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DO FINANCIAL CONDITIONS PLAY A ROLE IN UNIVERSITY DROPOUT? NEW EVIDENCE FROM ADMINISTRATIVE DATA

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Do financial conditions play a role in university dropout? New evidence from administrative data.

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Abstract

A large strand of research in the economics and sociology of education has highlighted the existence of deeply rooted inequalities in educational choices along socioeconomic lines, even net of prior performance. These disparities may take different forms at different stages of schooling and across institutional systems. Yet, due to the lack of data, it is often difficult to disentangle the role played by the various dimensions of socioeconomic background on students' educational careers. While parental education and occupation may shape aspirations (and thus the wish to undertake ambitious educational programs), the lack of income could represent a material obstacle to the continuation of the studies. In this chapter, we focus on the effect of financial conditions on the probability to drop out from university. Italy is an interesting study case because the education system is mainly public and university tuition fees are relatively low and income-progressive. Since direct costs for disadvantaged students are low, we could expect income not to be highly relevant in this context. By exploiting a unique data set of the University of Torino linking administrative data of students' university careers and information on parental characteristics collected at matriculation, we analyze how socioeconomic background influences the first-year dropout probability. While extremely relevant in earlier educational outcomes, parental education and occupation no longer exert a sizable effect at this point of student lives. Instead, we find that economic conditions greatly influence the chances to complete university. This result suggests that low tuition fees may be insufficient to foster the participation of low-income high school graduates, and that additional forms of support might be needed in order to ensure equity and at the same time raise the share of young people with higher education degrees, still too low in Italy.

JEL Codes: I2; I23; I24
Keywords: Higher education, University dropout; Household financial conditions

1. Introduction

There is a huge literature from the economics and sociology of education analysing the role played by family background and economic resources on individuals' schooling and college choices. Overall, this body of work provides overwhelming evidence that educational choices are strongly influenced by family background.

It is widely recognized that on average children from higher socioeconomic status perform better at school: this pattern is ascribed to the capability of more advantaged parents to purchase better quality education, offer cultural stimuli, and support their children in case of difficulties. Yet, students from advantaged backgrounds make more ambitious school choices and display better outcomes also net of prior scholastic results. Further differences in educational choices across family backgrounds may emerge because, acknowledging their own ability, rational individuals take decisions according to costs and expected benefits, maximising a utility function.

The sociologists Breen and Goldthorpe (1997) conceptualize utility in terms of the expectations concerning the social class destinations of their offspring and, emphasizing the role of aspirations, assume that individuals aim at minimizing the risk of social demotion (i.e., ending up in a lower class than that of their parents). Parental education is also valued as a major driver of aspirations, and most empirical analyses of the effects of family background on educational outcomes either focus on the role of parental education or control for it. Other channels might exacerbate differences across family backgrounds in retention. Tinto (1975) highlights the role played by social and academic integration on university dropout. Since first-generation university students lack good knowledge of the higher education system and have no familiarity with it, they will have higher chances of experiencing poor integration and thus withdraw.

A large body of the economic literature is centred on the role played by family income and the utility function is defined in terms of children's future earnings. As discussed in Becker (1975), low-income families may face limited borrowing opportunities. Credit constraints may discourage college attendance among youth from low-income families, even when the financial returns are high. However, Cameron and Heckman (2001) and Carneiro and Heckman (2002) find relatively small gaps by family income after controlling for children's ability. They conclude that it is the long-run factors associated with family income – family environment, early investments in children's education – that play a prominent role in explaining differential college enrolment rates by family income as compared to short-term borrowing constraints. Similarly, Stinebrickner and Stinebrickner (2008) study college dropout decisions and report little evidence of credit constraints on most students. Instead, other scholars find that financial constraints are important drivers of university enrolment and completion (Ellwood and Kane 2000, Belley and Lochner 2007). Comparing the mid-

seventies cohorts studied in Heckman and colleagues' work with mid-nineties cohorts of students, Belley and Lochner (2007) find that family income has become substantially more important over time. They conclude that it is likely that borrowing constraints have become more stringent, although they acknowledge that other factors such as social networks, imperfect information, college admissions policies might have played a major role as well. Bound et al. (2012) find that growing difficulties in financing a college education, especially among students from low-income families, contribute to increase student employment to cover a greater share of college costs, and in turn to increase time to degree. Examining college dropout, Stinebrickner and Stinebrickner (2012) argue that students learn about their academic ability or grade performance while in college and provide evidence that a substantial share of withdrawals can be attributed to the gained awareness of poor performance. Indeed, families invest more in their children's education the higher are the expectations on their ability (Checchi 2000). While affluent parents might still find it worthwhile to keep financing their offspring's education even of poor performing, low-income ones are more likely to give up.

The issue of credit constraints is addressed mainly in the research on US and UK, where the tertiary education system is strongly differentiated, and tuition fees are generally high. In European countries, where higher education institutions are mainly public and direct costs are much lower, the explanations put forward by scholars of the potential influence of family income on university attendance (conditional on prior ability and schooling careers) are more generically related to the inability to face costs, including the cost of living, and to foregone earnings (Glocker 2011, Barone et al. 2014). Where financial difficulties and no efficient student aid system exist, disadvantaged students often need to cover their costs by working, increasing time to degree and dropout (Glocker 2011, Triventi 2014). In favourable labour market conditions pull factors may also operate, as in particular low-income students might be induced to accept good job offers and leave university.

Indirect evidence of an impact of family income on higher education attendance and completion is also provided by the numerous studies showing the beneficial effect of student aid in different countries (eg. Dynarski 2003, Glocker 2011, Mealli and Rampichini, 2012, Singell 2014, Bettinger et al. 2019, Denning et al. 2019, Modena et al. 2020).

Against this background, in this chapter, we analyze whether family economic conditions affect the probability to drop out from Italian university upon enrollment. Italy is an interesting study case because the education system is mainly public and university tuition fees are relatively low and income progressive. While parental education and occupation may shape aspirations – and thus the wish to undertake ambitious educational programs – the lack of income could represent a material obstacle to the continuation of the studies. Yet, since direct costs for disadvantage students are low, we could expect income not to be highly relevant in this context. As we will show, this is not the

case: economic conditions appear strongly associated to student dropout, and as we will discuss, there are strong reasons to believe this is a causal effect. To our knowledge, there is little existing evidence in Italy on the role played by financial conditions on student academic careers in university. One reason is the lack of appropriate data. Although administrative data provide a measure of family income, it is difficult to identify its effect because of the potential confounding of other family background characteristics.

Our research focuses on student educational careers upon higher education enrollment. Exploiting a unique data set of the University of Torino that links administrative data of students' university careers, information on family income and wealth, and information on mothers' and fathers' characteristics collected at matriculation, we disentangle the effects of income, parental education, and parental occupation on the probability to drop out in the first academic year. Information on the financial situation of the family is provided by the ISEE indicator (*Indicatore della Situazione Economica Equivalente*). Instead, parental education and occupation are not available in university registries. To overcome this limitation, the University of Torino has been collecting data on parental education and occupation since academic year 2014/15, through an online questionnaire that students fill at matriculation. Although this section is not mandatory, the large majority (approx. 90%, evenly distributed across subgroups) provide the information. However, nearly 30% of the students do not disclose the ISEE documentation. We show that these data are not missing at random and that a non-negligible share can be attributed to early dropout decisions. Since in this case complete case analyses or naïve solutions will deliver biased estimates of income effects, we tackle this problem by implementing an appropriate ad hoc imputation strategy.

The rest of the chapter is organized as follow. In Section 2 we summarize the existing evidence for Italy. In Section 3 we describe the data, and in Section 4 we illustrate the problem of missing information investing income data and how we tackle it. In Section 5 we describe the empirical strategy and in Section 6 we present our findings. Conclusions follow in Section 7.

2. The Italian context

Despite the absence on formal barriers to track choice and access to university, the Italian educational system is flawed by strong socioeconomic inequalities (Cobalti and Schizzerotto 1993; Checchi and Flabbi 2007). In comparative research, Italy stands as a country with particularly large inequalities across parental class and education in upper secondary school choices and access to tertiary education (Jackson, 2013). Family background critically influences students' high school choices (Gambetta 1987; Schizzerotto and Barone 2006). Even if inequalities in access to upper secondary education have witnessed a consistent reduction and the share of students enrolling to the academic track has

increased over time (ANVUR 2016), class inequalities in track choices have not changed much (Panichella and Triventi 2014). Horizontal segregation in high school has strong consequences on inequalities of university enrolment, as the transition rate to tertiary education varies largely across tracks (around 80% for students with a lyceum diploma, and below 30% for students with a vocational/technical diploma, ANVUR 2016). Overall, there is evidence of increasing participation to higher education and slightly decreasing inequalities up to the 2000s (Argentin and Triventi 2011, Guetto and Vergolini 2017), but in the most recent decade, probably due to the economic crisis, transition rates have been declining and differences across high school tracks have increased, determining a change in the composition of the enrolled population (ANVUR 2016).

Research on student academic careers has been limited by the lack of appropriate longitudinal data at the national level. For this reason, the existing literature on university dropout is largely based on retrospective survey data on high school graduates, periodically run by the National Statistical Institute (Cingano and Cipollone 2007, Di Pietro and Cutillo 2008, Cappellari and Lucifora, 2009, Ghignoni 2017, Contini et al. 2018). This literature reports substantial differentials related to family background and shows that disadvantaged groups in terms of enrolment are also disadvantaged in persistence. These groups include students who attended high schools with a lower academic content (largely composed by students of lower socioeconomic background), although parental education and social class influence university attendance and retention also given prior schooling. Disadvantaged students are also less likely to enroll in a second tier, once obtained a bachelor's degree (Bratti and Cappellari, 2012).

Only a few studies are based on micro-level administrative data (Belloc et al 2010, Clerici et al 2014, Carrieri et al 2015, Zotti 2016. Contini and Salza 2020, Scagni 2021). Since the archives on schooling and university careers are not linked together, it is not possible to study the enrolment choice and thus consider selection effects. Moreover, a major limitation is that while it is possible to obtain data on family income, there is no information on parental characteristics. Parental education and occupation influence individuals' aspirations and shape their expectations about future life chances. Economic conditions influence the possibility to bear the direct and indirect costs of schooling. To disentangle these effects, data on all these dimensions are needed.

While parental education and class strongly influence high school choices, in Italy there is no evidence of income effects at this stage (Checchi 2000). This is hardly surprising, because schooling is free up to high school completion, and the expansion of the educational system has now made high school attendance almost universal, as nearly 85% of the young attain a high school qualification. The evidence on the role of economic resources in higher education is mixed. Analyzing a national sample in the survey on Household Incomes and Wealth, Checchi (2000) reports that family income

does not seem to play a significant role in preventing the enrolment in Italian public universities. Instead, Aina (2013) finds sizable effects on the enrolment probability but little effects on dropout. Using administrative data from single institutions, Zotti (2016) and Scagni (2021) report income effects on the dropout probability. Although analysing the data of single institutions has limited external validity, focusing on more homogeneous environments has the advantage of better controlling for contextual confounding effects. Analysing the University of Salerno, Zotti (2016) reports significant differences between low- and medium-income families in the dropout probability. Scagni (2021) analyses the data of the University of Torino and finds a sizable effect of income on dropout choices. Instead, Belloc et al. (2010) report the opposite finding, that low-income students drop out less, for the University Roma La Sapienza. Yet, this result is derived from including university performance (a mediator of dropout) as a control, and thus it is not comparable with the other studies. In a different perspective, Barone et al. (2018) use measures of material deprivation to study university enrolment and find that net of other variables meant to capture the rational choice mechanisms in line with the Breen and Goldthorpe's theoretical model, economic deprivation as such matters, but does not play a major role.

Indirect evidence of the role of financial conditions on student academic careers is provided by the compelling evidence that income support provided to low-income students are effective in preventing dropout and fostering in-time graduation (Mealli and Rampichini, 2012, Martini et al 2020, Vergolini and Zanini 2015, Modena et al. 2020). Scholarships may favour college enrolment and persistence by providing income that allows students to allocate more time to school activities instead of work.[1]

3. Data

We exploit administrative data provided by the Ministry of Education on the entire careers of the cohorts of students first enrolled at the University of Torino in a bachelor's program in the academic years 2015/16-2017/18. The archive contains full information on the students' progression – including exam transcripts and credits earned, degree changes, change of institution, timing of degree attainment or withdrawal – demographic characteristics (gender, age, place of birth and place of residence) and information on previous schooling (type of high school and final examination marks). These data have been integrated with information on family income and tuition payments, with information on scholarship recipiency[2], and with a unique piece of information on parental education and occupation, that has been collected independently by the University of Torino at matriculation

[1] As shown by Triventi (2014), students from upper-middle classes have a lower probability of working while studying and working students have much poorer performance outcomes than full-time students.
[2] Data on scholarships was made available by EDISU-Piemonte (Ente Regionale per il Diritto allo Studio Universitario).

since 2014[3]. This allows to improve our understanding of socio-economic inequalities in higher education, assess the independent contribution of each of these family characteristics, and disentangle the effect of economic conditions.

We analyze the determinant of first year drop out, with a particular focus on the role played by family income. Withdrawal is defined implicitly, based on whether we observe re-enrollment in year 2. Since we have access only to the microdata of the University of Torino, we cannot distinguish between changes of institution and withdrawal from higher education altogether.[4] Yet, previous analyses based on more comprehensive data have shown that among bachelor students only a small share of the observed dropouts belongs to the former group, thus we believe we can safely interpret the results in terms of system-level dropout.

In Italian public universities tuition fees are progressive, depending on the household economic conditions. Students make a first payment of a fixed amount at the beginning of each academic year. In late fall they are asked to provide an official document released by the tax authorities delivering a measure of the household economic condition, based on official records of family members labor income, properties, and real estate assets, and normalized by the number of components. This measure, called ISEE (*Indicatore della Situazione Economica Equivalent*e) is employed to determine the total amount due by each student.[5] Students whose ISEE exceeds a given threshold (currently set around 85,000 euros) or not providing the income declaration are requested to pay the maximum fee (approximately 2500 euros per year). Nearly 30% of the students do not provide the ISEE declaration. In the next section we deal with this issue: as we will show, this piece of information is clearly not missing at random. This implies that we cannot ignore the issue and conduct a complete case analysis: instead, missing data will be imputed, based on the available information on the following academic years, on parental education and occupation and tuition payments.

4. Missing data on family income

If we could assume that conditional on observed variables, data on income were "missing at random" (MAR), we could conduct a complete case analysis including all the relevant explanatory variables in the models. Yet, there are good reasons to believe this is not the case.

First, since high income students have no tuition reductions, they have no incentives to provide the income declaration. Let us label these students as *rich*. Indeed, if we could assume that all

[3] This collection spurred from the project EqualEducToEmploy, financed by the Compagnia di San Paolo in 2012-2016.
[4] Students changing degree program are not considered dropouts.
[5] Students may figure as an independent household only if they have lived on their own for at least two years and if they have earned at least 7000 euros/year. This rule was introduced in the early 2000s to discourage the previous common practice of changing residence to figure as a separate household with a low income and pay low tuition fees.

individuals with missing ISEE exceed the highest threshold, it would not be a big problem, because we would have relevant information on income that we could exploit. Unfortunately, there is evidence against this assumption. When we analyze the characteristics of the students with missing ISEE we find that: a) many of the students with missing ISEE come from disadvantaged family backgrounds in terms of parental education and occupation (see Table A.1 in the Appendix A); b) many students not disclosing income in year 1 do so in subsequent years, often reporting a low ISEE value (see Table A.2 in the Appendix A). If economic conditions are fairly stable over a short time span, we may assume that in year 1 they had missed the deadlines, so we call these students *sloppy* and exploit the information provided in later years.

Second, the students who decide to leave their studies within the first couple of months of the academic year, also have no incentives to declare ISEE, because ISEE determines the second tuition payment, due in the late fall. We may call these students *early dropouts*. The choice timeline is depicted in Figure 1.

[Figure 1 around here]

While the *rich* and *sloppy* can be easily handled by imputing high income or subsequent ISEE values, *early dropouts* involve an endogeneity issue that must be dealt with. Endogeneity results from the fact that, although we are dealing with missing of an independent variable, whether this variable is observed or not may depend on the dependent variable itself. Hence, we cannot simply ignore the issue and exclude these cases from the analysis, because we would end up with potentially highly biased estimates of the effect of income on the dropout probability. As we will see later, this practice would lead to substantial underestimation of the effect of interest.

We now describe how to identify the students in these subgroups and our imputation strategy. We classify the students in the cohorts of interest in terms of whether they have or have not provided the income declaration in academic years 1 and 2, whether they have or have not enrolled in year 2, and when relevant, whether they have paid the second tuition instalment: this piece of information is useful to identify the early dropout students. Details are provided in Table 1.

[Table 1 around here]

Most of the students (more than 70% of the entire student population matriculated in bachelor's degree courses) provide ISEE in year 1. Consider the students not declaring ISEE in year 1 (29.37% of the total population). As discussed above, we may identify three relevant clusters: the *rich*, the

sloppy and the *early dropouts*, as well as an additional residual group. In the following lines, we describe how we identify them and the imputation strategy.

Let us start from those not dropping out by year 2.

i) *SLOPPY*. As argued above, we assume that those not declaring income in year 1 and declaring income in year 2 had previously missed the deadlines: the *sloppy* represent 5.07% of the total population. Assuming short-term stability of economic conditions, we impute ISEE in year 1 using the value reported in year 2.

ii) *RICH*. Some students fail to provide the information even in year 2 (and in subsequent years). These students (17.5% of the total population) are labeled *rich*, under the assumption that if a student keeps disclosing ISEE it is because there would be no substantial tuition reduction justifying the burden required to produce the documentation. For these individuals we impute ISEE with a conventional value exceeding the maximum threshold. To keep it simple, we impute the value 100,000 and run robustness checks with alternative values (see Section 6).

After these imputations, the share of students with no information on economic condition drops from 29.37% to 6.76%. Even if the size of the missing ISEE population is small at this point, we must still account for the most problematic subgroup of students: those who do not enroll in year 2.

iii) *EARLY DROPOUTS*. To identify them, we exploit an additional piece of information: whether students have made the second tuition payment, due in late fall. We assume that those who did not (4.46% of the total population) have taken the dropout decision before the ISEE deadline. Our imputation strategy for the early dropout students relies on the available information on parental education and occupation and on the observed relation between these family background characteristics and ISEE. Let us define I as the household economic condition indicator and z the vector of dummy variables describing mother's and father's education and occupation. Assuming a linear relation $I_i = a + bz_i + u_i$, we estimate model parameters, predict ISEE for given combinations of parental background characteristics, and use the estimated $E(I|z)$ to impute missing ISEE. Yet, to address the endogeneity issue we must acknowledge that the relation between I and z is generally different in the dropout population from that holding in the student population at large, because economic conditions and other dimensions of family background may themselves affect dropout (see proof in the Appendix B). Against this background, we estimate the relation between I and z among those dropouts disclosing income and impute the predicted expected value $\hat{E}(I|z, \text{drop out})$, under the additional assumption that the same relation holds for early and late dropouts.

iv) *OTHER DROPOUTS*. There is an additional small residual group of dropouts (2.3% of the total population) who did not declare ISEE in year 1, but, having paid the second instalment, should not be considered as early dropouts. In principle we could exploit the observed relation between parental characteristics and income, and impute expected income as done for the early dropouts; however, this would imply neglecting their decision not to disclose their income. Instead, we may acknowledge that this group is likely to be composed of *sloppy* and *rich* students. However, because they drop out, we cannot observe their behavior in year 2, so we have no means to identify them. Hence, we will assume they are all rich. Although this is unlikely to be true for all the students in this group, by imputing a high value of income to all of them, we tend to narrow the economic differences between dropouts and non-dropouts, delivering a conservative estimate of the true income effect.

5. Empirical strategy and variables description

The original sample included 33485 individuals first matriculated in bachelor's degrees between 2015 and 2017. We excluded from the analyses the students not reporting parental occupation nor parental education for both parents (approximately 10% of the original sample, apparently randomly selected) and those who attained the high school degree abroad, because most of them did not report family background information (final sample size N=29719).

In Table 2 we show descriptive evidence on the ISEE and the parental education distributions of dropouts and non-dropouts. On average the former display substantially less favorable economic conditions and a smaller share have parents with higher education degrees. In the last columns we report the share of dropouts within the population at large, and among those providing and not providing the income declaration. As we can see, dropouts are overrepresented among those not disclosing income, confirming the suspicion that provision of the income declaration may be endogenous to the early dropout decision.

[Table 2 around here]

To analyze the role of family economic conditions on the dropout probability we estimate logit models where the dependent variable is the binary indicator taking value 0 if the students enrolled in year 1 re-enroll in year 2 and value 1 if they do not re-enroll, focusing on students first matriculated between 2015 and 2017 in 3-year degree programs.

We consider the following baseline specification:

$$D_i^* = \beta_0 + \beta_1 I_i + \beta_2 x_i + \beta_3 z_i + \beta_4 f_i + \beta_5 c_i + u_i \quad (1)$$

$$D_i = \begin{cases} 1 \ if \ D_i^* > 0 \\ 0 \ if \ D_i^* < 0 \end{cases} \quad (2)$$

where D^* is the latent utility of dropout, D is the observed binary counterpart, and the error term u is distributed as a logistic random variable. The explanatory variable of main interest is $I = ln(\text{income})$, while control variables are x =parental education and occupation, z =socio-demographic characteristics and prior schooling, f = field of study and c = matriculation cohort.

Given that we can control for a large array of explanatory variables capturing all the main determinants described in the existing literature, we are confident that we are able to estimate a causal effect of family economic conditions on the probability of withdrawal. What often prevents from being able to interpret the income effect as causal is the unavailability of information on parental education and occupation. In the absence of such controls, due to the association between these variables and family income, we would not be able to disentangle pure income effects from other effects related to family background. Nonetheless, we do acknowledge the existence of possible selection effects that might affect our results, since by observing only university students we cannot model the enrollment decision. We address this issue in section 6.3 and in the Appendix B, where we show that under reasonable assumptions our estimates can be conceived as conservative estimates of the pure causal income effect.

Explanatory variables are defined as follows.

- *Income* is defined as the natural logarithm of the ISEE indicator, determining family economic conditions from household income, parental wealth, and family size. When missing, we use the imputation strategy described in section 4.
- *Parental education* is recorded separately for mothers and fathers, according to the classification: up to lower secondary school, upper secondary school, higher education. However, in the estimation, we include the highest level between mother and father, further distinguishing between households where one parent or both parents have a university degree.
- *Mother and father occupation* is categorized as: blue collar, low skilled white collar, high skilled white collar, self-employed[6]. For the mother, we add the category housework.
- *Female* is dummy variable identifying female students, to account for the widespread evidence of gender differences in educational outcomes.

[6] "Blue collar" includes workers, "Low skilled white collar" includes clerks and service workers, "High skilled white collar" includes senior officials, professionals, teachers, and managers, "Self-employed" includes business owners, self-employed and freelance.

- *Age at matriculation* is included because there is extensive evidence that individuals not enrolling right after the end of high school (possibly after a period of occupation, or while working) or more generally at older age are more likely to leave university before degree completion. The variable is included in a categorical version (<=19 years old, 20 years old, 21-25 years old and more than 25 years old) to capture possible non-linear effects.
- *High school track* is included because prior schooling has been shown to strongly affect higher educational choice and outcomes. It is classified into traditional lyceums (classic and scientific), other lyceums (linguistic, human science, artistic), technical schools and vocational schools. Students who attended high school abroad (*n*=881) were excluded from the analyses.
- *High school final grade*, ranging between 60 (pass) to 100 (excellent) is a proxy of academic preparedness and has been shown to be an important predictor of students' outcomes.
- *Area of origin* may influence the dropout probability for several reasons. First, because there is evidence from national and international standardized assessments that the level of competencies reached in school widely differs across the country (highest in the North and lowest in the South, Bratti et al. (2007)). Second, because students moving out of the family of origin, bearing higher costs of living, on the one side might be more exposed to changes in family economic conditions, on the other, might be more motivated than stayers. The area of origin has been based on information on the high school location. We adopt the classification: Turin, Piedmont, North-West, North-East, Centre, South.
- *Field of study*. University careers – withdrawal/completion, credit attainment speed, grades – vary across majors and disciplines. We classify the field of study into broad categories: Scientific, Political and Social Sciences; Economics; Humanities; Health; Psychology.
- *Scholarship* is a binary variable taking value 1 if the student receives financial aid in the form of a (small) scholarship and 0 otherwise. In some specifications we include the variable in the model to account for the evidence that financial aid has a beneficial effect on student progression.
- *Working student* is a binary variable taking value 1 if the student declares being a working student and 0 if she is a full-time student. In some specifications we include this variable because this condition often entails worse academic outcomes and higher chances of withdrawal.

Descriptive statistics on the full set of variables are presented in Table 3.

[Table 3 around here]

6. Main results

In Table 4 we summarize the results of logit model estimation relative to the effect of income on the dropout probability. All models control for parental education and occupation, gender, age at enrollment, high-school type and final grade, area of origin, and include field of study and cohort fixed effects. For comparative purposes, we start with two naïve strategies: a complete case analysis (column 1), and a model including all observations, with a variable taking the observed *ISEE* value if available and 0 if missing, and a dummy indicator for missing $ISEE$ (column 2).[7] We then move to models using the imputed ISEE, according to the procedure described in the previous section: a model with the baseline explanatory variables (column 3), and models adding as control variables an indicator of the student being a scholarship recipient and whether the individual is a working student (columns 4-6).[8]

The effect of income is negative and highly significant in all models, implying that students from more affluent families experience lower chances of withdrawal.[9] The effect appears weaker in the complete case model than in the models where we address the missing data issue with appropriate imputation. The effect is even weaker when we estimate the naïve model in column 2: interestingly, the estimates reveal that the dropout probability for individuals not disclosing ISEE is substantially larger even than the probability experienced by those reporting very poor economic conditions, confirming the suspicion that missing income is at least partially endogenous. In column (3) we find our preferred estimates, we explain why below. The average marginal effect (AME) is -0.234, thus between the 5th and the 95th income percentile (8.45 and 11.51) the dropout probability of two otherwise identical individuals in terms of demographic characteristics, prior schooling, field of study and parental background, differs by 7.16 percentage points.[10] The size of the effect is large, if we consider that the overall dropout share in the first academic year is 15-16%. In columns (4)-(6) we include the additional controls: the income effect increases when we include the scholarship variable and decreases slightly when we include the variable student worker. Interestingly, the effects of both controls are large and highly significant. Ceteris paribus, scholarship recipients have a dropout probability which is approximately 8 pp. lower than that of non-recipients: this result confirms the findings of rigorous impact evaluation studies reporting a positive impact of scholarship on student

[7] In this way the income coefficient describes the effect of ISEE among those who declared it, and the missing ISEE dummy coefficient captures the difference between those who do not provide ISEE and individuals with ISEE=0.
[8] In the first year the scholarship is granted according to family income, although only approximately half of the eligible students apply for it. From the second academic year upon enrolment, also merit restrictions apply.
[9] By making a single imputation for each missing ISEE value, the standard error of the estimates will be underestimated to some extent. However, due to large sample size, we are confident that the estimates will still be highly statistically significant. Multiple imputation techniques will be applied in further developments of this research.
[10] Robustness checks with alternative values of imputed income (80,000, 100,000 and 120,000) are shown in Table A3 in Appendix A. Only marginal changes are observed.

academic careers. Instead, student workers have a much higher dropout probability (13 p.p.) than non-workers.

[Table 4 around here]

We believe the overall causal effect of income is best captured by the model that does *not* include being a scholarship recipient and being a student worker as explanatory variables (Table 4, Column 3), because these variables are endogenous to income and play a role of mediators. In fact, both receiving the scholarship and being a student worker are influenced by income: by including them in the model as controls, we would capture the direct effect of income on the dropout probability, missing to acknowledge the – positive or negative – indirect effects. Let us be more specific. (i) Scholarships are typically granted to less affluent students, with the explicit aim of supporting their studies. Including the variable in the model would result in inflating the estimate of the income effect, because in this way the income effect would capture the difference in the dropout probability between more affluent and less affluent non-recipient students (or recipients, although this comparison seems less salient). In other words, in doing so we would end up interpreting the income effect as if income support policies did not exist. (ii) Working students are generally less affluent than non-workers (Triventi 2014); moreover, as we have seen, they have much higher chances lo leave university before completion. By interpreting the income effect when controlling for this variable (and thus comparing students with different income, but either both working or non-working) we would then end up underestimating the income effect by ascribing part of the negative effect of the lack of income to the condition of being a student worker, although being a student worker is itself influenced by the lack of income.

6.1 Heterogeneity of the income effect

Does income influence the dropout probability for all students, or is the observed average effect driven by the behavior of specific subgroups? To answer this question, we conduct separate analyses by gender, high school type, parental education, area of origin, field of study. Overall, income seems to exert a sizable influence on all subgroups, with minor differences between them and only few exceptions. We also estimate the income effect by levels of the two mediator variables, indicating whether the student is a scholarship recipient or a working student. The results are shown in Tables 5 to 8. Our findings may be summarized as follows.

Gender differences are small (Table 5). Income seems to have a slightly lower impact on the dropout probability of girls than boys, but the difference in not statistically significant. Income has a

stronger effect on students holding technical and vocational high school degrees. Having previously self-selected into less academically oriented high school types, these students are likely to be more exposed to difficulties and may be able to count on lower family support than students from lyceums (Table 6, Columns 1a to 4a). Instead, there are no sizable differences across parental education levels (Table 6, Columns 1b to 4b). Income does not seem to exert an influence on students coming from the Center-South of Italy: we interpret this result in terms of self-selection as well. Although these students display a higher propensity to leave their studies as compared to students from the North (results not presented here) – perhaps because as shown by standardized assessments they reach lower competence levels (Bratti et al. 2007) – they are likely to be especially positively selected in terms of aspirations and motivation and might thus be less exposed to the detrimental effects of low economic resources (Table 6, Columns 1c to 4c).

[Tables 5 and 6 around here]

Income plays a role in all fields of study except for health degrees (Table7). This is not surprising, because admission to these programs is regulated by strict ability restrictions and *numerus clausus*. Being strongly self-selected at entrance, these students are highly motivated, and generally display very low dropout rates. Similarly, although still sizable and statistically significant, we observe a smaller income effect among students enrolled in the scientific study field, where in many degree programs there are ability restrictions at entrance as well.

[Tables 7 around here]

We find no income effects for working students, who are usually engaged in full-time jobs and display much higher dropout probabilities than full time students. We interpret the absence of income effects for this subgroup as being related to the fact that, earning their own income, they are less dependent on the family economic conditions. Income effects are weaker for scholarship recipients (AME=0.017) than for non-recipients (AME=0.032). This result provides additional evidence of the beneficial effect of student aid policies, as the scholarship contributes to making recipients less exposed to the negative impact of a lack of family economic resources (Table 8).

[Table 8 around here]

6.2 The effect of parental education and occupation

As the role of economic conditions emerges clearly, the effect of parental education and occupation is less clear. In Table A4 in the Appendix A we show the estimated effects for all family background dimension. The effects of parental education go in the expected direction, but they are small and barely significant, and even weaker results are observed for parental occupation.[11] Hence, we may conclude that at this point of the educational career – after a strong previous social selection that may be represented as an obstacle course for low-SES and a flat road for high-SES individuals – parental education and occupation do not seem to exert any substantial residual effect on the decision to complete the bachelor's degree.

6.3 Self-selection issues

By exploiting administrative data of university students, we cannot account for selection effects related to previous educational decisions – the choice of the high school track, high school completion, university entrance. Hence, our estimates of the effect of economic conditions on university dropout are not estimates of a causal effect in the usual sense: being conditional only on observed features, they do not capture the differences across the income distribution among individuals otherwise identical in terms of both observed and unobserved characteristics. The comparison is not fully "like with like", because due to the strong social selection operating along the entire schooling career, upon university enrollment low-socioeconomic status individuals are likely to be positively selected and thus more endowed in terms of unobserved traits such as motivation and resilience than more advantaged students (Cingano and Cipollone 2007). For this reason, we expect our estimates to be conservative estimates of the pure causal effect. This conclusion holds under the assumption that motivation is independent of family income, net of parental education and occupation (see the Appendix B for a proof of these results).

7. Conclusions and discussion

As maintained by Manski (1989) and more recently by Bertola (2021), college dropout need not to be considered a social problem, because 'students contemplating college entrance do not know whether completion will be feasible or desirable. Hence, enrolment is a decision to initiate an experiment, one of whose possible outcomes is dropout (Manski, 1989, page. 1). While we do agree with this point, we believe that dropout becomes a social problem if it is mainly experienced by students of disadvantaged backgrounds. And if this is the case, we need to gain a better understanding

[11] Even when parental occupation and ISEE are not controlled for. This result is not shown here and is available upon request.

of how to weaken barriers to higher education attainment among young individuals who have taken the decision to enroll in college, and thus reduce intergenerational transmission of education and income.

Exploiting the unique administrative database of the University of Torino, that augments administrative university data with information on mothers' and fathers' educational level and occupation since academic year 2014/15, we have been able to analyze whether and how the family economic condition, parental education and occupation influence the university students' dropout probability and disentangle their effects. We highlight the existence of a severe missing data problem, elicited by the lack of incentives to provide the ISEE documentation if the student's income exceeds a certain threshold, and most importantly, in case of an early dropout decision. This source of missing data cannot be ignored. We deal with the endogenous missing data issue with an *ad hoc* imputation strategy and find that at this stage of the schooling career – after a strong previous social selection operating up to university enrollment – parental education and occupation no longer exert a sizable effect on educational choices. Instead, there is evidence that despite the progressive character of tuition fees and the existence of scholarships provided to low-income students, financial conditions have a substantial impact on university dropout.

Our results suggest that low tuition fees and current student aid policies, although beneficial, are not sufficient to eliminate the negative effect of a lack of economic resources on student academic careers. Further investigation is needed to gain a better understanding of why this happens. While still preliminary, our analyses reveal that scholarship recipients are much less exposed to family income effects than non-recipients, even if a sizable effect exists also among them. Moreover, despite in recent years all the eligible applicants received the scholarship, the take-up rate is low, as only about half of the students meeting the income requirements apply for the scholarship (Laudisa 2017). Whether this is due to a lack of information or to other reasons is still to be understood if we wish to promote equity and at the same time raise the share of young people with tertiary education, still dramatically low in Italy.

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TABLES

Table 1 Classification of students (matriculated population in BA degrees, 2015-2017)

YEAR 2 / **YEAR 1**	**Not enrolled in year 2 (dropout)**		**Enrolled in year 2 (not dropout)**		**TOTAL**
			ISEE provided	**ISEE not provided**	
ISEE provided	N=3120 9.32%		N=19424 58.01%	N=1105 3.30%	N=23649 70.63%
ISEE not provided	**Second tuition payment**		N=1698 5.07% ***(SLOPPY)***	N=5873 17.54% ***(RICH)***	N=9836 29.37%
	Yes	N=770 2.30% ***(OTHER DROPOUTS)***			
	No	N=1495 4.46% ***(EARLY DROPOUTS)***			
TOTAL	N=5385 16.08%		N=21122 63.08%	N=6978 20.84%	N=33485 100%

Note: Authors' elaboration.

Table 2. Family economic condition (ISEE) and parental education by dropout status and share of dropouts among students providing and not providing the income declaration.

	ISEE			Parental education					
	25th percentile	50th percentile	75th percentile	Both ≥ high school	At least 1 higher education	Both higher education	All %	Decl. ISEE %	Not decl. ISEE %
Dropouts	9886	18325	29025	75.8%	22.2%	6.8%	15.5	12.7	16.7
Non-dropouts	15819	28990	65116	80.7%	29.4%	10.2%	84.5	87.3	83.3

Note: Authors' elaboration.

Table 3 – Descriptive statistics

Variable	Obs	Mean	Std. Dev.
Drop out	29,719	.155	-
Age at enrollment			
<=19 years old	29,719	.693	-
20 years old	29,719	.182	-
21-25 years old	29,719	.102	-
(>25 years old	29,719	.021	-
Gender			
Females	29,719	.399	-
Males	29,719	.600	-
Secondary school			
Lyceum	29,719	.528	-
Other Lyceum	29,719	.149	-
Technical	29,719	.210	-
Vocational	29,719	.082	-
High school missing	29,719	.029	-
High school grade	29,719	77.51	11.06
Education of parents			
Lower secondary	29,719	.203	-
Upper secondary	29,719	.521	-
One higher education	29,719	.177	-
Both higher education	29,719	.097	-
Occupation father			
Blue collar	29,719	.260	-
Low skilled white collar	29,719	.238	-
High skilled white collar	29,719	.139	-
Self-employed	29,719	.326	-
Occupation missing	29,719	.035	-
Occupation mother			
Blue collar	29,719	.184	-
Low skilled white collar	29,719	.350	-
High skilled white collar	29,719	.154	-
Self-employed	29,719	.171	-
Housework	29,719	.117	-
Occupation missing	29,719	.020	-
Income (log)	29,719	10.21	.98
Scholarship	29,719	.056	-
Student worker	29,719	.161	-
Field of study			
Scientific	29,719	.249	-
Political Science	29,719	.211	-
Economics	29,719	.195	-
Humanities	29,719	.209	-
Health	29,719	.105	-
Psychology	29,719	.029	-
Residence			
Torino	29,719	.606	-
Piedmont	29,719	.240	-
North-West	29,719	.058	-
North-East	29,719	.007	-
Centre	29,719	.008	-
South	29,719	.078	-
Missing	29,719	.000	-
Cohorts			
Cohort 2015	29,719	.303	-
Cohort 2016	29,719	.340	-
Cohort 2017	29,719	.355	-

Note: Authors' elaboration.

Table 4 - The effect of economic conditions on first year dropout probability (AME)

	(1)	(2)	(3)	(4)	(5)	(6)
Income	-0.0153***	-0.0124**	-0.0234***	-0.0302***	-0.0215***	-0.0276***
	(0.0041)	(0.0042)	(0.0031)	(0.0028)	(0.0026)	(0.0022)
Income missing		0.0783***				
		(0.0095)				
Scholarship				-0.0845***		-0.0779***
				(0.0070)		(0.0075)
Student worker					0.1384***	0.1343***
					(0.0073)	(0.0071)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Field of study	Yes	Yes	Yes	Yes	Yes	Yes
Parental occupation	Yes	Yes	Yes	Yes	Yes	Yes
Parental education	Yes	Yes	Yes	Yes	Yes	Yes
Individual characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21,114	29,714	29,714	29,714	29,714	29,714

Note: Robust standard errors in parentheses clustered at field of study level. *** p-value<0.001, ** p-value<0.01, * p-value<0.05. Cohort fixed effects include 2015, 2016 and 2017. Field of study includes Scientific, Political Science, Economics, Humanities, Health and Psychology. Parental occupation includes Blue collar, Low skilled white collar, High skilled white collar, Self-employed for the father, and Blue collar, Low skilled white collar, High skilled white collar, Self-employed and Housework for the mother. Parental education includes Lower secondary, Upper secondary, Higher education or both Higher education. Individual characteristics in clude age (<=19, 20, 21-25 and >25 years old), Female, High school type (Lyceum, Other lyceum, Technical and Vocational), High-school grade, Residence (Turin, North-west, North-East, Centre and South).

Table 5 – Heterogeneous effects by gender

	(1)	(2)
	Females	Males
Income	-0.0215***	-0.0261***
	(0.0024)	(0.0055)
Observations	17,842	11,872
Cohort FE	Yes	Yes
Field of study	Yes	Yes
Parental occupation	Yes	Yes
Parental education	Yes	Yes
Individual characteristics	Yes	Yes

Note: Robust standard errors in parentheses clustered at field of study level. *** p-value<0.001, ** p-value<0.01, * p-value<0.05. Controls as in Table 4, Column 3.

Table 6 – Heterogeneous effects by high school type, parental education, and area of origin

	(1a)	(2a)	(3a)	(4a)
	Lyceum	Other Lyceum	Technical	Vocational
Income	-0.0213***	-0.0142***	-0.0296**	-0.0403***
	(0.0031)	(0.0029)	(0.0096)	(0.0061)
Observations	15,712	4,431	6,254	2,454
	(1b)	(2b)	(3b)	(4b)
	Lower secondary	Upper secondary	One parent HE	Two parents HE
Income	-0.0245***	-0.0243***	-0.0217***	-0.0204**
	(0.0049)	(0.0043)	(0.0051)	(0.0076)
Observations	6,044	15,510	5,266	2,886
	(1c)	(2c)	(3c)	(4c)
	Turin	Piedmont	North	Centre-South
Income	-0.0212***	-0.0338***	-0.0252*	-0.0006
	(0.0033)	(0.0026)	(0.0128)	(0.0086)
Observations	18,016	7,147	1,968	2,583
Cohort FE	Yes	Yes	Yes	Yes
Field of study	Yes	Yes	Yes	Yes
Parental occupation	Yes	Yes	Yes	Yes
Parental education	Yes	Yes	Yes	Yes
Individual characteristics	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses clustered at field of study level. *** p-value<0.001, ** p-value<0.01, * p-value<0.05. Controls as in Table 4, Column 3.

Table 7 – Heterogeneous effects by field of study

	(1)	(2)	(3)	(4)	(5)	(6)
	Scientific	Political Science	Economics	Humanities	Health	Psychology
Income	-0.0159***	-0.0329***	-0.0248***	-0.0250***	-0.0069	-0.0267***
	(0.0048)	(0.0055)	(0.0045)	(0.0051)	(0.0064)	(0.0098)
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Field of study	Yes	Yes	Yes	Yes	Yes	Yes
Parental occupation	Yes	Yes	Yes	Yes	Yes	Yes
Parental education	Yes	Yes	Yes	Yes	Yes	Yes
Individual characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,408	6,273	5,800	6,093	3,004	815

Note: Standard errors in parentheses. *** p-value<0.001, ** p-value<0.01, * p-value<0.05. Controls as in Table 4, Column 3.

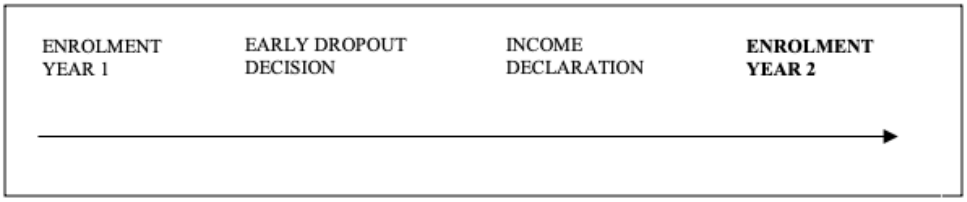
Table 8 – Heterogeneous effects by scholarship and working student.

	(1a)	(2a)
	Scholarship	No scholarship
Income	-0.0172***	-0.0325***
	(0.0046)	(0.0033)
Observations	28,039	1,538
	(1b)	(2b)
	Working student	Not working student
Income	-0.0051	-0.0253***
	(0.0047)	(0.0031)
Observations	4,785	24,929
Cohort FE	Yes	Yes
Field of study	Yes	Yes
Parental occupation	Yes	Yes
Parental education	Yes	Yes
Individual characteristics	Yes	Yes

Note: Robust standard errors in parentheses clustered at field of study level. *** p-value<0.001, ** p-value<0.01, * p-value<0.05. Controls as in Table 4, Column 3.

Figures

Figure 1 Decision making timeline.



Note: Authors' elaboration.

Appendix A: Additional tables

Table A1 Individuals with ISEE missing, father education and occupation (%)

Occupation of father	Education of the father			
	Lower secondary	Upper secondary	Higher education	Total
Blue-collar	9.31	3.47	0.19	12.98
Low skilled white collar	3.28	11.69	3.03	18.00
High skilled white collar	0.56	7.27	13.55	21.38
Self-employed	15.14	20.52	11.98	47.64
Total	28.29	42.95	28.75	100.00
Occupation of mother	**Education of the mother**			
	Lower secondary	Upper secondary	Higher education	Total
Blue-collar	7.08	3.65	0.26	10.99
Low skilled white collar	4.55	22.39	5.85	32.79
High skilled white collar	0.19	6.38	13.67	20.25
Self-employed	6.28	12.03	8.04	26.34
Housework	4.62	3.92	1.09	9.63
Total	22.71	48.37	28.91	100.00

Note: Authors' elaboration.

Table A2: ISEE distribution in year 2. Individuals with missing ISEE in year 1 revealing ISEE in year 2.

Percentile	ISEE
5	4776
10	8320
25	18091
50	32599
75	53427
90	81883
95	98306

Note: Authors' elaboration.

Table A3 - The effect of economic conditions on first year dropout probability (AME) – using different values of imputed income.

	(1) 80,000	(2) 100,000	(3) 120,000
Income	-0.0246*** (0.0031)	-0.0234*** (0.0031)	-0.0224*** (0.0031)
Cohort FE	Yes	Yes	Yes
Field of study	Yes	Yes	Yes
Parental occupation	Yes	Yes	Yes
Parental education	Yes	Yes	Yes
Individual characteristics	Yes	Yes	Yes
Observations	29,714	29,714	29,714

Note: Robust standard errors in parentheses clustered at field of study level. *** p-value<0.001, ** p-value<0.01, * p-value<0.05. Controls as in Table 4, Column 3. Benchmark estimates in Column (2).

Table A4 – The effect of economic conditions on first year dropout probability (AME) - All controls

	(1)	(2)	(3)	(4)
Income	-0.0208***	-0.0199***	-0.0239***	-0.0234***
	(0.0033)	(0.0031)	(0.0032)	(0.0031)
Education of the parents (ref: Upper secondary)				
Lower sec		0.0069***		0.0124***
		(0.0012)		(0.0009)
1 parent HE		-0.0032		-0.0064*
		(0.0034)		(0.0026)
2 parents HE		-0.0053		-0.0113
		(0.0086)		(0.0113)
Occupation of the father (ref: Low skilled white collar)				
Blue collar			-0.0041	-0.0065
			(0.0034)	(0.0036)
High skilled white collar			0.0000	0.0033
			(0.0091)	(0.0093)
Self-employed			0.0174**	0.0171**
			(0.0060)	(0.0058)
Occupation missing			0.0011	0.0002
			(0.0087)	(0.0086)
Occupation of the mother (ref: Low skilled white collar)				
Blue collar			-0.0044	-0.0081
			(0.0043)	(0.0045)
High skilled white collar			0.0026	0.0064
			(0.0075)	(0.0095)
Self-employed			0.0169***	0.0162***
			(0.0043)	(0.0048)
Housework			-0.0142*	-0.0171**
			(0.0056)	(0.0054)
Occupation missing			-0.0359**	-0.0367**
			(0.0122)	(0.0120)
Age (ref. <=19 years old)				
20 years old	0.0278***	0.0278***	0.0279***	0.0281***
	(0.0034)	(0.0034)	(0.0035)	(0.0035)
21-25 years old	0.0602***	0.0598***	0.0614***	0.0610***
	(0.0117)	(0.0116)	(0.0117)	(0.0116)
>25 years old	0.1781***	0.1747***	0.1834***	0.1784***
	(0.0389)	(0.0384)	(0.0393)	(0.0394)
Female	-0.0240***	-0.0246***	-0.0234***	-0.0240***
	(0.0042)	(0.0043)	(0.0041)	(0.0042)
High school type (ref: lyceum)				
Other-lyceum	0.0677***	0.0670***	0.0683***	0.0673***
	(0.0080)	(0.0078)	(0.0082)	(0.0079)
Technical	0.0781***	0.0765***	0.0804***	0.0785***
	(0.0096)	(0.0095)	(0.0099)	(0.0096)
Vocational	0.1306***	0.1288***	0.1346***	0.1325***
	(0.0062)	(0.0058)	(0.0071)	(0.0065)
High school missing	-0.0363	-0.0370	-0.0348	-0.0357
	(0.0329)	(0.0327)	(0.0331)	(0.0329)
High-school grade	-0.0036***	-0.0036***	-0.0036***	-0.0036***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Area of origin (ref: Turin)				
Piedmont	0.0015	0.0012	0.0005	0.0003
	(0.0090)	(0.0089)	(0.0092)	(0.0091)
North-West	0.0310***	0.0311***	0.0285***	0.0287***
	(0.0062)	(0.0063)	(0.0061)	(0.0062)
North-East	0.0554***	0.0577***	0.0520***	0.0558***
	(0.0157)	(0.0158)	(0.0150)	(0.0156)
Centre	0.1011***	0.1030***	0.0981***	0.1006***

	(0.0089)	(0.0090)	(0.0074)	(0.0080)
South	0.0651***	0.0652***	0.0653***	0.0653***
	(0.0116)	(0.0116)	(0.0126)	(0.0126)
Field of study (ref: Scientific)				
Political Science	-0.0012	-0.0013	-0.0012	-0.0016
	(0.0030)	(0.0031)	(0.0030)	(0.0031)
Economics	-0.0663***	-0.0664***	-0.0671***	-0.0672***
	(0.0014)	(0.0013)	(0.0014)	(0.0014)
Humanities	-0.0107***	-0.0111***	-0.0105***	-0.0111***
	(0.0019)	(0.0019)	(0.0019)	(0.0020)
Health	-0.0955***	-0.0958***	-0.0951***	-0.0956***
	(0.0015)	(0.0016)	(0.0015)	(0.0016)
Psychology	-0.0858***	-0.0859***	-0.0872***	-0.0875***
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Cohort (ref: 2015)				
2016	-0.0101*	-0.0100*	-0.0106*	-0.0104*
	(0.0050)	(0.0051)	(0.0050)	(0.0050)
2017	0.0115**	0.0116**	0.0115**	0.0118**
	(0.0042)	(0.0043)	(0.0040)	(0.0041)
Observations	29,714	29,714	29,714	29,714

Note: Robust standard errors in parentheses clustered at field of study level. *** p-value<0.001, ** p-value<0.01, * p-value<0.05.

APPENDIX B: Proofs

a) The relation between income and parental education and occupation in the dropout group differs from the entire student population.

Calling D the binary variable describing dropout after year 1, I income, and x the vector of dummy variables capturing mother and father education and occupation, we now prove that:

$$E(I|x) = a + bx \neq E(I|x, D = 1) \quad \text{(a1)}$$

Model (1)-(2) for the dropout decision assumes that the dropout probability depends on income, parental education and occupation, prior schooling characteristics, other individual variables like age at enrollment and area of residence, field of study and matriculation cohort. Simplifying the notation, we indicate with C the vector of all explanatory variables other than parental education and occupation.

If D^* is the latent propensity of dropping out after year 1, and

$$D_i^* = \beta_0 + \beta_1 I_i + \beta_2 x_i + \beta_3 C_i + u_i \quad \text{(a2)}$$

$$P(D = 1|I, x, z) = P(D^* > 0|I, x, C) = P\big(u > -(\beta_0 + \beta_1 I + \beta_2 x + \beta_3 C)\big) \quad \text{(a3)}$$

If $I = a + bx + v$, where v is the error term following the usual assumptions:

$$E(I|x, D = 1) = a + bx + E(v|D = 1) \quad \text{(a4)}$$

$$= a + bx + E(v|u > -(\beta_0 + \beta_1 I + \beta_2 x + \beta_3 C)) \quad \text{(a4.1)}$$

$$= a + bx + E(v|u > -(\beta_0 + \beta_1 (a + bx + v) + \beta_2 x + \beta_3 C)) \quad \text{(a4.2)}$$

$$= a + bx + E(v|\beta_1 v > -(\beta_0 + \beta_1 a + (\beta_1 b + \beta_2)x + \beta_3 C + u)) \quad \text{(a4.3)}$$

Even if $\rho(v, u) = 0$, the relation between I and x in the population of dropouts differs from that holding in the population of university students at large. The relation is weaker among dropouts because in this group v is negatively correlated with x. If income negatively affects the dropout decision (i.e., $\beta_1 < 0$), other things being equal, individuals from advantaged parental education and occupation need a relatively low income to make the dropout choice (if income positively affected the dropout choice the opposite would hold; however, there are no theoretical reasons for this to occur).

b) The effect of sample selection on the estimation of the income coefficient.

We consider the following specification for the university enrolment choice:

$$E_i^* = bSES_i + gC_i + \varepsilon_i \quad \text{(b1)}$$

$$E_i = \begin{cases} 1 \ if \ E_i^* > 0 \\ 0 \ if \ E_i^* < 0 \end{cases} \quad \text{(b2)}$$

where SES is socio-economic status, for simplicity defined as binary (high SES=1, low SES=0) and C the full array of control variables.

The dropout choice is modeled as:

$$D_i^* = \beta SES_i + \gamma C_i - u_{Mi} - u_{Li} \quad \text{(b3)}$$

$$D_i = \begin{cases} 1 \ if \ D_i^* > 0 \\ 0 \ if \ D_i^* < 0 \end{cases} \quad \text{(b4)}$$

where u_M is an unobserved factor representing the individual motivation component that is not captured by the other controls such as the high school track and the final grade, and u_L is the usual idiosyncratic unobserved component representing pure luck.

The causal SES effect is defined as the difference in the propensity to drop out between high and low SES, net of all individual observed characteristics and (unobserved) motivation:

$$E(D^*|SES = 1, C, u_M) - E(D^*|SES = 0, C, u_M) = \beta \quad \text{(b5)}$$

Instead, the estimable effects is:

$$E(D^*|SES = 1, C, E = 1) - E(D^*|SES = 0, C, E = 1) = \beta^* \quad \text{(b6a)}$$

$$= \beta - [E(u_M|SES = 1, \varepsilon > -b - gC_i) - E(u_M|SES = 0, \varepsilon > -gC_i)] \quad \text{(b6b)}$$

Since $\rho(u_M, \varepsilon) > 0$ (because more motivated individuals are more likely to attend university) the expression in square parenthesis is negative, as it takes a smaller ε for high SES individuals to enroll, and smaller ε entails a smaller u_M. As $\beta^* > \beta$ and $\beta < 0$, β^* will be closer to 0 (if negative) than the true causal effect β. In other words, without controlling for sample selection we will obtain an underestimate of the true (negative) effect of SES on the dropout probability. This argument has been made in a slightly simpler form by Cingano and Cipollone (2007).

Yet, we must acknowledge that these conclusions hold conditional on the additional hypothesis that $\rho(u_M, SES) \leq 0$. However, one might argue that higher SES individuals display higher aspirations and are more motivated to attain the university degree than lower SES individuals – to avoid social demotion, higher SES individuals are more prone to make ambitious educational plans (Breen and

Goldthorpe, 1996). If this is true, β^* need not to be a conservative estimate of the SES effect, as $E(u_M|SES = 1) > E(u_M|SES = 0)$. Here, even if on average among the enrolled ε is larger for low SES than for high SES (because the condition $\varepsilon > -b - gC_i$ is less stringent than $\varepsilon > -gC_i$), the expression in square parenthesis in (b6b) need not be negative.

On the other hand, what we are interested in here, is the effect of family economic conditions net of parental education and occupation. The caveats just made above should apply to the family background dimensions directly shaping educational aspirations, most likely related to the social position (parental education and social class, usually operationalized in terms of occupation) rather than to economic resources.

Against this background, our conclusion is that the effect of income estimated on university students, controlling for parental education and occupation but not accounting for sample selection, can be safely interpreted as a conservative estimate of the pure causal effect on income on the dropout decision.