LUND UNIVERSITY
School of Economics and Management

Manufacturing matching crisis

A cost-benefit analysis of providing vocational industrial education for upper-secondary general graduates in Sweden

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Abstract

This paper sets out to analyse the potential effectiveness of providing complementary upper-secondary Industry Programme education. The target group of individuals is young upper-secondary graduates from general programmes that have not continued into tertiary education. Relying on economic literature on education effectiveness in general, existing aggregate public data on incomes, reports from agencies and interest groups and interviews with education organisers, this paper finds generally positive signs of effectiveness of this education to this group of students and other stakeholders. This paper therefore opts for recommending the implementation of the policy. The recommendation comes with a caveat, stating that the organisers should within reasonable limits control the composition of the classes in order to effectively move people from unemployment to employment. For large positive effects education organiser should ensure a good labour market for their graduates upon graduation with relevant employment within their field of study.

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Chapter I: Introduction

The Swedish labour market is in growing need of people with vocational training, educated at the upper-secondary level. The graduation rates from the vocational programmes at the Swedish upper-secondary schools, Gymnasieskolan, have been declining steadily, whilst the demand for these skills is expected to grow as the future labour market will require more specialisation (Stjernkvist, 2020; SCB, 2021a).

Especially dire is the expected need for graduates from the upper-secondary Industry Programme. The industry-programme is an upper-secondary education which aims to equip its students with relevant skills in order to enter manufacturing or other industrial vocations upon graduation. According to labour market forecasts, the supply of people with the right industrial skills is expected to decline by 40 percent by 2035, with demand staying relatively constant (SCB, 2021a). A massive labour shortage is therefore expected. Conversely, the over-supply of graduates from Gymnasieskolan's general programmes who have not continued into tertiary education is expected to grow by about 65 000 people in the same time period, with the labour market unable to keep up with the demand for work from this group of 'unskilled' workers. These 65 000 individuals alone are just enough to cover the expected 40 percent drop in the industrial sector. Swedish upper-secondary education thus has a serious matching problem.

Upper-secondary education in Sweden is predominately organised or financed by the Swedish municipalities. In turn, the municipalities are also the primary public beneficiary of an upper-secondary educated citizenry, due to the Swedish income tax structure. Thus, the skills gap and matching problem is largely a municipal issue.

As Gymnasieskolan's upper-secondary schools are unable to equip the labour market with the right skills (Hagnefur, 2016), there is a need to find new ways of providing young people with relevant skills for the future labour market. This paper investigates one such avenue. The purpose of this paper is to assess the potential policy effectiveness of providing complementary municipal upper-secondary Industry Programme education for young upper-secondary graduates from general programmes that have not attended further education five years after graduation. Adult municipal vocational education is an educational form,

organised by the municipalities but co-financed between the central government and the municipality. This paper asks the questions: What are the costs and benefits of industrial vocational education? What are realistic estimates for these costs and benefits? To what extent is central government co-financing important under these conditions for the implementation of the educational programmes?

Working under a cost-benefit analysis framework as laid out by Boardman et.al. (2018), this paper identifies the actors with standing, their potential costs and benefits from offering this type of education and then investigates whether the investment is worthwhile. The time frame chosen is 12 years – in line with the European Commission's (2014) recommendation investments in business infrastructure and other sectors.

This paper adds to existing literature by being the first study to comprehensively assess the potential effectiveness of municipal industrial adult education as well as being the first to be wholly devoted to weighing costs and benefits of adult vocational upper-secondary education in Sweden. A few previous attempts have been made to assess and compare the efficacy of adult education (e.g. Ekström, 2003; Stenberg, 2011; Stenberg & Westerlund, 2015; Liljeberg et.al., 2019). However, none of these previous studies have focused on industrial education in Yrkesvux, the municipally run institution for adult vocational education. Additionally, previous cost-benefit assessments have usually focused on tertiary education or has devoted little space and discussion to the cost-benefit aspects of their analysis (e.g. Stenberg, 2011; Stenberg & Westerlund, 2016). By focusing on industry-education in a clear cost-benefit analysis structure, this paper expands the existing knowledge by providing a more in-depth view of one specific educational programme as well as placing the potential efficacy in a relatively short time frame at the forefront of the analysis.

Due to the lack of individual level microdata, this paper relies on public aggregate data, interviews with educational organisers and literature to generate a feasible average student and see if the investment is worthwhile for the relevant actors. Due to the municipal actor being the prime decision-maker of whether to implement the policy, a subsequent analysis singles out this actor and provides an assessment of whether the policy pays off for this particular actor.

The results of the analysis expectedly point to increased employment chances, starting salary and wage progression being key elements when determining if providing this type of education is a worthwhile investment. This paper therefore posits that a comparably high starting salary and a good wage progression are key points to ensure that the education pays off. Even more central however, is that the education is able to move a share of their participants from unemployment to employment as a result of the education.

The disposition of the rest of the paper is as follows: After this introductory chapter, Chapter 2 is dedicated to giving the reader a background on the Swedish upper-secondary education system, the declining interest in vocational programmes, the expected future labour shortages and what solutions to this issue currently exist. In Chapter 3, this paper lays out the theoretical foundation of this paper, focusing on education as an investment in human capital. It also provides the reader with a review of previous literature relating to this topic. Chapter 4 starts by explaining cost-benefit analysis as a method of evaluation and how it is generally applied to education. Thereafter, Chapter 4 lays out the starting assumptions in order to assess characteristics of an average student, as well as discussing potential biases and assumptions regarding the counterfactual. The chapter then continues to recognise and monetise the relevant impacts to the actors with standing. Chapter 5 presents the results of the analysis. First it presents the costs and benefits of this paper's baseline analysis. It also presents results with employment and earnings held constant respectively. Secondly, it singles out the municipalities and presents the results of this actor-specific analysis. This is followed by Chapter 6, which discusses the results in light of existing literature and the current public discourse, and suggests avenues for further research. Finally, Chapter 7 concludes this paper by briefly summarising the main findings of this analysis.

Chapter II: Background

2.1 Brief background on Swedish upper-secondary education

Swedish upper-secondary education is normally attended between the ages of 16 and 19, under the name of Gymnasieskolan. It is not a mandatory element of the Swedish educational system, however completing it is often considered a requirement for sustained stable participation in the Swedish labour market (e.g. Arbetsförmedlingen, 2015; Ekonomifakta, 2021a).

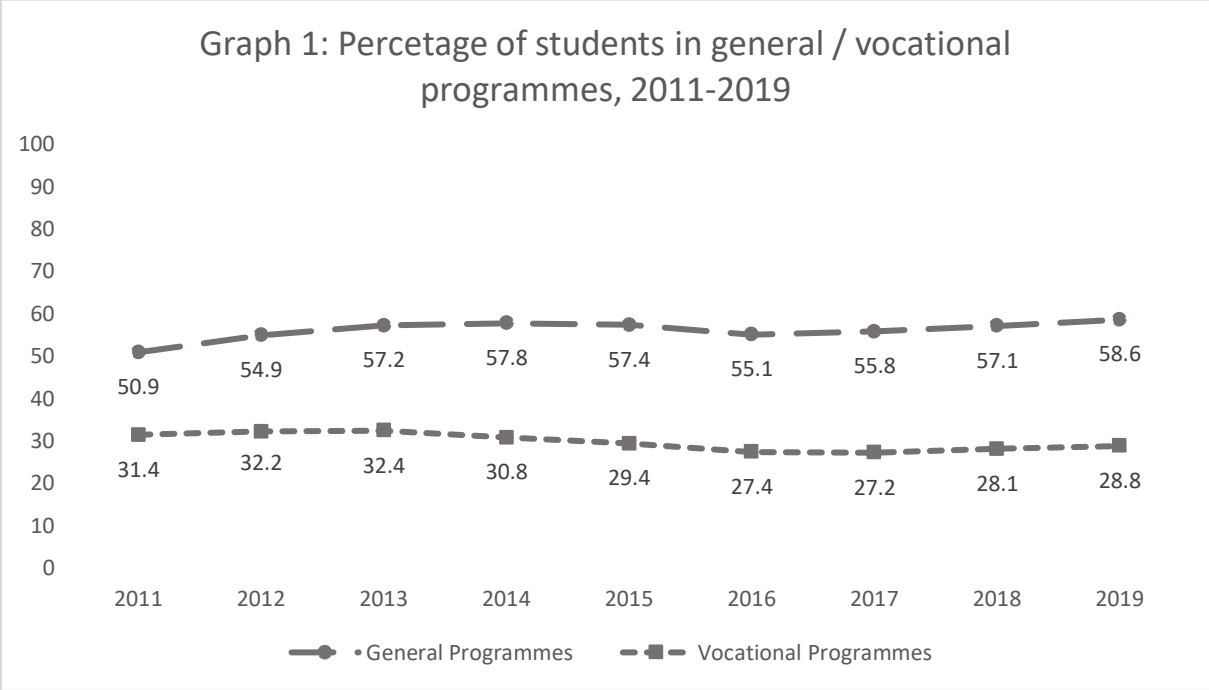
Over the past 50 years, Swedish upper-secondary education has broadly been unified under Gymnasieskolan and divided into two different streams: vocational programmes and general programmes (Skolverket, 2011). Whilst the education is technically on a course-by-course basis, Gymnasieskolan is almost always organised into various national programmes, following curriculums set by the Swedish school government agency, Skolverket. The similarities between and composition of the programmes in each stream has varied quite significantly over time, however the aim of each stream has remained constant. The aim of the vocational programmes is to equip student with relevant skills to enter specific industries immediately upon graduation. The upper-secondary programme of concern in this paper, the Industry Programme, sorts into this stream (Skolverket, 2020a). The general programmes' aim is to prepare their students for further studies in tertiary education. Prior to the 2011 upper-secondary reform, Gy11, there were two general programmes: the social sciences programme and the natural sciences programme. The last graduates of the old form were admitted in 2010 and graduated in 2013. Prior to the Gy11 reform, all programmes automatically granted the students with the basic requirements (Swedish: högskolebehörighet) for tertiary education. After the reform, it is only granted automatically to those in general programmes (Skolverket, 2011). It is possible for students in the vocational programmes to elect courses to meet the basic requirements for tertiary education.

The responsibility for quality of Gymnasieskolan is placed on the municipalities. The education is run by municipalities, clusters of municipalities or private actors. Regulated by Swedish law, the municipalities are responsible for "to the greatest extent possible" providing places in the programmes in accordance with the wishes of the prospective students of the upper-secondary education (SFS 2019:947, Skollagen, 15 kap. 30 §).

2.2 Declining interest in vocational programmes

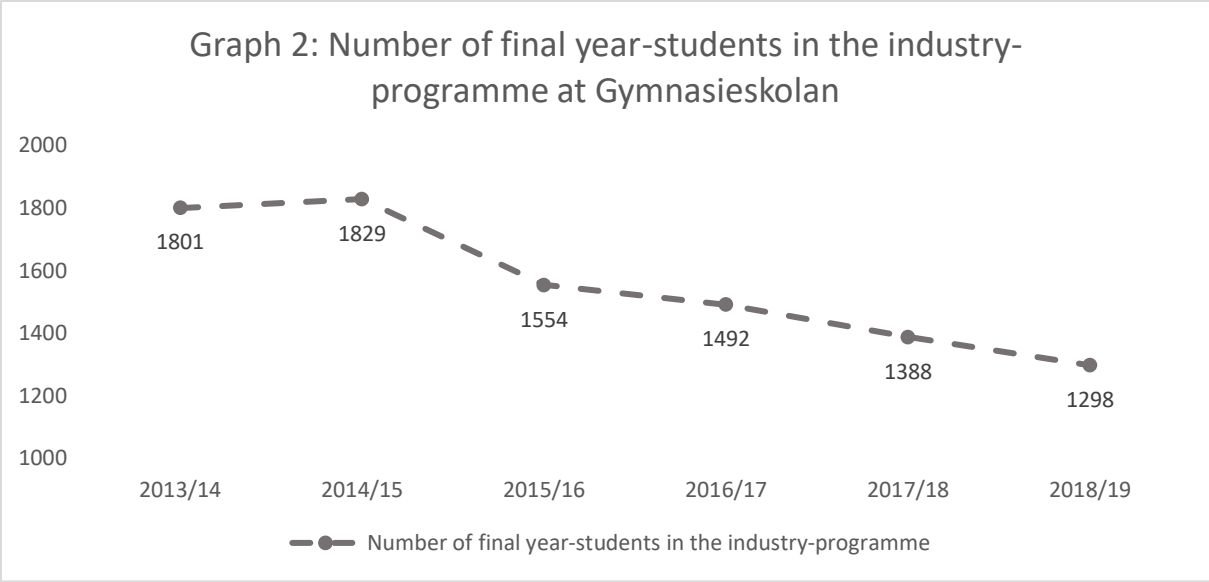
As is evident from Graph 1, the share of students attending vocational programmes in Gymnasieskolan has slowly declined over the past decade. Conversely, the share of students attending general programmes has increased.

A study published by Svenskt Näringsliv (2021) asked 15 year-olds who have recently chosen their programmes for upper-secondary school about their programme choices, in light of the decline of the vocational programmes since the Gy11-reform. According to the study, more than a third of the students attending general programmes considered applying for vocational programmes. Of these, 54 percent stated that they decided against a vocational programme since they wanted to meet the basic requirements for higher education without picking the correct electives. 36 percent of the respondents stated that they felt that a vocational programme was too narrow in terms of career options later in life. The general courses were also considered better options because of various career options upon graduation.



Source: Skolverket (2021e)

The Industry Programme is certainly no exception in the decline of the vocational programmes. Graph 2 shows the decline in final year students at the programme since its principal class under the new Gy11-system of 2013/14 until 2018/19.



Source: Skolverket (2021b)

As noted by Hagnefur (2016), the interest in the vocational programmes shows "no signs of recovery" (Hagnefur, 2016: p. 3).

2.3 Adult upper-secondary education

In addition to upper-secondary education being offered as grade 10-12 in the Swedish school system, there are also adult education versions of Gymnasieskolan level education. This is generally referred to as Komvux (Swedish short for municipal adult education, kommunal vuxenutbildning). Taking primarily vocational courses is usually referred to as attending Yrkesvux.

As opposed to Gymnasieskolan, Yrkesvux offer no centrally regulated programmes. Rather, the education is done on a course-by-course basis (Liljeberg et.al., 2019). There are however some national guidelines, "nationella yrkespaket", with suggestions of what vocational educations ought to contain for better coherence and transferability of the education in the labour market (Skolverket, 2021a). The guidelines for the Industry Programme consists of basic industry-related courses amounting to 700 credits and then vocation specific courses, such as welding or process operating, of an additional 300-700 credits (Skolverket, 2021b), bringing the total to 1 000 – 1 300 credits. This amount of credits can be studied in one

school-year, according to education organisers in Skåne[1]. However, the education organisers are not obliged to follow the suggestions when starting a new programme. This leads to vocational education at Komvux being very diverse, and study tracks with the same name can be vastly different in both in content and time depending on municipality. This makes analysis of the effectiveness of this type of education very difficult (Liljeberg et.al., 2019).

When offering educational programmes, the municipalities are supposed to strive to offer education both in regard to demand of individuals and need in the labour market (SFS 2020:447, Skollagen, 20 kap. 2 §). Another regulation is that the municipalities are not allowed to fully decide who attends a vocational programme. Preference should be given to those who have "short prior education and who 1) wish to finish previously started education, 2) need the education to complete previously started education or 3) need the education for ongoing vocational activities or planned choice of vocation." (Skolverket, 2021c).

By far, the most common education at Yrkesvux is that of Health and Social Care, which in 2014 attracted over 13 000 students or 44.9 percent of all Yrkesvux students. The same year, the Industry Programme attracted just over 1 400 students, or 4.8 percent of the total students at Yrkesvux (von Zweigbergk, 2015). As mentioned, students do not study regulated programmes at Yrkesvux, so these figures might vary depending on the definition of a student of a certain track, as it pertains to what type of education attended and scope of this education.

In order to stimulate the implementation of more vocational education programmes, the central government sponsors a share of the cost. As of 2021, the central government sponsors 93,75 SEK per credit taken in the industrial education. This is meant to cover the full cost of the education. However, there exists a co-financing requirement, meaning that 30 percent of the educational spaces need to be financed by the municipalities themselves (Skolverket, 2021d). This effectively means that the municipalities stand for 30 percent of the cost and the central government for the remaining 70 percent. Prior to 2021 the government only financed half of the spaces, effectively paying for 50 percent of the cost of the education.

There is also another form of adult education as well in Sweden, called Labour Market Training, not of direct concern of this paper but a topic of more comprehensive previous

[1] Pernilla Bergkvist, Samordnare Teknikcollege Trelleborg, 2020-04-27; Anders Davidsson, Yrkeslärare Industritekniska programmet Helsingborg, 2020-04-22

academic literature. This form of education is either organised or bought by the Swedish public employment service, Arbetsförmedlingen. The education is provided to the unemployed and paid for by the government agency. As opposed to Yrkesvux, the students at the Labour Market Training are reimbursed through the social security scheme for the unemployed, whereas the students at Yrkesvux are entitled to loans and grants to finance their day-to-day expenses. Both forms of education are, as all upper-secondary education in Sweden, tuition free (Liljeberg et.al., 2019).

2.4 Current and coming labour shortages

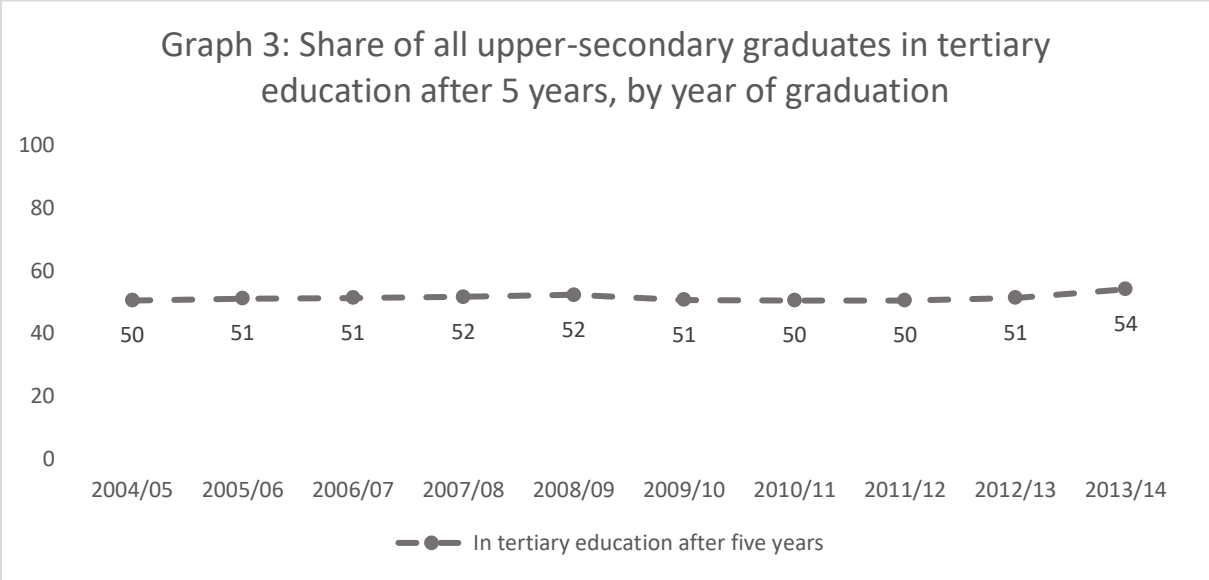
The need for more people with certain vocational skills is a topic of much debate yet general agreement in public Swedish education discourse. The view that Sweden needs to educate more young people with non-tertiary skills to the labour market is shared by both sides of the political spectrum, as well as by both labour unions and employer organisations (e.g. Olsson & Carlsson Tenitskaja, 2018; Jällhage, 2020; LO & Svenskt Näringsliv, 2015).

In 2020, a survey found that 74 percent of relevant employers stated that there was a shortage of recent graduates with skills gained from the Industry Programme (SCB, 2020a). The shortage was not limited to the Industry Programme, but existed in a wide array of vocations requiring upper-secondary education. Notably, relatively few employers see a shortage of people with Health and Social Care skills, despite quite few graduates from this programme at Gymnasieskolan. This is probably due to the large amount of people graduating from adult education versions of this education later in life. This shows that there are ways in which adult education can ‘cover’ for poor graduation rates at Gymnasieskolan.

If the shortage today seems acute, it is dwarfed by future outlooks. The most recent triennial labour market and education forecast by Statistics Sweden (SCB, 2021a) adds to the gloomy picture. The report forecasts supply and demand of various educational levels and streams on the labour market in Sweden. According to the study, the demand for people with upper-secondary vocational skills will increase by about 200 000, whilst the supply is expected to decrease by 130 000 people. Among the bleakest forecasts is that of the Industry Programme. Already marred with a labour shortage, a wave of retirements in the upcoming decade and a half means that the shortage of aptly skilled workers will be severe. The demand for the skills compared to today is forecasted to decrease by 2 percent, whilst the supply of skilled workers

is expected to decrease by 40 percent until 2035. The study has calculated that around 1 500 people will graduate from the Industry Programme annually, with an additional 800 from Labour Market Training and 500 from Yrkesvux. The report's section on the Industry Programme ends by stating that "[a] doubling of examinations from Komvux compared to today, would only marginally affect the relationship between supply and demand." (SCB, 2021a: p. 39).

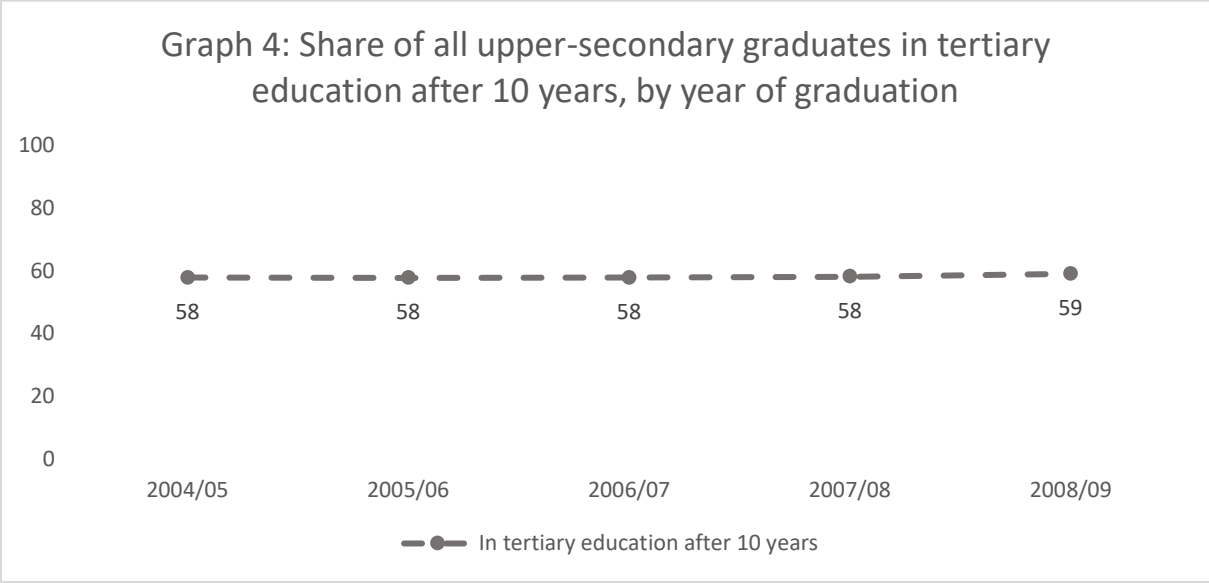
Conversely, the over-supply of upper-secondary generalists is expected to grow. Despite an increase in the share of students choosing general programmes, the share of students continuing into further education has not increased. Graph 3 and 4 shows the total share of student who have continued into further education five and ten years after graduation, in the most recent compilation from 2018. In 2020, it was stated that 40 percent of those in general programmes do not go on to study at a tertiary education institute (Stjernkvist, 2020). Since the number of attendees increase in general programmes yet the same percentage of student venture into teritary education, the number of students from general programmes without tertiary education will increase.



SCB (2021c)

Until 2035, the over-supply of upper-secondary generalists is expected to grow by about 65 000 people whilst the demand is expected to remain relatively unchanged. From this group, around 20 percent are today working in retail, 10 percent in health and social services and 10 percent in manufacturing industry. Due to the demand for re- and up-skilling of the

workforce, many of the occupations held by upper-secondary generalists today will require upper-secondary vocational education in the future (SCB, 2021a).



Source: SCB (2021c)

In summary, there is a matching problem today in the Swedish labour market, as it pertains to upper-secondary skills. The matching issues are likely to be further exaggerated in the future. Naturally, labour markets are notoriously difficult to forecast (e.g. Meagher & Pang, 2011), so the future demand and supply should be taken with a grain of salt. Nonetheless, the patterns are very stark and it is therefore fairly safe to assess that the matching problem will grow in the future.

It should be noted that despite these coming projected shortages, many municipalities are wary of implementing Industry Programme educations at an adult level, with costs often being cited as a main concern (Sveriges Kommuner och Regioner, 2018). This issue could perhaps be attributed to the rather dire state that many municipalities find themselves in financially. In short, municipalities are according to law bound to have a balanced budget (SFS 2018:600, Kommunallagen, 11 kap. 12 §). A larger non-working-age population is expected to severely strain the municipal welfare-systems (Mörk et.al. 2019), meaning that municipalities are careful with their spending.

2.5 Suggested solutions

In recent years, a number of solutions to the upper-secondary matching problem have been presented. From the Swedish Trade Union Confederation LO and from the Social Democratic Party of Sweden, a suggested solution has been to reinstate the automatic fulfilment of basic requirements for tertiary education in all upper-secondary programmes (Olsson & Tenitskaja, 2018; Wreder & Kjellgren, 2020). The argument is that this would increase the status of the vocational programmes (Jällhage, 2020). This suggested change was put to a vote by Swedish parliament in 2018. It was voted down by the opposition. The argument for voting it down was that the issue of too low graduation rates in upper-secondary schools would "not be solved by forcing students [to take] more academic courses" (Olsson & Tenitskaja, 2018), according to the former minister of education Jan Björklund.

In 2020, a Swedish Government Official Report called Collective Responsibility (Swedish: Gemensamt Ansvar) was released. The report contained a wide array of suggestions, some of the most notable and relevant to this paper will be covered hereforth. The report suggested that both the supply and variety of spaces at the Yrkesvux need to increase. It suggested a more centralised governance of spaces in both Gymnasieskolan and Yrkesvux. Most controversially, it proposed a change in the law regarding the municipal allocation of spaces at Gymnasieskolan. Instead of allocating spaces based on the wishes of the youth, the report suggested that spaces should be allocated according to both the "students' demand and need and the needs of the labour market" (Stjernkvist, 2020: p. 25). The responsibility of allocation in accordance to these criteria would extend to both municipalities and private actors.

The proposed changes have been met with criticism. The criticism has partly been about a fear that more central governance of education policies would lead to less municipal influence over the education (e.g. Helsingborg stad, 2020; Sveriges Kommuner och Regioner, 2020). Another concern is that the addition of labour market need to the allocation of study spaces at the programmes at Gymnasieskolan would lead to less motivated students, since it does not solve the issue of the vocational programmes being perceived as less attractive (Andersson, 2020).

A more recent attempt of increasing the vocational graduates in upper-secondary school was announced by the Swedish Department of Education (Swedish: Utbildningsdepartementet) in March 2021. The government announced that they would start a trial in which general and

vocational courses were integrated. The trial will consist of parts of the vocational Retail programme (Swedish: Handelsprogrammet) being integrated as an electable track within the general Business programme (Swedish: Ekonomiprogrammet). The idea is to give vocational skills to those students who will not continue into further studies, prior to them having made the decision not to go into tertiary education. Since the project is still in its very early phase, it is still not possible to evaluate its effects (Utbildningsdepartementet, 2021).

The issue with all of the above suggestions is that they are based on an assumption that increased marketability or better access to further studies will increase the share of participants in vocational programmes at Gymnasieskolan. No solution comprehensibly deals with the risk of the interest in vocational programmes in this age group remaining or sinking even further regardless of intervention.

Therefore, this study will discuss a separate solution to the matching problem. In this paper, the potential costs and benefits of providing upper-secondary vocational education to young upper-secondary generalists will be explored. Since this is an underresearched area, few real-life versions of this education exists and due to the lack of publicly available data, this paper will rely on a set of assumptions regarding programme structure, feasible average student and their career progression afterwards. Despite these assumptions, it is still a necessary investigation, since there is a need to start exploring options to get more into vocational education a few years *after* graduation from Gymnasieskolan.

Chapter III: Theoretical Foundation and Previous Literature

In order to assess the effectiveness of education, it is important to have a firm understanding of the economic theory of education. This chapter starts by rather comprehensively explaining the economic theory of education from the point of view of the primary stakeholders, namely the individual, firms and society. It will start by discussing what makes an individual decide to engage in voluntary education, then discuss why firms are interested in an educated workforce yet often unwilling to pay for it, and end with what positive effects education has on society and why it is generally a worthwhile investment. The discussion is rather general, yet important in order to understand why this paper exclusively explores public education and what the obstacles are to individual attendance.

This chapter will end with a discussion on previous literature relating to this paper and where this study fits into the existing stream of literature.

3.1 Education to the individual

According to economic theory, an individual makes decisions in order to maximise their utility. In the case of education and labour economics, maximising utility is often – for simplicity – equated with maximising earnings (e.g. Card, 1999; Becker, 1993). This paper is no different, and will assume that people make career decisions with the objective of maximising life earnings. An individual's wages is determined by their marginal productivity. The higher the individual productivity, the higher the individual's wages (Varian, 2014). An individual's productivity is in turn determined by their human capital.

Human capital is sometimes equated with an individual's number of years of education. However, human capital is actually anything that adds to an individual's productivity in the workplace, such as field of study, work-place learning, motivation, cognitive ability and health (Stenberg, 2019). Human capital is cultivated throughout life, can decay with time and an individual can take active measures to increase it (Card, 1999; Becker, 1993). Mandatory schooling is a way to ensure that (almost) all citizens have a minimum amount of human capital to function efficiently in the labour market.

According to human capital theory, optional education is just an investment choice in increased human capital (van Lith, 1998). And much like any other investment, an individual

will pursue it if the benefits exceeds the costs. In the (simplified) case of education, the individual benefit is the income that the individual earns upon completion of the education. The individual costs are the direct costs borne by the individual, meaning possible tuition fees as well as for example costs for textbooks and supplies, and the opportunity cost, meaning the additional income or training they would have accumulated during the education had they not attended the education (Becker, 1993) as well as the income the individual would have earned had they not completed the education (McCall et.al, 2016).

In reality, there is no way for the individual to know what the income effect of the education will be, as well as what their foregone earnings would be if they do not attend the education. Thus, the investment is made with reference to the expected income upon completion, the expected income lost due to the education and the expected income had the education not been attained, given the information the individual has at the given time of the decision. An individual makes an education decision in accordance with the following formula, heavily inspired by McCall et.al. (2016: p. 489),

$$E\left\{\sum_{j=0}^{\infty}\frac{(Y_{t_0+j}^{1}-Y_{t_0+j}^{0})}{(1+r+\delta)^{j}}\,\middle|\, I_{t_0}\right\} > c$$

where $Y_{t_0+j}^{1}$ is the income in future periods, j, after the commencement of the education, $Y_{t_0+j}^{0}$ is the future income without the education investment, $0 < r < 1$ is the market interest rate (relevant when the individual take loans for the education), $0 < \delta < 1$ is a discount rate, I_{t_0} is the information at the start of the education and c is the direct cost. The formula states that the individual will decide to engage in education if they believe, according to the information available to them, that their earnings as a result of the education will overtake the direct costs and the lost earnings from not attending the education.

The above formula differs from the one presented by McCall et.al. (2016) in its inclusion of the discount rate δ.[2] This inclusion implies a present-bias in the individual, meaning that income received today is preferable to the same income received at a later date. The case of present-bias is well documented as it pertains to financial decision-making (Angner, 2016),

[2] In their presentation of a dynamic model of human capital accumulation over time, McCall et.al. (2016) do include a present-biased discount factor in their formula.

yet admittedly an underexplored area as it pertains to education decisions (see for example Lavecchia et.al., 2015). However, since education is treated as a purely financial decision herein, it makes sense to include it. As opposed to McCall (2016), this paper will not include a decay-rate of skills attained through education. Rather, this paper will, for simplicity, assume that once a person has commenced employment with an employer, they will receive training to the extent that the human capital is kept constant.

Thus, for the purposes of this paper, an individual will decide to invest in education if they expect the discounted excess income stemming from the education investment decision to exceed the expected foregone earnings and direct costs of the education, given the information available to the individual at the time of the investment decision.

Naturally, the above discussion relies on the assumption that choice of education is a rational financial decision, which is of course not always the case. People decide their education based on a wide variety of factors (Altmejd et.al., 2020). However, attempting to find alternate motivations for why individuals attend an education is difficult and lies beyond the scope of this paper.

As it pertains to bearing the direct costs of the education, there are often hurdles to the individuals to pay for it out of their own pockets (Stenberg, 2019). This is due to education investment most often occur prior to the individual having accumulated enough wealth to pay for it themselves. Therefore, the costs can either be paid for collectively (i.e. through taxes) or through lending. In the case of Sweden, the direct costs of education is covered by the public whereas funding of day-to-day expenses are available through generous government loans and grants (McCall et.al., 2016).

3.2 Education to the firm

To the individual firm, an increase in human capital is associated with greater productivity which in turn means greater revenue for each unit of input (Varian, 2014). The benefits do not only extend to the individual's productivity level – there is evidence that increased human capital means less time spent on management and recruiting and increased productivity in other parts of an organisation (IBM, 2014). An educated workforce is therefore a competitive

advantage to the individual firm. However, according to economic theory, firms should be hesitant to invest in human capital (Stenberg, 2019).

According to Becker (1993), there are two types of human capital investments available to the firms: specific training and general training. Specific training is training or education that is only beneficial to the employer and not to any other firm or competitor. Training in firm specific regulations or in programmes only used by the firm are (imperfect) examples here. On the other hand, general training is that which can be used by any employer, such as communicative skills. In reality, as stated by Becker, most at-work education is a mix between the two. Therefore, firms ought to be unwilling to invest in training for their employees. As explained by Stenberg (2019: p. 15), "An employer might also be unwilling to pay [for education] since they cannot be sure that the employee will remain in the company after the education. Those insecurities might result in profitable investments in education for adults not being implemented." This market failure, Stenberg posits, paves way the for publicly funded education. Nonetheless, this paper assumes that the skills of the individual does not decay with time, or – more correctly – that the decay rate is matched by investments in human capital by the employer. This means that employers are not interested in improving the productivity of their employees, however are interested in their employees not dropping in productivity as the effect of their education wanes.

3.3 Education to society

With the individual often not able to cover the full cost of education by themselves and the firms often unwilling to sufficiently invest in education this leaves the public to fund education. The potential benefits to society from funding education are however plentiful.

The primary benefits comes in the form of increased tax revenue resulting from higher citizens' wages and higher firm productivity. The positive effects could potentially be off-set by a so-called crowding out effect, meaning that people with education simply take jobs that people without education would have performed otherwise. Whilst the increased firm productivity and the higher wages from the individual would have remained, this would mean that the public has provided unnecessary education, since the investment has just 'shifted' employment from one individual to another. As it pertains to this paper, Dahlberg and

Forslund (2005) found no significant evidence of a crowding-out effect due to Swedish labour market training.

Secondary benefits are the positive association between education and national GDP-growth. According to macroeconomic theory as well as empirical evidence, a higher educational level is a cornerstone of economic growth (Jones & Vollrath, 2013; Birch Sorensen & Whitta-Jacobsen, 2010).

3.4 Previous Literature

As it relates to previous literature, this paper is somewhat unchartered territory. There exist quite rich strands of literature on the effects of education in general on earnings and employment as well as on the effects of adult education on the unemployed. However, very little research has gone into the potential effects of providing specifically adult vocational education to a group of individuals who on average have a decent standing in the labour market.

As it relates to cost-benefits analyses of vocational education, this paper is especially reliant on two articles by Stenberg (2011) and Stenberg & Westerlund (2016). Stenberg (2011) analyses publicly provided formal education for low skilled individuals, and finds an average income return of 4.4 percent from the education. The author relies on longitudinal register data from Statistics Sweden from 1990 to 2004, analysing individuals who have not completed upper-secondary school, attended adult education in 1994-1995 and were between the ages of 24-43 in 1994. Stenberg & Westerlund (2016) on the other hand analyse the effect of tertiary education. The methodology is similar to Stenberg (2011). The authors use data from Statistics Sweden, with individuals enrolling in tertiary education in 1992-1993 as the treated group. In Stenberg & Westerling (2016) the age group is 29-55 years and the years of analysis 1982 to 2011.

In both instances, the authors dedicate the bulk of the analysis and discussion to earnings and employment changes as a result of the education analysed. There is no comprehensive discussion relating to cost-benefit analysis as a method of evaluation, nor are the cost-benefit calculations the prime focus of the articles. The calculations are presented in an appendix, given relatively little space. Nonetheless, two points of these calculations are of particular

relevance to this paper. Stenberg & Westerlund (2016) uses a 3 percent discount rate as their low estimate of a discount rate, with five percent being the high estimate. Stenberg (2011) only uses the 3 percent discount rate. The 3 percent rate will be used as a baseline estimate in this paper, with the 5 percent rate being used in the sensitivity analysis. Secondly, both papers decide to multiply earnings by 1.4, in order to include payroll taxes and reflect an inherent production value. This is done, since a person's productivity is reflected by the total amount of revenue they raise for their employer which this metric aims to capture. This multiplicator will also be used in this paper.

In terms of findings on the cost-effectiveness, Stenberg (2011) finds that investment in education for the low-skilled yields negative returns. Additional revenues in terms of earnings cover 57 percent of the direct cost of the education and foregone earnings. The author attributes this to "[adult education] credits are accomplished slowly over time and that only about half of the treated, completing at least one year of AE, drive the positive estimates." (Stenberg, 2011: p. 1274). Stenberg & Westerlund (2016), in their analysis of tertiary education, finds large positive effects of investment into tertiary education – however that the positive effects only emerge after approximately 10 years.

As it relates to analyses of earnings and employment of education in Sweden, there is more literature. Starting with literature on the effects of education in general. Palme & Wright (1998) used the Swedish Level of Living Survey (SLLS) in 1968, 1981 and 1991 with the primary objective to assess whether there was a decline in the returns to schooling from the late 1960s to 1991. The SLLS is a longitudinal survey, with data collected once per decade, which originally was a random sample of 1/1000 of the Swedish population between 15 and 75 years of age. The dataset contained data on years of schooling, highest level achieved and salary on 3 000 – 3 500 individuals per year of data collection. The authors use a version of the Mincer equation, fit with a cubic spline for experience, to see how education affects logged wages. The Mincer equation is a classic formula for calculating the effects of education, which uses experience and years of education to explain (logged) wages. The results of the paper suggest that the return to schooling declined between 1968 and 1981, yet remained relatively constant between 1981 and 1991. The returns to one additional year of vocational upper secondary schooling was 2.5 percent for men and 2.7 percent for women in 1991, in their specification correcting for selection bias. It should be noted that this return

relates to education in vocational education at Gymnasieskolan, not as adult education. In general, across all types of education, the returns to schooling was 4.6 percent in 1991.

Another study on the SLLS dataset is that of Björklund & Kjellström (2002), in which the authors criticize previous Mincer-equation research and therefore adds some flexibility to the model by applying a Box-Cox transformation to the variables, as well as making some varying assumptions regarding retirement age and employment rates. For an additional year of upper-secondary school, the authors find results in the range 3.1 to 4.9 percent in 1991.

Isacsson (2004) also used the SLLS dataset in 1991 but complemented it with twin-data from the twin-registry. He analysed the returns to schooling for various educational levels through a number of specifications and samples including separate regressions for monozygotic and dizygotic twins. Isacsson finds positive yet very diverse results for the returns to an additional year of schooling, depending on specification. For an additional year of upper-secondary schooling beyond two years, he finds consistently positive returns between 2.8 and 9.8 percent depending on the specification. Notably, is that the author finds returns between -3.9 percent and 5 percent for two years of upper secondary school – the length of the vocational programmes under the Gymnsieskolan structure prior to 1994. However, as this paper analyses the returns to an additional year of vocational schooling, beyond the mandatory general programmes, precedence is given to the finding regarding an additional year of upper secondary beyond two years.

Before moving on to the literature on the effects of adult education specifically, one important thing should be noted. These analyses on this subject have, either explicitly or in practice, focused on the effects of adult education on the unemployed. Plenty of literature focus on the publicly provided Labour Market Training schemes, which are only offered to unemployed individuals with a poor standing in the labour market. As it relates to the literature at the Yrkesvux level, this type of analysis is firstly rarer. Secondly, due to the legal framework surrounding the admissions into this type of education, the group of individuals analysed comprises of people with a fairly poor footing on the labour market. With this in mind, covering some literature on the effects of adult education is still relevant.

Ekström (2003) for example, finds negative earnings effects for adults undertaking adult secondary education. The author uses data on people who undertook any amount of credits of

adult secondary education in the years 1988-1995 and follows them until the year 2000. Albrecht et.al. (2005) found no significant effects of adult secondary education on earnings of a sample in the 1990s. On the other hand, Stenberg & Westerlund (2008) found very large positive effects of 14 percent income increases for males and 23 percent income increases for females. In the aforementioned follow-up study, however, Stenberg (2011) argues that these latter findings are largely influenced by the sample. In the same study, Stenberg (2011) studies an on average younger age group than Ekström (2003) and Albrecht et.al. (2005) as well as a different preferred specification, and finds that a year of adult education is associated with an annual earnings increase of 4.4 percent. Again, these investigates so called low-skilled individuals – meaning individuals that have not attained upper-secondary education prior to their adult attendance.

In more recent years, Liljeberg et.al. (2019) adds to the literature on adult education efficacy. The authors of this paper analyses individuals attending Yrkesvux education separately, in the years 1995-2015. Notably, the authors analyse people who have a passing grade in one course relating to a vocational programme. This means that the authors effectively analyse people who commence vocational education rather than complete it. In the later samples, about 30 percent were unemployed when they started the education, with about 20 percent on social benefits an 60 percent employed in the year prior to the start of the education. The authors find that vocational education is associated with a 2.8 percent increase in income, with effects increasing from 0.2 percent to 6.3 percent from the 1995-1999 sample to the 2010-2015 sample. However, they find that those who study Industry Programme related courses have a negative, yet statistically insignificant, effect on income levels with -2.9 percent. One should however note that the sample of individuals for the Industry Programme is very, very small, with often close to zero yearly participants. This could be compared with the social care programme of about 15 000 yearly participants or the transport programme with around 2 000 yearly participants.

This paper adds to the existing literature by assessing the potential effect of adult education in a group of individuals that normally do not attend this type of education. Due to the legal framework surrounding the admission to these programs and by extension what data is available, all previous literature has explicitly or in practice focused on adult education provided to individuals who are far from employment. Due to expected shortages in people with vocational skills and an over-supply of upper-secondary generalists and the enrolment in

this type of education being strictly voluntary, it is important to assess the potential effects of providing adult vocational education to the average upper-secondary generalist.

Finally, on the topic of the effects of Yrkesvux education on individuals, Region Skåne released a report in the late spring of 2021 (Region Skåne, 2021). The study used register data from SCB and specifically looked at the effects of both Komvux and Yrkesvux and ascertained their importance for the regional labour market in Skåne. This paper has gained access to some graphs and tables on the joint effect of the industry and the adjancent electric- and energy programme (Swedish: El- och energiprogrammet) of graduates in 2014. These graphs and tables are available in Appendix B.

Broadly, Region Skåne (2021) found that of the people who had attended the industrial or electric- and energy programme had quite successful labour market returns. Of 189 students who graduated in 2018, 146 were in employment the year after and rose to 153 by 2018. This compared to fewer than half being in employment the year before starting the education. The annual incomes of those who were working before rose from 233 000 SEK the year before starting to 305 000 SEK two years after, rising to 333 000 SEK by 2018. Those who were students before starting the education or unemployed generally had lower incomes than those who worked the year prior to the education. However, their incomes two years after graduation, at around 260 000 SEK annually were still higher than the pre-education incomes of those who had been working prior to the education and significantly higher than their own previous incomes. It should be noted that this study has relied on existing previous students. As mentioned, these students can probably not be directly equated with the target group of interest in this paper – being young upper-secondary graduates from general programmes. However, that the education in Skåne has been successful in moving people from unemployment to employment, and the potential effects the education has had on earnings is still interesting to this paper. It should further be noted that due to time constraints, the results of this study has not been fully incorporated into this paper. However, the results will be referenced to and the findings of this paper will be discussed in the light of Region Skåne's (2021) report.

Chapter IV: Methodology

4.1 Cost-benefit analysis as a method of evaluation

A cost-benefit analysis is an analysing tool which identifies the positive and negative consequences of a policy or project thereby guiding decision-making (Naturvårdsverket, 2008). It is a tool used in various levels of government, across countries and in a multitude of industries (European Commission, 2014).

The basic idea is that the negative aspects (costs) and positive aspects (benefits) of a policy are identified, monetised and weighed against each other in order to make an objective recommendation, based on economic measurements rather than the subjectivity of the decision-maker (Boardman et.al., 2018). To make a recommendation, this paper will use the so-called Kaldor-Hicks criterion to make a recommendation. The Kaldor-Hicks criterion stipulates that a policy should be recommended if the (time discounted) benefits of all stakeholders exceed the (time discounted) costs of all stakeholders (Boardman et.al., 2018). This allows for one stakeholder to make a loss, as long as that loss is made up for by a different stakeholder. In other words, the actors who benefit should, *theoretically*, be able to fully compensate the actors with losses and still have gains left as a result of the policy.

In the analysis this paper uses the ten major steps of cost-benefit analysis as outlined by Boardman et.al. (2018). The full list of ten steps can be found in Appendix A.

4.2 Counterfactual and standing

First, in accordance with Boardman et.al.s (2018) ten steps, the alternative to the policy should be established. This paper will use the so-called ‘status quo’ option as alternative projects – meaning that the alternative to the investment in Industry Programme education is no education. This alternative is not as clear-cut as it might seem. One could for example have used a different educational route as a comparison. The rational for using the status quo option is twofold. Firstly, the status quo alternative has been used in prior education cost-benefit analyses in Sweden (e.g. Stenberg, 2011; Stenberg & Westerlund, 2016). Secondly, without any additional information on attendees, it is hard to assess what an alternative ‘standard’ route would be. One could hypothesise about the student leaving for tertiary

education or perhaps attending some other form of upper-secondary adult education. However, data to form an alternative route is not available to this analysis.

Next, so-called standing, i.e. who the stakeholders are, should be clearly established. As discussed in Chapter 3 of this paper, there are three potential actors whom can bear the costs and likewise three actors that are potential beneficiaries of educational investment. These are 1) education participants, 2) firms, and 3) government. In the case of a crowding-out effect, the education would also have an impact on non-participants. However, as mentioned in the previous chapter, Dahlberg & Forslund (2005) found no significant crowding-out effects as a result of adult labour market training. Therefore, this paper will assume that there is no crowding-out effect as a result of this form of adult education either.

4.3 Identifying costs and benefits

In keeping with this paper's theoretical discussion, costs are generally counted in two separate posts. Firstly, the direct cost of the programme, meaning the expenses relating to material, venues, material and so on that are directly associated with organising the programme. Secondly, opportunity cost represented by foregone earnings. This way of counting costs is standard in the literature on government funded education, both in Sweden and abroad (e.g. Boardman et.al., 2018; Hoeckel, 2008; Stenberg, 2011; Stenberg & Westerlund, 2016; Tsang, 1997; Woodhall, 1992). In foregone earnings, both the lost post-tax earnings of the individual and the lost tax revenue of the government are accounted for. Firms' additional production loss, stemming from lost labour in an imperfect market, will be covered in the multiplication of earnings with 1.4 to reflect pay-roll taxes and inherent production value. This is in line with previous literature on Swedish educational cost-benefit analyses (Stenberg, 2011; Stenberg & Westerlund, 2016), which were discussed in *3.4 Previous Literature*.

Regarding benefits, there are a few different ways to account for these. The most common approach is to either look at increased earnings after the education, increased employment chances or to look at both (McCall et.al., 2016). There are however other factors that one could take into account. Hoeckel (2008) for example lists a wide array of potential benefits of explicitly vocational education and training both in the short-term and in the long-term. Due to the timeframe of this analysis and the severe difficulties in measuring and monetising the long-term benefits acknowledged by Hoeckel, this paper only considers the short-term

benefits. Hoeckel (2008) lists better employment chances and earnings levels first, but also adds increased work satisfaction as a relevant benefit for the individual. For the employer, they list higher productivity and lower recruiting costs and for society they list saved expenses for social benefits. Another positive aspect of education mentioned in the literature, probably caught by Hoeckel (2008) but not explicitly mentioned, is improved health resulting both from increased employment and career-progression (Boardman et.al., 2018).

This paper will include earnings effects, employment effects and health effects as the benefits. This is in line with the short-term benefits to the individual as laid out in Hoeckel (2008). More discussion will be allocated to the earnings effects. This is due to earnings being both the most considerable cost and benefit relating to the education. Three different scenarios will be presented for how a year of Industry Programme education can affect the earnings of young people who have previously attended general programmes in upper-secondary school. The costs and benefits included in this analysis are listed in Table 1.

TABLE 1:

Costs and Benefits of One Year of Industry Programme Education

Costs	**Benefits**
Education costs (direct costs) Foregone earnings (indirect costs)	Increased income (earnings effect) Employment chances (employment effect) Better health (health effects)

4.4 Some starting assumptions

As stated in the Chapter I, the purpose of this paper is to assess the potential policy effectiveness of providing complementary upper-secondary Industry Programme education for young upper-secondary graduates from general programmes that have not attended further education. To progress with this analysis and create viable estimates, some initial assumptions have to be made in order to facilitate the study. These assumptions are that the average individual 1) graduated from Gymnasieskolan five years before the industrial education starts, 2) from a general programme, 3) with complete grades, and 4) has not pursued tertiary education before commencing the education. The first assumption above, regarding years passed since graduation from Gymnasieskolan, is made to facilitate facilitates the analysis as this provision can be matched with specific, relevant income data from SCB (2021b).

This paper will assume that from this group, the attendees is a random draw. This is most relevant to the employment numbers used in this paper. The assumption is not that most, nor a plurality, starting the programme are unemployed. Rather the assumption is that the employment levels among the group of individuals going into the education reflects the employment level of the group in general. Thus, this paper assesses the effectiveness of providing this type of education at random in the target population, rather than offering it only to those with little or no employment.

A relevant question is whether an employed individual would be interested in taking up this type of education. To gauge an individual's interest in the education, one should return to the discussion in *3.1 Education to the individual*. As explained in this section, given that an individual is concerned with maximising their earnings, they will decide to pursue the education if they believe that the income after the additional education will exceed foregone earnings both during the education and after. An individual's interest in the education is therefore a function of prospective earnings. Thus, the earnings effect discussed later will not only assess the potential benefits but also the potential interest of people attending the education.

In regards to the education structure there is no regulation on what constitutes an Yrkesvux education, as stated in the *2.3 Adult upper-secondary education*. The guidelines for the vocational programmes, however, state that the Industry Programme should contain between 1 000 and 1 300 upper-secondary credits. Whilst a normal school year usually consists of 800 credits, educational organisers have stated that 1 000 – 1 300 credits can be studied in one school year in the case of adult education. Herein, the education's scope is therefore assumed to consist of 1 000 – 1 300 credits, all credits taken within one school year (i.e. ten months). The municipal actors will be interested in the education paying off relatively quickly. For the municipal-specific analysis an income tax rate of 21 percent will be used – the average municipal tax rate in Sweden rounded to its nearest integer (SCB, 2020b).

As mentioned in *3.4 Previous Literature*, this paper will use a 3 percent discount rate in the baseline analysis, in keeping with the rate used by Stenberg (2011) and the lower rate used by Stenberg & Westerlund (2016). In the sensitivity analysis it will apply the higher 5 percent rate used by Stenberg & Westerlund (2016).

A twelve-year timeframe will be applied, where the first year is the year in which the attendees attend the education[3]. The reason for choosing this timeframe is threefold. Primarily, it is in keeping with the European Commission recommendations regarding time frames used for investments in business infrastructure as well as other sectors, which states that CBAs should employ a 10-15 year time frame (European Commission, 2014). 12 years is thus in the middle of this recommended time span. The secondary reason is that methodology in this paper relies on data extrapolation. A relatively low number of years of extrapolation somewhat mitigates the inherent insecurities of this method. Thirdly, a relatively short time frame is better suited for the financial insecurities relating to the municipalities' budget constraints.

With these assumptions in place, there is a general framework to build upon in this analysis.

4.5 Biases

Before finally moving on to estimating the metrics, a discussion about biases relating to education and the labour market should be had, as well as a discussion about counterfactuals.

Sorting into education as well as success in the labour market is non-random (McIntosh & Morris, 2016). This constitutes one of the core issues in the research of returns to education (Willis & Rosen, 1978). Both personal characteristics, such as cognitive ability, attention-span and motivation, as well as exogenous factors such as parental support and classmate characteristics are potentially important determinants in the educational and career success (Lavecchia et.al., 2015; Henderson et.al., 2020). This means that it is very difficult to infer what potential effects on income and working conditions stem from skills obtained through the education and what stems from individual characteristics shared by the people attending the education (Gunderson & Oreopoulos, 2010).

Since the barriers to admission into the Gymnasieskolan's general programmes are generally higher than admission into vocational programmes, one could hypothesise that graduates from general programmes who obtain Industry Programme skills later in life will have more

[3] Since the education is 10 months rather than a full year, the first year is only considered to be the ten months in which the individual attends the education. This has bearing on the analysis through the foregone earnings metrics.

favourable careers than those who attended the Industry Programme at Gymnasieskolan, as they have sorted into a more selective group earlier. Thus, observed effects after the education is not only due to the skills but also due to the cognitive ability of the participant. This type of unobservable influence on the data would be called an ability bias.

However, one could just as well hypothesise that the people who have graduated from a general programme yet not pursued expected tertiary education constitute the least motivated or able group of graduates within the general programmes group. Whereas the majority of people who have found employment upon graduating from the Industry Programme at Gymnasieskolan are the most motivated of the students from this programme. Thus, the observed effects from the education would be smaller than for Industry Programme graduates, due to motivation from the attendees. This would be called a selection bias.

These biases can affect the data in any number of ways, and the above two paragraphs above constitute just two examples. Using different examples, the same biases could also have the opposite effect on incomes, depending on the assumptions made about the attendees of the education.

The reason why these biases matter greatly to this paper is because they determine how one should build a believable counterfactual. It is naturally impossible to know what someone would have earned had they not done something, just as it is very, very difficult to ascertain how education will affect one's income without individual data. Instead proxies are used, and they have to be used with these biases in mind. As this chapter progresses, the potential biases of the metrics and what is being mitigated with various assumptions will be discussed in relation to this section.

4.6 The estimates

4.6.1 Educational direct costs

As mentioned in Chapter I, the direct costs of adult municipal education is entirely publicly funded. Whilst the school funding stems from the either municipalities or clusters of municipalities, there are central government grants available to the municipalities for Yrkesvux education. There are two brackets for funding vocational programmes, determining

amount of money given, in which the Industry Programme belongs to the upper one (Mörtvik, 2018). As of 2021, the government grant amounts to 93,75 SEK per credit taken (Skolverket, 2021d). For an education of 1 000 – 1 300 credits, this would equate to 93 750 – 121 875 SEK per education space. This is meant to cover the costs of the programme. However, of the education organisers spoken to, two out of three state that the per annum grant is insufficient in covering the costs of the programme[4]. One municipality instead charges neighbouring municipalities 120 SEK per credit (through a municipality cluster deal), meant to represent the costs of the programme. This would put the cost of a 1 000 – 1 300 point programme at 120 000 – 156 000 SEK.

This paper will therefore use 121 000 SEK as a baseline direct cost, with 93 750 SEK as a low estimate and 156 000 SEK as a high estimate of education costs in the municipal co-finance analysis. It should be noted that these are costs associated with keeping a programme up and running and would not cover starting costs.

Further, there is a co-financing demand in order to access the grant, meaning that the municipalities have to finance 30 percent of the education spaces themselves (Skolverket, 2021d). Effectively, this means that the central government only covers 70 percent of the financing, to a maximum amount of 65 625 – 85 313[5] SEK per student for a 1 000 – 1 300 programme.

This would mean that the costs for one study space for the central government falls between 65 625 SEK and 85 313 SEK. The baseline cost of 121 000 SEK would mean a government grant covering 70 percent, or 84 700 SEK. The municipal cost falls between 28 125 SEK and 70 687 SEK, with the baseline cost of 121 000 SEK leaving the municipality to pay 36 300 SEK per student.

4.6.2 Foregone earnings

Whilst getting an estimate for educational direct costs is a fairly straightforward process, getting an estimate for foregone earnings is all the more difficult. Firstly, as mentioned in the

[4] Andreas Hügard, utbildningskoordinator, Göinge Utbildningscentrum, 2020-04-28; Camilla Kronholm, Rektor, Yrkesvux och Yrkeshögskolan, 2020-04-26

[5] (93 750 – 121 875) * 0.7 = 65 625 – 85 313. Whilst the municipality technically has to fund 30 percent of the spaces, it practically means that the municipality has to cover 30 percent of the costs, since the costs are shared between students.

bias discussion, there are inherent difficulties in trying to ascertain what an individual would have done had they not studied. It is an impossible task, but there are certain steps to get credible estimates of foregone earnings. The real difficulty for this paper is that it does not have information regarding what existing students have done prior to getting the education and no information of what they are doing whilst getting educated.

The ideal approach would have been to have access to detail-rich microdata on a large population, including both people who are attending the education ("the treated") and people who have not ("the non-treated"). You would then match people in the treated category with people with similar traits in the non-treated category. Regarding foregone earnings, you would then see how both the treated and the non-treated income progresses during the education and compare the two. You would assume that the people attending the education would have had the incomes of the non-attendees and the difference in income between the groups would be the foregone earnings. This matching technique is quite commonly used when measuring the effects of education (e.g. de Luna et.al., 2008; Liljeberg et.al., 2019; Stenberg, 2010). The virtue of using this matching approach is that it quite convincingly gets around the issue of selection bias into education and employment. By employing a propensity score matching technique this issue is averted since a persuasive alternative route for the individual attending the education is created. The issue with this approach is that detail rich microdata is an absolute necessity to perform this type of analysis, which is hard to attain. Even with good microdata, the estimates are still somewhat unreliable, since 'similar' individuals do not equate with 'same' individuals.

This paper will use a different approach. Instead utilising the assumptions made about the average student earlier in this chapter, publicly available aggregate income data from Statistics Sweden (Swedish: SCB) can be used to obtain estimates of lost income for the share of attendees that would have been employed had they not started the education. Statistics Sweden provides median income data on upper-secondary Gymnasieskolan graduates one, three, five and ten years after graduation. The last available year for data is 2017/18. Therefore this paper will use these estimates in accordance with this paper's starting assumptions of an individual, as laid out in 4.4.

The median salary for working general programme graduates between 2004 and 2013[6] is collected, adjusted to 2019 price level, and then averaged to gain an estimate of salary levels one, three, five and ten years after graduation. Then the average of the two general programmes is taken. The results of this procedure is shown in Table 2. An unwanted inclusion in this data is that some of the people included will have attained some vocational upper-secondary education, which likely will be reflected in an upward bias in the group's income levels. There is no way of excluding these individuals from the sample nor knowing how many they are. They are likely not too many, since the legal framework stipulates that preference to these educations should be given to those with incomplete upper-secondary Gymnasieskolan qualifications.

The reason for averaging across ten years is to avoid any potential outliers in the yearly data. Naturally, there is a slight issue as it pertains to an upward bias relating to general economic growth and its effect on wages, which has to be borne in mind.

TABLE 2:

Median Income for Generalists

	Years since graduation	Annual Earnings in SEK
Median income of Gymnasieskolan generalist graduates	1	161 218
	3	236 580
	5	283 044
	10	355 473
Earnings given in SEK. Average median annual income of graduates from the social sciences programme and natural science programme in the years 2004-2013, adjusted to 2019 price level. Graduation means graduation from Gymnasieskolan. Individuals who have attended tertiary education are not included.		

Source: SCB (2021b), own calculations

Since the assumption of this paper is that the average student attends the education five years after graduation, the annual earnings five years since graduation is chosen as a basis for the lost earnings whilst attending the education. Table 2 shows how the annual income estimate five years after graduation for graduates from a general programme is 283 044 SEK.

[6] The last year of the former Gymnasieskolan structure.

Regarding the educational programme, an assumption was made that it was finished within one school-year (ten months), and that it was studied at an increased pace. Given this, it is assumed that the average student finishes in ten months but that they do not engage in other income generating activities in the meantime. This would leave the income lost during the ten months of education at 235 870 SEK[7]. This will be the lost income used in this paper.

The study from Region Skåne (2021) discussed in *3.4 Previous Literature* showed that the individuals who worked the year prior to starting the Yrkesvux industry or electric- and energy programme in Skåne in 2014 were on average making about 233 200 SEK that year, or 248 200 SEK adjusted to 2019 price levels. It should be noted here, that due to the legal framework this group likely contains few people who have previously completed a general upper-secondary education programme. The estimate used in this paper is in line with the findings in Region Skåne (2021), albeit slightly higher. Since the individuals of interest in this paper has previously likely on average sorted into a more selective group of individuals by attending a general programme, it is not unreasonable to think that these individuals could have a higher counterfactual incomes.

Now, whilst the lost earnings metric used in this paper encompasses both lost income and lost income tax it does not fully capture the full societal value of wage. In accordance with Stenberg (2011) and Stenberg & Westerlund (2016) in their cost-benefit calculations of Swedish education efficacy, the 235 870 SEK will be multiplied with 1.4 to include both payroll taxes and to better reflect an inherent production value. Therefore the total indirect costs in the form of foregone earnings in this paper will be 330 218 SEK[8].

Regarding the counterfactual, i.e. what the individual would have earned had they not gotten the education, this paper is going to linearly interpolate between the five years income level and the ten years income level. Linear interpolation means fitting a straight line between two points. Thereby this paper assumes that the annual income increase between the two points will be constant in pre-tax payments. On average, over the five years, this assumes an income growth rate of about 4.6 percent. Notably, since all incomes have previously been converted to 2019 prices, this wage growth is the growth corrected for inflation.

[7] (283 044 / 12) * 10 = 235 870.
[8] 235 870 * 1.4 = 330 218

To obtain estimates for years beyond the final observed year, this paper will linearly extrapolate for an additional six years. In order to do this, an estimate for the income on the sixteenth year after graduation from Gymnasieskolan needs to be obtained. A common extrapolation technique is to assume that the income growth between the fifth and tenth year continues for an additional six years. This assumption is however very unlikely when it comes to earnings. A post-inflation income increase of 4.6 percent is very high, and will certainly lessen in pace with time. This is already observed in the data, with the income increases declining in pace in the data points that are available. It is a more likely assumption that the wage will continue to increase, however at a slower pace. In order to potentially attain a more believable estimate, a logarithmic line is fit with the existing datapoints for income one, three, five and ten years after Gymnasieskolan graduation, in accordance with the formula below,

$$y = \alpha + \beta * \ln(x) + \varepsilon$$

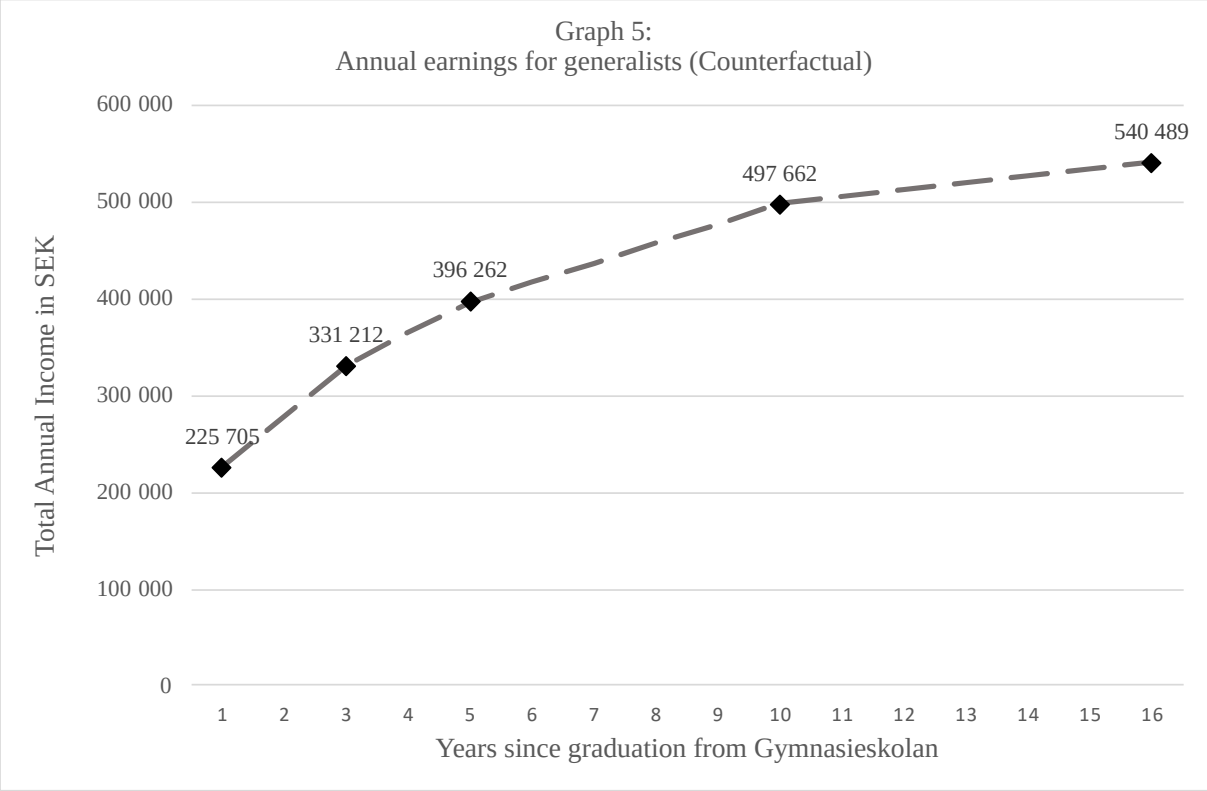
where y is an individual's income, α is an intercept, $\ln(x)$ is the natural logarithm of years since graduation, ε is an error term. Fitting a logarithmic line means that the decline in pace of wage increases existing in data is caught and can be used to extrapolate to the desired year.

The above formula is used to extrapolate to the sixteenth year after graduation from Gymnasieskolan, or the twelfth year after the adult education. This line suggests an average annual income increase, post-inflation, of 1.3 percent. The average annual income increase in the years 1995-2020 has been 2.1 percent, with low-earners having seen smaller income increases in the period (Ekonomifakta 2020; 2021b). Thus, a 1.3 percent annual income increase is a more likely counterfactual assumption than 4.6 percent.

This means when the education starts, the individual earns about 23 500 SEK per month. In the first five years, if they do not attend education, their income would increase to about 29 500 SEK per month and in the subsequent six years increase to about 32 000 SEK per month. This final salary is just below the median salary for all privately employed workers in Sweden (Ekonomifakta, 2021c), thus a likely a fairly high counterfactual estimate.

Questions regarding the representativeness of this metric are naturally valid. In the time span between five and ten years the composition of the group changes, likely largely due to people commencing tertiary education. In relation to biases one could either say that the people

sorting into tertiary education are those that are unhappy with their current labour situation and therefore pursues further education or that it is those that have a better ability for further education. Either way, this attrition rate is likely to have affect the salaries, however, it is unclear whether positive or negative. As the logarithmic extrapolation in this paper yields quite convincing income levels as it relates to the Swedish labour market as a whole (Ekonomifakta 2020; 2021b), this paper has opted for using this metric as a believable counterfactual.



Source: SCB (2021b), own calculations
Earnings given in SEK. Total incomes from SCB for social science and natural science graduates. The incomes have been multiplied by 1.4 to more correctly reflect income including pay-roll tax and to reflect an inherent production value. Data available 1, 3, 5 and 10 years after graduation. Incomes between these points have been attained using linear interpolation. To attain estimates beyond ten years, a logarithmic line has been fit to the sixteenth year, using the previous four data points. Thereafter a line has been linearly extrapolated to this sixteenth year.

4.6.3 Earnings effects

This section will cover the earnings effects. Since this paper cannot attain metrics using quality individual data, it will provide three versions/scenarios of potential earnings effects that the education can have on an individual. Each version will come with its own set of assumptions, mitigations and outcomes.

The first earnings effect will assume that the effects of the programme is reflected in the general increase in wage levels associated with existing literature on the returns to schooling in Sweden, both in terms of upper-secondary education, adult education and education in general. Some key literature on this topic will be discussed and an estimate of an increase in salary will be derived therefrom. This will, broadly, assume that education has the same effect on one's salaries regardless of field or direction of studies. In other words, it will assume that income is a function of personal characteristics and years of education, where field of study or experience does not matter.

The second earnings effect will assume that the effect of the education is a movement from the income level of generalists to the income level of Industry Programme graduates. This firstly assumes that neither years of industry-specific experience nor personal characteristics in the groups matter in terms of income level. Secondly, it assumes that the people who study the adult education programme will distribute themselves in the same way as those who obtained the same qualifications at upper secondary level. Here, income is implicitly assumed to be a function entirely of general experience and vocational skills.

The third earnings effect will make assumptions regarding the starting salary and wage progression, based on occupation and age data from Statistics Sweden and the labour unions in the Swedish industrial sector. This will assume that the individual will enter relevant employment as well as the wage increases reported by the unions are accurate and relevant to full-time employees. Here, income is assumed to be a function of age and vocational skills and that relevant employment is guaranteed.

It should be noted here, that the following discussion on earnings will be based on an employed individual, leaving employment to go into the education. A discussion regarding employment effects of the education will be had later. For now, it should be noted that those unemployed have an income equal to zero. It is likely that a significant number of individuals have some sort of income from unemployment benefits. However, in keeping with Boardman et.al. (2018) this would constitute a transfer from one actor with standing (the public) to another (the individual). Transfers should not be included in the analysis, as their inclusion could lead to double counting.

Further, some reference should be made to Region Skåne's (2021) study. The study found that for participants who worked the year prior to commencing the education and completed 800 credits of education or more, average earnings increased from the aforementioned 233 500 SEK the year prior to the education to 305 300 SEK two years after, 317 900 SEK three years after and 331 000 SEK four years after starting the education. As mentioned, the group analysed in this study is likely quite different from the target group of this paper, but these findings can still be borne in mind.

4.6.3.1 Earnings effect 1

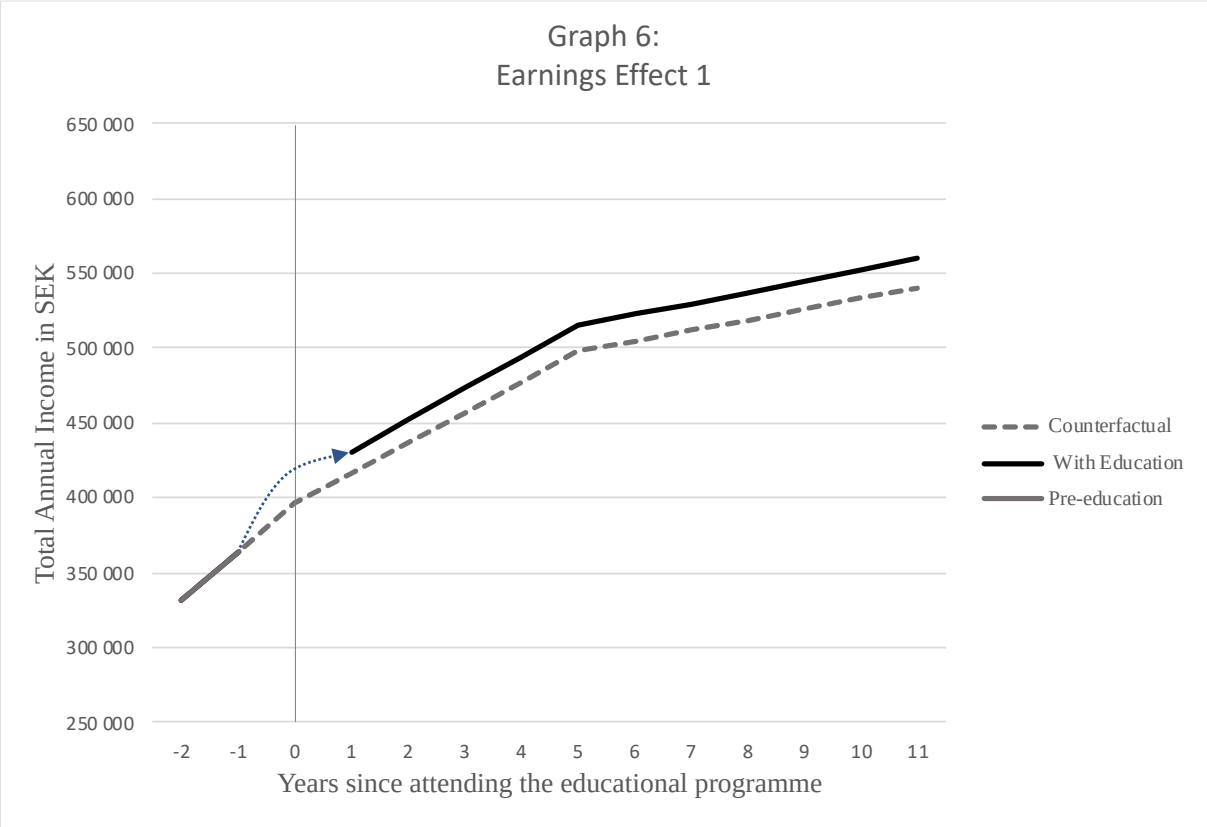
Graph 7 displays the individual earnings under the first version of earnings effect. The black line is the income after the education, whereas the dashed grey line constitute the counterfactual income. This effect has been calculated by adding a 3.5 percent wage premium on the counterfactual earnings.

The 3.5 percent are derived from the literature on returns to schooling in Sweden. As is evident from *3.4 Previous Literature*, the findings of income effects are rather diverse. However, quite a lot of literature find earnings premiums of around 4 percent from an additional year of education in Sweden (e.g. Palme & Wright, 1998; Isacsson, 2004; Björklund & Kjellström, 2002; Stenberg, 2011; Backman, 2013; Nybom, 2017). This literature covers both effects of secondary education and tertiary education. In the only recent study of Yrkesvux however, Liljeberg et.al. (2019) find a lower earnings premium of 3 percent and (insignificant) negative for the industry programme specifically. Thus, the four percent are revised slightly downwards. As its first effect, this paper has opted for a 3.5 percent wage premium of the education, displayed in Graph 7.

In terms of monthly incomes, this means the individual earns about 25 500 SEK upon graduation. After five years, an individual earns 31 000 SEK and by the end of the timeframe, they earn about 33 500 SEK per month.

As it pertains to assumptions and biases, this earnings effect assumes that an individual's earnings is entirely a function of an individual's personal characteristics of the individual and the number of years of education. The field of study is in this situation to a large extent disregarded. A year of additional education yields 3.5 percent increased salary, as that is the increased general productivity of the employee following the additional education. By

extension, the reason why an individual with a general degree is making less than a person with a vocational degree is due to ability, not because of the choice of education.



Source: SCB (2021b), own calculations
Earnings given in SEK. The first earnings effect has been attained by adding 3.5 percent onto the counterfactual earnings for each year of the timeframe. The vertical line represent the time spent in the education (year 0; 10 months). The blue arrow shows the jump in earnings as a result of the education.

4.6.3.2 Earnings effect 2

The second version of earnings effect will make use of the information on students after the Gymnasieskolan Industry Programme, corresponding to the information gathered on the generalists. Keeping all other variables constant and changing only the programme attended, Table 3 shows the Statistics Sweden information on graduates from the Industry Programme for a number of years after graduation.

As with gaining estimates on foregone and alternative earnings, these numbers are also multiplied by 1.4 and the same inter- and extrapolation techniques are applied to gain estimates for income each year within this paper's time frame upon graduation from the Industry Programme.

TABLE 3:

Median Income for Industry Programme Graduates

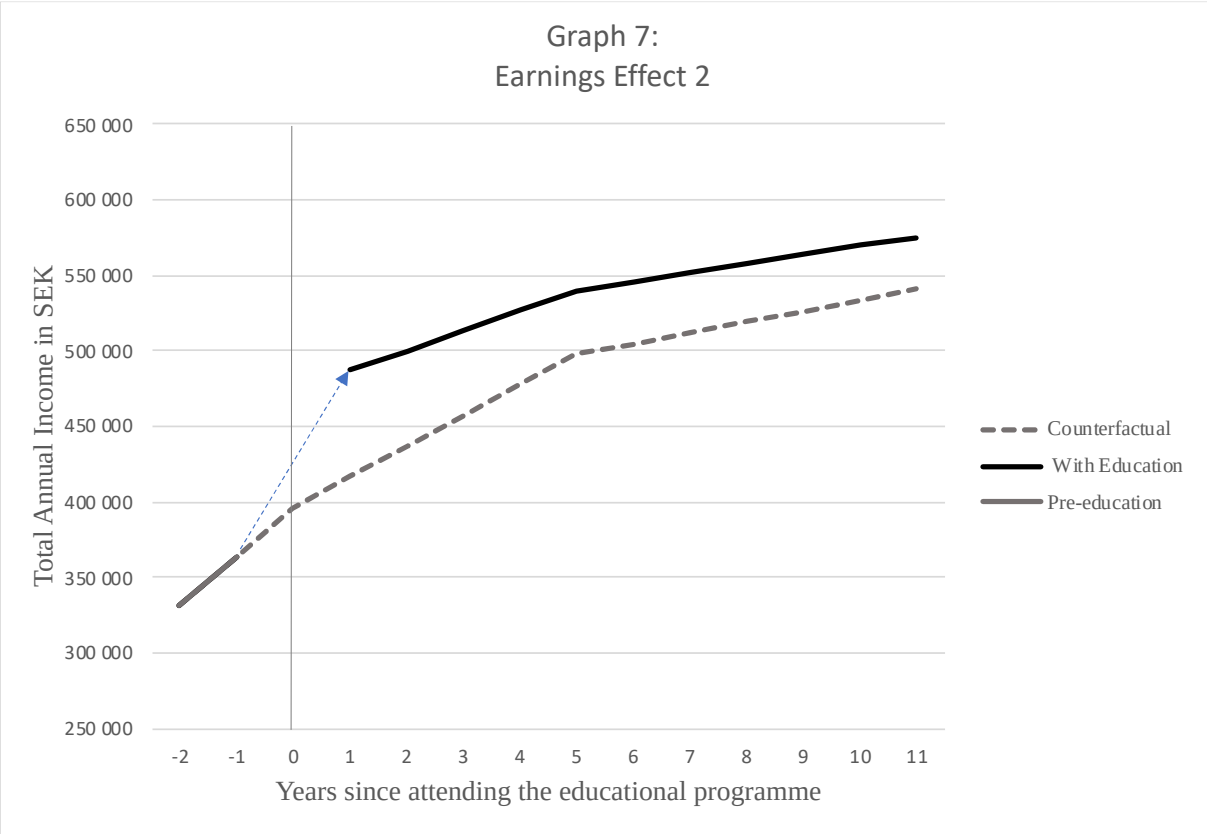
	Years since graduation	Income
Gymnasieskolan, Industry-Programme graduates, median income	1	246 004
	3	305 845
	5	338 360
	10	385 772
Average of graduation years 2004-2013, adjusted to 2019 price level. Prices given in SEK.		

This version will then assume that the move upon completion of the Yrkesvux programme is a simple upwards shift, from the income level of generalists to the income level of Industry Programme graduates. Whereas the previous earnings effect version can be said to assume that income is a function of individual properties, such as length of education, and of years of general experience, this second income effect instead assumes that earnings is a function of educational choice (and years of general experience).

The practical assumption is that the inherent properties of people do not matter in terms of labour market outcomes. The reason why graduates from the Industry Programme have a higher income is solely because of the qualifications they have attained during Gymnasieskolan. Once similar skills have been attained by the generalists, they will be making the same wages and in extension earn the same income. Furthermore, it assumes that the distribution of the graduates from the Yrkesvux programme will mirror that of those from the Gymnasieskolan Industry Programme. It is safe to assume that not everyone who has attended the Industry Programme and who is working five years after graduation is working in an industry-related job. This scenario assume that this distribution is mirrored for those generalists who graduate from the Yrkesvux programme and get new employment as a result of the education. The earnings effect from this version is visualised in Graph 8.

In terms of monthly incomes, in this scenario the individual earns about 29 000 SEK upon graduation. After five years, the individual earns 32 500 SEK and by the end of the time frame, they earn about 34 000 SEK per month.

Naturally, the assumptions made here are very tenuous. Whereas the former income effect assumed that choice of education had nothing to do with an individual's wages, this iteration assumes that differences is entirely due to choice of education. Here, there is either no ability bias nor any difference between the groups. Further, industry-specific experience also does not matter in this version, however, general experience does.



Source: SCB (2021b), own calculations
Earnings given in SEK. Earnings Effect 2 assumes that upon graduation from the industry programme, the graduates will enter the labour market in the same position as those who attained the same qualifications at Gymnasieskolan five years prior. The vertical line represent the time spent in the education (year 0; 10 months). The blue arrow shows the jump in earnings as a result of the education.

4.6.3.3 Earnings effect 3

The final earnings effect version will base its assessment on existing public occupational salary data and available salary increase data from the industry sector in Sweden.

The municipalities in Skåne and the western municipalities of the adjacent region Blekinge jointly run a website, providing information on the Gymnasieskolan and choice of education, called Skanegy. On their page with information on the Industry Programme, they provide a

list of suggested professions, available for graduates. These suggestions can subsequently be matched to the SSYK-4. The SSYK-4 is a list of professions to which individuals' work can be matched for better within- and between employment comparison. Thereafter, it is possible to obtain average monthly salary for and number of people in these professions, split into various age groups. The youngest cohort is people in the ages 18-24. The average monthly salary for people in this age cohort and in these professions is 29 039 SEK[9]. The annual earnings is 348 468 SEK[10].

The third scenario is that these earnings act as the starting income for someone who has recently graduated. Admittedly, someone in this category can have up to six years of experience. At the same time, some people will have less experience. Seeing as the counterfactual assumption is that the individual attending the education has some unrelated work experience and is 24 years old, it seems fairly reasonable that this individual would have a starting salary corresponding to people in the same occupation with less total experience but more specific experience.

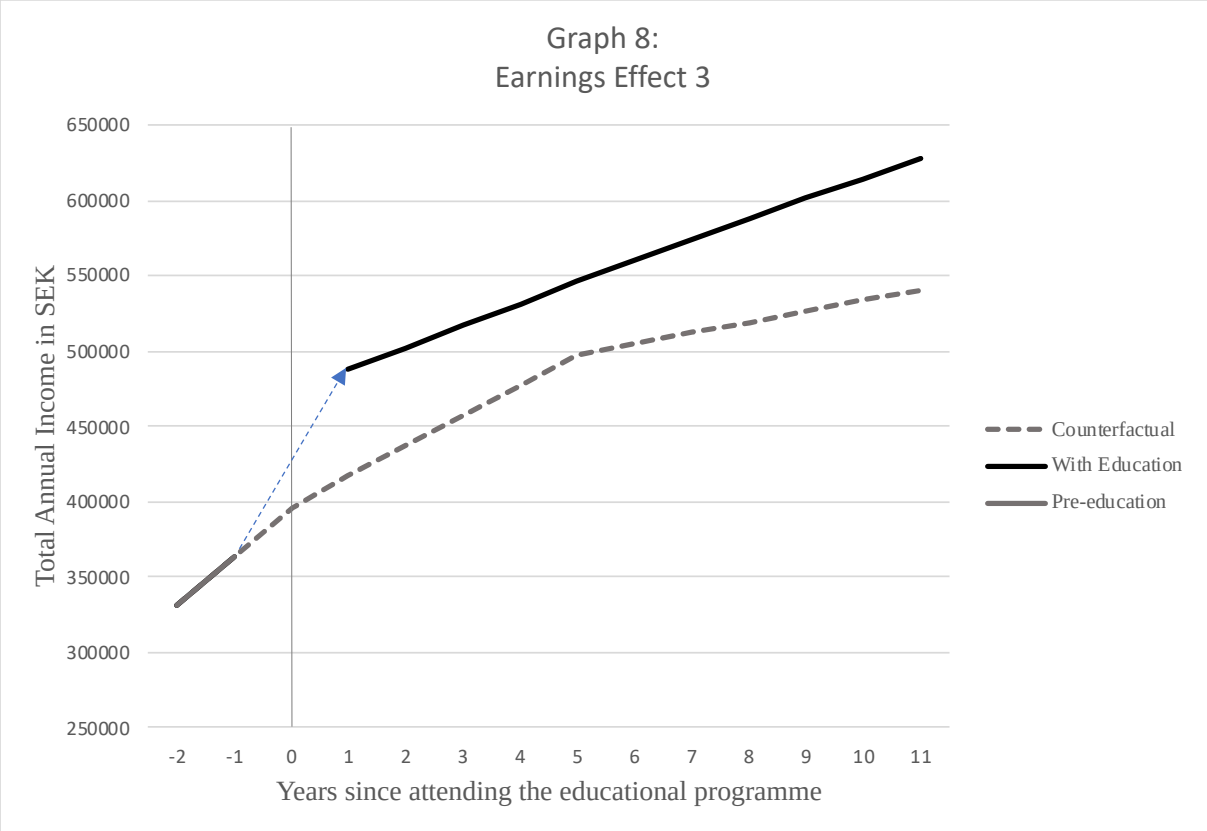
The salary progression in this version is based on information from the Swedish collective of labour unions in the industrial sector, Facken i industrin (2014; 2015; 2016; 2017; 2018; 2019; 2020). Each year, these unions release a report on salaries and salary increases of union members. The salary increases vary quite significantly depending on the state of the economy, with low salary increases during turbulent economic times and high salary increases during economic booms. However, by inspecting the graphs in the reports, a few trends become clear. Most importantly, it is evident that whilst salaries continue to increase regardless of age, the pace of the increase attenuates. The reports provide salary increase information for those between the ages of 24 and 64. Generally, the salary increase for 24 year-olds is slightly above 4 percent. Ten years later it has declined to 3.5 percent and then stabilises at 2-3 percent around the age of 45. Based on this, this paper will assume that the salary starts by increasing at 4.3 percent, and then continues to grow by 0.1 percentage point slower speed each year for the entirety of the timeframe. The salary increase for each corresponding year after graduation is available in Appendix D.

[9] The full list of occupations, the number of people in these professions, the respective average salary and a full explanation of how the 29 039 SEK is reached is available from Appendix C.
[10] 29 039 * 12 = 348 468

Earlier income effect iterations been adjusted to 2019 price levels, thereby correcting for inflation. Therefore, the annual salary increase should also be adjusted for inflation. The consumer price index saw an average increase of 1.3 percent annually in the years 2000-2019 (Facken i industrin, 2020). If 1.3 is subtracted from all the annual increases, then an approximation of the annual increase – controlled for inflation – is obtained.

Graph 8 shows the difference in salary compared to the counterfactual. As in earlier iterations, the income is multiplied by 1.4.

Regarding monthly incomes, this means the individual earns about 29 000 SEK upon graduation. After five years, the individual earns 32 500 SEK and by the end of this timeframe, they earn about 37 500 SEK per month.



Source: Facken i industrin (2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020), own calculations
Earnings given in SEK. Earnings Effect 3 relies on profession- and age-data to get an estimate for a starting salary, and subsequently uses information from Facken i industrin on wage growth for people ages 25-34 to obtain wage progression estimates. The vertical line represent the time spent in the education (year 0; 10 months). The blue arrow shows the jump in earnings as a result of the education.

This version does not make a comparison between the groups of generalists and Industry Programme graduates, but rather between generalists and those who have found relevant employment in the industry sector at a young age. It is quite a compelling case. Given that there exists some ability bias, that the most ambitious generalists have left for tertiary education and that those who find relevant employment upon graduation from the Industry Programme at a young age are among the more ambitious graduates from this programme, it seems reasonable that a standard graduate would find relevant employment upon graduation and therefore make a salary comparable to that of a young Industry Programme graduate with perhaps a few years of experience.

4.6.3.4 Earnings Effects Summary

The previous three subsections have been dedicated to present three different potential outcomes on earnings as an effect of the education. The first one assumed a 3.5 percent wage premium as a result of the education, compared to the counterfactual. The second earnings effect relied on wage data for Gymnasieskolan's industry programme graduates and assumed that these earnings would be replicated in the new group. The third earnings effect used earnings by vocation and age data to gain an estimate of starting earnings upon graduation and aggregated union member data to assess wage progression.

The three different effects can be interpreted as three different outcome in the labour market. The first one can be viewed as an outcome in which a person gains better employment as a result of the education however not related to their education. Thus, their productivity has increased as a result of the education which is reflected in their pay – however, they do not earn similar levels as other individuals with industry-skills and/or in industry vocations. The second can be viewed as an outcome in which a graduate gains better employment as a result of the education, however since they spread out similarly to Gymnasieskolan's industry graduates, many of them likely do not go into industry vocations specifically. The third and final effect can be viewed as those who do gain better employment as a result of the education enter vocations which are very relevant to their education and additionally have employers who are willing to retain their employees (reflected in the starting wage and wage progression, respectively).

4.6.4 Employment Effects

Thus far in this chapter, the unemployed share of the potential attendees have been overlooked. The different earnings outcomes from relevant employment upon graduation from the education have been compared to that of an individual's counterfactual employed earnings to show the earnings effect of the education. This section will discuss the potential employment effect of the education programme used in this paper. The employment effect matters in two ways. Firstly, an increase in employment means that more people earn wages, work and pay taxes, meaning that the benefits increase this way. Secondly, increases in employment matters since there are health benefits associated with going from unemployment to employment. These health benefits will be covered in the next section of this chapter.

According to official national statistics, the employment rate for natural science graduates that have stayed in Sweden, are not studying and have not obtained tertiary qualifications is between 75 percent and 80 percent, five years after graduation[11]. The respective number for social science graduates is 84 percent to 88 percent, and for industry graduates 92 percent to 95 percent. Ten years after graduation, this number has risen slightly for generalists, to about 80 percent to 85 percent for natural science graduate and 87 percent to 88 percent for social sciences graduates and. For industry graduates it remains fairly constant[12] (SCB, 2021b). Stjernkvist (2020) produce similar results, on graduates from programmes four years after graduation that have not continued into further education. The study shows that 32 percent of the graduates from the natural sciences programme in 2014 that have not started tertiary education were without employment in November 2018. The same figure for the social science graduates was 20 percent and for Industry Programme graduates it was 15 percent.

Based on this, this paper will assume that in a standard class of people attending the education explained in this paper, 80 percent will come from employment and 20 percent will come from unemployment. Without education, the unemployment rate in this group will decline linearly throughout the timeframe by 0.5 annually, meaning that 85.5 percent of the people will be employed by the end of the time period.

With education, the unemployment rate is assumed to drop to 10 percent upon graduation. This is based on a report by Skolverket (2020b), which showed that of people attending the

[11] Most recent data available, graduates in 2009, 2010, 2011, 2012, 2013.
[12] Most recent data available, graduates in 2005, 2006, 2007, 2008, 2009

Industry Programme at Yrkesvux 8 percent were neither in employment nor in further studies both one and two years after graduation. Additionally, national statistics show that among the age group 20-39 year-olds with upper-secondary industry education, the employment rate was is 87.2 percent in 2018 (SCB, 2021b). Over time, this unemployment rate will decline linearly to 5 percent by the end of the time frame.

Admittedly, the Skolverket (2020b) report showed that 60 percent of graduates from the Yrkesvux Industry Programme had a so-called "established status" (Swedish: etablerad ställning) in the labour market two years after graduation, meaning an annual income of at least 187 000 SEK, employment in November and no indications of unemployment in the past year. An additional 25 percent are in less secure employment. As it pertains to this paper, however, it will assume that the graduates from the educational programme either go into relevant employment in the industrial sector, or take up generalist employment in accordance with the counterfactual discussed earlier in this chapter. It is unlikely that graduates on average would accept lower wages and a worse footing in the labour market upon graduation from the education by accepting a relevant part-time job in the industry sector as opposed to returning to their former employment.

As it comes to group outcomes, Statistics Sweden has shown that among 20-39 year olds, 60,6 percent of the people with upper-secondary Industry Programme education are working in a relevant field. This 60 percent is further echoed by Skolverket (2020b), which shows that 63 percent of the graduates from the Yrkesvux programme that are established in the labour market work in the manufacturing and extraction industry. Thus, this paper will assume that upon graduation, 60 percent of the graduates will obtain relevant jobs in the industry-sector, and thus follow the income effects outlined previously. 30 percent will obtain generalist employment in accordance with the counterfactual above. 10 percent will be unemployed. As mentioned, as time progresses the unemployment rate will drop to 5 percent, the number of people in relevant employment will increase to 65 percent and the people in generalist employment will remain constant at 30 percent.

Notably, this paper does not include a metric relating to people moving from the municipality. This would have an adverse effect of the results at the municipal level. However, there is some evidence that people who can get an education and employment are more likely to stay

at the place where they get educated (Lovén et.al., 2016). This evidence mainly relates to tertiary education though and is inconclusive.

Returning to the study made by Region Skåne (2021), the data shows that just under half of the 189 participants in their sample was working a year prior to starting the education. A year after completing the education 77 percent were employed. This number rose to 81 percent in the upcoming three years until 2018. Notably as well, whilst a fairly large number of individuals (about 14 percent) were studying the year before starting their education, only between three and six percent were doing so in the years following the education.

4.6.5 Health Effects

This section will briefly cover health effects. As mentioned previously, health effects are a relevant factor to include when accounting for the benefits of education. There is evidence that more educated people tend to have better health (e.g. Spasojevic, 2010), perhaps due to more stimulating employment upon completion. However, as it pertains to this paper this aspect is not relevant. The labour market move made as a result of the Yrkesvux education is, at least in theory, a lateral one. The individual goes from being an upper-secondary generalist to an upper-secondary specialist. However, the individual is still in the same labour market segment as it relates to the educational, and in turn vocational, level. As far as the research for this paper has extended, it has found no conclusive evidence on how lateral moves in the labour market will affect ones health.

However, those who as a result of the education moves from unemployment to employment will see positive health effects as a result of having a job. That employment, compared to unemployment, generally has a positive effect on an individual's health is well established (Wilson & Walker, 1993). A paper by Norström et.al. (2019) converts the drop in health due to unemployment into Quality-Adjusted Life Years (QALY) in Sweden. For their youngest cohorts, 20-34 year olds, the authors find that unemployment is associated by a 12.6 percent decrease in QALY. The confidence interval, however, is rather large, [-0.21, -0.06]. According to national guidelines from the Swedish National Board of Health and Welfare (Socialstyrelsen, 2019), the moderate cost for a QALY is in the range of 100 000-499 999 SEK. Therefore, this paper will use the midway of this estimate, 350 000 SEK as a metric for a QALY. The value of employment is obtained by multiplying the QALY-value with the percentage drop in QALY associated with unemployment. This procedure yields that the

baseline health value of employment equals 44 100 SEK[13], meaning that employment is associated with benefits of 44 100 SEK annually compared to unemployment.

4.7 Summary of metrics

Table 5 shows a summary of all the metrics established in this chapter, including low and high estimates which will be used in this paper's sensitivity analysis.

Table 5:
Estimates

Estimate	**Base Value**	**Further Analysis**	
Time Frame	12 years	**Low**	**High**
Discount rate	3%		5%
Direct Cost	121 000	93 750	156 000
of which			
Municipal	36 300	28 125	70 687
Governmental	84 700	65 625	85 313
Foregone Earnings	330 218		
Health Benefits of Employment	44 100		
Employment, ingoing	80%		
Employment, outgoing	90%		
of which			
Relevant	60%		
Generalist	30%		
Annual Employment Increase			
Counterfactual	0,5%		
Relevant	0,5%		
Generalist	0,0%		

Earnings scenarios

year since education	*No edu.*	*Ear. Eff. 1*	*Ear. Eff. 2*	*Ear. Eff 3*
1	416 542	431 121	486 979	487 859
2	436 822	452 111	500 255	502 495
3	457 102	473 101	513 530	517 068
4	477 382	494 090	526 805	531 546
5	497 662	515 080	540 081	545 897
6	504 800	522 468	545 920	560 091
7	511 938	529 856	551 759	574 093
8	519 076	537 243	557 598	587 871
9	526 214	544 631	563 437	601 392
10	533 351	552 019	569 276	614 623
11	540 489	559 406	575 115	627 530

Prices given in SEK.
The higher discount rate will be used in the sensitivity analysis. The low and high values of the educational costs will be used in the co-financing analysis. The earnings are not discounted.

[13] 100 000 * 12.6 = 12 600; 350 000 * 12.6 = 44 100; 500 000 * 12.6 = 63 000

Chapter V: Results

This chapter will present the results of this paper's analysis. The chapter will start by presenting the baseline results and discussing these. Subsequently, it will present results with the employment numbers held constant and subsequently with the earnings held constant – thereby highlighting which factors are of extra importance for the results. It will also use the higher discount rate and see what effects this has on the results.

This is followed by a section in which the costs and benefits only relevant to the municipality has been presented. The municipalities are the prime decision-makers as it relates to implementing the programme – therefore it is of special importance that this actor is singled out. A Monte Carlo Simulation is subsequently performed to assess how important co-financing between the central government and the municipalities are.

5.1 Baseline Results

To reiterate, this section will present the results from this paper's baseline analysis. A 12 year timeframe is used, where the first year is the year in which the participants attend the educational programme. A 3 percent annual discount rate is used. The employment assumption is that the employment rate is 80 percent at the start of the education. In the counterfactual situation, this employment rate increases by 0.5 percentage points annually. With the education, the employment rate drops to 0 percent during the education, and subsequently increases to 90 percent by the end of the education. These 90 percent are comprised of 60 percent is relevant employment, whereas 30 percent have 'returned' to so-called generalist employment. The relevant employment rate then rises linearly to 65 percent throughout the timeframe, whereas the generalist employment is held constant. The earnings are given in three different versions. The results are displayed in Table 6.

From Table 6 it is clear that under the baseline circumstances laid out in this paper the educational investment pays off in all three earnings scenarios. The net present value (NPV) per person of the no education is just over 4 000 000 SEK over the entire timeframe. The first earnings effect, where the effect is a premium of 3.5 percent on earnings across the entire timeframe, overtakes the effect by 182 680 SEK or about 4.5 percent. Then, the positive effects increase with the second and third earnings effect. Earnings effect three show positive

results compared to the counterfactual of nearly three times the magnitude of the first earnings effect.

Table 6

Baseline Results

Treatment	**Net present value**	**Policy Benefit**
No Education (Counterfactual)	4 020 758	
Education		
Earnings Effect 1	4 203 438	182 680
Earnings Effect 2	4 375 830	355 072
Earnings Effect 3	4 532 299	511 541

Net present value represents the total (discounted) value of the policy today, before its implementation. Policy Benefit is the difference between implementing the policy and the No Education treatment. Prices given in SEK. Discount rate is 3 percent.

The first income effect relies most heavily on an assumption of the generalisability of education – for those who find better employment upon graduation, an additional year of studies yields 3.5 percent more in salary and does not rely on assumptions of a connection between area of study and employment (2nd effect) or relevant employment upon graduation (3rd effect). The first earnings effect can be interpreted as the effect the education would have regardless of employment taken up upon graduation, since the education in accordance with economic theory is likely to contribute to an individual's productivity no matter the subsequent employment. Yet, in the first effect, this increased productivity is discernible in 60 percent of the graduates upon graduation – the remaining 30 percent of those in work 'return' to work with no benefits to their earnings. The second effect relies on there being a (direct) connection between the vocation ventures upon graduation and the area of studies – meaning that individual qualities, such as age, do not matter in terms of employment. The third effect relies on an individual entering relevant employment with market wages and a good wage progression. In a labour market where there is such employment for the individual to pursue, the third specification is perhaps the most likely specification for a general individual – however, on a larger scale, it is not overly likely that a group of individuals would all enter into relevant employment upon graduation.

Thus, the different results can be said to reflect the quality of matching upon graduation. The better the matching to relevant work, the better pay-off.

It should be noted here, that the cost of the education will not have much bearing on the overall positive results. As can be seen in *4.7 Summary of metrics*, the educational cost varies between 93 750 SEK and 156 000 SEK, with 121 000 used in the baseline analysis. Applying either the lower or the higher cost would not significantly alter the baseline results. It will matter more in terms of the co-financing analysis, and therefore the cost variation will be applied and discussed in this analysis.

Moving onto the sensitivity analysis displayed in Table 7. The sensitivity analysis takes a more pessimistic approach to the analysis, first by assuming that one of the effects is inexistent. To clarify, holding earnings constant means that the effect of the education on employment is still happening however the education has no earnings effect. This scenario could possibly imply that the additional year of education on average acts as a door opener for new work, however that the work obtained is not more qualified than the one previously had. Conversely, holding employment constant means that the education still has an effect on salaries, however it does not move people into employment or into more employment.

Table 7

Sensitivity Analysis

Treatment	**Net present value**	**Policy Benefit**
Removing Earnings Effect	4 104 441	83 638
Removing Employment Effect		
Earnings Effect 1	3 699 334	-321 423
Earnings Effect 2	3 853 093	-167 665
Earnings Effect 3	3 993 219	-27 539
High Discount Rate (5%)		
Counterfactual	3 616 706	
Earnings Effect 1	3 738 918	122 211
Earnings Effect 2	3 897 311	280 605
Earnings Effect 3	4 029 650	412 944

Net present value represents the total (discounted) value of the policy today, before its implementation. Policy Benefit is the difference between implementing the policy and the No Education treatment. Prices given in SEK. Discount rate for the removed effects is 3 percent.

The results presented in Table 7 shed light on some interesting aspects of this analysis. Naturally, since both employment and earnings affect the overall earnings over the time period positively, holding them constant means that the effect of the education decreases.

However, with earnings held constant the policy still proves beneficial, with the net present value of education exceeding the net present value of no education by 83 638 SEK. On the other hand, when the education has no effect on level of employment yet an effect on earnings the net present value of the policy is lower than for no education. This is true for all three earnings versions. Overall, this implies a greater importance of employment than earnings to get positive effects from the policy under the circumstances of this paper.

As it relates to the discount rate, it becomes clear that applying a higher annual discount rate does not make a massive difference in terms of the results. This is noteworthy, but naturally explained by the main share of both costs and benefits come as earnings, meaning that they are both discounted at the same rate regardless of discount rate.

5.2 Municipal accounting

For this section, only the costs and benefits relevant to the municipalities will be presented. Singling out this actor is done for a few reasons. Firstly, the municipalities are the prime decision-makers in regards to implementing the policy. Due to the municipalities' financial situation and the short-terminism that follows, the somewhat altruistic Kaldor-Hicks approach of weighing all (relevant) benefits against all (relevant) costs might not be the best guide for a municipality of whether or not to implement the policy. Additionally, despite the municipality being the prime decision-maker it has, up until this point, been lumped together with the other public actors, most notably the state.

Table 8

Municipal Results		
Treatment	**Net present value**	**Policy Benefit**
No Education	603 114	
Education		
Earnings Effect 1	606 551	3 437
Earnings Effect 2	632 410	29 296
Earnings Effect 3	655 880	52 767

Only accounting for municipal direct costs and direct revenues. Net present value represents the total (discounted) value of the policy today, before its implementation. Policy Benefit is the difference between implementing the policy and the No Education treatment. Prices given in SEK.

Table 8 shows the results from singling out the municipal actor. The actor-specific direct cost has been assumed to be 36 300 SEK. For the benefits, 21 percent of the pre-payroll tax and

production value adjusted earnings have been taken to reflect the direct tax revenue raised by the municipality. The individual health benefits have been excluded, as these have no direct bearing on the municipalities.

As is evident, the policy pays off in all three earnings scenarios. The first earnings effect is however very close to zero. These results point to the policy being a good investment for the municipalities, especially if one accounts for scalability. The results in Table 8 is per student. Naturally, the average cost per student is not applicable to a class of one individual. With a class of 10 individuals, the effects would be scaled by a factor of 10. Thus in the Earnings Effect 3 scenario a class of 10 individuals would, according to this analysis, generate additional tax revenues of 527 670 SEK for the municipalities. This is naturally given that the people live in the same municipality that they got educated.

Noteworthy however is that under these circumstances, the municipalities are subsidised by the central government. Without the subsidies, the costs for the education would go up by 84 700 SEK in all three scenarios – meaning that the costs would exceed the benefits regardless of earnings effect.

Table 9

Sensitivity Analysis - Municipal Results

Treatment	**Net present value**	**Policy Benefit**
High Discount Rate (5%)		
Counterfactual	542 506	
Earnings Effect 1	537 468	-5 038
Earnings Effect 2	561 227	18 721
Earnings Effect 3	581 078	38 572

Only accounting for municipal direct costs and direct revenues. Net present value represents the total (discounted) value of the policy today, before its implementation. Policy Benefit is the difference between implementing the policy and the No Education treatment. Prices given in SEK.

In terms of applying a higher discount rate to the municipal analysis, it is notable that the first earnings effect goes from being slightly positive to slightly negative.

5.3 Co-Financing Results

In this section, results relating to the co-financing between municipalities and the central government is discussed. As has been assessed earlier, municipalities are probably far more likely to invest in the education if their direct benefits in the form of tax revenue outweighs

the direct costs from implementing the education. As was showed in Table 7, the municipal benefits outweigh their costs, i.e. the results are above "break-even" in all three earnings scenarios. However, this is the case under the baseline provisions. Costs per space is 121 000 SEK per student, and the government pays for 70 percent of this, or 84 700 SEK. Previously, this paper assessed that costs can realistically fall between 93 750 SEK and 156 000 SEK per student and year. Additionally, the 70 percent co-financing up to 121 876 SEK is the current level, but has been changed. Thus, this section will test how durable the results are given a different set of costs and cental government co-financing. It will do so in two steps.

First, Table 8 shows the results of Monte Carlo simulations. It is an analysis of the municipal results. However, the cost variable follows a uniform distribution and falls between 93 750 SEK and 156 000 SEK. A simulation is run 10 000 times, in four different versions. First 10 000 iterations the co-financing is, like today, 70 percent. For the next 10 000 iterations, the co-financing randomly falls between 50 percent and 70 percent. Thereafter it falls between 30 percent and 50 percent and lastly between 0 percent and 30 percent. In all instances, the central government only covers a share of the costs up to a total cost of 121 876 SEK, like today. The rationale for doing this is broadly testing what earnings are required for different co-financing levels in order for the policy to be a worthwhile investment to the municipality.

Table 10

Monte Carlo Simulation

	Break-Even Probability		
	1	2	3
Below break-even			
Government Co-financing			
= 70%	49,97%	8,39%	0,00%
50% – 70%	84,08%	27,71%	0,91%
30% – 50%	100,00%	73,72%	29,06%
0% – 30%	100,00%	100,00%	79,98%

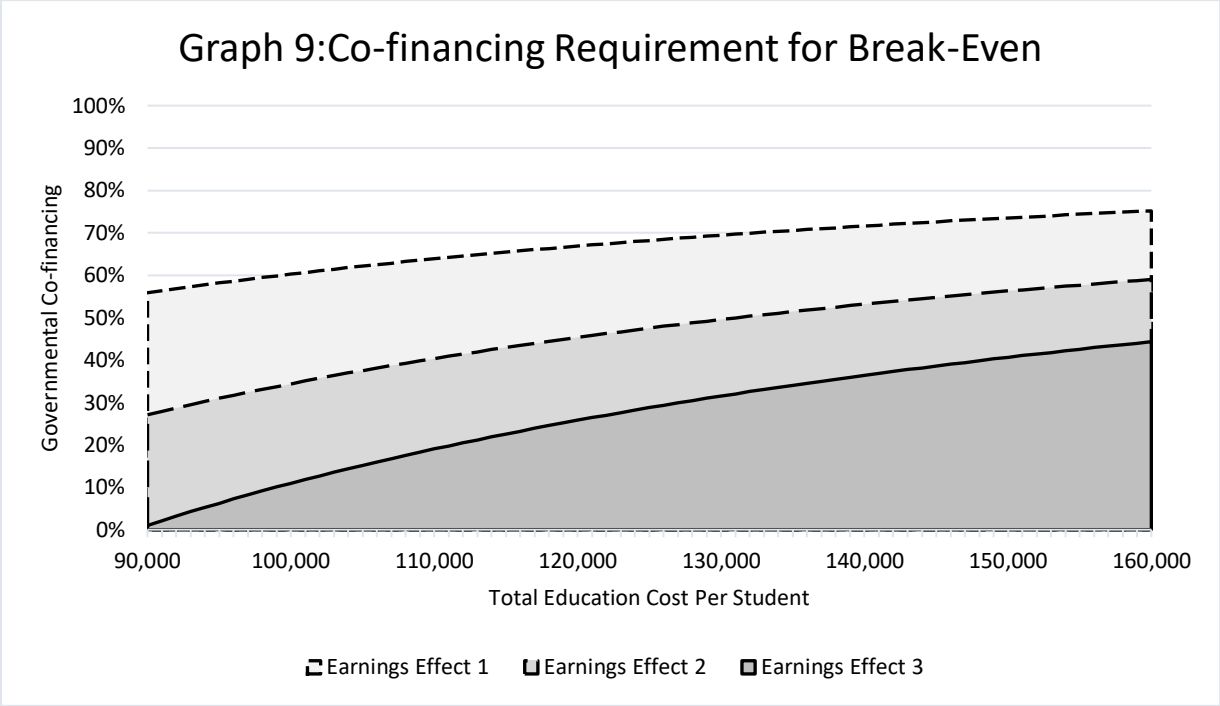
10 000 iterations per range. All prices given in SEK. The total cost of the education ranges from 93 750 SEK to 156 000 SEK in a uniform distribution. The government co-finances a share of the expenses up to a total cost of 121 876 SEK. The percentages show in how many instances the net present value of no education exceeds the net present value of education.

From Table 8, it is evident that the co-financing requirement is key to making the investment worthwhile for the municipalities. When the co-financing is 70 percent, as today, the net

present value of the policy is greater than that of no education in a majority of cases in all three earnings scenarios (i.e. not “Below break-even”). Whilst the first earnings scenario essentially splits down the middle, the latter two overwhelmingly show the education being worthwhile.

As the co-financing becomes smaller, it becomes clear that the education seems like a worthwhile investment in fewer and fewer instances. With co-financing between 30 percent and 50 percent, the majority of cases in the first two earnings scenario point to the investment not being worthwhile. And with little to no co-financing, the investment is not worthwhile in any of the earnings scenarios.

Graph 9, on the other hand, shows what level of co-financing is necessary for municipalities to break-even in the three different earnings scenarios. Here, for visual purposes, the costs range from 90 000 SEK to 160 000 SEK per student.



Graph 9 shows the extent to which the central government has to co-finance the education in order for it to break even for the municipalities, when only direct municipal costs and benefits are taken into account. Today, the central government subsidises the municipalities of up to 70 percent per educational place. Costs given in SEK.

As is evident from Graph 9, the level of co-financing necessary for municipalities to break even is highly dependent on both costs and what earnings effect is deemed most likely. With costs of 90 000 SEK per student and earnings effect 3, the co-financing requirement is close

to zero percent. However, with costs of 160 000 SEK and earnings effect 1 an almost 75 percent governmental co-financing is necessary for the education to break even. Notably, however, is that in all instances, some sort of governmental co-financing is necessary in order for the education to make sense from a direct financial point of view to the municipalities.

Chapter VI: Discussion

This chapter will discuss the results of this paper's analysis. It will start by discussing the results from the baseline analysis, interpret the findings and make a recommendation in accordance with the Kaldor-Hicks criterion. Thereafter it will reflect on the results from the municipal and co-financing analysis and their potential implications on the recommendation. These findings will thereafter be discussed in the light of previous studies covered in this paper. This is followed by a discussion on limitations and on areas of further research. Lastly, there is a short section covering the policy implications stemming from this paper's recommendation.

6.1 Baseline analysis and recommendation

According to Boardman et.al.'s (2018) ten steps of a CBA, the final step is to make a recommendation. As mentioned earlier, in light of the baseline analysis results this paper will make a recommendation based on the Kaldor-Hicks criterion. To reiterate, the Kaldor-Hicks criterion states that if benefits exceed costs at the aggregate level for all involved actors, the policy should be recommended. The relevant actors in this paper have been assessed to be individuals, the public and firms.

The majority of results in this paper point towards the policy being a good investment. The net present value of getting the education exceeds the net present value of not getting educated in all baseline scenarios herein. This is also the case when earnings are held constant post-education. However, when employment is held constant the educational investment yields negative returns in all three earnings scenarios. This points to an important point. Moving people from unemployment to employment as a result of the education is key to getting positive returns. If an education organiser manages to get a random draw of participants where it is possible to move some participants from unemployment into employment, the education will be beneficial on the aggregate. Thus, the recommendation on whether or not to implement the policy hinges on whether or not it is believable that the education is able to move people into employment. Most previous literature point to this being a very likely scenario. Especially, the Region Skåne (2021) study is of particular relevance, which has shown quite overwhelmingly that Yrkesvux industry education and its adjacent programme has moved people from unemployment to employment quite effectively.

In the light of this, this paper recommends that the policy is implemented. However, education organisers should be wary about class composition when admitting to the education.

How large the positive returns of the education will be is in turn dependent on which of the earnings scenarios is deemed most believable. As mentioned, the three earnings scenarios can be considered three different labour markets facing the individuals upon graduation. The first earnings effect, which assumed a 3.5 percent income increase compared to the counterfactual, is potentially an outcome for an individual that graduates from the industry education into a labour market which is characterised by few relevant job openings and high competition for the jobs, meaning that the industry jobs do not pay significantly more than the job the individual left. The share that go into relevant employment will however, in accordance to economic theory, use their gained productivity from the education to obtain a higher income as a result of their employment. The second earnings effect, which assumes that the outcomes to the adult-education graduates would mirror that of upper-secondary Industry Programme graduates, can be interpreted as an outcome in which graduates face a labour market characterised by a relatively high demand for the skills yet likely fairly diverse outcomes in terms of jobs, stemming from a diversity in motivation and preferences of the individuals. The graduates from the programme spread out just like the graduates from the corresponding Gymnasieskolan education and whilst the link between education and vocation is strong it is not determined. The third earnings effect places high relevance on those individuals finding relevant work as a result of the education, obtain work with good pay and good wage progression, i.e. a labour market where there is a high demand for industry skills and firms are willing to pay and retain their personnel.

As discussed in Chapter 2, the future shortage in the labour market of upper-secondary graduates with industry-skills is expected to be very large. Even with a relatively high graduation rate from this type of education, the future labour market for graduates is likely to be good. Further, since the individuals attending the hypothetical education laid out in this paper in many cases have left employment, it is quite reasonable to assume that they will be more keen to gravitate towards relevant employment than those in the corresponding Gymnasieskolan education. Thus, the most likely specification of this paper is assumed to be somewhere between income effect 2 and income effect 3. Additionally, in medium-to-small,

industrially-oriented municipalities, where the connection to industrial employers can be particularly good and the labour force competition is likely smaller, the effects are likely to be closer to effect 3 than in other municipalities.

Which earnings effect is deemed to be more likely also has bearing on whether the industry-programme specifically is a worthwhile investment. The first earnings effect, which assumes a general 3.5 premium of one year of education, could just as well be replicated on other types of vocational education. If this is deemed the most likely outcome, then a municipality would be better advised to go for a cheaper education alternative than the relatively costly industry-programme. The latter two earnings effects, on the other hand, are more reliant on industry-education specific careers.

The last point is especially important to underscore. Not only is good wages and good wage progression important in terms of having a more effectful policy – it is, according to theory, central to getting individuals interested in attending the education in the first place. As covered in Chapter 3, economic theory posits that people will only choose to invest in education if their expected earnings upon graduation exceed their expected earnings had they not invested in the education. Thus, with more favourable earnings effects, the more likely an individual is to attend the education and the more efficient the policy will be.

Thus, in order to ensure significant benefits from the policy, the policy maker should ensure that the graduates face a comparatively labour-beneficial labour market upon graduation, meaning good wages and decent wage progression.

6.2 Municipal analysis

The results from the analysis from the point of view of the municipality also point to the education yielding positive – albeit naturally smaller – returns. The municipalities were considered separately for two reasons. Firstly, because they are the prime decision-makers as it relates to implementing the policy or not. Secondly, due to the rather strained financial state of the municipalities, they are likely to be more concerned with direct gains as compared to other public actors. From the co-financing analysis however, it becomes absolutely clear how pivotal the central government grants are in order for the policy to be worthwhile for municipalities. Without a fairly high degree of co-financing the direct benefits of the

education does not outweigh the direct costs to the municipalities. Thus, a central finding of this paper is that in order to increase the supply of adult industry-programme spaces at Yrkesvux, co-financing is key. Under conditions like today, however, the investment in this type of education seems like a great investment.

Naturally, in the light of this paper's findings, the policy seems like a good investment to municipalities. Whilst this certainly looks the case it is important to remember the role of the counterfactual. The comparison is made between someone who would not have undergone any other education in the meantime. There are countless other counterfactual that can be used, such as attending tertiary education, attending a different adult upper-secondary programme or attending vocational post-upper secondary education (Swedish: Yrkeshögskolan). Nonetheless, setting opportunity cost alternatives somewhat aside, the results of this analysis seemingly point to offering industry education is a very beneficial investment for a municipality.

6.3 Findings in the light of previous studies

A discussion regarding the decision to recommend to implementation of the policy should naturally be had in the light of what has previously been written on the topic of adult education and its efficacy. The findings of this paper point to this type of education being a good investment. This stands in contrast with Stenberg (2011) findings on the efficacy of adult education. Firstly, and quite obviously, Stenberg (2011) relied on individual level micro data to gain estimates, whereas this paper has relied on other types of sources. This means that Stenberg's (2011) results are more grounded in actual previous outcomes of participants. However, this does not necessarily explain the difference. Firstly, Stenberg (2011) only analyses so-called 'low-skilled' individuals, meaning people with no upper-secondary qualifications. This group of individuals likely differ quite a lot from the group of interest in this paper – which are people who have previously finished upper-secondary education and also done so from programmes to which the barriers of entry are usually comparatively high. Secondly, Stenberg (2011) considers both vocational and general studies in their analysis and uses an on average higher age cohort than this paper – both likely to affect the results in terms of comparisons to this study.

The returns resulting from the education also differs from the findings of Liljeberg et.al. (2019). They found, using individual level micro data, that the returns of adult industry-education at Yrkesvux is associated with negative returns of 3 percent. Notably, this stands in contrast to the findings of Region Skåne (2021). Here, the difference is likely due to methodological differences relating to how one defines a student. Liljeberg et.al. (2019) considers any individual to have studied a programme if they have attended a relatively low number of credits relating to this qualification. Whilst this is undeniably both relevant and interesting study, it differs from the purpose of this paper. This paper has considered individuals that have attended and completed the full recommended qualifications set out by Skolverket. The individuals that manage to complete the programme and gain full qualifications very likely see more positive returns than the collective group of individuals that commences the education.

The previous study that is most in line with this paper is that of Region Skåne (2021). Whilst the results of the Region Skåne (2021) study have not been fully incorporated into this paper's analysis due to time constraints, it has been referenced throughout this paper. The results from this analysis on earnings and employment are largely in line with the estimates used in this paper. As previously discussed, the differences can likely to a fairly large extent be explained by the fact that the group of concern for this paper is different than the group of indivuals that have actually been analysed by Region Skåne (2021). This paper is concerned with upper-secondary graduates from general programmes, whereas Region Skåne analysed all attendees at the programme, regardless of prior qualifications.

4.4 Limitations and areas of further study

This section will discuss the limitations of this paper as it relates both to the topic as well as the data. It will, through this discussion, also offer areas in need of further research.

Starting with a limitation relating to the actual cost-benefit analysis and the stakeholders. Boardman et.al.'s (2018) ten steps state that once the relevant stakeholders have been identified, all relevant impacts should be mapped and monetised. In this respect this paper falls somewhat short. As has been mentioned, this paper likely does not *fully* capture the benefits of both firms and the central government. From the point of view of firms, the analysis did not include metrics relating to costs associated with either on-the-job training for

people who do not have the proper skills or in a worse case costs relating to relocation due to an inability of finding aptly-skilled labour. These costs are certainly relevant and have been omitted due to issues relating to their generalisability across firms and a lack of data. This does however mean that the benefits to the firm from offering this type of education is likely underestimated. The benefits of the public in general, and the central government in particular, are likely underestimated as well – however probably not to the same extent. There is some evidence of positive synergies in the form of higher economic growth that come from a higher educational level in the form more school-years in society, which have not been captured in this paper's analysis either. This has been also been omitted due to data limitations, as well as the assessment of these effects on economic growth being somewhat contested. Estimates for these omissions, particularly for costs per worker associated with relocation and on-the-job industry training, would be very helpful areas of future research.

As it relates to the metrics used in this paper, there are certain limitations in regards to these as well. Most notably perhaps is the third earnings effect, which sees the education attendee reach quite a high comparable income at the end of the time frame of this paper. The feasibility of an individual earning this level of income can certainly be questioned. However, income from this type of work is likely to increase as the shortage of labour becomes more acute. Secondly, the counterfactual used in this paper also likely yield a fairly high income for someone with no additional education after leaving upper-secondary school. Some of the people included in the counterfactual likely gain vocational upper-secondary skills, creating an upwards bias in the income levels. Omitting this bias is however to difficult due to the way vocational education is shaped today, based on courses rather than programmes. In general, due to the lack of quality data, the metrics and estimates used in this paper are insecure. Nonetheless, they should offer some interesting insight into the potential of offering this type of education to this specific group of individuals.

As aspect that would have been interesting to look into further that has been omitted from this paper due to space constraints, would be to include a more rigorous analysis of the effects of employment. This paper has held employment constant and shown that the positive effects of the education then vanishes. It would be interesting to see how the results changes with other altercations of the employment metrics used in this paper.

Returning to the discussion of the counterfactual which was touched upon in the discussion of municipality, this paper opted for using a status quo counterfactual, meaning that the alternative explored was to obtain no education. Whether this is the fairest counterfactual is a topic for debate. Whilst most do not, a considerable amount of the people who have not ventured into tertiary education after five years have attained some tertiary education after ten years, meaning that there is an attrition rate in the counterfactual that this paper has not accounted for. That being said, as briefly discussed in Chapter 3, this attrition rate can affect the estimate in both directions. However, an area for further research would be to assess what an investment in this type of education would be in comparison to getting more people into tertiary education. To perform such an analysis in a satisfying way, micro data would most likely be necessary to properly catch drop-out rates and individual labour market outcomes. Further, this paper has not analysed to what extent people will move to a different municipality. Whilst it does not matter at the individual level, as long as the individual remains in Sweden, it poses a considerable risk at the municipal level. However, as mentioned, there is some inconclusive evidence that both employment opportunities and that an individual has studied in the municipality increases the chance of someone remaining in the same municipality afterwards. More research into this area would also be of help.

One of the most considerable limitations of this paper is that it has not investigated whether the individuals in this analysis would even be interested in the education. As mentioned earlier in this chapter, one can make a theoretically sound argument that the education would be pursued if wages are sufficiently high. However, issues such as information asymmetry, overestimation of one's own ability or an improper factoring of costs could hinder an individual from entering the education, as they would not believe that it would increase their expected earnings. One could speculate that the draw of individuals could both come from a higher earners and lower earners in the spectrum chosen, yet it is hard to know which. This would also be an interesting avenue for further research, with higher quality data.

In conclusion, many of the limitations of this paper could be solved with higher quality data. Plenty of the assumptions made in this paper should be tested against real-world individual level data in order to ascertain their credibility. Gaining one credible estimate – rather than three speculative – for earnings effects would for example be very helpful. Additionally, research into certain areas could make the existing analysis more sophisticated, for example

by including metrics for firm training/relocation costs. This goes as well for being able to find better metrics as it relates to direct educational costs. This information today is rather scarce.

6.5 Policy implications

To reiterate, this paper has opted for recommending the education to be implemented. These recommendations hinge on the education organisers ensuring that the graduates enter a labour market in which their skills are in clear demand, and that the recruitment into the education is effective.

In order to implement this, the legal framework would have to be changed. Today, preference to these educational programmes must be given to individuals far away from the labour market. This paper posits that class composition should be determined by the municipalities rather than the central government. This will become more vital as it will likely be in society's interest to sooner rather than later shift people away from generalist work into specialist vocational work. Due to the many insecurities of this study, it is certainly a valid point that some of the effects of this paper ought to be tested on reliable micro-data before a large scale implementation. Therefore, testing the efficacy of the policy in a small scale would perhaps be a preferable start.

Chapter VII: Conclusion

This paper set out to analyse the potential effectiveness of offering complementary upper-secondary Industry Programme education to young upper-secondary graduates from general programmes that have not continued into tertiary education. Due to a lack of previous studies on the topic as well as a lack of access to relevant individual-level data, this paper has relied on existing economic literature on education effectiveness in general, existing aggregate public data on incomes, reports from agencies and interest groups and conversations with education organisers. The results point to the education being an effective policy compared to not getting the education. This paper recommends the implementation of the policy, with two important caveats. Firstly, in order to give preference to the industry education as compared to other cheaper educations it is important that the graduates face a local labour market where their skills are in high demand. Secondly, the results show that a very important aspect of getting positive returns is that the education is successful in moving some of its participants from unemployment to employment. This requires greater municipal control of class composition. This paper concludes by stating that in order to ensure this latter point, the legal framework surrounding this type of education ought to be changed.

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APPENDIX A: Boardman et.al.'s ten steps of a cost-benefit analysis

From Boardman et.al.'s (2018, p. 5)

1. Explain the purpose of the CBA
2. Specify the set of alternative projects
3. Decide whose benefits and costs count (specify standing)
4. Identify the impact categories, catalogue them, and select metrics
5. Predict the impacts quantitatively over the life of the project
6. Monetize (attack dollar values to) all impacts
7. Discount benefits and costs to obtain present values
8. Compute the net present value of each alternative
9. Perform a sensitivity analysis
10. Make a recommendation

APPENDIX B: Graphs and Tables from Region Skåne.

Table B1
Sample Characteristics

Year of Graduation	2014
Total number of students	189
Students from electricity programme	125
Students from the industry programme	64
Men	172
Women	17
Average age	30

Attendees of Yrkesvux in Skåne.

Table B2
Activity

	Before Yrkesvux	2015	2016	2017	2018
Working	92	146	149	152	153
Student	27	6	10	9	6
Registered Unemployment	14	6	7	8	4
Other Unemployment	56	31	23	20	26

The Before Yrkesvux category signifies the year before starting the yrkesvux education. The year of graduation is 2014 for all participants.

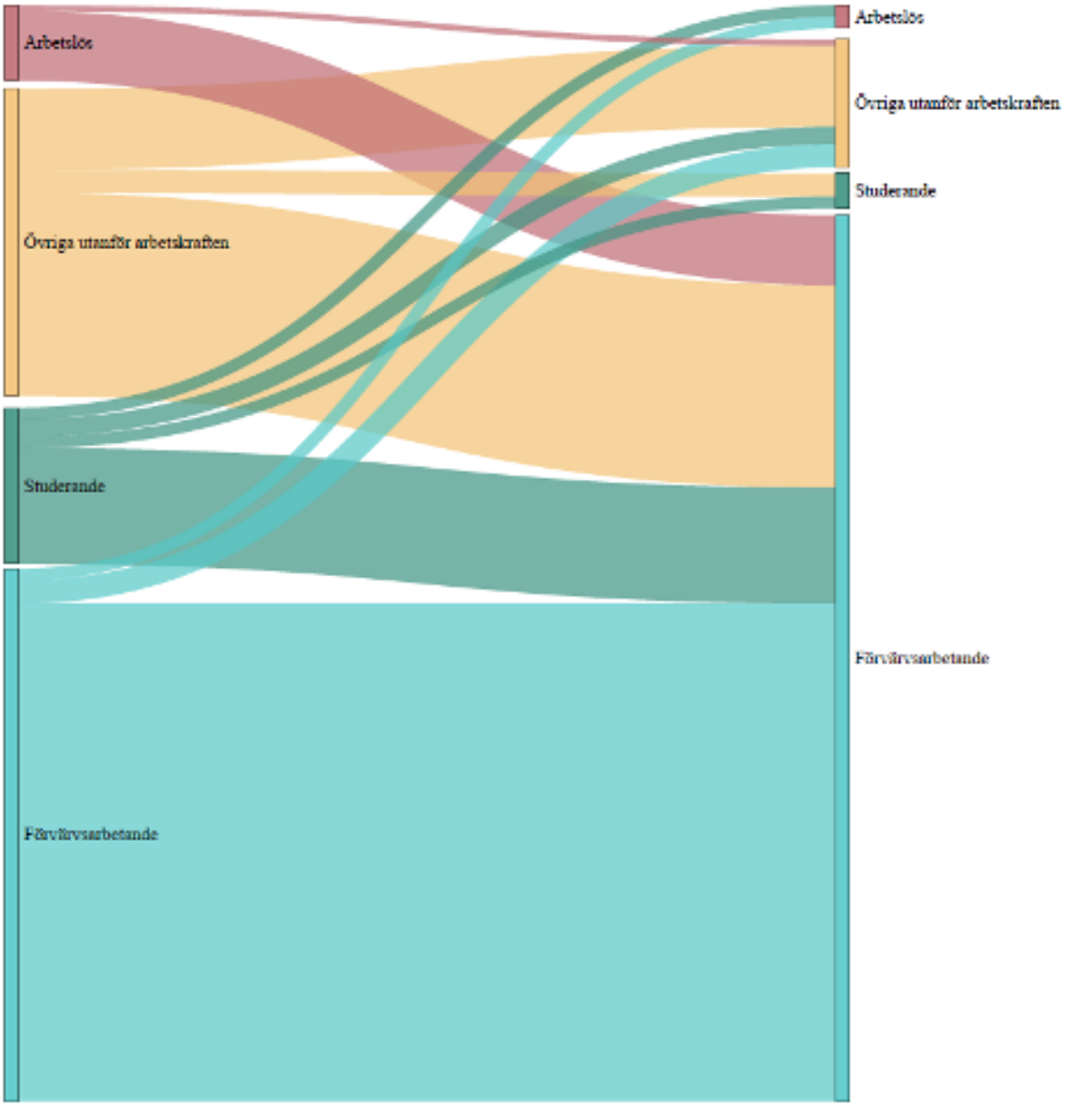
Table B3
Annual Income of Those Working upon graduation

Activity Before	Income Before	2016	2017	2018
Working	233 000	305 000 (82)	318 000 (84)	333 000 (86)
Student	4 000	258 000 (18)	272 000 (19)	294 000 (20)
Registered Unemployment	55 000	256 000 (12)	324 000 (11)	298 000 (12)
Other Unemployment	32 000	274 000 (37)	299 000 (38)	337 000 (35)

The categories *Activity Before* and *Income Before* signifies the year before starting the yrkesvux education. The year of graduation is 2014 for all participants. The number in the parentheses are the number of students from each group that are in employment.
Incomes rounded to closest 1000 SEK.

Graph B1

Activity flows from Yrkesvux graduation (2014) to 2018



Graph created by Region Skåne (2021).
Arbetslös = Registered Unemployment
Övriga utanför arbetskraften = Other Unemployment
Studerande = students
Förvärvsarbetande = Working

APPENDIX C: Suggested Vocations After Graduating from the Industry Programme

The website skanegy.se provides information regarding the choice of Gymnasieskolan education in the Skåne region and the western part of the Blekinge region. It is run by the municipalities in Skåne and West Blekinge. The website provide a list of potential jobs to do upon graduation from the Industry Programme. The jobs are then, when possible, matched with a corresponding SSYK number available from SCB and the subsequently matched with the corresponding real salary for individuals aged 18-24 in 2019. To obtain the starting salary estimate, the salaries were multiplied with the number of people having the job and then divided with the total number of people. Categories that did not have both salary and number of people available were omitted.

	Employment in Suggested Vocations, ages 18-24, Sweden						
	Job	**4-digit SSY**	**People in 4-digit**	**Average Monthly sal**	**People * Salary**		**Vocation matched with 4-digit SSYK**
1	Industrilackerare	7132	N/A	N/A			
2	Gjutare	7211	N/A	N/A			Gjutare, metall hantverk
3	Verktygsmakare	7222	N/A				
4	CNC-operatör - metall	7223	6 400	28 800	184320000		
5	Servicemekaniker	7223	as above	as above	as above		Servicemekaniker, bilverkstad
6	Svetsare	7223	as above	as above	as above		Svetsare, maskin
7	Underhållsmekaniker	7233	2 300	29 100	66930000		
8	Låssmed	7311	N/A	N/A			
9	CNC-operatör - trä	7523	N/A	24 700			
10	Maskinsnickare	7523	N/A	24 700			
11	Sågverksoperatör	8173	840	29 700	24948000		
12	Processoperatör kemi	8192	710	29 300	20803000		Processoperatör, kemisk industri
13	Laborationstekniker inom kemisk indu	8192	as above	as above	as above		
14	Automationsmekaniker	8199	220	32 000	7040000	**Average salary**	Automationstekniker, installation o. service industriro
15	Internationell svetsare	N/A				Salary / peopl	N/A
	Total		**10 470**		**304041000**	**29039**	

APPENDIX D: The average annual salary increase in industry occupations

Earnings Effect 3: Estimated annual salary increases for the individuals attending the education.

Table D1:

Estimated annual salary increases for industrial workers

Years since graduation	Annual Salary Increase	Annual Increase After inflation control
1	4.3	3.0
2	4.2	2.9
3	4.1	2.8
4	4	2.7
5	3.9	2.6
6	3.8	2.5
7	3.7	2.4
8	3.6	2.3
9	3.5	2.2
10	3.4	2.1
11	3.3	2.0

Source: Facken i industrin (2014-2020), own calculations

The graphs used to gain these estimates can be found in the following studies. Estimates of interest are for ”Arbetare” ages 24-35.

Facken i industrin (2014) *Löner inom industrin 2013*, Report August 2014, p. 6: Diagram 2.5 Löneökningar 2012 och 2013 uppdelat på ålder

Facken i industrin (2015) *Löner inom industrin 2014*, Report June 2015, p. 6: Diagram 2.5 Löneökningar för identiska individer 2013 och 2014 uppdelat på ålder

Facken i industrin (2016) *Löner inom industrin 2015*, Report June 2016, p. 7: Diagram 2.4 Löneökningar för identiska individer 2014 och 2015 uppdelat på ålder

Facken i industrin (2017) *Löner inom industrin 2016*, Report September 2017, p. 7: Diagram 2.4 Löneökningar för identiska individer 2015 och 2016 uppdelat på ålder

Facken i industrin (2018) *Löner inom industrin 2017*, Report October 2018, p. 7: Diagram 2.4 Löneökningar för identiska individer 2016 och 2017 uppdelat på ålder

Facken i industrin (2019) *Löner inom industrin 2018*, Report June 2019, p. 7: Diagram 2.4 Löneökningar för identiska individer 2017 och 2017 uppdelat på ålder

Source: Facken i industrin (2020) *Löner inom industrin 201*9 Report June 2020, p. 8 Diagram 2.4 Löneökningar för identiska individer 2018 och 2019 uppdelat på ålder

APPENDIX E: Database entries

Statistics Sweden – Statistikdatabasen (Source: SCB, 2021b)

Data	Location at Statistikdatabasen	URL
Average salaries by profession	Arbetsmarknad > Lön efter yrke (4-siffrig SSYK) > Genomsnittlig grund- och månadslön samt kvinnors lön i procent av mäns lön efter sektor, yrke (SSYK 2012), kön och ålder. År 2014-2020	https://www.statistikdatabasen.scb.se-/pxweb/sv/ssd/START__AM__AM01-10__AM0110A/LonYrkeAlder4A/
Average salaries by upper-secondary education attainment	Utbildning och forskning > Sysselsättning och inkomster efter avslutad utbildning > Inkomster (spridningsmått) bland de som arbetar efter gymnasieskolan. Avgångsår 1996/1997 – 2017/2018	https://www.statistikdatabasen.scb.se-/pxweb/sv/ssd/START__UF__UF0503-/UF05035a/

Skolverket – Sök statistik (Source: Skolverket, 2021e)

Share of students in general-/vocational programmes	Gymnasieskolan > Riket > Samtliga > Elever > 2019 > Elever på högksoleförberedande program, yrkesprogram och introduktionsprogram > Urval > År: 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019	https://www.skolverket.se/skolutveckling-/statistik/sok-statistik-om-forskola-skola-och-vuxenutbildning?sok=SokB&vform=21-&omr=Elever&ar=2019&run=1
Number of final year students in the industry programme	Gymnasieskolan > Riket > Samtliga > Elever > 2019 > Karta, antal elever per program > Läsår: 2013/14, 2014/15, 2015/16, 2016/17, 2017/18, 2018/19 > Skolår: 3 > Program: Industritekniska programmet > Inriktning: Alla > Riksstatistik: Antal Elever	https://www.skolverket.se/skolutveckling-/statistik/sok-statistik-om-forskola-skola-och-vuxenutbildning?sok=SokB&vform=21&omr-=Elever&ar=2019&run=1