CONSUMPTION VALUE IN HIGHER EDUCATION
THE PRICE OF PREFERENCES

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Contents

Abstract

This paper examines the price that individuals pay for choosing fields of study with high consumption value instead of choosing fields of study with higher future earnings. The institutional setting for further education in Denmark allows us to analyze a situation where all individuals included in our sample could have freely chosen fields within humanities and business, where access criteria were very equal for a long period of time. After controlling for a rich set of observable characteristics, including scores from a range of high-school courses, we find that individuals who chose to enroll in humanities gave up roughly 29 % of disposable income 10 years after enrollment for their choice of humanities instead of business.

1   Introduction

Educational choice is one of the most important decisions faced by young individuals. Much effort has been devoted to estimating payoffs to the level of education, but lately the attention of researchers and policymakers has increasingly turned to the consequences of field choice. There are different types of returns that may motivate an individual to choose one field of study over another. Education is an investment in the future earnings potential, and each field of study will provide their students with knowledge and skills that raise labor productivity, which they will be remunerated for in future jobs. This type of return represents each field of study's production value. But education has many other types of value than pecuniary returns, all of which are captured by what has been labelled the consumption value. It includes the value of having joy in obtaining knowledge, the social status and experiences in school and future jobs, and much more (Becker, 1964; Lazear, 1977). These are returns that may be gained both during time at university and in future occupations, and because consumption value of any educational field is shaped by individual preferences, it is likely to vary across individuals.

Access to different fields of study is in most countries not universal, but regardless of the restrictions that any individual faces, the choice is made from a fixed set of options. When high-school graduates face the choice of what field of study to pursue from that set of options, the choice can be boiled down to a relative valuation of the sum of production and consumption value in one field over another. The production value is at least partially observed in official statistics and can be measured in pecuniary terms, whereas it is less obvious how to measure and estimate the conspumtion value of each potential choice.

A large and growing literature has documented large differences in the returns to different fields of study especially between programs in humanities and business (see Altonji et al. (2016) for an extensive survey). Estimation of these relative returns is difficult because students select into fields of study and unobserved ability might differ across fields of education. But even though no studies fully overcome the challenges in establishing pure causal estimates, it is unlikely that the large differences in earnings are entirely due to selection. If we accept that there indeed are large differences in potential future earnings between two fields of study, and applicants are at least partially informed about these differences, why do some students choose the field of study they know will lead to relatively low future income? We argue that this must be because their valuation of the difference in consumption value between the two fields of study outweighs the difference in production value.

In this study we ask what the *price* of this choice is in terms of lost income. An individual who enrolls in a low-income field of study, because she has preference for the consumption value it offers, will eventually end up paying for this choice through a loss in future earnings. We estimate this price for a selected group of university students in Denmark, where the institutional framework and access to detailed registry data allows us to exclude many of the usual problematic confounding factors that make a comparison of incomes across fields of study difficult. More specifically, we seek to estimate the share of disposable income that students in four humanities programs forego because they did not study one of four business programs instead.

A first best estimate would observe counterfactual incomes for the same individuals having obtained a degree in each field. In reality this is not observable, so we turn to a second best estimate; the differences in income for different individuals who are equally talented based on observable characteristics and have exactly the same formal educational choice sets, but where some choose a lower-paying field above the other.

Studying higher education and consumption value in Denmark is interesting because higher education is free and publicly provided, and the relatively high taxes might push individuals to choose too much consumption value relative to the social optimum (Malchow-Møller et al., 2011). The reason for this is that the production value of education (earnings income) is taxed while consumption value is not.

Access to university is based primarily on the student's high-school GPA, there are no tuition fees, and students even receive a monthly subsidy while enrolled. We limit our analysis to eight fields of study where the cut-offs determining access were very similar for a long period of time, and further only include individuals who in each year had a GPA high enough to enter any of the included programs, had they wished to. This enables us to keep constant all of the usually unobserved constraints to educational choice, and allows an analysis of educational and future income paths for cohorts who after high-school graduation had precisely the same educational choice sets. By exploiting a rich administrative data source, we further control for observable characteristics that might explain part of the differences in future earnings that are not due to differences in production value, and most importantly we control for average grades in different subjects.

For our chosen set of educational programs within humanities and business-school degrees, we observe large differences in average earnings between individuals, even though the formal access criteria have been very similar and stable over time (KOT,

2017). First, this shows that large groups of individuals turn down the possibility of obtaining degrees that will lead to high future earnings, and that it is not a temporary phenomenon, which might be the case if individuals could not observe differences in earnings. Second, as we are dealing with fields that have very equal access criteria in terms of GPA cut-offs, it shows that such a choice must be driven by a preference for consumption value.

The available data limits our analysis to short term income differentials, looking at average incomes 10 years after enrollment to university. We thus estimate the short term cost of choosing a program with high consumption value by comparing disposable incomes across two groups of programs. Under the assumption that our empirical method controls for both absolute and relative skills and that the only reason for choosing a low-earnings program is due to preferences for consumption value, we estimate the gap in disposable income that comes from choosing a humanities program over a business program.

Our results show a gap in disposable income of 31 % before controlling for observable characteristics, showing that individuals who enroll in humanities give up almost a third of the disposable income they potentially could have earned if they had enrolled in a business program. The estimated income gap decreases to 29 % when we control for our full set of observable characteristics. Like most of the related literature, our results must be interpreted with some caution in the light of potential remaining bias caused by unobserved heterogeneity which affects field-specific wage returns, that is not controlled for, even with our extensive list of observable characteristics.

The institutional setting in which our analysis is performed is very important. Denmark is a very egalitarian country with free tuition at all levels of the educational system, high taxes, and a relatively generous unemployment insurance system. Each of these factors, or interactions of them, could be driving factors behind individuals placing larger weight on consumption value in making an educational field-choice. Even though publicly funded education is important to remove the liquidity constraints that students might otherwise face, it also funds private con- sumption, which might not be the intent of the government in the first place. Our results indicate that this private consumption befalls some individuals more than others and is concentrated in certain fields of study.

Our results can also help inform future cohorts that there is a rather large pecuniary cost involved in enrolling in a field of study with high consumption value. For

governments and social planners, the estimate is important with regards to optimal allocation of talent and the optimal educational mix. If there is an increasing taste for consumption value, and individuals are willing to sacrifice a large share of their future earnings, that could in some contexts indicate a degree of over-education or that educational ressources could be redistributed more optimally. The study that is the most comparable to our study is Alstadsæter (2011) who estimates both ex ante and ex post earnings differentials between teaching and business programs in Norway. She finds an ex post differential in realized lifetime earnings of 34.1 %, but does not observe the actual individual GPA's or grades in specific subjects. Therefore she is not able to control for these types of ability and ultimately also includes an unknown but potentially important amount of individuals who would never have had the choice to enter the comparison field, had they wanted to, in the sample. This study is an improvement to that part of the existing research.

The paper proceeds as follows. Section 2 reviews the literature and highlights factors that determine educational field choice and estimation methods. In section 3 we present our empirical strategy. Section 4 presents the data, introduces the educational fields we analyze, describes how we select the sample for our regressions and presents descriptive statistics. Regression results are presented in section 5, before section 6 concludes and discusses the results.

2 Literature

This section briefly outlines the literature on the determinants of educational choice as well as the estimation of the returns to fields of study. Besides reviwing the existing literature, this serves as a guide to determine which factors are important to control for in the following empirical application.

2.1 Determinants of educational choice

In our framework we argue that the choice of what educational field to enroll in is both affected by pecuniary payoffs of the educational investment and consumption value. The degree to which different factors affect the choice is in all cases dependent on the information and beliefs of individuals. Very little research has looked at the degree to which students are fully informed about the contents of fields and future outcomes, but those factors do play a role in shaping educational choice.

A number of studies show that expected earnings are just one of many determinants of educational choice. Most notably, Beffy et al. (2012) and Zafar (2013) look at how students make educational decisions based on expected earnings and other non-pecuniary characteristics of fields of study. They find a significant effect of expected earnings on major choice, but the size of the estimate is rather small, suggesting that other factors play a more important role. Reacting to expected earnings is closely related to risk aversion, a risk which in turn is de- termined by (occupation-specific) labor market conditions and wage dispersion. Using Danish data, Nielsen and Vissing-Jørgensen (2005) estimate the role of risk aversion in an educational choice model and find that fields with higher mean income and low risk are preferred to more risky alternatives.

Some research shows that preferences for being engaged in certain environments with different levels of consumption value is a primary factor in determining educational field choice. Different fields of study lead to different types of jobs, and because individuals have different preferences for job types, that will affect educational choice. Wiswall & Zafar (2015) find that heterogeneity in educational taste is the most important determinant for educational choice, but also find that 80 % of the variation in tastes is not explained by observables. On a similar note, Carneiro et al. (2003) find that non-pecuniary factors are main determinants of educational choice in the US. Arcidiacono (2004) and Zafar (2013) find that observable characteristics such as age and gender, as well as the influence of one's peers and family

play a role. Zafar (2012) finds that one of the most important factors in expected educational choice is that parents approve of the choice.

An important point by Arcidiacono (2004) is that learning about specific types of ability while in college plays a role in the final choice of major. An early study by Pagliano and Rufolo (1990) shows that skills and grades in math are a determinant for college choice. While some of these beliefs are likely to develop and can even be fully formed in high-school, one might argue that students are only informed through the grades they receive. Under this assumption, controlling for course specific grades controls for the type of selection caused by the knowledge of special abilities in certain fields. Fricke et al. (2015) find that exposing first-year university students to a specific field of study affects the preference of studying the field they were exposed to. Similar experiences in high-school and earlier life stages are likely to form interest and preferences for specific fields of study. As we only keep individuals who finish the major they first enrolled in, we assume expectations to be sufficiently formed at the time of enrollment.

The level of overall ability is also an important determinant, as Arcidiacono (2004) and others show. But as they document large wage differentials across different fields of study after controlling for ability sorting, that indicates that it is more likely that preferences for different educational fields and not only abilities determine educational choice.

Other less documented factors might also play a role in shaping educational choice. Myopic students might place higher value on consumption in the near future than pecuniary consumption many years ahead. A growing litterature in the field of behavioral economics argues that myopic behavior leads to lower pensions contributions and savings, because consumption today is weighted more heavily than consumption in the future. As some of the consumption value of education is consumed during the student's time in university, myopic behavior is likely to be another source leading to choosing programs with higher consumption value. Hence, less myopic individual might be more likely to choose a program with less consumption today and higher future production value, such as it could be the case for a business program.

2.2 Measuring causal pecuniary returns to education

The empirical methods used in this paper are related to a vast literature that seeks to find causal estimates of the relative returns across fields of study. Altonji et al. (2016) provide a rigorous summary of methods and results, and highlight that the literature has yet to determine whether observed differences in wages are due to differences in productivity levels or if they are explained by other factors. Income differentials could represent compensating differentials for non-pecuniary aspects of jobs or differences in unobserved high-school preparation and ability. Only in the latter case does comparing average incomes across fields of study like we do in this study cause concern – and only in the case where such factors are unobserved.

First, general or absolute ability may be different across fields of study if that ability is related to nonpecuniary preferences for different fields or types of occupations. If more talented individuals need to put in less effort or spend less time to complete a major, that might also affect high-ability to select into certain fields. Second, students may choose fields where they have higher relative ability. Under this type of selection, a comparison of income across fields is difficult because individuals who are relatively good at business and bad at humanities will also have a higher return if they study business than had they studied humanities.

A number of methods have been applied to factor out any selection effects that might drive observed differences in income. The most common method is to control for ability as we do in this study, but studies differ with regards to the controls that are used. Almost all studies include basic demographic variables such as age, gender, and race, while some include information on parental income and education. Most studies also control for high-school grades, and Webber (2014) even includes results from personality tests to control for the factors that may be associated with labor market success.[1] A recent and promising method uses more or less random variation in the GPA admission cut-offs to different fields of study to estimate relative returns. Kirkebøen et al. (2016) and Heinesen (2016) exploit this method on Norwegian and Danish data, respectively. The randomness places students on either side of the threshold in either their preferred field or a next-best alternative, which yields causal estimates of differences in returns to those fields. But because the effects are only valid for individuals exactly at the cut-off and furthermore places extreme data requirements, as one would need a large sample of individuals with

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1 Again we refer to Altonji et al. (2016) and especially their table 8 for an overview.

the same first and second alternatives, there are still issues to this approach that need to be sorted out.

Altonji et al. (2016) write that even though no study has yet estimated pure causal estimates, the evidence indicates that a substantial part of the effects are causal, so that "...humanities majors would earn more had they majored in business. That they choose not to major in the more lucrative fields suggest compensating differentials in school or in the workplace, and an important role for heterogeneity in tastes for fields of study and the occupations they lead to." (p. 391)

We apply the simplest method where we compare disposable income after controlling for a range of observable characteristics, and most importantly overall GPA and course-specific grades from high-school. This allows us to compare individuals with the same observable characteristics and who therefore had the same formal qualifications and opportunities before entering university. Our approach is limited to controlling for observable confounding factors, so any unobserved selection that is not explained by the controls we include remains.

An important difference to the earlier litterature is that we do not focus only on wage earnings. We are interested in measuring the full cost of an educational choice, so all types of income are relevant to our application. Tax payments are, just as recieved benefits, also a part of what makes up the full inome, so our focus is on disposable (after-tax) income.

3 Empirical Strategy

The strategy we apply concentrates the analysis of relative income to a group of individuals who were equally suitable to enter either of the programs. We do this in two steps. First, we select what we call a balanced sample, including only individuals who in reality had the possibility to enter all of our eight programs. And second, we control for any remaining observable factors that differ across fields.

3.1 A Balanced Sample

In order to evaluate the returns to different fields of education, it is important that the sample contains individuals who in fact had the possibility to freely choose any of the fields included in the analysis. Most studies, and especially those in an American context, cannot do this because the selection into college and university is based on very different criteria that are much more restrictive than in the Danish case. This includes academic achievement criteria but most importantly, there are strong financial constraints to the choice of college in the US. In Denmark, on the other hand, there are very few financial constraints, and admission to university is almost universal - as long as high-school GPA is high enough. By selecting student cohorts from a range of business and humanities fields, who all in the year of admission would have been able to join any of the included fields, we make sure that we only look at students who had the same formal possibilities for a free choice of field. We outline the specifics behind this selection in the data section.

An important type of bias that we get rid of by placing these restrictions on our data is the ability-sorting that is otherwise an inherent problem in analyses of returns to education. Ability- sorting arises if there is a field of study that for some reason pays higher wages than another field, maybe because the jobs you get with that education are less fulfilling, which you will be remunerated for. High-ability individuals (those with the highest GPA) could then self-select into this field, at the expense of individuals with lower GPA, who would then have to choose the other field. Within our fields of choice, access cut-offs were very stable over a long period, which suggests that there is no such sorting.

Further, by studying programs with historically very similar access cut-offs, we do not face any problems with self-selection into programs which might arise because some programs have a reputation of being hard to get into, which could serve as a

signalling device to future employers and affect earnings. This certainly applies to some fields of study in Denmark.

After this implementation, there will naturally still be observable differences between individuals in each field of study, that we wish to control for. For example, even though our included programs have the same access cut-offs, the distributions of GPA and grades for individuals in each fields are not completely equal. We do so with the multivariate model introduced in the next section.

3.2 OLS

This study is limited to short-term differences in disposable income, and we measure individuals' disposable income ten years after the year of admission. After selecting a sample which is completely free from formal access restrictions, we estimate the following multivariate model, which controls for differences in observable characteristics *prior* to entering university, that serve as proxies for the remaining differences in unobserved ability.

Our model's specification is therefore:

(1) $$\log DI_{t+10,i} = \phi_0 + \gamma E_i + x_i' \beta + \delta_1 GPA_i + \delta_2 G_i + T_i + \epsilon_i$$

where subscripts i represent individuals who belong to a cohort enrolling in university in year t. We regress the log of disposable income (DI) in year $t+10$ on E_i, a dummy variable equal to 1 if the student enrolled in a business program and 0 otherwise, and γ measures the difference in disposable income from choosing a business program over a humanities program. In the vector x_i' with corresponding parameters in β, we control for a number of observable characteristics, including age at the time of enrollment, gender, years from high-school graduation to enrollment, and parental information on combined earned income, employment status, and education level in the year before admission (t-1). ϕ_0 represents the constant of the model.

GPA_i is the overall grade point average from high-school, with a corresponding coefficient, δ_1. Like in the earlier literature, this variable proxies for overall ability. G_i is a vector of specific grades from courses in Danish, History, Mathematics and English, all of which proxy for relative ability, and are a supplement to the overall GPA because ability is not a one-dimensional trait. Lingual skills may be beneficial

in other ways than for example math skills. In relation to our setting, we would expect the occupations which a business educated individual works in to be more math intensive, and this type of relative ability is exactly what we wish to control for. Finally, T_i represents a set of dummy variables equal to one if individual i belongs to a cohort that enrolls in a specific year, and zero otherwise.

Within this framework, all observable differences between students in each field of study are balanced out. The only reason why some individuals chose to study business and others chose humanities is assumed to be due to differences in individual preferences and taste for the consumption value offered in each field. Again we emphasize that some unobserved differences may remain.

Some of the observed difference in incomes could be explained by a difference in e.g. working hours and different employment rates across occupations. But we are not interested in explaining the difference in income that can be attributed to factors that determine earnings after entering university. For the same reasons, we do not, as in classical Mincer (1958) regressions, control for factors such as labor market experience and occupation observed at time $t + 10$. We are interested in the difference in disposable income for comparable individuals all with the same observable formal possibilities who, at time t, chose different paths in their lives.

4 Data

This section first explains the sample selection procedure in detail and thereafter presents the data used for estimating earnings differences. The approach outlined in the section above places high demands on the level of detail and quality of data, and that is exactly the advantage of Danish administrative records. Here we have information on the full population with a link to their educational record as well as the income data in the years that follow.

Focusing on the years 1997-2005, our dataset includes graduates from Danish gymnasiums (10th through 12th year, equivalent to US high-school), where we have access to all final grades for high-school and observe their earnings ten years after enrollment. Access to course-specific grades allows us to control for these in our estimation as well as ensure that students fulfill all program-specific criteria. Each course can be finished at either A-, B-, or C-level, with A being the highest level and C the lowest. Numerical grades, ranging from 0 to 13, both represent yearly finals examinations and teachers' assessment of the student's overall performance in classes. After high-school each student receives a final GPA which will serve as the main basis for enrollment in university. There are different types of gymnasium-level high-schools in Denmark. Some are more focused on STEM-courses, others are focused on preparation for business school, and some only take 2 years to complete instead of three. We only include students who graduated from the most common type of high-school, the Gymnasium, which offers a broad selection of courses. Students either select a lingual or a mathematical line, something we also observe. We select individuals only from these high-schools to keep the unobserved selection mechanisms as constant as possible. Students graduating from business-preparing high-schools are in many respects not comparable to students from normal gymnasiums in our context.

4.1 Programs

Further education in Denmark is based on GPA-sorted admission, free tuition and the provision of student benefits around \$US 940[2] per month as well as student loans provided at no or very favorable interest rates. This strongly reduces any liquidity constraints that would usually limit obtaining the desirable level and type of education.

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2 DKK 6,015 at the current exchange rate per July 2017.

Each program has a fixed number of seats for which the enrollment process follows two mecha- nisms. First, applicants to a particular program are sorted acccording to their GPA and students with the highest GPAs are enrolled until the program is full. This creates an observable cut-off for each program, and students with GPA below this are not enrolled. Each student can apply for up to ten programs, and will be enrolled in the program of her highest priority for which she has a GPA at or above the program-specific cut-off. Second, students can apply for programs with a letter of motivation, which functions independently from the mechanism described above. Our data shows how students were enrolled, and we only include students who entered programs according to the first sorting mechanism.

Interest in this study is in returns to further education at Master's levels, which in this context is defined as programs that are stipulated for 5 years. For the purpose of this study, eight programs have been selected, based on two criteria; first they are part of either classical humanities or business fields of study with typically large differences in future career paths, occupations of employment, and wages, as well as the unobservable consumption value. Second, the selected studies have access cut-offs at around the same levels for a relative long period of time, which enables us to isolate at least some of the selection effects that determine students' choice of program. The included programs also had a relatively large yearly intake of new students, which is beneficial as we later limit the sample to meet some rather strict criteria.

The four programs we group under humanities are all offered at the University of Copenhagen; Danish, English, History, and Philosophy. Even though the four pro- grams are very different, they share a common focus on communicational skills, the understanding of the media and cultural interaction, and language.

The four business programs, all offered at Copenhagen Business School, have a common base in that they are variations of Business Economics, but each of them with their own fields of focus. One is an allround program (HA almen), and the three others have courses in common with each other but focus on Law, Philosophy, and Computer Science, respectively. They share a focus in economic analysis and marketing, organisation, finance, and accounting practices. Employment in the private sector is more common among business students.

Given what we observe in the raw earnings statistics, and under the assumption that education comes with two types of value to the individual, we hypothesize that the humanities programs must offer more consumption value than the business pro-

grams. An important note is that we do not claim that the business programs have no consumption value. Just as well as somebody might find non-pecuniary value in becoming a high-school teacher, it might be that someone sees it as her meaning in life to become a regional manager in a medium-sized paper company. Leading back to the way we define our research question, we hypothesize that differences in consumption value explain why some students choose programs with low expected earnings compared to other programs.

Table 4.1. Yearly admission cut-offs to university programs, 1997-2005

	1997	1998	1999	2000	2001	2002	2003	2004	2005
Humanities									
Danish	9.3	9.3	9.1	8.8	8.5	8.7	8.5	-	8.2
English	8.9	8.9	9.0	8.3	8.0	7.8	8.0	-	7.4
History	9.1	9.1	9.0	8.6	8.3	8.5	8.5	7.7	8.4
Philosophy	9.3	9.2	9.1	8.9	8.4	8.4	8.4	8.3	8.6
Business Economics									
General	8.2	8.2	8.2	8.2	8.2	8.2	8.1	8.2	8.1
Law	8.6	8.7	8.5	8.3	8.2	8.1	8.0	8.1	8.1
Philosophy	8.6	8.8	8.8	8.8	8.4	8.1	8.5	8.1	8.3
Computer Science	8.4	8.8	8.5	8.7	7.5	7.5	-	-	7.5

Note: Underlined values show the highest cut-off for each year, and represent the minimum yearly GPA at which individuals are included in the sample. "-" indicates that no cut-off was established for the program in the year. Roughly 700 individuals were accepted to Humanities programs each year, and yearly business en- rollment was around 800 to 900. These cut-offs are average among cut-offs for all programs that are available at the University of Copenhagen or Copenhagen Business School.

Source: The Coordinated Registration, KOT.

4.2 Sample selection

In our final sample, we include students who, had they wanted to, would have been able to enroll in any of the included programs in the year they were enrolled. First, this means that they needed a GPA at or above the highest yearly cut-off among the included programs, $GPA_i \geq max(K_j)$. The yearly admission cut-offs, K_j, are presented in table 4.1, where the underlined cut-offs show the yearly minimum

GPA needed to be included in the estimation sample.3[3] Second, some programs require applicants to have certain courses on some minimum level from high-school. Because most of the business programs included in this study require a minimum of B-level mathematics, our full sample complies with this.

These two criteria, and the fact that we only included students from gymnasium, makes the population we analyze homogenous in the sense that groups of students share a common educational background and were able to freely choose among the eight programs (and naturally many other programs not analyzed here). This excludes a problem faced by many other studies on returns to field of study that to some extent compare students who never formally had access to the other programs in the analysis than the one they enter themselves.

Finally, we only include individuals who finished a master's degree in the same program as they were enrolled in within a maximum of eight years. This limits this analysis to earnings effects for those individuals who do not change career paths after enrollment, and makes the interpretation of our results more clear.

Table 4.2 illustrates how the sampling steps affect the raw differences in observed disposable income between business and humanities graduates. Starting with all individuals who enrolled in either of our selected humanities and business programs between 1997 and 2005, the column "Finishers" calculates the difference in disposable income ten years after enrollment for students who finished their degree in up to eight years. This difference in disposable income of 27 % roughly corresponds to what most previous studies have used as a starting point. Next, we exclude students that did not have high enough GPA to freely choose among any of the programs in the year they enrolled. We see that this sampling step is important, as the difference in disposable income for this "Cut-off sample" is 30 %. Finally, we only keep individuals with mathematics at minimum B-levels and who graduated from gymnasiums, i.e. the estimation sample used in the further analyses. This final selection results in a difference in disposable income of 31 %. The excercise performed here illustrates that the selection criteria alone makes an important difference when the goal is to measure differences in income across educational fields.

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3 For example we only include students enrolled in 1997 with a GPA at or above 9.3, in 2000 we only include students with cut-offs at or above 8.9, and so forth. Humanities programs, especially Danish, have the highest cut-offs for most years, with a few exceptions. In 2003 and 2004 a few of the included studies had no cut-offs.

Table 4.2. Difference in log(Disp. income) between humanities and business graduates, %, by different stages of sample selection

	Finishers	Cut-off sample	Final sample
Δ log (Disp. Income, DKK)	-27.0 %	-29.6 %	-31.1 %
N	4,551	2,044	824

Note: The table shows how much lower humanities graduates' disposable income was, compared to business graduates', in %. For all samples, disposable income is measured 10 years after enrollment at university. Finishers are defined as individuals who finish the programme they enroll in within 8 years. Cut-off sample includes individuals who, in the year they enroll, have GPA high enough to enroll in all of the programs included in this study. The final sample is the one used in the regressions, and further limits the sample to those who graduated from standard gymnasiums and had math-courses on B-levels or above (a common admission criteria in most Business School programs).

Source: Own calculations based on registry data provided by Statistics Denmark.

4.3 Descriptive Statistics

The following presents descriptive statistics using the sample we later apply in the multivariate analysis. This excludes individuals who do not fulfil the cut-off requirement explained above or have a missing value in any of the variables used in the full model specification. This leaves us with a somewhat small sample of only 824 individuals.

As interest lies in short term differences in the pecuniary value of education, we measure yearly disposable income 10 years after the year of admission to university. Disposable income includes wage earnings, income from self-employment, state benefits, sick benefits, as well as a number of state transfers. These are calculated net of taxes, and thereby represents the exact amount of money individuals have for consumption. This is in contrast to other studies that only focus on wage earnings. It is important to apply this measure of income because educational choice is influenced by not only wage earnings when the individual is in employment, but a much wider set of conditions are relevant. What ultimately impacts income is employment possibilities, the structure of the tax system, and the safety net individuals can expect when they fall out of employment. Finally, our measure of disposable incomes are deflated to 2010-levels.

Table 4.3. Descriptive Statistics, full sample

Differences in means	Humanities	Business	Difference
Log(Disp. Income, DKK)	12.312	12.683	-0.372***
Disp. Income t+10, DKK	241,137	348,143	-107,006***
Sex. =1 if male	0.491	0.647	-0.156***
Age	20.162	19.653	0.510***
Immigrant/Descendant	0.013	0.054	-0.041**
Years to start	1.833	1.393	0.440***
Gym. Lingual line	0.145	0.064	0.081***
Gym. Math line	0.829	0.920	-0.091***
Other lines	0.026	0.015	0.010
Total GPA	9.306	9.081	0.224***
Math scores	8.750	9.035	-0.285**
Danish/language scores.	9.414	8.748	0.666***
Log (sum of parents' income t-1)	13.265	13.481	-0.215*
Parents married	0.808	0.844	-0.036
F. edu: High-school	0.150	0.146	0.004
F. edu: Vocational	0.162	0.200	-0.038
F. edu: Short/med. uni	0.282	0.295	-0.013
F. edu: Long uni	0.312	0.310	0.002
M. edu: High-school	0.154	0.166	-0.012
M. edu: Vocational	0.167	0.183	-0.016
M. edu: Short/med. uni	0.462	0.441	0.021
M. edu: Long uni	0.192	0.166	0.026

Note: N=824, 590 of which enrolled in Business, and 234 in Humanities. Incomes are measured in DKK 10 years after the year of enrollment, and deflated to 2010-levels. Variables for sex, immigrant/descendant, high-school lines, parents married, and parental education are dummies. All parental information is measured a year prior to start. Stars indicate significance of t-tests of difference in means. *: $p < 0.05$, **: $p < 0.01$, ***: $p<0.001$.

Source: Own calculations based on registry data provided by Statistics Denmark.

A rich set of control variables are included, such as age, gender, immigrant status, and parental information on income, employment status and education levels the year before admission, all of which we are able to link to each student through

administrative data from Statistics Denmark. As table 4.3 shows, there are also differences in these basic characteristics between students of business and humanities. Humanities students are more likely to be female, and they are about half a year older, which almost corresponds to the 0.4 years longer it takes them from graduating high-school to enrolling in university. Immigrants and decendants are more likely to enroll in business school.

Not surprisingly we see that humanities students are more likely to come from high-school lines that are lingual instead of mathematical, although the vast majority of the full sample come from mathematical lines, which is due to the requirement of mathematics at a B-level in our sample selection.

An important part of our analysis is that we control for the overall GPA as well as course-specific grades. Even though we only include individuals who could all have entered the eight programs included in our study, the actual levels and distributions of GPA across fields are not necessarily the same. In table 4.3 we see that the average GPA and Danish scores are somewhat higher among humanities students, but mathematical grades are smaller.

Family income is measured as the sum of both parent's personal incomes in $t-1$.[4] We do not measure disposable income here, as we are aiming to control for the types of ability that are transferred from parents represented by their earned income levels, and not the amount of money accessible in that year. Here, we see that individuals who enroll in business school have parents who earn a bit more on an annual basis than parents of those who enroll in humanities. Other parental information such as marital status and educational level does not differ across programs.

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4 When only one parent is found in the data, the income is for this one person.

5 Results

5.1 OLS

Table 5.1 presents the main results of OLS regressions where we gradually expand the set of control variables. Interest lies in the difference in disposable income between students who studied a business program relative to a humanities program, i.e. γ from equation (1).

Results from the simple model in column (1) of table 5.1, where no control variables are included, show that individuals with humanities degrees have disposable incomes ten years after the year of enrollment that on average are $-31.1.$ % (calculated as $(exp(-0.372)-1)*100)$ lower than individuals with business degrees. This corresponds to the raw difference in log incomes found in tables 4.2 and 4.3, and the estimate is highly significant. Including year dummies as well as individual-level characteristics sex, age, and immigration status, presented in column (2), the percentage difference in income drops to 30.1 %. The differences in the observable backgrounds of students across fields only explains very little of the income difference.

Next, in column (3) we expand the set of control variables with information on the number of years from high-school graduation to university start, as well as information on the specific type of high-school line. Information about course-specific grades from high-school is included in column (4). This again affects the magnitude of the coefficient, though none of the included controls enter the model significantly.

Finally, in the fully specified model (5) the estimate of γ is -0.340, which corresponds to a difference in disposable income of 28.8 %. The estimate is, as in all specifications, highly significant at a 0.1 %-level. This shows that there is a group of students who choose further education in humanities, and thereby obtain a lower disposable income that is 29 % lower than individuals who choose a business education. This difference is a strong indication of large differences in consumption value.

Table 5.1. OLS results. Dependent variable: log(DI, t+10)

	(1)	(2)	(3)	(4)	(5)
Edu. Business=1, γ	-0.372***	-0.358***	-0.350***	-0.341***	-0.340***
	(0.043)	(0.046)	(0.047)	(0.055)	(0.055)
Sex. =1 if male		0.058	0.035	0.035	0.036
		(0.039)	(0.043)	(0.042)	(0.042)
Age		-0.000	0.016	0.021	0.021
		(0.014)	(0.032)	(0.032)	(0.033)
Immigrant/Descendant		-0.081	-0.074	-0.056	-0.058
		(0.087)	(0.087)	(0.094)	(0.098)
Years to start			-0.013	-0.017	-0.014
			(0.028)	(0.028)	(0.028)
Gym. Lingual line			-0.142	-0.140	-0.156
			(0.089)	(0.092)	(0.098)
Other lines			-0.386	-0.392	-0.399
			(0.294)	(0.303)	(0.314)
Total GPA				0.002	0.002
				(0.007)	(0.007)
Math scores - A or B				0.037	0.035
				(0.020)	(0.020)
Math on A-level. 1=yes				0.013	0.013
				(0.044)	(0.044)
Danish/language scores				-0.000	0.002
				(0.032)	(0.032)
History scores				0.011	0.012
				(0.019)	(0.020)
English scores				-0.025	-0.024
				(0.016)	(0.016)
Constant	12.312***	11.864***	11.577***	11.047***	10.710***
	(0.038)	(0.730)	(0.898)	(0.999)	(1.026)
Parent controls	No	No	No	No	Yes
Observations	824	824	824	824	824

Note: Year-FE included but not shown in models (2)-(6). Reference category to high-school lines is Mathematical.

Parent controls included are dummies for education levels of both parents and their combined income in the year before enrollment.

Estimation sample: Students at or above the cut-off of the program with the highest cut-off of the 8 programs in the year they enroll.

$* p < .05, ** p < .01, *** p < .001$

Source: Own calculations based on registry data provided by Statistics Denmark.

6 Discussion

To sum up, this study compares disposables incomes of individuals with the same formal skill levels, measured by their overall GPA and course-specific grades, but who choose to study different types of further education. By cutting the sample in such a way that all individuals could have selected whatever field they wanted within our choice set, we exclude any possibility that the results are driven by selection of individuals with differenct choice sets - what is left after that, we hope to control for in the multivariate analysis. We do not argue that we can measure the true differences in earnings, had a humanities student chosen to study business. We ask: for two groups of students with the same formal possibilities, starting the same years, having the same GPA, entering programs with the same formal access criteria; how much do their earnings differ?

Even after controlling for a detailed set of observables, some caveats naturally remain and we do not claim that our estimates have a purely causal interpretation. As the full range of individual ability is not observed, we are not able to control for the full effect of absolute and comparative advantage on future wages. This means that some unobserved characteristics might be correlated with both educational choice and future earnings. The identification strategy of this paper is to control for grades obtained in a variety of high-school courses to proxy for the unobservable factors associated with both absolute and comparative advantages. As highlighted by many in the literature, there are problems in using grades to control for ability, as not all types of talent and ability is captured in obtaining a high score in a course. First, note that grades are not always a measure of true ability, but in part based on teachers' perception of a student's ability. Second, grades might be endogenous to the selection of program as some students already know that they want to enter for example a business program where mathematics skills are important, and therefore make an extra effort in mathematics courses. Individuals who know they want to enter a humanities program, can on the other hand relax their efforts in mathematics. We cannot rule out the unobserved mechanisms described here.

Finally, we only observe disposable incomes at one point at individuals' early stage in their careers. As we cannot follow our cohorts further in time, we cannot determine whether our estimates are representative of life time income differences. In order to get an indication of this, we have calculated differences in disposable income for all individuals with the educations we have studied in this analysis in 2014. Income differences between those with humanities and business educations with a varying number of years since graduation can in this way serve as one indicator

of how income trends differ. Remember that we found a difference in disposable income of 29 % ten years after graduation. We find roughly the same difference in disposable income when looking at the data in 2014 and average across individuals who graduated 10 years earlier (in 2004). However, the income difference increases to 40 % when we look at individuals who graduated 20 years ago, and this number further increases to 51 % when time from graduation is 25 years. These are not fully representative estimates, but serve as an indication that our main results from table 5.1 are most probably lower-bound estimates of the life time differences in disposable income across fields of study.

An important question is naturally what the economic significance of our results is. One cannot objectively decide that one type of return (e.g. production value) to education is more important or valuable to society than other returns (e.g. consumption value). In an economy such as the Danish, one important difference is that while pecuniary returns are taxed relatively high, the consumption value is purely tax free. This means that the tax system presumably is a contributing factor when individuals make their educational choices. One implication of this would be that students choose more consumption value and less production value than what is socially optimal.

7 References

Alstadsæter, A. (2011): "Measuring the Consumption Value of Higher Education". *CESifo Economic Studies 57*, 458-479.

Altonji, J. G., Arcidiacono, P., and Maurel, A. (2016): "The analysis og field choice in college and graduate school: Determinants and wage effects". *Handbook of the Economics of Education*, volume 5. Elsevier.

Altonji, J. G., Blom, E., and Meghir, C. (2012): "Heterogeneity in Human Capital Investments: High School Curriculum, College Major, and Careers". *Annual Review of Economics*, 2012 vol. 4, 185-223.

Arcidiacono, P. (2004): "Ability sorting and the returns to college major". *J. Econ.* 121, 343-375.

Becker, G.S. (1964): "Human Capital". *Columbia University Press*, New York.

Beffy, M., Fougere, D., and Maurel, A. (2009): "Choosing the Field of Study in-Post-Secondary Education: Do Expected Earnings Matter?" *IZA Working Paper* no. 4127.

Carneiro, Pedro, Hansen, Karsten T., and Heckman, James, J. (2003): "Estimating distributions of treatment effects with an application to the returns to schooling and Measurement of the Effects of Uncertainty on College Choice". *International Economic Review* 44 (2), 361-422.

Fricke, H., Grogger, J., and Steinmayr, A. (2015): "Does exposure to economics bring new majors to the field? Evidence from a natural experiment". *NBER Working Paper* No. 21130.

Hamermesh, D. S., and Donald, S. G. (2008): "The Effect of College Curriculum on Earnings: An Affinity Identifier for Non-Ignorable Non-Response Bias". *Journal of Econometrics*, 144, 479-491.

Heinesen, E. (2016): "Admission to Higher Education programs and Student Educational Outcomes and Earnings. Evidence from ". *Rockwool Foundation Research Unit Study Paper* 113.

Imbens, G. and J. Wooldridge (2009): "Recent developments in the Econometrics of Program Evaluation". *Harvard WP.*

Kirkebøen, L. J., Leuven, E., and Mogstad, M. (2016): "Field of Study, Earnings, and Self-Selection". *Quarterly Journal of Economics*, 131 (3), 1057-1111.

KOT (2017): Website of the Danish Ministry og Higher Education and Science, visited in November 2017. https://ufm.dk/uddannelse-og-institutioner/statistik-og-analyser/sogning-og- optag-pa-videregaende-uddannelser/grundtal-om-sogning-og-optag/kot-hovedtal

Lazear, E. (1977): "Education: Consumption or Production?". *Journal of Political Economy*. 85, 569- 598.

Malchow-Møller, N., Nielsen, S.B. and J. R. Skaksen (2011): "Taxes, tuition fees and education for pleasure". *Journal of Public Economic Theory* 13, 189-215.

Mincer, Jacob (1958): "Investment in Human Capital and Personal Income Distribution". *Journal of Political Economy* 66 (4), 281-302.

Nielsen, H. S. and A. Vissing-Jørgensen (2006): "The Impact of Labor Income Risk at Educational Choices: Estimates and Implied Risk Aversion". *Working Paper, University of California, Berkeley.*

Rubin, Donald (1974). "Estimating Causal Effects of Treatments in Randomized and Nonrandomized Studies". *Journal of Educational Psychology*, 66 (5), 688-701.

Webber, Douglas A. (2014): "The Lifetime Earnings Premia of Different Majors: Correcting for Selection Based on Cognitive, Noncognitive, and Unobserved Factors". *Labour Economics* 28, 14-23.

Wiswall, M. and Zafar, B. (2015): "Determinants of College Major Choice: Identification using an Information Experiment". *Review of Economic Studies* 82, 791-824.

Zafar, B. (2012): "Double Majors: One for Me, one for the Parents?" *Econ. Inq.* 50, 287-308.

Zafar, B. (2013): "College Major Choice and the Gender Gap." *J. Hum. Resour.* 48, 545-595.

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