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Effect of dropout on labour market outcomes for upper secondary vocational track students

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Effect of dropout on labour market outcomes for upper secondary vocational track students

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Dropout from upper secondary schooling alarms policymakers in many Western societies. In this analysis, we study Norwegian upper secondary students enrolled in vocational study programs. To identify a causal effect on labour market outcomes, we instrument dropout by the availability of apprenticeship contracts for a given county, year, and specialization. We find that dropping out reduces the job probability at age 23 by 26 percentage points, and it increases the risk of not being in employment nor in education by 23 percentage points. The latter effect is particularly strong for women and individuals who lagged behind in their educational career.

JEL codes: I21, I26, J24

Keywords: human capital, dropout, employment, NEET, vocational education, upper secondary education, apprenticeship, instrumental variable

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1. Introduction

It is well known from previous research that school dropout is strongly associated with weak labour market attachment in adulthood. This raises great concern internationally, and Norway is no exception (OECD, 2018). The challenge is to uncover the mechanisms behind this association: is school dropout *causing* the maladaptation later in life, or simply a reflection of underlying individual characteristics which increase both the possibility of school dropout and labour market exclusion? In this analysis, we aim to establish causation by using a presumably exogenous dropout predictor: local variation in the cost of upper secondary completion arising from variation in the probability of securing an apprenticeship contract.

This analysis focuses on students in vocational education and training (VET) in Norway. Similarly to many other European countries, students at the upper secondary level choose between academic and vocational tracks, and completion of most vocational programmes depends on a successful apprentice period. Recently, Bertrand *et al.* (2020) find that a reform in 1994 that improved and streamlined vocational education increased social mobility and reduced dropout in disadvantaged groups. Even so, for several decades, the proportion of students who drop out has been far higher at the vocational programmes than the academic programme - in 2021, 30 % versus 10.6 %, respectively (Statistics Norway, 2022). In their report, the Office of the Auditor General argues that "because of the lack of available training places, teen-agers do not complete their vocational training, and this is regarded as a major cause of the large dropout rate in upper secondary education» (Office of the Auditor General of Norway, 2013). Dropout from upper secondary is defined as not having completed upper secondary after 5 years, that is, by the age of 21, as is common in official statistics and Norwegian literature.

After a short review of relevant literature, this paper proceeds with institutional details of the Norwegian upper secondary school system, where students in the second year of the vocational track select into programme areas with several specializations where they apply for apprenticeships. We then describe the data sources and the selected sample, give a detailed account of how the instrument is constructed, and explain the estimation strategy. The outcomes we consider at age 23 are primarily employment and not being in employment nor post-secondary education, while also analysing the effect on income from wages or self-employment.

Our results indicate that, indeed, dropping out from vocational education has substantial detrimental effects on early labour market experience. Dropping out reduces the job probability by 26 percentage points according to our IV estimates. Similarly, the risk of not being in employment nor in education increases by 23 percentage points. The results are robust to several sensitivity checks. Because we focus on outcomes conditional on the chosen track, we cannot claim that we have established a causal effect of dropping out from upper secondary education in general or that the results strengthen (or weaken) the argument for having a vocational track in upper secondary education. However, our results add to previous research for several reasons: first, in the present institutional context, dropout from the non-academic track represents the majority of non-completion at this education level. Second, we explore the mechanism behind dropout from this track by relating the number of contracts signed to completion in the first stage of our IV. Because re-tracking is possible, this is not a mechanical relationship. Third, we specifically consider dropout from a chosen track for enrolled students who actually demand further vocational education – the comparison group is not students who did not qualify or who chose another track.

2. Literature

In human capital theory, individuals invest in education to the point where the marginal earnings gain is equal to the rate of discount. In practice, most industrialized countries have mandatory schooling laws that make education compulsory up to the lower secondary level, while offering education at the upper and post-secondary level for those who qualify. Even so, non-completion is substantial. According to OECD, one in five students on average across the OECD drops out of the education system before finishing upper secondary (OECD 2012). Technological change and globalization, implying fiercer competition in product and labour markets, increase the importance of education. On this background, it is understandable that policymakers and educators worry about dropout from secondary education.

It is, however, not clear that all drop out is sub-optimal for society. Manski (1989) argues that when education is voluntary, joining a program is an experiment. The prospective student does not know (for sure) if s/he will be able to complete and find it worthwhile. Thus, the outcome of the experiment may be non-completion for some students, and without further assumptions one cannot conclude whether the observed dropout rates are too high or low from society's point of view. While Manski addresses post-secondary education, the key to his argument is that joining the programme is voluntary. Eckstein and Wolpin (1999) consider dropout from (compulsory) high school in a sequential choice model and conclude that dropouts are less motivated for schooling and have comparative advantages in jobs that are done by nongraduates, hence policies for reducing dropout that do not alter those traits will have limited success.

In empirical research, the design of compulsory schooling schemes has been used to identify the causal effect of education on income (e.g., Angrist and Krueger 1991; Oreopoulos, 2006; Aakvik *et al.*, 2010). Oreopoulos (2007) specifically considers whether models that imply

efficiency in early school-leaving decisions can adequately explain estimates for the total gains from staying in school. He concludes that the opportunity costs of dropping out are substantial and suggests that students (in compulsory schools) are myopic, and this is supported by experimental evidence (Levitt *et al.*, 2016).

In the literature, there is also a discussion of the virtues of specific vocational school tracks, as summarized by Bertrand *et al.* (2021). The argument against such programmes is that they may lock in students at a too early age to non-academic careers and low paid jobs. Moreover, vocational programmes may be of poor quality, aimed at students with low abilities. On the other hand, a too academic focus may contribute to fewer years of completed schooling, and the alternative for young people is not necessarily labour force participation. Bertrand *et al.* (*ibid*) evaluate the Norwegian educational reform in 1994, that streamlined the vocational upper secondary school track and improved apprenticeship access, but also facilitated transitions from the vocational to the academic track (also see the Institutional Framework section). They find that the reform increased college enrolment and improved social mobility.

Empirical studies that specifically investigate dropout from vocational secondary education include Barth and von Simson (2013), Aspøy and Nyen (2017), Brockmann *et al.* (2010), Neyt *et al.* (2020), and Hanushek *et al.* (2017). The two latter studies investigate the relative labour market effects of vocational programmes and are concerned with selection into study tracks. Hanushek *et al.* present evidence that early gains from vocational training may be offset by later losses relative to workers with general education. Reiling and Strøm (2015) find that completion of upper secondary education is counter-cyclical: students who enrol in an economic downturn are more likely to graduate. Riphahn and Zibrovius (2016) compare early labour market outcomes of German secondary school graduates who do not qualify for tertiary education and find that vocational training generates strong positive returns. Fersterer *et al.* (2008) estimate the returns to

length of apprenticeships in Austrian firms that close down. The authors find that the positive returns to apprenticeships cannot be explained by selection (*ibid*). Our study is similar to these two in that we take the choice of a vocational study track as given. However, we apply full population data and exploit exogenous variation in the probability of securing an apprenticeship contract to assess effects of not completing vocational education. Reiling and Strøm (*op. cit.*) suggest that the strong positive unemployment effect on completion at the vocational track, combined with absent enrolment effects, indicates that apprenticeship availability is not important. In this paper, we have data on apprenticeship contracts that enable us to explore this mechanism.

3. Institutional framework

3.1 The Norwegian school system

In Norway, compulsory schooling lasts for ten years, including three years of lower secondary schooling, which pupils finish at age 16. Upper secondary schooling is governed by Norway's (up until recently) 19 counties, which are responsible for offering upper secondary education ("vidaregåande skule", vgs) to all who have completed compulsory schooling. There is a comprehensive follow-up of compulsory school graduates, and almost all of them enrol in upper secondary school (OECD, 2018), which is voluntary with no fine for non-participation (unlike for instance England, Brockmann *et al.*, 2010). Pupils are entitled to three years of upper secondary schooling, and one extra year if the student decides to change his/her choice of education programme or programme area.[1]

[1] Up until 2017, the entitlement to upper secondary was restricted to 5 years from start of vgs. As of 2021, there is no time limit.

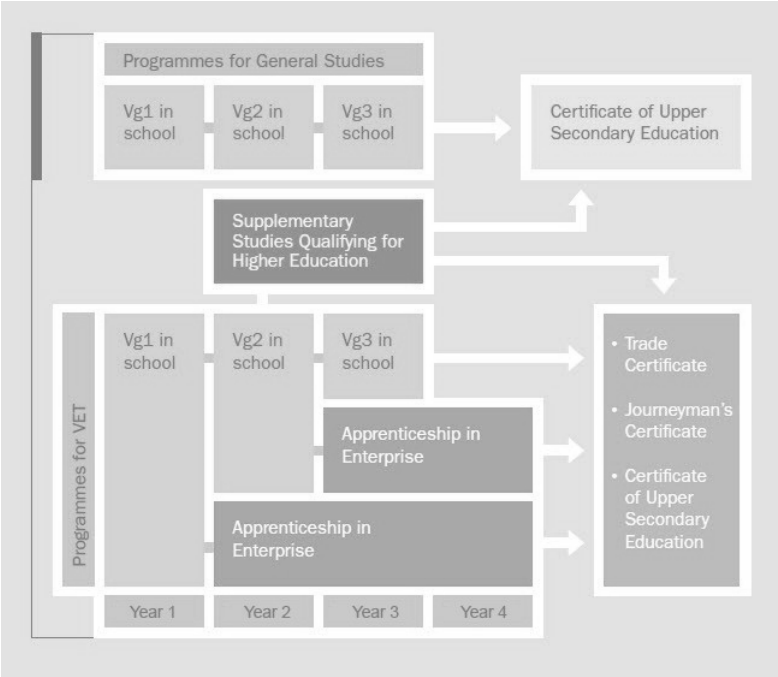

Figure 1. The structure of upper secondary education, see https://www.udir.no/in-english/norwegian-vocational-education-and-training/ .

Upper secondary schooling is divided between academic track ("programmes for general studies") and vocational track, see Figure 1. More than half of all compulsory school graduates enrol in VET, where the dominant model is two years of mostly school-based education followed by two years as an apprentice[2]. However, students are not guaranteed an apprenticeship contract, and in 2011, one third of the applicants did not obtain a training place despite giving this alternative top priority in their application (Office of the Auditor General of Norway, 2013). The proportion rejected varies considerably by education programme and county (Aspøy and Nyen, 2015). For students who do not obtain an apprenticeship, counties are obliged to offer Vg3 in school as an alternative route to

[2] The structure within VET depends on specialization, and Figure 1 shows two exceptions to the dominant model: i) 1 year of classroom education and 3 years as an apprentice, and ii) Vg3 in school, which means that students have all their VET education at school. In some counties, there are also a limited number of spots offered for students to combine classroom teaching and work-place training throughout all four years. ("vekslingsmodellar").

a trade/journeyman's certificate, but this is considered less attractive because of its short duration and lack of work-based training (*ibid*).

In recent decades, much effort has been made to facilitate crossovers from VET to academic track at different stages, to give VET students the option of qualifying for higher education. Still, switching costs out of VET are probably considerable. Notably, VET students at Vg2 level may be offered a third year of classroom education (called "supplementary studies qualifying for higher education" in Figure 1), but this is a very demanding option because of its intensity and focus on academic subjects.

For this analysis, the hierarchical structure within the vocational track is of particular interest. Students apply each spring to be enrolled in upper secondary the following autumn, at different levels. At the lowest level (called Vg1) they may choose between nine *education programmes*[3], and below we illustrate the structure for one of them, named Sales, service and transport.

[3] For school years starting 2009-2012 these programs were the following: Healthcare, Childhood and Youth Development; Technical and Industrial Production; Building and Construction; Electricity and Electronics; Service and Transport; Media and Communication; Agriculture, Fishing and Forestry; Design, Arts and Crafts; and Restaurant and Food Processing.

Year 1 Vg1 - Upper sec. level 1 *Education programme*	Year 2 Vg2 - Upper sec. level 2 *Vg2 programme area*	Year 3 Vg3 - Upper sec. level 3 *Vg3 programme area*	Year 4	Trade certificate
Sales, service and transport	IT services	IT services	Cont.	IT service worker
	Tourism	Tourism	Cont.	Travel agent
		Receptionist	Cont.	Receptionist
	Sales, service and safety	Office and administration	Cont.	Service and adm. worker
		Sales	Cont.	Sales representative
		Safety	Cont.	Security guard
	Transport and logistics	Logistics	Cont.	Logistics operator
		Professional driver	Cont.	Professional driver

Figure 2. The VET structure, exemplified by the education programme Sales, service and transport. Shaded areas represent classroom teaching, unshaded areas represent the apprenticeship period (our translation from Norwegian web site vilbli.no).

The first year of upper secondary, all students within an education programme follow the same classes. Having finished Vg1, they can choose from a given menu of Vg2 *programme areas*; within Sales, service and transport, there are four alternatives (see Figure 2). Their Vg2 programme area determines which Vg3 programme area ("lærefag") they are allowed to specialize in, that is, which Trade Certificate, Journeyman's Certificate or Certificate of Upper Secondary Education they seek to qualify for. For instance, if they choose Transport and logistics, then at Vg3 level they may apply for an apprenticeship within Logistics (aiming at a trade certificate as Logistics operator) or within Professional driver. However, they cannot apply for a receptionist apprenticeship, unless they first complete the Vg2 education programme Tourism. This structure is made clear to students when they apply for Vg2 spots (vilbli.no).

For the school years starting 2011-2014, there were 47 Vg2 programme areas, which potentially lead to 182 Vg3 programme areas. Students were allowed to change their mind once

within this structure, that is, switch to another education programme or to another programme area within the same education programme (The Norwegian Directorate for Education and Training, a). Thus, students who do not obtain an apprenticeship may (besides opting for Vg3 in school or supplementary studies qualifying for higher education) restart their upper secondary career within a different education programme or Vg2 programme area, repeat their current Vg2 programme area, find a job, or become inactive with respect to education as well as employment. For teen-agers, finding a job may be easier after turning 18, because then there are less safety regulations and restrictions on working hours and it becomes possible to get a driving license.

3.2 The process of gaining an apprenticeship

Students enrolled at Vg2 in August in a given school year apply electronically for further education by March 1 in the same school year, signalling their three prioritized alternatives. If they apply for an apprenticeship, an administrative body within the county ("yrkesopplæringsnemnda") will inform potential employers (firms or municipalities) of their interest. Students are also encouraged to get in touch with employers on their own. The county where the signing firm is located, supervises the fulfilment of apprenticeship contract conditions. Students may start their apprenticeship despite not having passed all Vg2 exams, but missing exams will be noted on the contract, and must be passed before the student is qualified for a trade/journeyman's certificate. Contracts are registered administratively, and employers are remunerated according to fees fixed at the national level.

4. Data

4.1 Data sources

Information on employment is taken from the State Register of Employers and Employees ("Aa-registeret"), managed by the Norwegian Labour and Welfare Administration. Reporting to the register is mandatory. Information about annual income is taken from Statistics Norway's database for the income and wealth statistics for households.

The dropout indicator is based on information from the national education database (NUDB), regarding the person's highest level of completed education. This database also shows education activity updated by 1 October each year, with a 6-digit code representing the type of study (level and field), as well as final grades from lower secondary school (*GPA*) and includes information on mother's and father's highest level of completed education.

Additional information on education is found in the database VIGO, owned by Norwegian counties and administered by Vigo IKS. It holds detailed data on students' top priority when they apply to be admitted for upper secondary education at various levels (for instance, regarding school and education programme at Vg1, Vg2 programme area, and Vg3 programme area). Similar data has been used in one report (Aspøy and Nyen, 2015); otherwise, this data source is underutilized in research. Vigo data is available from the school year 2011/2012 onwards.

Regarding apprenticeships, The Norwegian Directorate for Education and Training (Udir) publishes annual data on the number of applicants whose top priority at Vg3 is an apprenticeship, aggregated by Vg3 programme area and county. The web page also gives information on the number of signed contracts within a calendar year, with the same level of specificity (udir.no).

Data on students' background characteristics are provided by Statistics Norway, which covers all Norwegians and contains individual information on sex, year of birth, immigrant background, family relations, etc.

Information extracted from these sources has been merged using the personal identifier, and we have access to data up to 2019 (for income only up to 2018).

4.2 Sample selection

We focus on students who prefer to follow the most common track within the VET structure, two years of classroom instructions and two years of apprenticeship. Therefore, we restrict the sample to students who enrol in a Vg2 programme area that may make them qualified for an apprenticeship the subsequent year, at Vg3 level.[4] Information on Vg2 enrolment is taken from the NUDB data, the variable *igang*. Thus, we exclude VET students who drop out of upper secondary schooling altogether during the first year; however, we allow one extra year in upper secondary before they enrol in Vg2, that is, they are 17 or 18 years old when enrolled[5], and have the opportunity of completing upper secondary by age 21. Because of data availability, the sample is restricted to students enrolling in VET Vg2 for the school years 2010/2011-2013/2014, that is, the birth cohorts 1992-1996, see Appendix Figure 1. After dropping 2 825 individuals due to missing on lower secondary school grades (*GPA*), we are left with a sample of 91 095 students labelled Vg2 Sample, see Appendix Figure 2.

[4] Thus, we exclude students who enrol in VET Vg2 programme areas which do not involve an apprenticeship but lead to Certificate of Upper Secondary Education instead ("yrkeskompetanse med vitnemål"), and Vg2 programme areas where the apprenticeship starts already at Vg2 level ("særløp") or at vg4 level.

[5] If the same student is enrolled more than once at Vg2 level, we keep the last observation (at age 18). We follow the same principle for Vg3 applicants.

In our main analysis, we will apply a subsample of these 91 095 students, namely students who apply for an apprenticeship as their top priority wish for Vg3.[6] This implies that we exclude those who were enrolled in Vg2 in October but did not apply for Vg3 altogether, for example dropouts or switchers to another Vg2 programme area (12 208 students) or students who prefer another Vg3 option to apprenticeship, for example cross-over to academic track (27 640 students). The remaining 51 247 individuals constitute our estimation sample, together with 1 944 individuals who prioritize apprenticeship in their Vg3 application without being Vg2 students the same school year. Thus, the main estimation sample, labelled Vg3 sample, counts 53 191 individuals.

4.3 Outcomes

We measure outcomes at age 23, that is, two years after individuals are defined as dropouts or not. An overview of outcomes, instruments, and explanatory variables is found in Appendix Table 1.

We have generated an indicator variable for being registered as employed by 1 October, that is, having the number of contracted hours greater than zero *(employed).* Since employment and formal education are mutually exclusive activities to some extent, we also investigate the outcome *NEE*, which equals one if the person is not employed and is not undertaking formal education at the post-secondary level, and zero otherwise.[7] The outcome *employed* may reflect small part-time jobs and, on the other hand, does not include self-employment, therefore, we also analyse the magnitude of labour activity by defining an indicator (*Income>G)* for having income from wages and self-employment above the National Insurance scheme basic amount ("G"), equal to about

[6] This subsample includes "lærekandidatar", that is, students who aim at "kompetansebevis", which is regarded basic education. However, this group is small. In 2011-2014, between 3.3 and 3.6 percent of all Vg3 applicants with their first wish of becoming an apprentice/"lærekandidat" end up as "lærekandidatar".

[7] Note that while the definition of NEET ("Not in employment, education or training") in official statistics includes formal secondary education as well as informal education ("training") (ssb.no), these activities are not relevant in our NEE outcome. For instance, NEE = 1 if the person is unemployed and participates in formal secondary education or training, and NEE = 0 if the person is enrolled in education level 5 ("fagskole") or higher.

10 000 Euros in 2016.[8] Furthermore, for our robustness analysis, we also define an indicator variable *NEE2,* which equals one if the person has an income below G and is not in post-secondary education. Our income information is only updated up to 2018, therefore outcome variables Income>G and NEE2 are not available for the 1996 birth cohort.

4.4 Explanatory variables

The treatment variable, dropout from upper secondary (*dropout)*, is defined as not having completed upper secondary by the age of 21, as is common in official statistics and Norwegian literature.[9] Thus, for a student who is 18 (19) the calendar year when applying to be enrolled at Vg3 level, there are three (two) years left before he/she reaches the age when dropout is defined. For all included, this time interval is sufficient for completing VET (two years of apprenticeship or one year of Vg3 in school).[10]

As control variables, we include indicators for sex (*male),* being foreign-born *(immigrant*), being 19 when applying for Vg3 (*ageVg3=19),* each parent's highest level of completed education (*compulsory, intermediate, higher, missing),* where the base category is compulsory education. Furthermore, we include grade point average from lower secondary (*GPA),* as well as separate indicators for Vg3 programme area and school year, as well as county. «County» refers to the county which will be responsible for supervising the VET education, if the application for apprenticeship is successful.

[8] The basic amount "G" is set yearly on a national basis, in nominal terms, and was NOK 92 576 by 1 May 2016 (Grunnbeløpet i folketrygden - nav.no).

[9] There are 5 possible states regarding level of upper secondary education after five years (at age 21), the last 3 are defined as dropping out: completion within the prescribed time, completion after the prescribed time, still in upper secondary education after 5 years, has followed upper secondary education but did not pass, and left upper secondary schooling without completing.

[10] Recently, the definition of dropout for VET students has been changed, now based on status within six years (Changes in the implementation statistics - SSB).

4.5 Instrumental variable

Our instrumental variable should reflect the cost of completing upper secondary education. In the context of this analysis, it should reflect the probability of achieving an apprenticeship, that is, the degree of competition for apprenticeship. The instrument is therefore a ratio of the number of contracts signed to the number of applicants.[11] The denominator represents all students whose top priority wish for Vg3 is apprenticeship, whether they applied through the application system or obtained a contract on their own. Data on number of contracts signed and number of applicants are readily available by Vg3 programme area, county, and calendar year (The Norwegian Directorate for Education and Training (2021).[12] This proportion, named *ratio*, applies as instrument for our main sample.

Appendix Figure 3 shows the distribution of this instrument by county, across Vg3 programme areas. While the median of *ratio* is in the range 0.6-0.8, there is large variation. The instrument is not associated with students' background characteristics to any noteworthy extent; although some coefficient estimates are statistically significant, they are ignorable in economic terms (see Appendix Table 2).

As a robustness check, we estimate on a sample extracted at Vg2 level, that is, *before* students have signalled their top priority wish for a specific Vg3 programme area. For this sample, we construct a less specific instrument, utilizing the fact that a Vg2 student is only qualified for an apprenticeship within his/her chosen Vg2 programme area. Thus, *ratioVg2* is the number of

[11] Number of contracts offered is not registered in any statistics.

[12] The ratio reflects competitiveness in the geographical area (county) where the applicant prefers to obtain an apprenticeship, which may differ from the applicant's county of residence. For a few programme areas, admission is at the national level ("landslinje"), so that all students applying for these programmes the same year will have the same ratio.

contracts signed to the number of applicants, now aggregated by Vg2 programme area, county and calendar year (according to vilbli.no).

4.6 Descriptive statistics

Table 1 presents mean values on outcomes and explanatory variables for the main sample, split by the dropout indicator.

Table 1. Descriptive statistics

	Whole sample	**Dropout = 0**	**Dropout = 1**
N	53 191 (100%)	34 582 (65%)	18 609 (35%)
Outcomes (at age 23)			
Employed	.77	.83	.67
NEE	.17	.10	.31
Income>G	.81	.87	.7
NEE2	.14	.06	.28
Instrumental variable:			
Ratio	.68 (.19)	.70 (.18)	.64 (.21)
Explanatory variables:			
Male (%)	72	72	71
Immigrant (%)	5.2	3.7	8
GPA	33.8 (6.3)	35.5 (6.0)	30.7 (5.8)
AgeVg3 = 19 (%)	28	17	49
Mother's education (%)			
Compulsory	29	25	36
Intermediate	49	51	44
Higher	20	22	16
Missing	2	2	4
Father's education (%)			
Compulsory	27	24	33
Intermediate	56	60	50
Higher	12	13	10
Missing	4	3	6

Standard deviation in parentheses.

As expected, individuals who have not completed upper secondary by the age of 21 score poorly on employment and income at the age of 23 (see column to the right). One third of them are not

employed, compared to 17 % among those who finished upper secondary. The difference is even larger if we look at the probability of being neither in employment nor in post-secondary education (31 % versus 10 %). These frequencies are unadjusted for background characteristics, and we see that the dropout group is characterized by a higher share of immigrants, parents with low levels of education, they are older when they apply for Vg3 (42% versus 13 % are 19 years old) and have poorer results from lower secondary (GPA 30.7 vs 35.5). Men constitute 72 % of the sample, and they are about equally represented among dropouts and non-dropouts.

5. Empirical strategy

We use an IV approach to estimate the causal effect of dropping out from vocational upper secondary education, *D*, on early labour market outcomes, *Y* (employed, NEE, Income>G, NEE2) for individual *i* who had previously applied for an apprenticeship in year *t* in programme area *p* in county *c*. Assuming a linear model for the equation of interest, the outcome of student *i* at age 23 is

$$Y_{ipct} = \alpha + \rho_i D_{ipct} + \gamma X_i + \theta_p + \theta_c + \theta_t + \varepsilon_{ipct}, \qquad (1)$$

where X_i denotes the exogenous control variables detailed in the previous section, including an indicator for applying at age 19. We include programme area, county, and application cohort fixed effects, θ_p, θ_c, and θ_t, respectively. Note that *D* is measured two years before the labour market outcome, and three (two) years after the application year for students who applied at age 18 (19). The treatment effect ρ_i is assumed to be heterogenous. There are several reasons why the treatment variable, *D*, may be endogenous to the outcome, such as unobserved abilities and motivation, mental and physical health, or credit restrictions. We therefore instrument the endogenous

treatment with the *ratio* of signed contracts to the number of applicants in the student's programme area and county, in a given year. The first stage is

$$D_{ipct} = \pi_0 + \pi_1 ratio_{pct} + \pi_2 X_i + \mu_p + \mu_c + \mu_t + \vartheta_{ipct}, \qquad (2)$$

where μ_p, μ_c, and μ_t are programme, county, and application cohort fixed effects, respectively.

A valid instrument should be randomly distributed across VET students and have no direct effect on the outcomes other than by its effect on *D*. It is important to note that students that are not offered a contract have other options for completing upper secondary, thus there is not a mechanical relationship between the *ratio* instrument and dropout. The *ratio* varies across programme areas, counties, and time, and the student cannot observe *ratio* when enrolling in a specific programme area.

We therefore argue that the instrument is independent of potential outcomes (realizations of *Y*) and potential treatment assignments (dropping out or not). If so, the effect of *ratio* on *D* in equation (2) is causal. Because *ratio* is realized before *D*, that is a reasonable assertion. We also argue that the exclusion restriction holds; that the instrument has no direct effect on labour market outcomes other than by its effect on the dropout probability. It is unlikely that the apprenticeship probability has a direct effect on employment, therefore we maintain that this assumption is reasonable, as well.

Given that the exogeneity assumption holds, the IV estimate identifies a LATE (local average treatment effect) for students who are affected by the overall contract probability (compliers). Some students drop out whatever the level of *ratio* (always-takers), whereas others always complete, e.g., by switching to another specialization or to the academic track (never-

takers). We must also assume that those who do respond to a decrease in *ratio* in their specialization do so by not completing upper secondary, and not conversely. This is the monotonicity assumption. For the sake of argument, assume that the instrument has only two values, high or low probability of securing an apprenticeship. Then, if the value switches from high to low, the student should have at least the same probability of not completing upper secondary as if the value was high. One could imagine that a student who is offered an apprenticeship realizes that s/he is on the wrong track and responds by quitting upper secondary altogether instead of completing in another programme. On the other hand, if not getting a contract in the first place, s/he would change to another programme and complete upper secondary on this alternative track with a higher probability. However, we think this chain of events is sufficiently unlikely that the monotonicity assumption is reasonable.

Our instrument is similar in spirit to Fersterer *et al.* (2008), who use information on failing firms to identify the causal effect of apprenticeships on early labour market outcomes. However, our instrument reflects the "normal" variation in demand for apprentices over the business cycle and across industries.

The relationship between *ratio* and dropout is visualized in Figure 3.

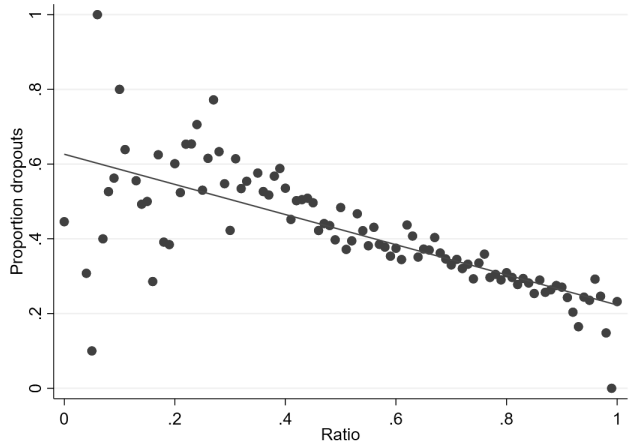

Figure 3. Relationship between *ratio* and proportion dropouts. *Ratio* is the probability of getting an apprenticeship, defined for each combination of Vg3 programme area, county and year. Proportion dropouts is the proportion of students who applied for Vg3 programme areas with a given ratio (rounded to two decimal places) and who dropped out by the age of 21.

Clearly, there is a negative relationship between the instrument and the dropout rate, but there is also considerable variation. In the next section we shall see that the negative relationship remains when controlling for a wider set of observable characteristics.

Regressions should be estimated with clustered standard errors when clusters of individuals, rather than individuals themselves, are assigned to a treatment (Abadie *et al.*, 2017). Since *ratio* is assigned at a cluster level (Vg3 programme area × county × year), we would like to cluster by that level; however, that would imply a small number of observations within some clusters. We therefore cluster standard errors on a higher level, Vg3 programme area, where we consider the fact that students within a Vg3 programme area most likely share some characteristics, for instance outside options to completing upper secondary.[13]

6. Results

6.1 Main results

Our main results are reported in Table 2.

[13] In our OLS regressions, where treatment (dropout) is at the individual level, robust standard errors are justified. Estimations yield the same results, whether with robust or with clustered standard errors.

Table 2. Main results.

	(1) OLS	(2) red.	(3) IV
Panel A – dropout (1st stage)			
Ratio	-.24***		
	(.022)		
Observations	53191		
avg(outcome)	.35		
Panel B - employed			
Dropout	-.16***		-.26***
	(.0045)		(.056)
Ratio		.063***	
		(.014)	
Observations	53191	53191	53191
avg(outcome)	.77	.77	.77
Panel C – NEE (not in employment nor in post-secondary education)			
Dropout	.19***		.23***
	(.0042)		(.048)
Ratio		-.056***	
		(.013)	
Observations	53191	53191	53191
avg(outcome)	.17	.17	.17

The table shows 1st stage results (Panel A) for the endogenous variable dropout, and OLS (column 1), reduced form (column 2) and IV results (column 3) for the outcomes *employed* (Panel B) and *NEE* (Panel C). Control variables included in the regressions are listed in Appendix Table 1 (sex, immigrant, ageVg3, parents' education, GPA). In addition, county, year and Vg3 programme area indicators are included. Standard errors in parentheses clustered at Vg3 programme area.
* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$

First stage results, reported in Panel A, show that the coefficient estimate for the instrument is -0.24 with an estimated standard error of 0.022; that is, a student who applies for an apprenticeship within a Vg3 programme area where the ratio is high, has a lower probability of dropping out. Other things equal, a 0.2 rise in ratio (i.e., 20 percentage points increase in probability of apprenticeship) is associated with almost 5 percentage points lower probability of dropping out. The reduced forms (the association between the instrument and our outcomes of interest) are also estimated with great precision (column 2).

Our interest lies in whether the relationship between dropout and being employed is causal or not. OLS results (Panel B, column 1) tell that the probability of being employed at age 23 is 16 percentage points lower if the individual had not completed upper secondary by age 21. This is the same difference as reported in descriptive statistics (Table 1), controlling for observable background characteristics has not altered the picture. Estimated by IV, the effect is stronger; the employment probability is reduced by 26 percentage points if dropping out (Panel B, column 3). Compared to IV, the OLS result is too small in absolute value. That may be because the IV identifies the local average treatment effect on compliers. In the OLS, the local effect is washed out by students who are not affected by *ratio* in their decision to drop out from upper secondary or not (always-takers and never-takers).

It could be that students who were defined as dropouts at age 21 later caught up and were in post-secondary education at age 23, a "success" that might not be reflected in the employment indicator. Taking educational activity into account does not change the qualitative results; dropping out increases the probability of being out of employment and post-secondary education (NEE) by 23 percentage points for the IV estimate (Panel C, column 3). Like the results for the employment outcome, the IV estimate is larger than the OLS estimate. The estimated coefficients of control variables are reported in Appendix Table 3, and overall, they are modest in magnitude.

6.2 Heterogeneity

The effect of dropping out may vary at the group level. We have inspected this first by splitting the sample by sex, and results are reported in Table 3.

Table 3. Heterogeneity by gender.

	Men			Women		
	(1) OLS	(2) red.	(3) IV	(4) OLS	(5) red.	(6) IV
Panel A – dropout (1st stage)						
Ratio	-.25***			-.21***		
	(.027)			(.032)		
Observations	38041			15150		
avg(outcome)	.35			.36		
Panel B - employed						
Dropout	-.14***		-.27***	-.19***		-.29**
	(.0053)		(.066)	(.0084)		(.12)
Ratio		.067***			.061**	
		(.017)			(.025)	
Observations	38041	38041	38041	15150	15150	15150
avg(outcome)	.78	.78	.78	.76	.76	.76
Panel C - NEE						
Dropout	.17***		.23***	.21***		.31***
	(.0049)		(.053)	(.0079)		(.1)
Ratio		-.056***			-.063***	
		(.014)			(.021)	
Observations	38041	38041	38041	15150	15150	15150
avg(outcome)	.16	.16	.16	.19	.19	.19

The table shows 1st stage results (Panel A) for the endogenous variable dropout, and OLS, reduced form and IV results for the outcomes *employed* (Panel B) and *NEE* (Panel C), separately for men (columns 1-3) and women (columns 4-6). The same set of control variables as in the main results (Table 2) is used (immigrant, ageVg3, parents' education, GPA, year, county and Vg3 programme area indicators). Standard errors in parentheses clustered at Vg3 programme area.

* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$

IV coefficient estimates are larger in the women subsample, where dropping out leads to a 29 percentage points lower probability of *employment*, compared to a 27 percentage points decrease for men (Panel B). The absolute difference in effect of dropout on *NEE* is even larger, estimated at 31 versus 23 percentage points increase for women and men, respectively. In relative terms, the difference in effect by sex is even larger; women seem more sensitive to variation in the probability

of getting an apprenticeship. This result is worth noting, given that the public concern has been directed to men who drop out.

Another effect heterogeneity we find interesting is linked to the great flexibility in the VET structure, see Table 4.

Table 4. Heterogeneity by age at start of Vg3.

	18 years old			19 years old		
	(1) OLS	(2) red.	(3) IV	(4) OLS	(5) red.	(6) IV
Panel A – dropout (1st stage)						
Ratio	-.25***			-.21***		
	(.025)			(.031)		
Observations	38415			14776		
avg(outcome)	.25			.61		
Panel B - employed						
Dropout	-.17***		-.27***	-.14***		-.28***
	(.0056)		(.074)	(.0077)		(.11)
Ratio		.069***			.061**	
		(.018)			(.024)	
Observations	38415	38415	38415	14776	14776	14776
avg(outcome)	.79	.79	.79	.72	.72	.72
Panel C - NEE						
Dropout	.19***		.17***	.18***		.41***
	(.0053)		(.057)	(.007)		(.094)
Ratio		-.044***			-.088***	
		(.015)			(.021)	
Observations	38415	38415	38415	14776	14776	14776
avg(outcome)	.15	.15	.15	.23	.23	.23

The table shows 1st stage results (Panel A) for the endogenous variable dropout, and OLS, reduced form and IV results for the outcomes *employed* (Panel B) and *NEE* (Panel C), separately for 18-year-olds (columns 1-3) and 19-year-olds (columns 4-6). The same set of control variables as in the main results (Table 2) is used (male, immigrant, parents' education, GPA, year, county and Vg3 programme area indicators). Standard errors in parentheses clustered at Vg3 programme area.
* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$

While most VET students follow the beaten track and are 18 years the year when they apply for Vg3, some have had pauses or restarted on their VET track so that they fill 19 the year when they apply for Vg3. It is conceivable that spending an extra year within the VET structure at an early stage could lead to a better match between the student's talents/interests and his/her specialization, yielding better labour market outcomes. Another, and perhaps more likely presumption, is that 19-year-olds are negatively selected, or perceived as such by potential employers. For instance, their mean GPA is 32.2 compared to 34.4 for 18-year-olds. After controlling for background characteristics such as GPA, we find that the effect of dropping out is substantially larger for VET students who are 19 when they apply for Vg3. In particular, the effect of dropping out on NEE is striking, dropout is estimated to give 41 versus 17 percentage points increase in probability of NEE (Panel C). One could argue that this result is partly mechanical, that is, 19-year-olds drop out more easily because they have one year less to complete upper secondary education, which in turn is a prerequisite for entering post-secondary education, and their dropout rate is 0.61 compared to 0.25 for 18-year-olds. If they eventually "catch up", we should observe that by the age of 23 (instead of 21), many more within this group have completed upper secondary. Indeed, 38 % of 19-year-olds who dropped out by age 21 finish upper secondary education by age 23, while for 18-year-olds it is only 26 % (not reported elsewhere). Since first stage is actually weaker for 19-year-olds, it is heterogeneity in the reduced form results (of rate on outcomes) that drives the difference in IV effect estimates.

7. Discussion

In an international perspective, a large proportion of upper secondary students enrol in the vocational track in Norway. However, completion rates within VET are low, particularly if assessed within the regular programme duration. Even two years later, the completion rate is

considerably lower than the OECD average (for the 2009 cohort, 63 % vs 70 %, see OECD, 2018). We have found that dropout has large negative consequences for early labour market outcomes, using instrumental variable method to trace the causal effect of dropout. Below, we investigate the robustness of our results.

7.1 Robustness

We have learned that within a county, the instrument *ratio* varies considerably (confer Appendix Figure 3), and so does the number of applicants by programme area. One may suspect that results could be driven by programme areas with few students, where the instrument (calculated for each combination of Vg3 programme area, county and year) is more likely to take extreme values. We have tested this by excluding Vg3 programme areas where the number of applicants is five or less for each combination of year and county. This reduces the sample by six per cent. We learn from Table 5a that effect estimates are somewhat reduced compared to the main specification reported in Table 2, although still considerable and very precisely estimated.

Table 5. Robustness analysis.

5a. Small Vg3 programme areas excluded.

	Baseline			Small vg3 programmes excluded		
	(1) OLS	(2) red.	(3) IV	(4) OLS	(5) red.	(6) IV
Panel A – dropout (1st stage)						
Ratio	-.24***			-.3***		
	(.022)			(.024)		
Observations	53191			50060		
avg(outcome)	.35			.35		
Panel B - employed						
Dropout	-.16***		-.26***	-.16***		-.21***

	(.0045)		(.056)	(.0046)		(.054)
Ratio		.063***			.062***	
		(.014)			(.017)	
Observations	53191	53191	53191	50060	50060	50060
avg(outcome)	.77	.77	.77	.78	.78	.78

Panel C - NEE

Dropout	.19***		.23***	.19***		.17***
	(.0042)		(.048)	(.0043)		(.048)
Ratio		-.056***			-.052***	
		(.013)			(.016)	
Observations	53191	53191	53191	50060	50060	50060
avg(outcome)	.17	.17	.17	.17	.17	.17

For comparison, the table first presents the baseline OLS, reduced form and IV results (columns 1-3) for outcomes *employed* (Panel B) and *NEE* (Panel D). Columns 4-6 present the corresponding results for the sample where small Vg3 programme areas are excluded. The same set of control variables as in the main results (Table 2) is used (male, ageVg3, immigrant, parents' education, GPA, year, county and Vg3 programme area indicators). Standard errors in parentheses clustered at Vg3 programme area.
* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$

It is worth noting that while counties are obliged to offer all Vg1 education programmes, they have discretion in deciding which Vg2 and Vg3 programme areas to offer. There are no national guidelines regarding how many spots to offer and counties have been criticized for poor dimensioning of the upper secondary school system (see The Norwegian Directorate for Education and Training, 2019). Most likely, counties differ with respect to how quickly they adjust the VET system to (expected or realized) changes in the demand for and supply of apprenticeship spots, as well as in their effort in matching applicants and potential employers. These features create variation in *ratio* over time that is exogenous to individual student characteristics.

In our main specification, the instrument is calculated at the most detailed level possible (Vg3 programme area). This level should reflect the student's chance to get an apprenticeship the best; therefore, we expect that first stage results are weaker and estimated effect of dropout is smaller in magnitude if we estimate at a more aggregated level (instrument at Vg2 programme area), implying less variation in *ratio*. Table 5b confirms this, when we compare the estimated

effects on employed (panel B, column 6 versus 3) and on NEE (panel C, column 6 versus 3). This is because reduced form is weaker when the instrument is defined on a more aggregated level (compare colums 2 and 5) and less precisely reflects the student's chances of getting an apprenticeship.

5b. Instrument generated at Vg2 level. and sample extension.

	Baseline			Instrument on vg2 level			Instrument and sample on vg2 level		
	(1) OLS	(2) red.	(3) IV	(4) OLS	(5) red.	(6) IV	(7) OLS	(8) red.	(9) IV
Panel A – dropout (1st stage)									
Ratio	-.24***								
	(.022)								
RatioVg2				-.23***			-.082***		
				(.034)			(.028)		
Observations	53191			53191			91095		
avg(outcome)	.35			.35			.37		
Panel B - employed									
Dropout	-.16***		-.26***	-.16***		-.17**	-.13***		-.14
	(.0045)		(.056)	(.0045)		(.073)	(.0035)		(.1)
Ratio		.063***							
		(.014)							
RatioVg2					.039*			.011	
					(.02)			(.0084)	
Observations	53191	53191	53191	53191	53191	53191	91095	91095	91095
avg(outcome)	.77	.77	.77	.77	.77	.77	.75	.75	.75
Panel C - NEE									
Dropout	.19***		.23***	.19***		.18***	.18***		.16
	(.0042)		(.048)	(.0042)		(.063)	(.0032)		(.1)
Ratio		-.056***							
		(.013)							
RatioVg2					-.041**			-.013	
					(.018)			(.009)	
Observations	53191	53191	53191	53191	53191	53191	91095	91095	91095
avg(outcome)	.17	.17	.17	.17	.17	.17	.17	.17	.17

For comparison, the table first presents the baseline OLS, reduced form and IV results (columns 1-3) for outcomes *employed* (Panel B) and *NEE* (Panel D). Columns 4-6 present the corresponding results for instrument aggregated on Vg2 level, and columns 7-9 for extended sample that includes 17/18 year-old students enrolled in Vg2 VET in school years 2010/2011-2013/2014, in addition to instrument aggregation on Vg2 level. The same set of control variables as in the main results (Table 2) is used (male, immigrant, ageVg3, parents' education, GPA, year, county and Vg3

programme area indicators). Standard errors in parentheses clustered at Vg3 programme area level.
* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$

Another potential concern is that while we argue that the instrument is exogenous, the student might adjust his/her choice of Vg3 programme area during Vg2, based on updated information on the chances of obtaining an apprenticeship contract and subsequent job opportunities (they apply for apprenticeship in the last semester of Vg2). Therefore, we estimate the effect on a broader sample, VET students enrolled in the first semester of Vg2, about six months before they revealed their preferences for Vg3 studies/apprenticeship. This sample counts 91 095 students and includes students who drop out during Vg2, chose another Vg2 programme area, or chose something else than apprenticeship as their first wish for Vg3 (see Appendix Figure 2). Results are reported in Table 5b, columns 7-9. Because we have more students included that are not directly affected by the *ratio* since they don't apply for apprenticeship, we expect to find weaker relationships in columns 7-9 than in columns 4-6, where the same instrument is used, but on a more focused sample. Indeed, first stage as well as reduced form estimates are considerably smaller, and the estimated IV effect is insignificant for both outcomes. Note that the OLS coefficients are rather similar.

To better reflect the magnitude of employment, we extend the analysis to include the effect on *Income>G* and *NEE2.* These outcomes define a higher threshold for "success" than *employed* or *NEE*. As expected, Table 5c shows that the effect of dropping out on *Income>G* and *NEE2* is larger than on *employed* or *NEE*, when we estimate these outcomes on the exact same sample, that is, after excluding the 1996-cohort, for whom information on income is not available.

Table 5c. Alternative outcomes *Income>G* and *NEE2* (without 1996-birth cohort).

	Baseline (without 1996-cohort)			Alternative outcomes (without 1996-cohort)		
	(1) OLS	(2) red.	(3) IV	(4) OLS	(5) red.	(6) IV
Panel A – dropout (1st stage)						
Ratio	-.25***			-.25***		
	(.025)			(.025)		
Observations	39705			39705		
avg(outcome)	.36			.36		
Panel B - employed				***Panel C – Income > G***		
Dropout	-.16***		-.28***	-.16***		-.33***
	(.0052)		(.058)	(.0049)		(.062)
Ratio		.071***			.082***	
		(.016)			(.016)	
Observations	39705	39705	39705	39705	39705	39705
avg(outcome)	.77	.77	.77	.81	.81	.81
Panel D – NEE				***Panel E – NEE2***		
Dropout	.19***		.26***	.19***		.28***
	(.0048)		(.051)	(.0045)		(.056)
Ratio		-.065***			-.07***	
		(.015)			(.015)	
Observations	39705	39705	39705	39705	39705	39705
avg(outcome)	.18	.18	.18	.14	.14	.14

For comparison, the table first presents the baseline OLS, reduced form and IV results without 1996-birth cohort (columns 1-3) for outcomes *employed* (Panel B) and *NEE* (Panel D). Columns 4-6 present the corresponding results for alternative outcomes *Income>G* (Panel C) and *NEE2* (Panel E). The same set of control variables as in the main results (Table 2) is used (male, immigrant, ageVg3, parents' education, GPA, year, county and Vg3 programme area indicators). Standard errors in parentheses clustered at Vg3 programme area level.
* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$

7.2 Concluding remarks

In the extensive literature on returns to education and - the other side of the coin – on consequences of dropout, a concern is whether the results represent causal relationships, that is, whether endogeneity issues are considered. In this analysis, we address the issue of unobserved individual

heterogeneity in the probability of dropping out by applying an IV strategy, where dropout is instrumented by the probability of securing an apprenticeship, quantified at an aggregated level.

Our analysis shows that non-completion of upper secondary is detrimental to labour market participation and educational activity at age 23. Dropping out decreases the employment probability by 26 percentage points and increases the probability of being not in employment nor undertaking post-secondary education by 23 percentage points. The latter effect is particularly strong for women and individuals who lagged behind in their educational career, that is, they were 19 years old when applying for Vg3.

In this analysis, we benefit from full population data and information on students' educational choices, and we zoom in on students who have revealed a clear preference for vocational education and for specializing within the vocational track. Not only have they been enrolled in VET during their second year of upper secondary, but they also apply for an apprenticeship as their prioritized wish for further upper secondary education. Our results demonstrate how strongly the availability of apprenticeship contracts impacts on student dropout from VET, in a system with great flexibility with regard to choosing various paths to completing upper secondary schooling.

The effect of dropout should be interpreted as a local average treatment effect, that is, it applies to VET students whose probability of completing upper secondary depends on obtaining an apprenticeship contract. From a policy perspective, this group is of particular interest, since the supply of apprenticeship contracts might be responsive to policy measures. A recent reform of upper secondary schooling aims at having 90 % completion in 2030, and one of the key reform elements is improving the quality of Vg3 in school for students who do not obtain an apprenticeship contract, while actions taken to increase the supply of apprenticeships are less emphasized

(Ministry of Education and Research, 2021). The current government has this as a major policy tool in this policy area (regjeringen.no, 2022).

Because we focus on outcomes conditional on the chosen track, we cannot claim that we have established a causal effect of dropping out from upper secondary education in general or that the results strengthen (or weaken) the argument for having a vocational track in upper secondary education. However, our results add to previous research on dropout from upper secondary vocational track both in terms of the method applied and the sample studied. We claim several contributions to the literature: first, in the present institutional context, dropout by VET students is a highly relevant topic since they are strongly overrepresented among dropouts from upper secondary. Second, we explore the mechanism behind dropout from this track by relating the proportion of applicants who succeed in securing an apprenticeship to completion in the first stage of our IV. Because re-tracking is possible, this is not a mechanical relationship. Third, we specifically consider dropout from a chosen track for enrolled students who actually demand further vocational education – the comparison group is not students who did not qualify or who chose another track.

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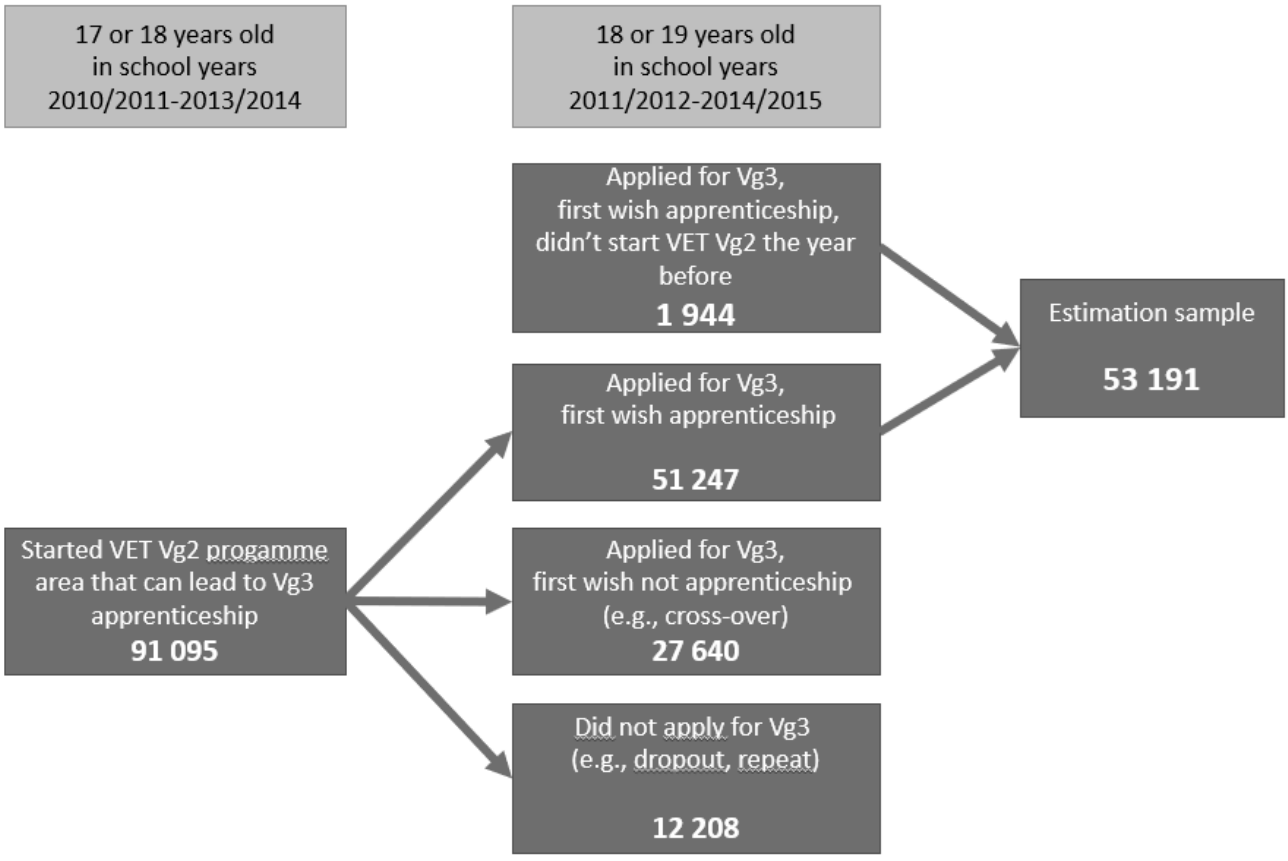
APPENDIX

APPENDIX FIGURES

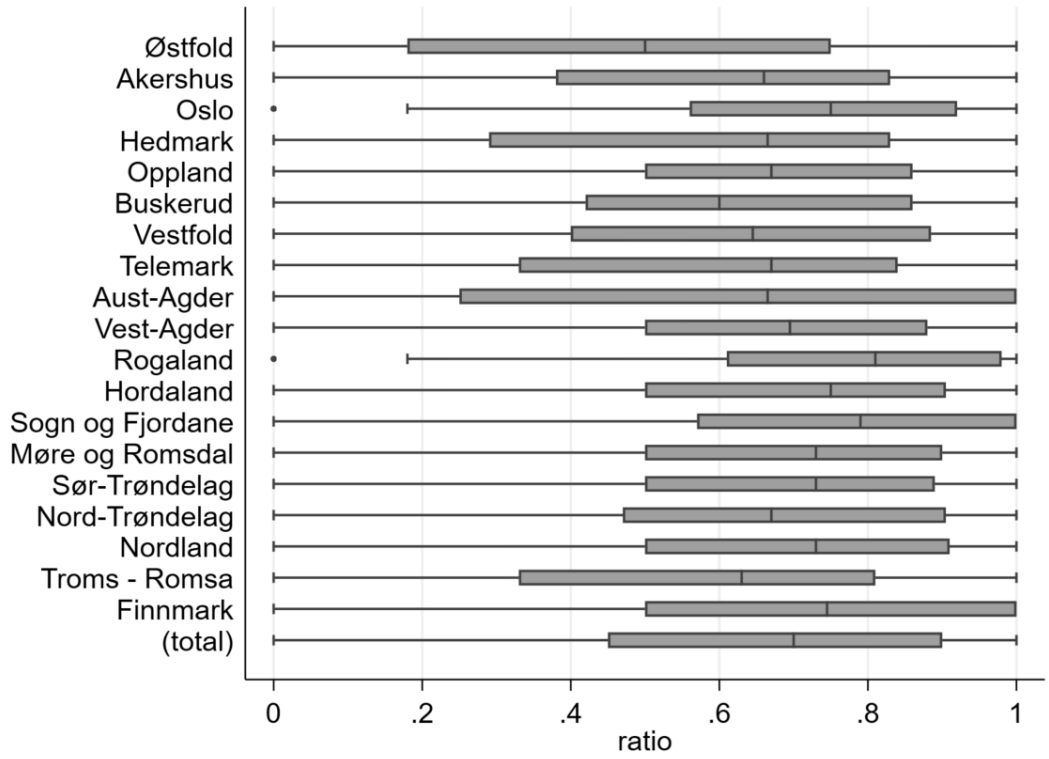
	Year								
Year of birth	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1992	19	20	21	22	23	24	25	26	27
1993	18	19	20	21	22	23	24	25	26
1994		18	19	20	21	22	23	24	25
1995			18	19	20	21	22	23	24
1996				18	19	20	21	22	23

Potential start Vg3 Dropout measured Outcome

App. Figure 1. Timeline. Numbers in the table represent student age.



App. Figure 2. Sample selection.



App. Figure 3. Distribution of the instrumental variable *ratio*, by county in 2011.
The boxes are bordered at the 25th and 75th percentiles of the ratio with a median line at the 50th percentile. Whiskers extend from the box to the lowest and highest values.

APPENDIX TABLES

Appendix Table 1. Variables

Variable	Description
Outcomes (at age 23):	
Employed	1 if registered in A-registry in Oct.(i.e., contracted hours worked > 0)
NEE	1 if not employed (in A-registry) nor in post-secondary education by Oct 1st
Income > G	1 if income from employment or self-employment exceeds G (*grunnbeløp,* NOK 92 576 in 2016)
NEE2	1 if income from employment or self-employment is below G (*grunnbeløp,* NOK 92 576 in 2016) and not in post-secondary education by Oct 1st
Instrumental variables:	
Ratio	Ratio of signed apprenticeship contracts to number of Vg3 applicants whose top priority wish was apprenticeship. Per calendar year, county, and Vg3 programme area (0<=ratio<=1).
RatioVg2	Ratio – assigned to Vg2 students - of signed apprenticeship contracts to number of Vg3 applicants whose top priority wish was apprenticeship. Per calendar year, county, and Vg2 programme area (0<=ratio<=1).
Explanatory variables:	
Dropout	1 if upper secondary is not completed by the calendar year when the student reaches age 21
Male	1 if male
Immigrant	1 if foreign-born, by foreign-born parents
	Indicators for highest level of education for mother and father:
Compulsory	1 if compulsory education
Intermediate	1 if upper secondary education or post-secondary but not higher
Higher	education
Missing	1 if higher education
	1 if information on education is missing
YearVg3	start of school year relevant for Vg3 application
AgeVg3	1 if aged 19 when applies for Vg3, 0 if aged 18
GPA	Grade point average ("grunnskulepoeng") from lower secondary school

Appendix Table 2. Association between instrument *ratio* and background characteristics

	(1) Ratio	se
Male=1	.0061***	(.0022)
Immigrant=1	-.0018	(.0033)
AgeVg3=19	-.0078***	(.0016)
Mother's education (ref. mandatory):		
Secondary	.00073	(.0015)
Higher	.00091	(.0019)
Missing	-.00033	(.0046)
Father's education (ref. mandatory):		
Secondary	.0028**	(.0015)
Higher	.002	(.0022)
Missing	-.00072	(.0036)
GPA	.0013***	(.00011)
YearVg3=2011	0	(.)
YearVg3=2012	.0009	(.0019)
YearVg3=2013	-.0071***	(.0018)
YearVg3=2014	-.015***	(.0019)
YearVg3=2015	-.029***	(.0033)
Constant	.56***	(.0055)
Observations	53 191	

Coefficients are from an OLS estimation including indicators for Vg3 programme area and county.
Robust standard errors in parentheses. * $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$

Appendix Table 3. Main results including coefficient estimates for control variables.

	Dropout	Employed			NEE		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	1st stage	OLS	reduced	IV	OLS	reduced	IV
Dropout		-.16***		-.26***	.19***		.23***
		(.0045)		(.056)	(.0042)		(.048)
Ratio	-.24***		.063***			-.056***	
	(.022)		(.014)			(.013)	
Male	-.039***	.0041	.01	-.00018	-.013**	-.02***	-.011*
	(.011)	(.0064)	(.0082)	(.0081)	(.0058)	(.0073)	(.0065)
Immigrant	.027**	.013	.0091	.016	-.0076	-.0026	-.0089
	(.013)	(.011)	(.015)	(.013)	(.01)	(.014)	(.012)
AgeVg3=19	.31***	-.0085*	-.056***	.025	.00019	.057***	-.014
	(.024)	(.0049)	(.0041)	(.021)	(.0045)	(.004)	(.017)
Mother's education (ref. mandatory):							
Secondary	-.045***	.011***	.018***	.0065	-.014***	-.022***	-.012***
	(.0058)	(.0042)	(.0035)	(.0044)	(.0038)	(.0033)	(.0038)
Higher	-.047***	-.024***	-.017***	-.029***	-.003	-.012***	-.00075
	(.0065)	(.0055)	(.0044)	(.0057)	(.0048)	(.0041)	(.005)
Missing	-.0046	-.023	-.022	-.023	.014	.013	.014
	(.017)	(.014)	(.014)	(.015)	(.014)	(.013)	(.014)
Father's education (ref. mandatory):							
Secondary	-.041***	.0095**	.016***	.0051	-.0098***	-.017***	-.0079**
	(.0042)	(.0042)	(.0034)	(.0042)	(.0038)	(.0032)	(.0038)
Higher	-.033***	-.052***	-.047***	-.056***	.013**	.0069	.015***
	(.0063)	(.0067)	(.0069)	(.0067)	(.0057)	(.0049)	(.0049)
Missing	-.0029	-.028**	-.028**	-.029***	.023**	.023**	.023**
	(.013)	(.012)	(.012)	(.011)	(.011)	(.011)	(.01)
GPA	-.023***	.0013***	.0048***	-.0012	-.0045***	-.0087***	-.0034***
	(.00087)	(.00033)	(.00074)	(.0015)	(.00029)	(.00057)	(.0011)
YearVg3=2012	-.015***	.00059	.0029	-.0011	-.0029	-.0057	-.0022
	(.0044)	(.0054)	(.0052)	(.005)	(.0048)	(.0048)	(.0046)
YearVg3=2013	-.018***	.024***	.027***	.022***	-.025***	-.028***	-.024***
	(.0055)	(.0053)	(.0059)	(.0061)	(.0047)	(.0054)	(.0056)
YearVg3=2014	-.026***	.021***	.025***	.019***	-.02***	-.025***	-.019***
	(.0061)	(.0053)	(.0058)	(.0064)	(.0046)	(.0049)	(.0055)
YearVg3=2015	-.059***	.024**	.034***	.019*	-.023***	-.034***	-.02*
	(.011)	(.0095)	(.0099)	(.011)	(.0087)	(.01)	(.011)
Constant	1.2***	.87***	.66***	.99***	.23***	.46***	.17***
	(.039)	(.018)	(.029)	(.069)	(.016)	(.024)	(.055)
Observations	53191	53191	53191	53191	53191	53191	53191
Avg(outcome)	.35	.77	.77	.77	.17	.17	.17

The table shows 1st stage results (column 1) for the endogenous variable dropout and results for the outcomes *employed* (columns 2-4) and *NEE (*not in employment nor post-secondary education) (columns 5-7). County and Vg3 programme area indicators are included as controls. Standard errors in parentheses clustered at Vg3 programme area. * $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$