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Thesis Master of Science

Does a master's degree at BI generate added value for a bachelor's graduate?

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MASTER THESIS REPORT

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This master thesis is the concluding work for our 2-year long master's degree program of Master of Science in Business, major in finance. We found writing about our thesis a challenging yet interesting journey. We believe that our thesis would be insightful and informative for students who are considering taking a master's degree at BI Norwegian Business School. We are also grateful to have managed to finish our thesis during these very difficult times for everyone amidst the COVID-19 crisis.

We would like to express our special gratitude and thanks to our considerate supervisor Espen Henriksen for his guidance and provision of valuable insights during the process of writing our thesis paper.

Moreover, we also would like to thank Quirino Puzo, who is a data analyst at BI Norwegian Business School, for providing us with the data required and necessary for making analyses and evaluations in our thesis.

Abstract

The aim of our master thesis is to investigate whether taking a master's degree at BI Norwegian Business School generates added value in terms of lifetime salary earnings for a bachelor graduate. In addition, we plan to interpret and examine the main contributing factors that give the student the added value from attending the master's degree at BI.

By performing an empirical study and creating our own tailor-made NPV model that is well-suited to a BI student, we found out that attending a master's degree contributes to an added value by generating a positive NPV of NOK 3.5 million. We also analyze the importance of the key variables contributing to the added value by formulating a regression model to study the impact of different factors on educational returns (i.e. salary). Consequently, we found out that 'Master program', 'Age', 'Male', 'Grade', 'EFCAB' and 'TESLO' are the most significant variables that explain the added value to the starting salary of BI graduates.

Simultaneously, we acknowledge that there is a concern of endogeneity in our analyses and that this could lead to a bias in our results, meaning that the key dependent variable 'salary' and the independent variable "Master program" could be influenced by other unobservable endogenous variables such as human capital. This could impact not only the student's decision whether he/she should attend a master's program, but also impact his/her starting salary at a later stage. Despite this concern, we believe our findings and results give valuable insights into the valuation of a master's degree.

In conclusion, our thesis suggests that pursuing a master's degree at BI is a profitable and worthy long-term investment for students and therefore, we recommend that bachelor students should invest their time and effort in a 2-year master's program for lifetime value creation.

CONTENTS

1. INTRODUCTION

1.1. Background Information

In recent years, studies have shown that there has been an increasing number of students enrolling in higher education in Norway in terms of bachelor's, master's, and Ph.D. degrees. According to Statistisk Sentralbyrå (2021), 35.8% of the Norwegian youth population between 19-24-year-olds were in higher education in 2019, which is a progressive increase from 30.7% in 2009. This means that the increase is not only due to population growth, but also is a relative increase in students attending higher education in Norway.

Some jobs where only a bachelor's degree was necessary to apply in the past, now require a master's degree. For example in the U.S., the number of graduate students has tripled since the 1970s, and according to some estimates, 27% of employers now require master's degrees for roles in which historically undergraduate degrees sufficed (Chamorro-Premuzic, 2020). This point is also supported in the increasingly bigger gap in the premium salary development of a bachelor's degree versus a master's, and it seems that because of the increase in the amount of bachelor's degree students, a master's degree is deemed necessary to differentiate yourself from the flock. People who have graduate school degrees are generally paid more money than those who do not. While a 25% increase in earnings is the average boost people see, attending the top MBA programs can increase your salary by as much as 60-150% (Chamorro-Premuzic, 2020).

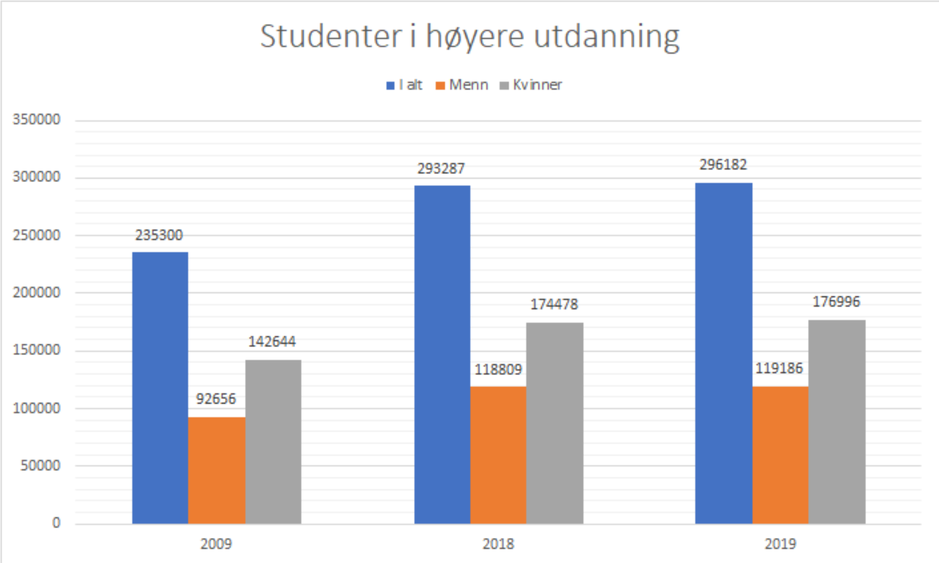

Figure 1: Number of students in higher education (Statistisk sentralbyrå, 2021)

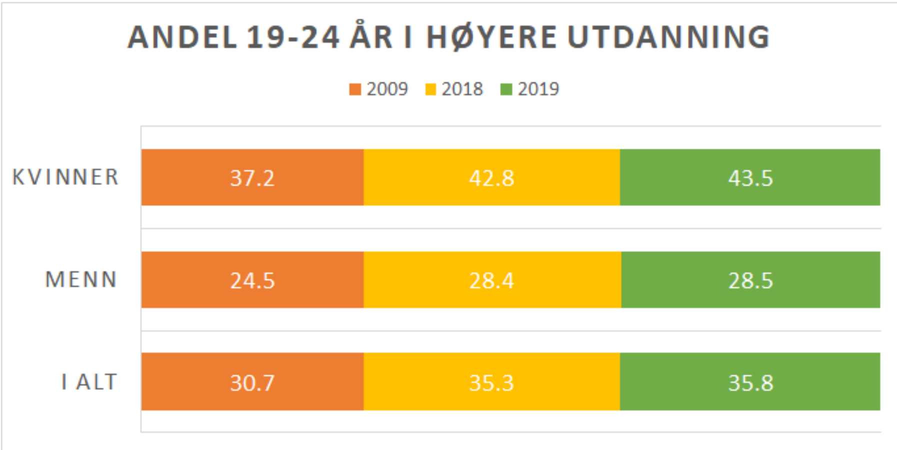

Figure 2: Share of 19-24-year-olds in higher education (Statistisk sentralbyrå, 2021)

1.2. Motivation & Objectives

Since the importance of higher education, especially the master's degree, is rapidly growing nowadays, therefore in our thesis, we are motivated to find out whether our investment in our futures in regards to a master's degree in BI is worth it, both in terms of money spent as well as time invested in our studies. Moreover, we also want to investigate the potential upside or downside of our past decisions of enrolling for a master's degree at BI and see whether we can learn from them and highlight the right decision. After having gone through a lot of material on the value of education internationally, we are eager to find out if this kind of data and information are also made available for students making their decision to enroll in a master's degree in Norway, and particularly at BI. What we discovered was that the information in Norway was lacking and as a result, we wish to contribute to this lacking data with our research. An additional goal of our paper would be to hopefully encourage others, who are unsure about whether taking a master's at BI, that it is worthwhile and to prove the economic significance of having a master's degree in this day and age.

In order to fulfill the purpose outlined above, we performed an empirical investigation and analysis by first developing our own tailor-made net present value model in this thesis paper to examine the added value and premium salary generated from attending a master's degree at BI. By building this NPV model, we were also able to identify the return on investment and internal rate of return for attending a master's degree at BI. In addition, we implemented a sensitivity analysis to compare how the results from our NPV model vary under different circumstances. Finally, we also intend to uncover the most relevant observable factors and variables that generate added value to a student who completes a master's degree at BI Norwegian Business School while still acknowledging the issues related to endogeneity, which we will discuss in detail later on in our thesis. Overall, our thesis aims to investigate the research questions indicated below.

Main research question:
Does a master's degree at BI generate added value for a bachelor's graduate?

Sub research question:
What are the most important factors that give a student added value from attending a master's program at BI Norwegian Business School?

1.3. Roadmap

In Section 2 and Section 3, we make a review on how our thesis is connected to existing literature, and explain theories and key concepts that are relevant and crucial for setting up our analysis. Moreover, Section 4 outlines the hypotheses we are going to test out, while Section 5 clarifies our process in collecting necessary data and variables useful for our study. Section 6 contains detailed information on the designation of our methodological approach which is key to answer our research questions. Thereafter, we present our results in Section 7 and further perform a multicollinearity test for our regression models in Section 8. In Section 9, we elaborate on the limitations in our thesis and propose ideas on how our study could be further developed for future research. Ultimately, we make our final conclusions about our thesis in Section 10.

2. LITERATURE REVIEW

2.1. Returns of Higher Education

There have been hundreds of papers written in the field of education economics regarding the computation of the returns of higher education. One of the most important and extensive pieces of literature in this segment is that of Mincer (1974). In his literature, he discussed the returns to education using the remarkable semi-log Mincer equation:

$$log\, y = log\, y_0 + \mathrm{r}S + \beta_1 X + \beta_2 X^2 \qquad (2.1)$$

In this equation the variables have the following meanings: y is the earnings; the intercept y_0 is the earnings of someone with no education and experience; S is years of schooling; X is potential labor market experience; the parameters r, β_1, and β_2 can be interpreted as returns to schooling and experience.

According to Lemieux (2006), the Mincer equation has become the ‘workhorse’ of empirical research on earnings determination and it has been estimated on thousands of datasets for a large number of countries and time periods which clearly makes it one of the most widely used models in empirical economics. Moreover, its popularity lies in the fact that this Mincer equation is based on a formal model of investment in human capital (Lemieux, 2006).

The next literature applicable to our thesis is that of Webber (2016), which examines the value of a college degree over a lifespan of work. It takes into account factors such as major, student loans, and individual ability when finding financial value. One of the equations included in the methodology of the literature is as follows:

$$y_{ij} = \alpha_0 + \alpha_1 Age_{ij} + \alpha_2 Black_i + \alpha_3 Hisp_i + \alpha_4 Gender_i + Educ_i \gamma + \varepsilon_{ij} \quad (2.2)$$

In this case, the dependent variable is the natural log of various factors such as age, cultural background, gender as well as education level. The methodologies used in both Mincer (1974) and Webber (2016) are relevant to our vision on how we want to go forth in our thesis, which is to simulate and estimate the lifetime earnings trajectory of returns on education based on different factors.

Another relevant piece of literature is that of Lobo & Burke-Smalley (2018). Their studies compare the financial value of taking a bachelor's degree compared to alternative costs of working after high school by computing NPV and IRR estimates for bachelor's degrees in the US. In their NPV model, they include both the incremental future earnings of an individual with a degree as well as the present value of the incremental cost. The cost consists of the tuition fees that are growing at a historical tuition inflation rate, as well as potential interest payments on the student loans. In addition, their studies also include the graphical illustration of the differences in wage profiles of high school graduates and college graduates from all majors, and it shows that there is a massive wage differential between these two wage profiles. In conclusion, the literature states that a college degree will generate a positive NPV only if tuition fees remain below a certain level, and debt-financing in comparison to self-financing produces a higher return.

2.2. Endogeneity

In our thesis, we consider the endogeneity problem as a noteworthy issue to determine and acknowledge when finding which factors are most significant in explaining the starting salary for the graduates at BI. Endogeneity is most commonly described in the context of ordinary least squares (OLS) estimation and refers to a situation in which an independent (explanatory) variable correlates with the structural error term (also referred to as 'disturbance term' or 'residual') in a model (Zaefarian et al., 2017). Endogeneity may occur due to the omission of variables in a model and if such variables are omitted from the model and thus not considered in the analysis, the variations caused by them will be captured by the error term in the model, thus producing endogeneity problems (Zaefarian et al., 2017). Endogeneity bias can lead to inconsistent estimates and incorrect inferences, which may provide misleading conclusions and inappropriate theoretical interpretations (Ullah et al., 2018). Sometimes, such bias can even lead to coefficients having the wrong sign (Ullah et al., 2018).

There are several methods used by researchers to solve and address the endogeneity problem. Lynch & Brown (2011) suggests that endogeneity issues can be solved by (1) finding "replacement" variables ("instruments") that are correlated with an endogenous x variable but are uncorrelated with the error term, (2) regressing the original x variable on these instruments and forming predicted values from this result to replace the original endogenous x, and (3) regressing the outcome on the exogenous x variables and the predicted values formed in step (2). Moreover, Shepherd (2019) stated that the most common approach to solve this issue is to lag the suspect variables by one or more periods.

Nevertheless, the error term in endogeneity bias is unobservable, so there is no direct way to statistically test that an endogenous variable is correlated with the error term (Ullah et al., 2018). Also, exogenous variables are probably never exogenous precisely (Ketokivi & McIntosh, 2017). It is therefore almost impossible to statistically ensure that an endogeneity problem can be completely resolved (Roberts & Whited, 2012).

For our master thesis, we want to expand on these ideas related to returns of higher education while also acknowledging the endogeneity problem, and find that BI business school is the best comparison given that it is a private university in Norway and the school we attend. We found that there was a gap in terms of information about the value of education specifically in Norway. Thus, in our thesis, we want to fill this gap and make it possible for future research to build on our findings and ideas. In addition, we think that because of the increasing number of students taking a higher education degree, it is now more important to look at the comparison between having a master's degree and a bachelor's degree instead of comparing a bachelor's degree to a high school diploma.

3. THEORETICAL FRAMEWORK

In this session, we are going to present the relevant theories that have a connection with our master thesis.

3.1. Net Present Value (NPV)

Arshad (2012) claims that the net present value is the sum of all the future cash flows to determine the present value. Cash flows include both cash inflows and outflows as following:

$$NPV = \textit{Cash inflows} - \textit{Cash outflows or expenditure of Investment} \tag{3.1}$$

The net present value actually shows the sum of the present values in excess of its cost at some defined rate of interest or discount rate (i) (Arshad, 2012). PV formula is applied when calculating NPV. Net present value is the excess of present value (PV) of future cash inflows to be generated by a project over the amount of initial investment (I) (Arshad, 2012).

$$NPV = PV - I \tag{3.2}$$

$$NPV = -CF_o + \frac{CF_1}{(1+i)^1} + \frac{CF_2}{(1+i)^2} + \dots\dots\dots\dots \frac{CF_1}{(1+i)^n} \tag{3.3}$$

When the NPV is positive, this means that the value of cash inflows is greater than the value of cash outflows. This indicates that the investment is favorable and yields positive returns. On the other hand, when NPV is negative the value of cash outflows is bigger than the value of cash inflows, thus the investment will result in a net loss. If NPV is zero, then there is no loss or gain.

3.2. Internal Rate of Return (IRR)

NPV describes the value of the investment in amount but IRR shows the amount in percentage (Arshad, 2012). Paltrinieri & Khan (2017) defined IRR as the discount rate at which the present value of all future cash flows is equal to the initial investment, that is, the rate at which an investment breaks even. It can be calculated as:

$$NPV = -CF_o + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \dots\dots\dots\dots \frac{CF_1}{(1+r)^n} \quad (3.4)$$

Here IRR (r) is a rate of return for which the NPV is zero. The higher an investment's IRR, the more desirable it is to carry on with the investment (Paltrinieri & Khan, 2016). Ebrahimi & Keshavarz (2015) stated that the calculation of IRR is vital for the economic valuation because it calculates the profitability margin (IRR - discount rate) of the project. If IRR is greater than the discount rate, then the investment is safe and adds value. Otherwise, if IRR is less than the discount rate then the investment is bad and deteriorates value.

3.3. Return On Investment (ROI)

In general, return on investment (ROI) is a performance measure used to evaluate the efficiency of an investment or compare the efficiency of a number of different investments (Fernando, 2020). It measures the amount of return on a particular investment in relation to the cost of that investment. There are several versions of the ROI formula. Some of the most common ones are:

$$ROI = \frac{\text{Net Income}}{\text{Cost of Investment}} = \frac{\text{Return (Benefit)}}{\text{Investment (Cost)}} \tag{3.5}$$

Frank & Hovey (2014) claims that return-on-investment (ROI) analysis can be used to identify the most impactful and cost-effective education programs. It is a rational and reasonable way to consider, for instance, whether the master program is the best option to maximize returns from your scarce dollars or not, in comparison to the bachelor program.
The key difference between NPV and ROI methods is that NPV measures the cash flow of an investment when ROI measures the efficiency of an investment (DB, 2021). On the other hand, ROI can also be an alternative method of analyzing the investment compared to IRR. According to Banton (2020), both ROI and IRR are performance measurements for investments or projects. However, ROI is more common than IRR, as IRR tends to be more difficult to calculate—although the software has made calculating IRR easier (Banton, 2020). ROI indicates the total growth, start to finish, of an investment, while IRR identifies the annual growth rate (Banton, 2020).

4. HYPOTHESES

Our mission in this thesis is to find out whether a master's degree is a valuable investment decision for a bachelor graduate. In order to capture this valuation, we have different parameters to assess such as net present value, the return on investment, and the internal rate of return. In addition, we will also look at which variables are the most significant and bestow added value to students for attending a master's program at BI Norwegian Business School.

Hypothesis 1:

Does a master's degree at BI generate a positive valuation for its students?

H_0*: It generates a positive valuation and adds value for the students.*

Hypothesis 1a:

Does taking a master's degree at BI generate a positive NPV decision for a bachelor student?

H_0: It does generate a positive NPV by making a decision to take a master's degree.

Hypothesis 1b:

As a bachelor student, does investing your time, resources, and effort in taking a master's degree at BI, generate a high-performing return on investment decision?

H_0: Taking a master's degree generates a high-performing ROI.

Hypothesis 1c:

Does the internal rate of return exceed the cost of financing for taking a master's degree at BI?

H_0: The internal rate of return exceeds the cost of financing.

Hypothesis 2:

Do the variables 'Age', 'Master', 'Gender', 'Grade', 'PrivateSector' and 'Industries' provide the students with the additional value from attending their bachelor and master's program at BI?

H_0: These variables 'Age', 'Master', 'Gender', 'Grade', 'PrivateSector' and 'Industries' are significant in explaining the added value to the starting salaries of BI students.

5. DATA COLLECTION

5.1. Data Sources

For the purpose of our thesis, we are required to have access to the historical and quantitative data regarding the salaries and other necessary information of BI's alumni who have completed either a bachelor's or master's at BI. The main data source for this is from BI's annual labor market survey and for this, BI has provided us with two different datasets for individuals who responded to these surveys alongside the variables we require for our empirical analysis. The first dataset is for the alumni who had graduated during 2015-2019, and this consists of information about the variables 'sector', 'industry', 'salary', 'program', 'gender', and 'age' of each graduate student. Another dataset is for the alumni who graduated during 2018-2019, which involves previously mentioned variables as well as the ' average grade' of each graduate.

5.2. Limitations of Data

One of the limitations in our data collection process is the time frame. In the early stages of our thesis, our intention was to analyze the salary data of BI students for the past 30 years. However, the earnings data available to us regarding BI's alumni is only from the previous 5 years (2015-2019).

In addition, there are some typing errors and extreme outliers since some cells in the datasets provided by BI were typed manually. The most common mistake contained in the dataset is an extra or one less zero for salary data of some alumni students. To solve this, we are required to clean and filter the data before carrying out our analysis by removing extreme outliers as well as making some modifications to the salary data.

Moreover, some of the most important variables necessary when trying to explain the added value in starting student salaries are in fact unobservable and not provided by our datasets. The unobserved variables could be attributes related to human capital such as problem-solving skills, willingness to work hard, communication skills, experience, wisdom as well as creativity. As a consequence, we can only use the variables available to us that are in fact observable and quantifiable. This results in a problem of endogeneity.

5.3. Data Transformations

Almost all variables in the datasets we obtained from BI are categorical, apart from the 'salary' variable which is denoted by numerical values in our datasets. In order to be more informative with the categorical data, we transformed and coded the categorical variables either into numerical labels or dummy variables. Suits (1957) stated that the dummy variable is a simple and useful method of introducing into a regression analysis information contained in variables that are not conventionally measured on a numerical scale, e.g., race, sex, region, occupation, etc. Where a categorical variable has more than two categories, it can be represented by a set of dummy variables. It takes values of 0 and 1, where the values indicate the presence or absence of something (Bock, 2018).

5.4. Description of Variables

The description of the variables we use in our empirical investigation and regression analysis is demonstrated as below:

<u>Dependent Variable</u>

'salary': the annual 100% full-time salary that the graduate gains approximately 6 months after graduation (in NOK).

<u>Independent Variables</u>

'sector': the sector in which the graduate is employed.

{Private sector = 1}, {Public sector = 0}

'industry': the job industry in which the graduate is employed.

This variable consists of 30 different industry categories according to the datasets provided by BI. Hence for the sake of the regression's feasibility in accordance with the number of observations, we decided to consolidate some common and homogeneous categories into more specific group sectors as follows:

- Economics, Finance, Consultancy, Accounting & Business (EFCAB)
- Building, Real-estate, Industry, & Production (BRIP)
- Private & Public services (PPS)
- Tech, IT, Media, PR, & Telecom (TIMPT)
- Transport, Energy, Shipping, Logistics & Oil (TESLO)
- Hotel, Restaurant, Travel, Arts, & Culture (HRTAC)

'program': the highest level of education obtained by the graduate.

{Bachelor = 0}, {Master = 1}

'grade': average grade achieved when last graduated.

{A = 6}, {B = 5}, {C = 4}, {D = 3}, {E = 2}, {F = 1}

'gender': {Female = 0}, {Male = 1}

'age': the age group to which the graduate belongs.

{Under 23 = 1}, {23 to 25 = 2}, {26 to 28=3}, {29 to 31 = 4}, {32 or older = 5}

6. METHODOLOGY

6.1. Formulation of NPV Model

In order to answer our main research question, which is whether or not having a master's degree at BI generates added value for a bachelor graduate, we construct our own tailor-made NPV model that reflects the lifetime value creation of having a master's degree from BI as a graduate.

Our approach to answering this question is by first assuming that the student of interest in our NPV model is a 19-year old who has two options: (1) commit to a three-year bachelor's degree at BI and then start working or (2) first commit to a three-year bachelor’s degree at BI and then continue with two-year master’s degree at BI before starting to work. Under the assumption that there are no selection effects and everybody is exactly identical except for receiving education at different lengths at BI, our intention is to discover which of these two options generates the highest NPV. To investigate this, we assemble our NPV model as shown below.

$$NPV = \underbrace{\sum_{t=\tau}^{t=N}\left[\frac{W_t}{(1+r)^t}\right]}_{\text{PV of Salary Premium}} - \underbrace{\sum_{t=\tau}^{t=N}\left[\frac{P_t}{(1+r)^t}\right]}_{\text{PV of Down Payments}} - \underbrace{\sum_{t=\tau+1}^{t=N}\left[\frac{i_t}{(1+r)^t}\right]}_{\text{PV of Interest Payments}} - \underbrace{(A_{\tau-2}\,.r^2 + A_{\tau-1}\,.r)}_{\text{Alternative costs discounted forward}} \tag{6.1}$$

Note: τ represents the year 2020 and *N* represents the year 2060

Based on our NPV model, the very first thing we did was to calculate the present value of the salary premium. Afterward, we subtracted all associated costs such as the present value of loan down payments, the present value of loan interest payments and the alternative costs of not attending master’s degree at BI discounted forward.

The duration of five-year studies, including both bachelor’s and master’s, for the student of interest in our model, would be 2015-2019. For every year, the student had to go through annual costs related to tuition fees (T) and Books (B). Even though there is a significant difference in tuition fees for bachelor’s and master’s degrees, both grow at the inflation rate (π). In addition, our model also considered the alternative costs (A) of not working as soon as the student finished a bachelor’s degree. Moreover, we assume that the student took out a loan from “lånekassen” through these years with the student debt (D) accounting for the sum of both tuition fees and books. We further deduce that the student undergoes a 10-year loan repayment plan, starting to pay out the first loan interest (i) in 2021 and the first down payment (P) in 2020. After graduation, we presume that the master graduate starts working in 2020 and earns a wage premium (W) until he/she retires in 2060.

6.2. Building Blocks in NPV Model

In this section, we will be presenting the building blocks or the elements that we used for constructing our NPV model and the required cash flows in detail. We will be explaining our thought, reasoning, and justification for the inclusion and calculation process of each building block.

Master Salary (MS)**:* Firstly, we ran a univariate regression on the master salaries of BI students for the last 5 years. We found that the statistics we obtained from the students graduating in 2018 and 2019 provided us with the highest R^2, meaning that the model fit is superior to the prior years. Therefore, as a forecasting measure, we decided to use the average master salary of those 2 years, which is approximately NOK 479 795, assuming that the growth of the master salary would follow historic data. In addition, we deduce that it is also crucial to consider the probability of employment for master graduates in our forecast of master salaries. According to BI Norwegian Business School (2020), 95% of master students found employment within 6 months of graduation in 2020. Hence in our calculation the starting point of our cash flows in 2020 is 95% of the average master salary, which is *95% x NOK 479,795 = NOK 455,806.**

***Bachelor Salary (BS)**:* We proceed using the same methodology as in the prior part for calculating the master salary. The average bachelor salary we obtained is NOK 405,451. According to BI Norwegian Business School (2020), 82% of bachelor students found employment within 6 months of graduation in 2020. Therefore, the starting point of our cash flows for bachelor's salary in 2020 is 82% of the average bachelor's salary *(82% x NOK 405,451 = NOK 332,470)*.

***Growth rate (g)**:* When forecasting for master and bachelor salaries, it is crucial for us to know at which rates these salaries grow throughout the time horizon we use in our NPV model. Since we believe that a master's degree has higher significance in today's era, our understanding is that the growth rate for a master's salary should be higher than the growth rate for a bachelor's salary. We then found an expected future master salary growth rate based on the annual percentage change in master salaries using our past history data on master graduates at BI for the past three years (2016-2019). The average annual growth rate we found out is 3.43% for the master salaries and we used this for further growth calculation until a terminal growth rate of 2.17%, which is an average inflation rate in Norway for the last 35 years (Statista, 2021), takes over in 2030. Using a similar method, we then discovered that the average growth rate of bachelor salaries is 0.81%. The value for a bachelor's salary is projected with this growth rate until 2030 when the terminal growth rate (2.17%) takes over.

If we are to look at the growth rate for salaries until retirement age, with the low-interest-rate environment we are currently in, future salaries matter a lot for the calculation of present value. Moreover, it is crucial and difficult to forecast future growth rate, and therefore we assumed a terminal growth rate growing at the same pace as inflation after 10 years of employment.

Wage Premium (W)*:* After accounting for appropriate salary growth rates from the data we have, we proceed with our analysis by calculating a yearly salary premium, which is the difference between yearly master and bachelor salaries, from the year 2020 until the expected year of retirement in 2060.
Alternative Costs (A)*:* In our model, these costs refer to the opportunity costs or the benefits lost by master students for not entering employment after finishing their bachelor studies. We used the average bachelor's salaries from 2018 and 2019 as alternative costs to finish the master's degree. For the purpose of calculating NPV, we then forwarded these costs to 2020.

Tuition fees (T)*:* For the tuition fees, we used historical cost data of bachelor and master fees from BI, and made adjustments for inflation using the rate of 2.17%.

Books (B)*:* We estimated that books cost approximately NOK 4000 on average in 2015. Some students buy new books and others buy used ones. We assume that the costs for books also grow each year at an inflation rate of 2.17%.

Total Debt (D): For the accumulation of total student debt, we decided to neglect the living expenses as we assumed that everyone regardless of their status and educational background has to bear these expenses. Moreover, we believe that the living expenses are not really associated with our mission in finding the added value of a master's degree at BI. Therefore, the total debt we have used in our calculation is just the cumulative number of tuition fees and the costs of books. The total debt accumulated over the education span of a master's degree is also reduced by "lånekassen" in Norway in terms of obtaining a scholarship when you have finished your degree. This percentage is 26% off from the total debt accumulated.

Loan interest payments (i): An average loan interest rate for students set by ‘‘lånekassen’’ is 1.4% (Lånekassen, 2021). We use this loan interest percentage and assume that the interest payments commence in 2021 (the second year of our cash flow projections) until 2030.

Down Payments (P): In order to know how much loan down payment each year the student needs to commit to after master's graduation, we use the service provided by lånekassen's website for debt and repayment calculations. We chose the 10-year repayment plan option, and eventually found out that equal installments of NOK 32,863.92 should be made annually to satisfy this plan.

Discount rate (r): We used a discount rate of 5%, which is the market risk premium in the Norwegian market (Mjelde et al., 2018). Instead of using treasury yields as suggested in other papers, we decided to use a high discount factor due to uncertainties regarding the future job market cycle since the probability of getting employed and starting salaries depends on this cycle. Therefore, we decided to use the Norwegian stock market premium as it is a high beta asset (=1) and offers a higher discount rate than treasuries.

Present value of premium: After projecting the premium salary, which is the difference between bachelor and master salaries, the present value of premium from 2020-2060 is calculated at the 5% discount rate.

Present value of down payments: The present value of loan down payments for 10 years is also calculated at the 5% discount rate.

Present value of interest payments: The interest rate "lånekassen" has currently posted on their website is 1.4%. We have used this in our calculation over the 10 years down payment plan, and we have discounted this with a 5% discount rate.

Alternative costs discounted forward: Alternative costs or opportunity costs incurred by master students for not working as soon as they finish bachelor's degree are forwarded to the year 2020 using the discount rate of 5%.

6.3. Calculating Return on Investment

$$ROI = \frac{PV(W)}{Forwarded\ costs\ (A) + PV(P) + PV(i)} \tag{6.2}$$

After the computation of the added value of attending a master's degree using the NPV model, we plan to further analyze and project the return on investment for making a decision to pursue a master's degree at BI. As shown in the equation above, this value was calculated by dividing benefits by the associated costs. In this case, the present value of the wage premium (the benefit) is divided by the sum of alternative costs discounted forward, the present value of down payments, and the present value of interest payments (total costs associated with taking the master degree decision).

6.4. Calculating Internal Rate of Return

$$NPV = \sum_{t=\tau}^{t=N}\left[\frac{W_t}{(1+\mathrm{IRR})^t}\right] - \sum_{t=\tau}^{t=N}\left[\frac{P_t}{(1+\mathrm{IRR})^t}\right] - \sum_{t=\tau+1}^{t=N}\left[\frac{i_t}{(1+\mathrm{IRR})^t}\right] - (A_{\tau-2}\,.\,\mathrm{IRR}^2 + A_{\tau-1}\,.\,\mathrm{IRR}) \tag{6.3}$$

We also observe the IRR to measure the student investment's rate of return for deciding to continue taking a master's degree at BI Norwegian Business School. This will give us an insight into what percentage of our investment in master's degree education at BI breakevens. According to Lobo & Burke-Smalley (2018), the investment's IRR needs to exceed the cost of financing (i.e. the discount rate) for the project to be considered 'good.' As a result, our investment decision which is currently discounted at the market premium of 5%, should yield an internal rate of return greater than 5% to be profitable and can be considered good.

6.5. Regression Model

Inspired by the Mincer equation (1974) and Webber (2016), we also plan to further construct a regression model that analyzes salary earnings for BI students as a function of independent variables in order to answer the sub research question of our thesis, which is to determine the factors and variables that contributes to the added value obtained from attending master's degree at BI.

$$salary_i = \beta_0 + \beta_1 Male_i + \beta_2 Age_i + \beta_3 Master_i + \beta_4 Grade_i + \beta_5 PrivateSector_i + \beta_6 \ldots \beta_{11} \text{ Industry Dummy Variables} + \epsilon_i$$

(where i= 1, 2, 3, …)

(6.4)

We constructed the multivariate regression with a dummy variables model as illustrated above to test out and estimate how the variables included in the datasets provided by BI contribute to earnings/returns to education at BI. In general, our regression model consists of dependent variable '*Salary*', independent variables *'Male'*, *'Age'*, *'Master'*, *'Grade'*, *'PrivateSector'* and other six other industry dummy variables namely *'EFCAB'*, *'BRIP'*, *'PPS'*, *'TIMPT'*, *'TESLO'* and *'HRTAC'* as well as ϵ as the error term.

However, since we are provided by BI with two datasets consisting of different lengths of time, a different number of variables, and observations we are required to estimate two contrasting regression models. The first dataset is for BI's alumni who graduated during the time period 2015-2019. This dataset involves all the aforementioned variables except *'Grade'*. In total, this dataset has a sample size with 2538 observations of bachelor and master students who graduated from BI during these 5 years. To carry out statistical analysis and parameter estimates for this first dataset, our regression model is expressed as below.

$$salary_i = \beta_0 + \beta_1 PrivateSector_i + \beta_2 Master_i + \beta_3 Male_i + \beta_4 Age_i + \beta_5 EFCAB_i + \beta_6 BRIP_i + \beta_7 PPS_i + \beta_8 TIMPT_i + \beta_9 TESLO_i + \beta_{10} HRTAC_i + \epsilon_i$$

(where i= 1, 2, 3, …)

(6.5)

On the other hand, the second dataset we obtained from BI is for the students who graduated during 2018-2019. This dataset in total consists of 788 observations for bachelor and master students who graduated during these 2 years. The reason we decided to also take this dataset into consideration is mainly due to the fact that it contains an important variable for our economic analysis, namely the overall *'Grade'* of the students who graduated, unlike the previous dataset for 2015-2019 in which the information about the grades is not provided. To perform statistical analysis and parameter estimates in a similar fashion to the first dataset, we constructed a regression model for this second dataset as follows:

$$salary_i = \beta_0 + \beta_1 Male_i + \beta_2 Age_i + \beta_3 Master_i + \beta_4 Grade_i + \beta_5 PrivateSector_i + \beta_6 EFCAB_i + \beta_7 BRIP_i + \beta_8 PPS_i + \beta_9 TIMPT_i + \beta_{10} TESLO_i + \beta_{11} HRTAC_i + \epsilon_i$$

(where i= 1, 2, 3, …)

(6.6)

6.6. Estimation of Parameters

To estimate parameters in the two regression models we are going to analyze, we use the Ordinary Least Squares (OLS) method. In econometrics, the Ordinary Least Squares (OLS) method is widely used to estimate the parameter of a linear regression model (Albert, 2016). OLS estimators minimize the sum of the squared errors (a difference between observed values and predicted values) (Albert, 2016). A lack of knowledge of OLS assumptions would result in its misuse and give incorrect results for the econometrics test completed (Albert, 2016).

According to the Classical Linear Regression Model's assumptions, (1) the error terms should have zero mean, (2) the variance of error term should be constant and finite, (3) the errors should be linearly independent of one another, (4) there should be no relationship between the error term and corresponding explanatory variables, and (5) the error term should be normally distributed. If these assumptions hold, then the OLS method is BLUE meaning that it is unbiased and efficient.

6.7. Testing for Significant Variables

In order to determine which variables greatly contribute to the added value of earning an academic diploma from BI Norwegian Business School, we perform a two-sided test of significance (t-test) to evaluate which of the variables in the two regression models we have constructed are the most significant at 1%, 5%, and 10% significance levels. For each parameter estimate, the hypotheses would be $H_0 : \beta = 0$ versus $H_A : \beta \neq 0$. In general, the null hypothesis indicates that the parameter estimate is statistically zero and the alternative hypothesis indicates that the parameter estimate is statistically not equal to zero. The formula for the calculation of the test statistic is as shown below.

$$\text{Test statistic} = \frac{\hat{\beta}}{\text{SE}\,(\hat{\beta})} \tag{6.7}$$

Afterward, we calculate critical values at 1%, 5%, and 10% significance levels using T-2 degrees of freedom, in which T stands for the number of observations in the sample and 2 stands for the number of estimated variables. We would reject the null hypothesis if the test statistic is greater than the critical values we calculated. Otherwise, the null hypothesis would be true if the test statistic is lower than the critical values and the variable will have no statistical significance in our regression model.

7. RESULTS & ANALYSIS

In this section, we are going to present the outcomes of our data and discuss the significance of the results in accordance with our objective for the thesis. We will focus on analyzing and evaluating our results for the net present value, return on investment, and internal rate of return of studying for a master's degree at BI Norwegian Business School. In addition, we will also carry out a sensitivity analysis to observe how the net present value varies according to changes in external circumstances. Finally, we will discuss the outcomes of parameter estimates and t-test for the regression models we have constructed.

7.1. NPV Analysis

Prior to the evaluation of NPV results, we make a forecast for the salary premium, which is the difference between the salaries of a master graduate and a bachelor graduate, to distinguish between whether attending a master's degree at BI contributes to superior salaries in comparison to bachelor's degree. According to *Figure 3*, our analysis proves that this premium is increasing in the long run from 2020 to 2060, which suggests the growing importance of a master's degree for now and for the future.

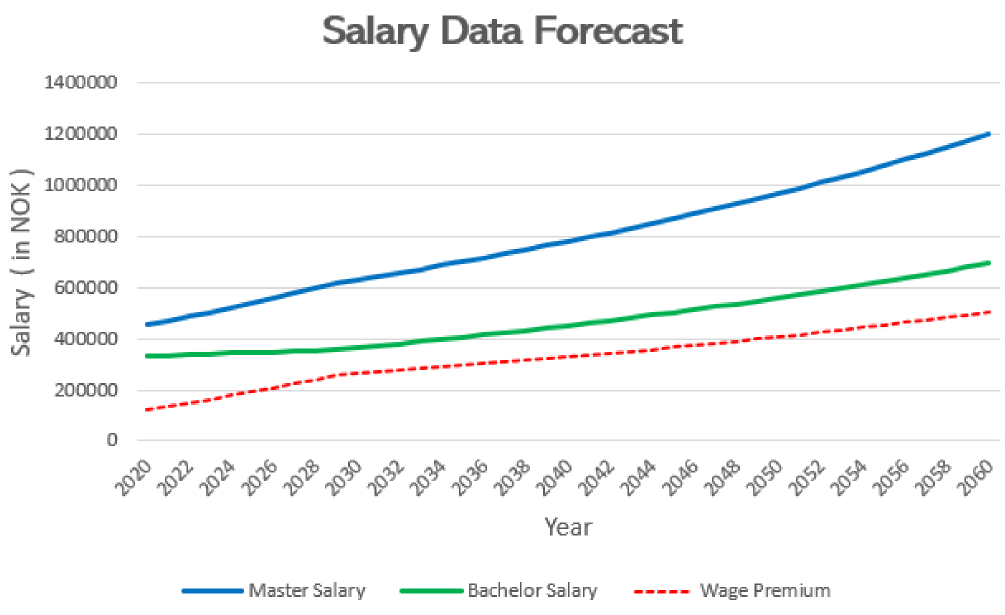

Figure 3: Forecasting trends in bachelor salary, master salary, and wage premium (2020-2060)

PV of Premium	NOK 4,694,742.33
PV of Downpayments	(NOK 272,981.33)
PV of Interest Payments	(NOK 20,964.36)
Alternative Costs Discounted Forward	(NOK 872,464.21)
Net Present Value	NOK 3,528,332.43

Table 1: Calculation of NPV using the present values of benefits and associated costs

After discounting the cash flows with a 5% market premium as a discount factor, *Table 1* shows a summary of the values affecting the NPV of gaining the master's degree at BI. One of the important factors is the present value of the premium on master salary versus bachelor's salary over the 40 year time horizon of the calculation. Another is the present value of the down payments of the loan as well as the interest payments. The last variable is about the alternative cost, which is the amount you could have made had you chosen to find employment after finishing a bachelor's degree instead of deciding to attend a master's degree.

After thorough analysis and calculation as displayed in *Table 2*, we found out that completing the master's degree at BI generates a positive lifetime Net Present Value as much as NOK 3.5 million, and therefore it is a profitable decision for bachelor students to make. There are two variables that have the largest impact on the net present value. The first one is the growth rate of the master salary which gives us a high premium in comparison to the growth rate of the bachelor salary. The difference resulted in a present value of the premium for a lifetime of as much as NOK 4,694,742. The other essential variable is the discount factor at 5% having a huge impact on the present value. Since the future job market environment is uncertain, one would have to forecast possible future salary growth rates as well as the uncertain discount rate. To test whether the positive NPV of our analysis can resist future negative shocks to these variables, we have performed a sensitivity analysis in the next section of our thesis.

						Starting point of CFs										Terminal year				Retirement year
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**.........**	**2060**
Master Salary				475,231	484,360	455,806	471,423	487,575	504,281	521,559	539,429	557,912	577,027	596,798	617,246	630,640	644,325	658,307	....	1,200,836
Bachelor Salary				400,323	410,579	332,470	335,159	337,871	340,604	343,359	346,137	348,937	351,760	354,605	357,474	365,231	373,156	381,254	....	695,455
Premium						123,336	136,263	149,705	163,677	178,200	193,292	208,975	225,268	242,193	259,772	265,409	271,169	277,053	....	505,380
Costs:																				
Alternative Costs				400,323	410,579															
Interest payments (Loans)							4,601	4,141	3,681	3,221	2,761	2,300	1,840	1,380	920	460				
Tuition fees	75,294	76,964	78,671	95,091	97,200															
Books	4,000	4,087	4,175	4,266	4,359															
Downpayments						32,864	32,864	32,864	32,864	32,864	32,864	32,864	32,864	32,864	32,864	32,864				
Total Debt	79,294	160,345	243,192	342,548	444,107	328,639	295,775	262,911	230,047	197,184	164,320	131,456	98,592	65,728	32,864	(0)				
Alternative Costs discounted forward						(872,464)														
Present value of premium						4,694,742														
Present value of downpayments						(272,981)														
Present value of interest payments						(20,964)														
Total NPV						3,528,332														

Notes:
a. Premium = Master Salary - Bachelor Salary
b. Discount rate = 5%
c. Master salary growth rate = 3.43% (before terminal year) & 2.17% (After terminal year)
d. Bachelor salary growth rate = 0.81% (before terminal year) & 2.17% (after terminal year)
e. Interest rate = 1.4%

Table 2: A detailed calculation of the forecasted lifetime net present value for a 19-year old student who first commits to a three-year bachelor's degree at BI and then continues with a two-year master's degree at BI before entering employment. *(All the values are denoted in NOK)*

7.2. Sensitivity Analysis

Two parameters are critically important for the calculation and estimation of net present value in our thesis. Those parameters are 'master salary growth rate' and 'discount factor'. The most predominant driving factor behind our NPV analysis is the 'master salary growth rate' because it determines the salary premium which is directly related to the result of the NPV calculation. The predefined master salary growth rate of 3.43% that we used in our NPV analysis is based solely on our calculation of historic annual percentage changes in master salaries. Given the importance of the growth factor, we are uncertain whether this growth rate would remain constant, fluctuate or drastically change in the future. Therefore, it is important to find the correct growth rate and test to see whether the investment still provides us with positive NPV results even if the growth rate should deviate from our estimates.

Another important parameter for our NPV analysis is the 'discount factor'. Finding and using the correct discount factor is both difficult and crucial. In our thesis, we decided that we should use a discount factor of 5% due to our presumption that there are similarities in risks associated with taking a master's degree and the stock market premium. However, it is also interesting for us to observe how our results would respond differently if the market premium changes in the future, or if the real "beta" of attending a master's degree is in fact not similar to the stock market's beta (=1). Since the probability of getting employed and starting salaries depend on a highly uncertain future job market cycle, we believe that the discount factor is an important parameter we need to consider in our sensitivity analysis to verify that our NPV results are still positive even if these unpredicted circumstances occur in the future.

In order to comprehend how the changes in the growth rate of master salary interact with the changes in the discount factor, we perform a sensitivity analysis for our NPV calculations with these two most critically important parameters. Additionally, it is intriguing for us to find out whether our NPV results are still sustainable in a bad job market cycle when the growth rate of the master salary drops and the discount factor relative to the market premium increases due to higher risk. *Table 3* illustrates the sensitivity analysis on how the NPV of the added value of attending a master's degree at BI changes accordingly to the variations in the growth rate of master salary and market premium discount factor.

Growth rate of master salary	NPV table	Discount factor/market premium 1,00%	3,00%	5,00%	7,50%	10,00%
	0,00%	NOK 3 200 693,25	NOK 1 776 147,77	NOK 944 139,42	NOK 334 815,48	-NOK 27 617,51
	0,50%	NOK 4 007 189,95	NOK 2 285 182,57	NOK 1 282 171,54	NOK 551 119,67	NOK 119 794,38
	1,00%	NOK 4 845 095,69	NOK 2 813 683,91	NOK 1 632 844,85	NOK 775 249,28	NOK 272 342,27
	2,00%	NOK 6 619 514,84	NOK 3 931 776,69	NOK 2 373 842,91	NOK 1 248 036,96	NOK 593 523,60
	3,43%	NOK 9 393 401,77	NOK 5 676 992,53	NOK 3 528 332,43	NOK 1 982 690,73	NOK 1 091 134,40
	4,00%	NOK 10 595 304,40	NOK 6 432 290,97	NOK 4 027 264,15	NOK 2 299 527,62	NOK 1 305 249,54
	5,00%	NOK 12 816 511,70	NOK 7 826 888,64	NOK 4 947 501,12	NOK 2 882 983,12	NOK 1 698 850,81
	6,00%	NOK 15 207 464,39	NOK 9 326 428,75	NOK 5 935 679,58	NOK 3 508 310,26	NOK 2 119 794,99

Table 3: Sensitivity Analysis on how NPV varies with changes in master salary's growth rate and discount factor

As mentioned earlier, the current rates we are using as benchmarks for the growth of master salary and the market premium are 3.43% and 5% respectively. We believe that the beta of the investment should be close to the market beta value of 1. Nevertheless, how the market premium will change in the future is uncertain. Most likely the premium will still revolve around 5%, but it would be interesting for us to discover how the change of this market premium to 10% or 1% affects our NPV result. As we can see in *Table 3*, if the discount factor changes to 10% with our current growth rate of master salary at 3.34% we still obtain a positive NPV of NOK 1,091,134. In addition, if our assumption about the master salary growth rate will not hold in the future, which is likely, then the NPV will also change accordingly. If the master salary growth rate changes to 0% and the discount factor remains unchanged at 5%, this investment is still profitable with an NPV at NOK 944,139.

Even at the worst-case scenario in our sensitivity analysis, if the discount factor changes to 10% and our real master salary growth rate changes to 0%, the investment still barely generates a negative NPV of -NOK 27,618. However, we believe that this scenario is unrealistic both in terms of the extremely high discount rate and no growth in master salary. Consequently, our sensitivity analysis with these two parameters has proven that NPV is positive in the majority of cases, and under realistic conditions, the case of negative NPV is rare and uncommon. Hence we believe that the investment choice is quite resistant to future changes, and without taking into account the cognitive factors of a master's degree the investment decision for a bachelor student to choose to invest his/her time and effort in a master's degree appears to be a profitable decision.

	Multiple for tuition fees					
	1,00	2,00	3,00	4,00	5,00	13,596
NPV	NOK 3 528 332,43	NOK 3 248 211,45	NOK 2 968 090,48	NOK 2 687 969,50	NOK 2 407 848,53	NOK 0.00

Table 4: Sensitivity Analysis on how NPV changes with a tuition fee multiple

Another parameter that in theory should be crucial to our valuation of master's degree and NPV estimation is the 'tuition fees. However, an interesting observation is that our NPV results are rather insensitive to changes in tuition fees as illustrated in *Table 4.* At our benchmark scenario with the current rate of tuition fees for both bachelor and master programs in BI, our NPV is approximately NOK 3.5 million. Even if we double or triple the tuition fees, the NPV remains largely unaffected. In fact, we need to raise the multiple to a level of 13.596 for our NPV to break even. At this breakeven point, we found out that BI could raise the yearly bachelor tuition fees to NOK 1 million and the yearly master tuition fees to NOK 1.3 million, and the students would still be able to recover expenses and experience no loss from their investment in education. Nevertheless, this scenario is highly unlikely to occur. Therefore, we believe that tuition fees have a low effect on our NPV results. As a result, the parameters regarding "master salary growth" and "discount factor" are much more crucial in our NPV analysis. However, if students at BI students were not given the possibility to have their tuition fees covered by a loan provided by Lånekassen, then the effect of an increase in tuition fees would be much larger.

7.3. ROI & IRR

After performing NPV calculation and sensitivity analysis, we computed the return on investment (ROI) and internal rate of return (IRR) for deciding to take a master's degree at BI Norwegian Business School. First of all, we calculated ROI by using the formula in our methodology, which is the present value of the wage premium divided by the sum of alternative costs discounted forward, the present value of down payments, and the present value of interest payments.

Return on Investment Calculation	$ROI = \frac{\text{PV of Premium}}{\text{PV of Downpayments} + \text{PV of Interst Payments} + \text{Forwared Alternative Costs}}$ $= \frac{\text{NOK } 4{,}694{,}742.33}{\text{NOK } 272{,}981.33 + \text{NOK } 20{,}964.36 + \text{NOK } 872{,}464.21}$ $= \mathbf{402\%}$

Table 5: Calculation of Return On Investment

By using the data of the present values we generated in our NPV analysis, we calculated ROI as shown in *Table 5* and found out that the ROI for deciding to take on a master's degree is 402%, which is an astronomically high number especially when not accounting for time, effort, and psychological strain on the individual undergoing the education.

Afterward, by using the same NPV model we carried out a simulation to generate IRR for a bachelor student who decides to continue pursuing a master's degree at BI using a Solver function in Excel. Our simulation generates an internal rate of return of 16.53% which is significantly greater than our current cost of financing or discount factor of 5%. This implies that a bachelor student's decision to invest in pursuing a master's degree at BI generates positive net returns for the student and can be deemed as a profitable decision. The high IRR also gives more room for the discount factor to grow in the future if the interest rate environment and job market should change for the worse.

7.4. Results from Econometric Tests

In this part, we carried out inferential statistical tests to identify which factors contribute to gaining an added value from attending a master's degree at BI. For this purpose, we used MATLAB software to run the multivariate regressions to estimate regression parameters for the two datasets provided by BI, and also performed a 2-sided test of significance (t-test).

7.4.1. Results for 1st Dataset (2015-2019, without *'Grade'* variable)

As outlined before in the previous section on the research methodology of our thesis, we first constructed the regression model for the first dataset as shown below.

<u>*Regression Model (1):*</u>

$$salary_i = \beta_0 + \beta_1 PrivateSector_i + \beta_2 Master_i + \beta_3 Male_i + \beta_4 Age_i + \beta_5 EFCAB_i + \beta_6 BRIP_i + \beta_7 PPS_i + \beta_8 TIMPT_i + \beta_9 TESLO_i + \beta_{10} HRTAC_i + \epsilon_i$$

(where i= 1, 2, 3, ...)

(7.1)

	Estimate	SE	tStat	pValue
(Intercept)	3.3591e+05	12622	26.613	8.9938e-138
PrivateSector	-4718.3	9973.2	-0.4731	0.63618
Master	25979	4451.8	5.8356	6.0454e-09
Male	11057	4273.3	2.5874	0.009725
Age	30532	2176.4	14.028	4.1445e-43
EFCAB	15254	7727.1	1.9741	0.048476
BRIP	-6431.5	8226.4	-0.78182	0.4344
PPS	6285.6	12347	0.50907	0.61075
TIMPT	-8171.4	8477.3	-0.96392	0.33518
TESLO	26605	12519	2.1252	0.033671
HRTAC	-25360	15057	-1.6843	0.092247

Number of observations: 2538, Error degrees of freedom: 2527
Root Mean Squared Error: 1.07e+05
R-squared: 0.106, Adjusted R-Squared: 0.103
F-statistic vs. constant model: 30, p-value = 3.99e-55

Table 6: Parameter estimates for the Regression Model (1)

Secondly, we estimated the parameters in this regression as displayed in *Table 6* by using MATLAB software as our aid for econometrics analysis. Our regression with 11 estimated parameters and a sample size of 2 538 has a degree of freedom of 2 527. The intercept in this model represents the starting salary of a BI student six months after graduation without taking into account any of the independent variables. While most of the explanatory variables display a positive correlation with the salary and contribute a positive salary premium, there are four variables namely *'PrivateSector'*, *'BRIP'*, *'TIMPT'* and *'HRTAC'* that contribute negatively towards the salary. The main drawback we would like to emphasize in this regression model is the low value of R^2 implying that the model fit is low and has a below-average explanatory power, which we believe is mainly due to the problem of endogeneity.

After estimating regression parameters, we performed a two-sided t-test to see which variables are the most significant in our regression model and contribute to the added value of achieving a degree at BI Norwegian Business School. With 2538 degrees of freedom at 99%, 95%, and 90% confidence intervals, the critical values turn out to be 2.5778, 1.9609, and 1.6455 respectively. The null hypothesis H_0, which insists that the parameter estimates are statistically zero and insignificant, will only be rejected if the test statistic of each estimated parameter in our regression is greater than these critical values. By referring to the test statistics of parameter estimates in *Table 6*, we found out the significant variables for our regression model at different confidence intervals as shown below.

Significant variables:
At 99 % confidence interval: Master, Male, Age
At 95 % confidence interval: Master, Male, Age, EFCAB, TESLO
At 90 % confidence interval: Master, Male, Age, EFCAB, TESLO, HRTAC

For financial calculations (including behavioral finance), 5% is the generally accepted limit (Seth, 2021). As the confidence level increases, the margin of error increases, and the interval is wider (MathBoothCamps, 2013). This means that at 99% confidence intervals there is only a 1% chance of being wrong. On the other hand, a 90% confidence interval would be narrower and there is a higher chance of being wrong. Therefore, for our thesis we decided to stick with the regression at 95% confidence interval when performing a t-test because (1) it is the most commonly used confidence interval, (2) it is a golden middle ground between 90% and 99% confidence intervals, and (3) provides a good balance of avoiding the likelihood of type I or type II error.

Therefore, this multivariate regression analysis for the first dataset suggests that there are five variables (Master, Male, Age, EFCAB & TESLO) that are of statistical significance in terms of the starting salary for bachelor and master students at the 5% significance level. As a result, we finally conducted parameter estimates consisting only of these five significant variables to give us better insights for making conclusions to our regression results.

	Estimate	SE	tStat	pValue
(Intercept)	3.2564e+05	5739.9	56.733	0
Master	26187	4448.4	5.8869	4.456e-09
Male	10752	4258.7	2.5246	0.011642
Age	30615	2163.9	14.148	8.526e-44
EFCAB	20893	4438.7	4.7071	2.6482e-06
TESLO	32315	10805	2.9906	0.0028108

Number of observations: 2538, Error degrees of freedom: 2532
Root Mean Squared Error: 1.07e+05
R-squared: 0.104, Adjusted R-Squared: 0.102
F-statistic vs. constant model: 58.9, p-value = 3.53e-58

Table 7: Parameter estimates for Regression Model (1) only with significant variables

According to *Table 7*, having a master's degree provides the student with a premium of NOK 26 187 with a standard deviation of NOK 4 448. Another important insight our analysis provides us with is the fact that the actual gender of students matters for the calculated premium in terms of their starting salary. In the later years of our dataset, our findings portray a story where there is still a statistically proven wage gap between female and male students at BI. Having been born as a male provides you with a premium salary of NOK 10 752 with a standard deviation of NOK 4 259. Moreover, we also find out that one of the most important variables in explaining a premium in starting salary is the age of the student. Here, an increase of approximately 2 years in age equals a premium of NOK 30 615 with a standard deviation of NOK 2 164.

Our data also suggests that there are two industry groups that have a significant impact on the salary, namely EFCAB and TESLO. EFCAB is a combination of the industries: Economics, Finance, Consultancy, Accounting, and Business. Our data conveys that these industries will provide BI graduates with a high added premium. Hence when choosing which major topic or program to attend, a student at BI should consider choosing a job in these industries. This will grant the student in theory an added starting salary of NOK 20 893 with a standard deviation of NOK 4 439.

Another industry group that we found significant and also has the highest premium of the two is the TESLO group, consisting of Transport, Logistics, Oil, Energy, and Shipping. This group provides the student with an added value of NOK 32 315, with a standard deviation of 10 805 NOK. Therefore, in general, when choosing which major to attend at BI, it is advantageous for the student to consider choosing a major or program within economics, logistics, shipping, finance, accounting, or business based on our findings. Our data also suggest that after attending a program at BI, there appears to be a higher premium in the starting salary if you were to choose an industry that is considered relevant and similar to BI's points of expertise in terms of what topics and programs the school specializes in, namely finance, business, shipping, accounting, etc. This is either due to the fact that you obtain an added expertise from BI or maybe these industries consider education from BI to be more worthwhile.

7.4.2. Results for 2nd Dataset (2018-2019, with *'Grade'* variable)

For this section, we will use a regression model for the second dataset as we have constructed before in our methodology.

Regression Model (2):

$$salary_i = \beta_0 + \beta_1 Male_i + \beta_2 Age_i + \beta_3 Master_i + \beta_4 Grade_i + \beta_5 PrivateSector_i + \beta_6 EFCAB_i + \beta_7 BRIP_i + \beta_8 PPS_i + \beta_9 TIMPT_i + \beta_{10} TESLO_i + \beta_{11} HRTAC_i + \epsilon_i \quad (7.2)$$

(where i= 1, 2, 3, …)

	Estimate	SE	tStat	pValue
(Intercept)	2.9469e+05	30688	9.6025	1.0458e-20
Male	15451	6773	2.2813	0.022804
Age	17718	3991.3	4.439	1.0348e-05
Master	49266	8105.1	6.0784	1.9024e-09
Grade	14146	5406.4	2.6165	0.0090556
PrivateSector	11047	14296	0.7727	0.43994
EFCAB	-672.64	13950	-0.048217	0.96156
BRIP	-17775	14938	-1.19	0.23443
PPS	8386.7	21251	0.39464	0.69321
TIMPT	-18174	14736	-1.2333	0.21783
TESLO	28264	19337	1.4616	0.14425
HRTAC	-36097	27590	-1.3083	0.19114

Number of observations: 788, Error degrees of freedom: 776
Root Mean Squared Error: 9.35e+04
R-squared: 0.172, Adjusted R-Squared: 0.16
F-statistic vs. constant model: 14.7, p-value = 5.1e-26

Table 8: Parameter estimates for the Regression Model (2)

Our estimates for this regression model using MATLAB consists of 12 estimated parameters, now including the *'Grade'* variable, and 788 observations. As illustrated in *Table 8*, the dependent variable *'salary'* is positively correlated to most variables except four of the industry dummy variables namely *'EFCAB'*, *'BRIP'*, *'TIMPT'* and *'HRTAC'*. Similar to the first dataset, we encounter a recurring drawback of our regression model, which is the low value of R^2 mainly due to endogeneity problems.

Afterward, a two-sided t-test was carried out to identify the most significant variable in our regression model related to the second dataset. With 776 degrees of freedom at 99%, 95%, and 90% confidence intervals, the critical values are calculated to be 2.5822, 1.963, and 1.6468 respectively. In reference to the test statistics of parameter estimates in *Table 8*, we eventually found out the significant variables for our regression model at different confidence intervals as follows:

Significant variables:
At 99 % confidence interval: Age, Master, Grade
At 95 % confidence interval: Male, Age, Master, Grade
At 90 % confidence interval: Male, Age, Master, Grade

Similar to the prior t-test for the first dataset, we decided to draw conclusions for our results at the 95% confidence interval. At this 5% significance level, we witnessed that *'Male'*, *'Age'*, *'Master'*, and *'Grade'* are the most significant factors that explain the added value of attending a BI Norwegian Business School. This t-test has also proven to us that industry dummy variables are insignificant for our multivariate regression model and do not make any contribution to the added value of attending BI Norwegian Business School.

	Estimate	SE	tStat	pValue
(Intercept)	3.0137e+05	25645	11.751	1.7627e-29
Male	15925	6741.7	2.3622	0.018412
Age	17334	3940.9	4.3984	1.2416e-05
Master	52642	8012.5	6.5699	9.1788e-11
Grade	13319	5369.9	2.4803	0.013337

Number of observations: 788, Error degrees of freedom: 783
Root Mean Squared Error: 9.39e+04
R-squared: 0.156, Adjusted R-Squared: 0.152
F-statistic vs. constant model: 36.3, p-value = 7.32e-28

Table 9: Parameter estimates for Regression Model (2) only with significant variables

Finally, we ran the regression only with the significant variables as shown in *Table 9*. Our second data set, this time including the grade of the students at BI gives us an additional reference point to which we can explain the premium salaries of the students. There are many similarities to the former dataset in the conclusion. However, in this dataset, none of the industries provide significant premiums to the starting salaries. Hence when there is an additional variable in terms of grade and performance of students, our data suggests that industries are not as relevant if the student is capable of achieving a high-performing grade.

In this regression analysis, gender provides a premium of NOK 15 925 for males with a standard deviation of NOK 6 742, in comparison to the premium NOK 10 752 of the previous dataset. One could therefore assume that the gender wage differential for BI students has in fact increased in this time period.

Our findings also portray that the importance of a master's degree has increased in recent years, adhering to our initial thoughts on the growing importance of a master's degree. Having a master's degree will now give BI graduates a premium of NOK 52 642 and a standard deviation of NOK 8 013, in comparison to the premium NOK 26 187 from the former dataset. Consequently, it seems that the importance of a master's degree has more than doubled in the last 3-5 years.

In contrast, our next variable has lost most of its importance, namely the age of the student, which now has a premium of NOK 17 334. This leads us to anticipate that where age and experience were more valued in the past, now grades and having the master's degree have become significantly more important.

Our final variable that has a significant impact on the starting salaries of BI students is the grade they achieved on either their bachelor's or master's degree. Our data suggest that there is a premium of NOK 13 319 for having a higher grading average for their completed degree per GPA point with a standard deviation of NOK 5370.

7.5. Remarks On Our Results In Light of Endogeneity

Even though our analyses have proven that attending a master's degree at BI generates a positive added value, it is vital for us to take into consideration the nature of endogeneity in our results, acknowledge it and verify its effects on our findings.

A key concern of endogeneity in our results is the fact that there may be endogenous variables, such as human capital, that are crucial when trying to understand people's decisions on their choice of education. These endogenous variables related to human capital, such as endurance, motivation level, ability to learn as well as other cognitive abilities, could have an impact on whether they choose to attend only a 3-year bachelor program at BI or a 5-year (bachelor + master) program at BI. Moreover, we are also aware that these variables could have an effect on the increase in salary earnings at a later stage in one's life. As a matter of fact, these human capital skills could be correlated with the increasing salary premium and could be one of the reasons why there is an added value in attending a master's degree.

When evaluating the added value of attending a master's degree at BI, a difficult aspect with our dataset is to verify that the increase in salary is not partly due to the inborn human capital that a person inhabits, which may have been a determining factor both for pursuing a masters degree and for later salary. In other words, our assumption that the student who has finished higher education after the bachelor's degree and the student who has pursued a master's degree have otherwise completely identical characteristics may lead to biased results. In addition, the uncertainty regarding whether BI is solely responsible or not for the added value we found in attending a master's degree is in fact explanatory for why we obtained the low R^2 values in our regressions.

In conclusion, because of the endogeneity problem, it is hard to verify that the premium we found is actually generated by attending BI, not by other circumstances or correlation with endogenous variables.

8. MULTICOLLINEARITY

According to Alin (2020), multicollinearity refers to the linear relation among two or more variables. Multicollinearity among independent variables will result in less reliable statistical inferences (Hayes, 2021). Attempts to apply regression techniques to highly multicollinear independent variables generally result in parameter estimates that are markedly sensitive to changes in model specification and to sample coverage (Farrar & Glauber, 1967). It is a data problem that may cause serious difficulty with the reliability of the estimates of the model parameters (Alin, 2010).

Testing for multicollinearity gives us the insight to see whether the explanatory variables are correlated and if so provides us with false and inappropriate results for our significance tests. For this objective, we generated correlation matrices for the two datasets to examine whether there is an existence of multicollinearity in our data and regression models.

Correlation	*Salary*	*Private sector*	*Master*	*Male*	*Age*	*EFCAB*	*BRIP*	*PPS*	*TIMPT*	*TESLO*	*HRTAC*
Salary	1,00										
Private sector	-0,03	1,00									
Master	0,14	-0,02	1,00								
Male	0,07	0,06	0,04	1,00							
Age	0,28	-0,05	0,09	0,05	1,00						
EFCAB	0,08	0,05	0,00	0,03	-0,01	1,00					
BRIP	-0,06	0,09	-0,02	0,00	-0,04	-0,42	1,00				
PPS	0,03	-0,32	0,04	-0,05	0,07	-0,17	-0,12	1,00			
TIMPT	-0,05	0,05	0,01	0,02	-0,02	-0,37	-0,26	-0,11	1,00		
TESLO	0,06	0,00	0,02	0,03	0,04	-0,16	-0,11	-0,05	-0,10	1,00	
HRTAC	-0,04	-0,02	-0,01	-0,03	0,06	-0,13	-0,09	-0,04	-0,08	-0,03	1,00

Table 10: Correlation Matrix for the first dataset (2015-2019)

Correlation	Salary	Male	Age	Master	Grade	Private Sector	EFCAB	BRIP	PPS	TIMPT	TESLO	HRTAC
Salary	1,00											
Male	0,09	1,00										
Age	0,24	0,01	1,00									
Master	0,34	0,04	0,31	1,00								
Grade	0,22	-0,04	0,14	0,48	1,00							
Private Sector	0,02	0,09	-0,01	-0,02	0,03	1,00						
EFCAB	0,04	0,04	-0,08	0,06	-0,02	0,10	1,00					
BRIP	-0,08	0,00	0,04	-0,17	-0,13	0,05	-0,39	1,00				
PPS	0,06	-0,09	0,08	0,08	0,05	-0,41	-0,18	-0,11	1,00			
TIMPT	-0,03	0,04	-0,05	0,05	0,11	0,05	-0,43	-0,26	-0,12	1,00		
TESLO	0,10	0,02	0,04	0,04	0,02	0,00	-0,19	-0,12	-0,05	-0,13	1,00	
HRTAC	-0,07	-0,06	0,07	-0,06	0,03	-0,07	-0,12	-0,08	-0,03	-0,08	-0,04	1,00

Table 11: Correlation Matrix for the second dataset (2018-2019)

Both matrices in *Table 10* and *Table 11* illustrate there being some negative correlations between the industries, but not enough to create a real multicollinearity problem. In *Table 10* for the second dataset, there is also a significant correlation of 0.48 between grade and master degree variables. However, this can also be explained by the need for high grades to be able to attend a master's degree. Overall, we deduce that multicollinearity is not a big issue to tackle in our statistical analysis since both of the correlation matrices display that the correlations between the explanatory variables are very low. As a result, we believe that in the bigger picture the variables are independent of one another and the parameter estimates would still be reliable.

9. LIMITATIONS & IDEAS FOR FUTURE RESEARCH

The biggest obstacle we have found working with the datasets we obtained from BI is the obvious concern of 'endogeneity' in our analyses. One of the considerable limitations is the endogeneity problem related to the low values of R^2 we estimated in our regression models. All the regressions and parameter estimates we have executed are mainly based on observable and quantifiable factors provided by BI Norwegian Business School. At the same time, we also comprehend that there are other unobservable factors that contribute to the starting salaries of BI graduates. However, the amount of variables we could receive from BI is limited and as a consequence, it is difficult to fix and increase the R^2 of our regression models only with the given amount of observable variables provided by BI. Moreover, these unobservable factors such as human capital, psychological factors, and cognitive attributes, which have explanatory power to our regressions to a certain extent, are extremely difficult to quantify.

Moreover, we also encountered endogeneity issues in relation to our NPV model. While making evaluations on the added value of a master's degree, it is uncertain for us whether the master salary premium is actually generated because of BI or just because the individual is smart, skillful, and motivated. Besides, we are also unsure whether the added value of attending a master’s degree is mainly due to knowledge provided by BI’s faculty or due to the administration office sorting out capable and competent students from less capable and inept students. To verify and address this problem, we would ideally have a data set consisting of 50 000 identical twins with similar human capital skills and cognitive attributes, half of them choosing to find a job after a bachelor’s degree at BI and the other half deciding to continue with postgraduate master’s degree at BI and learn something that creates added value. Then, we would have compared these two student groups of identical twins and generated unbiased conclusions and results about the added value. Nevertheless, with the limited amount of data we obtained from BI and from external sources it is impossible for us to fix and designate our current NPV model in a way that complies with our initial ideal plan. Therefore, we acknowledge that there is a certain degree of biases in our findings regarding the added value. However, we are still very much convinced that our current NPV model presents an ample description and justification of how an added value of a master's degree can be determined.

Another way we had planned to address whether BI is just a sorting mechanism for over-performing and under-performing students is to develop a counterfactual model by gathering additional information about the average grade of the master graduates during their 3-year bachelor program and compare with other bachelor graduates, who have the same average grade but choose to start working instead of pursuing the master’s degree. However, this additional data was not made available to us from BI as it could give us too much insight into confidential data and break the GDPR laws.

An additional limitation with our research is the fact that a lot of the same qualities that a person inhabits when deciding whether to attend a master’s degree are the same qualities that an employer would value highly in the labor market. However, these qualities are unobservable for us and therefore making it even harder for us to verify to what extent BI is the provider of these qualities that results in a higher starting salary.

There are numerous ways to further develop and improve upon our research. First of all, we believe it would be interesting to find out if other business schools in Norway behave the same way towards the starting salary and obtain a similar net present value decision. Moreover, one could also compare our results to that of other non-business schools and universities. Another important factor that would improve upon the research and generate better insights is to be able to comprehend or resolve the endogeneity problem to some extent because we believe that addressing this problem would enhance the significance of the results quite drastically. One of the ways to get around the endogeneity problem is to have access to more detailed registry data that give us more information on factors that determine long-term wages (i.e. high school grades of students, their parent's education level, and income). This data would in turn improve upon our results and their significance. Lastly, we believe that our study would be more explanatory and informative if one could incorporate and quantify psychological and cognitive factors such as stress, the absorptive capacity of students, attitudes, presentation skills, and motivation when evaluating the added value of taking a master's degree in the future research.

10. CONCLUSION

In summary, our master thesis paper has investigated and explored whether there is an added value generated for bachelor students by investing two more years of time, effort, and money in a quest to pursue a master's degree at BI Norwegian Business School. In accordance with our findings, we believe bachelor students should pursue further education with a master's degree because it generates an added value in terms of lifetime salary earnings by producing a positive NPV of approximately NOK 3.5 million, astronomical ROI of 402%, and IRR of 16.53% which is much greater than the cost of financing.

By using the two datasets we have, we have also determined the most significant factors and variables that contribute greatly to the added value of pursuing a master's degree at BI Norwegian Business School. According to our results, there are some variables that greatly affect the starting salaries of students and contribute to the added value. Our findings also suggest that 'Master', 'Age', 'Male', 'Grade', 'EFCAB' and 'TESLO' are the most significant variables. In regards to our findings, we found evidence that having a master's degree is positively correlated with lifetime salary earnings. Our results also indicate that there still is a wage gap between genders due to male graduates earning higher salaries, and it is in fact growing in recent years. Moreover, experience in terms of age is valuable and significant based on our results. The older you are when taking and completing the master's degree, the more leverage you have in negotiations with an employer. Furthermore, we consider the grade to be a significant variable. In light of this, our results show that the students with the higher average grades and GPA earn a premium in their starting salary. In addition, we would advise students to choose a career in the industries related to economy, finance, consulting, accounting or business (EFCAB) as well as transport, energy, shipping, logistic, and oil (TESLO) because our analysis presents the proof of an added value to be obtained from it.

Even though our analysis and results are affected by issues related to endogeneity and the unobservable endogenous variables such as human capital, we believe our findings still give significant and invaluable insight into the valuation of a master's degree. This is due to the fact that our results are based on actual data of BI students and important independent variables that explain within limits the added value incorporated with a degree. Furthermore, our outcomes cohere with our prior knowledge, beliefs, and our hypotheses. Therefore, the evaluations in our thesis can be a guideline for future students in their decision-making process on whether or not to enroll in a master's program at BI. On a final note, if bachelor students have the opportunity, we believe it will greatly benefit them to choose to attend a master's degree as our data portrays a picture where the valuation of a master's degree is worthwhile and therefore encouraged.

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12. APPENDIX

12.1. Matlab Codes for 1st Dataset

Contents


```
clear all;
close all;
clc;

format short g

data = readtable('Master Thesis (Simplified 2016-2020).xlsx');
data = rmmissing(data); %omit NaN rows
```

t-test %%

```
reg1 = fitlm((data), ...
    ['Salary ~ PrivateSector + Master + Male + Age + EFCAB + BRIP' ...
              '+ PPS + TIMPT + TESLO + HRTAC'])

alpha = [0.01, 0.05, 0.1];
T = reg1.NumObservations;
k = reg1.NumEstimatedCoefficients;
tcrit = tinv(1-1/2*alpha, T-k);
```

Regression with significant variables only %%

```
reg2 = fitlm((data),...
    'Salary ~ Master + Male + Age + EFCAB + TESLO')
```

12.2. Matlab Codes for 2nd Dataset

Contents


```
clear all;
close all;
clc;

format short g

data = readtable('Master Thesis (Simplified 2019-2020).xlsx');
data = rmmissing(data); %omit NaN rows
```

t-test %%

```
reg1 = fitlm((data),...
    ['Salary ~ Master + Male + Age + Grade + PrivateSector + EFCAB'...
    '+BRIP + PPS + TIMPT + TESLO + HRTAC'])

alpha = [0.01,0.05,0.1];
T = reg1.NumObservations;
k = reg1.NumEstimatedCoefficients;
tcrit = tinv(1-1/2*alpha, T-k);
```

Regression with significant variables only %%

```
reg2 = fitlm((data),...
    'Salary ~ Master + Male + Age + Grade ')
```