the risk (and slow down the process) for the transition to first job; we found its meaning by analyzing the length of studies for any field of education. Juridical degrees are the slowest in the transition and typically the Law studies last at least five years (as the One-Tier type). Another explanation is given by the fact that the One-Tier category is composed by both One-Tier degrees and Old system Universities. Those who graduated in 2011 with the Old system were some years out and this doesn't help with job research.

Another important result is about parental occupation. At least one self-employed parent seems to help their sons career but in a different intensity for the two research questions. In the competing risk model its effect on the risk of getting a fixed-term contract is much more stronger. That's because of how we defined this type of agreement and of the propensity of some individuals to go on with the parents craft.

Even gender effect is more significant; sadly getting a fixed-term as first contract for a women is less risky than for a man, not considering other features. This can be related to their "risk" of pregnancy and, for this, they can go on leave. Men don't have this type of issues; at least in 2011-2015 they could not properly go on leave. The Government should avoid this type of discrimination and we thought and hoped that we wouldn't have found this.

It was then very interesting to see that field of education is a strong influencing factor for the type of contract, as we expected, and, surprisingly, we didn't find exactly the same results we got for the timing.

As we expected for a postgraduate, not considering other features, it's more risky to get a fixed-term as first contract overall. Dealing with fixed-term contract we can see that, respect to the baseline case, firstly Medical and then Scientific have more risk to get this as first contract. On the other hand Engineering, Social-Sciences and Literary haven't a different behaviour from Economic-Statistics. Juridical degrees have the smallest hazard ratio between all the fields; it means that they have much smaller risk to get a fixed-term first contract than Economic-Statistics have. Dealing with the permanent contract Juridical degrees, in contrast to Economic-Statistics, change trend. Their transition to the first job is very slower than the others, such as their risk to get a fixed-term first contract; but they overcome 100% more risk to get the permanent one than Economic-Statistics do.

In the end if we combine the two analysis Medicals degrees offer best job reaching in terms of timing and type of contract. They haven't the trade-off between timing and length of contract that other fields have.

Doing this analysis allowed us to get confidence with demographic models and with answering questions that arise from everyday speeches. In addition we could see that many questions bring to others and for this, while dealing with a specific topic, we have to know its background and surroundings. In our case it was necessary to have a complete vision of Work and University situation in Italy, with which we have to face everyday.