Why Don't Italians Finish University ?

Explaining University Enrollment Behavior in Italy and Germany

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Abstract

Italy's university dropout rate of more than 60% is the highest of all OECD countries and thus contrasts sharply with Germany's dropout rate of 25%. I develop a model of university enrollment and job search that helps to understand the di¤erences between the two countries. For Italy, I identify two main groups of dropouts. Misguided students are ill-prepared to obtain an academic degree. Parking lot students drop out as soon as they get the …rst suitable job o¤er but obtain a degree in case they never get a job o¤er throughout their studies. In Germany, only misguided dropouts exist, and there are fewer of them than in Italy.

Keywords: university dropouts, educational system, youth labor market, labor demand, family background, maximum likelihood estimation

JEL Classi…cation: I21, J23

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1 Introduction

After reaching compulsory schooling age, students can either stay in education or drop out. In a world without uncertainty, students would choose their optimal level of schooling once and for all at the beginning of their educational career, taking into account labor market and earnings opportunities, interest rates, personal discount rates, and their ability. In reality, however, many of these factors are uncertain. We therefore observe transitions between education, employment and unemployment in all directions. Education plays an interesting role in so far as it supposedly increases one's labor market opportunities at the same time as it stops him from earning money. This trade-o¤ is well known from the literature on optimal schooling. Yet, if youths do not …nd a job, education can play a dual role: being a parking lot for people willing to enter the labor market and at the same time of increasing their labor market opportunities. This …rst e¤ect seems to be particularly true for Italy's university students. Italy's university dropout rate is the highest of all OECD countries. As a consequence Italy also has one of the lowest rates of people holding a tertiary degree. In contrast, Germany's university dropout rate is much lower and overall educational attainment higher than in Italy. In this paper, I address the factors explaining university enrollment and dropout behavior in both countries and present a job search model that takes into account the role of university education.

The paper is related to several strands of literature. Human capital theory provides a theory for the demand for education (Gary S. Becker, 1993). It considers education as an investment good which individuals acquire until the expected returns from an additional year equal the expected costs: in its simplest version students (respectively their parents) choose the optimal level of education at the beginning of their lives trading o¤ expected direct (tuition fees) and indirect (foregone earnings) costs against expected bene…ts (higher future earnings) given personal discount rates. In empirical work, often (optimal) schooling choice is not the primary object of study but only used indirectly in studies of returns to education as …rst stage in instrumental variables earnings regressions where schooling is considered an endogenous variable.

The literature on school enrollment trends (see e.g. Card and Lemieux, 1997 and Card and Lemieux, 2000) explicitly studies educational attainment of di¤erent cohorts across regions and time. Card and Lemieux (2000) extend a standard model of optimal schooling choice in two ways. First, they explicitly allow for distaste for schooling, thereby giving more scope to family background variables. Second, they allow for temporary shocks to the (local) labor market that may induce students to drop out earlier or to stay longer than originally planned. My paper is very much related to this literature although it takes an individual-level perspective and a di¤erent theoretical approach.

The literature on school-to-work transitions is very much related to this paper. Labor market transition patterns are studied using transition probability matrices, mobility indicators and multinomial logit estimation. Soro-Bonmati (2000) presents results based

on these approaches for Germany, Italy and Spain. However, she only considers transitions between 1993 and 1995, thus only one cross-section of transitions, and therefore she cannot control for regional e¤ects.

The paper is organized as follows. In section 2, I present the basic empirical facts. In section 3, I develop a job search model with two skill types, unskilled and skilled, in which the unskilled (high school graduates) can go to university, and become skilled (university graduates). Obtaining a degree and becoming skilled takes time and the model nicely shows how depending on their expected time to completion, some individuals might drop out of education before obtaining a degree if they get a job o¤er. The model is able to explain transitions between education, employment, and unemployment. Starting from the equations of the theoretical model, in section 4 I describe how the model can be brought to the data using maximum likelihood techniques. In section 5, I present the results of the estimation. In section 6, I conclude and provide some policy implications.

2 Some facts

2.1 Italy[1]

In Italy, in 1995, the percentage of those aged 25 to 34 holding at least a secondary degree (diploma or quali…ca professionale) was at 59.9% while being equal to 32.3% for the 35 to 65 years old. The percentage of those holding a university entry-certi…cate (diplomati) was at 54.2% for the 25-34 year old and 28.2% for those aged 35 to 65. This shows a trend towards higher education in Italy. Yet, obtaining a tertiary degree is rather unattractive compared to other countries. Non-college tertiary education is basically inexistent. Short degrees equivalent to a bachelor (laurea breve) were only introduced recently (1992-93) and reaching a university degree therefore required at least 5 years of study. The low rate of return to education of two to three percent (Flabbi (2000) and Manacorda (2000)) can hardly make up for the foregone earnings incurred during studies. For this reason, the percentage of those holding a university degree was at 12.2% for the 25-34 age group and at 7.7% for the 35-65 year old which is low compared to international standards. There are interesting di¤erences across genders and regions, though. University graduation rates are higher for women than for men. In the south of Italy still nowadays, 10% of all youth do not …nish compulsory education. There are also remarkable di¤erences in high school graduation rates and university graduation rates across regions. I will exploit these regional di¤erences in the empirical analysis below.

The overall low university graduation rate contrasts with a very high rate of …rst-year enrollment (About 70% of all high school leavers go on to university.[2]) Those two facts put together describe Italy's elevated university dropout rate which is the topic of this

[1] This section is based on the author's calculations using the 1995 SHIW data.

[2] However, this percentage has been slightly decreasing in recent years due to increased tuition fees.

study. Most dropouts occur between the …rst and second year of study. About 25% of all …rst-year students do not continue in the second year.

Another phenomenon characterizing the di¢culty Italian university students face in pursuing their studies is the high percentage of students lagging behind regular study times (fuori corso). More than 80% of all graduates need more time than foreseen to …nish their degree. In the academic year 1995/96, amongst all graduates, 45.9% …nished 3 or more years later than foreseen.[3]

In …gure 1, I plot enrollment rates of the 20-24 year old by region and gender over time obtained from the Italian SHIW data. A striking feature of the data is the drop in enrollment in 1989. The …rst idea that comes to mind is that this might have to do with a boom in the economy that induces a lot of youths to start working instead of studying. This hypothesis is refuted by the data. In …gure A, I show GDP in Italy over the 80s and 90s, which does not show any irregularity of this kind. A deeper look into institutional features, however, reveals the true cause of this drop in enrollment in 1989. In the late 80s, the Italian government promoted the so-called contratti di formazione e lavoro (CFL), a sort of apprenticeship for youths, and gave huge subsidies to …rms to hire young workers. As shown by Adam and Canziani [1998], the number of these special contracts attained its all-time high in the late 80s and later on was reduced because of tighter public budgets.

All of these facts about school and university enrollment have to be seen in the light of the problem of Italian youths to integrate into the labor market. Figure B shows the development of youth unemployment between 1984 and 1997 for Italy in comparison to Germany. Italy's youth unemployment rate lies consistently above 30% except for the period 1988-1992 in which the contratti di formazione e lavoro temporarily absorbed a lot of youths. In contrast, Germany's youth unemployment rate is considerably and consistently lower. Why is youth unemployment so pronounced in Italy?

The Italian youth labor market is characterized by job queues. Prime-age men are highly protected and basically cannot be …red. This prevents competititon between youths and adults for existing jobs. Youths can only enter the labour market when some older workers retire or die. It is a weird institutional feature that some labor contracts even arrange for the bequest of an adult's job to his child by renouncing to a fraction of the severance pay.

I will shortly describe some of the institutional features in Italy that have contributed to the creation of job queues for youths. Workers in core industries are highly protected by the so-called Cassa integrazione sytem. During a downturn in the economy, …rms can "temporarily" lay o¤ workers. While laid-o¤ workers still remain o¢cially employees of the …rm, they receive 80 percent of their previous wage as a kind of unemployment bene…t from the state. In the upturn of the economy, the …rm has to take these same workers back on their payroll. Until 1991, according to an Italian law, half of any additional

[3] See "Università e lavoro: statistiche per orientarsi" (Istat, 1999).

hiring had to be allocated from a list of unemployed from the local state employment agency (U¢cio di Collocamento). Only the other half was at free choice to the …rm.

Another contributing factor to the creation of job queues is the focus of the Italian social assistance on the family and not on the individual. Italian youths cannot claim unemployment bene…ts unless they have been employed before. Since most of the unemployed youths are …rst-job seekers, this ties them to their families and at the same time reduces their search activity because they are "in a safe place".

2.2 Germany

In Germany, in 1995, the percentage of those aged 25 to 34 holding at least a secondary degree[4] was at 64% while being equal to 56.4% for the 35 to 65 year old, based on GSOEP data. Thus, there is a trend towards higher education also in Germany, yet starting from a higher level. In particular, in the 1980s and 1990s, women quickly caught up in educational attainment and in the middle of the 1990s even overtook men in many dimensions: the rate of females starting university is by now slightly higher for women than for men.

Also Germany did not have short degrees (bachelors) until recently (1997).

Germany is well-known for its vocational training system integrating class-room teaching and on-the job training with …rms. The higher number of people with an apprenticeship is part of the explanation for the much higher rate of secondary degrees compared with Italy. Looking more speci…cally at degrees allowing access to university education (Abitur or Fachhochschulreife in Germany and laurea in Italy), the opposite is true: in 1995, 26.2% of 25 to 34 year old Germans had either Abitur or Fachhochschulreife, while this was true for 17.5% of the 35 to 65 year old.

As for university degrees, Germans again overtake Italians. While 13.4% of 25-34 year old Germans hold a university degree, it is 12.2% of Italians of the same age.

It is important to keep in mind, however, that the German educational system provides for many di¤erent educational opportunities. A lot of students, after working for some time, or after doing an apprenticeship, decide to return to formal education. This is known as zweiter Bildungsweg (second-chance education). In Italy, this option is much less common: the latest OECD …gures (Education at a glance, 2000) show that for the 1998 German cohort, 28% of them will enter university at some point in their life. For Italians, it is 42%. Comparing this to the percentage of people holding a university entry-certi…cate we see that for Italians the decision to go to university is a now-or-never decision while the German system is much more ‡exible in allowing many di¤erent educational and career paths.

[4] i.e. having done at least an apprenticeship (Lehre), …nished a specialized vocational school (Berufsfachschule), or holding an upper secondary schooling degree (Abitur) or having the Fachhochschulreife allowing access to technical colleges. For more details concerning the di¤erent school types see the section describing the school system.

In …gure 2, I plot enrollment rates of the 20-24 year old by region and gender over time obtained from the German GSOEP data. Again, there is considerable variation in enrollment rates across regions, genders and time.

2.3 Preliminary evidence for Italy based on data about high school graduates

To get a …rst idea of the forces behind the Italian dropout phenomenon, in this section I am going to exploit a survey data set from the Italian National Statistical O¢ce (Istat). It is a representative sample of the year 1995 high school graduates. In 1998, a sample of 18843 students was contacted by phone and asked questions about labor market and education experience during high school and in the three years after leaving high school. In addition, their schools were asked to provide information on students' performance in high school. The major drawback of the data is its limitation to just one cohort of diplomati. Yet, it is the only existing data source that allows to directly study the dropout phenomenon. I give some descriptive statistics in table 1.

Of the 8730 high school leavers that enroll in a corso di laurea (i.e. a long degree study) between 1995 and 1998, 8092 (i.e. 92.7%) do so immediately after leaving high school, i.e. in fall 1995.[5] To study the dropout phenomenon I select this subgroup because we can follow it for full three years and, from the information provided in 1998, see who is still in university and who dropped out. So, here we only lose a tiny fraction of students who …rst did their military service, or worked etc. and only later on went on to university. Using this well-de…ned subgroup we end up with a sample of 7495 individuals after deleting observations with missing observations on variables of interest.

In table 2, the dropout rate is broken up by type of upper secondary school. The di¤erences are striking: the dropout rate amongst students graduating from vocational tracks (istituto professionale and istituto tecnico) is several times higher than for students graduating from classical high school (liceo). Also note that the overall dropout computed from our sample is quite low compared to the OECD …gure of more than 60%. This can be explained by several arguments: our dropout rates only apply to dropouts within the …rst three years of study while the OECD …gure applies to the overall dropout rate, i.e. it also includes late dropouts. Additionally, the above OECD …gure applies to the peak in dropout rates in 1990 while the present data are for the 2nd half of the 1990s. After a sharp increase in tuition fees in the early 90s …rst-time university enrollment decreased, most probably lowering the number of misguided students.

In order to identify the factors behind the dropout phenomenon, I estimate a probit model[6] where the dependent variable is equal to 1 for university dropouts, and 0 other-

[5] This is in sharp contrast with Germany where a lot of students enroll only after an intermediate period of work or apprenticeship.

[6] I also estimated a linear probability model which yielded basically the same results.

wise. The results are displayed in table 3. The most interesting …nding is the signi…cant di¤erence in the probability to drop out across di¤erent school types even controlling for performance in both junior and senior high school. Students graduating from vocational secondary tracks (istituto professionale or istituto tecnico) are much more likely to drop out of university than are graduates from classical high school (liceo). This result raises doubts about the idea of allowing access to university to everyone. Students coming from professional or technical secondary schools on average do not seem to bring enough academic skills to survive in university. Interestingly, not only does the average grade when leaving high school (voto di maturità) positively in‡uence the probability to stay in university but also does the average grade in junior high school (voto di scuola media inferiore). So, even conditional on the "ability" right before entering university, the "ability" several years before going to university matters. While the number of siblings does not in‡uence the probability to drop out, parents' education - measured by the maximum of mother's and father's years of schooling - matters a lot. The more educated are the parents, the higher the student's probability to stay in university. This result is remarkable because it shows up although we control for performance in both junior and senior high school.[7] Finally, students that are older at high school graduation have a higher probability of dropping out. Number of classes repeated does not signi…cantly enter once we control for age.

What I take from this exercise is the fact that a lot of students are clearly misguided to university. This is particularly true for students coming from technical or professional secondary tracks, both of which are not supposed to prepare for academic studies in the …rst place. Answers of dropouts as to why they dropped out (table 4) show that a high percentage of students found their studies too di¢cult and thereby corroborates the …nding that too many low ability students are allowed to enter university in the …rst place. It also highlights the misconception by students about what university is and what their chances are to obtain a degree in the speci…c subject of their choice.[8]

Yet, it is striking to see that more than one quarter of the dropouts drops out because they already found a job. Additionally, it is interesting that the majority of those who drop out because they found the studies too di¢cult, are working in 1998, so a large number of them might not only have dropped out because the studies were too di¢cult but also because their job prospects were su¢ciently positive.[9] This interpretation is

[7] However, parents' education might pick up the e¤ect of family income, a variable we cannot control for.

[8] For this reason, in 1998, the Italian Ministry of Public Education introduced a system of pre-registration (http://www.istruzione.it/argomenti/orientamento/orpreiscrizioni.htm) by which students who wish to go to university after leaving high school can informally enroll in a subject of their choice. Then, a close cooperation between high schools and universities is set up: schools are being provided with informative literature and schools organize visits to nearby universities for trial lessons. In Germany, a system of following regular classes at university during the last year at high school to get an idea of what university is like, has been already set up many years ago.

[9] This is a standard problem in surveys when only one answer can be given.

supported by the fact that the percentage of students that claim to drop out because they found the studies too difficult is much higher in the North (41.3%) - where labor market conditions are very favorable for youths - than in the South (29.9%) - where the youth labor market problem is most pronounced.[10]

The evidence collected suggests that there are two main groups of dropouts: misguided students, mainly coming from vocational secondary schools, are ill-prepared to obtain an academic degree. Parking lot students drop out as soon as they get the first suitable job offer.

In the next section, I present a simple theoretical model capturing the interaction between university education and the labor market that can rationalize why so many high school graduates enroll in university and why such a high fraction of them later drops out.

3 A job search model with education

3.1 The basic version of the model

Consider a continuous time model with two skill types, unskilled and skilled. We can think of the skilled as holding a university degree and the unskilled as being high school graduates without a university degree. The unskilled can go to education, and obtaining a degree, they become skilled. Unskilled workers can be either unemployed, in education, or employed, while skilled workers can only be unemployed or employed. Denote by U_u the expected present discounted value (PDV) of income of an unskilled unemployed, and by U_s the PDV of income for a skilled unemployed. By W_u and W_s denote the PDV of being an unskilled employed and of being a skilled employed, respectively, and by E_u the PDV of being an unskilled in education. U_u, U_s, W_u, W_s, and E_u can be given asset interpretations and their relationship can be written in the form of arbitrage equations. Remark that I do not model the firm side here. Of course, this could be easily done but I abstract from it for two reasons: for the clarity of the exposition and for the reason that in the empirical part I do not have data on the firm side anyway.

Let b be the value of the outside option (we might think of it as unemployment benefits), w_u the wage rate of the unskilled and w_s the wage rate for the skilled, all of which are taken to be exogenous.[11] By r denote the rate of time preference. Assume that an unskilled unemployed has a constant probability λ_u of finding a job at any instant, and a skilled unemployed finds a job with instantaneous probability λ_s. Then, we can write the asset equations defining U_u and U_s as

[10] An alternative explanation would be that universitites are more demanding in the North.

[11] Since the number of school-leavers entering the labor market is small compared to the total labor force, we can reasonably consider school-leavers to be price-takers, with w_u and w_s determined by the distribution of skills in the population.

$$rU_u = b + \lambda_u(W_u - U_u) \tag{1}$$

$$rU_s = b + \lambda_s(W_s - U_s) \tag{2}$$

where for the time being we assume b to be the same for the skilled and the unskilled. An unskilled can take further education in which case he still receives job offers with probability λ_u that he can accept or reject, and with probability ϕ_i he obtains a degree and becomes skilled.[12] We assume that newly graduated individuals first go into unemployment.[13] Remark that ϕ is indexed by an individual-specific index i allowing for heterogeneity in "degree arrival rates". This reflects the fact that the expected time for reaching a degree varies considerably by individual. ϕ_i can be interpreted as individual ability and the setup therefore captures the idea that more able students obtain a degree more quickly than less able students. When the outside option remains b, we can write the asset equation defining E_u as

$$rE_{u;i} = b + \phi_i(U_s - E_{u;i}) + \lambda_u \max(W_u - E_{u;i}; 0) \tag{3}$$

In this first setup, the asset equations for W_u and W_s are very simple:

$$rW_u = w_u \tag{4}$$

$$rW_s = w_s \tag{5}$$

It is very important to stress that all of the arrival rates λ_u, λ_s, and ϕ_i in my model are instantaneous probabilities. Put differently, they are hazard rates of leaving a certain state, conditional on having been in that state until now. They can take values between 0 and infinity. Also remark that I assume all hazard rates to be constant, i.e. independent of the time elapsed in a given state. This is to say that occurrence of events is regulated by Poisson processes. Poisson processes are known to be memoryless processes. One crucial implication of this assumption is that the probability of leaving a state does not increase over time, i.e. one is not more likely to leave a state if he has been in it for a longer time span. For instance, considering the "degree arrival rate" ϕ_i, this means that conditional on already having been in university for a couple of years one has the same expected time to completion as someone who just enters university (i.e. conditional on having been in university for a very short time). This is of course a very strong assumption which is a better description of enrollment behavior for students at

[12] Implicit in this setup is the assumption that only degrees matter and that some education but no degree is no better than no education at all. The assumption that only degrees matter is known as sheepskin effects.

[13] This assumption is reasonable given that graduates do not start working immediately following their graduation.

the beginning of their studies. In a future extension to the model, I want to consider other types of processes that allow for increasing hazard rates to make the model more realistic also for later years of study.

To see which economic variables drive the decision to continue education or to drop out, consider an unskilled individual in education. When a job o¤er arrives, he can either accept or reject it. Given the heterogeneity in "degree arrival rates"/ability, there will be a marginal type of individual who is exactly indi¤erent between continuing education and dropping out. For this individual, the condition $W_u = E_{u;i}$ holds. Solving equation (1) for U_u and equation (2) for U_s and substituting in equations (4) and (5) respectively, we obtain the following expressions

$$U_u = \frac{1}{r + \lambda_u}(b + \lambda_u W_u) = \frac{1}{r + \lambda_u}(b + \frac{\lambda_u}{r} w_u) \tag{6}$$

$$U_s = \frac{1}{r + \lambda_s}(b + \lambda_s W_s) = \frac{1}{r + \lambda_s}(b + \frac{\lambda_s}{r} w_s) \tag{7}$$

For the marginal individual, the last term in equation (3) disappears because of the condition $W_u = E_{u;i}$ and therefore equation (3) can be rewritten as

$$E_{u;i} = \frac{1}{r + \theta_i}(b + \theta_i U_s) = \frac{1}{r + \theta_i}(b + \frac{\theta_i}{r + \lambda_s}[b + \frac{\lambda_s}{r} w_s]) \tag{8}$$

The condition $W_u = E_u$ can be expressed as

$$\frac{w_u}{r} = \frac{1}{r + \theta_i}(b + \theta_i U_s) = \frac{1}{r + \theta_i}(b + \frac{\theta_i}{r + \lambda_s}[b + \frac{\lambda_s}{r} w_s]) \tag{9}$$

This expression de…nes a threshold value θ^d for an individual indi¤erent between continuing education and dropping out. For individuals with $\theta_i > \theta^d$ the last term in (3) disappears and they continue education until they obtain a degree. For individuals with $\theta_i < \theta^d$ both the second and the third term in (3) are "active" and whatever event comes …rst, degree or job o¤er, they turn skilled or they drop out.

Even without explicitly solving for θ^d, we can apply the implicit function theorem[14] to see how di¤erent parameter values a¤ect individuals at the margin (and thereby also individuals o¤ the margin) in (9). We set $b = 0$ for simplicity and can write

$$\frac{\theta^d}{r + \theta^d} \frac{\lambda_s}{r + \lambda_s} w_s - w_u = 0 \tag{10}$$

[14] Implicit function theorem: Let $G(x;y)$ be a C^1 function on a ball about $(x_0;y_0)$ in R^2. Suppose that $G(x_0;y_0) = c$ and consider the expression $G(x;y) = c$. If $(@G=@y)(x_0;y_0) \neq 0$; then there exists a C^1 function $y = y(x)$ de…ned on an interval I about the point x_0 such that: (a) $G(x;y(x)) \equiv c$ for all x in I, (b) $y(x_0) = y_0$, and (c) $y'(x_0) = -\frac{(@G=@x)(x_0;y_0)}{(@G=@y)(x_0;y_0)}$.

Holding all other parameters constant, a marginal increase in the wages of the unskilled, w_u, induces more people to drop out of education:

$$\frac{\partial \tilde{\theta}_d}{\partial w_u} = \frac{(r+\theta_d)^2(r+\lambda_s)}{r w_s \lambda_s} > 0.$$

Similarly,

$$\frac{\partial \tilde{\theta}_d}{\partial w_s} = -\frac{(r+\theta_d)\theta_d}{r w_s} < 0$$

A marginal increase in the wages of the skilled, w_s, provides an incentive for students to stay in university.

$$\frac{\partial \tilde{\theta}_d}{\partial \lambda_s} = -\frac{(r+\theta_d)\theta_d}{(r+\lambda_s)\lambda_s} < 0$$

As the job arrival rate for skilled unemployed, λ_s, goes up, more students tend to continue university. Notice that the job arrival rate for unskilled unemployed, λ_u, does not enter the optimum.

$$\frac{\partial \tilde{\theta}_d}{\partial r} = \frac{\theta_d(2r+\theta_d+\lambda_s)}{(r+\lambda_s)r} > 0$$

An increase in the discount rate, r, has a positive effect on staying in university.

Conditioning on the values of all other parameters (which uniquely determine the cutoff level θ_d), differences in the ability distribution $f(\theta_i)$ will affect the fraction of dropouts. If the group of students holding a university-entry certificate is less able in country 1 than in country 2, then we expect more students to drop out of university. This describes the selection issue associated with university entry. If a country allows more students to enter university to begin with (Italy vs. Germany) and we assume innate ability to be the same for both countries, by definition a higher number of less able students enter university than if access was restricted. This in turn explains a lot of the Italian dropout phenomenon. To give an example, assume that θ_i is symmetrically distributed with $E[\theta_i] = \theta_d$. As the right tail of the distribution becomes fatter, the fraction of stayers increases while the fraction of dropouts increases in the opposite case. In order to compute the fraction of dropouts from the model, assume that θ_i is distributed over the interval $(0; 1)$ following a distribution function $F(\theta_i)$. Then the expected fraction of dropouts is given by $F(\theta_d)$.

In this first version of the model, only four states out of five actually occur. Unskilled individuals will always prefer education to unemployment because both their outside option b and the job arrival rate λ_u are the same in both states but in education they might also obtain a degree. In reality, however, we do observe unskilled in unemployment. This feature of the model can be changed by assuming the job arrival rate in education to

be lower than in unemployment. This version of the model is exposed in the following section.

Also, in this …rst setup, there is no job destruction and therefore all individuals will …nally end up in employment (given that wages are taken to be exogenous and therefore will not adjust the increased labor supply). Employment is an absorbing state. Job destruction can be easily introduced in the model by assuming an exogenous job destruction at rate $\pm_u$ for unskilled jobs and at rate $\pm_s$ for skilled jobs. Equations (4) and (5) can be modi…ed to read

$$rW_u = w_u + \pm_u(U_u - W_u) \tag{11}$$

$$rW_s = w_s + \pm_s(U_s - W_s) \tag{12}$$

This modi…ed set of equations (1)-(3) and (11)-(12) can again be solved for an expression de…ning a marginal individual indi¤erent between staying in and dropping out of education. Details for this setup are shown in the appendix.

3.2 Introducing di¤erent job arrival rates in unemployment and education

We saw that in the basic version of the model, no unskilled are observed in unemployment because $E_{u;i} > U_u$. When job arrival rates while in education are as big as they are while in unemployment, education is more attractive because it additionally provides for the chance of obtaining a degree.

In equation (3) we can introduce a job arrival rate $´_u < ¸_u$. This may be reasonable if being in education is associated with less time for job search than being unemployed. Equation (3) then reads

$$rE_{u;i} = b + °_i(U_s - E_{u;i}) + ´_u \max(W_u - E_{u;i}; 0) \tag{13}$$

Now, we want to see when $E_{u;i} ¸ U_u$. From the previous analysis (see equation (9)) we know that the threshold $°^d$ is independent from $¸_u$. We can therefore distinguish two cases:

- $°_i < °^d$, and hence $W_u > E_{u;i}$, and
- $°_i > °^d$, and hence $W_u < E_{u;i}$.

In the …rst case, the last term in (13) does not disappear and we can write

$$E_{u;i} = \frac{1}{r + °_i + ´_u}[b + °_i U_s + ´_u W_u] = \frac{1}{r + °_i + ´_u}[b + °_i \left\{\frac{1}{r + ¸_s}(b + \frac{¸_s}{r} w_s)\right\} + ´_u \frac{w_u}{r}] \tag{14}$$

For simplicity set $b = 0$. Then, $E_{u;i} - U_u$ reads

$$\frac{\phi_i}{(r + \phi_i + \theta_u)} \frac{\lambda_s}{r + \lambda_s} w_s + \frac{\theta_u}{(r + \phi_i + \theta_u)} w_u - \frac{\lambda_u}{r + \lambda_u} w_u \qquad (15)$$

This equation de…nes a new threshold value $\phi^e < \phi^d$, that determines whether an unskilled prefers to remain unemployed or to go to education. If $\phi_i < \phi^e$, the chance of obtaining a degree is so low that it cannot trade o¤ the lower job arrival rate in education. If $\phi_i > \phi^e$, the lower job arrival rate in education is set o¤ by a high enough degree arrival rate and therefore makes going to education worthwhile.

The second case is much simpler: since always $U_u < W_u$ but at the same time $W_u < E_{u;i}$ in this second case, we …nd $U_u < E_{u;i}$ and therefore everyone with $\phi_i > \phi^d$ goes to education. This is self-evident after studying the previous case: observing that $\phi_i > \phi^d > \phi^e$ yields the same result.

To sum up: in the case in which the job arrival rate for the unskilled in education is lower than in unemployment, there are three cases:

- $\phi_i < \phi^e$: those with a very low ability choose to remain unemployed instead of going to education
- $\phi^e < \phi_i < \phi^d$: in this intermediate case, unskilled individuals choose to go into education but drop out of education as soon as they obtain a job o¤er
- $\phi_i > \phi^d$: unskilled individuals with high ability prefer education to unemployment and stay in education until obtaining a degree even in the presence of job o¤ers

Figure 3 describes the possible cases.

Again, we can apply the implicit function theorem to (15) to see how di¤erent parameter values a¤ect individuals at the margin of enrolling in university or remaining unemployed. Holding all other parameters constant, a marginal increase in the wages of the unskilled, w_u, induces more people to remain unemployed:

$$\frac{\partial \phi^e}{\partial w_u}(w_u) = - \frac{\frac{r(\theta_u - \lambda_u) - \lambda_u \phi^e}{r + \lambda_u}}{\frac{\lambda_s w_s}{r + \lambda_s} - \frac{\lambda_u w_u}{r + \lambda_u}} = - \frac{\frac{r(\theta_u - \lambda_u) - \lambda_u \phi^e}{r + \lambda_u}}{U_s - U_u} > 0.$$

This is the case because the numerator is positive since $\lambda_u > \theta_u$ and the denominator is $U_s - U_u > 0$. In contrast, an increase in the wages of the skilled, w_s, incentivates more students to enroll in education:

$$\frac{\partial \phi^e}{\partial w_s}(w_s) = - \frac{\frac{\phi^e \lambda_s}{r + \lambda_s}}{U_s - U_u} < 0.$$

In the same way, as the job arrival rate for skilled unemployed, λ_s, goes up, more students enroll in education:

$$\frac{\partial \circ^{e0}}{\partial \lambda_s} = - \frac{\frac{r}{r+\lambda_s} \circ^e w_s}{U_s - U_u} < 0$$

An increase in the job arrival rate for the unskilled unemployed increases the number of people preferring to remain unemployed and the opposite is true for an increase in the job arrival rate while in education:

$$\frac{\partial \circ^{e0}}{\partial \lambda_u} = \frac{r(r+\circ^e+\acute{}_u) w_u}{U_s - U_u} > 0$$

$$\frac{\partial \circ^{e0}}{\partial \acute{}_u} = - \frac{w_u - \frac{\lambda_u}{r+\lambda_u} w_u}{U_s - U_u} < 0$$

In order to compute the fraction of dropouts in this case of the model, assume again that $\circ_i$ is distributed over the interval $(0; 1)$ with distribution function $F(\circ_i)$. Then the expected fraction of dropouts is given by $\frac{F(\circ^d) - F(\circ^e)}{1 - F(\circ^e)}$.

Remark that in a cross-section of individuals there are two margins a¤ecting enrollment behavior: the unskilled can choose to enroll or not and the enrolled can choose to accept job o¤ers when they arrive or to reject them. The decision to drop out does not change with respect to the basic version of the model. Behavior of individuals at both margins together determines overall enrollment behavior. Interestingly, comparative statics at both margins give an unambiguous answer on enrollment behavior. For instance, a higher skilled wage both increases the number of individuals who start education ("entry margin") and increases the number of individuals who reject job o¤ers while in education ("exit margin"). Therefore, the unambiguous e¤ect of an increase in skilled wages is a higher fraction of individuals in education. What is ambiguous is the implication for the dropout rate. To see this, consider an increase in the skilled wage w_s: both $\circ^d$ and $\circ^e$ go down and the shift of $\circ^d$ relative to $\circ^e$ determines whether $\frac{F(\circ^d) - F(\circ^e)}{1 - F(\circ^e)}$ goes up or down.

In the empirical part, I am going to analyze this version of the model employing a maximum likelihood procedure.

4 Maximum likelihood estimation

On the basis of the theoretical model there are four di¤erent groups of individuals:

- never-takers never enroll
- actual dropouts …rst enroll in university and later on drop out because they obtain a suitable job o¤er
- potential dropouts enroll in university, and are at risk of dropping out but simply do not happen to get a suitable job o¤er and …nally obtain a university degree

- always-takers enroll and never drop out, even in the presence of job offers

Every individual belongs to exactly one of the four groups with probabilities $\pi_{i;NT}$, $\pi_{i;AD}$, $\pi_{i;PD}$, $\pi_{i;AT}$ respectively. $Y_{ij} = 1$ if individual i belongs to group j, otherwise it is 0. This means that $\sum \pi_{ij} = 1$ and $\sum Y_{ij} = 1$. The likelihood contribution of individual i is then given by

$$l_i(b; Y_i; X_i) = (\pi_{i;NT})^{Y_{i;NT}} (\pi_{i;AD})^{Y_{i;AD}} (\pi_{i;PD})^{Y_{i;PD}} (\pi_{i;AT})^{Y_{i;AT}} \quad (16)$$

To be able to assess the estimation of this empirical model, an ideal data set would contain the following information besides standard personal and family characteristics which I use as proxies for individual ability:

- number and time of job offers received by each individual

- exact wage offered to an individual

Yet, I do not have information on job offers and wage offers by individual. They can only be proxied by some empirical counterpart which I describe in the following section.

Furthermore, ideally we would have a panel data set of high school graduates that contains information for the whole period between their year of graduation from high school until their late twenties. Then, we could study both the enrollment decision after finishing high school and the decision to continue university or to drop out.

In the Italian SHIW data, however, which basically consist of repeated cross-sections[15], we observe every youth only once. The only information we have about her educational career is her highest degree obtained and a dummy variable for being in university or not. This also implies that we are not able to classify her into one of the four groups.

The German SOEP data, in contrast, are a panel data set and we could exploit its longitudinal structure. Still, for reasons of comparability, in this paper I do not employ panel estimators on the German data, either. This will be done in a companion paper (Becker, 2000). What I would like to point out at this stage is that in the absence of information on the exact number and time of job offers, even possessing of panel data does not alleviate the problem of distinguishing potential dropouts from always-takers. Both groups obtain a degree and the crucial piece of information that would allow us to tell them apart is the missing information on number and time of job offers.

After explaining the main problems in bringing the theoretical model to the data, we can now have a closer look at the actual empirical implementation of the procedure.

[15] From 1989-1995, there is a small component of rotating panel. However, it is too small to be analyzed separately.

4.1 Maximum Likelihood Estimation for Italy

In the Italian data, we only observe youths to be in university ($Y_i = 1$) or not ($Y_i = 0$) at one single point in time. Lacking further information about her educational career, a non-enrolled youth could therefore be either a never-taker or an actual dropout. An enrolled youth could be either an always-taker or a potential dropout who just did not happen to get a job o¤er yet. Figure 4 illustrates the four cases in the Italian data. Understanding this "problem" also paves the way out. Although we can not tell with certainty which of the four states someone is in, we can attribute the probabilities of being in the respective states. This is equivalent to setting up the likelihood function in the following way:

$$l_i(b; Y_i; X_i) = P(Y_i = 0)^{1 \, i \, Y_i} P(Y_i = 1)^{Y_i} \tag{17}$$

where

$$P(Y_i = 0) = P(°_i < °^e) + P(°^e < °_i < °^d) ¤ P(\text{job o¤er received}) \tag{18}$$

and

$$P(Y_i = 1) = P(°_i > °^d) + P(°^e < °_i < °^d) ¤ P(\text{no job o¤er received}) \tag{19}$$

where $°^e$ is the entry threshold and $°^d$ is the dropout threshold and $°_i$ is the "degree arrival rate" (which can be thought of as ability).

In order to implement this likelihood function we make the following assumptions:

Assumption 1 (Age at enrollment)
Students enroll in university immediately after leaving high school or they never enroll, more speci…cally they enroll at age 19 or never.

This assumption is supported by OECD …gures which show that the majority of Italian students enrolls at age 19.

Assumption 2 (External observer information):

² The external observer knows that the thresholds $°^e$ and $°^d$ are functions of wages and job arrival rates and of an unobservable part:

$$°^e = \hat{°^e}(L) ¤ \#^e \tag{20}$$

$$\theta^d = \hat{\theta}^d(L) \cdot \#^d \tag{21}$$

where L denotes labor market variables and $\#^e$ and $\#^d$ are distributed according to the cdf function G(:).

[2] The ability of an individual can be proxied by family characteristics F but there remains an unobservable part as well:

$$\theta_i = \theta_i(F) \cdot \#^f \tag{22}$$

where $\#^f$ is also distributed according to the cdf function G(:).

Assumption 3 (Parametrization of θ^e and θ^d)
In the above analysis we did not provide closed-form solutions for θ^e and θ^d because they are rather involved non-linear functions of the labor market variables. As an approximation to these non-linear relationships and in accordance with the way hazard rates are typically parametrized in duration models, we assume θ^e and θ^d to be log-linear functions of the labor market variables, i.e. $\theta^e = \exp(L'\beta)$ and $\theta^d = \exp(L'\delta)$. To see why this is a not an arbitrary parametrization, let us have a look at the Taylor approximation to θ^d. From equation (10) it follows that:

$$\theta^d(a+h) = \theta^d(a) + \frac{\#\theta^d}{\#!_u}(a)h_1 + \frac{\#\theta^d}{\#!_s}(a)h_2 + \frac{\#\theta^d}{\#r}(a)h_3 + \frac{\#\theta^d}{\#\,_s}(a)h_4 \tag{23}$$

So we could approximate θ^d by a linear function of the labor market variables. The use of the exponential has the simple reason that we want θ^d to be positive because it represents a hazard rate. This does not change the fact that the signs of the coefficients β and δ represent the sign of the derivatives of θ^e and θ^d with respect to the labor market variables.

Assumption 4 (Parametrization of θ_i)
Following the example above, we parametrize $\theta_i = \exp(F'\cdot)$.

Assumption 5 (Parametrization of the probability of obtaining a job offer while in university)
One part of the likelihood function is the probability that a student receives a job offer before or after t years in university where t = age − 19 following assumption 1. Assuming the hazard rate λ_u to be constant, implies an exponential distribution of the spells in university. The spells in university thus follow a cdf $F(t) = 1 - \exp(-\lambda_u t)$. We can parametrize λ_u in the same way as the other hazard rates above: $\lambda_u = \exp(X'\gamma)$, where X denotes variables proxying the hazard rate.

Assumption 6 (Distribution of the unobserved components)
To make the model operational, we will assume that

- G(:) follows a lognormal distribution, i.e. $\#^e$, $\#^d$, and $\#^f$ can be written as $\exp(\varepsilon^e); \exp(\varepsilon^d)$;and $\exp(\varepsilon^f)$ respectively where $\varepsilon^e; \varepsilon^d$; and ε^f are normally distributed with standard deviation σ_e, σ_d, σ_f.
- $\varepsilon^e; \varepsilon^d$; and ε^f are independent.

With the above assumptions, the EO is able to identify the probability that the different outcomes will occur as follows:

If $\theta_i < \theta^e$; the youth does not enroll in university. The respective probability is

$$P(\theta_i < \theta^e) = P(\exp(F'\cdot)\exp(\varepsilon^f) < \exp(L'')\exp(\varepsilon^e)) \tag{24}$$

$$= P(\varepsilon^f - \varepsilon^e < L'' - F'\cdot) = \Phi\left(z_{fe} < \frac{L'' - F'\cdot}{\sqrt{\sigma_f^2 + \sigma_e^2}}\right) = \Phi\left(z_{fe} < L''\frac{1}{\sigma_{fe}} - F\frac{\cdot}{\sigma_{fe}}\right) \tag{25}$$

where we define $\sigma_{fe} \equiv \sqrt{\sigma_f^2 + \sigma_e^2}$ and where $z_{fe} \sim N(0;1)$.

If $\theta^e < \theta_i < \theta^d$, the youth is in the range of "potential dropouts" and can either be (still) in university ($Y = 1$) or have actually dropped out ($Y = 0$).

The probability of θ_i being in this intermediate range $(\theta^e; \theta^d)$ is

$$P(\theta^e < \theta_i < \theta^d) = P(L'' + \varepsilon^e < F'\cdot + \varepsilon^f < L'a + \varepsilon^d) \tag{26}$$

$$= P(F'\cdot + \varepsilon^f < L'a + \varepsilon^d) - P(F'\cdot + \varepsilon^f < L'' + \varepsilon^e) \tag{27}$$

$$= P(\varepsilon^f - \varepsilon^d < L'a - F'\cdot) - P(\varepsilon^f - \varepsilon^e < L'' - F'\cdot) \tag{28}$$

$$= \Phi\left(z_{fd} < \frac{L'a - F'\cdot}{\sqrt{\sigma_f^2 + \sigma_e^2}}\right) - \Phi\left(z_{fe} < \frac{L'a - F'\cdot}{\sqrt{\sigma_f^2 + \sigma_e^2}}\right) \tag{29}$$

$$= \Phi\left(z_{fd} < L'\frac{a}{\sigma_{fd}} - F'\frac{\cdot}{\sigma_{fd}}\right) - \Phi\left(z_{fe} < L''\frac{1}{\sigma_{fe}} - F'\frac{\cdot}{\sigma_{fe}}\right) \tag{30}$$

where following the previous definitions $\sigma_{fd} \equiv \sqrt{\sigma_f^2 + \sigma_e^2}$ and $z_{fd} \sim N(0;1)$. The probability of receiving a job offer in the first t years of study is

$$P(\text{job offer received} \cdot t) = 1 - \exp(-\exp(X'\beta)t) \tag{31}$$

Obviously, the probability of receiving no job offer in the first t years of study is the complementary probability

$$P(\text{no job offer received} \cdot t) = \exp(-\exp(X'\beta)t) \tag{32}$$

If $\delta_i > \delta_d$; the youth will be in university independent of wether he received a job offer or not. The respective probability is

$$P(\delta_i > \delta_d) = P(F'\cdot + \varepsilon_f > L'\alpha + \varepsilon_d) \tag{33}$$

$$= 1 - P(F'\cdot + \varepsilon_f < L'\alpha + \varepsilon_d) \tag{34}$$

$$= 1 - P(\varepsilon_f - \varepsilon_d < L'\alpha - F'\cdot) \tag{35}$$

$$= 1 - \Phi\left(z_{fd} < \frac{L'\alpha - F'\cdot}{\sqrt{\sigma_f^2 + \sigma_e^2}}\right) \tag{36}$$

$$= 1 - \Phi\left(z_{fd} < L'\frac{\alpha}{\sigma_{fd}} - F'\frac{\cdot}{\sigma_{fd}}\right) \tag{37}$$

Assumption 7 (Equal variance assumption)
Assume $\sigma_{fd} = \sigma_{fe}$ which is equivalent to saying $\sigma_d^2 = \sigma_e^2$ because in this case $\sigma_{fd} = \sqrt{\sigma_f^2 + \sigma_d^2} = \sqrt{\sigma_f^2 + \sigma_e^2} = \sigma_{fe}$.

This assumption allows us to identify the coefficients α, $\cdot$, and ε up to the scaling factor $1/\sigma_{fd} = 1/\sigma_{fe}$:

Putting together all of these pieces we obtain the likelihood function which is estimated in the sequel.

4.2 Maximum Likelihood Estimation for Germany

While the Italian data were essentially repeated cross-sections, the GSOEP data are a panel data set. This has one big advantage and one disadvantage for our purpose. The big advantage is that the GSOEP data are more informative in the sense that we can follow individuals over time and thus distinguish an actual dropout from a never-taker. Note that in the group of people finishing their degree potential dropouts and always-takers still cannot be told apart because we do not have the necessary information.

The disadvantage is that in order to make the results as comparable as possible to Italy, we cannot exploit the panel character of the data in the estimation itself. If we would do and use several observations per individual, i.e. employing panel data estimators, we could not be sure whether di¤erences in results across countries are driven by fundamental di¤erences in economic variables or whether they stem from di¤erent estimation techniques. For this reason, I opt for a rather unusual approach. We use the panel dimension only to obtain more information on the exact type of individual to be able to distinguish between never-takers and actual dropouts and to …nd out the exact year when students entered university.[16] After doing this, I randomly draw one observation per individual and from then on treat the data as repeated cross-sections.

Now we can set up the likelihood function in a way very similar to the Italian case. The only di¤erence is that we are able to distinguish between three groups in the German data: never-takers, actual dropouts and the group of people …nishing their degree which comprises potential dropouts and always-takers.

The likelihood contribution of individual i can written as

$$l_i(b; Y_i; X_i) = (¼_{i;NT})^{Y_{i;NT}} (¼_{i;AD})^{Y_{i;AD}} (¼_{i;FD})^{Y_{i;FD}} \tag{38}$$

where the su¢x FD denotes youths that …nish their degree and where

$$¼_{i;NT} = P(°_i < °^e) \tag{39}$$

$$¼_{i;AD} = P(°^e < °_i < °^d)P(\text{no job o¤er received}) \tag{40}$$

if we pick an observation for an actual dropout while she is still in university, and

$$¼_{i;AD} = P(°^e < °_i < °^d)P(\text{job o¤er received}) \tag{41}$$

if we pick an observation for an actual dropout when she has already dropped out,

$$¼_{i;FD} = P(°_i > °^d) + P(°^e < °_i < °^d)P(\text{no job o¤er received}) \tag{42}$$

and where $°^e$ is the entry threshold, $°^d$ is the dropout threshold and $°_i$ is the "degree arrival rate".

Apart from assumption 1 which is abandoned because we do observe the actual age at enrolment, all other assumptions are adopted from the Italian part.

Now, I can proceed to explain how I constructed the empirical proxies for the labor market variables of the theoretical model.

[16] Remember that for Italy we assumed that students enter university at age 19 or never, which we proved to be a very reasonable assumption. In Germany, in contrast, the prevalence of apprenticeships makes this an unreasonable assumption. Moreover, we do not have to assume anything about the …rst year in university if we can easily read it from the data.

4.3 Empirical proxies[17]

In the empirical part, I face the problem of choosing empirical proxies to the variables of the theoretical model. After some experimentation, the following proxies turned out to be good measures. I use the employment-population ratio of 20-24 year old high school graduates as a proxy for the job arrival rate of the unskilled, λ_u, the employment-population ratio of 30-34 year old university graduates as a proxy for the job arrival rate of the skilled, λ_s; and the return to university education (college premium) to measure $\frac{\lambda_s}{\lambda_u}$. All of these labor market variables L vary by region, gender and year. In contrast, the family background variables F vary at the individual level. Parents' education is measured by the years of schooling of the most-educated parent. Log income of the rest of the family (i.e. excluding the income of the youth herself) measures financial resources. Both family background variables are supposed to proxy the expected time to completion, θ_i. Further controls are age and gender.

5 Results

Our main interest lies in the variables defining the entry and dropout thresholds and we would like to see whether indeed the thresholds are affected as predicted by the theoretical model. While I do not have specific expectations about the size of the effects, the theoretical model is explicit about the direction of the effects, i.e. gives clear predictions about the sign of the coefficients. Also should the signs of the coefficients be the same at both thresholds. Let us first look at Italy.

5.1 Italy

The results (see Table 5) are as follows: while at the entry threshold the signs of the coefficients confirm with the predictions of the theory (although not at a high level of statistical significance)[18], at the dropout threshold only the coefficient on the employment-population ratio of high school graduates is in line with the predictions of the model.

At both the entry and the dropout thresholds higher demand for high school graduates seems to be associated with the thresholds moving to the right, i.e. with both less matriculations and more dropouts, which is consistent with the predictions of the theoretical model. Since the statistical significance is rather low, this result has to be taken

[17] See the data appendix for more details on the SHIW and GSOEP data.

[18] Currently, the regional data are computed from within the SHIW data and therefore have a bigger standard error than if they were computed from another source like social security data computed on the whole population. I am currently trying to get access to these data. Using these data, the standard errors should considerably decrease. At the same time, I want to compute these proxies at a more disaggregated level. Furthermore, I am experimenting with variables other than employment-population ratios to proxy for job arrival rates.

with care. At the entry threshold, higher demand for university graduates is associated with more matriculations (although statistically insigni…cant). The higher the college premium, the more matriculations we observe while at the dropout threshold we observe more dropouts although we would expect the opposite.

The variables characterizing the "degree arrival rate" respectively ability, parents' education and …nancial resources, are highly signi…cant and point in the right direction, i.e. "good" family background is associated with a higher probability of starting university and with a lower dropout probability.

The job o¤er rate while in university, $´_u$, is positively associated with the employment-population ratio of young high-school graduates.

The behavior of labor market variables at the dropout threshold which seem to be at odds with the predictions of the theoretical model, suggests the following interpretation: according to the survey question about motives for dropping out, a considerable share of students drops out of university because they …nd their studies too di¢cult. Discouragement of the misguided is not implemented into our model which assumes youths to have perfect knowledge of their ability parameter $°_i$. Obviously, discouragement results from a misconceived expectation of the time to degree completion. For misguided students, it does not even make sense to use university as a (very cheap but still costly) parking lot once they realize that their expected time to completion is very large (and maybe even in…nity). The dropout behavior of the misguided students is in some sense independent of the labor market situation at the time of dropout. However, to the extent that labor market variables are serially correlated, it is likely that the labor market situation at enrolment which induced those students to enroll in the …rst place (in accordance with our theoretical model), is still similar to the one that prevails when these misguided students drop out (i.e. doing the opposite of parking lot students), leading to a "wrongly-signed" impact of labor market variables for this group of dropouts at the dropout threshold. The "correct" behavior of non-misguided students might therefore be superimposed by the misguided students e¤ect.[19] Let us stress that - once we allow for misconception by students - the discouragement e¤ect is a direct consequence of the enrollment behavior of youths who in the absence of job opportunities (wrongly) consider university education the more promising alternative to unemployment. Thus, for these students enrollment and dropout are two sides of the same coin. Our estimates for the dropout threshold are therefore not really at odds with the theoretical model but simply complement it and add the missing piece.

To sum up the results for Italy, labor market variables play an important role in

[19] One possibility to check if this explanation is true, is to introduce interaction terms with type of secondary education, so e.g. with a dummy for liceo, the type of secondary school which has presumably by far the lowest number of misguided dropouts. This exercise, however is only possible for the 1995 (and the recently issued 1998) data, so reducing the variation in local labor market variables because of a shorter panel dimension; this part still remains to be done once I have more disaggregated measures that can make up for the loss in variation due to a shorter time series.

explaining university enrollment behavior. Lower demand for ("unskilled") high school graduates as well as higher demand for ("skilled") university graduates increases …rst-time university enrollment. Higher returns to university education induce more students to enroll. At the dropout threshold, there are most likely two opposed e¤ects: one subgroup of students (rationally) uses university as a parking lot and drops out as soon as they …nd a suitable job. This group is the one that I am able to describe by our theoretical model. The second subgroup consists of students with wrong expectations about their ability to obtain a university degree. Only after enrolling, they realize their actual ability and then drop out independent of current labor market variables.

All of these results together highlight again that the main problem for Italian youth is the di¢culty of …nding the …rst job.

5.2 Germany

For Germany, I …rst tried to estimate the procedure described in section (4.2). Depending on the starting values for the parameter vector, the procedure either did not converge at all or led to totally unreasonable parameter values (in the range of 10^4) with huge standard errors (in the range of 10^5). In the case of convergence, di¤erent starting values at each case led to very di¤erent but equally unreasonable estimates. We had to conclude that the data are simply not informative for our problem. Put di¤erently, the failure to …nd a well-de…ned parameter vector maximizing the likelihood function is an indication that the theoretical model underlying it does not to describe the German data.

Then I simpli…ed the problem by grouping (40) and (41) together, i.e. by denoting the likelihood contribution of actual dropouts as

$$¼_{i;AD} = P(°^e < °_i < °^d) \tag{43}$$

So, instead of di¤erentiating between actual dropouts that are still in university and those that already dropped out, I just use the information that they are actual dropouts and therefore must be in the medium ability range. When I estimated this simpli…ed version of the model, the problem of non-convergence or convergence to unreasonable parameter values remained the same.

Finally, I further simpli…ed the estimation procedure by "assuming away" potential dropouts, i.e. I wrote

$$¼_{i;FD} = P(°_i > °^d) \tag{44}$$

and thus implicitly assumed all university graduates to be always-takers. Note that by doing these simpli…cations, I remove all parts of the likelihood which contain the job arrival rate, a key ingredient of our theoretical model! Only now does the maximum likelihood procedure converge and yield estimates of reasonable size (although with the

signs not showing any pattern). Yet, what I estimate now is no longer a counterpart of the theoretical model and the estimates can basically not be interpreted at all.

But this is exactly what we should expect from a priori reasoning about the German case. The theoretical model was developed to yield a description of the Italian dropout phenomenon, and the results for Germany therefore do not come as a surprise. In Germany, youths do not have problems of integration into the labor market to the extent of Italian youths. As I pointed out above, a very common career path for German high school graduates is to …rst do an apprenticeship to acquire a vocational certi…cate which also gives them a backup position when going to university. University enrolment in general seems to be much more driven by a deep interest in the subject and by long-run perspectives as a university graduate than by short- or medium-run ‡uctuations of labor demand and wages as is the case in Italy.

6 Conclusion and Policy Implications

The motivation of this paper was to explain the striking di¤erence in university dropout rates between Italy and Germany. I presented a model that helped to understand the interactions between job search and university education. It highlighted the economic and institutional mechanisms inducing many high school graduates to …rst enroll in university and later drop out. The model allowed me to identify two main groups of dropouts in Italy. Misguided students are ill-prepared to obtain an academic degree. Their decision to enroll in university follows from the impossibility of …nding a job and can only be explained by their misconception of their own ability. Their dropout decision is the consequence of the hopelessness to obtain a degree and therefore independent of the labor market situation at the time of dropping out. Parking lot students in contrast drop out as soon as they get the …rst suitable job o¤er but obtain a degree in case they never get a job o¤er throughout their studies. In Germany, only misguided dropouts exist, and there are fewer of them than in Italy. There are no parking lot students in Germany because German high school graduates do not have a problem in entering the labor market, anyway.

As for policy conclusions, it seems that the Italian dropout problem has to be approached from many di¤erent angles at the same time. First, allowing access to university to graduates from basically all secondary school tracks contributes to the high number of youths who do enroll. This increases the pool of potential dropouts and leads to a high number of misguided youths in university who are ill-prepared for academic studies and after some time give up. While they are enrolled, they crowd university and deteriorate the study conditions of all other students. In contrast, in Germany, not all secondary school tracks lead to university and therefore, the pool of youths enrolling in university can be expected to be more able on average. In addition, for many overcrowded courses of studies, in Germany access is restricted by means of the so-called

numerus clausus, the minimum requirement for one's high school grade point average. In Italy, the numerus clausus also exists but is not as common as in Germany.

Second, Italy should provide for a vocational training system similar to the German one which equips youths with the skills appreciated in the labor market and thereby …lls the gap between only having a secondary schooling degree and having a university degree. This could be the key to improving labor market entry for Italian youth and lowering the number of parking lot students.

Third, the system of pre-registration that I mentioned in section (2.3) has to be continued and even extended. Since it was only introduced in 1998, it is too early to see its e¤ects on enrollment and dropout behavior, but it is very likely to decrease the number of misguided students.

7 Appendix

7.1 Introducing job destruction into the model

In section (3.1) I proposed an extension of the model to incorporate job destruction built on the modi…ed set of equations (1)-(3) and (11)-(12). Subtracting (1) from (11) and (2) from (12) and rearranging we obtain

$$(W_u - U_u) = \frac{(w_u - b)}{r + \gamma_u + \pi_u} \tag{45}$$

$$(W_s - U_s) = \frac{(w_s - b)}{r + \gamma_s + \pi_s} \tag{46}$$

which we can substitute back into equations (1) and (2) to obtain expressions for U_u and U_s:

$$U_u = \frac{1}{r}[b + \gamma_u \frac{(w_u - b)}{r + \gamma_u + \pi_u}] \tag{47}$$

$$U_s = \frac{1}{r}[b + \gamma_s \frac{(w_s - b)}{r + \gamma_s + \pi_s}] \tag{48}$$

Again, the marginal individual is indi¤erent between continuing education and dropping out. Thus again, we compare

$$W_u = \frac{1}{r}[w_u + \pi_u \frac{(b - w_u)}{r + \gamma_u + \pi_u}] \tag{49}$$

to

$$E_{u;i} = \frac{1}{r + \phi_i}[b + \phi_i U_s] = \frac{1}{r + \phi_i}\{b + \phi_i \{\frac{1}{r}[b + \gamma_s \frac{(w_s - b)}{r + \gamma_s + \pi_s}]\}\} \tag{50}$$

The equation

$$\frac{1}{r}[w_u + \pm_u \frac{(b - w_u)}{r + \lambda_u + \pm_u}] = \frac{1}{r + \circ_i}[b + \circ_i \frac{1}{r}[b + \lambda_s \frac{(w_s - b)}{r + \lambda_s + \pm_s}]] \tag{51}$$

defines a threshold value $\circ_d$ for an individual indifferent between continuing education and dropping out. Individuals with $\circ_i > \circ_d$ will continue education while individuals with $\circ_i < \circ_d$ will accept the first job offer they get or finish their studies whichever event comes first.

We simplify by setting $b = 0$:

$$w_u[1 - \frac{\pm_u}{r + \lambda_u + \pm_u}] = \frac{\circ_i}{r + \circ_i} \frac{\lambda_s w_s}{r + \lambda_s + \pm_s} \tag{52}$$

Applying the implicit function theorem to (52) we can see how different parameter values affect individuals at the margin of dropping out of education:

$$\frac{\partial \circ_d}{\partial w_u} = - \frac{1 - \frac{\pm_u}{r + \lambda_u + \pm_u}}{- \frac{r}{(r + \circ_d)^2} \frac{\lambda_s w_s}{r + \lambda_s + \pm_s}} = \frac{1 - \frac{\pm_u}{r + \lambda_u + \pm_u}}{\frac{r}{(r + \circ_d)^2} \frac{\lambda_s w_s}{r + \lambda_s + \pm_s}} > 0$$

The higher w_u, the more dropouts there are.

$$\frac{\partial \circ_d}{\partial w_s} = \frac{- \frac{\circ_d}{r + \circ_d} \frac{\lambda_s}{r + \lambda_s + \pm_s}}{\frac{r}{(r + \circ_d)^2} \frac{\lambda_s w_s}{r + \lambda_s + \pm_s}} = - \frac{(r + \circ_d)\circ_d}{r w_s} < 0$$

Higher skilled wages w_s are an incentive to continue education.

In contrast to the basic version of the model, here also λ_u plays a role because of the possibility of being fired on an unskilled job and the subsequent option to re-enter university.

$$\frac{\partial \circ_d}{\partial \lambda_u} = \frac{\frac{\pm_u w_u}{(r + \lambda_u + \pm_u)^2}}{\frac{r}{(r + \circ_d)^2} \frac{\lambda_s w_s}{r + \lambda_s + \pm_s}} > 0$$

The higher the probability of finding a job as an unskilled unemployed, the more dropouts there are.

$$\frac{\partial \circ_d}{\partial \lambda_s} = \frac{- \frac{\circ_d}{r + \circ_d} \frac{(r + \pm_s) w_s}{r + \lambda_s + \pm_s}}{\frac{r}{(r + \circ_d)^2} \frac{\lambda_s w_s}{r + \lambda_s + \pm_s}} = - \frac{(r + \circ_d)\circ_d (r + \pm_s)}{r \lambda_s} < 0$$

As in the basic case, the higher the probability of finding a job after obtaining a university degree, the less dropouts there are.

$$\frac{\partial \circ_d}{\partial \pm_u} = \frac{- \frac{(r + \lambda_u) w_u}{(r + \lambda_u + \pm_u)^2}}{\frac{r}{(r + \circ_d)^2} \frac{\lambda_s w_s}{r + \lambda_s + \pm_s}} < 0$$

The higher the job destruction rate for unskilled jobs, the less dropouts there are. The opposite is the case for the job destruction rate of skilled jobs:

$$\frac{\partial \Phi_d(\pm_S)}{\partial \pm_S} = \frac{\frac{\circ_d}{r+\circ_d}\frac{,_S w_S}{r+,_S+\pm_S}}{\frac{r}{(r+\circ_d)^2}\frac{,_S w_S}{r+,_S+\pm_S}} = \frac{(r+\circ_d)\circ_d}{r} > 0$$

As in the basic case above, we can compute the expected fraction of dropouts assuming that $\circ_i$ is distributed over the interval $(0; 1)$ with distribution function $F(\circ_i)$. Again, the expected fraction of dropouts is given by $F(\circ_d)$.

7.2 Institutional di¤erences

In this section, I describe the institutional di¤erences in the Italian and German school systems. The most remarkable di¤erence is in compulsory schooling age. While in Italy it is at age 14, in Germany it is at age 18.[20]

7.2.1 The Italian school system

Italian children …rst attend scuola materna from the age of 3 to age 6 (equivalent to kindergarten). Then, they move on to the scuola elementare for a period of 5 years. After this there is the scuola media inferiore, which lasts another 3 years. Its completion marks the end of compulsory education. Students who want to continue their education then go to the scuola media superiore, which consists of a number of di¤erent establishments o¤ering di¤erent specializations: these are the liceo classico, the liceo scienti…co, liceo linguistico, and the istituto tecnico, which take a further …ve years, the scuola magistrale and istituto magistrale, which takes 3 and 4 years, and the istituto professionale which takes between 3 and 5 years. The istituto d'arte and the liceo artistico are special arts schools preparing for the Academy of Arts. All of the tracks with less than 5 years can be "upgraded" by taking one or two additional years of schooling to complete a full 5 years of upper secondary education which is the only prerequisite for entering university.

As for vocational training, there are two di¤erent types of possibilities, both of which do not yield formal certi…cates. First, the classical apprendistato (apprenticeship) constitutes the start into a blue-collar career. It gives youths a contract of undetermined length. To …rms, it is rather unattractive because youths immediately have all rights of a blue-collar worker. On the other hand, the contratti di formazione e lavoro are contracts of predetermined length that are subsidized by the state.

For more details see Table 6.

[20] The regulations di¤er slightly across German Länder (regions) but in all of them full-time education has to be taken until age 16 and part-time education until age 18. Instead of taking part-time education between age 16 and 18 one can also take full-time schooling until age 17.

7.2.2 The German school system

After 4 years of elementary school, students can choose between three main tracks of secondary schooling, Hauptschule, Realschule, and Gymnasium, taking 5 , 6, and 9 years respectively. Successfully graduating from Gymnasium students obtain the Abitur, the high school diploma which gives access to university.

Following Hauptschule or Realschule, but also following Gymnasium, students can start an apprenticeship which combines on-the-job training with class-room education. Apart from this classical German type of vocational training, there are several specialized vocational schools like health care schools but also schools providing training for civil servants.

At the university level, until 1997, short degrees (bachelors) did not exist.

A more detailed picture of the German school system is given in Table 7.

8 Data appendix

In addition to the Istat on Italian high school graduates that I extensively discuss in section 2.3, I use two other data sets: the Bank of Italy Survey of Household Income and Wealth (SHIW) and the German Socioeconomic Panel (GSOEP).

8.1 The SHIW data

The survey is available from 1977 onwards and has been run on a yearly basis until 1987 (with the exception of 1985) and every other year since then. Although starting in 1989 a small component of rotating panel is introduced in the survey, I ignore this feature of the data here.

The SHIW data have several shortcomings that partly determine the selection of the sample and also the econometric approach.

First, before 1989, the survey is focusing on income-recipients and therefore only a very reduced set of variables is provided for non-income recipients. For instance, the current schooling degree held is only known for income recipients, i.e. basically for the working population. Since by de…nition, in the SHIW data one can not declare to be working and to be a student at the same time, for persons that declare to be students we do not know their current highest degree. So, for example, for a 19-year old, we can not say whether he is a student still in high school (holding a junior high school degree) or already in university (holding a high school degree). So, in order to be able to select the subsample of youth holding a high school degree, we have to restrict the analysis to the years 1989 and after.

Second, family background variables are not immediately at hand. In the SHIW data, a direct question about parents' education and occupation was only asked in 1995. To be able to use data for more years than just the 1995 cross-section, I therefore had to

restrict the analysis to youths living at home. Doing this, I am able to use information provided by the parents themselves. This should not influence the results too much considering that in Italy, 88% of youths aged 16-24 are still living at home.

Possible family background variables are parents' education and occupation and family income. Here, I use the maximum of mother's and father's years of education and family income of the rest of the family, i.e. excluding the youths' labor income, because non-enrolled youths are more likely to earn labor income than enrolled youths, thereby introducing a bias in the estimation. I express family income in 1998 Lira and then transform it into Euro. Doing the same for Germany makes the results directly comparable.

As regions I use five aggregated areas North-West, comprising Piemonte, Val d'Aosta, Liguria, and Lombardy, North-East, comprising Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, and Emilia Romagna, Center, comprising Tuscany, Umbria, Marche, and Lazio, South, comprising Campania, Abruzzo, Molise, Puglia, Basalicata, and Calabria, and Islands, comprising Sardegna and Sicily

8.2 The GSOEP data[21]

The GSOEP provides appropriate information for the problems under consideration. It is a representative longitudinal sample of the resident population containing socioeconomic information on private households. It began in 1984 with a sample of 12.245 respondents in 5.921 households in the western states of Germany. It consisted of two randomly sampled subgroups:

German Subsample: people in private households where the head of household is not Turkish, Greek, Yugoslavian, Spanish, or Italian nationality (the five largest groups of foreign nationals).

Foreign Subsample: people in private households where the head of household is of Turkish, Greek, Yugoslavian, Spanish, or Italian nationality.[22]

In 1990, already before official unification, the first wave of the East German Subsample was added. It includes individuals in private households where the head of household is/was a citizen of the German Democratic Republic.

In 1995, a special sample of immigrants was for the first time interviewed.

By now there are thus four different subsamples which can be aggregated using design weights.

In this paper, I only use the West-German and foreign subsample because of problems in comparability of the West- and East-German school systems. Also is the time series

[21] This section draws on several official publications by the German Institute for Economic Research (DIW) and on Wagner, Burkhauser and Behringer (1993).

[22] Note that the foreign sample consists of people who came to Germany in the 1950's and 1960's already and have therefore already assimilated to the native German population. In contrast, the immigrant sample (see below) includes foreigners who only recently came to Germany.

dimension for these subsamples longer than for the East German and immigrant samples. Using the years 1985-1995, the GSOEP data cover approximately the same years as the Italian SHIW data.

The GSOEP data also only provide a direct question on parents' education in one cross-section, in 1986. However, we can update this information in later years because we can follow individuals over time. This is an advantage over the Italian data. Yet, also in Germany 78% of youths aged 16-24 live at home.

Information about income of the rest of the family can be constructed similarly to the Italian data.

The regions used are nearly identical to the West-German states, the so-called Länder. Only the smallest Länder, i.e. the cities of Hamburg and Bremen and the Saarland had to be merged with neighboring states because their sample sizes would have been to small to obtain reliable estimates. I end up using the following 8 regions: Berlin, Schleswig-Holstein/Hansestadt Hamburg, Niedersachsen/Hansestadt Bremen, Nordrhein-Westfalen, Hessen, Rheinland-Pfalz/Saarland, Baden-Württemberg, Bayern.

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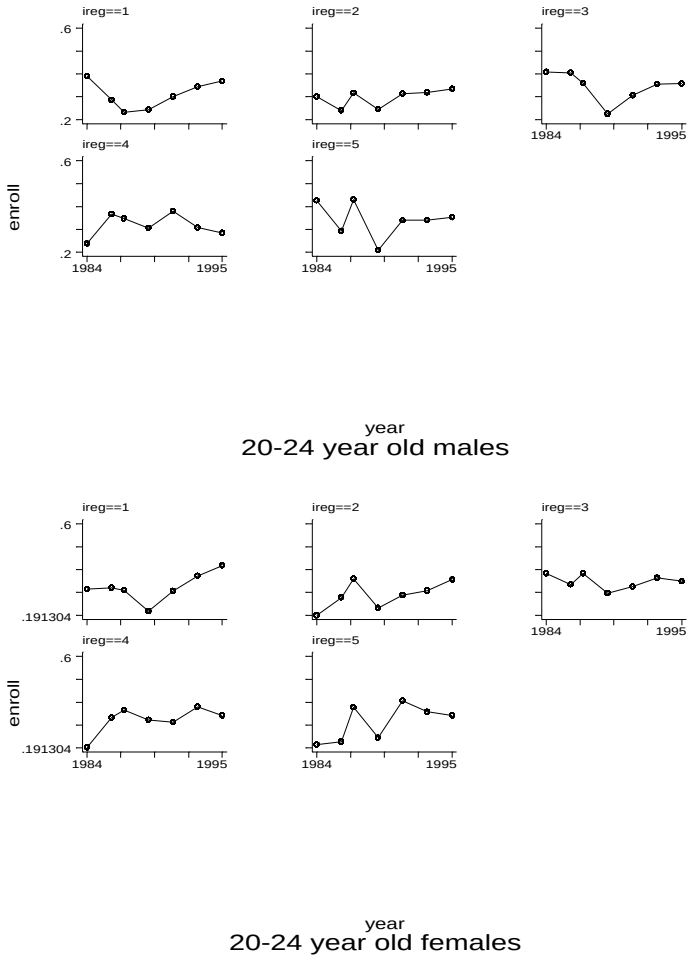


Figure 1: enrolment of Italian youth (20-24 year old)

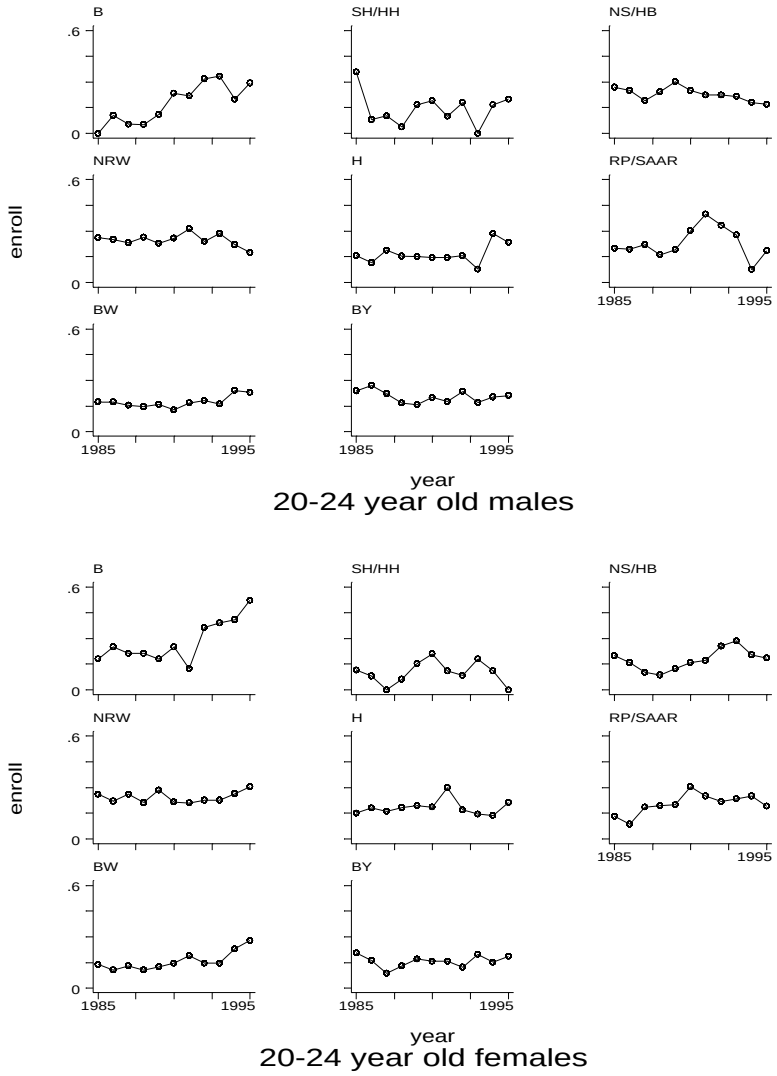


Figure 2: enrolment of German youth (20-24 year old)

Figure 3: Possible cases in the dropout model

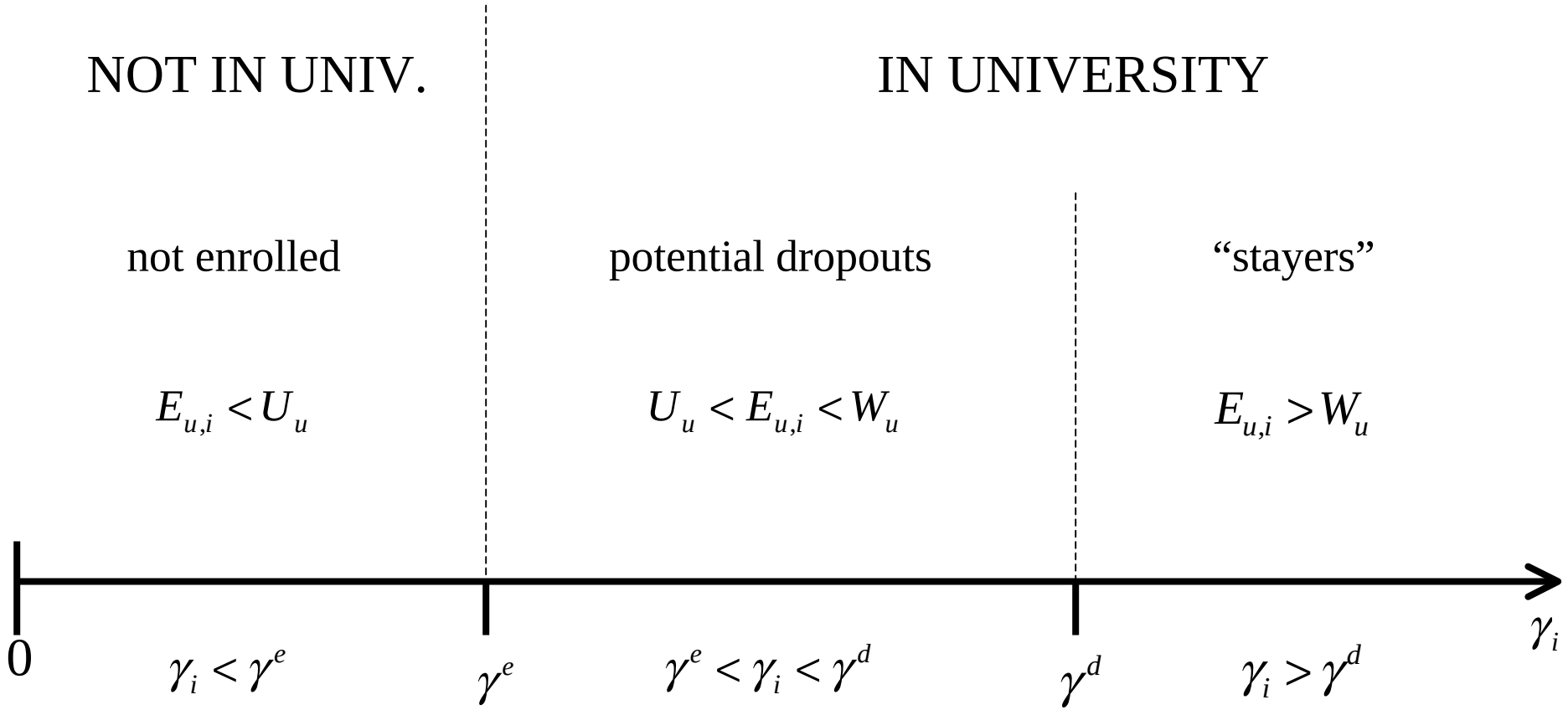


Figure 4: From the Model to the Data

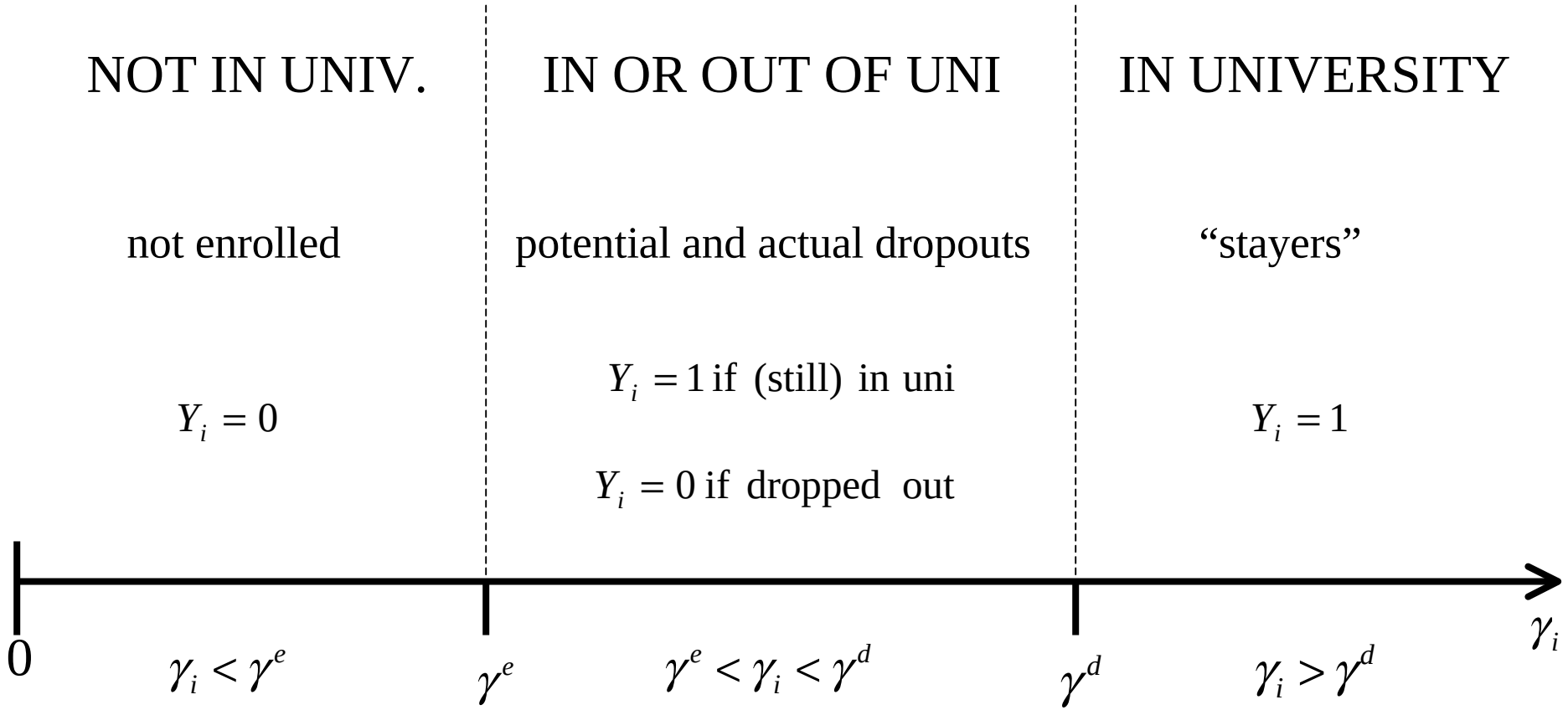


Figure A: GDP Italy

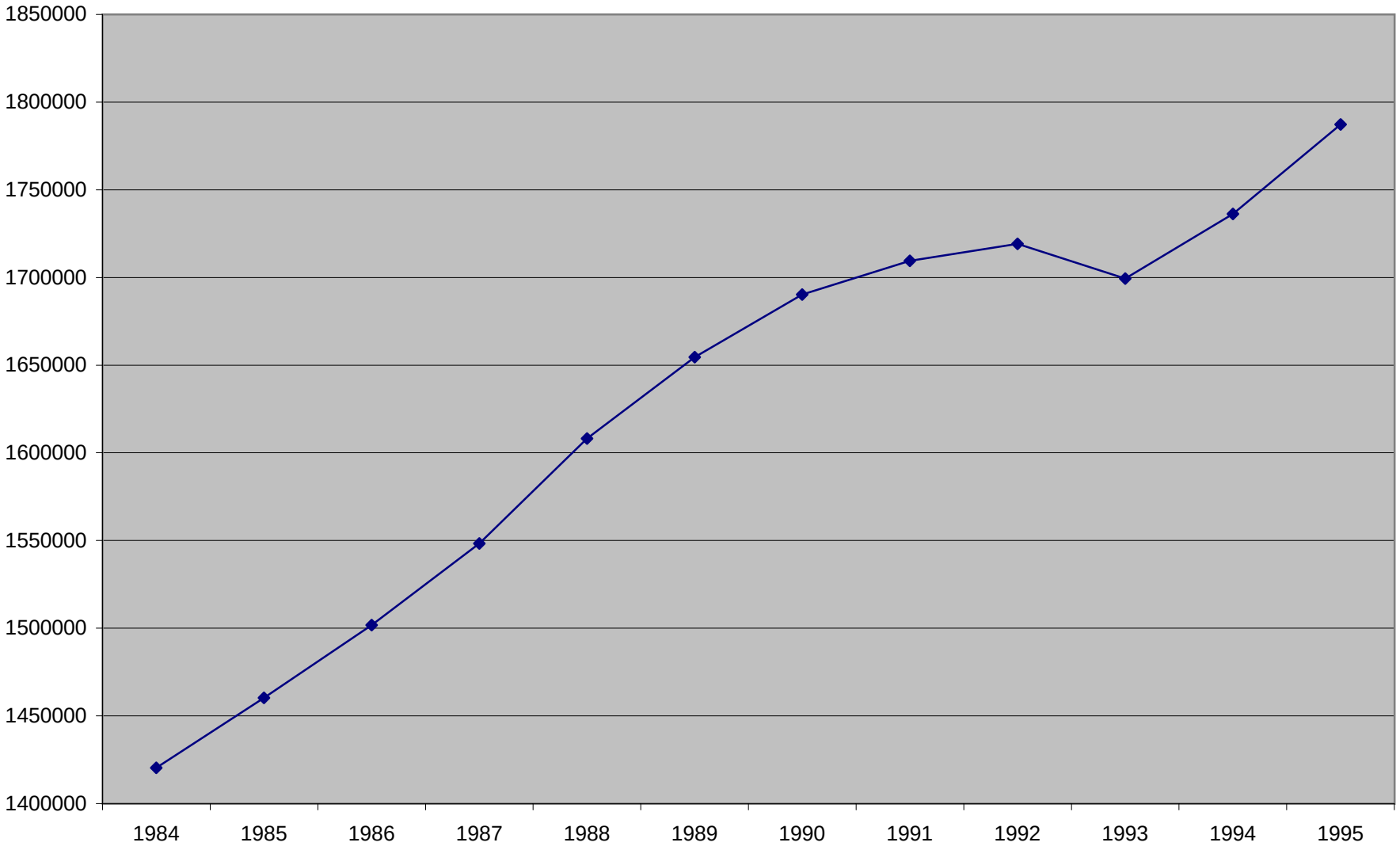


Figure B: Youth Unempl. in Italy and Germany (age 15-24)

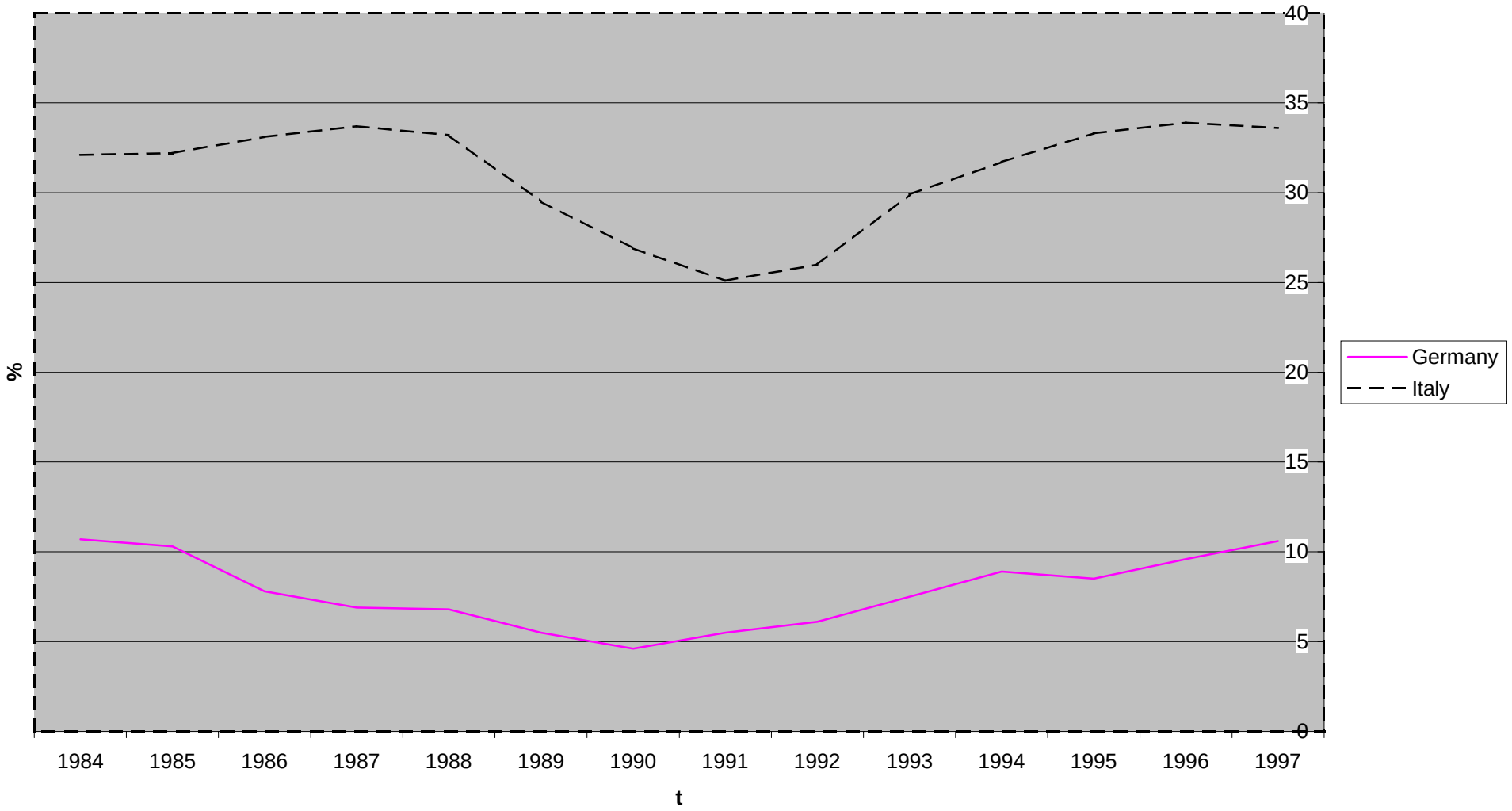


Table 1: Some descriptive statistics for the sample of high school graduates

Variable	Mean	Std.Dev.
Age (in years) in 1995	19.73	2.47
Sex (female=1)	0.55	0.50
Live at home in 1998	0.88	0.32
Married in 1998	0.04	0.20

Table 2: Dropout rates by type of secondary school

School type	Dropout rate	N
Istituto professionale	43.57	482
Istituto tecnico	28.36	2447
Liceo	8.06	3944
Other	17.04	622
Total	17.72	7495

Table 3: The probability of dropping out

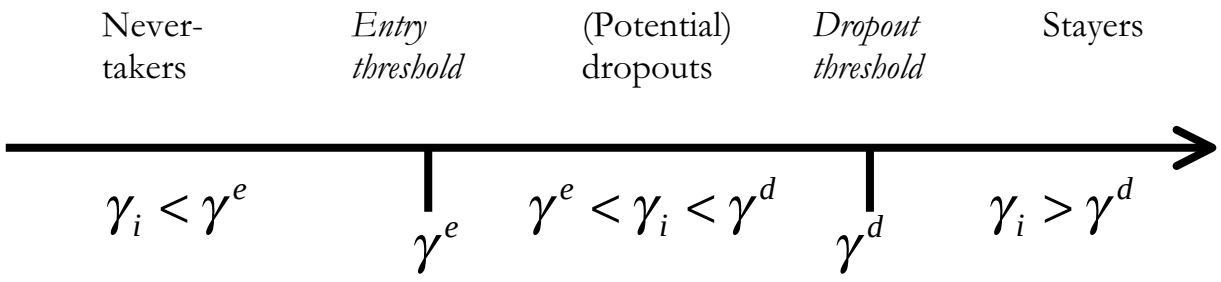
	marginal effects of the probit
Istituto professionale	**0.308**
	(0.028)**
Istituto tecnico	**0.180**
	(0.012)**
Other school	**0.0876**
	(0.021)**
Voto maturità	-0.008
	(0.000)**
Voto scuola media inferiore	-0.025
	(0.005)**
Number of siblings	-0.002
	(0.005)
Parents' education	-0.007
	(0.001)**
Age	0.024
	(0.006)**
Number of classes repeated	0.005
	(0.008)
Sex (female=1)	-0.008
	(0.015)
Number of observations	7495
R^2	0.16

Notes: Dependent variable: 1=dropped out of university between 1995 and 1998, 0 if not.
Reference school type is *liceo*
Standard errors in parentheses. * significant at 5% level; ** significant at 1% level.
Source: Istat data on high school graduates of the year 1995

Table 4: Motive for dropping out

Motive for dropping out	Frequency	Percent
Studies too difficult / didn`t like	475	35.77
To do different studies	62	4.67
Studies didn`t promise professional opportunities	37	2.79
Studying was too costly	67	5.05
Work	343	25.83
Personal motives	184	13.86
Military service	106	7.89
Other	54	4.07
Total	1328	100

Table 5:
Results from Maximum Likelihood Estimation



Employment- population ratio HS Grads	0.654 (0.354)	0.678 (0.535)
Employment- population ratio Uni Grads	-0.319 (0.245)	0.284 (0.295)
Returns to University Education	-0.532 (0.414)	0.579 (0.422)
Sex	-0.222 (0.087)	-0.161 (0.141)
Parents' education	-0.091 (0.005)	-0.091 (0.005)
Rest of family income	-0.230 (0.038)	-0.230 (0.038)
Constant	3.318 (0.450)	3.318 (0.450)

Job offer rate

Empl.-pop. Ratio HS Grads	3.065 (1.197)
Sex	0.434 (0.384)
Constant	-2.550 (0.726)

Note: Maximum likelihood estimation of the "Ordered Probit" model described in section 4. The dependent variable is an indicator taking value 1 if a youth is enrolled in university and 0 if he is not enrolled.

Table 6: The Italian Educational System

English Term (Diploma in Brackets)	Usual Years of Schooling, Training	Italian Term (Diploma in Brackets)
primary school	5	scuola elementare (licenza elementare)
lower secondary school (leaving certificate)	8	scuola media inferiore (licenza media inferiore)
upper secondary specialized school	13	istituto tecnico (diploma istituto tecnico)
academic secondary school / "high school" (university entry-level leaving certificate)	13	liceo classico, scientifico e linguistico (maturità)
upper secondary school for arts (requires licenza media inferiore)	+3 or +4	istituto d'arte, liceo artistico (diploma artistico)
vocational school (requires licenza media inferiore)	+3	istituto professionale (diploma professionale)
school for the formation of primary school teachers	+3	istituto magistrale (diploma magistrale)
additional preparation year(s) for university following vocational school, arts schools or istituto magistrale [requires diploma of the mentioned schools]	+1 or +2	anno integrativo (maturità)
health care school	+3	scuola infermieri (diploma infermieri)
university (BA, MA)	+4 or +5 (depending on subject)	università (laurea)
doctorate (Ph.D.)	+3	dottorato
apprenticeship (NO formal certificate!)	one or more years	apprendistato (NO formal certificate!)
special contract for youth of predetermined length with subsidies to the firm	one or more years	contratti di formazione e lavoro (NO formal certificate!)
civil servant school	+1 or +2	

Table 7: The German Educational System

English Term (Diploma in Brackets)	Usual Years of Schooling, Training	German Term (Diploma in Brackets)
primary school	4	Grundschule
lower secondary school (leaving certificate)	9	Hauptschule(Hauptschulabschluss) Volksschule (Volksschulabschluss)
intermediate secondary school (leaving certificate)	10	Realschule (Mittlere Reife)
comprehensive school / non-streamed secondary school	9-13	Gesamtschule
upper secondary specialized school (certificate of aptitude for specialized short course higher eduaction)	12	Fachschule (Fachhochschulreife)
academic secondary school / "high school" (university entry-level leaving certificate)	13	Gymnasium (Abitur)
part-time vocational school	+2	Berufsschule
technical college / commercial college (vocational extension certificate)	+2	Fachschule, Handelsschule (Fachschulreife)
specialized vocational school [requires lower or intermediate high school diploma]	+2	Berufsfachschule
health care school	+2	Schule des Gesundheitswesens
civil servant school	+1.5	Beamtenausbildung
polytechnical	+3	FH Ingenieurschule
university (BA, MA, PhD)	+5	Universität, Hochschule (Diplom, Magister, Doktor)
comprehensive university, specialized college	+5	Gesamthochschule
apprenticeship, agricultural apprenticeship	+1.5	gewerbliche, landwirtschaftliche Lehre
trade/commerce apprenticeship	+1.5	kaufmännische Lehre