Does making upper secondary school more comprehensive affect dropout rates, educational attainment and earnings?
Evidence from a Swedish pilot scheme

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by

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Abstract

Since the mid-20th century many OECD countries have discarded their previous selective schools systems, in which students early on were separated between academic and vocational tracks, in favor of more comprehensive schools. The effects of these reforms have generally been difficult to evaluate and their consequences for students' educational and labor market outcomes remain disputed. This paper evaluates the effects of the introduction of a more comprehensive upper secondary school system in Sweden in the 1990s. The reform reduced the differences between the academic and vocational educational tracks through prolonging and substantially increasing the academic content of all vocational tracks. The effects of this policy change are identified by exploiting a six year pilot scheme, which preceded the actual reform in some municipalities. The results show that the prolongation of the vocational tracks brought about an increased probability of dropping out among low performing students. Though one important motive behind the policy change was to enable all upper secondary school graduates to pursue a university degree, I find no effects on university enrolment or graduation. There are some indications, however, that attending the longer and more academic vocational track may have led to increased earnings in the long run.

Keywords: Upper secondary education, comprehensive school system, educational attainment, earnings, instrumental variables
JEL-codes: I21, I28

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1   Introduction

A much debated issue within education policy is whether, and at what age, students should be separated into academic and more vocationally oriented educational tracks. Across OECD countries, there is great diversity regarding the age at which this type of tracking[1] is done. In some countries, e.g. Austria and Germany, pupils are tracked into different types of schools already at the age of 10, while in some others, e.g. the US and Spain, the school system remains comprehensive all through secondary school. Likewise, countries differ in terms of the number of educational tracks available and the extent of curricular differences among the available tracks.[2] Since the Second World War, there has been a tendency in many OECD countries towards adopting more comprehensive school systems (see e.g. Leschinsky and Mayer, 1990). The effects of such policy changes have generally been difficult to evaluate as the reforms have often coincided with other major changes of the education systems[3] or been implemented at the same time across a whole nation. Such implementation schemes naturally make it difficult to separate the effects of reduced tracking *per se* from those of other concurrent changes or cohort effects. The consequences of these reforms therefore remain disputed.

This paper evaluates the effects of introducing a more comprehensive upper secondary school system in Sweden by making use of a pilot scheme, which preceded a major educational reform. In 1991, the Swedish Parliament decided on a reform which substantially reduced the differences in curricula between the academic and vocational tracks in upper secondary school. This was done by considerably increasing the academic content of all vocational tracks. The length of these tracks was at the same time extended from two to three years, giving them the same length as the academic tracks. As a result of these changes, students graduating from a vocational track attained basic eligibility for university studies. The reform was preceded by a six-year pilot-period in

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[1] The meaning of the term 'tracking' differs between Europe and the US. While in Europe tracking generally refers to the streaming of students into academic and vocational educational tracks, in the US it rather signifies ability grouping within schools. In this paper, I use the term to refer to the former type of selection.
[2] See e.g. OECD (2004, p. 262) for a comparison of structural features of school systems across the OECD countries.
[3] For instance, in the comprehensive school reforms in the Scandinavian countries in the 1940-1970s, postponing division of students into different educational tracks coincided with increases in the number of compulsory years of education, and the introduction of new national curricula. See e.g. Meghir and Palme (2005), Aakvik *et al.* (2003) and Pekkarinen *et al.* (2006) for studies of these reforms in Sweden, Norway and Finland, respectively.

which the new vocational tracks were tried out in some municipalities. As the pilot scheme did not coincide with any other changes of the upper secondary school system, it can be used to identify the effects of introducing more academic vocational tracks on students' later educational and labor market outcomes.

In theory there are compelling arguments both in favor of and against this type of shift towards a more comprehensive school system. Opponents of the 1991 reform argue that not all students may benefit from an upper secondary education with a substantial academic content. To make everyone pursue such a track may be a waste of resources, since it retains into academic education individuals who may lack the ability to benefit from it or who have already made up their mind to pursue a non-academic career (Brunello and Checchi, 2007). This could potentially even cause some students to drop out of upper secondary school and consequently have a negative impact on their educational attainment.

Proponents of the reform instead argue that it is advantageous that students no longer have to choose a definitive educational direction, which may restrict them in the future, at an early age. Educational systems with early tracking are exposed to the risk of students ending up in the wrong track as it may be difficult to anticipate future educational performance at an early point in the educational career (see e.g. Brunello *et al.*, 2004). Also, the willingness to proceed up the educational ladder may not yet be well formed. The consequences of choosing the wrong track will be mitigated when all tracks enable students to continue to higher education. This argument is frequently brought up with regard to students with low-educated parents, as they are thought to often end up in vocational tracks for reasons unrelated to their ability.[4, 5]

There are some previous studies which also investigate the effects of adopting a more comprehensive school system using within-country variation in tracking regimes. The abolishment of tracking in British secondary schools during the 1960s and 1970s is a

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[4] A country's choice of tracking policy is likely to also affect students' performance through peer effects; see e.g. Hanushek and Wössman (2006) for a discussion. Moreover, a selective school system is generally favored by the view that it is easier to teach homogenous classes. The 1991 reform did not necessarily alter the composition of students in academic versus vocational tracks. Thus, we should not expect any major effects of the reform operating through these channels.

[5] See e.g. Brunello and Checchi (2007) for a more extensive discussion of the relative merits of a comprehensive versus a selective school system.

particularly well-studied case; see e.g. Galindo-Rueda and Vignoles (2005) and Kerk-hoff *et al.* (1996). As this reform took place only gradually, it produces a set-up with regional variation in students' exposure to the comprehensive system. However, in a recent paper Manning and Pischke (2006) show that the regions that chose to implement the reform early were systematically different from the late adopters. They argue that studies exploiting this variation are unlikely to remove the selection bias between students attending different types of schools.

Other researchers have tried to estimate the effects of different tracking regimes by utilizing cross-country variation in these policies; see e.g. Hanushek and Wössman (2006). Such studies face the difficulty of accounting for all unobserved country-specific factors which are correlated with the choice of tracking regime, and which also affect students' performance. Failure to do this will lead to biased estimates. Waldinger (2007) finds that the results of this literature are very sensitive to model specification as well as to which countries are included in the analysis.

The pilot scheme studied in this paper was implemented gradually over a 3-year period. Moreover, different regions came to participate to different extents as not all vocational tracks were converted to 3-year tracks within all participating municipalities. This generates a setting with temporal as well as regional variation in students' exposure to the pilot tracks, which I exploit to identify the effect of introducing a more comprehensive upper secondary school system. Unlike the British case described above, the participation decision was not given to the municipalities or schools themselves, but to a central government agency. As the selection of municipalities was based on stipulated criteria and observed characteristics, I am able to address selection bias in a more reliable way compared to previous studies of similar reforms.[6]

The results show that the introduction of more comprehensive upper secondary schooling – through prolonging and adding more academic content to the vocational tracks – increased the drop out rate. The probability of dropping out of upper secondary school is estimated to have increased by 3.8 percentage points as a consequence of at-

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[6] The effects of this pilot scheme have previously been studied by Ekström (2003). However, she uses data for only a single cross section of students and thus cannot control for unobserved differences across municipalities. Moreover, due to data restrictions only individuals who graduate from upper secondary school are included in her analysis.

tending a 3-year rather than a 2-year vocational track. This increase is entirely driven by students who finished compulsory school with a below-average grade point average (GPA). Although an important motive behind the policy change was to enable all upper secondary school graduates to pursue a university degree, the results give no indication that the extra year of schooling increased the transition rate to university studies. There is some weak evidence, however, that the extra year of education may have led to increased earnings in the long run.

The outline of the rest of the paper is as follows. The next section describes the 1991 reform of Swedish upper secondary school as well as the pilot scheme preceding the reform. *Section 3* presents the empirical strategy and the data. The results are reported in *Section 4*. Finally, *Section 5* discusses the results and concludes.

2 The 1991 reform of upper secondary school and the pilot scheme

All individuals who have completed nine years of compulsory schooling are entitled to upper secondary education. Schooling at the upper secondary level is voluntary although the vast majority of students choose to attend. Among those who finished compulsory schooling in 1988, almost 90 percent continued directly to upper secondary education.[7] This share has increased over time and in 1998 amounted to about 97 percent.[8] Upper secondary school comprises several different educational tracks to which individuals apply based on their grades from compulsory school. Students generally attend a school in their municipality of residence, but if the desired track is not offered they can instead choose to attend it in a nearby municipality.

Individuals who are older than 20 when they begin upper secondary education are not entitled to attend a general upper secondary school, but instead enter the adult education system. Within this system, both those who lack any upper secondary education and those who dropped out before graduating can finalize a degree. It is also possible to supplement e.g. a 2-year upper secondary degree in order to obtain a 3-year degree.

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[7] Palme (2002), p. 207.
[8] National Agency for Education (1999), p. 45.

In 1991 the Swedish Parliament decided on a major reform of upper secondary education. The reform can be categorized as a step from a selective towards a more comprehensive upper secondary school system.[9] Before the reform, upper secondary education consisted of a few academic and several vocational tracks. The vocational tracks were two years long and consisted mainly of vocational training. The academic tracks typically lasted three years and prepared the students for higher education.[10]

The general aim of the 1991 reform was to bring about a higher quality of education as well as to increase the flexibility of the upper secondary school system. The largest changes concerned the vocational tracks, which through the inclusion of several general theoretical subjects in the curriculum received a considerably higher academic content. The length of the vocational tracks was also extended from two to three years, hence giving them the same length as the academic tracks. These changes were motivated by the view that there was an increasing need for a broader education in working life as well as by the desire to enable everyone to continue to university studies. As a result of the reform, all students graduating from a vocational track attained basic eligibility[11] for university studies.[12]

2.1 The pilot scheme with prolonged vocational tracks

Concerns about the need to modernize the vocational upper secondary education had been raised all through the 1980s (see e.g. Prop. 1983/84:116). In 1984 the government appointed a committee with the task of reviewing the vocational education and putting forward suggestions for improvements. The proposals led to a nation-wide pilot period between 1988 and 1993 in which new 3-year vocational tracks were tried out in some municipalities.[13]

The 3-year vocational tracks in the pilot scheme had increased academic content compared to the ordinary 2-year tracks. While Swedish was the only general theoretical subject included in all 2-year tracks, the pilot tracks also contained English, social stu-

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[9] The reform is thoroughly described in e.g. SOU 1996:1 and National Agency for Education (2000).
[10] There were also a large number of short, more specialized vocational courses.
[11] 'Basic eligibility' does not mean eligibility to all university studies as some programs have special requirements.
[12] The reform contained more elements than those described here. There were, for instance, several organizational changes in the upper secondary school system as well as changes in the structure of the different educational tracks.
[13] See e.g. Prop. 1987/88:102 for a description of the pilot scheme.

dies and an elective course. Math appears to be by far the most common choice of elective.[14] As a result of these additions, students graduating from the pilot tracks attained basic eligibility for university studies. Another difference between the 2- and 3-year tracks is that the latter located a larger share of the vocational training in workplaces rather than in schools.[15]

2.1.1 The implementation of the pilot scheme[16]

The pilot scheme contained about 6,000 available places in 1988, 10,000 in 1989, and 11,200 in 1990. This represented approximately 11-20 percent of the total number of available places in vocational tracks.[17] A class in the pilot scheme would always replace a class in a corresponding 2-year track, implying that the total number of available places in vocational tracks was not expanded. On top of this, in 1987 there was a very limited pre-pilot scheme only including 500 places. The tracks in the pre-pilot scheme differed somewhat from those in the pilot scheme as they did not contain more extensive workplace training.

The National Board of Education was responsible for allocating the pilot scheme among the different vocational tracks, as well as for deciding in which municipalities it should be located each year. The allocation of places among the different tracks was done primarily on the basis of proportionality; the goal was that each track should receive the same share of available 3-year places as they received of 2-year places. There were however some deviations from this principle, e.g. tracks with a small number of places were somewhat overrepresented. The allocation decision was further restricted by the fact that in the beginning of the pilot period no curricula had yet been prepared for some of the 3-year tracks. This meant that out of the 18 3-year tracks available, the pilot scheme could include only 10 in 1988 and 17 in 1989. In 1990 all 18 tracks were

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[14] The National Board of Education (1990a) reports that 86 percent of the students in 1988 chose to study math.

[15] Compared to the pilot tracks, the 3-year vocational tracks that were implemented after the 1991 reform contained even more academic subjects and possibly somewhat less training in workplaces.

[16] This section is mainly based on SOU 1989:106, which describes the implementation process in 1988 and 1989. The implementation in 1990 has not been documented, but was most likely carried out according to the same principles. Regarding the pre-pilot scheme in 1987, there is no available documentation of the implementation process.

[17] National Board of Education (1989a), (1989b) and (1990b).

included. *Table 1* shows which tracks were included each year as well as each track's number of available and share of vacant places.[18]

Table 1 Number of available places and share of vacant places by pilot track and year

	1987		1988		1989		1990	
	No. of places	Share vacant	No. of places	Share vacant	No. of places	Share vacant	No. of places	Share vacant
Electrical engineering	48	0.00	528	0.02	656	0.03	776	0.02
Health care	46	0.02	2 182	0.03	2 918	0.03	3 072	0.10
Heating, ventilation & sanitation	64	0.11	64	0.00	72	0.00	104	0.00
Industry	352	0.01	1 608	0.09	1 952	0.13	1 968	0.12
Business & services			210	0.01	660	0.03	990	0.05
Caring services: children, youth			256	0.01	420	0.01	420	0.08
Construction			296	0.08	408	0.02	432	0.01
Textile & clothing manufacturing			136	0.11	208	0.22	224	0.17
Transport & vehicle engineering			752	0.04	992	0.03	1 056	0.02
Use of natural resources			352	0.12	640	0.09	720	0.04
Constructional metalwork					56	0.14	56	0.05
Food manufacturing					224	0.08	256	0.11
Handicraft					32	0.03	64	0.05
Painting					56	0.04	88	0.05
Process technology					176	0.17	208	0.23
Restaurant					336	0.00	416	0.00
Wood technology					144	0.10	168	0.09
Graphic							112	0.00
Total	**510**	**0.03**	**6 384**	**0.05**	**9 950**	**0.06**	**11 130**	**0.07**

Notes: Share of vacant places by September 15th each year. Source: National Board of Education (1988), (1989a), (1989b), and (1990b).

Regarding the geographical location of the pilot scheme, the Government stipulated that it should be distributed among regions with different industry and population structures. There should also be variation regarding the extent to which different regions participated. In some participating regions, all or a large share of the vocational tracks should be converted to 3-year tracks, while in other regions only a few of the tracks should be prolonged. The motive behind these requirements was to get an idea of how the more extensive work place training worked in different types of labor markets, as well as of the strain on the labor market if it was implemented on a large scale. On top of these criteria, the National Board of Education emphasized whether or not the local labor market was prepared to arrange the extended workplace training. In judging this

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[18] The share of vacant places was in general somewhat lower for the 3-year vocational tracks than for the 2-year tracks. For the 2-year tracks the share of unfilled places amounted to 0.07 in 1987, 0.08 in 1988, 1989 and 1990.

they relied upon recommendations from employer and union representatives in different sectors.

The initiative to participate always came from the municipalities themselves, as they had to apply to the county school board in order to be considered. The board then made recommendations based on which municipalities they believed had the best prerequisites to participate. With the help of these suggestions, the National Board of Education made the final selection according to the criteria listed above. The same procedure was repeated each year, with the exception that schools that had participated in the pilot scheme one year always were included the following years. The interest to participate was large; each year there were applications for far more places than what was available.

Sweden had 284 municipalities during this time period. Only about 68 percent of them offered vocational tracks. Students residing in the other municipalities hence had to attend school in a nearby municipality if they wanted to obtain a vocational degree. *Figure 1* illustrates the share of (all) municipalities that participated in the pilot scheme each year, as well as how the extent of their participation varied over time. The pre-pilot scheme in 1987 only involved 22 municipalities, all of which participated to a quite small extent. When the actual pilot scheme was introduced in 1988, about 40 percent of the municipalities were granted participation. In 1990, this share had increased to about 52 percent. The extent to which the municipalities participated also increased each year. Thus, throughout the pilot period the pilot scheme was extended both to new municipalities as well as often to more tracks within already participating municipalities.

Figure 1 Share of municipalities that participated in the pilot scheme each year, and the extent of their participation
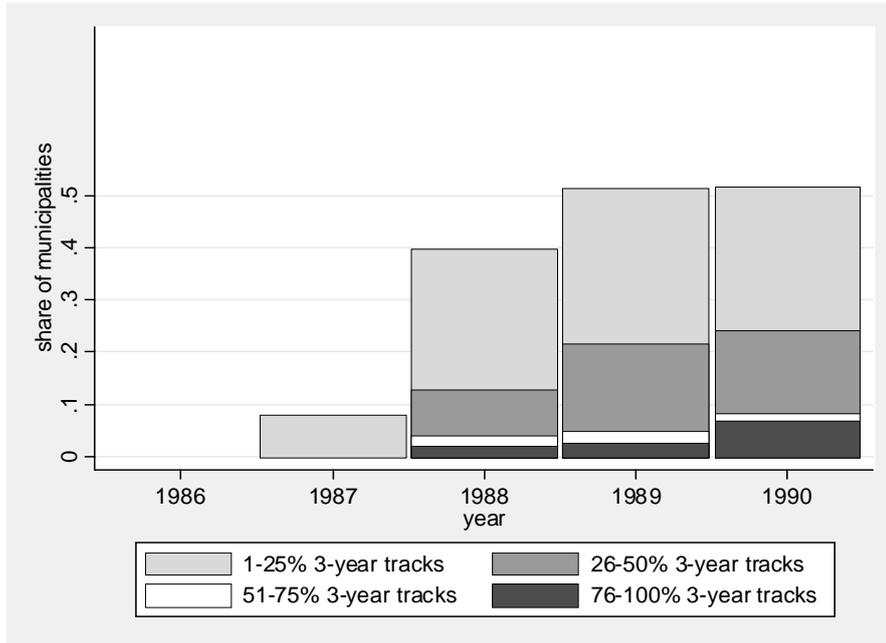
Notes: '% 3-year tracks' is the percent of all vocational tracks available in a municipality which were part of the pilot scheme. Source: Own calculations based on the Upper secondary school application record.

All through the pilot period most participating municipalities came to offer both 2- and 3-year vocational tracks. Sometimes the exact same track was offered in both lengths within the same municipality. Even in municipalities only offering either 2- or 3-year tracks, students could in some cases have a choice of program length if a nearby municipality offered tracks of a different length. The design of the pilot scheme thus generates a setting where some students were given *the choice* of attending a 3-year rather than an ordinary 2-year vocational track. The degree to which a student had this choice depended on where he or she lived as well as on which year he or she began upper secondary education.

3 Estimating the impact of the prolongation of vocational upper secondary education

3.1 Data

The data used come from different administrative records maintained by Statistics Sweden.[19] The records cover the entire Swedish population during the period 1985-2006. One of the most important registers for this study is the *Upper secondary school application record*, which contains information on when and where an individual began upper secondary school as well as what track (type and length) he or she started. I use this record to construct the sample of individuals, but also to acquire information on which educational tracks each municipality offered each year.

The population of interest consists of all persons who finished compulsory school during 1986-1990 and who thereafter continued directly to upper secondary school. Only individuals who began a vocational track – a regular 2-year track or a 3-year pilot track – are included. An additional restriction imposed is that only pilot tracks which corresponded to regular 2-year tracks are included, and vice versa.[20] The population consists of 202,072 individuals. However, almost 9 percent are excluded due to missing information on some of the variables[21], giving me a final sample of 184,101 persons.

These data are matched with information on the individuals' later educational attainment and earnings, as well as with some background variables. More specifically, I consider the following outcomes: whether the person has dropped out of upper secondary school; whether his/her highest education level is at least three years of upper secondary education; whether he/she has begun university studies; whether he/she has completed a university degree; and the natural logarithm of annual earnings.

To determine whether an individual has dropped out of upper secondary school, I use data from the *Upper secondary school graduation record*. A person is considered to have dropped out if he or she still has not graduated six years after being admitted. As

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[19] *Table A1* presents all variables and which registers they originate from.
[20] This restriction excludes students in the 3-year Graphic and Handicraft tracks since they do not correspond to any of the 2-year tracks. *Table A2* lists the included 2- and 3-year tracks.
[21] The majority of these individuals are excluded due to missing information on either municipality of residence or grades from compulsory school.

mentioned before, it is possible for those who have dropped out to later supplement their education within the adult education system. Such complementary courses are not included in the graduation record, implying that these individuals are still considered dropouts.

To determine whether a person has obtained at least three years of upper secondary education, I use data collected by Statistics Sweden on the individual's highest education level. This measure includes courses obtained within the adult education system. Data on initiated and completed university studies are obtained from the *University enrolment* and *graduation records*. These three educational outcomes are measured 15 years after the person began upper secondary school. Most students begin upper secondary education at age 16, implying that these outcomes are generally measured at age 31.

The earnings measure used is defined as the annual sum of the individuals' gross wage earnings (in SEK). I consider earnings for 16 years after the person started upper secondary school.

The individual background variables include: sex; immigrant background[22]; municipality of residence the year before applying to upper secondary school; and GPA the last year of compulsory school. The students have also been linked to their biological parents in order to obtain information on the parents' highest education level and their immigrant background.

Table 2 presents descriptive statistics for the individual background variables. It also shows the local unemployment rate during the relevant time period. The individuals in the sample are separated into two groups based on the degree to which their municipality of residence participated in the pilot scheme. Municipalities with an above-average share of 3-year tracks in 1990 are considered 'high level' regions, while those with a below-average share are referred to as 'low level' regions.[23] The average share of 3-year tracks in 1990 was 0.18. We see from the table that the two groups are very similar in terms of all observed individual level characteristics. The local unemployment rate is in general somewhat higher in the municipalities that participated to a high degree in the

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[22] A person is considered to have immigrant background if he or she is born in a Non-Nordic country.

pilot scheme. It is also important to note the dramatic increase in the unemployment rate in the beginning of the 1990s. This was a very turbulent period on the Swedish labor market. Descriptive statistics for the individual outcome variables are presented in the next section.

Table 2 Sample characteristics

	Level of pilot scheme (1990) in municipality of residence[♦]	
	Low	High
Individual characteristics:		
Average GPA compulsory school	2.88	2.86
Prop. of females	0.41	0.40
Prop. of immigrants (=born in non-Nordic country)	0.02	0.02
Prop. whose parents are both immigrants	0.02	0.03
Prop. whose parents have upper secondary education	0.55	0.55
Prop. whose parents have post upper secondary educ.	0.16	0.17
Municipality characteristics:		
Average unemployment rate[♣]		
1988	3.6%	3.9%
1989	3.0%	3.3%
1990	3.0%	3.3%
1991	5.0%	5.4%
1992	8.7%	9.1%
1993	12.9%	13.3%
Number of individuals	97,671	86,430

Notes: High level of pilot scheme municipalities are defined as municipalities where the share of 3-year programs was above the average (=0.18) in 1990. The sample consists of all individuals who finished compulsory school 1986-1990 and the same year began a vocational track in upper secondary school. [♦]Municipality of residence is measured the year before the individual started upper secondary school. [♣]The unemployment rate is measured at the county level and includes participants in labor market programs.

3.2 Identification strategy

The purpose of this paper is to evaluate the effects of the prolongation of vocational upper secondary education on individuals' educational attainment and earnings. The following econometric model characterizes the effect of attending a 3-year rather than a 2-year vocational track on an individual's educational or labor market outcome:

$$Y_{ijk} = \gamma_j + \mu_k + \beta D_{ijk} + \boldsymbol{\delta} \mathbf{X}_i + \varepsilon_{ijk} \tag{1}$$

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[23] The 'low level group' includes the municipalities that did not participate in the pilot scheme at all.

where Y_{ijk} is the outcome of interest for individual i, beginning upper secondary school in year k, and residing in municipality j. γ_j and μ_k denote municipality-of-residence and cohort fixed effects, respectively, and $\mathbf{X}_i$ is a vector of individual characteristics. D_{ijk} is a dummy variable, where $D_{ijk} = 1$ if the individual chose to attend a 3-year vocational track, and $D_{ijk} = 0$ if he or she attended a 2-year track. β is thus the effect of attending the longer and more academically oriented vocational track.

Estimating model (1) with Ordinary Least Squares (OLS) may lead to biased estimates as ε_{ijk} and D_{ijk} are likely to be correlated. Even if we have a rich data set of individual characteristics, we are unlikely to be able to control for all factors which are correlated with the individual's choice of track length and which also affect his or her later educational or labor market outcomes.

The pilot scheme however provides us with a potential source of exogenous variation in track length, which can be exploited in order to estimate the causal effect of attending a 3-year vocational track. As we have seen, the pilot scheme gave some students the choice of attending a 3-year rather than a regular 2-year vocational track. The extent to which a person had this choice depended on which year he or she finished compulsory school – as the pilot scheme was introduced gradually over time – as well as on where he or she lived – as the degree to which municipalities participated in the pilot scheme greatly varied. After controlling for cohort and municipality of residence (during compulsory school), individuals' exposure to the pilot scheme is potentially exogenous to the unobserved component of the outcomes of interest and can consequently be used as an instrument for the length of the chosen track (D_{ijk}).[24]

I will estimate the model using Two Stage Least Squares (2SLS). The first stage can be written as:

$$D_{ijk} = \gamma_j + \mu_k + \alpha P_{jk} + \boldsymbol{\lambda} \mathbf{X}_i + v_{ijk} \tag{2}$$

The instrument, denoted by P_{jk}, is the extent to which the individual's municipality of residence participated in the pilot scheme by the time he or she began upper secondary

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[24] Similar identification strategies have been used in earlier studies; see e.g. Duflo (2001).

school, measured as the share of the available vocational tracks which constituted 3-year tracks.[25,26] I measure municipality of residence during the fall semester of the individual's last year of compulsory school. This means that, unlike municipality of upper secondary school attendance, it is likely to be exogenous with respect to the location of the pilot scheme. In general it seems implausible that students would move already during compulsory school as a consequence of the introduction of 3-year vocational tracks, especially as it was already possible to apply to upper secondary schools in municipalities other than ones own. This assertion is also supported by the fact that the decision of where to locate the new available pilot places each year was not taken until during the following spring, i.e. after the point in time when I measure municipality of residence.[27]

P_{jk} is a valid instrument for the length of the vocational track under the assumption that it is not correlated with any unobserved variables affecting the outcomes of interest, and that it had no impact on the outcomes other than through influencing whether the person attended a 2-year or a 3-year track. This entails assuming that the availability of pilot tracks did not affect the individual's choice of whether to begin a vocational track at all. If the pilot tracks attracted students from the academic tracks or students who would otherwise have chosen not to attend upper secondary school, the individual's untreated state is not clear and the results will consequently be hard to interpret. This part of the identifying assumption is tested below (see *Section 3.2.2*). Of course, for the method to work P_{jk} must also have explanatory power in the first stage.

If the effects of obtaining additional education vary across individuals, the estimated coefficient for D_{ijk} (in equation 1) should be interpreted as the average effect of attending a 3-year vocational track for those who, due to the availability of pilot tracks in their municipality of residence, chose to begin a 3-year rather than a 2-year track (see Imbens and Angrist, 1994). For this to be the correct interpretation, increased availabili-

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[25] P_{jk} is zero for municipalities not offering any vocational tracks.
[26] Ideally, P_{jk} would be measured as the share of the available *places* in vocational tracks which represented 3-year tracks. However, such data are not available at the municipality level.
[27] At least this was the case with the localization decision in 1988 and 1989, which were the years that involved the largest increases of available places in the pilot scheme. Details are found in SOU 1989:106. The decision process in 1987 and 1990 has not been documented.

ty of pilot tracks in a municipality must never have decreased participation in the 3-year tracks among those living in that municipality.

The vector of individual characteristics ($\mathbf{X}_i$) in the model includes GPA for the last year of compulsory school, sex, immigrant background, the parents' highest education level and whether both of the parents have immigrant background.[28] An additional factor which is potentially important to account for is the local unemployment rate when the individual finished upper secondary school. As was shown in *Table 2*, the unemployment rate rose steeply in the beginning of the 1990s. This means that students following a 3-year track systematically graduated under worse labor market conditions than those attending a regular 2-year track. Not accounting for this implies that the estimated effect of attending a 3-year track will *include* the effect of graduating in a worse labor market situation. I will return to this issue in *Section 4*, where I present the results.

3.2.1 Descriptive analysis

Table 3(*a*) illustrates the basic idea behind the identification strategy. It shows means of the outcome variables for the cohort that started upper secondary school the year before the pilot scheme was introduced (in 1986) as well as for those who started when it was fully implemented (in 1990). The individuals are additionally separated into 'high' and 'low level of pilot scheme' regions, based on where they lived the year before they started upper secondary school. As in the previous section, municipalities with an above average share of 3-year tracks in 1990 are considered 'high level' regions, and those with a below-average share are referred to as 'low level' regions. The table shows the difference in average outcomes between the two cohorts, in both types of regions.[29]

Let us start by looking at the share of individuals whose highest education level is at least three years of upper secondary education. This share will include everyone who has completed some type of post-secondary education. At least partly, this explains why about 27 percent of the vocational students already in the 1986 cohort – when all vocational tracks were 2-year tracks – obtained this level of education. Some of them could

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[28] I have also estimated a model that includes controls for what type of track (five categories) a person attended. The estimated effect of attending a 3-year track is virtually identical for this model. These results are not reported but can be obtained from the author.

[29] This analysis is inspired by Duflo (2001).

also have attended supplementary courses within the upper secondary school system after completing their 2-year vocational degree or have changed from a 2-year vocational to a 3-year academic track during their course of study. Regarding this outcome, there is no visible difference between the two types of regions for the cohort starting upper secondary school in 1986. From 1986 to 1990, this share more than doubled in both high and low level regions. However, it increased significantly more in the high level regions. Under the assumption that general trends in educational attainment would not have been systematically different between the two types of regions in the absence of the pilot scheme, this difference-in-difference estimate can be interpreted as a causal effect of the pilot scheme.

For the 1986 cohort, there is no significant difference between the high and low level regions regarding any of the other outcomes either. We see that the share of students dropping out decreases significantly over time in the regions that participated in the pilot scheme to a low extent, while there is no significant change in the high level regions. This indicates that the prolongation of the vocational tracks may have increased the dropout rate from upper secondary school. Regarding the share of students obtaining a university degree and log earnings, the changes over time are not significantly different between the two types of regions.

Table 3 Descriptive analysis: Means of outcome variables by cohort and level of pilot scheme

	Share with at least 3 years of USE			Share dropping out[*]		
	Level of pilot scheme (1990) in municipality of residence			Level of pilot scheme (1990) in municipality of residence		
	High	Low	Difference	High	Low	Difference
(a) *Experiment of interest:* *Vocational students*						
Starting USE (Upper secondary educ.) in 1990	0.651 (0.014)	0.588 (0.007)	0.063*** (0.015)	0.119 (0.007)	0.105 (0.004)	0.014* (0.008)
Starting USE in 1986	0.267 (0.007)	0.266 (0.005)	0.000 (0.008)	0.125 (0.008)	0.126 (0.004)	-0.002 (0.009)
Difference	0.384*** (0.012)	0.321*** (0.009)	0.063*** (0.015)	-0.006 (0.006)	-0.022*** (0.004)	0.016** (0.007)
(b) *Control experiment:* *Academic students*						
Starting USE in 1990	0.947 (0.002)	0.945 (0.002)	0.002 (0.003)	0.055 (0.004)	0.054 (0.002)	0.001 (0.004)
Starting USE in 1986	0.870 (0.005)	0.869 (0.005)	0.001 (0.007)	0.076 (0.006)	0.079 (0.005)	-0.003 (0.007)
Difference	0.077*** (0.005)	0.076*** (0.004)	0.001 (0.006)	-0.020*** (0.003)	-0.025*** (0.005)	0.004 (0.006)

Table 3, cont.	Share with university degree			Log annual earnings[♦]		
	Level of pilot scheme (1990) in municipality of residence			Level of pilot scheme (1990) in municipality of residence		
	High	Low	Difference	High	Low	Difference
(a) *Experiment of interest: Vocational students*						
Starting USE in 1990	0.097	0.097	-0.000	12.026	12.026	-0.000
	(0.004)	(0.003)	(0.005)	(0.011)	(0.009)	(0.014)
Starting USE in 1986	0.065	0.068	-0.003	11.936	11.926	0.010
	(0.003)	(0.003)	(0.005)	(0.011)	(0.009)	(0.014)
Difference	0.032***	0.029***	0.003	0.090***	0.100***	-0.010
	(0.004)	(0.003)	(0.005)	(0.014)	(0.011)	(0.018)
(b) *Control experiment: Academic students*						
Starting USE in 1990	0.419	0.405	0.014	12.144	12.163	-0.019
	(0.013)	(0.006)	(0.014)	(0.009)	(0.008)	(0.012)
Starting USE in 1986	0.362	0.342	0.020	12.099	12.113	-0.014
	(0.014)	(0.008)	(0.016)	(0.012)	(0.013)	(0.018)
Difference	0.057***	0.063***	-0.006	0.045***	0.049***	-0.005
	(0.007)	(0.006)	(0.009)	(0.012)	(0.011)	(0.016)

Note: High level of pilot scheme municipalities are defined as municipalities where the share of 3-year tracks was above the average (=0.18) in 1990. Robust standard errors in parentheses, allowing for clustering by municipality of residence. */**/*** denotes significance at the 10/5/1 percent levels respectively. [♣]Dropping out is here defined as to not complete USE with grades in all subjects. [♦]Earnings are here measured 16 years after the person began upper secondary school. All individuals with positive wage earnings are included.

3.2.2 Evaluating the identifying assumptions

The assumption that, in the absence of the pilot scheme, trends in educational attainment and earnings would not have differed systematically between high and low level of pilot scheme municipalities is of course impossible to test directly. However, it is possible to examine an implication of this assumption as I also have data for students attending academic tracks in upper secondary school. The length of the academic tracks was not altered during the pilot period. Hence, there should not be any systematic differences in the changes of the outcome variables between the two types of regions for these students.

Table 3(b) presents means of the outcome variables in the same fashion as *3(a)*, but for students attending academic tracks. We see that for none of the outcome variables are there any significant differences between the two types of regions. This is the case for both cohorts. This suggests that the statistically significant difference-in-difference estimates for the dropout rate and share completing at least three years of upper secondary education for the vocational students, are not results of unsuitable identifying assumptions.

As discussed earlier, it is possible that the introduction of 3-year vocational tracks affected the individual's choice of whether to obtain an academic or a vocational upper secondary degree. If this is the case, the individuals' untreated state is not clear, which would make the results hard to interpret. The same problem would arise if the pilot scheme affected individuals' decisions of whether or not to begin upper secondary school.

Table 4 shows the share of students beginning vocational as well as academic tracks before and after the full implementation of the pilot scheme, i.e. in 1986 and 1990.[30] The shares are calculated separately for municipalities that participated in the pilot scheme to different extents. We see that the share of students starting a vocational track decreases slightly over time, while the share starting an academic degree increases. There are, however, no significant differences in these patterns between municipalities that participated in the pilot scheme to a higher or a lower degree.

Table 4 Share of students in vocational vs academic tracks by cohort and level of pilot scheme

| | Share starting vocational tracks | | | Share starting academic tracks | | |
| | Level of pilot scheme (1990) in municipality of residence | | | Level of pilot scheme (1990) in municipality of residence | | |
	High	Low	Difference	High	Low	Difference
Starting USE (Upper secondary educ.) in 1990	0.411	0.427	-0.015	0.546	0.536	0.010
	(0.015)	(0.008)	(0.017)	(0.014)	(0.009)	(0.016)
Starting USE in 1986	0.430	0.442	-0.012	0.517	0.513	0.004
	(0.018)	(0.009)	(0.020)	(0.016)	(0.010)	(0.018)
Difference	-0.019**	-0.015***	-0.004	0.029***	0.023***	0.006
	(0.008)	(0.005)	(0.009)	(0.007)	(0.005)	(0.008)

Note: High level of pilot scheme municipalities are defined as municipalities where the share of 3-year tracks was above the average (=0.18) in 1990. Robust standard errors in parentheses allowing for clustering by municipality of residence. */**/*** denotes significance at the 10/5/1 percent levels respectively.

Table 5 shows the share of students finishing compulsory school who start upper secondary school the same year. Again, the individuals are separated based on their municipality of residence's level of participation in the pilot scheme. Since the first year for which there are data on students finishing compulsory school is 1988, I here compare changes between 1988 and 1990. The number of available places in the pilot scheme in 1990 was almost double that of 1988. Thus, any divergent trends in upper secondary

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[30] Upper secondary school also comprised a number of short more specialized vocational courses. These are not included in the table.

school participation arising as a consequence of the pilot scheme are likely to be visible also by comparing these years. We see from the table that there are no significant changes in the share starting upper secondary school in any of the two groups of municipalities.

To sum up, according to the checks performed in this section the identifying assumptions imposed seem appropriate.

Table 5 Share of students finishing compulsory school who continue directly to upper secondary school, by cohort and level of pilot scheme

	Share starting upper secondary school		
	Level of pilot scheme (1990) in municipality of residence		
	High	Low	Difference
Starting USE (Upper secondary educ.) in 1990	0.853	0.856	-0.003
	(0.006)	(0.004)	(0.007)
Starting USE in 1988	0.856	0.857	-0.001
	(0.005)	(0.004)	(0.006)
Difference	-0.002	-0.001	-0.001
	(0.003)	(0.004)	(0.005)

Note: High level of pilot scheme municipalities are defined as municipalities where the share of 3-year tracks was above the average (=0.18) in 1990. Robust standard errors in parentheses allowing for clustering by municipality of residence. */**/*** denotes significance at the 10/5/1 percent levels respectively.

4   Results

4.1   The effect of the pilot scheme on the choice of track length

Before presenting the results from the instrumental variables estimation, I report estimates for the first stage relationship, showing that the intensity of the pilot scheme in an individual's municipality of residence is a good predictor for his or her choice of track length. This section also gives some additional evidence indicating that the pilot scheme is a valid instrument.

The first two columns of *Table 6* present the results for the first stage relationship. Column (1) reports estimates from a regression containing only the instrument, cohort fixed effects and municipality-of-residence fixed effects. In column (2) all individual characteristics are included. Comparing column (1) and (2), we see that the coefficient for the instrument is very robust to the inclusion of additional control variables. The estimate reveals that the pilot scheme intensity in a person's home municipality has a

clear impact on the probability that he or she begins a 3-year, rather than a 2-year, track. The coefficient is statistically significant at the 1 percent level and suggests that increasing the share of 3-year tracks by, for instance, 50 percentage points in a person's home municipality on average increases the probability that he or she begins a 3-year track by nearly 30 percentage points. The fact that there is not a one to one correspondence between the share of 3-year tracks and the probability that a person begins such a track is likely to be mainly explained by the possibility for students to attend schools outside their municipality of residence. The last row of *Table 6* reports the F-statistic for the null hypothesis that the coefficient for the instrument is zero. The F-statistic is about 184, which indicates that a weak instrument is not a concern.[31]

Some of the other variables also have a significant impact on the probability of beginning a 3-year track. As can be expected, students with a high GPA from compulsory school and students with highly educated parents are more likely to choose the longer and more academically oriented vocational track. Gender and immigrant background have no significant impact on the choice of track length, while having immigrant parents is associated with a significantly lower probability of choosing the 3-year track.

It is also important to mention that the location of the pilot places seems to have been exogenous to the individuals. The fact that the addition of individual controls does not affect the estimate for the instrument suggests that any excluded individual variables are unlikely to be correlated with the pilot scheme intensity. Moreover, the selection of pilot municipalities appears to have been based largely on characteristics that are likely to have remained relatively constant throughout the relevant time period (see *Section 2.1.1*), e.g. industry and population structure. The relevant municipality characteristics should therefore be captured by the municipality fixed effects. However, as an additional test for endogeneity, I also estimate the first stage regression for the sample of students attending academic tracks.[32] Since the academic tracks were not part of the pilot scheme, there should not be any effect of the pilot scheme intensity on the choice of track length for these students. A significant 'effect' would instead suggest the presence

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[31] Staiger and Stock (1997) suggest that an F-statistic less than 10 indicates weak instruments.
[32] As one of the academic tracks lasted four years, this regression estimates the effects of the pilot scheme on the probability of choosing a 3- or a 4-year, rather than a 2-year, track.

of unobserved variables, which are correlated with the pilot scheme intensity.[33] The results from this test are reported in column (3) and (4) in *Table 6*. The test gives no sign of an endogenous relationship as the estimate for the pilot scheme is statistically insignificant.

Table 6 Effects on the probability of beginning a 3-year track

	Vocational students		Academic students[♦]	
	(1)	(2)	(3)	(4)
Pilot scheme intensity in municipality of residence	0.577*** (0.050)	0.577*** (0.050)	-0.015 (0.016)	-0.019 (0.015)
Cohort fixed effects	Yes	Yes	Yes	Yes
Municipality-of-residence fixed effects	Yes	Yes	Yes	Yes
GPA compulsory school		0.026*** (0.005)		0.298*** (0.011)
Female		-0.005 (0.008)		-0.079*** (0.003)
Immigrant background		0.011 (0.008)		-0.002 (0.005)
Parents with immigrant background		-0.008* (0.005)		0.045*** (0.005)
Parent with upper secondary education		0.007*** (0.001)		0.030*** (0.002)
Parent with post-upper secondary education		0.026*** (0.002)		0.038*** (0.003)
Sample size	184,101	184,101	224,337	224,337
F-statistic on the instrument	131.32	131.61	0.81	1.67

Note: Robust standard errors in parentheses allowing for clustering by municipality of residence. */**/*** denote significance at the 10/5/1 percent levels respectively. ♦As one of the academic tracks lasted four years, these regressions estimate effects on the probability of beginning a 3-year, or longer, track.

In sum, the results presented in this section show that the pilot scheme intensity had a significant and substantial effect on the probability of beginning a 3-year vocational track, and that it can be used as an instrument for the students' choice of track length. Let us therefore move on to the effects of attending the prolonged vocational tracks.

4.2   The effect of attending a 3-year track on the probability of dropping out

I start by presenting the estimated effect of beginning a 3-year, rather than a 2-year, vocational track on the probability of dropping out of upper secondary school for the full sample of vocational students. I use two different measures of dropping out: to have still

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[33] If these unobserved variables are also related to the unobserved variables in the outcome equation, the instrument would most likely be invalid.

not graduated six years after admittance, and to have not graduated with complete grades before this point in time. A person will graduate with incomplete grades if he or she has not attended school enough to obtain grades in all subjects, meaning that he/she is likely to have dropped out of some, but not all, of the classes.

Table 7 shows 2SLS as well as OLS estimates. In both cases, the model is estimated both with and without the individual covariates.[34] The OLS estimates for the effect of attending a 3-year track would be biased if e.g. those choosing to attend a 3-year track would differ in motivation from those attending a 2-year track. However, when the individual covariates are included in the model, the OLS estimates turn out to be quite similar in size to the 2SLS estimates.

The preferred specification (column 4) suggests that choosing to attend a 3-year rather than 2-year vocational track increased the probability of dropping out by 3.8 percentage points, and the probability of not finishing with grades in all subjects by as much as 7.5 percentage points. The estimates are statistically significant at the 5 and 1 percent levels, respectively. Hence, the prolongation of the vocational tracks seems to have caused a large increase in the dropout rate from upper secondary school. It is important to note, however, that if students dropped out during the third year, they still received more education compared to if they would have chosen to attend a 2-year track. Unfortunately, there are no data on when a person dropped out. Thus, I am not able to estimate the effect on the amount of upper secondary education received.

It is tempting to jump to the conclusion that the increased dropout rate was caused by the increased length and/or increased academic content of the program. Another possibility is that individuals actually dropped out because they found employment. As described in *Section 2.1*, the 3-year tracks contained more training in workplaces compared to the ordinary 2-year tracks, which naturally would imply more contacts with potential employers. In order to get some idea of whether this explanation seems likely, I have estimated the effect of starting a 3-year track on annual wage earnings during the first two years following admittance, for the sub sample who did not graduate (using the preferred 2SLS specification). This analysis gives no indication that attending a 3-year

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[34] Results for the control variables are available upon request.

track implied increased earnings for these students during the time period preceding expected graduation.[35] Note however that this analysis is very tentative as there is no way of knowing when a person dropped out. Limiting the sample based on an outcome variable may also introduce some sample-selection issues that could bias the results.

Table 7 Effects on the probability of dropping out of upper secondary school (full sample)

	OLS	OLS	2SLS	2SLS
	Dependent variable: Pr(dropping out of upper secondary school)			
Effect of attending a 3-year vocational track	0.030*** (0.005)	0.044*** (0.004)	0.041** (0.019)	0.038** (0.019)
Cohort fixed effects	Yes	Yes	Yes	Yes
Municipality-of-residence fixed effects	Yes	Yes	Yes	Yes
All individual covariates	No	Yes	No	Yes
Mean of dependent variable	0.109	0.109	0.109	0.109
	Dependent variable: Pr(not finishing with complete grades)			
Effect of attending a 3-year vocational track	0.070*** (0.006)	0.086*** (0.005)	0.079*** (0.021)	0.075*** (0.021)
Cohort fixed effects	Yes	Yes	Yes	Yes
Municipality-of-residence fixed effects	Yes	Yes	Yes	Yes
All individual covariates	No	Yes	No	Yes
Mean of dependent variable	0.126	0.126	0.126	0.126
Sample size	184,101	184,101	184,101	184,101

Note: Robust standard errors in parentheses allowing for clustering by municipality of residence. */**/*** denotes significance at the 10/5/1 percent levels respectively. The following covariates are included in column (2) and (4): final GPA in compulsory school, sex, immigrant background, the parents' highest education level and their immigrant background.

Table 8 reports separate estimates of the effect on the probability of dropping out, by final GPA from compulsory school and levels of parental education (using the preferred model specification). The results indicate that the large increase in the probability of dropping out is entirely driven by a higher dropout rate among the low performing students. A GPA lower than 3, on the scale 1-5, is here considered 'low'.[36] The estimated effect is large in magnitude for this group; the point estimates suggest that the probability of dropping increased by 8.3 percentage points and the probability of not obtaining grades in all subjects by as much as 13.6 percentage points. For students with higher previous grades, attending the longer track does not seem to have affected the likelihood

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[35] The effect on both the log of earnings and the probability of having positive earnings is insignificant for these years.

of dropping out. If the model is instead estimated separately for students with academic versus non-academic parents, the results exhibit a similar pattern. 'Academic parents' is here defined as to have at least one parent with more than two years of upper secondary education. Thus, it seems to be mainly among students who, for study purposes, were relatively less advantaged that the probability of dropping out increased substantially as a consequence of the prolongation of the vocational tracks.

Table 8 Effects on the probability of dropping out for different sub samples

	Dependent variable: Pr(dropping out of upper secondary school)			
	High GPA compulsory school	Low GPA compulsory school	Academic parents	Non-academic parents
Effect of attending a 3-year vocational track	-0.017 (0.023)	0.083*** (0.023)	0.006 (0.026)	0.052** (0.021)
Mean of dependent variable	0.049	0.158	0.086	0.118
	Dependent variable: Pr(not finishing with complete grades)			
Effect of attending a 3-year vocational track	0.001 (0.024)	0.136*** (0.026)	0.037 (0.029)	0.092*** (0.023)
Mean of dependent variable	0.055	0.184	0.102	0.137
Sample size	82,558	101,543	53,697	130,404
Method	2SLS	2SLS	2SLS	2SLS

Note: Robust standard errors in parentheses allowing for clustering by municipality of residence. */**/*** denotes significance at the 10/5/1 percent levels respectively. All models include cohort fixed effects, municipality-of-residence fixed effects, and controls for final GPA in compulsory school, sex, immigrant background, the parents' highest education level and their immigrant background. 'High GPA' refers to students with at least grade 3 (on the scale 1-5). 'Academic parents' means that at least one parent has a long degree from upper secondary education or a higher degree.

4.3   The effect of attending a 3-year track on educational attainment

Table 9 presents the estimated effects of attending the longer and more academic vocational tracks on students' long-term educational attainment. Again, I start by showing the results for the full sample of vocational students. The top part of the table shows the effect on the probability that the individual's highest education level obtained is at least three years of upper secondary education. Note that the OLS estimates are very similar to the 2SLS estimates for this outcome. The results for the preferred specification (column 4) suggest that beginning a 3-year track increased the likelihood of obtaining at least 3 years of upper secondary education by about 40 percentage points. This estimate is significant at the 1 percent level.

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[36] During this time period, Sweden used relative grades on the scale 1-5 (with 5 being the highest grade). The scale was supposed to follow a normal distribution, with a mean of 3, on the national level.

One important motive behind the decision to prolong the vocational tracks was to enable all upper secondary school graduates to continue to university studies. The bottom part of *Table 9* shows the estimated effect of attending a 3-year track on the probability of beginning as well as completing a university degree. The OLS estimates for these effects will be biased upwards if students choosing the longer track in general are more motivated to pursue higher education than those choosing the shorter option. The results confirm this: while the OLS estimates show a significant and positive effect on both outcomes, the 2SLS estimates suggest that there is no effect of attending the 3-year track; neither on the probability of starting nor completing a university degree. The results are very similar if I limit the sample to only include students who actually graduated from upper secondary school.[37]

As was discussed earlier (see *Section 3.2*), students who completed a 3-year track systematically graduated during worse labor market conditions than those completing a 2-year track. A higher unemployment rate is likely to increase the transition rate to higher education, which implies that the effect of attending a 3-year track may be overestimated in these regressions. However, we may still conclude that the results give no indication that beginning a 3-year track would increase the probability of enrolling or graduating from university studies. Hence, the prolongation of the vocational tracks seems to have increased educational attainment through increasing the amount of upper secondary schooling received, but the additional year of schooling does not seem to have caused more students to pursue a university degree.

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[37] Results are available upon request.

Table 9 Effects on educational attainment (full sample)

	Dependent variable: Pr(at least 3 years of upper secondary education)			
	OLS	OLS	2SLS	2SLS
Effect of attending a 3-year vocational track	0.411*** (0.006)	0.388*** (0.005)	0.403*** (0.026)	0.403*** (0.023)
Cohort fixed effects	Yes	Yes	Yes	Yes
Municipality-of-residence fixed effects	Yes	Yes	Yes	Yes
All individual covariates	No	Yes	No	Yes
Mean of dependent variable	0.435	0.435	0.435	0.435
Sample size	181,445	181,445	181,445	181,445
	Dependent variable: Pr(university enrolment)			
Effect of attending a 3-year vocational track	0.056*** (0.009)	0.033*** (0.005)	-0.005 (0.018)	-0.006 (0.016)
Cohort fixed effects	Yes	Yes	Yes	Yes
Municipality-of-residence fixed effects	Yes	Yes	Yes	Yes
All individual covariates	No	Yes	No	Yes
Mean of dependent variable	0.184	0.184	0.184	0.184
Sample size	184,101	184,101	184,101	184,101
	Dependent variable: Pr(university degree)			
Effect of attending a 3-year vocational track	0.039*** (0.007)	0.026*** (0.004)	0.003 (0.011)	0.004 (0.010)
Cohort fixed effects	Yes	Yes	Yes	Yes
Municipality-of-residence fixed effects	Yes	Yes	Yes	Yes
All individual covariates	No	Yes	No	Yes
Mean of dependent variable	0.083	0.083	0.083	0.083
Sample size	184,101	184,101	184,101	184,101

Note: Robust standard errors in parentheses allowing for clustering by municipality of residence. */**/*** denotes significance at the 10/5/1 percent levels respectively. The following covariates are included in column (2) and (4): final GPA in compulsory school, sex, immigrant background, the parents' highest education level and their immigrant background.

Table 10 shows results from separate estimations by compulsory school GPA and parental education. We see that the effect on the probability of completing at least three years of upper secondary education is significant and substantial for all four groups. The point estimate is somewhat higher for low performing than for high performing students, and is higher for students with non-academic parents than for those with academic parents. This pattern seems reasonable since high performing students and students with academic parents are more likely to obtain this level of education even without access to the longer vocational tracks. For none of the groups are there any significant effects on the probability of beginning or completing a university degree.

Table 10 Effects on educational attainment for different sub samples

	High GPA compulsory school	Low GPA compulsory school	Academic parents	Non-academic parents
	Dependent variable: Pr(at least 3 years of upper secondary education)			
Effect of attending a 3-year vocational track	0.356*** (0.033)	0.445*** (0.030)	0.330*** (0.037)	0.432*** (0.026)
Mean of dependent variable Sample size	0.544 81,318	0.347 100,127	0.534 52,748	0.395 128,697
	Dependent variable: Pr(university enrolment)			
Effect of attending a 3-year vocational track	-0.010 (0.030)	-0.002 (0.016)	0.027 (0.031)	-0.019 (0.018)
Mean of dependent variable Sample size	0.288 82,558	0.100 101,543	0.273 53,697	0.148 130,404
	Dependent variable: Pr(university degree)			
Effect of attending a 3-year vocational track	0.009 (0.022)	-0.002 (0.009)	0.007 (0.024)	0.004 (0.012)
Mean of dependent variable Sample size Method	0.149 82,558 2SLS	0.028 101,543 2SLS	0.127 53,697 2SLS	0.064 130,404 2SLS

Note: Robust standard errors in parentheses allowing for clustering by municipality of residence. */**/*** denotes significance at the 10/5/1 percent levels respectively. All models include cohort fixed effects, municipality-of-residence fixed effects, and controls for final GPA in compulsory school, sex, immigrant background, the parents' highest education level and their immigrant background. 'High GPA' refers to students with at least grade 3.0 (on a scale from 1.0-5.0). 'Academic parents' means that at least one parent has a long degree from upper secondary education or a higher degree.

4.4 The effect of attending a 3-year track on earnings

Finally, let us turn to the effect of attending the longer vocational tracks on annual wage earnings. As was shown in the previous section, the prolongation of the vocational tracks caused many individuals to acquire an extra year of upper secondary education. This naturally means that they would enter the labor market one year later than those from the same cohort who attended a 2-year track, and would consequently have less work experience. Here I estimate the effect of attending a 3-year track on earnings without controlling for education or experience. The estimated effect will thus depend on, among other things, how more schooling is valued relative to more experience on the Swedish labor market.

The effects on earnings are estimated in separate regressions for different years after the person began upper secondary school, starting with two years after admittance and including the subsequent 14 years. *Figure 2* shows 2SLS estimates of the effects on the natural logarithm of annual wage earnings for the full sample (with positive earnings).

The parameter estimates (2SLS as well as OLS) are also reported in *Table 11*, which additionally includes the estimated effect on the probability of having positive earnings.

Figure 2 shows a significant negative effect of attending a 3-year, rather than a 2-year, track on annual earnings the second and third year after admittance. This captures the fact that those completing the 3-year track entered the labor market one year later. Except for the last year – 16 years after admittance to upper secondary school – none of the other 2SLS estimates are significantly different from zero. The earnings estimate for the 16th year is positive and significant at the 10 percent level, suggesting a 6.4 percent increase in annual wage earnings due to attending a longer and more academically oriented vocational track. The estimated return to an additional year of education is thereby somewhat higher than what is found by e.g. Meghir and Palme (2005), which studies the effects of the prolongation of the Swedish compulsory school. The estimated return is however in the lower range of estimates in international comparisons.[38]

Figure 2 indicates that the return to the additional year of schooling may increase somewhat over time, which suggests that there potentially could be positive effects on earnings later on in the individuals' labor market career. However, without access to data for more years I cannot examine this hypothesis. One possible explanation to the pattern portrayed in the figure is that the loss of experience matters more than the extra year of education in the beginning of a person's working life, but that the positive effect of more schooling dominates later on. The absence of positive effects for most of the time period could potentially also be driven by lower earnings for those who dropped out prematurely as a consequence of the prolonged education. However, the pattern turns out to be similar if I limit the sample to only include those who actually graduated from upper secondary school, which does not support this explanation.[39]

As in the previous section, these regressions ignore the fact that students completing a 3-year track systematically graduated under worse labor market conditions than those completing a 2-year track. This implies that these individuals faced a higher risk of being unemployed and consequently of having low wage earnings in the beginning of their labor market career. Not accounting for this means that the estimated effect of attending

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[38] See e.g. Card (1999) for a survey of empirical studies estimating the returns to schooling.

a 3-year track on earnings could be underestimated. Unemployment after graduation may also have scarring effects on employment and earnings later on in a person's career. Analyzing roughly the same cohorts of students, Nordström Skans (2004) finds that being unemployed the year after graduating from upper secondary school has negative effects on earnings and employment during the subsequent five years. The negative effect however seems to decrease over time and is not significantly different from zero six years after the graduation date. This suggests that the effects of attending a 3-year track presented in this section may be underestimated, but that the bias is likely to decrease over time.

Figure 2 Effects on ln earnings (sample with positive earnings)
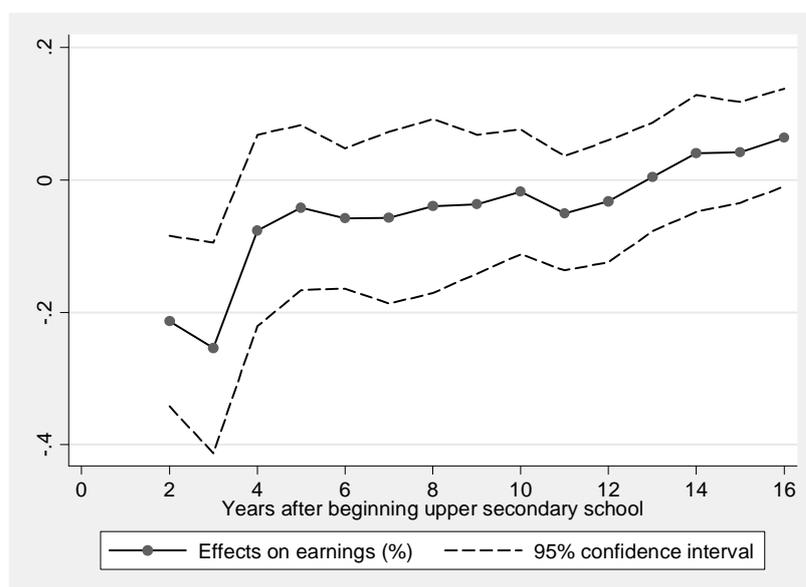
Note: The regressions are estimated with 2SLS. The following covariates are included: cohort and municipality-of-residence fixed effects, compulsory school GPA, sex, immigrant background, the parents' highest education level and their immigrant background. Robust standard errors, clustered by municipality of residence.

Moving on to the rest of the results in *Table 11*, we see that the 2SLS estimates of the effect on the probability of having positive earnings do not reveal any clear pattern, at least if we recognize that these estimates may be biased downwards during the beginning of the time period (see column 4). The table further indicates that the OLS estimates may be biased for both outcomes as they suggest quite different patterns com-

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[39] Results are available upon request.

pared to the 2SLS estimates (see column 1 and 3). If the students who choose to attend the longer tracks in general were more able or had a higher level of career ambition than those attending the 2-year tracks, we would expect an upward bias in the OLS estimates. This is in line with the results for most years.

The earnings effects have also been estimated separately by compulsory school GPA and parental background. The estimates do not show any clear differences between the different sub groups.[40]

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[40] These results are not reported but are available upon request.

Table 11 Effects of attending a 3-year vocational track on annual wage earnings

	Dependent variable:			
	Ln(earnings)	Ln(earnings)	Pr(positive earnings)	Pr(positive earnings)
No of years after admittance to upper secondary school:				
2 years after admittance	-0.423***	-0.213***	-0.024***	-0.014
	(0.013)	(0.065)	(0.003)	(0.018)
Sample size	171,669	171,669	184,052	184,052
3 years after admittance	-0.380***	-0.253***	-0.012***	-0.019
	(0.015)	(0.081)	(0.004)	(0.017)
Sample size	170,051	170,051	184,022	184,022
4 years after admittance	-0.013	-0.076	0.009**	-0.014
	(0.014)	(0.073)	(0.004)	(0.022)
Sample size	165,027	165,027	183,995	183,995
5 years after admittance	0.037***	-0.042	0.015***	-0.016
	(0.013)	(0.063)	(0.004)	(0.015)
Sample size	161,555	161,555	183,960	183,960
6 years after admittance	0.055***	-0.058	0.021***	-0.032*
	(0.012)	(0.054)	(0.003)	(0.017)
Sample size	160,301	160,301	183,964	183,964
7 years after admittance	0.059***	-0.057	0.016***	-0.029*
	(0.013)	(0.066)	(0.003)	(0.016)
Sample size	160,370	160,370	183,830	183,830
8 years after admittance	0.058***	-0.040	0.019***	-0.030*
	(0.013)	(0.067)	(0.002)	(0.016)
Sample size	162,295	162,295	183,520	183,520
9 years after admittance	0.061***	-0.036	0.014***	-0.017
	(0.011)	(0.053)	(0.003)	(0.016)
Sample size	163,402	163,402	183,188	183,188
10 years after admittance	0.051***	-0.018	0.016***	-0.005
	(0.009)	(0.048)	(0.002)	(0.013)
Sample size	163,903	163,903	182,790	182,790
11 years after admittance	0.042***	-0.050	0.010***	0.001
	(0.010)	(0.044)	(0.002)	(0.014)
Sample size	164,949	164,949	182,422	182,422
12 years after admittance	0.039***	-0.032	0.011***	0.012
	(0.010)	(0.047)	(0.002)	(0.014)
Sample size	165,731	165,731	182,137	182,137
13 years after admittance	0.038***	0.004	0.009***	-0.001
	(0.009)	(0.042)	(0.002)	(0.013)
Sample size	165,934	165,934	181,888	181,888
14 years after admittance	0.030***	0.040	0.011***	-0.006
	(0.010)	(0.045)	(0.003)	(0.012)
Sample size	165,553	165,553	181,677	181,677
15 years after admittance	0.041***	0.042	0.009***	0.016
	(0.009)	(0.039)	(0.003)	(0.011)
Sample size	164,822	164,822	181,449	181,449
16 years after admittance	0.020**	0.064*	0.011***	0.017
	(0.009)	(0.038)	(0.003)	(0.012)
Sample size	164,207	164,207	181,226	181,226
Method	OLS	2SLS	OLS	2SLS

Note: Robust standard errors in parentheses allowing for clustering by municipality of residence. */**/*** denotes significance at the 10/5/1 percent levels respectively. All models include cohort fixed effects, municipality-of-residence fixed effects, and controls for final GPA in compulsory school, sex, immigrant background, the parents' highest education level and their immigrant background.

4.5   What can we learn about the effects of the 1991 reform?

The effects of attending a prolonged and more academic vocational track have been estimated by exploiting a pilot scheme in which 3-year vocational tracks were tried out in parts of the country. Later on, in 1991, longer and more academic vocational tracks were implemented on a national scale. As the vocational tracks put in practice through the reform differed somewhat from those in the pilot period, some words about the validity of these results for the effects of the actual reform are necessary.

The first thing to note in this regard is that since 2- and 3-year vocational tracks co-existed in many municipalities during the pilot period, the students who attended the pilot tracks had at least to some extent chosen to do so. After the reform, since all tracks were prolonged no choice of program length existed. If the effects of attending a prolonged track vary across individuals, the average effect for those attending the pilot tracks may differ from the average affect for the population of vocational students. It is conceivable that the individuals who took advantage of the opportunity to study an extra year were motivated and had high expected returns for doing so. This means that the estimated effect on the probability of dropping out is potentially a lower bound of the effect for the whole population of vocational students, while the estimated effect on university attendance and earnings may be an upper bound.

Another important difference between the pilot tracks and the 3-year tracks that were implemented after the reform is that the latter contained even more general theoretical subjects and possibly somewhat less training located in workplaces[41]. If the inclusion of more academic courses is part of the explanation for the increased probability of dropping out, the dropout rate could potentially have increased even more as a consequence of the 1991 reform. However, the increased probability of dropping out could also be simply a consequence of the increased length of the program. How adding even more academic subjects to the curriculum would affect transitions to university studies is difficult to say given that the addition of the first few academic courses did not seem to

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[41] According to the curricula, the amount of training located in workplaces was somewhat lower after the reform. However, reports indicate that the extent of training in workplaces in the pilot tracks often did not meet the intentions, (see SOU 1989:90 and SOU 1990:75). Hence, it is unclear whether in there was a reduction of workplace training in practice.

have any effect on this outcome. Likewise, it is hard to say whether one should expect the effects on earnings to differ as a consequence of the altered content of the program.

An additional point to note regarding the validity of my results for the 1991 reform is that the coexistence of 2- and 3-year vocational tracks during the pilot period may have implied altered peer groups compared to both the pre-pilot and post-reform periods, when only one program length existed. Thus, if peer group effects are important for these outcomes, the effects of the pilot scheme could differ from those of the actual reform.

Finally, the prolongation of all vocational tracks after 1991 could have had general equilibrium effects on the returns to education, in which case the earnings effects may differ from the earnings effects of attending a pilot track.

5   Conclusions

The results presented in this paper suggest that the introduction of a more comprehensive upper secondary school system, through prolonging and adding more academic content to the vocational tracks, brought about a higher dropout rate. The probability of dropping out of upper secondary school is estimated to have increased by 3.8 percentage points as a consequence of attending a 3-year, rather than a 2-year, vocational track. The results also show that this increase is entirely driven by a higher dropout rate among students with below-average grades from compulsory school. These findings are well in line with the results of a few studies investigating the effects of raised graduation standards on high school dropout decisions. For example, Lilliard and DeCicca (2003) find that higher graduation requirements in the US led to increased dropout rates and Dee and Jacob (2006) that the use of exit exams reduced the probability of graduating among disadvantaged groups of students.

Although one important motive behind the decision to prolong the vocational upper secondary education was to enable all upper secondary school graduates to pursue a university degree, the results give no indication that the extra year of schooling increased transitions to university studies. There are some indications however that the extra year of education may have led to increased earnings in the long run. More research will be

needed – when data become available for additional years – in order to establish this relationship with more certainty.

The absence of an effect on university enrolment is at odds with the findings of an earlier study of the same pilot scheme; Ekström (2003) finds that attending a pilot track significantly increased the probability of beginning university studies. The difference between my findings and hers seems to be largely explained by the fact that my regression model includes municipality fixed effects. It may also be interesting to compare my findings to those of Meghir and Palme (2005) who study the Swedish comprehensive school reform in the 1940s. This reform improved access to higher education by increasing compulsory schooling to nine years, and by abolishing the division of students into academic and non-academic schools after grade six. Meghir and Palme find that this reform increased the education level even beyond the new compulsory level. The difference between my results and theirs suggest that the effects of de-tracking a school system may differ for students of different ages. However the content of the two reforms differ in several other aspects, making it hard to rule out other possible explanations.

Many countries have taken steps towards more comprehensive school systems. These types of policy shifts can be accomplished in many different ways, e.g. by delaying the tracking age or reducing the number of tracks. This paper provides evidence on a particular type of such transitions, where a less selective school system is obtained through making all educational tracks academic enough to prepare the students for university studies. The consequences of this policy change appear not to be straightforwardly positive or negative. The increased probability of dropping out among weak students gives support to the fear held among people opposing this policy shift; that not all students may benefit from an upper secondary education with a substantial academic content. On the other hand, the average educational attainment among vocational students did increase, and there are indications that this may have led to increased earnings in the long run. The absence of an effect on university enrolment suggests that, perhaps already in the old system, the costs of changing direction from a vocational path to pursuing university studies, were not large enough to prevent individuals who changed their minds from doing so. After all, even before the pilot period, it was possible to supplement a 2-

year vocational degree in order to obtain university eligibility within the adult education system.

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Appendix

Table A1 Variable definitions

Variables	Definitions
Instrument:	
Pilot scheme intensity in municipality of residence	Share of available vocational tracks which constituted 3-year tracks in the person's municipality or residence♦, when he/she began upper secondary school. (The Upper Secondary School Application Record)
Outcome variables:	
Dropped out of upper secondary school	Dummy variable = 1 if the person has not graduated six year after admittance; 0 otherwise. (The Upper Secondary School Graduation Record)
Did not finish upper secondary school with complete grades	Dummy variable = 1 if the person has not graduated six year after admittance, or has graduated but with one or more grades coded as missing; 0 otherwise. (The Upper Secondary School Graduation Record)
Completed at least three years of upper secondary education	Dummy variable = 1 if the person's highest education level is three years of upper secondary education or higher; 0 otherwise. Measured 15 years after admittance to upper secondary school. (LOUISE)
Enrolled at a university	Dummy variable = 1 if the person has enrolled at a university; 0 otherwise. Measured 15 years after admittance to upper secondary school. (The University Enrolment Record)
Completed university degree	Dummy variable = 1 if the person has completed a university degree; 0 otherwise. Measured 15 years after admittance to upper secondary school. (The University Graduation Record)
Ln earnings	The natural logarithm of annual gross wage earnings. (LOUISE)
Individual characteristics:	
Female	Dummy variable = 1 if female; 0 otherwise. (The Multi-Generation Register)
Immigrant background	Dummy variable = 1 if born in non-Nordic country; 0 otherwise. (LOUISE)
GPA compulsory school	GPA the last year of compulsory school. (Cohort 1986-87: the Upper Secondary School Application Record. Cohort 1988-90: the Compulsory School Graduation Record)
Parental characteristics:	
Immigrants	Dummy variable = 1 if both biological parents are born in non-Nordic countries; 0 otherwise. (LOUISE)
Upper secondary education	Dummy variable = 1 if the parents' highest education is upper secondary education; 0 otherwise. Measured the year the student finished compulsory school. (LOUISE)
Post-secondary education	Dummy variable = 1 if the parents' highest education is post-secondary education; 0 otherwise. Measured the year the person finished compulsory school. (LOUISE)

Notes: Statistics Sweden registers in parenthesis. ♦Municipality of residence is measured on December 31st the person's last year of compulsory school.

Table A2 Vocational tracks in upper secondary school

Regular 2-year vocational tracks	3-year pilot tracks
Agriculture Forestry Gardening	Use of natural resources
Business & administration Distribution & administration	Business & services
Caring services Social services	Health care
Caring services: children & youth	Caring services: children & youth
Clothing manufacturing	Textile & clothing manufacturing
Construction	Construction Constructional metalwork Heating, ventilation & sanitation Painting
Consumer studies[♦]	
Electrical engineering	Electrical engineering
Food manufacturing	Food manufacturing Restaurant
Operation and maintenance engineering[♦]	
Process technology	Process technology
Vehicle engineering	Transport & vehicle engineering
Wood technology	Wood technology
Workshop techniques	Industry
-	Handicraft[♣]
-	Graphic[♣]

Notes: [♦]Tracks which do not directly correspond to any of the pilot tracks, but are still included in the analysis as important elements of them appear to be present on one or more of the pilot tracks. [♣]Tracks which are not included as they do not correspond to any of the 2-year tracks.

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