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Labour market returns to higher education: An empirical analysis of marginal students

Evidence from BI Norwegian Business School

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Master of Science in Business

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Abstract

This thesis targets the returns to higher education in Norway, respectively if a selection of students experienced positive labour market gains from graduating. The selection refers to bachelor students in business-administrative fields at BI Norwegian business school, where comparing students from different parts of the skill-distribution is our main area of study in an attempt to determine *who benefits the most from taking an academic degree.* Correspondingly, we compare marginal students to non-marginal students; using below or above the threshold of 3.5 in average high school grade points.

To conduct the analysis, we merged internal BI student-registers with data from Statistics Norway, providing insight into the students' actual labour market gains from graduating between the year 2003 and until 2012. We perform a regression analysis controlling for different variables and their individual effect on our key dependent labour market variables; *Wage* and *Employement.* In addition, we use an instrumental variable approach to study the effect of the Progression requirement, a measure introduced in 2006, in an attempt to reduce the share of bachelor dropouts.

Our main findings point to the fact that completing a bachelor degree at BI has a positive impact on both wage and employment; graduating before the age of 25 increased wages and degree of employment, at age 25, with respectively 62% and 13%, compared to the reference group whom never graduates. Further, when studying the marginal and non-marginal students separately, we found that both groups indeed experience higher wages from graduating. However, there is seemingly evidence of a stronger relationship between graduating on wages for the non-marginal students; graduating before turning 25 led to 68% higher wages at age 25, compared to 49% for the marginal students. Thus, our results do point to a case of positive selection. Finally our IV-estimates, investigating the effect of the Progression requirement, proved that it for a fact increased student quality by resulting in a 29% higher share of graduates, and in turn causing a 20% wage growth for the 25 year olds.

Keywords – Educational Economics, labour economics, Marginal students, BI

Contents

List of Figures

List of Tables

1 Introduction and motivation

The human capital is an important concept in educational economics, and a way of expressing the population's knowledge and skills. An individual may increase their human capital by turning to education, which is considered an important investment in own human capital. Nowadays in Norway, a large proportion of the population invests heavily in their level of education (Kirkeboen, 2010). By these means, it is relevant to obtain as much knowledge as possible regarding what the outcome of choosing one specific education will be. Thus, to ensure investments in higher education is still favorable, research on whether academic graduates experience increased labour market success from graduating seems highly relevant to avoid inefficient labour market allocations and mismatches.

Mismatch in labour markets may arise if graduates are forced to take "non-college jobs" - pushing high school graduates out of the labour market altogether (Omvik and Blom, 2011). Statistics Norway's projections indicate that there will be a surplus of certain types of highly educated workers, especially graduates with a business-administrative education, accounting for 20% of the total students share (Forskningsrådet, 2020). On the same token, a recent condition report for higher education in Norway estimate that there will, in 2030, be 50 000 more people with a bachelor's degree in business administration than what is needed (NTB, 2015). This may indicate that, with a limited market demand for business-administrative competence alongside an increasing supply, the returns to education might be diminishing (Dokka, 2018). Furthermore, as competition between these students continue to increase, individual abilities may be of rising influence as to whom benefits the most from pursuing this specific education.

As follows, despite overwhelming evidence of a positive correlation between education and labour market status, researchers have been cautious to draw strong inferences about the causal effect of schooling. In the absence of concrete evidence, it is very difficult to determine whether the higher earnings observed for better-educated workers are caused by their higher education, or if individuals with greater abilities and greater earning capacity have chosen to acquire more schooling (Card, 1999). Similar issues can be mentioned in

Norwegian context: If the increasing number of students pursuing business-administrative fields at a bachelor level leads to diminishing returns to a higher education, will this investment in further human capital indeed be a worth-while investment for people with different cognitive abilities?

This all boils down to the following research proposition: *We evaluate labour market outcomes for students in business administrative fields; estimating the returns to education for marginal students, in an attempt to determine who benefits the most from taking an academic degree.*

1.1 Limitations and prerequisites

BI Norwegian Business school is the largest supplier of business- administrative competence in Norway, with more than 200 000 graduates since 1983 (Armacad, 2021). Admission to the bachelor studies at BI only requires a general university admissions certification. This implies that a substantial amount of marginal, or academically weaker, students are admitted to these specific study programs, as opposed to similar fields in institutions with stricter admission requirements. A considerable number of these students have weak prerequisites for completing an academic study, as opposed to students in the upper half of the skill distribution. Thus, we limit the analysis by exclusively evaluating students in bachelor programs at BI.

With the intention to study the returns to higher education for the academically weaker students, we construct some comparable sub-groups. Considering that high school grades are a feasible and relevant measure for ability early on, this is used as ground for group separation. Hence, we define marginal students to be students with an average high school grade of lower than 3.5, and following, non-marginal students captures students with an average grade point of higher than or equal to 3.5.

It is worth mentioning that this thesis only assess the pure economic aspects of higher education. This is, of course, not the only consideration that young people take into account when choosing to acquire more schooling. Education also has a value beyond the purely economic aspect, for example, it gives the opportunity to delve into their areas of interest and raise their own level of

knowledge (With, 2018). By these means, parts of the returns to education comes from the ability to do and work with something you like, where simply the joy of learning consciously makes them choose an education that provides a lower life expectancy income, because this is compensated in other manners. However, in line with limitations and area of study, we consider the economic aspect of education to be our main field of interest, where we regard wage as an important, and easily attainable, measure to study individual success in the professional career.

2 Literature review

This part of the thesis presents fundamental principles, a review of the potential labour market gains of higher education for marginal students. We have been comparing studies conducted by some of the most reputable researchers within this area of expertise, where names such as David Card, Lars Kirkeboen and Seth Zimmermann can be disclosed. We will also present the theoretical foundation for the thesis at this stage.

Author	Year	Title	Published	Method	Key Findings
Kirkebøen Leuven Mogstad	2016	Field of study, earnings and self-selection	The quarterly journal of economics	IV Estimation	Different fields of study have substantially different labour market payoffs, the effect on earnings from attending a more selective institution is relatively small compared to payoffs and estimated payoffs to the field of study are consistent with individuals choosing fields with comparative advantage
Barrow Malamud	2015	Is College a worthwile investment?	National Bureau of Economic Research	Comparison of discounted earning profiles	College is certainly a worthwhile investment on average, and likely worthwhile for many subgroups, although not necessarily for everyone
Zimmerman	2014	The returns to College admission for academically marginal students	Yale University	RDD	The marginal admission yield gains of 22% between 8 and 14 years after high school completion, outstripping the costs of college attendance, most for male students and free-lunch recipients.
Turner	2012	The returns to higher education for marginal students: Evidence from Colerado Welfare recipients	University of Maryland, College Park Department of Economics and NBER	Individual fixed effects approach	Women who attend college after entering welfare experience large and significant earnings gains. These returns are driven by credential receipt and when sub-associate's degree credentials are observable, positive earnings gains will be inappropriately attributed to college attendance alone.
Brand Xie	2010	Who benefits from college? Evidence for negative selection in heterogeneous economic returns to higher education	American Social Review	OLS and heterogeneous treatment effect	Found evidence to support the negative selection effect, in other words that individuals who are least likely to obtain a college education benefit the most from college.
Hægeland	2003	Økonomisk avkastning av utdanning	Statistisk Sentralbyrå	OLS and RDD	Clear prediction; Education provides significant financial return.

Card	1999	The causal effect of education on earnings	Department of Economics, University of California at Berkeley	IV Estimation	The paper surveys the recent literature on the causal relationship between education and earnings. The main areas of focus: Theoretical and econometric advances in modelling the causal effect of education in heterogeneous returns to schooling

Table 2.1: Literature review

In general, the literature we have chosen to base our research on constitutes different methods of evaluating whether marginal students benefit from taking a higher education. Previous research within the field is mostly performed in the United States, but we have also found literature with research stemming from both Italy and Denmark. The articles are grappling with issues regarding marginal returns to higher education, over-education, contribution of education to economic growth and self-selection into education. The methods they are using are mostly regression discontinuity design and natural experiments. Overall, general findings were that marginal students in most cases will benefit from college. Additionally, higher education is a continuous contributor to economic growth, hence over-education is at this point still not proven to be of major issue(Caroleo and Pastore, 2015). In regards to self-selection into education, most papers state that in cases with heterogeneous opportunity costs, the possibility to self-select is an inefficient solution.

To give a more precise and detailed review of our chosen literature, we have limited the analysis by further elaborating on some of the most important and relevant articles above. We have elected the papers which we find to be more similar and comparable to the research we are going to conduct. The following literature papers are Zimmerman (2014), Brand and Xie (2010) and Card (1999).

In research performed by Zimmerman (2014), he examines further into the difference in students and their respective output, more specifically the returns to scale for marginal students. He defines marginal students as students with grades just above a threshold for admissions eligibility (Zimmerman, 2014). The key question of his research is whether students who are only marginally prepared for higher education are able to realize economic returns large enough

to justify the investment of time and money. What he found was that students with grades just above a threshold for admissions eligibility at a large public university in Florida are much more likely to attend any university than below-threshold students. The marginal admission yields earnings gains of 22% between 8 and 14 years after high school completion. If this is in fact the case, we can detect which constraints need to be relaxed in order to persuade more such students to invest in higher education (Zimmerman, 2014).

In the literature by Brand and Xie (2010), they consider how the economic return to a college education varies across members of the U.S. population. Based on principles of comparative advantage, individuals who are most likely to select into college also benefit most from college. However, Brand and Xie (2010) found that for net observed economic and non-economic factors influencing college attendance, individuals who are least likely to obtain a college education benefit the most from college. This is a so-called negative selection hypothesis. For both men and women, and for every observed stage of the life course, we find evidence suggesting negative selection. Results from auxiliary analyses lend further support to the negative selection hypothesis (Brand and Xie, 2010).

Finally, Card (1999) surveys the recent literature on the causal relationship between education and earnings. His main areas of focus is the theoretical and econometric advantages in modelling the causal effect of education in terms of heterogeneous returns to schooling. Particularly, Card (1999) finds evidence stating the estimated returns to schooling to be around 20-40%. He states that part of the explanation for this finding may be that marginal returns to schooling for specific subgroups tend to be higher than the average marginal returns to education in the population as a whole (Card, 1999).

3 Descriptive statistics

To shed light on our research question, we link data from BI's study administrative system to Statistics Norway's register data. These data include relevant characteristics of the students' background, alternative study paths and occupational participation, career choice and salary. The variable list as a whole can be found in Appendix 1. Preliminary material from this system includes just over 32 000 students who have started one of BI's bachelor studies from and including the year 2003. It will thus be possible to describe labour market outcomes far into the professional career.

Strengths of these data include the detail of the academic records, for both public institutions in addition to BI, and the relatively long panel component of the earnings data, which tracks students for many years after their graduation year. The main challenge with conducting such an analysis is to construct a research design which makes i possible to control for ability, as this is the main method to obtain valuable causal effects. Furthermore, our analysis makes several good attempts to take this into account by controlling for different aspects in which may directly or indirectly impact individual ability. Even so, there do exist some possible weaknesses in our data which can create biased estimates and weaken the validity of future outcomes if not begin accounted for.

First, when studying earnings outcomes for graduates versus dropouts, there are several aspects that might decrease the outcome validity for the dropout group. It may be the case that students leaves BI temporarily, returns after one or more years, and completes the commenced study, or others may change from BI to another educational institution in higher education, and completes a study there. Thus, the dropout comparison could obtain some omitted variable bias. We have attempted to fully account for this by studying wage at age 25 and 30, and additionally, students whom graduate at some point before or after age 25. Thus, we somewhat eliminate the potential risk of exiting biases from students potentially taking a break from their studies to return at a later point. Second, it is known that when studying earnings outcomes, a majority of things will affect the wages an individual earns. By including several controls

for ability, we are able to study this aspect on a broader level, and along with corresponding literature, we found these ability controls to be some of the most important measurable impact on wage.

Prior to the analysis, in order to reduce the existence of further weaknesses in outcomes, we remove a number of observations considered to be less relevant or believed to distort the outcomes estimates, such as observations that lack key variables or are assumed to influence the estimates too much. In relation, we remove all observations with a negative wage or income, when controlling for earnings outcomes, as well as excluding part time workers or non-workers from the analysis, to make sure we compare graduates in similar working situations. As we do in fact include observations with zero in wage, we use log to Wage + 1, as log to zero is unattainable. Further, as the new bachelor reform in 2003 potentially affected student ability and in turn earnings outcomes, we exclude all observations prior to this, as they are to be considered less comparable.

3.1 Summary statistics

As our data set includes a great number of observations and variables, we present this thesis' main data using descriptive statistics, obtaining an overview of the most important features of the data set. Initially, with the intention to study marginal students in bachelor programs at BI, we proceed to exclude all other educational programs from the analysis. In Table 3.1, key measures to evaluate the returns to higher education for all bachelor students at BI are introduced.

	Observation[1]	Mean[2]	Std. Dev.[3]	Min[4]	Max[5]
Start year	32 588	2007.77	2.8467	2003	2012
Gender	32 588	.4887	.4998	0	1
Graduate degree	32 588	.6444	.4786	0	1
Graduate degree SSB	32 588	.4869	.4998	0	1
Grade points	32 588	126.39	78.61	0	416
GPA High school	32 588	3.7704	.5594	1	6
Marginal students	32 588	.3083	.4617	0	1
Graduated at 25	32 588	.3415	.4742	0	1
Graduated at 30	32 588	.4471	.4972	0	1
Graduated at 35	32 588	.4714	.4991	0	1
Employed 25	32 588	.7078	.4547	0	1
Employed 30	32 588	.9514	.2148	0	1
Employed 35	32 588	.9643	.1853	0	1
Wage 25	30 100	244 089	175 568	0	2 794 200
Wage 30	17 682	426 675	276 348	0	8 291 300
Wage 35	5 487	447 828	332 801	0	4 005 149

Note: The table works as a representation of all descriptive statistics of relevance to enlighten our respective study. The variables of interest is chosen to get an overview of how bachelor students at BI perform in general, and can be described as key measures to predict the outcome of our study.

1. The number of observations includes all students from the period 2003 until 2012 that completed a bachelor degree at BI Norwegian Business School. We can behold that the number of observations diminish with age, as not all students from our data set has reached that certain age.
2. Representation of the mean from all observed values in each of the chosen variables The standard deviation reflect the amount of variation in our set of data, or how far each variable measure lies from the mean
3. The minimum observation for each of the dependent variables chosen. We can observe that we deal with five dummy variables, with value of either 0 or 1
4. The maximum observation for each of the dependent variables chosen. For grade points we can spot that the maximum value of 416 points means that one observation in our data set has more than one bachelor degree of respectively 180 grade points.

Table 3.1: Descriptive statistics

Before assessing and evaluating the actual findings in the data, we present the main statistics for this thesis. Indeed, 64 % of the students from our selection have graduated with a bachelor's degree, implying that the majority of the bachelor students in BI complete their studies. We observe that the marginal student group accounts for 30% of the total student body. This gives an initial indication that a significant share of students belong to the group we intend to study. To examine students' payoff from education in general, we include some feasible measures for determining labour market outcomes. From Table 3.1, these measures are represented as *"Employed"* and *" Wage"*, at each of our chosen age intervals, to evaluate development in labour market measures throughout the respective career. With the intention to limit the scope of the study, we only consider the early stages of the career. It is known that wages

tend to vary in a certain way over the course of life: Early in the professional career, strong wage growth is common, and over time, wage developments tend to flatten (Kirkeboen, 2010). This is in line with the outcomes in our table for the wage variable, as we indeed see that the wage growth between age 25 and 30 is quite immense, and then diminish at age 35. However, it is important to note that there may exist weaknesses in only regarding the early stages. Erling Barth's study from 2005, in relation, finds evidence to support larger returns to education later on in the career (Barth, 2005). Particularly, it would have been ideal to study the wage variable throughout the entire professional career. However, limitations to the extent of this analysis forced us to take a stand on the matter. By these means, the analyses are therefore sensitive to the age composition of the data set.

Obtaining a bachelor degree in the Norwegian educational system, given that the student completes within stipulated time, takes three years. As we know that students use a minimum of three years to complete their education, we construct an interval where the variable start year has a maximal value of 2012, in order to capture graduated students that are at least five years into their professional career. We note that this interval will only be applicable for students who finish their degree at quite an early age. According to SSB, Norwegian students are amongst the oldest in Europe, where every fourth student is of age 30 or older (Keute, 2018). Thus, to ensure we study graduated students' respective labour market outcomes, we include a variable *"Graduated at .."*, indeed capturing at what respective age our students had become actual graduates.

3.1.1 General labour market developments

The Scandinavian educational system, with a combination of compressed wages, progressive taxation and generous student aid, has provided us with a workforce of a very high level of education (Barth, 2005). As previously mentioned, Norway continues to educate an increasing number of people each year. Thus, studying the wage gap based on individual skills is important to answer the potential question of inefficient allocations in the labour market.

Before digging into the actual returns from graduation, we provide some basic

figures for introducing the students general development in the labour market variable *Wage*. We use birth year as a dependent variable, in order to study developments in wage from the beginning of our data set.

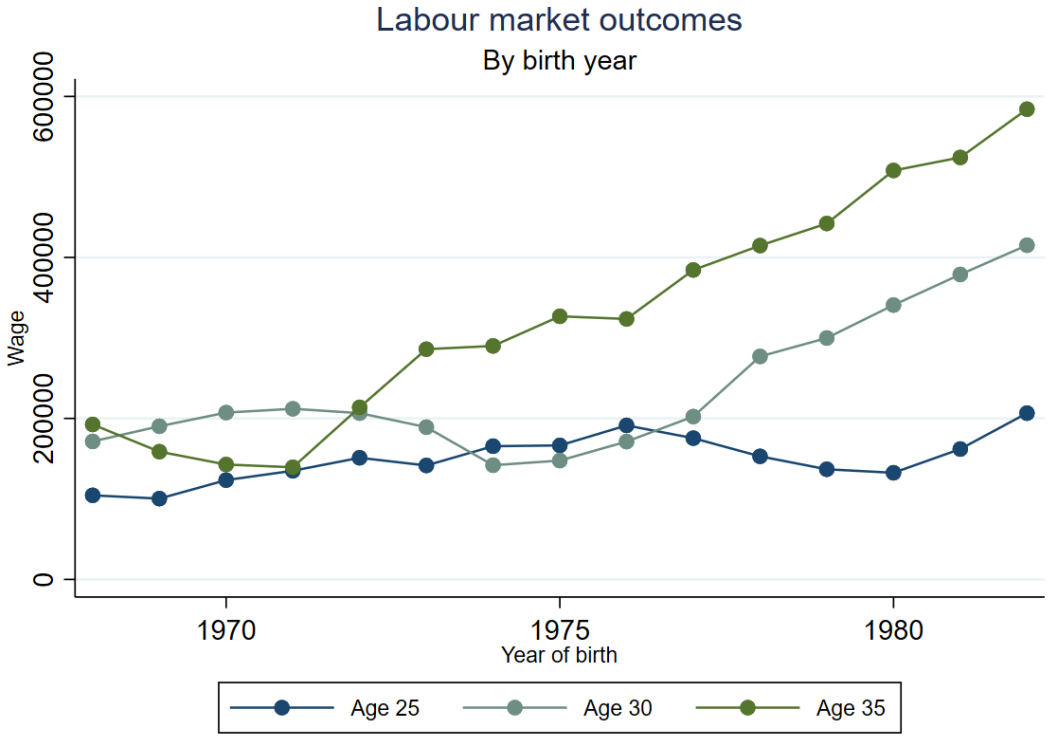

Figure 3.1: Wage level at age 25, 30 and 35, conditional on the individuals birth year

What we note from Figure 3.1 is that there seems to have been major positive wage advancements in the labour market over a series of decades. The increase in wage is continuously steepened, indicating that young workers have become progressively profitable. One can also mention that the wage gap between 25, 30 and 35 year olds has considerably expanded, which implies that the differences in wage in the early stages are more distinct now than previously. Especially, one can note that the 30 and 35 year olds seem to have exceeded the 25 year olds on wage. This might be a result from the career choices and educational paths young people make today, vs. just a couple of decades ago. An assumption is that young people use more time on higher education today, so that the wage level is lower at this specific age, but results in them accelerate on wage at a lager stage once graduated. We can cross-check this theory by including the development in work participation at the defined age levels; another indicator of career performance.

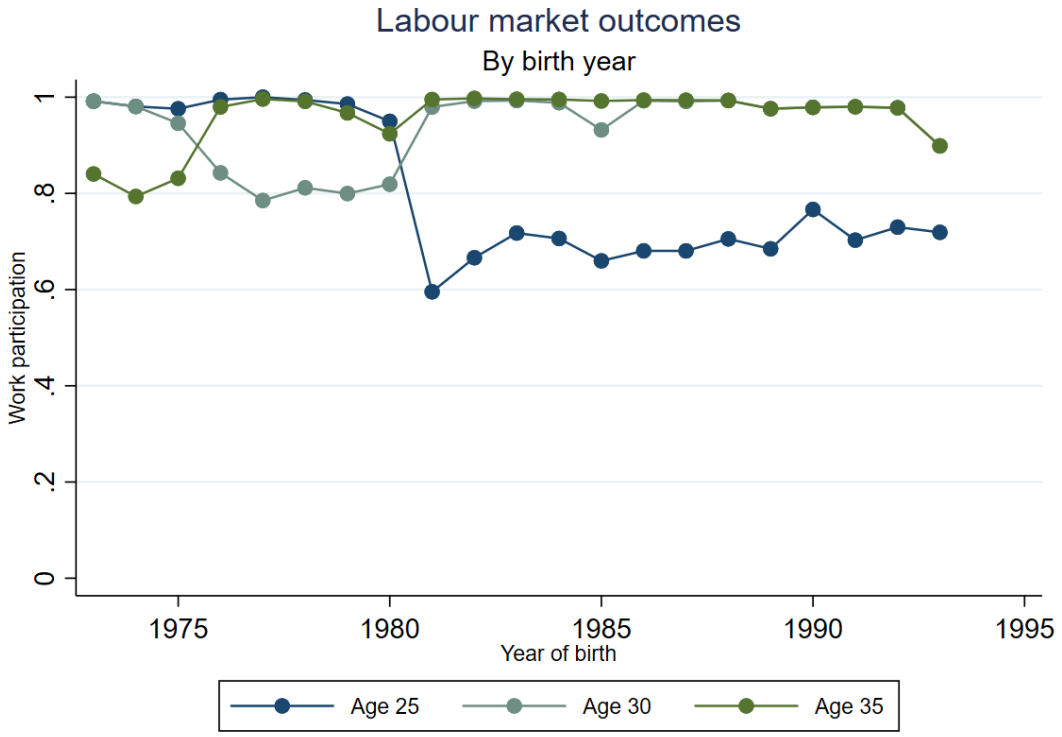

Figure 3.2: Work participation at age 25, 30 and 35, conditional on the individuals birth year

As demonstrated in Figure 3.2, there is a rather high employment rate for all groups. Especially at age 30 and 35, the employment rate is significantly high. Strikingly, and somewhat consistent with the mentioned assumption, is the major fall in work participation at age 25 with the birth year 1980. This could be a result from a higher share of young people pursuing higher education rather than to work, but the size of the fall seems to be more of a shock to the economy rather than a growing trend for pursuing other occupations such as higher education. Looking at historic events, which might have negatively impacted the labour market, we can mention that people born in 1980 would be 25 in 2005. In this period of time, we were approaching a major financial crisis which included rapid limitations in a tough labour market. Total labour force participation fell from 73 % in the second quarter of 2004 to 72% in the second quarter of 2005, where the decline was strongest among young women (age groups 16-19 and 20-24) (SSB, 2005). Young workers are often the most vulnerable of the three groups in times of recession, and with little to no working experience compared to the two other groups, they may therefore be an easier target when companies in crisis are in need to lay off or slow down

employment processes. However, these are only basic assumptions, and it might as well be the case that there exist some weaknesses or deficiencies in our data from this period.

We stress the importance of mentioning that both Figure 3.1 and 3.2 are extracted on a highly general basis, to get a preliminary overview of labour market developments for the young people in our selection. As we intend to study academically weaker students and impact from graduation, we use a similar approach as the one above to asses the impact from actually completing a degree on labour market outcomes.

3.1.2 Challenges in the labour market and impact of student quality

Many researchers in the field of educational economics claim that higher education will increase future working possibilities, independent of your original skill-set. Correspondingly, the share of low educated workers in Norway that are employed has decreased from 74% in 2008 to 64% in 2018 (Fedoryshyn, 2018). There has been a major decline in existing jobs that do not require higher education, and as a result, the competition amongst the lower educated workers is rising. Thus, it is crucial to ensure that all students are successful, in the matter of attaining relevant work post studies, in order to avoid pushing lower educated workers out of the labour market altogether.

Declining productivity in the educational sector, declining quality among students or a falling demand curve from employers are all mechanisms that will increase the importance of class quality, as the size of the classes continues to grow. Are employers willing to pay regardless of student and class-specific quality, or will we find any traces of quality reductions in the wage distribution within the educational groups?

The answer to the first question is rather straightforward. The wage premium for education has not fallen in the last 30 years and there are still signs of increased return to education in many countries (Barth, 2005). This means that the labour market has continuously been willing to employ the large classes without any drop in initial wages. Nevertheless, it is conceivable that reduced

quality mainly appears within the people from the lower part of the wage distribution. Maybe it's just the weakest among them with higher education that has declined in quality?

3.2 Dividing the students

In order to evaluate students' individual return to higher education, we proceed by dividing students into the two groups as suggested in section 1.1; the marginal and the non-marginal student group. We further provide two separate tables, 3.2 and 3.3, comparing earnings outcomes in order to find if there exists any noticeable deviations between students when splitting our selection based on individual ability.

It is of major importance to the study to compare the students that successfully graduates with a bachelors degree, to the students that drops out, in order to find the actual returns to acquire more schooling. This could also be an alternative method for perceiving weaker and stronger students, as we do expect that many of our marginal students from high school possess lower abilities to complete an academic degree, and thus struggle to graduate. Hence, before comparing the skill-set groups, we provide an initial overview of how many students that complete their bachelor studies at BI.

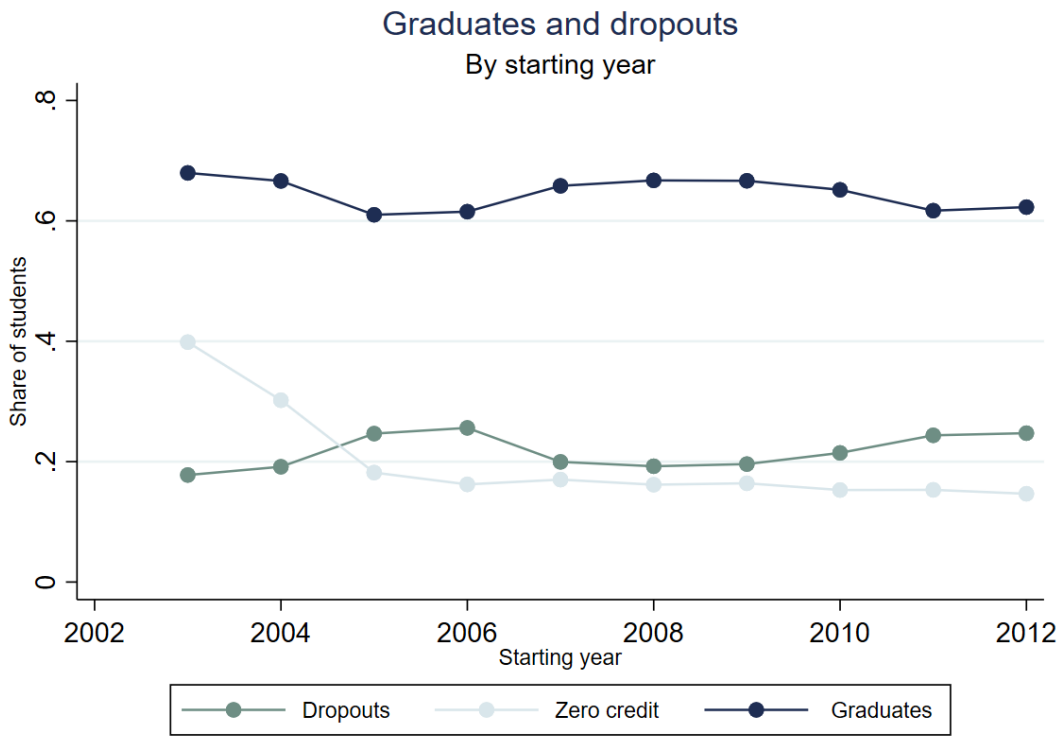

Figure 3.3: Initial overview of graduates, dropouts and zero credit students conditional on starting year

From Figure 3.3, we note that approximately 30 % of the selection drops out at one point throughout their study. The share has remained quite consistent, ever since the beginning of the program, with an exception of a somewhat higher share of zero credit students in the first year of the new bachelor program in 2003.

Previously, in Table 3.1, we introduced the variable marginal students, accounting for 30 % of the selection. In other words, the hypothesis claiming that marginal students from high school stay marginal in higher education seems to be somewhat consistent with the actual outcomes of our data. However, to validate it even further, we include a figure comparing dropouts to high school grades; our chosen measure for ability to determine who are marginal.

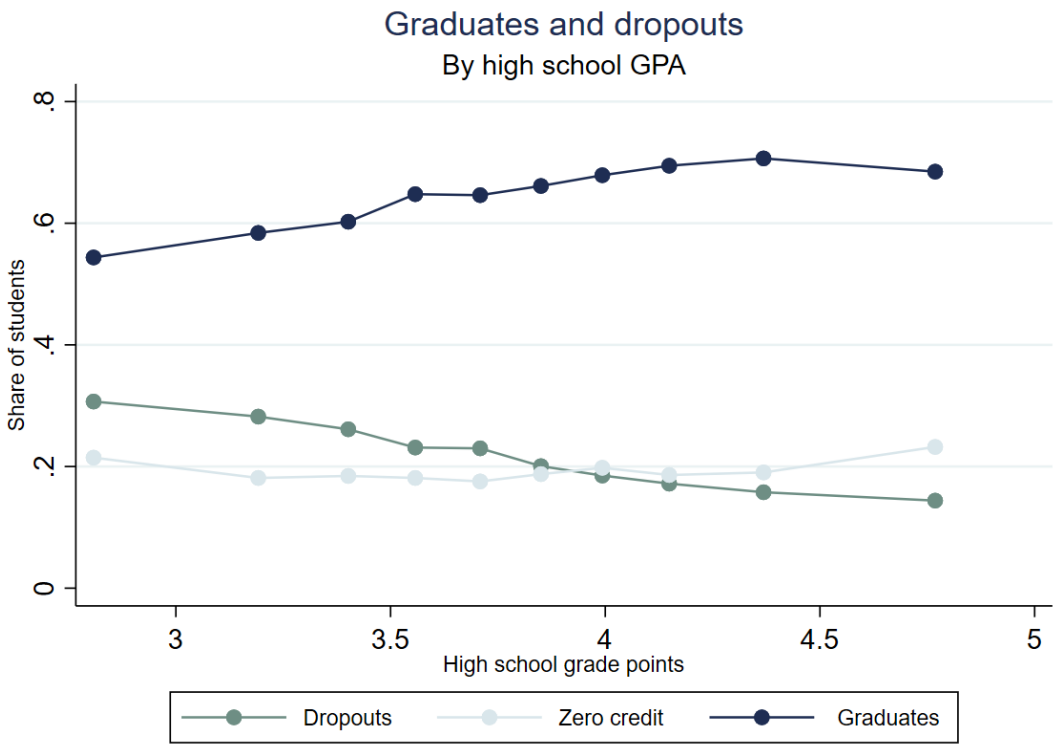

Figure 3.4: Initial overview of graduates, dropouts and zero credit students conditional on average high school grade points

From Figure 3.4 we observe a continuous correlation between obtaining higher grade points in high school and achieving greater success in higher education. Even so, a US study finds that a one-point increase in GPA doubles the probability of completing college – from 21% to 42% – for both genders (French, 2014). From the figure above, we can similarly note a coexisting trend, however not to as large of an extent. The difference in completion rate from GPA 3.5 to 4.5 is about 10% in favour of higher GPA. Correspondingly, the share of dropouts decline with higher grades from high school, whilst the opposite trend is visual for the graduated group.

Hovdhaugen and Aamodt (2005) also studied the relationship between dropping out from higher education and high school GPA. They found that, with an average grade point below 4, 25 % of the students dropped out. As observed in the figure, this also corresponds well to our student selection. This implies that students with good grades from high school must, to a higher extent, be expected to stay in higher education as opposed to students with weaker grades.

After initially recognizing that success in higher education does, to a larger extent, stem from non-marginal students, we control for whether this trend will

maintain consistent when studying labour market outcomes within the actual definition of the two groups.

3.2.1 Initial returns to education

We continue to take advantage of the employment rate and wage at each predetermined age level to evaluate progress in individual performance, considering whether both student groups experience equally large returns throughout their career. The wage variable, in particular, is very relevant to study considering that corresponding research find that wage can, to a greater extant than for instance income (see Appendix 2), be claimed to be more dependent on the level of education (Kirkeboen, 2010).

Degree	Employed 25	Employed 30	Employed 35	Wage 25	Wage 30	Wage 35
No final grade	.6652	.9538	.9710	214 747	355 532	401 757
	(4 251)	(4 251)	(4 251)	(4 004)	(2 465)	(829)
Graduated	.6975	.9528	.9679	235 393	418 389	449 711
	(5 796)	(5 796)	(5 796)	(5 425)	(3 393)	(1 279)
Total	.6838	.9533	.9629	226 626	391 939	430 852
	(10 047)	(10 047)	(10 047)	(9 429)	(5 858)	(2 108)

Note: Employed equals working 30 hours or more per week, to control for work participation; we exclude part time workers and non-workers. Wage corresponds to wage level at a given age. Total number of observations in parenthesis.

Table 3.2: Mean statistics for marginal students

Degree	Employed 25	Employed 30	Employed 35	Wage 25	Wage 30	Wage 35
No final grade	.6603	.9467	.9625	214 082	382 642	373 562
	(7 337)	(7 337)	(7 337)	(6 772)	(3 874)	(1 067)
Graduated	.7466	.9525	.9620	270 557	473 727	497 580
	(15 204)	(15 024)	(15 204)	(13 899)	(7 950)	(2 312)
Total	.7185	.9506	.9622	252 055	443 884	458 418
	(22 541)	(22 541)	(22 541)	(20 671)	(11 824)	(3 379)

Note: Same intuition as Table 3.2

Table 3.3: Mean statistics for non marginal students

Differences between educational groups, in our case marginal and non-marginal students, is a perspective that is interesting both in terms of efficiency and distributional considerations. In today's Norway, a large proportion of the population invests heavily in their education. Since individuals invest so much in own education, it is relevant to obtain as much knowledge as possible regarding what the outcome of choosing one specific education will be (Kirkeboen et al., 2016).

A general finding from the tables above is that we identify a positive effect from graduating, both for marginal and non-marginal students. Rephrased, the initial interpretation is that completing a higher education is beneficial

regardless of where you are on the skill distribution. We acknowledge that a larger part of the non-marginal students actually obtains a degree compared to the marginal group; 33 % of the observations are dropouts, compared to 40 % in the marginal selection. This gives reason to support the previous stated hypothesis claiming that marginal students are more likely to drop out.

According to SSB, wage earners with more education have higher average wages (Bye, 2018). The growth in wage is statistically, as mentioned, expected to increase with age, which is also true in all the above estimates. Thus, obtaining a degree will become more beneficial with age, independent of your initial results. Previously, in Figure 3.3 and 3.4, we received initial remarks of how the students at BI perform in terms of graduating. In order to evaluate differences between students who graduate and not, on labour market outcomes, we separate between wages earned at age 25, 30 and 35, to study if there are any distinct differences in the gains from graduating.

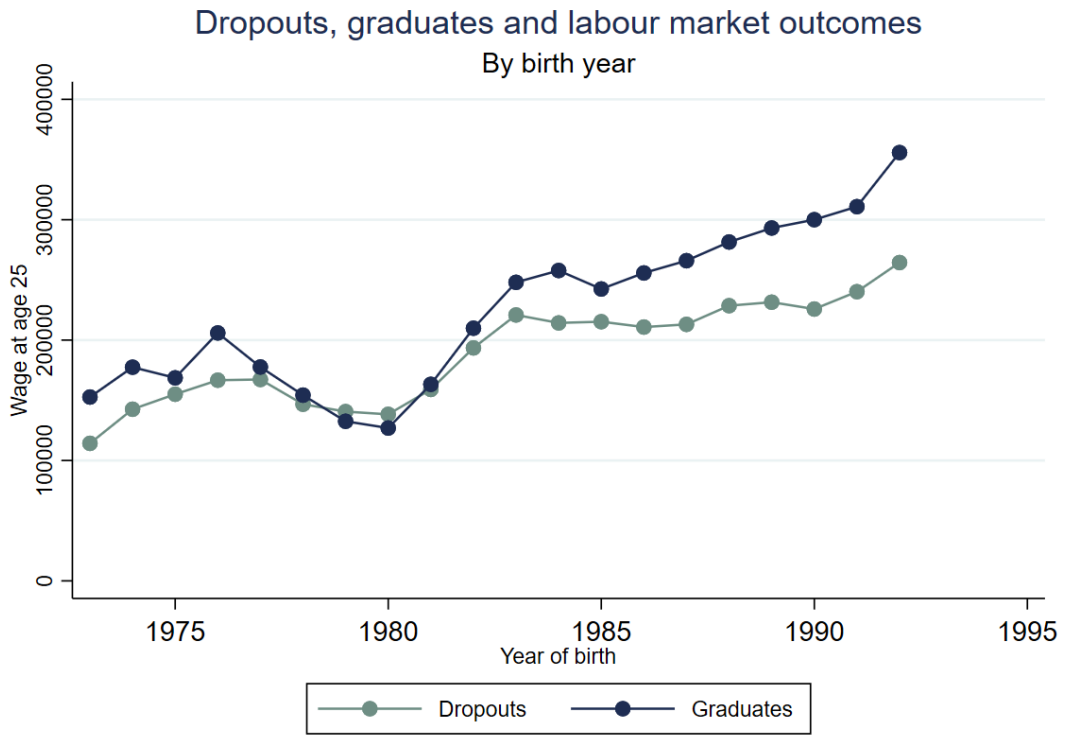

Figure 3.5: Wage level at age 25, conditional on the individuals birth year, for dropouts and graduates separately

From Figure 3.5, we note that the wage difference between graduates and dropouts, at age 25, is slowly increasing in birth year. This may correlate with the fact that we, in recent times, have seen tendencies of a labour market shift,

mainly due to technological advancements. What is more, technological change has seemingly reduced the need for routine mechanized work and increased both the demand and pay for high-skilled technical and analytic work (Brown and Loprest, 2018). Thus, the market seems to increasingly value the competence and skills students obtain from a bachelors degree at BI, indicating that our findings might be consistent with Brown's research; a potential result from technological changes. In addition, the trend for pursuing higher education might lead to students graduating earlier, which also results in earning higher wages at an earlier stage than before.

It is here relevant to mention the fact that people with shorter education more rapidly reach their maximum wage level. Higher education entails a longer period of very low pay at the beginning of the life course. When people with higher education, on the other hand, complete their education and enter the workforce, they have a wage growth that is stronger than what the lower educated workers had at the beginning of their professional career, and during relatively short time, the highly educated have surpassed the lower educated in annual wages (Kirkeboen, 2010). As follows, we expect the wage gap between dropouts and graduates to increase even further with age.

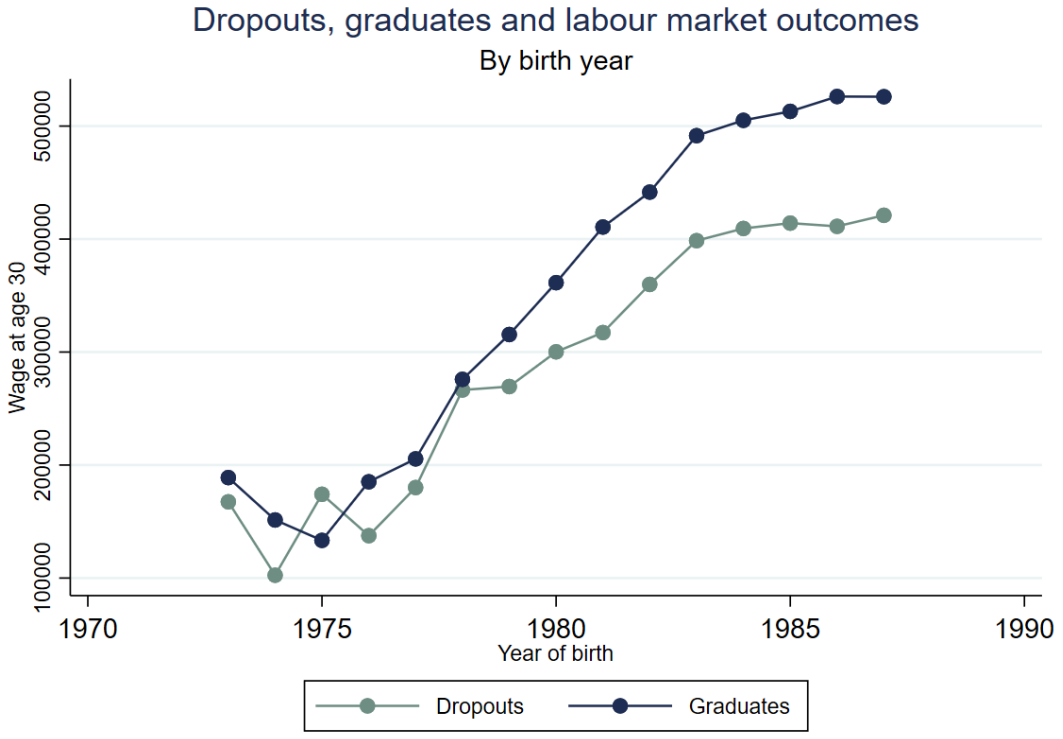

Figure 3.6: Wage level at age 30, conditional on the individuals birth year, for dropouts and graduates separately

The most distinctive difference between Figure 3.5 and 3.6 is that for the 30 year olds, the curve is much steeper, indicating a larger wage growth for this particular group, which aligns with our above mentioned expectations. In fact, a study from 1999 by Raaum found that those with higher education surpass those with only upper secondary, or lower, education when they are between 25 and 30 years old (Raaum et al., 1999), which is almost identical with our interpretations from the figures above.

Additionally, it seems that graduating is getting progressively profitable as the wage gap between graduates and dropouts is growing in time. In fact, the difference between the two groups has become about 100 000 NOK, compared to what we see just 10-15 years back, where the effect of graduating on wage was not as distinct.

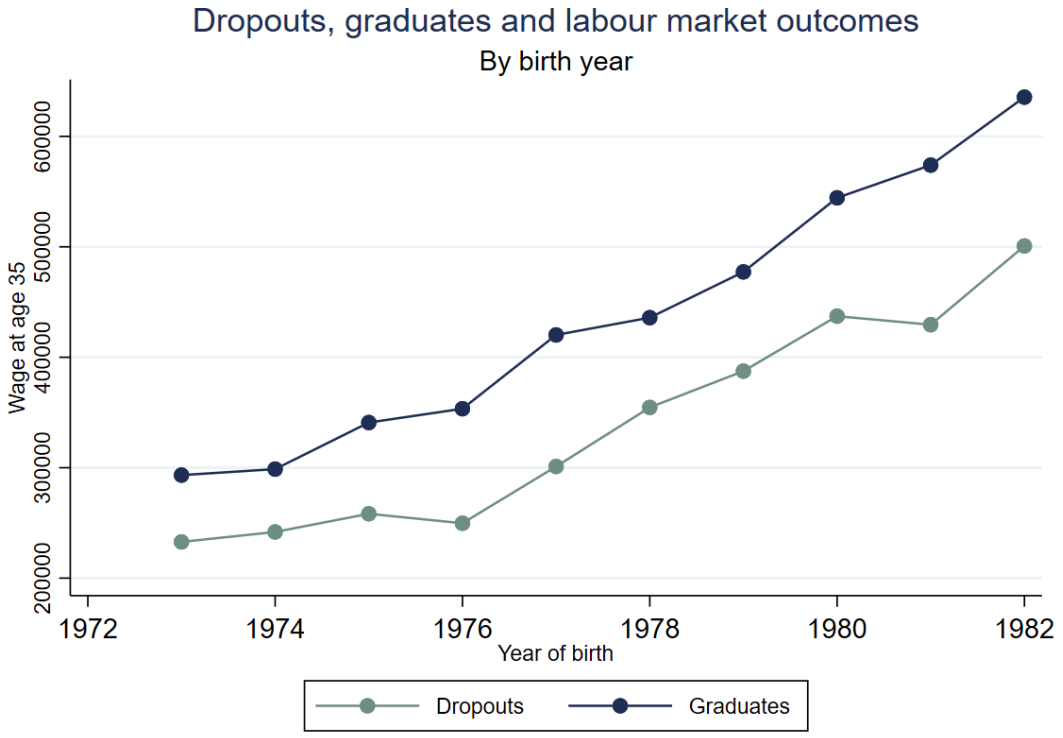

Figure 3.7: Wage level at age 35, conditional on the individuals birth year, for dropouts and graduates separately

For the 35 year olds, there seems to be less of a noticeable difference in wage development over time. The wage gap between graduates and dropouts has remained quite constant, where graduates born in 1973 (35 in 2008) had approximately 22% higher wages than dropouts, compared to around 26% higher wages in 1982 (35 in 2017). Thus, we do in fact find significant evidence

of positive labour market returns from education on all ages, even though there seems to be larger effects in the earlier stages of the career. This is also something we are going to take advantage of in our regression analysis, primarily focusing on evaluating the earlier stages.

After dividing the age groups by birth year and looking at wage advancements between dropouts and graduates over time, we have found positive indications of completing a higher education on wage. However, from Table 3.2 and 3.3, it seems to be more beneficial to pursue higher education as a non-marginal student, since the wage gap between graduates and dropouts is continuously larger in this specific group. This points to a positive selection effect, in other words that students with a higher grade point average will have more of a comparative advantage from higher education (Carneiro et al., 2011). Thus, we can use the same method to evaluate the students, but now compare wages to high school grades in order to grasp how the marginal students perform compared to others.

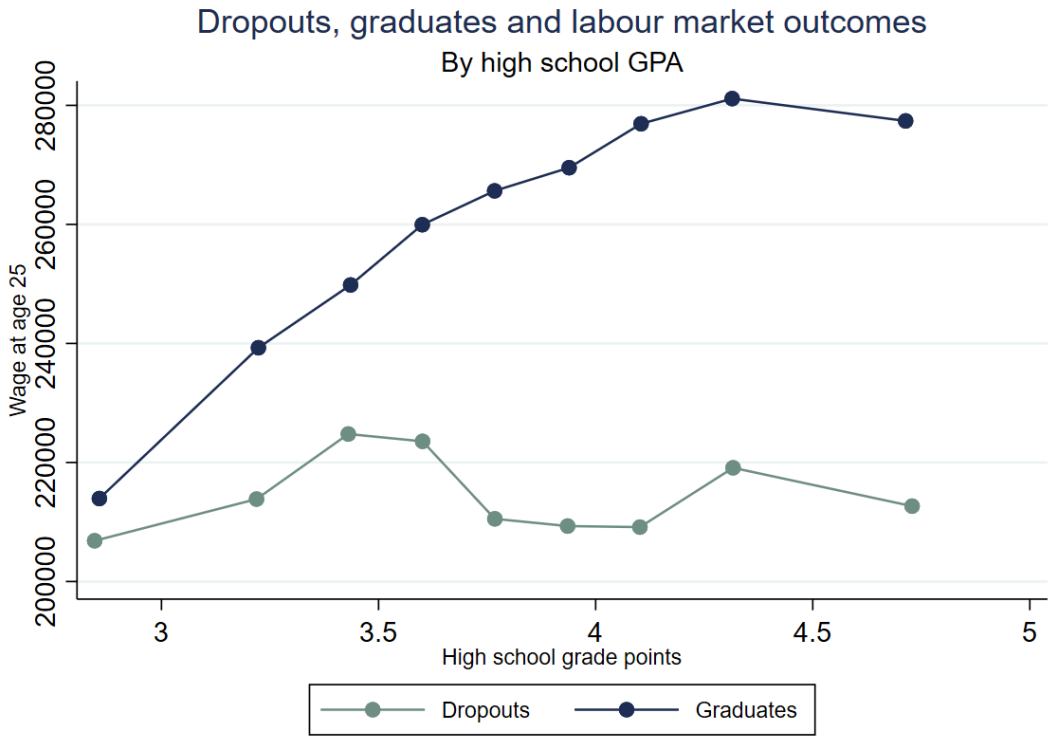

Figure 3.8: Wage level at age 25, conditional on average high school grade points, for dropouts and graduates separately

In Figure 3.8, we have extracted dropouts and graduates with their respective grade point average from high school to verify if there are signs of a positive

selection effect in higher education at BI, as indicated in Table 3.2 and 3.3. We immediately note that for the graduated group, wages are continuously increasing in higher grade points, and there is a major difference especially for the students with a high GPA.

For the dropouts, however, high school grade points seem to have less effect on wage, as the curve seems to minimally fluctuate around the same level. Accordingly, the students with a grade point average of around 3.5, our marginal threshold, obtain higher salaries than the dropouts with a higher high school GPA. This is an interesting discovery, indicating that even though non-marginal students that graduate benefit more from higher education than marginal students that graduate, GPA has less impact on wage for the dropout group. However, it is essential to underline the fact that we only accounted for age 25 at this point, and we might see different trends when discerning a later point in the career.

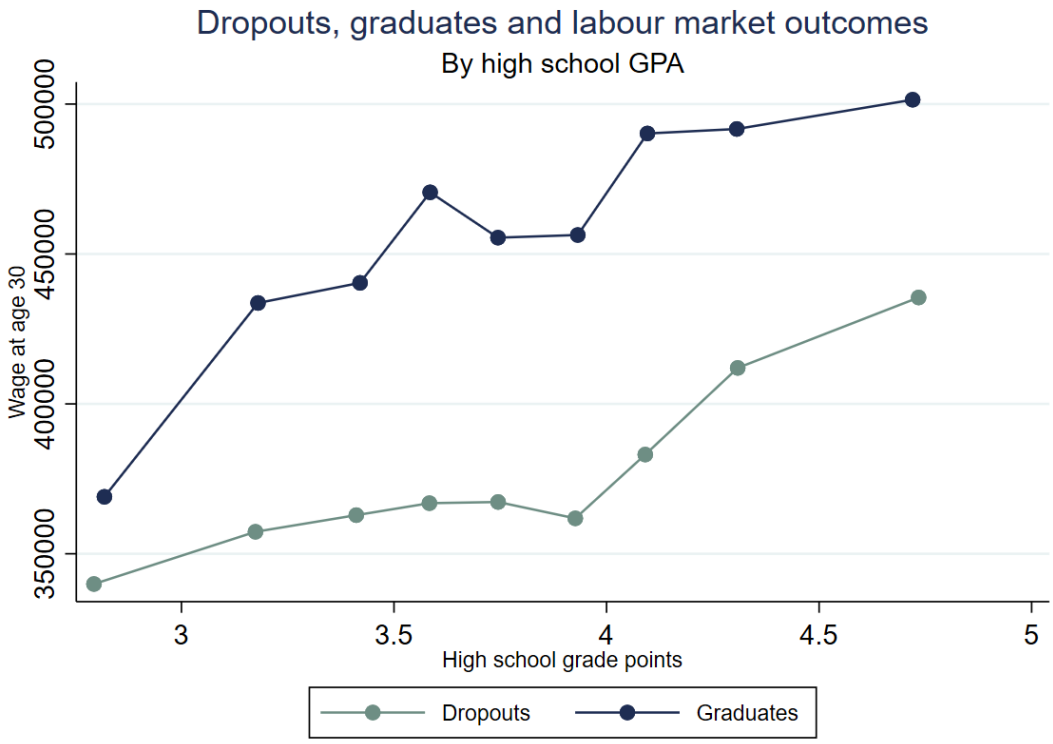

Figure 3.9: Wage level at age 30, conditional on average high school grade points, for dropouts and graduates separately

Whilst we, in Figure 3.8, observed smaller differences between lower and higher grade point averages for the dropouts, we can in Figure 3.9 actually identify a shift in the foregoing trend. There seems to be more of a positive impact from

grade points on wage for the 30 year olds, for both graduates and dropouts. In addition, it seems that the students with a higher GPA are approaching each other, so that the differences between dropouts and graduates are not as high as they were at age 25.

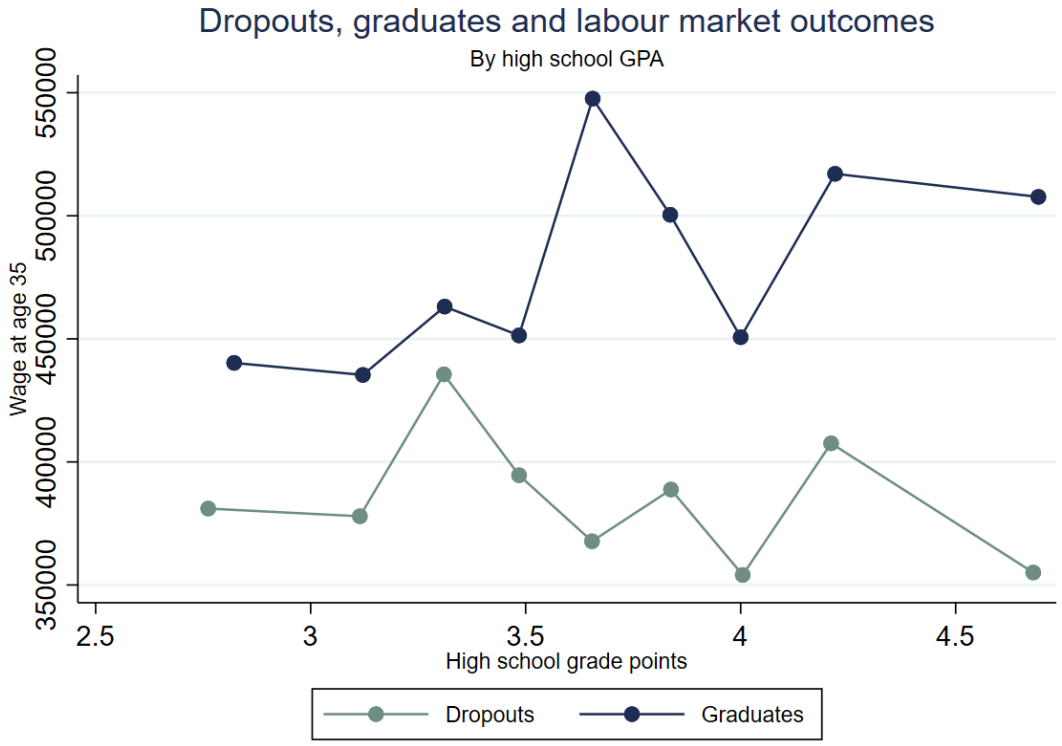

Figure 3.10: Wage level at age 35, conditional on average high school grade points, for dropouts and graduates separately

At age 35, it seems that the amount of impact from high school grade points made on wage highly varies. This is to be expected, as high school grades are only one way to measure ability, and are often used early in the career when there is lack of other attainable measures such as work experience. What we can again note here, which was also recognized in Figure 3.8, is that the dropouts with grades around 3-3.5 are approaching the graduates. As this lies within the interval of our marginal student group, it might be another indicator of smaller effects of graduating on wage for academically weaker students.

What is important to mention after looking at the listed figures is that we cannot yet conclude on whether it is less beneficial for marginal students to graduate from BI. On one hand, we have proven a higher degree of employment in addition to increased wages for the marginal graduates, as opposed to those who are marginal and drop out. These results are comparable to Zimmerman

(2014), who found strong evidence for substantial labour market outcomes for marginal students who graduate from college. However, our findings imply that it may be more beneficial to graduate if you are in the upper half of the skill distribution, which has similarities with the results in the study from Barrow and Malamud (2015) in the US. They concluded that college is certainly a worthwhile investment on average, and likely worthwhile for many subgroups, although not necessarily for everyone.

To further validate our preliminary results from this descriptive part, one may commonly use regression methods to determine whether the relationships observed in the sample data actually exist in the population. In our case, we are going to use regression methods to pin down whether it is actually true that graduating will have remarkably positive effects on earnings for both predetermined groups, although more for the non-marginal students.

4 Regression

As a part of our statistical analysis, we use a regression method in order to describe the relationship between the labour market outcomes and other independent variables (Schroeder, 1986). The standard method for studying income differences related to education is to estimate a Mincer equation (Mincer, 1974). As future earnings can be expressed as a function of schooling and labour market experience using this earnings equation (Polachek, 2007), it provides us with important information about whether investment in education is an efficient allocation of capital.

4.1 Definitions

In the opening remarks, we introduce our key dependent labour market variables to study the actual earnings effect from schooling through the Mincer equation.

Wage: We check for earnings effects from graduating on three different wage variables; wage at age 25, wage at age 30 and wage increase from age 25 to age 30, in order to show the effect of graduating in the long run.

Employed 25: We check for labour market participation, as an additional measure for the returns to schooling; accounting for work participation at age 25. Employed is a dummy variable, equivalent to the variables Grad and GPA, corresponding to students working 30 hours or more per week.

Further, we examine the independent variables in this analysis, in which we control for, to study the causal relationship between graduating and earnings. As we indeed are not able to control for all aspects which may impact future earnings, we have chosen to include the variables we find to be the most feasible to conduct, as well as being easily comparable. We also determined which variables to control for by looking into our literature, so that we could receive comparable estimates when studying eventual outcomes.

Grad: Dummy variable for obtaining a final grade (=1), dropout (=0). Grad is defined for students having started on a bachelor program at BI, and we elect graduating before or after 25 as a threshold in this analysis. This threshold

was chosen in relation to what we previously found in the descriptive part, that there seemed to exist larger wage differences between age 25 and 30, than at a later stage in life.

$$Grad_0 = \begin{cases} 1, & Graduated\ after\ \ age\ 25 \\ 0, & \text{Otherwise} \end{cases} \tag{4.1}$$

$$Grad_1 = \begin{cases} 1, & Graduated\ before\ age\ 25 \\ 0, & \text{Otherwise} \end{cases} \tag{4.2}$$

However, when referring to causal analysis, we wish to construct the regression such that everything that the students influences, or what is endogenous, is to be placed on the left hand side of the equation; as the outcome variable. On the contrary, all in which the students cannot influence, belongs on the right hand side. Therefore, it is a bit questionable that we place the Grad variable to the right of the equality, as this is indeed endogenous. Thus, we keep this in mind in going forward with the analysis.

GPA: Coded as a dummy variable for grade point average from high school, rounded from 1-6.

$$GPA_1 = \begin{cases} 1, & if\ 2.5 < GPA \leq 3.49 \\ 0, & \text{Otherwise} \end{cases} \tag{4.3}$$

$$GPA_2 = \begin{cases} 1, & if\ 3.5 < GPA \leq 4.49 \\ 0, & \text{Otherwise} \end{cases} \tag{4.4}$$

$$GPA_3 = \begin{cases} 1, & if\ 4.5 < GPA \leq 5.49 \\ 0, & \text{Otherwise} \end{cases} \tag{4.5}$$

$$GPA_4 = \begin{cases} 1, & if\ 5.5 < GPA \leq 6 \\ 0, & \text{Otherwise} \end{cases} \tag{4.6}$$

t: Year for when the student started on the study program (could also include student birth year)

i: Identification of student

f: Family identification

As the labour market effect of graduating/dropping out can be conditional on high school grades, we might set up a model with interaction effects. Students may drop out after having passed several exams, possibly indicating that GPA would be a feasible control variable. In addition, we include what we call "other control variables", as the relationship between schooling and GPA, as identified, might not necessarily imply causality.

As follows, we present the Mincer earnings function based on our regression:

$$\begin{aligned} log(Wage_{it}+1) &= \beta_0 Grad_{it0} + \beta_1 Grad_{it1} + \gamma_1 GPA_{it1} + \gamma_2 GPA_{it2} \\ &+\gamma_3 GPA_{it3} + other\ control\ variables + \epsilon_{it} \end{aligned} \tag{4.7}$$

The *"other control variables"* include students' birth year, start year on the study program and gender. In a second model specification, we also control for parents' highest education level.

Finally, we estimate a model with sibling fixed effects. Let f denote the identity of mothers, and let θ_f be sibling fixed effects. This yields our third regression model:

$$\begin{aligned} log(Wage_{ift}+1) &= \beta_0 Grad_{ift0} + \beta_1 Grad_{ift1} + \gamma_1 GPA_{ift1} \\ &+\gamma_2 GPA_{ift2} + \gamma_3 GPA_{ift3} + \theta_f + other\ control\ variables + \epsilon_{ift} \end{aligned} \tag{4.8}$$

4.2 Labour market gains from graduating

From recent studies we know that the Mincer equation indicates that tertiary education, as opposed to primary education, may not provide the greatest returns with respect to future earnings (Patrinos, 2016). With this in mind, it is natural to consider that education, as any other investment of capital, has diminishing returns to scale.

However, as economies become more complex and technological developments

alter the demand for education, decades-old cross-sectional data may not be informative when it comes to the returns to current investment decisions. In fact, growing demand for higher educated workers, alongside a decreasing demand for less-educated workers, has increased the earnings differential between educated and less-educated workers (Rainie and Anderson, 2017). Nonetheless, the relationship between schooling and earnings is not straightforward to assess, as it again does not necessarily imply causality.

4.2.1 Control variables

David Card, a professor within the field of educational economics, claims that a unifying theme in much of this work is that the return to education is not a single parameter in the population, but rather a random variable that may vary with other characteristics of individuals, such as family background, ability, or level of schooling (Card, 1999). In going forward, this broader perspective of the effect of education contributes to reconciling the various findings in the literature, and provides a useful framework for generating new hypotheses and insights about the connection between education and earnings. To discern the question of causality, we include a set of explanatory variables to further investigate the effect of schooling on earnings. We compare three sets of estimates, that is, some principal economic variables of interest; GPA from high school, parental education level and sibling fixed effects. The idea behind this is to investigate if any effect of *Graduating* on *Wage* is sufficiently strong to still be present when we include the different set of controls.

On a first note, we believe that some of the students ability can be captured by controlling for high school GPA. Although previous studies have found a relationship between higher levels of education and greater earnings, less is known about the association between academic performance in high school and future earnings. On the bottom line, one may assume that results from upper secondary education, hereby referred to as GPA, and ability to complete a degree in higher education is, on some level, correlated with each other. Moreover, GPA can also, to some extent, reflect how well the student masters an academically higher education. In this control, the reference group are students with an average grade point of below 2, comparing students to the

academically weakest in our selection. More specifically, we run a nonlinear control for GPA, with dummy variables for grades rounded to 2, 3, 4, 5 and 6. We point out that as the control for GPA goes "through" our variable *Graduated at 25*, most of the effects are captured by the dummy variable. Hence, this control may be of weaker significance when studying the actual outcome estimates.

In addition to GPA, there are undoubtedly other explanatory factors that could have impact on student ability. In fact, the actual returns to higher education might widely differ and be dependent on social background, and thus be an important control to the individual's cognitive ability. Broadly speaking, the intention of such an analysis is to examine whether our data supports the hypothesis stating that abilities are in fact inherited. Thus, additional controls for parental education level and sibling fixed effects seems convenient, which is in line with the arguments presented by (Schroeder, 1986).

Researchers stress the importance of family background for educational attainment, emphasizing general cultural background, knowledge, disposition, and skills that children acquire from their parents (Harmon and Walker, 2001). Moreover, it is of major interest for our research to study impact from family background as driven by the fact that children's schooling outcomes are highly correlated with the characteristics of their parents, and in particular with parents´ level of education. On the same token, we can mention that parents influence their children through several channels beyond parental education, such as investment in their children's education, transmission of cultural values, attitudes or social skills, and genetic endowments (Li and Qui, 2018).

In like manner, the basis for additionally controlling for sibling fixed effect is that some of the unobserved differences, that bias a cross-sectional comparison of education and earnings, are reduced or eliminated within families (Card, 1999). It is a clear reason to believe that siblings are more alike than randomly selected pairs of students. Particularly, they share common heredity, financial support, as well as geographic and sociological influences (Harmon and Walker, 2001).

Along these lines, we use GPA, in tandem with parental education and sibling

fixed effects, as control variables to gauge more causality from graduating at an early or later stage. Thus, we regress the model on the effects simultaneously. By using a logarithmic form, our measurement of earnings will present a functional form of the regression model.

	Dependent variable			
	Wage 25	Wage 30	Wage increase[1]	Employed 25[2]
	(1)	(2)	(3)	(4)
Panel A: Baseline model				
Graduated after age 25	.3645	.5646	.2852	.0039
	(.0401)***	(.0568)***	(.0659)***	(.0062)
Graduated before age 25	.6191	.8134	.2419	.1293
	(.0373)***	(.0525)***	(.0629)***	(.0060)***
Observations	30 100	17 682	17 123	32 588
R-Squared	0.0324	0.0782	0.0227	0.1073
Panel B: Parent's educational level[3]				
Graduated after age 25	.3772	.5389	.2299	.0039
	(.0416)***	(.0591)***	(.0691)***	(.0289)
Graduated before age 25	.6149	.7815	.1998	.1293
	(.0380)***	(.0548)***	(.0662)**	(.0060)***
Observations	28 662	16 597	16 138	30 227
R-Squared	0.0919	0.1354	0.0802	0.1524
Panel C: Sibling fixed effects and parity[4]				
Graduated after age 25	.5473	.6814	.3275	.0376
	(.1786)**	(.3926)	(.3938)	(.0287)
Graduated before age 25	.6024	.3507	-.1766	.1207
	(.1535)***	(.3576)	(.3744)	(.0269)***
Observations	3 224	1 104	1 064	3 492
R-Squared	0.5713	0.5869	0.5595	0.5601

Note: Robust standard errors clustered by individual in parenthesis, *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.This regression model is based on a mincer earnings function describing the relationship between schooling and earnings, with main outcomes referring to the effect of graduating against the reference group who never graduates. The baseline model includes control for GPA, gender, startyear and birthyear. Additional control for parental education and sibling fixed effects is incorporated to investigate whether any effect of graduating on wage is sufficiently strong to still be present in these controls. We note that all controls are coded as dummy variables. The table reports estimated coefficient of earnings outcomes for graduating on four dependent variables (1) - (4). The outcome refers to bachelor students in BI only, with the selection obtained in the period 2003-2012.

1. Wage increase correspond to the differences in wage from age 25 to age 30
2. Employed 25 represents those in the selection that are employed at the age 25. As earlier, employed is defined by working 30 hours or more per week
3. Controlling for the highest obtained education of the parents; a very detailed control including many dummy variables for both mothers and fathers' educational level from 1-8 in addition to type of education. This control also includes the same controls as the baseline model; GPA, gender, startyear and birthyear.
4. Controlling for sibling fixed effects, where having siblings refers to having at least one or more sibling attending BI. This control also includes the same as the baseline model; GPA, gender, startyear and birthyear, and also parity. Parity is additional control for the impact of which number you are in the sibling flock.

Table 4.1: The labour market gains of graduating

In Table 4.1, we evaluate the returns to schooling through our elected variable of interest, "Graduated at 25", on four dependent labour market variables. The main idea behind this approach stems from the assumption that the majority of students in bachelor programs complete their degree before the age of 25. According to SSB, half of bachelor students, starting their degree before the age of 21, complete within stipulated time; thus are graduates before 25 (Drahus

and Sundberg, 2019). Indeed, this is also supported by Table 2 from our descriptive section, displaying that approximately half of the graduates from our selection had completed their degree at age 25. In addition, we previously found evidence of large wage growth between the age 25 to 30, and thus we wanted to evaluate whether this is correlated with graduating early. Finally, as we intend to study the actual returns to schooling, we must include student graduates early on to evaluate whether wage at age 25 is sufficiently impacted by graduating. For simplicity, we further the discussion by referring to students graduating before the age of 25 as "early graduates" and respectively, graduating some time after 25, as "late graduates".

From the coefficient estimates in the baseline model, Panel A1, we immediately observe a positive relationship between graduating early on wages. From the table, we can observe that the students that graduate with a bachelors degree at a young age, on average, earn 61% higher wages at 25 compared to our reference group; those who never graduate. Equivalently, the late graduates earn approximately 36% higher wages at age 25 compared to the reference group. We can assume that many of the late graduates probably work part time at the age of 25, next to their ongoing studies, a consideration we account for later on in Table 4.2, but it is interesting that this percentage is as high given that those who never graduate might to a larger extent be in full time jobs at this point. Generally, we do acknowledge that our coefficient estimates seem to give immediate indications of high returns to graduating, especially at a younger age, as pointed to earlier in the descriptive analysis.

As continuously argued and visualized, there are vast differences in labour market advancements between the age 25 to 30. Thus, we expect the late graduates to catch up with the early graduates at a later stage in the career. Looking at Panel A2, the estimates are quick to illustrate large benefits from graduating early, also at 30 years old. In fact, with an average wage of approximately 25% higher than the later graduates, early graduates keep advancing on wages, at the exact same pace as at age 25. This may corresponds to the fact that graduating early gives you earlier access to the labour market, and thus also potentially a more rapid growth in wages than for those who graduate at a later point. Firms may also to a larger extent invest more

in younger talents. In addition, completion rate is an important measure for efficiency and quality in education, where SSB claims that the youngest students are more likely to complete their study within stipulated time (Drahus and Sundberg, 2019).

The table also produces promising estimates when it comes to work participation for early graduates, in Panel A4. Through the employed variable, we can clearly observe the same trend of a significant positive effect; in particular, a 13% higher employment rate compared to the reference group. In turn, we can again note that late graduates do not have as strong of an impact; only affecting the employment rate by 0.3%.

Even though we have acquired sufficient estimates for positive effects from graduating on labour market outcomes, it is important to raise the question of causality. By these means, it is highly relevant to discern what a person who graduates would have earned if that person would in fact not have graduated, and crosswise, which is the conditional unobserved covariates (Brand and Xie, 2010). Could it be the case that a bachelor graduate would have done equally well without a degree, simply because he or she possesses general abilities to succeed in the labour market altogether? In relation, we wish to examine whether there are other confounders which might impact this relationship.

4.2.2 Cognitive ability

In relation to the above mentioned control variables of interest, we will begin the discussion by controlling for cognitive ability through GPA. Looking at our coefficient estimates, we find GPA to be quite prominent on both of our dependent wage variables (1) and (2) (see Appendix 3). Peculiarly, it seems as the initial striking wage effects decrease in higher GPA. In comparison, a study by Michael French in the US finds that a one-point increase in GPA raises annual earnings in adulthood by around 13%, averaging for both genders (French, 2014). This implies positive selection; higher ability students are more likely to benefit from higher education than academically weaker students (French, 2014). Our coefficient estimates does not point to the same trend. Consequently, it is difficult to imply any form of causality in this relationship, and by so we stress the importance of acknowledging the double dummy causing

omitted variable biases. In addition, neither of the estimates are significant on either of the chosen conventional levels.

Nonetheless, as we did locate a strong positive relationship between higher GPA and wage in the descriptive discussion, the results obtained in this control check point to the fact that indeed all the impact from GPA is captured by the dummy variable, and thus not proven to give any valid estimates in this control. Subsequently, we will in chapter 5 further this analysis by introducing sub-groups, allocating comparable groups of students, to attain significant estimates on whether graduating is a sound investment for students with different levels of cognitive ability.

4.2.3 Parental education

According to Gooding (2001), a significant part of the covariation between the parental education level and the children's educational success is due to biologically transferred characteristics. Two possible explanations on the importance of such ability controls, according to Salvanes et al. (2005), and why parental education level tends to have a significant impact on the children's future earnings, is that the type of parent who has more education and earns a higher salary has the type of child who will do so as well, regardless. Another story might be that obtaining more education makes one a different type of parent, and thus leads to the children having higher educational outcomes. However, other studies find that family backgrounds are weak or invalid instruments; not proven to have an immediate impact on student success (Harmon and Walker, 2001).

Thus, we can investigate whether this control poses a significant effect on our students success in the labour market. From Table 4.1 in Panel B, controlling for parental education seems to be of no significant impact to our estimates. For instance, we note that for both early and late graduates, the impact from parental education does not seem to change the coefficient estimate on wages compared to Panel A. Indeed, we can actually observe the same trend for all the dependent variables, (1) to (4), of interest; the coefficients remain relatively stable. Thus, the extra ability acquired from parents, given the other control variables in the model, especially GPA, has little to no impact on our dependent

labour market outcomes. We also add that the validity of these results are very high, considering that all estimates are statistically significant on all conventional levels, which gives us very good reason to trust our outcomes.

In comparable research, family background are found to be factors strongly associated with the students' performance in school. Brand and Xie (2010) found that college graduates are more likely to come from families with high income and highly educated parents, compared to dropouts. They predicted the effect of college completion on earnings for students with parents with a low educational level to be about 30%, while the predicted effect for students with parents in possession of a higher level of education is about 10%. This supports the negative selection effect, that an individual with parents who are high school dropouts, and who himself has low measured ability, benefits more from completing college, on the magnitude of an estimated 20%, compared to individuals whose parents went to college and who themselves has high measured ability. This is also supported by the study from Barrow and Malamud (2015).

One indicator for the limited impact of parental education in our selection, given the control for GPA, could be the difference in area of study. Perhaps, because the named research is conducted in the US, the sufficient impact from parental education on graduate wages might be resulting from college being an opportunity for the most privileged ones. Students may be more dependent on parents' resources, particularly, income and education. To support this assumption, higher education in Norway is indeed available for everyone. Moreover, the average public two-year college costs a total of $12 320, a significant estimate compared to public universities in Norway (Bridgestock, 2021). In relation, student loans and other privileges are very accessible in Norway (Regjeringen, 2021). Thus, Norwegian students might not be as affected by their parental background as interpreted from similar research performed in the US, and it seems plausible that our results tend to differ.

Even though we were unable to find any causal effects of parental education on student earnings in our data, this might not be true when studying the sibling fixed effects. In fact, researchers claim that siblings are more comparable, as they grew up in the same environment and share heredity. As similar research, stemming from other Nordic countries, finds sufficient evidence proving that

individuals with many siblings in the selection can expect to earn less in the labour market (Jäntti and Bjorklund, 1998), these may be more comparable to our research, as Nordic countries have a more similar education model than the US, and somewhat more comparable economies.

4.2.4 Sibling fixed effects

In this control, we intend to include aspects that are not captured by the above controls, to conclude on whether wages can be explained by further social background. Indeed, we observe confirmable estimates from Panel C, indicating initial effects from siblings. Interestingly, we do locate significant positive synergies for late graduates on wage at age 25, where the coefficient increases by around 20%, and another 12% on wage at age 30 compared to the baseline model in Panel A. One argument may be that late graduating siblings share knowledge that is mutually beneficial throughout their course of study. Further on, they might help each other into the labour market altogether. On the other hand, we observe that for the earlier graduates, they have almost no impact from siblings on either of the dependent variables, where the coefficient stays relatively constant. Despite this, they are somewhat negatively impacted by siblings on wage at 30. Thus, we do obtain very inconclusive estimates in the control for sibling fixed effects, and their addition impact on labour market outcomes.

Correspondingly, similar to when controlling for GPA, we stress the importance of mentioning the validity of these estimates. Generally speaking, almost neither of the coefficients were found to be statistically significant at the chosen conventional levels. This may come from the fact that we, in this control, account for very few number of observations, negatively affecting the outcomes of interest. In relation, the majority of the students attending BI have no siblings within the same institution, resulting in an almost inconsiderable amount of observations to account for in order to achieve any significant outcomes. Thus, it is not as straightforward to imply causality between siblings fixed effects and higher wages in our selection (Card, 1999).

Similar research, studying the effect of having siblings in higher education on future earnings, have also proven to be somewhat inconclusive.Wijanarko (2015)

finds that the number of siblings does not have a significant direct impact on income. However, he seems to support the fact that having a smaller family with fewer siblings is, economically speaking, a favourable option for parents who want to maximize human capital development, higher income levels, and higher welfare for their children in the future (Wijanarko, 2015). This is in line with research performed by Jäntti and Bjorklund (1998), stating that there is, in fact, a negative relationship between an individual's number of siblings and success in the labour market.

Claiming that family size, or number of siblings, might not display any effect on earnings, it is known that siblings affect each other via various social mechanisms (Peter et al., 2018). Furthermore, we wish to investigate the birth order effect for siblings in higher education. In this regard, parity will contribute to evaluate whether the first-born has any wage advantage compared to the last-born. Indeed, several studies point in the direction that the first-born, on average, has a higher intelligence and that the intelligence falls slightly for each place down in the herd (Spilde, 2015). However, from our data, we do not find evidence to support this statement. In fact, our analysis finds a slightly more positive effect of being the second born sibling in the family on earnings, however very modest. Because Norway has substantially equal opportunities, along with an inclusive educational system inducing limited costs, students might not be as affected by being further behind in the group of siblings, as opposed to other countries with more expensive educational systems (Regjeringen, 2021).

The simple analysis of average earnings for higher education mask a number of issues. The omission of additional controls assumes that variables that affect wages are uncorrelated with schooling – which seems implausible. For instance, older people are likely to have lower levels of education, but higher levels of work experience, giving very different 'returns' for a certain level of schooling, as we saw tendencies of for the later graduates. Nordic countries, in particular, have low average returns to schooling (Harmon and Walker, 2001). Correspondingly, we have indeed conducted several controls to justify our results, however, only to a general note. Hence, as an addition to the discussion of impact from the control variables, we are going to use heterogeneity to cross-check whether our

findings will remain when electing sub-specific skill-set groups.

4.3 Heterogeneous effects in educational outcomes and earnings

A common way of studying heterogeneous treatment effects by observed covariates is to examine the interaction between education and specific factors that influence wages and the probability of attaining a degree in higher education (Brand and Xie, 2010). Considering heterogeneous treatment effects, which is, running separate regressions for sub-groups of the students and thereby adding them to the previous findings, will contribute to cross-check our analysis (Anoke et al., 2019).

In order to understand the sources of differences in the earnings effects, the following Table 4.2 presents estimates of changes in educational outcomes across the cutoff for different sub-groups of students. These effects are estimated using the main specification of second degree polynomials, with the GPA threshold of 3.5. Given the large differences in earnings effects, the degree of similarity in the educational outcomes for the different aspects of the students is observed.

	Dependent variable		
	Wage 25	Wage 30	Wage increase
	(1)	(2)	(3)
Panel A: Employed at 25 years[1]			
Graduating after 25	.4764	.5355	.1764
	(.0591)***	(.0763)***	(.0913)
Graduating before 25	.8288	.8538	.0713
	(.0524)***	(.0672)***	(.0842)
Observations	20 571	11 703	11 448
R-squared	0.1106	0.1630	0.102
Panel B: Zero credit students[2]			
Graduating after 25	.3650	.5414	.2078
	(.0484)***	(.0705)***	(.0833)*
Graduating before 25	.5941	.7750	.1512
	(.0453)***	(.0689)***	(.0817)
Observations	23 064	12 732	12 394
R-Squared	0.095	0.151	0.087
Panel C: Marginal students[3]:			
GPA <3.5			
Graduating after 25	.2900	.5018	.3002
	(.0705)***	(.0988)***	(.1155)**
Graduating before 25	.4895	.7512	.3485
	(.0813)***	(.1177)***	(.1461)*
Observations	8 691	5 252	5 147
R-squared	0.130	0.183	0.154
Panel D: Non-marginal students[4]:			
GPA =>3.5			
Graduating after 25	.4384	.5708	.2072
	(.05387)***	(.0764)***	(.0904)*
Graduating before 25	.6761	.8166	.1812
	(.0445)***	(.0660)***	(.0791)*
Observations	19 572	10 974	10 626
R-squared	0.112	0.158	0.096

Note: Robust standard errors clustered by individual in parenthesis, *** p < 0.001, ** p < 0.01, * p < 0.05. This table functions as an extension of the analysis from Table 4. The heterogeneous effects describes the relationship between schooling and earnings, with main outcomes referring to the effect of graduating against the reference group whom never graduates. We include a set of sub-groups, that is selecting on employed 25 years, excluding 0 credit students, only marginal students and only non-marginal students. The table reports estimated coefficient of earnings outcomes for graduating on three dependent variables (1) - (3). The outcome refers to bachelor students in BI only, with the selection obtained in the period 2003-2012.

1. We select on the ones employed at age 25, with the intention to study effect of graduation on the dependent variables
2. We select on the ones employed at age 25, with the intention to study effect of graduation on the dependent variables
3. We separate between dropouts and zero credit students; zero credit students defined as getting zero grade points in their first study year. This is an important selection as in fact one can believe that some students accepted to BI may not actually start their studies, and thus induce weaker estimates.
4. Addressing the return to schooling for the lower ability individuals; selecting on students with an average GPA of lower than 3.5
5. Addressing the return to schooling for the higher ability individuals; selecting on students with an average GPA of equal to or above 3.5

Table 4.2: Heterogeneous effects in educational outcomes and earnings

In Panel A, from Table 4.2, we select on students that are full-time employees at the age of 25, in correspondence to observe whether this changes our estimates in either direction comparing it to the baseline model, Panel A. What we observe from the coefficient estimates is that the employed early graduates earn almost 83% higher wages than the ones that never graduates, giving strong effects of graduation on earnings. We also note that the estimate has increase over 20 % from the baseline model Panel A1, which indicates that the full effects from graduating on wage is captured when also controlling for full-time employment. On average, graduated BI bachelor students earned 461 000 in 2021 (BI, 2021), compared to the average earnings estimates for those with only upper secondary education in their early stages of NOK 455 520 (SSB, 2021[1]). This may point to some biases in our estimates, as BI graduates do not seem to earn sufficiently more than non-graduates. However, we note that this is a very general estimate extracted across all sectors and occupations, and there are also vast differences in wages early in the professional career, as previously stated. Thus, the numbers are indeed not entirely comparable, but an interesting estimate to note. What is more, we note that the employed late graduates only earn 47% higher wages than the ones who never graduate. In correlation, it is important to point out that our definition for full-time employment is only controlled for number of working hours, and might therefore include observations with zero income, eg. interns and volunteering, which might disturb our estimates. On a concluding note, we do observe the same trend as in Table 4.1; it seems that the earlier the students graduate and obtain work, the more they will benefit from their bachelor's education.

Further, we select on so-called zero credit students in order to see how these may impact our model. As students tend to apply for several institutions in advance of pursuing higher studies, we suspect that the ones that never began BI, were actually accepted to another program at a different institutions, likely with higher admission requirements. Moreover, implying that these students drop out for the benefit of pursuing another study program, it could negatively impact the analysis for the dropouts. What we distinctly notice is

[1]The estimate is retrieved from SSB with 2020 data; we have extracted only those with upper secondary education that are 0-4 years into their professional career (to get as close to age 25 as possible). All study fields from upper secondary education are included.

that the estimates induce slightly weaker effects on wages for both early and late graduates, compared to the baseline model output in Panel A, however to a minimal degree. This implies that the outcomes are not severely impacted by zero-credit students, which indicates that the estimates obtained by comparing graduates to dropouts, as in previous analysis, are still very much significant.

Earlier, in the descriptive part of the thesis, there were tendencies for larger labour market outcomes for the non-marginal students. However, in the control for GPA, we were not able to conclude on a consistent trend due to the existence of the double dummy variable. Thus, we continue by including the two main sub-group, that is, excluding on student ability. In relation, we reintroduce the baseline estimates in Panel A Table 4.1, for early and late graduates, of respectively 62% and 36% effect on wages. At a first glance, we can comprehend that when selecting for marginal students only, we do in fact observe tendencies of a weaker impact on all wage variables; respectively 48% and 29% positive effect on wages. Hence, we witness a decrease of 14% on the effect of wages for early graduates, and 7% for the late graduates. Thus, referring to marginal students only, it seems as if the early graduates are indeed affected by ability. The same can be said about wages at age 30, were both early and late graduates still seem to lay approximately 6% behind on wages compared to the baseline results. On the contrary, non-marginal students have the opposite effect; larger positive estimates on all labour market variables; we mark 5% and 7% higher wages at age 25 for respectively early and late graduates compared to the baseline estimates. With this, there is clear evidence to support the hypothesis of positive selection, with basis in ability.

Nonetheless, it seems clear that the returns to education may differ across the wage distribution. Evidence based on linear regression methods suggests that the returns are higher for those in the top decile of the income distribution compared to those in the bottom decile (Harmon and Walker, 2001), which is consistent with what we have found in previous analysis, but also through heterogeneously controlling for marginal and non-marginal students in Table 4.2. A possibility, which substantiates this claim, is that the inequality in higher education may have increased in recent years through a complementary effect between ability and education. By these means, if higher ability individuals

earn more, this explains the higher returns in the upper deciles of the wage distribution. This will in fact have important implications for determining the effect of education on future earnings. What is more, it is also an important implication for explaining the variance in the quality of graduates produced by the higher education system. Harmon and Walker (2001) points to two possible explanations. Firstly, a degree is not sufficient to ensure a graduate job – other complementary skills are expected by graduate employers. Secondly, since genuine over-education can emerge, it is clear that the labour market does not adjust fast enough (Harmon and Walker, 2001). Therefore, it seems clear that student quality is an important aspect of the analysis in order to increase the effect of pursuing such a level of education on future earnings.

The proportion of students who complete their degree on time is one of the management parameters for higher quality in education. In recent years, the share of bachelor students completing an education without spending extra time has increased (Kunnskapsdepartementet, 2020). However, there are still a sufficient number of students that are unable to complete within stipulated time (Drahus and Sundberg, 2019). Older students tend to have a longer completion time, and men complete to a lesser extent than women. The Government has incorporated several measures to ensure that a higher degree of students complete their education on time. Nevertheless, still less than half of new students in bachelor's programs complete their degree within three years. Who are these students, and why is this number so high?

Herewith, we further the analysis by including an instrumental variable approach, studying the impact of the so-called Progression requirement on student quality. More precisely, by including a minimum limit to proceed to next year studies - in an attempt to reduce the share of bachelor dropouts.

5 Instrumental variable analysis

To create fixed effects models we will use the panel data together with the instrumental variables (IV) techniques, in order to examine the effect of the Progression requirement. Initially, the Progression requirement was introduced by BI in 2006, in order to prevent dropouts and motivate the students to complete within stipulated time, hence, a measure to increase the quality of the students (Moe, 2007). In correspondence, we evaluate whether the Progression requirement actually improved graduation and later students' wage levels.

The IVs technique is an intriguing option for researchers interested in estimating causal relationships using observational data, especially researchers working with large-scale assessment data, consistent with what we do. The main obstacle for using this technique on large-scale assessment data, is the difficulty in finding a proper IV that suits a particular problem and fulfills all required assumptions is not easy (Pokropek, 2016).

Before all else, we emphasise that students can still graduate, even if they fail to meet the Progression requirement, if they take the required exams later. On the same token, some students may also learn to adapt to the requirement, without actually increasing in quality, which we do not control for.

5.1 The motivation behind the IV-approach

The initial idea behind this instrumental variable approach is to compare students who are close to the 30 grade point limit; one group has sufficient progression to continue, whilst the other does not. Did the introduction of the progression requirement lead to a higher proportion of students that succeeded to advance to next year studies?

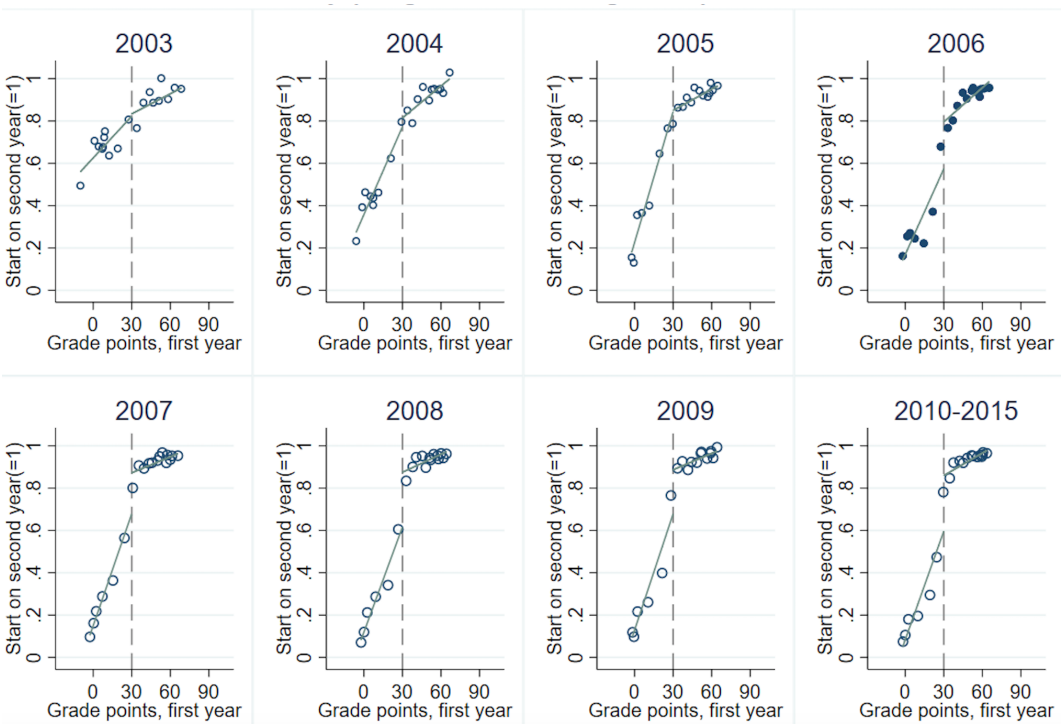

Figure 5.1: Study progression and grade points

From the figure above, we observe the relationship between the number of credits obtained in the first year of study and the tendency to advance to the second year of the bachelor's studies at BI. We note that from the year 2006, in which the requirement was introduced, there is a sudden jump in the proportion of students starting their second study year, at the 30 grade point limit. We can also pick up on the fact that with the years, it seems to be an increasing share of students which proceed to second year of studies, compared to the period before 2006, where we observe a more widespread set of observations. These initial indications for actual effects of implementing the requirement on student success, eager us to further the analysis to receive specific estimates of just how much of an impact it made.

5.1.1 Limitations

Firstly, we note that we only regard students proceeding to their second year of studies, even though there is also a 60-point limit to advance to the third year. Moving on, we have in previous analyses been looking at several labour market outcomes in order to draw stronger inferences between schooling and earnings; both wage advancements and employment rate. However, in this

section, we are forced to make some choices in order to limit the extent to the analysis. Thus, we continue by studying wage at age 25, given the fact that this is quite comparable to what we did in both Table 4.1 and 4.2. Furthermore, we distinguish between the effect of the progression requirement on graduating at some point, and graduating before turning the age 25. The idea behind this approach is to study the aspect of graduating at a certain age, in line with the regression analysis. Are there still differences, in this case when studying impact from the progression requirement, in the returns to graduating?

5.2 The instrument

To conduct this analysis, we need an instrumental variable which affect schooling, but otherwise are uncorrelated with wages. This issue has kept researchers away from estimating the true causal effect of schooling on wages (Card, 1999).

By so, we instrument $Grad_{it}$ by three controls in total:

$$Qualify_{it} = \begin{cases} 1, & 30 \textit{ grade points in year } 1, \textit{ conditional on having started} \\ & \textit{in } 2006 \textit{ or later} \\ 0, & \text{Otherwise} \end{cases} \tag{5.1}$$

Points: Denote number of grade points in year 1.
GPA: The same as in 4.1 Definitions.
i and t: The same as in 4.1 Definitions.

Stage 1: We regress $Grad_{it}$ on $Qualify_{it}$ and other controls (gradepoints, GPA, startyear and birthyear) to obtain the first stage regression using the following equation:

$$\begin{aligned} Grad_{it} &= \beta_0 Qualify_{it} + \beta_1 Points_{it} + \beta_2 Points_{it}^2 + \gamma_1 GPA_{it1} \\ &+ \gamma_2 GPA_{it2} + \gamma_3 GPA_{it3} + other\ control\ variables + u_{it} \end{aligned} \tag{5.2}$$

What is more, the basic idea behind 2SLS is that the endogenous explanatory

variable is replaced by its own estimate based on a regression on its instruments and all other exogenous variables in the model; we replace the level of schooling variable by its value fitted from the first stage of the model.

Stage 2: We therefore regress labour market outcomes on the predicted values of $\widehat{Grad_{it}}$ and other controls (gradepoints, GPA, startyear and birthyear) using the following equation:

$$\begin{aligned} Log(Wage_{it}+1) &= \delta_0\widehat{Grad_{it}} + \delta_1 Points_{it} + \delta_2 Points_{it}^2 + \gamma_1 GPA_{it1} \\ &+\gamma_2 GPA_{it2} + \gamma_3 GPA_{it3} + other\ control\ variables + u_{it} \end{aligned} \tag{5.3}$$

Further, for the instrument, $Qualify_{it}$, to be valid, it must satisfy the following conditions:

1. Instrument relevance: $corr(Qualify_{it}, Grad_{it}) \neq 0$
2. Exclusion restriction: $corr(Qualify_{it}, u_{it}) = 0$

To answer whether the first condition is satisfied, we can look at our T-value for the first stage estimate. What we observe, is in fact a T-value of 30.42 (see Appendix 4), which indeed points to the fact that the first condition for "Instrument relevance" is very much satisfied, as it indicates that the difference between $Qualify_{it}$ and $Grad_it$ is significantly different from zero.

The second condition is satisfied if the instrument $Qualify_{it}$ only affect the outcome of interest, as well as being a strong predictor of the relevant explanatory variable, i.e. be a sufficiently strong instrument (Sørensen and Greys, 2016). It is somewhat challenging to find an instrument that excludes any direct influence of whether a student completes the bachelor study or not. One could argue that the level of ability is a determinant of wages in the labour market which is highly correlated with the selection into education. Particularly, individuals with higher ability level tend to get more schooling and therefore become more attractive as employees and hence tend to have higher expected income. However, we can actually validate that the effect of the progression requirement, $Qualify_{it}$, on labour market outcomes goes "through" *Graduate*, and thus the conditions is indeed satisfied.

5.3 Principle outcomes

	Dependent variable			
	Grad[1]	*Grad 25*[2]	*Wage 25*[3]	*Wage 25*[4]
	(1)	(2)	(3)	(4)
First stage estimate	.2922	.1493		
	(.0097)***	(.0008)***		
Reduced form estimate			.2039	.2039
			(.0062)***	(.0069)***
IV- Estimates			.6978	1.3659
			(.2120)	(.4183)
Observations	32 586	32 586	30 100	30 100

Note: Robust standard errors clustered by individual in parenthesis, *** p < 0,001, ** p < 0,01, * p < 0,05. This regression model is based on an instrumental variable estimation describing the relationship between the progression requirement on graduation and future earnings. *Qualify* at the very left resembles the progression requirement in question. We split the table into two sections: The left hand side refers to the instrument effect, the introduction of a 30 grade point limit in year one, on graduation. The right hand side corresponds to the earnings effects from qualifying, both instrumented by Grad and Grad25. In both stages we control for obtaining 30 grade points in first year, GPA, startyear and birthyear. The outcome refers to bachelor students in BI only, with the selection obtained in the period 2003-2012.

1. Grad is a dummy variable for obtaining a bachelor degree, against the reference group whom never graduates.
2. Grad 25 is a dummy variable for obtaining a bachelor degree before the age of 25, against the reference group who graduates either after the age of 25 or never graduate at all.
3. Using Grad as instrument to estimate Wage 25
4. Using Grad25 as instrument to estimate Wage 25

Table 5.1: Estimated effects from progression requirement on future earnings

We use the second-degree polynomial, or quadratic form, in order to analyze initial effect of the 30 point limit. From Table 5.1, we indeed observe, from the first stage estimate, a positive effect of introducing the progression requirement; increasing the probability of completing a bachelor's degree with approximately 29% (column 1). By these means, we want to point out that all polynomials receive very similar estimates, especially for *Grad* (See Appendix 5), which makes the analysis highly robust. Further, we do observe that the effect of graduating at age 25 (column 2) is slightly less than the effect of graduating in general; around 15%, and very significant.

Further, the reduced form estimates addresses the direct effect of the instrument on wage at age 25. Strictly speaking, we look at the effect of introducing the progression requirement on wages, for those who indeed qualify for their second study year. From the table, we observe a direct positive effect on wage, approximated to 20%, which is also very significant on all conventional levels.

The final part of Table 5.1 presents the IV-estimate for graduates (column 3) and graduates at age 25 (column 4). We use these two instruments to estimate the effect on wage, both at age 25. On a first glimpse, we see that the effect of graduating leads to a wage increase of almost 70% (column 3), against those who never graduates. This is clear estimate that is significant on all conventional levels. We note that this group may or may not yet be finished with their degree, but the positive synergies between graduating at some point on wage at age 25 might come from the fact that students who graduate possesses greater abilities than those who never graduates. In column 4, we instrument Graduate at 25, with the idea to compare those who graduate at some point after 25, or never graduates, with those who graduate before the age of 25, in correspondence to previous findings from the regression analysis. We will thus be able to evaluate whether graduation age differ in the impact on wage at age 25. Confirmingly, we observe a very strong effect, a coefficient value of 1.36, which states that Graduating before the age 25 or before results in 136% higher wage.

The above-mentioned strong effects can mark several explanations. Hence, we consider whether the effects can be explained by the fact that some of the students in the selection may still be studying, and therefore is only registered with a part-time job. To control for this, as done in the regression analysis, we considering heterogeneous effects, that is distinguish between subgroups to confirm our preliminary results. Particularly, we validate whether the above argument still holds, when selecting for the full-time employees. In addition, we split the graduates in the same predefined skill-groups, to mark out differences in instrument impact.

5.4 Heterogeneity in second stage

As the main idea behind the instrumental variable approach is to compare students who are close to the 30-point limit, such a design requires that students near the border are somewhat comparable. This can be investigated by looking at high school GPA, as conducted in the regression chapter. Thus, we are able to study the estimated effects for the marginal students exclusively.

5.4.1 Heterogeneous effects

	Dependent variable
	Wage 25
Qualify	(1)
Employed at 25 years[1]	
Graduating before 25	1.8673
	(.4913)***
Observations	21 683
R-squared	0.0049
Marginal students[2]:	
GPA $<$ 3.5	
Graduating before 25	.7762
	(1.0565)
Observations	9 429
R-squared	0.0218
Non-marginal students[3]:	
GPA $=>$ 3.5	
Graduating before 25	1.4954
	(.4019)***
Observations	20 671
R-squared	0.0079

Note: Robust standard errors clustered by individual in parenthesis, *** p $<$ 0,001, ** p $<$ 0,01, * p $<$ 0,05. This table functions as an extension of the analysis from Table 6. The heterogeneous effects describes the relationship between the progression requirement on student success, with main outcomes referring to the effect of introducing a progression requirement on wage. We include a set of sub-groups, that is selecting on employed 25 years, only marginal students and only non-marginal students. The outcome refers to bachelor students in BI only, with the selection obtained in the period 2003-2012.

1. Selecting on the students that are full-time employees and have graduated at age 25 (against the reference group)
2. Addressing the return to schooling for the lower ability individuals; selecting on students with an average GPA of lower than 3.5
3. Addressing the return to schooling for the higher ability individuals; selecting on students with an average GPA of equal to or above 3.5

Table 5.2: Heterogeneous effects of progression requirement on future earnings

Surprisingly, we observe a continuous positive effect when selecting on full-time employees, but now even stronger; 186%. Indeed, we expected the percentage to decrease against the IV-estimate of 136% as we exclude the part-time workers. By the means of it, it does not seem to be the case that part-time students disturb our preliminary estimates, which is indeed a positive finding for the validity of the IV analysis. However, it is important to emphasize the observed high standard errors, and it is therefore an uncertainty related to the estimate; 1.86 is a point estimate. In relation, this might be because of what is previously mentioned; there may exist some weaknesses in our employed variable, as we only control for working hours. Thus, it may be the case that a number of observations fulfill the number of hours worked without getting a salary, e.g. interns and volunteering.

The essence of this thesis as a whole is to compare students with different ability and skill-sets, and in relation, we study the estimates obtained for the marginal and non-marginal students. We quickly note that the non-marginal students have a 72% higher positive effect from the progression requirement on future earnings than what the marginal students do. Again, we can point to continued evidence for larger benefits from a bachelor education at BI for the non-marginal students. However, we do note that the estimate obtained for the marginal students are not significant on any levels, which makes it problematic to draw strong conclusive inferences on these results alone.

6 Conclusion

This thesis contributes to recent literature on the returns to schooling, in particular, the economics of education. Throughout our analysis, we have studied several aspects of the earnings effect from graduating BI, where impact from student ability has been fundamental in an attempt to determine who benefits the most from taking an academic degree. The study focuses on comparing marginal students to non-marginal students, defined by using high school GPA of 3.5 as threshold. Previous studies within the field have found inconsistent results regarding the returns to education for individuals from different parts of the skill-distribution. Harmon and Walker (2001) and Barrow and Malamud (2015) found evidence for larger labour market benefits from education for the academically stronger students. Brand and Xie (2010) and Zimmerman (2014), on the other hand, found evidence for negative selection, that students with lower ability experienced larger returns to completing a higher education. Thus, as other research seems inconsistent in who actually benefits the most from higher education, we found it highly relevant to study these effects. In addition, limited studies have been conducted on this area of research in the Norwegian labour market, and with an increasing number of students in business administrative fields, along with a decreasing labour market demand for such competence, we found this to be a study of high relevance to future labour market functions.

Our main findings suggests that completing a bachelor's degree from BI Norwegian business school, before turning 25, increases wages at age 25 by 62%, and respectively with 36 % for those completing at some point after the age 25; both estimates compared to the reference group whom never graduates. This points to substantial positive effects from graduation on earnings. In addition, we also found the effect of graduating before the age of 25 to increase the degree of employment, at age 25, with respectively 13%. What is more, as we intend to study student ability and its impact, we found that the non-marginal students, graduating before turning 25, earns almost 20 % more than the marginal students in the same category. This earnings difference also remained at a later stage in the career, however not to as large of an extent. In addition, we used

an IV-approach to estimate graduation and earnings effects from introducing a Progression requirement, proving that it for a fact increased student quality by resulting in a 29% higher share of graduates, and in turn causing a 20% wage growth for the 25 year olds. Lastly, when dividing the students, we find that the non-marginal students wage returns were 72% higher than the for marginal group, even though these results were not very significant. Again, we point to large earnings differentials between the two ability groups.

Clearly, our analysis are specific to students attending a bachelor's degree at BI only, and hence may raise concerns about the general nature of the results and thereby the implication of it. Accordingly, we have included additional ability controls to strengthen our analysis, such as GPA, parental education level and sibling fixed effects. Nonetheless, as there are many aspects in which can affect future earnings, we have to mention the possibility that our estimates impose some form of omitted variables biases, as not all controls may have a causal effect on earnings. With this said, we can not conclude that our findings can function as a generalization of all students in higher education in Norway, but they do seem to point to a trend regarding who benefits the most from an academic degree.

Studying the relationship behind the variations in school performance allowed us to take part in a complex discussion. Future research on labour market outcomes for marginal students would be very valuable in terms of gaining a deeper understanding of the benefits of higher education, particularly who benefits more from an academic degree. Moreover, our conducted research lays ground for further research within the field. On the same note, BI might benefit from further research on student quality and earnings outcomes by evaluating other students, such as master students, in accordance to the ongoing debate regarding possible over-education. It may also be highly relevant to perform similar research in other institutions, in occupational study paths, as the Norwegian educational system are under continuous pressure to meet market demand, in regards to recent debate on future labour market prospects. Thus, corresponding research of the sort may provide important suggestions for future selection into education, as it indeed is of substantial relevance for proper labour market allocations.

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Apendix

Variable	Notation	Measurement
Bachelor candidate	Bachelorkandidat_year	Corresponds to students enrolled in three years-bachelor program
Employed 25	Employed25_new	Dummy variable; equal to 1 if employed, with employed defined as working 30hrs per week or more at age 25.
Employed 30	Employed30_new	Dummy variable; equal to 1 if employed, with employed defined as working 30hrs per week or more at age 30.
Employed 35	Employed35_new	Dummy variable; equal to 1 if employed, with employed defined as working 30hrs per week or more at age 35.
Fathers education	NUS2000_FAR_16	Control for fathers highest educational level
Gender	gender	Dummy variable; equal to 1 if gender equals female
GPA High school	gpavgs	Grade point average from high school
GPA High school round	gpavgs_round	Grade point average from high school, rounded from 1-6
Grade points	GradePoints	Number of grade points for graduates and undergraduates
Grade points year 1	GP1	Number of grade points in first year (data from 2003)
Grade points year 2	GP2	Number of grade points in second year (data from 2003)
Grade points year 3	GP3	Number of grade points in third year (data from 2003)
Graduate degree	Grad	Dummy variable; equal to 1 for students that completed their degree
Graduate degree SSB	Grad	Dummy variable; equal to 1 for students that completed their degree (statistics Norway definitions)
Graduated at 25	GradAge25	Students graduating at age 25, calculated by graduation year – year of birth. Controlled for observations in the population above 60 years old.
Graduated at 30	GradAge30	Students graduating at age 30, calculated by graduation year – year of birth. Controlled for observations in the population above 60 years old.

Graduated at 35	GradAge35	Students graduating at age 35, calculated by graduation year − year of birth. Controlled for observations in the population above 60 years old.
Graduation year	GradYear	First graduation year
Income 25	logIncome25	Income level at 25. Controlled for zero income or negative income. In order to find 25 year olds in the population we use year of birth = current year - 25.
Income 30	logIncome30	Income level at 30. Controlled for zero income or negative income. In order to find 30 year olds in the population we use year of birth = current year - 30.
Income 35	logIncome35	Income level at 35. Controlled for zero income or negative income. In order to find 35 year olds in the population we use year of birth = current year - 35.
Marginal students	MargStud	Dummy variable; equal to 1 for students having a grade point average from high school of lower than 3.5.
Master candidate	Master_year	Corresponds to students enrolled in the two years-masters program
Mothers education	NUS2000_MOR_16	Control for mothers highest educational level
Mothers identification number	lnr_fnr_mor	A randomly assigned number to identify individuals in the data set, in this case only student with the same mother
Number of siblings	antsoske	Number of siblings (including self)
Old bachelor candidate	CandMag_year	Corresponds to students enrolled in the old bachelor program before 2003, a four year program
Program	Program	The program in which students are enrolled to, where we exclusively look at program==2 being bachelor candidates
Progression requirement in first year	GP_30	Dummy variable for 30 grade points in first year
Progression requirement in second year	GP_60	Dummy variable for 30 grade points in second year
Start year	StartYear	Start year on study program
Student birth year	faar	Student birth year
University candidate	Hoyskolekandidat_year	Corresponds to students enrolled in universities

Wage 25	logWage25	Wage level at 25. Controlled for zero income or negative income. In order to find 25 year olds in the population we use year of birth = current year - 25.
Wage 30	logWage30	Wage level at 30. Controlled for zero income or negative income. In order to find 20 year olds in the population we use year of birth = current year - 30.
Wage 35	logWage35	Wage level at 35. Controlled for zero income or negative income. In order to find 35 year olds in the population we use year of birth = current year - 35.
Wage increase 25-30	DlogWage2530	Wage increase from age 25 to age 30
Working hours at 25	Arbtid_25	Number of working hours at age 25
Working hours at 30	Arbtid_30	Number of working hours at age 30
Working hours at 35	Arbtid_35	Number of working hours at age 35

Table 1: List of variables

	Observation[1]	Mean[2]	Std. Dev.[3]	Min[4]	Max[5]
Start year	32 588	2007.77	2.8467	2003	2012
Gender	32 588	.4887	.4998	0	1
Graduate degree	32 588	.6444	.4786	0	1
Graduate degree SSB	32 588	.4869	.4998	0	1
Grade points	32 588	126.39	78.61	0	416
GPA High school	32 588	3.7704	.5594	1	6
Marginal students	32 588	.3083	.4617	0	1
Graduated at 25	32 588	.3415	.4742	0	1
Graduated at 30	32 588	.4471	.4972	0	1
Graduated at 35	32 588	.4714	.4991	0	1
Employed 25	32 588	.7078	.4547	0	1
Employed 30	32 588	.9514	.2148	0	1
Employed 35	32 588	.9643	.1853	0	1
Wage 25	30 100	244 089	175 568	0	2 794 200
Wage 30	17 682	426 675	276 348	0	8 291 300
Wage 35	5 487	447 828	332 801	0	4 005 149
Income 25	30 100	255 263	178 090	0	3 372 560
Income 30	17 682	443 158	277 369	0	8 291 300
Income 35	5 487	444 558	332 575	0	4 005 149

Note: The table works as a representation of all descriptive statistics of relevance to enlighten our respective study. The variables of interest is chosen to get an overview of how bachelor students at BI perform in general, and can be described as key measures to predict the outcome of our study.

1. The number of observations includes all students from the period 2003 until 2012 that completed a bachelor degree at BI Norwegian Business School. We can behold that the number of observations diminish with age, as not all students from our data set has reached that certain age.
2. Representation of the mean from all observed values in each of the chosen variables The standard deviation reflect the amount of variation in our set of data, or how far each variable measure lies from the mean
3. The minimum observation for each of the dependent variables chosen. We can observe that we deal with five dummy variables, with value of either 0 or 1
4. The maximum observation for each of the dependent variables chosen. For grade points we can spot that the maximum value of 416 points means that one observation in our data set has more than one bachelor degree of respectively 180 grade points.

Table 2: Extended table 3.1

		Dependent variable			
		Wage 25	Wage 30	Wage increase[1]	Employed 25[2]
		(1)	(2)	(3)	(4)
Panel A: Baseline model					
	Graduated after age 25	.3645	.5646	.2852	.0039
		(.0401)***	(.0568)***	(.0659)***	(.0062)
	Graduated before age 25	.6191	.8134	.2419	.1293
		(.0373)***	(.0525)***	(.0629)***	(.0060)***
	Observations	30 100	17 682	17 123	32 588
	R-Squared	0.0324	0.0782	0.0227	0.1073
Panel B: Parent's educational level[3]					
	Graduated after age 25	.3772	.5389	.2299	.0039
		(.0416)***	(.0591)***	(.0691)***	(.0289)
	Graduated before age 25	.6149	.7815	.1998	.1293
		(.0380)***	(.0548)***	(.0662)**	(.0060)***
	Observations	28 662	16 597	16 138	30 227
	R-Squared	0.0919	0.1354	0.0802	0.1524
Panel C: Sibling fixed effects and parity[4]					
	Graduated after age 25	.5473	.6814	.3275	.0376
		(.1786)**	(.3926)	(.3938)	(.0287)
	Graduated before age 25	.6024	.3507	-.1766	.1207
		(.1535)***	(.3576)	(.3744)	(.0269)***
	Observations	3 224	1 104	1 064	3 492
	R-Squared	0.5713	0.5869	0.5595	0.5601
Additional Panel D: High school GPA[5]					
	Grade 3	1.3205	-1.9266	-3.9648	-.2504
		(.8282)	(3.0477)	(3.2323)	(.1797)
	Grade 4	1.4349	-2.1651	-4.1075	-.2460
		(.8435)	(3.0688)	(3.2456)	(.1815)
	Grade 5	1.4229	-2.3789	-4.5064	-.1984
		(.8566)	(3.1037)	(3.2796)	(.1850)
	Grade 6	1.2191	-1.7137	-3.5859	-.5158
		(1.0115)	(3.1825)	(3.4284)	(.1965)
Additional Panel E: Parity[6]					
	2	.1577	.8191	.0278	.0739
		(.1946)	(.4821)	(.5421)	(.0319)
	3	.4005	2.2189	1.0643	.0617
		(.3817)	(.9716)	(1.0765)	(.0621)
	4	.6592	1.7787	.5396	.0106
		(.5349)	(1.3588)	(1.4811)	(.0978)
	5	1.6300	2.7702	-.4804	-.0296
		(.9057)	(1.7428)	(1.8809)	(.1260)

Note: Robust standard errors clustered by individual in parenthesis, *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.This regression model is based on a mincer earnings function describing the relationship between schooling and earnings, with main outcomes referring to the effect of graduating against the reference group who never graduates. The baseline model includes control for GPA, gender, startyear and birthyear. Additional control for parental education and sibling fixed effects is incorporated to investigate whether any effect of graduating on wage is sufficiently strong to still be present in these controls. We note that all controls are coded as dummy variables. The table reports estimated coefficient of earnings outcomes for graduating on four dependent variables (1) - (4). The outcome refers to bachelor students in BI only, with the selection obtained in the period 2003-2012.

1. Wage increase correspond to the differences in wage from age 25 to age 30
2. Employed 25 represents those in the selection that are employed at the age 25. As earlier, employed is defined by working 30 hours or more per week
3. Controlling for the highest obtained education of the parents; a very detailed control including many dummy variables for both mothers and fathers' educational level from 1-8 in addition to type of education. This control also includes the same controls as the baseline model; GPA, gender, startyear and birthyear.
4. Controlling for sibling fixed effects, where having siblings refers to having at least one or more sibling attending BI. This control also includes the same as the baseline model; GPA, gender, startyear and birthyear, and also parity. Parity is additional control for the impact of which number you are in the sibling flock.
5. Grade point average from high school, where the outcomes corresponds to estimated effect on the dependent variable against the reference group with a GPA of 2 or lower
6. Number in the sibling flock

Table 3: Extended table 4.1

	Dependent variable			
	Grad[1]	*Grad 25*[2]	Wage 25[3]	Wage 25[4]
	(1)	(2)	(3)	(4)
First stage estimate	.2922	.1493		
	(.0097)***	(.0008)***		
T-value	30.42	18.72		
Reduced form estimate			.2939	.2939
			(.0062)***	(.0062)***
T-value			3.29	3.29
IV-Estimates			.6978	1.3659
			(.2021)	(.4183)
Z-Value			3.29	3.27
Observations	32 586	32 586	30 100	30 100

Note: Robust standard errors clustered by individual in parenthesis, *** p < 0,001, ** p < 0,01, * p < 0,05. This regression model is based on an instrumental variable estimation describing the relationship between the progression requirement on graduation and future earnings. *Qualify* at the very left resembles the progression requirement in question. We split the table into two sections: The left hand side refers to the instrument effect, the introduction of a 30 grade point limit in year one, on graduation. The right hand side corresponds to the earnings effects from qualifying, both instrumented by Grad and Grad25. In both stages we control for obtaining 30 grade points in first year, GPA, startyear and birthyear. The outcome refers to bachelor students in BI only, with the selection obtained in the period 2003-2012.

1. Grad is a dummy variable for obtaining a bachelor degree, against the reference group whom never graduates.
2. Grad 25 is a dummy variable for obtaining a bachelor degree before the age of 25, against the reference group who graduates either after the age of 25 or never graduate at all.
3. Using Grad as instrument to estimate Wage 25
4. Using Grad25 as instrument to estimate Wage 25

Table 4: Extended table 5.1

		Dependent variable
		Grad
First stage regression	1^{st} degree polynomial	.2677467
Polynomials in grade points		(.009103)***
	2^{nd} degree polynomial	.2945642
		(.0092621)***
	3^{rd} degree polynomial	.2401889
		(0.138038)***
	Observations	32 586

Note: Robust standard errors clustered by individual in parenthesis, *** p < 0,001, ** p < 0,01, * p < 0,05. This regression model is based on a instrumental variable estimation describing the relationship between the progression requirement on graduation, with main outcomes referring to the effect of graduating against the reference group who never graduates. The baseline model includes control for GPA, startyear and birthyear. The outcome refers to bachelor students in BI only, with the selection obtained in the period 2003-2012.

Table 5: First stage polynomials for Grad