Access to education and disability insurance claims

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Abstract

The paper provides the first causal evidence of how access to education affects disability insurance (DI) claims among low-skilled youths. The research design exploits recent changes in high school eligibility criteria among a set of low-performing compulsory school graduates in Sweden. The results show that the immediate inflow into the DI system increased by 5.1 percentage points among the students who were excluded from standard high school programs. The fact that outflow from DI is very low (half of all young claimants remain in the system after 10 years) together with auxiliary findings indicating that the impact remains high during the short follow-up period suggest that the effect is likely to persist over many years. The results highlight that the design of education systems is a crucial determinant of DI claims among young people and that reforms which limit low-skilled youths' access to education can have lasting detrimental effects on their labor supply.

Keywords: Access to education, Disability insurance, Education Policy

JEL Codes: I24, I26, I28

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1 Introduction

Inflow of youth into disability insurance (DI) benefit schemes has been increasing in several OECD countries, opposing the average trend among the total working-age population (see e.g. OECD, 2010, 2014, 2015, 2019). While the proportion of youth on DI is generally still low,[1] the increasing enrollment trend raises concerns. Along with the spendings on cash benefits, long benefit persistence adds to the costs. The DI exit rate is low and even if claimants leave the DI benefit, they are far more likely to move onto another benefit scheme (Pearson and Prinz, 2005; OECD, 2010, 2012). As youth disability spells start earlier and are more often tied to diagnoses with lower mortality rates,[2] their lifetime benefit amounts may exceed those of older awardees (Von Wachter et al., 2011; Ben-Shalom and Stapleton, 2015). Lastly, early DI take-up adds to the social costs via negative association with employment prospects and labor earnings, and positive association with unemployment and poverty (see e.g. OECD, 2010).

The key in controlling the youth DI rolls, similarly to the DI rolls among the full working-age population, lies in controlling the *inflow* into the system as it has been proved to be ineffective to help people return to the labor market after an absence (Autor, 2011; Koning and Lindeboom, 2015).[3] Among others, more stringent screening systems and employer incentives that encourage the rehabilitation of potential DI beneficiaries before their entry into the system have been used in different countries. The employer incentives are, however, less relevant for young people who, without any work experience, transfer directly from the education system into benefit dependency. Instead, changes within the education system may matter for that group.

The literature on causes and consequences of the rising DI rolls points at the link between DI take-up and low level of education (Autor and Duggan, 2003; Autor, 2011; Kostol and Mogstad, 2014; Korkeamäki and Kyyrä, 2012; Prins, 2013; Banks et al., 2015). Furthermore, the education difference between beneficiaries and non-beneficiaries is shown to have increased over time (OECD, 2010). Yet, this paper is the first to present quasi-experimental evidence on how access to education affects the inflow into DI system.[4] Establishing the causal link is important for avoiding unintended (long-term) social costs and effects on public finances that education reforms may come with. It would also improve projections of future trends in DI participation considering the changes in the educational composition

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[1]On average, 1.8% of 16–29-year-olds were awarded a DI benefit in OECD in 2013 (OECD, 2016a,b).

[2]Mental ill-health is the most common underlying cause for the DI benefits among young people (OECD, 2014, 2019; Banks et al., 2015).

[3]This holds particularly for people suffering from mental illnesses (OECD, 2015).

[4]Closest in spirit is the paper by Poterba et al. (2017) which, relying on a selection-on-observables strategy, shows that men with a high school degree are 0.23 percentage points less likely, and women 0.34 percentage points less likely to participate in DI programs than people without a high school degree.

of the population (Poterba et al., 2017).

For estimating the causal effect of education on youth DI enrollment, I exploit an exogenous change in *access*[5] to vocational high school education introduced by a Swedish high school reform in 2011. The reform raised high school eligibility requirements. For cohorts graduating from compulsory school in 2010 or earlier, passing grades in compulsory school math, English and Swedish classes were required for qualifying for vocational high school programs. In 2011, demand for five additional passing grades was introduced. I use a difference-in-differences identification strategy to analyze the impact of the reform on students' DI claims and other economic outcomes. To this end, I compare the students who were eligible for vocational high school studies before but not after the reform to other low-performing students who remained eligible throughout the sample period.

My results show that the immediate inflow into the DI system increased by 5.1 percentage points among the students who were excluded from standard high school programs. The results are robust to a range of different falsification tests and different sample restrictions. For example, the new eligibility requirements did not have any effect on DI take-up among the students who failed compulsory school math, English or Swedish classes and were, therefore, never eligible for high school studies. Lack of effect on DI take-up by older siblings further shows that the affected students do not come from families that are more likely to participate in the DI system.

Supplementary analyses instead show that labor supply of the affected students fell dramatically: their employment probability declined by 36% and they were 12% less likely to be registered unemployed three years after compulsory school graduation. Additionally, labor earnings of the affected students fell by 37%. In line with previous studies (e.g. Black et al., 2002; Rege et al., 2009; Bratsberg et al., 2010), the findings suggest that adverse shocks to employment prospects may induce the inflow into the DI system. Follow-up studies on longer time-series are needed to understand if the short-term effects on labor market outcomes persist or reflect the fact that the affected students stayed in school system longer; most of them started high school studies in preparatory programs that prolong study period. Heterogeneous results by gender show that the reform had a negative effect on boys along all the studied dimensions.

I evaluate the effects of limited access to education on youth DI take-up in a context where, in addition to declined work capacity, young people can be awarded the DI benefit for completing their education in case of disability-related prolongation of studies. That aspect of the system deserves special attention as it opens up another channel for the inflow of youth into the DI system. While specific to the Swedish system, the DI take-up for prolonged schooling is very similar to the DI take-up for declined work capacity

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[5]The focus is on the access to education as this is the margin that matters for people with low ability, and that group, in turn, is the one that is overrepresented among the DI beneficiaries.

leading to a long benefit dependence. On average, about a third of the youth awarded DI for prolonged schooling remain in the DI system 10 years later. My findings show that the students who did not qualify for vocational high school studies after the reform were more likely to enter the DI system for prolonged schooling. Thus, implementation of the reform that prolonged low-skilled students' studies in the institutional setup that allows for entry into the DI system for prolonged schooling might have magnified the unintended effect of the reform. The finding emphasizes on the importance of taking joint efficiency into consideration when designing different systems.

The reform that increased the high school eligibility standards affected a limited part of population. Hence, the absolute magnitude of the effect is small and alleviated by the strong demographic decline in the relevant age groups coinciding with the reform. In spite of this, it is important to consider the huge relative effects when reforming education systems. In 2016, a report commissioned by the Swedish Government suggested that the entry requirements for vocational high school programs were to be increased to the level of nine additional passing grades (SOU, 2016). In the light of the findings of the paper, such a change could have increased the inflow of youth into the DI system even further.

By providing a causal estimate of limited access to education on the inflow of youth into the DI system, the paper enriches the literature of causes and consequences of increasing DI rolls (see e.g. Black et al., 2002; Autor and Duggan, 2003; Autor, 2011; Kostol and Mogstad, 2014). The findings on the interaction between the education system and the DI system contribute to the literature on the interactions between DI and other institutions, such as unemployment insurance systems, dismissal policies and (early) retirement systems (Hassink et al., 1997; Koning and van Vuuren, 2007; Rege et al., 2009; Bratsberg et al., 2010; Korkeamäki and Kyyrä, 2012). Through the focus on the margin of becoming eligible for vocational high school programs, the paper further informs the discussion about the returns to career and technical education (Kemple and Willner, 2008; Jacob, 2017; Dougherty, 2018; Brunner et al., 2019). Lastly, the paper is related to the literature on the effects of post-compulsory education on various other outcomes, such as crime (Lochner and Moretti, 2004; Hjalmarsson et al., 2015; Åslund et al., 2018; Huttunen et al., 2019).

The paper is organized as follows. Section 2 gives an overview of the Swedish DI system, including the most recent trends in youth DI participation, and the Swedish education system. After describing the changes in access to high school studies enforced by the high school reform in 2011, Section 3 proceeds with information on the data and sample construction and Section 4 with the methodological approach. Section 5 presents the main findings together with a list of robustness and falsification tests. Section 6 concludes.

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2 Institutional setting

2.1 The Swedish disability insurance system

The DI system serves as a part of the social safety net that helps people with limited working ability to alleviate poverty, and enables them to participate in society. In Sweden, different tax-funded benefit schemes are in place for that purpose for younger and older people. Throughout the study period of 2007–2012, 19–29-year-olds who, due to sickness, accident or disability, were not able to work full time at any job available in the labor market for at least a year were eligible for an activity compensation (*aktivitetsersättning*). 30–64-year-olds suffering from permanently reduced work capacity were eligible for a more permanent benefit scheme—sickness compensation (*sjukersättning*). As this paper studies the inflow of youth into the DI system, the focus of the paper is on the activity compensation.

The activity compensation provides youth suffering from a lasting reduced work capacity with replacement of foregone earnings. A majority of the beneficiaries are eligible for the tax-funded guaranteed compensation.[6] People who due to sickness, accident or disability are not able to graduate from high school on time could apply for the benefit for completing their studies (DI benefit for prolonged schooling). For that, it has to be shown that the inability to graduate from school on time indeed depends on a disability or declined health, and not on other problems such as social issues, tiredness of school etc.

People first qualify for the activity compensation in July of the year when they turn 19, and the benefit can be assigned for 1–3 years at once. The temporary nature of the benefit is to combat the lock-in effect in the social insurance system affecting especially young people (ISF, 2013). Despite the fact, about 50% of the beneficiaries are still in the DI system 10 years later (shown in Figure 2 in the next section). The benefit is supposed to be accompanied with different rehabilitation activities to improve the work capacity of the beneficiaries and, hence, enhance their return to the labor market. If still suffering from declined work capacity by the age of 30, the beneficiaries can transfer to the more permanent benefit scheme for 30–64-year-olds.[7]

The activity compensation is fairly generous. In 2011, individuals with no previous work experience were entitled to guaranteed compensation at the average amount of 7,900 SEK (approx. 900 EUR) per month.[8] In addition to that, DI beneficiaries may receive

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[6]In 2014, about 93% of all activity compensation beneficiaries received the guaranteed level of the benefit (Riksrevisionen, 2015). Only a small share of all beneficiaries qualify for the income compensation funded by social insurance contributions.

[7]A majority (about 70%) of the youth who transfer to the permanent benefit scheme suffer from various mental disorders and 8% have diagnoses related to various nerve system disorders (Försäkringskassan, 2017). Since 2017, people aged 19–29 who are permanently disabled qualify for the permanent benefit scheme as well. During the period 2003–2016 the only possible DI benefit for the latter group was, however, the activity compensation.

[8]This is a pre-tax benefit level. The guaranteed compensation level does not depend on individual's work

a non-taxable housing supplement. Single people with low income could in 2011 get at most 5,000 SEK (550 EUR) per month to cover their housing costs. For cohabiting people, the housing subsidy is half of the amount. To set the figures into perspective, the unemployment subsidy available for people under 25 years of age with no previous work experience (*utvecklingsersättning*) amounted to 1,050 SEK (approx. 100 EUR) per month and the monthly minimum wage[9] was approx. 20,000 SEK (2,200 EUR) in 2011.

The DI system is managed by the Swedish Social Insurance Agency (SSIA). In order to be awarded the benefit, an application together with relevant health-related information must be sent to the SSIA. Each application is assigned to a case manager—an employee of the SSIA who determines a claimant's right for the benefit. The case managers may obtain additional information by consulting the doctor who diagnosed the medical cause underlying the application, and other relevant parties for decision making. In case of a declined application, the applicant may request that the SSIA reconsider the decision and may thereafter appeal the decision to an administrative court.

When awarding activity compensation for prolonged schooling, different rules apply for students in regular schools and those enrolled in schools for students with learning disabilities.[10] The case managers have to decide in each case whether an applicant's need for prolonged schooling is tightly linked to disability. For that purpose, a medical certification proving a disability must be issued by a healthcare specialist. In addition, necessary information has to be obtained from the applicant and the school they are enrolled in. No medical certificates are needed for the decision for students enrolled in schools for students with learning disabilities. In these cases, a document confirming enrollment in such a school is enough to prove the existence of an underlying disability.

The decision making is complex and has become more so as the set of diagnoses has expanded (Försäkringskassan, 2018b). The case managers find it particularly difficult to determine the right for the activity compensation for prolonged schooling for students enrolled in regular schools. It is also considered difficult to assess when a student's right for the DI benefit for prolonged schooling starts and how long it should last. The potential for higher quality of the DI award decisions for prolonged schooling has been addressed in the SSIA's legal quality monitoring (Försäkringskassan, 2018a). DI benefits awarded for declined work capacity suffer from similar problems (Försäkringskassan, 2016).

history, but it is age dependent. People with previous work experience before getting sick were entitled to income compensation at the amount of 64.7% of the average monthly salary during the past year, with a ceiling set at 17,120 SEK (approx. 1,900 EUR).

[9]As there is no statutory minimum wage in Sweden, it is proxied by the 10th percentile of the actual wage distribution in 2011.

[10]Students with developmental disorders may enroll in schools for students with disabilities (*särskola*). Students with deafness or impaired hearing can attend special needs schools (*specialskola*) with ten years of education.

2.1.1 Swedish youth on disability benefits

While DI participation among younger people is well below the participation rate of older people,[11] the trend in youth DI enrollment has been increasing over time. In 2003, when the activity compensation scheme was first introduced, 0.4% of 19–29-year-olds were enrolled in the benefit scheme. The share had increased by a factor of 7.5 to 3% in 2017 (see Figure 1). DI participation among 30–64-year-olds has, in contrast, declined from its peak of 12.2% in 2006 to 6.1% in 2017.

Figure 1: Trends in DI participation among 19–29- and 30–64-year-olds during the period 2003–2017
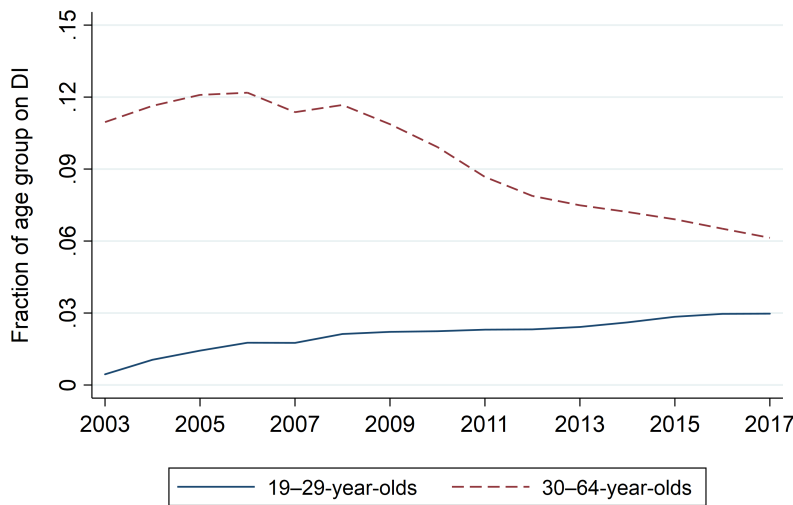
Early DI take-up is highly persistent. The Kaplan-Meier survival estimates in Figure 2 indicate that 69% of all people who at the age of 19 were awarded the activity compensation were still on DI benefits five years later and 50% 10 years later. Furthermore, about 38% of the initial pool had transferred to the permanent benefit scheme for 30–64-year-olds by the age of 31.

Falling into the benefit dependency is associated with various costs. Table 1 shows descriptive associations between education, earnings and early DI take-up. People who are awarded DI benefit at the age of 19 are very unlikely to obtain any post-secondary education. While 31.4% of all 19-year-olds in 2003–2007 had obtained some post-secondary education by age 23, the figure was 29.1 percentage points lower for those on DI benefits. Virtually none of the early DI beneficiaries had obtained a three year college degree by

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[11]About 3% of all 19–29-year-olds were awarded a DI benefit in 2017. The figure is twice as high among 30–64-year-olds.

Figure 2: Survival estimates for adolescents' DI participation
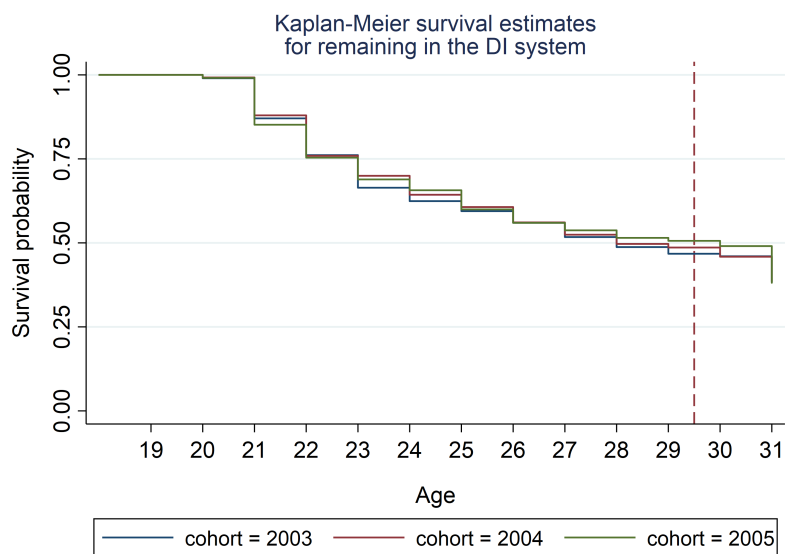
Notes. The figure plots 13 year survival estimates for remaining in the DI system for people who were awarded the activity compensation at the age of 19. Data for 19-year-olds in 2003–2005 are used. Only people with one continuous DI spell during the time period are included in the analysis (about 72% of all the 19-year-old DI beneficiaries in 2003–2005). The vertical dashed line marks the end of the eligibility for the activity compensation and the beginning of the eligibility for the sickness compensation scheme for 30–64-year-olds.

age 23. Secondly, people on DI benefits have worse labor market outcomes. Labor income (measured at the age of 29) of the early DI beneficiaries was about 70% below that of the non-beneficiaries and their disposable income was about 37% lower than that of the non-beneficiaries.

2.2 The Swedish school system

2.2.1 The Swedish compulsory school system and transition to high school until the school year 2010/2011

The Swedish school system stipulates nine years of compulsory schooling starting at the age of 7 and ending in grade nine at the age of 16. Grade repetition is very uncommon. After compulsory school graduation, most students continue their studies at the post-compulsory level. The Swedish high school system provides students with a selection of various programs. Academic high school programs prepare students for further studies at the tertiary level, whereas a majority of the graduates from vocational tracks enter the labor

Table 1: Associations between post-compulsory education, earnings and early DI take-up

	(1) Any post-secondary education	(2) 3 year college	(3) Labor earnings	(4) Disposable income
DI take-up	-0.291***	-0.075***	-163.073***	-85.921***
	(0.002)	(0.001)	(1.414)	(0.761)
Observations	559,264	559,264	531,117	524,738
R^2	0.005	0.001	0.020	0.017
Mean dep. var.	0.314	0.077	234.448	230.238
Cohort dummies	Yes	Yes	Yes	Yes

Notes. Dependent variables are given by the column headers. Data for 19-year-olds in 2003–2007 are used for the analysis. DI take-up is measured at the age of 19, highest level of education at the age of 23, annual labor earnings and disposable income at the age of 29. Observations with no data on the highest level of education, all negative values of the income variables and the observations with income above the 99th percentile within each cohort are excluded from the analysis. Labor earnings and disposable income are presented in thousands of Swedish kronor. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

market directly. Before 2011, students could choose between 17 national programs[12]—four academic and 13 vocational—which were often provided within the same schools. High school admission is determined by students' final grades from compulsory school.

During most of the compulsory school, students do not receive official grades.[13] Until the academic year of 2010/2011, official grades were assigned in each of the compulsory school subjects in the end of each semester from grade eight onward, and the grades could take the values of Pass, Pass with Distinction, Excellent or Fail, where the first three were considered as passing grades with numeric values of 10, 15 and 20, respectively, and the latter (with numeric value of 0) indicated failure in a subject. In the end of the spring term of grade nine, students receive their school leaving certificates with final grades.

To become eligible for high school studies, students must have obtained passing grades in grade nine math, English and Swedish classes. Most students met the eligibility criterion: the share of those below the threshold varied from 11.6% to 12.3% during the period of 2007–2010 (see Appendix Table A2). Students below the threshold could obtain passing grades in the missing courses in summer school, and after that apply for any of the national programs. Alternatively, they could start their high school studies in an individual program with a low probability of high school graduation.[14] Out of the approximately 12,000 students who started in the individual program in 2002, only 19% had graduated

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[12]In addition to these, a few non-national programs (e.g., International Baccalaureate and individual program) were available.

[13]Instead, individual development plans follow students' development.

[14]This program could be adapted to the particular needs of each student who lacked passing grades in some or all of the three key subjects with the main purpose of preparing them for the education in standard high school programs. It could also be combined with studies in the program that a student pursued to get enrolled in.

from high school in four years and 23% in five years ([Regeringen, 2009](#)). For comparison, about 80% of the students who enrolled in vocational programs graduated from high school in four years ([Skolverket, 2014a](#)).

In order to enroll in any of the national high school programs, students list their school×program preferences. In smaller municipalities, the choice often reduces to the choice of a program only. Conditional on meeting the eligibility criterion, seats are allocated based on the final grades from compulsory school.

2.2.2 Stricter high school entry requirements since 2011

On July 1st, 2011 a high school reform "Upper Secondary School 2011" (*Gymnasieskola 2011*, GY2011 hereafter) that tightened high school eligibility requirements was enforced in Sweden. The purpose of the reform was to guarantee that (i) the prospective students would be better prepared for high school studies and the dropout rates from high school would shrink, and (ii) high school graduates would be better prepared for further studies at the tertiary level or for direct entry to the labor market ([Skolverket, 2011](#)).

To reach the target, a set of changes was introduced. Most importantly for this study, GY2011 tightened high school entry requirements to ensure that the students enrolled in different programs would indeed have the necessary prerequisites for coping with these.[15] The students graduating from compulsory school in 2011 or later must have obtained passing grades not only in grade nine math, English and Swedish classes as earlier,[16] but in additional five subjects as well for qualifying for vocational high school studies. There are no restriction on the set of the five additional courses.[17] The new rules apply for both public and private schools.

Students below the threshold can start their high school studies in one of the five new introductory programs.[18] These programs were to replace and improve the earlier individual program, and to provide students with skills necessary for transferring to some national program or familiarizing them with working life. The probability of transferring to a national high school program and graduating from any such program remained, similarly to

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[15]Additionally, the set of high school programs was expanded to six academic and 12 vocational programs. The difference between the academic and vocational programs was increased. GY2011 removed direct eligibility to studies at the tertiary level from vocational programs. In order to become eligible for such studies, vocational students must adjust their high school curriculum with additional English and Swedish courses since 2011. A new grading system was introduced as well. The earlier scale was replaced with the one ranging from A to F, where A–E are passing grades and F a failing one.

[16]As an exception, newly arrived students from countries where no tuition was provided in English were allowed to enroll in national high school programs even without passing grades in compulsory school English classes.

[17]Students aiming for academic programs must have obtained passing grades in nine additional subjects, whereas program-specific requirements apply.

[18]Alternatively, the students could stay in compulsory school for another year for obtaining the missing passing grades.

the earlier individual program, low among the students enrolled in the introductory programs. 38.5% of all students who started in an introductory program in 2011 dropped out of high school without ever transferring to any national program (Skolverket, 2014b). Labor market outcomes of the students who only have been enrolled in introductory programs are shown to be weak (Skolverket, 2019).

3   Data

The study relies on student level Swedish register data for the cohorts who graduated from compulsory school in 2007–2012.[19] Compulsory school records of these students are linked to data on students' high school enrollment, their employment and unemployment records, DI participation data, as well as data on their parents.[20] Data on the results of national tests in math, Swedish and English conducted in grade nine are also used but due to different data sources, these data cannot be merged to the main data set that contains information on DI take-up.

I focus on students with passing grades in grade nine math, English and Swedish classes. All these students would have been eligible for vocational high school studies both before and after 2011 without the reform. Furthermore, while GY2011 tightened the entry requirements for both academic and vocational programs, I only focus on the students who are at the margin of making it into vocational ones. For that purpose, all students with at least nine additional passing grades from the final year of compulsory school are excluded from the sample as they could potentially be eligible for academic programs.[21] The reason for focusing on the vocational graduates is twofold. First, labor market outcomes are not determined for the students enrolled in academic programs shortly after high school graduation as most of the students continue their studies at the tertiary level. Vocational students enter the labor market faster, providing relevant data when studying the effects on labor market outcomes. Secondly, the less precisely determined requirements for enrollment in academic programs (due to the track-specific demands) would undermine the identification at that threshold.

The main sample of the study contains data for 10,795 students who graduated from compulsory school during the period 2007–2012 with passing grades in grade nine math,

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[19]Due to changes in compulsory education that coincided with GY2011, the post-reform cohorts of 2010/2011 and 2011/2012 are the only ones that went to compulsory school under the same rules as the pre-reform cohorts and, thus, provide me with comparable data. The changes in compulsory education affected both curriculum and grading system. The new system was first implemented on the cohorts who were at most in grade eight in 2011/2012 (SOU, 2016).

[20]For a small share of students with several compulsory school graduation records, the earliest one is used.

[21]Whether they were or not depends on the exact set of passing grades they obtained and their study choices as the entry requirements were stated at a more detailed level for the academic programs.

English and Swedish classes. Additionally, all of these students had 1–8 passing grades in different compulsory school subjects. The cohorts graduating from compulsory school at the latest by the end of the academic year 2009/2010 are treated as *pre-reform cohorts* and those graduating in 2011 or later as *post-reform cohorts*. Students with less than five additional passing grades from grade nine form the group of *ineligible students*—the students who are no longer eligible for vocational high school programs after the reform, even though students with the same results graduating during the earlier years were. Since 2011, ineligible students could start their high school studies in some of the introductory programs with much lower graduation probability or choose not to enroll in high school at all. Students with 5–8 additional passing grades form the group of *eligible students* who remained eligible for vocational high school studies throughout the study period. In the empirical estimation, that group serves as a control group and the group of ineligible students as a treatment group.

The sample is, as expected, different from the full pool of students as shown in Appendix Table A3, which limits the external validity of the study. However, the indications that DI take-up is higher among the low-educated (Black et al., 2002; Autor and Duggan, 2003; Korkeamäki and Kyyrä, 2012; Kostol and Mogstad, 2014; Karnehed et al., 2015) and low-ability population (Gravseth et al., 2008; Johansson et al., 2012) clearly support the focus on the lower end of the ability distribution.

4 Empirical strategy

4.1 Main model

For estimating the effect of tighter high school eligibility requirements on adolescents' inflow into the DI system, I employ the difference-in-differences (DiD) estimation technique. Under the parallel trend assumption, it enables me to estimate the parameter of interest by comparing the DI take-up rates among the eligible and ineligible students before and after the implementation of the reform. The model is given by eq. 1, where $Ineligible_s$ is a dummy variable that takes the value of one for students who do not meet the stricter high school eligibility standards, $Post_y$ is a dummy for post-reform period and β_3 denotes the main parameter of interest that captures the effect of limited access to vocational high school studies on DI take-up. A set of background characteristics X_{iy}, such as gender, migration status, and parental characteristics (DI take-up, income and education), is used in some specifications.

$$Y_{iy} = \beta_0 + \beta_1 Ineligible_s + \beta_2 Post_y + \beta_3 Ineligible_s Post_y$$
$$+ X'_{iy}\varphi + \epsilon_{iy}$$

(1)

The main outcome variable (Y_{iy}) of interest is DI take-up three years after compulsory school graduation. Young people could be awarded activity compensation at the earliest in July of the year when they turn 19. This corresponds to the year $t + 3$ (where t is the year of compulsory school graduation) in most of the cases. In some of the robustness analyses, I measure DI take-up at $t + 2$ and $t + 4$ to study how the effect evolves over time. In terms of the DI benefit, the paper focuses on the take-up of the guaranteed level of activity compensation as very few students qualify for the income related part.

In addition to DI take-up, I study the effects of the reform on various student outcomes such as enrollment in vocational and academic high school programs, starting high school studies in any of the introductory programs and not enrolling in high school at all (see Section 5.1). As the total high school enrollment rate decreased by less than one percentage point after the reform (see Appendix Figure A1), these models mostly study the reform effect on the reallocation of students between different high school programs.[22] I also ask how the reform affected the probability of high school completion over time,[23] the share of students still enrolled in high school four years after initial enrollment (I call this prolonged schooling), and the high school dropout rate. Students are defined as dropouts if they neither graduated from high school three years after compulsory school graduation nor were enrolled in high school four years after compulsory school graduation.

In order to assess the channels of the reform effect on youth DI take-up, I estimate the reform effect on various labor market outcomes. The following outcome variables are used for that purpose: probability of employment (to be classified as employed, people must have been working for at least one hour a week in November), probability of unemployment (people are defined as unemployed if they were registered as open unemployed and/or participants of any labor market programs for at least a day in a particular year), length of unemployment conditional on being unemployed (that indicates the total number of days a person was registered as open unemployed and/or a participant of some labor market program), annual labor earnings and disposable income.

4.2 Threats to validity

The DiD estimates are unbiased under a few assumptions. Most importantly, identification of the parameter of interest requires that in the absence of the reform, the actual trend of DI take-up among the eligible students and the counterfactual trend of DI take-up among

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[22]Students enrolled in the International Baccalaureate, specially designed programs (up to 2011) or programs with nationwide admission cannot be classified into any of these categories unless there is enough information for re-classifying them into some of the national programs. All of the students are kept in the sample for the analysis, but no high school category has been assigned for them.

[23]Even students who passed courses for at least 2500 high school credit points, that corresponds to full course-load, but did not meet all diploma requirements are treated as high school completers.

the ineligible students would have been the same. In other words, both groups should have experienced the same average change in the outcome variable had the reform not taken place. The parallel trend assumption is crucial, because the DiD approach eliminates time-invariant differences between the groups of ineligible and eligible students, but the time-dependent variation remains intact.

Since the counterfactual trend among the group of ineligible students is not observable, I cannot test the assumption directly, but Figure 5 (shown together with the main results in Section 5) provides rather compelling evidence in favor of it. Panel A of the figure illustrates that the DI take-up rate evolved rather similarly among the ineligible and eligible students during the pre-reform era (2007–2010). Panel B shows further that the effect of stricter high school eligibility requirements on DI take-up in 2007–2009 did not differ statistically significantly from the effect in 2010 (the last pre-reform year). However, DI take-up among the ineligible students increased significantly in 2011 when the reform was introduced. The DI take-up rate among the eligible students does not show any sharp changes after the reform.

Related to the parallel trend assumption, it is important that the composition of the groups of eligible and ineligible students did not change together with the reform. Behavioral changes leading to differential sorting into programs could have occurred since GY2011 removed direct eligibility for tertiary education from vocational programs. If academically stronger students were interested in having the direct eligibility and responded to the reform by exerting extra effort to qualify for academic programs, the reform might have led to negative selection in the control group. I analyze the composition of the groups by studying the balance of predetermined covariates in the sample. Table 2 shows that the groups of eligible and ineligible students experienced similar changes in terms of most of the pre-determined characteristics.[24]

The stability of the composition of the groups is further assured by Figure 3 which plots the predicted DI take-up among the groups of ineligible and eligible students. The predicted DI take-up is first estimated for each individual as a function of their pre-determined background characteristics (gender, migration status, compulsory school GPA, parents' DI take-up in the year when the student graduated from compulsory school, sum of parents' income, their employment status and education). Figure 3 shows that both groups experienced very similar trend in the predicted outcome throughout the sample period. Thus, the baseline characteristics of the groups cannot explain any sharp changes in the actual DI take-up among the ineligible students after the reform.

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[24]In Section 5.4 I present a set of robustness tests, including one addressing the concern of potential negative selection in the control group by expanding the sample to students just above the eligibility threshold for academic tracks (those with nine and 10 additional passing grades).

Figure 3: Predicted DI take-up rate among the ineligible and eligible students three years after compulsory school graduation
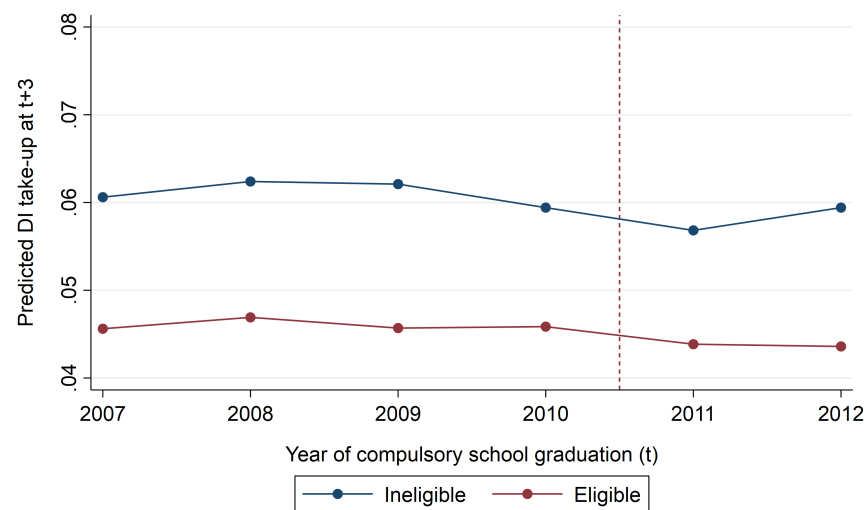
Notes. The predicted DI take-up is estimated as a function of students' gender, migration status, compulsory school GPA, parents' DI take-up, sum of parents' income, their employment status and education. The vertical dashed line marks the introduction of the stricter high school eligibility requirements. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011.

Table 2: Balance of covariates

	(1) Effect of Ineligible×Post	(2) Std. Err.	(3) Pre-reform mean
Students' characteristics:			
Female	-0.033	0.031	0.414
Not born in Sweden	-0.028*	0.015	0.072
Math test score$^\diamond$	0.065	0.046	-0.428
English test score$^\diamond$	-0.004	0.041	-0.294
Swedish test score$^\diamond$	0.011	0.043	-0.431
National test score in math missing$^\diamond$	0.083***	0.030	0.185
National test score in English missing$^\diamond$	0.062**	0.028	0.146
National test score in Swedish missing$^\diamond$	0.031	0.026	0.152
Parents' characteristics:			
Mother on DI	0.005	0.021	0.153
Father on DI	-0.007	0.017	0.095
At least one parent on DI	0.007	0.025	0.224
Mother not working	0.026	0.027	0.194
Father not working	-0.007	0.023	0.166
Sum of parents' income (hundreds of SEK)	141.3	193.4	3657.1
Mother - less than high school	0.021	0.026	0.213
Mother - high school/some post-secondary	-0.031	0.030	0.662
Mother - tertiary education	0.010	0.020	0.098
Father - less than high school	0.017	0.026	0.246
Father - high school/some post-secondary	-0.024	0.029	0.615
Father - tertiary education	0.007	0.018	0.058
F-test	0.753		
p-value	0.711		

Notes. The results in column 1 are estimated by equation 1, where Y_{iy} stands for the variables presented in the first column. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. For estimating the effect of the reform on students' national test scores, actual grade in a corresponding subject is imputed for all of the missing values. ($\diamond$) Data on national tests come from a different data source and cannot be linked to the rest of the data. Due to that, the joint significance test reported in the end of the table excludes these variables. A separate joint significance test testing whether all of the coefficients of the national test scores and the indicators of missing test data are simultaneously equal to zero report a F-statistic of 1.533 with a p-value of 0.163. *** p<0.01, ** p<0.05, * p<0.1.

5 Results

5.1 Effects on high school enrollment

I start by presenting the results on the effects of GY2011 on various student outcomes. Figure 4 and Table 3 suggest that the increased entry barriers come with a strong reallocation of students across different programs, the effects being just at the margin where students were targeted by the reform (similar results for the full student population are presented in Appendix Figure A2). Students just below the stricter high school eligibility threshold are 59.5 percentage points less likely to enroll in vocational programs. Instead, the probability of starting high school studies in any of the introductory programs (with a generally low probability of high school graduation) increases by 55.9 percentage points. As expected, no significant change between the groups occurs in the enrollment in academic high school programs.

Table 3: Effects of GY2011 on high school enrollment

	(1) Enrolled in vocational programs	(2) Enter introductory programs	(3) Not enrolled in high school	(4) Enrolled in academic programs
Ineligible×Post	-0.595***	0.559***	0.058***	-0.017
	(0.025)	(0.027)	(0.019)	(0.013)
Ineligible	-0.098***	0.062***	0.030***	-0.001
	(0.012)	(0.008)	(0.005)	(0.010)
Post	0.155***	0.012*	-0.000	-0.153***
	(0.010)	(0.007)	(0.004)	(0.006)
Observations	10,795	10,795	10,795	10,795
R^2	0.072	0.126	0.010	0.033
Mean dep. var.	0.671	0.088	0.034	0.186

Notes. Dependent variables are given by the column headers. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Perhaps less intuitive is the fact that the enrollment in vocational programs increases somewhat even for the control group. This is not too surprising, though, as these are the students who in the absence of the reform would have been eligible for any national high school program. The stricter requirements for academic tracks force some students with true preference for academic tracks into vocational programs.

A small fraction of students below the new eligibility threshold respond to the reform by not enrolling in high school at all immediately after compulsory school graduation. The probability increases by 5.8 percentage points among the affected students. I show later in the paper that the effect dominates among boys. Appendix Table A4 shows that the effect

Figure 4: Share of students enrolled in different high school programs before and after the reform
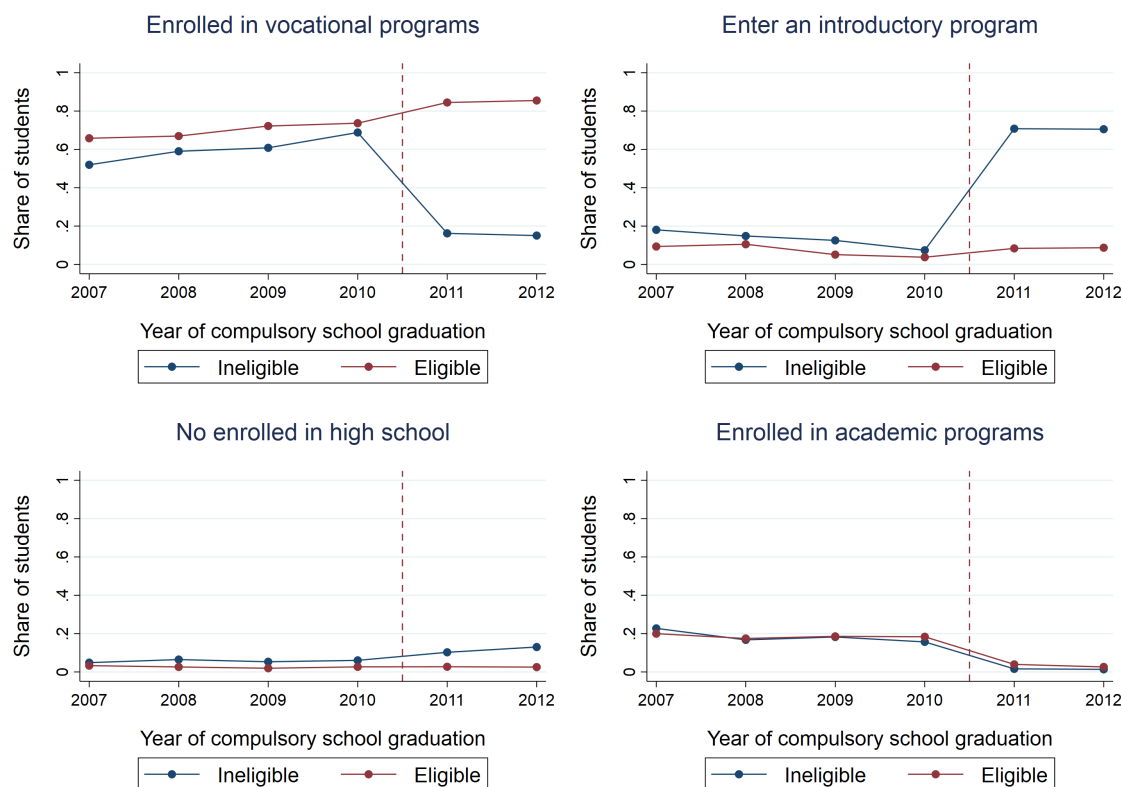
Notes. Until the school year of 2011/2012, the introductory programs were not organized in the same way but an individual option existed. The vertical dashed lines mark the introduction of the stricter high school eligibility requirements. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011.

is temporary: most of the students who do not enroll immediately, do it one year later. In line with that pattern, the fraction of students who stay in high school for a fourth or fifth year increases (12.5 and 4.1 percentage points, respectively; see Appendix Table A5). The changes reflect (partly) a mechanical effect on the prolongation of studies due to the need to spend additional time in preparatory programs before transferring to any standard high school program. Appendix Table A6 shows that the probability of completing high school studies three years after compulsory school exit declines by 9.5 percentage points, whereas the probability of high school completion four years later increases by 7.1 percentage points. The probability of completing high school at any point within five years declines, but the effect is statistically insignificant (see Appendix Table A7).

5.2 Inflow into the disability insurance system

This section answers the central research questions of the role of limited access to education on low-skilled youths' entry into the DI system. The main results are summarized in columns 1 and 2 of Table 4 and illustrated in Figure 5. The results show that the immediate inflow into the DI system increases by 5.1 percentage points among the students who do not meet the stricter eligibility requirements. Considering that on average 4.4% of the pre-reform cohorts were awarded the DI benefit at that time, the effect translates into more than a two-fold increase in the inflow of marginal students into the DI system.[25]

Adding covariates to the analysis changes the point estimates just marginally, which confirms again that the predetermined background characteristics are balanced across the groups. As the covariates increase the precision of the estimates very little, the estimates from column 1 are treated as the main findings. In the following tables I refer to these as the baseline results.

Table 4: Effect of limited access to vocational high school programs on DI take-up

	(1) DI take-up at $t+3$	(2) DI take-up at $t+3$	(3) DI take-up at $t+4$
Ineligible×Post	0.051***	0.052***	0.068***
	(0.020)	(0.020)	(0.023)
Ineligible	0.021***	0.019***	0.038***
	(0.006)	(0.006)	(0.007)
Post	0.015***	0.017***	0.022***
	(0.006)	(0.006)	(0.007)
Observations	10,795	10,795	10,795
R^2	0.006	0.019	0.009
Mean dep. var.	0.044	0.044	0.068
Controls	No	Yes	No

Notes. Dependent variables are given by the column headers. The results in column 2 are adjusted for gender, migration status and parental characteristics (DI take-up, income and education). As the data on national tests cannot be linked to the rest, the data are not used as controls. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. t denotes the year of compulsory school graduation. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

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[25]The effect is much larger than the estimates reported by Poterba et al. (2017) who show that men with a high school degree are 0.23 percentage points less likely, and women 0.34 percentage points less likely to participate in DI programs than people without a high school degree. Besides the fact that their selection-on-observables identification strategy differs from the one used in this paper, the studies focus on very different samples and margins of interest. Poterba et al. (2017) study the data on all 50–62-year-olds. I focus on much younger cohorts at the entry margin of (vocational) high school studies. Due to the nature of the new eligibility standards I focus on students from the lower end of the ability distribution, where the effects are thought to be larger.

Figure 5: Average DI take-up rate by eligibility status (Panel A) and the effect of not meeting the stricter high school eligibility standards on DI take-up (Panel B), by cohorts

(a) Average DI take-up at $t+3$ among the eligible and ineligible students
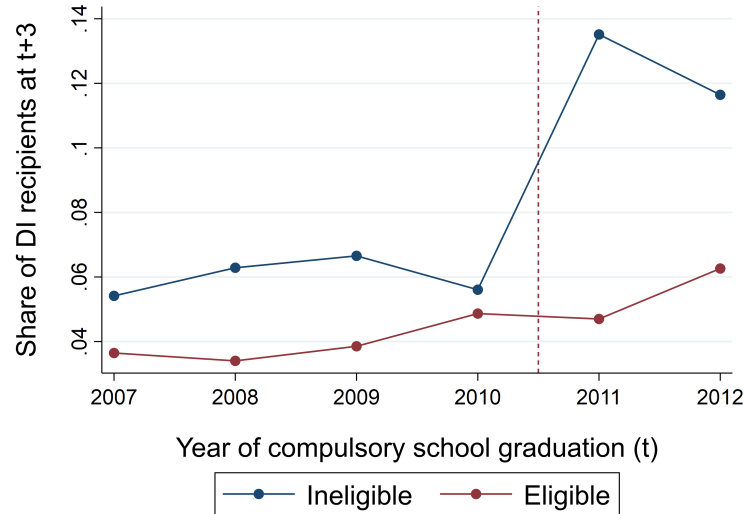
(b) Effect of not meeting the stricter high school eligibility standards on DI take-up
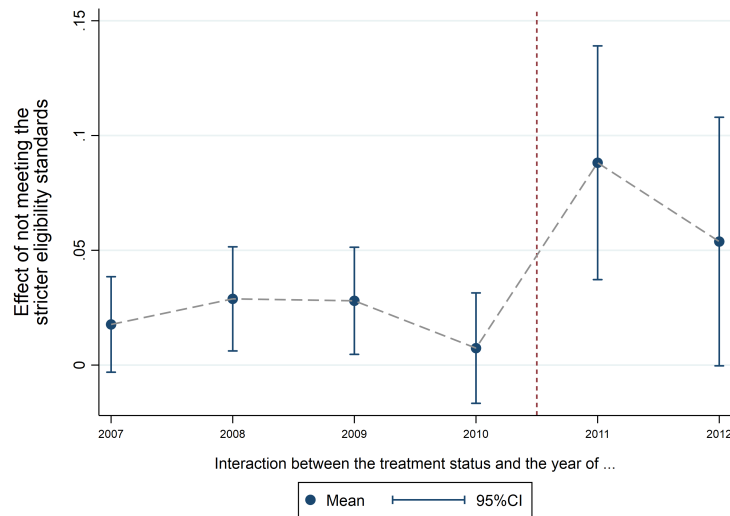
Notes. The vertical dashed lines mark the introduction of the stricter high school eligibility requirements. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011.

The results in column 3 estimate the effect of the stricter high school eligibility standards on youth DI take-up at the age of 20 (i.e. four years after compulsory school grad-

uation). The point estimate of 6.8 percentage points suggests that the effect remains large over the short follow-up period. Together with the high persistence of youth DI participation the results point at the potentially long-lasting effects of the reform on the affected students.

5.3 Placebo tests

The baseline findings are supported by a set of placebo tests which are summarized in Table 5 and illustrated in Figure 6. In the analysis presented in columns 2–4 of Table 5, I rely on the pre-reform eligibility requirement. Even if students had obtained at least five additional passing grades from grade nine but failed one of the key subjects, i.e. math, English or Swedish, they did not qualify for high school studies in vocational programs regardless of cohort. Thus, I should not see any difference in DI take-up at $t + 3$ around the threshold of five additional passing grades when focusing on the students who fail any of these key subjects. The results are very convincing, indicating that GY2011 did not affect the DI enrollment among any of the groups.

Figure 6: The baseline estimate in comparison with the placebo estimates
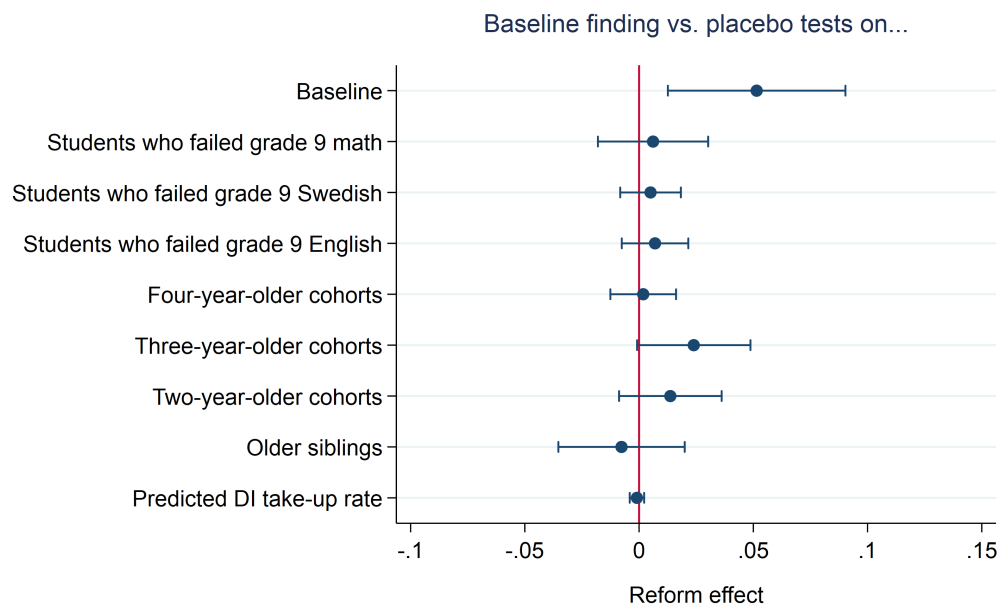
The placebo tests in columns 5–7 investigate whether the sudden increase in the ineligible students' DI enrollment rate in 2014 and 2015 may reflect a more general increase in the DI awards during these years rather than the true effect of GY2011. To study that, I create three new samples of students who graduated from compulsory school in 2005–2010 (two-year-older cohorts, column 7), 2004–2009 (three-year-older cohorts, column 6) and 2003–2008 (four-year-older cohorts, column 5), which I further split into comparable groups by eligibility status.[26] As neither the group of eligible nor ineligible students in any of these cohorts were affected by GY2011, a similar effect as observed for my main sample would call the main results in question. Reassuringly, the results show that the ineligible students did not experience any significant increase in the DI take-up rate (measured at $t+5$ and $t+7$, respectively) neither in the two- nor four-year-older cohorts. The placebo test run on the sample of compulsory school graduates of 2004–2009 (the three-year-older cohorts, DI take-up is measured at $t+6$) is the only placebo test out of the total of eight which indicates that there might have been some other factors in 2014 and 2015 that could have affected the increase in the DI enrollment.

To understand whether the students who did not meet the stricter high school eligibility standards after the reform come from families that are more likely to use DI than similar students before the reform, column 8 studies the DI take-up rate among older siblings of the people in the main sample. A sudden increase in the DI enrollment in 2014 and 2015 among the older siblings would indicate that my main findings originate from changes in students' background rather than the effect of GY2011. The results confirm that the baseline findings reflect the response to GY2011.

Lastly, column 9 of Table 5 shows the results that were already depicted in Figure 3. In that placebo test, I use the predicted DI take-up rate as an outcome instead of the actual one.[27] The results are in line with Figure 3 showing no effect of the limited access to vocational high school studies on the affected students' predicted DI take-up. This and all of the other placebo tests, apart from one, lend support to the baseline findings.

5.4 Additional robustness tests

Table 6 and Figure 7 present the results of additional robustness tests to confirm that the sample construction is not driving the findings. In column 2 of the table I estimate the effect of limited access to high school education on early DI take-up on the sample of students

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[26]I.e. I only focus on people from the cohorts who graduated from compulsory school with passing grades in math, English and Swedish. Those with 1–4 additional passing grades are defined as ineligible students and those with 5–8 additional passing grades as eligible students.

[27]The DI take-up rate is predicted as a function of gender, migration status, compulsory school GPA, parents' DI take-up, sum of parents' income, their employment status and education. National test scores cannot be used in the analysis due to different data identifiers.

Table 5: Summary of the placebo tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline	Failed grade nine ...			Older cohorts			Older siblings	Predicted DI take-up
		Math	Swedish	English	+4 yrs	+3 yrs	+2 yrs		
Ineligible×Post	0.051***	0.005	0.007	0.002	0.006	0.024*	0.014	-0.008	-0.001
	(0.020)	(0.007)	(0.007)	(0.007)	(0.012)	(0.013)	(0.011)	(0.014)	(0.002)
Ineligible	0.021***	0.002	0.001	0.000	0.039***	0.035***	0.032***	0.014**	0.015***
	(0.006)	(0.003)	(0.004)	(0.004)	(0.006)	(0.006)	(0.007)	(0.006)	(0.001)
Post	0.015***	0.021***	0.017***	0.016***	0.019***	0.016***	0.020***	0.009	-0.002***
	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.001)
Observations	10,795	28,242	23,255	22,802	13,788	13,383	15,113	11,042	10,795
R^2	0.006	0.002	0.002	0.001	0.007	0.008	0.006	0.001	0.064
Mean dep. var.	0.044	0.059	0.058	0.057	0.058	0.056	0.062	0.044	0.050

Notes. Dependent variable is DI take-up three years after compulsory school graduation for columns 1–8 and predicted DI take-up three years after compulsory school graduation for column 9. Models in different columns are estimated on different samples of students (columns 2–8) or using another outcome variable (column 9). Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

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who obtained 0–8 additional passing grades from grade nine. The main sample did not include the people who met the persistent eligibility requirement only (i.e. those with 0 additional passing grades) because it is not completely clear whether these students might have been enrolled in special schools. In columns 3–5, the main sample is restricted further by narrowing the "bandwidth" of the additional passing grades in order to better capture the unobservable characteristics that could bias the estimate. The students with only one additional passing grade may arguably be rather different from those with eight additional passing grades. As such, limiting the sample as done in the baseline analysis may not capture the unobservable characteristics well enough. In column 3, I limit the sample to 2–7, in column 4 to 3–6 and in column 5 to 4–5 additional passing grades. In the latter case, the students may be considered much more similar to each other than in the main analysis. The results show that the reform effect on DI take-up has very similar magnitude in all of the cases. Due to loss of observations, the estimates in columns 3–5 become less precise.

Figure 7: Robustness of the main finding to different sample restrictions
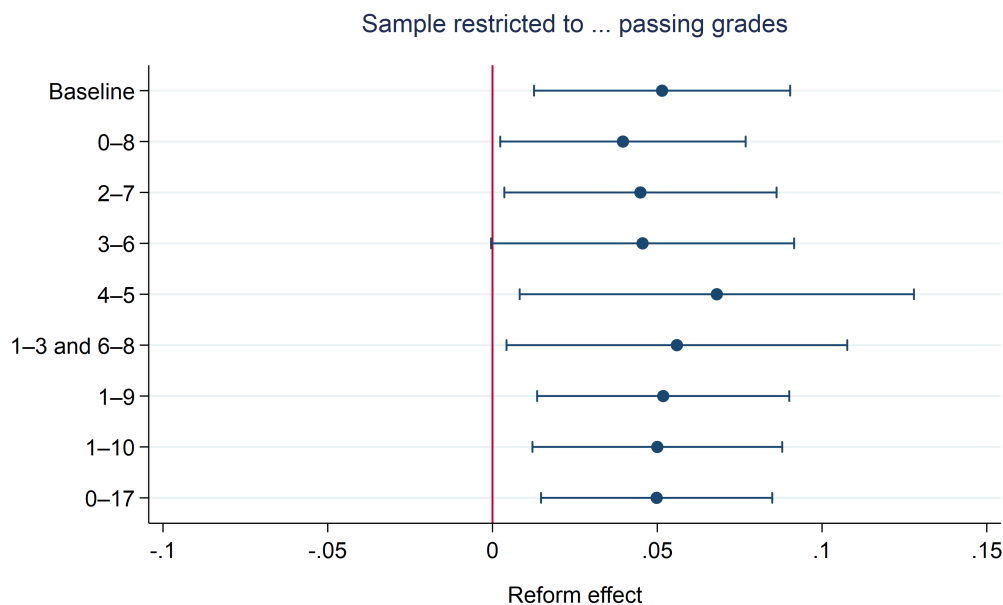
In column 6, the students just around the threshold of becoming eligible for vocational high school studies (i.e. students with four and five additional passing grades) are excluded from the sample. The incentives for manipulating the system, e.g. by being graded more leniently or asking teachers to provide them with a missing passing grade, were presumably the highest for these students. Excluding the cases at the margin does not affect the baseline findings much.

Table 6: Robustness tests on different samples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Sample restrictions based on the number of additional passing grades							
	Baseline 1–8	0–8	2–7	3–6	4–5	1–3 and 6–8	1–9	1–10	0–17
Ineligible×Post	0.051***	0.040**	0.045**	0.046*	0.068**	0.056**	0.052***	0.050***	0.049***
	(0.020)	(0.019)	(0.021)	(0.023)	(0.031)	(0.026)	(0.020)	(0.019)	(0.018)
Ineligible	0.021***	0.030***	0.010	0.002	-0.018*	0.034***	0.023***	0.028***	0.064***
	(0.006)	(0.006)	(0.006)	(0.008)	(0.011)	(0.007)	(0.006)	(0.005)	(0.005)
Post	0.015***	0.015***	0.014**	0.002	-0.019	0.022***	0.015***	0.017***	0.004***
	(0.006)	(0.006)	(0.007)	(0.009)	(0.014)	(0.006)	(0.004)	(0.003)	(0.000)
Observations	10,795	11,101	7,442	4,703	2,254	8,541	15,168	21,146	606,326
R^2	0.006	0.007	0.004	0.002	0.003	0.009	0.005	0.006	0.004
Mean dep. var.	0.044	0.047	0.048	0.053	0.056	0.041	0.041	0.036	0.006

Notes. Dependent variable is DI take-up three years after compulsory school graduation. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

In columns 7 and 8, the upper threshold is slightly increased to control for the potential bias of the baseline estimate stemming from a potentially negatively selected control group. If the control group were in fact negatively selected, my baseline findings could potentially underestimate the true effect. Including students with nine or 10 additional passing grades enables me to capture the marginal students who, by exerting extra effort, managed to obtain 1–2 additional passing grades in order to qualify for academic high school studies. The estimates are very similar to the baseline, which is a good indication that negative selection is not a concern. Column 9 finally expands the sample to full student population eligible for high school studies under the old requirements. The effect of not meeting the stricter eligibility requirements on DI take-up at the age of 19 estimated on the broad sample is still very close to the baseline estimate.

5.5   Inference

Even though the DiD estimation technique enables me to obtain the effect of GY2011 on youth DI take-up, there is a substantial literature pointing at its weaknesses when it comes to the estimation of unbiased standard errors (Bertrand et al., 2004; Cameron and Miller, 2015; Abadie et al., 2010; Brewer et al., 2013). The two main concerns that have caught attention are grouped error terms and the serial correlation common for the data used in the DiD setup. The first of the issues often arises as the unit of observation differs from the level of variation. The serial correlation tends to be especially severe as the reforms that are often used in the DiD framework (such as GY2011) tend to represent an absorbing state. The reform indicator contains the value of zero for a set of units until the reform is enforced, and switches to the value of one from that point onward. For the control group, the reform indicator is zero throughout the sample period.

In what follows, I study the robustness of the main inference by implementing different standard error corrections. Columns 2 and 3 in Table 7 first deal with the issue of potentially grouped errors terms and report two different types of clustered standard errors. In column 2, clustering is implemented at the level of cohort × number of passing grades, in column 3 only 16 clusters (clustered at the level of post-reform dummy × number of additional passing grades) are used. In both of the cases, the clustered standard errors prove to be slightly larger than the baseline ones. In spite of this, the main inference holds.[28]

To correct for the potential issue of serial correlation I rely first on the block bootstrap method suggested by Bertrand et al. (2004) (column 4, Table 7) which leads to the largest standard errors. In column 5, I ignore the time-series information altogether by collapsing the data at the pre- and post-reform level. The standard error estimates found on the

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[28]Application of the wild cluster bootstrap-t method suggested by Cameron and Miller (2015) for dealing with small number of clusters is undermined by the binary independent variable.

Table 7: Standard error corrections

	(1) Baseline	(2) Clustered s.e	(3) Clustered s.e.	(4) Bootstrapped s.e.	(5) Collapsed data
Ineligible×Post	0.051***	0.051**	0.051**	0.051**	0.051**
	(0.020)	(0.024)	(0.021)	(0.025)	(0.017)
Ineligible	0.021***	0.021***	0.021**	0.021*	0.021*
	(0.006)	(0.006)	(0.009)	(0.011)	(0.011)
Post	0.015***	0.015*	0.015*	0.015*	0.015
	(0.006)	(0.009)	(0.008)	(0.009)	(0.008)
Observations	10,795	10,795	10,795	10,795	16
R^2	0.006	0.006	0.006	0.006	0.602
Mean dep. var.	0.044	0.044	0.044	0.044	0.044
# of clusters	NA	48	16	16	8
# of bootstrap reps.	NA	NA	NA	1000	NA

Notes. Dependent variable is DI take-up three years after compulsory school graduation. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

collapsed data also support the inference drawn in Section 5.2.

5.6 Effects on labor market outcomes

Existing studies and quality reports of the DI awards indicate that not all of the beneficiaries may be truly disabled (ISF, 2011; Försäkringskassan, 2016, 2018a). While the case managers making the DI award decisions should always investigate whether the need for prolonged schooling is strongly linked to a disability or not, it has been proved to be difficult to assess (Försäkringskassan, 2018b). The literature on the substitutability between the unemployment insurance (UI) system and the DI system further suggests that at least part of the reform effect on adolescents' inflow into the DI system may occur as a response to an adverse shock to one's employment prospects (Black et al., 2002; Rege et al., 2009; Bratsberg et al., 2010). The level of the UI benefit available for young people with no previous working experience being considerably below the level of the DI benefit underlines the potential concern about the role of declined economic prospects on DI take-up even further.

GY2011 presents a negative shock to the affected students' chances in the labor market by negatively affecting their educational outcomes. The reform effects on youth high school enrollment (see Table 3) showed that the students affected by the reform were much more likely to start high school studies in introductory programs that are described by much lower graduation rate. About half of the students who started in introductory pro-

grams in 2011 dropped out of high school during the following three years, many changed between the introductory programs, and only a small share graduated from national programs in four years (Skolverket, 2014b). My results indicate a negative, albeit statistically insignificant, effect of the probability of graduating from high school within five years.

To understand whether economic incentives may have contributed to the increase in DI take-up as a response to the reform, I study the effects of GY2011 on several labor market outcomes (see Table 8, as well as Appendix Tables A10 and A11). I find a strong negative effect of failing to meet the new eligibility requirements on students' employment probability, the effect being as large as 10.6 percentage points (36% of mean employment). This result is in line with the fact that (at least) three-year high school education is important for increasing competitiveness in the labor market (see e.g. SOU, 2016). My results show further that the probability of being registered as unemployed three years after compulsory school graduation declined among the affected students as well (by 5.2 percentage points, 11.8% of mean unemployment). Conditional on being unemployed, the length of unemployment remains at the same time unaffected. The declined probability of unemployment together with the large drop in employment probability indicates a sizable decline in the labor supply of the students ineligible for vocational high school studies due to the new rules.

Table 8: Effects of GY2011 on various labor market outcomes at $t + 3$

	(1) P(Employment)	(2) P(Unemployment)	(3) Length of unemployment	(4) Labor earnings	(5) Disposable income
Ineligible×Post	-0.106***	-0.052*	6.303	-10.159***	-8.069***
	(0.027)	(0.031)	(11.089)	(2.789)	(2.589)
Ineligible	-0.043***	-0.009	12.223***	-4.774***	-0.832
	(0.011)	(0.013)	(3.815)	(1.055)	(0.983)
Post	0.060***	-0.055***	-5.966*	8.173***	6.419***
	(0.012)	(0.012)	(3.570)	(1.253)	(1.077)
Observations	10,795	10,795	4,628	10,688	10,578
R^2	0.006	0.003	0.004	0.009	0.005
Mean dep. var.	0.293	0.442	147.251	27.583	45.060

Notes. Dependent variables are given by the column headers. Employment is defined as having worked for at least one hour a week in November. Registered unemployment is defined by being registered as open unemployed or participating in some labor market program in a particular year. Length of unemployment stands for the total number of days registered in the two labor market schemes. All negative values of labor earnings and disposable income are treated as missing. Both of the variables (in thousands of Swedish kronor) are trimmed by 1% from both ends of the distributions. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. t denotes the year of compulsory school graduation. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The reform decreased annual labor earnings (measured three years after compulsory

school graduation) of the students below the new eligibility threshold as well. The affected students' earnings fell by 37%.[29] The income variables measured four years after compulsory school graduation (see Table A11) show, similarly to the main results, that the effect remains large during the short follow-up period.

The effects on labor market outcomes, while in line with the literature (Black et al., 2002; Rege et al., 2009; Bratsberg et al., 2010), are estimated in a short time window. More post-reform data are needed in order to study whether the effects persist, or reflect the increased risk of prolonged schooling among the affected students.

5.7 Different paths into the disability insurance system

The effect of GY2011 on youth DI take-up is evaluated in a context where young people could apply for the DI benefit for either declined work capacity or for completing their studies in case of permanent disability hindering their on-time graduation. While context-specific, the DI take-up for prolonged schooling is very similar to the DI take-up for declined work capacity as it tends to lead to a long benefit dependence. On average, about one third of the youth awarded the DI for prolonged schooling remain in the DI system 10 years later. At the same time, it serves as an alternative path for youth into the DI system and presents, thus, a channel for controlling the inflow.

Table 9 focuses more closely on DI take-up four years after compulsory school graduation. At $t+4$, I can further analyze the effect of GY2011 on DI take-up among those who never enrolled in high school or who enrolled, but did not graduate from high school in three years and were not enrolled in high school at $t+4$ (high school dropouts, see column 2 of Table 9), and the students who did not graduate from high school at $t+3$, but were still enrolled in school at $t+4$ (students with prolonged schooling, see column 3 of Table 9). I use the groups of high school dropouts and students with prolonged schooling as proxies for the types of DI awards. I assume that the dropouts were more likely to be awarded the benefit for declined work capacity and students still in school at $t+4$ for prolonged schooling.

Virtually none of the students who completed high school at $t+3$ were on DI a year later, but GY2011 increased DI take-up for both the dropouts and the students with prolonged schooling. Although the point estimate is slightly larger and statistically significant only for DI take-up among the students still in high school at $t+4$, the estimates do not differ statistically significantly from each other. The findings suggest that the exclusion of low-skilled youth from vocational high school studies in the presence of the specific path into the DI system may have contributed additionally to the increase in the youth

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[29]The results on labor earnings shown in tables 8, A10 and A11 include observations with zero earnings. Using log earnings and, hence, conditioning on positive earnings leads to estimates of very similar magnitude; -0.391 with robust standard error of 0.137 at $t+3$ and -0.351 with robust standard error of 0.137 at $t+4$.

Table 9: Underlying reasons for the DI participation at $t+4$

	(1) DI take-up at $t+4$	(2) Dropout $\times$ DI	(3) Prolonged schooling $\times$ DI	(4) Complete high school at $t+3 \times$ DI
Ineligible$\times$Post	0.068***	0.026	0.043**	-0.001
	(0.023)	(0.016)	(0.018)	(0.007)
Ineligible	0.038***	0.013***	0.023***	0.002
	(0.007)	(0.005)	(0.005)	(0.002)
Post	0.022***	0.011**	0.008*	0.004
	(0.007)	(0.005)	(0.004)	(0.003)
Observations	10,795	10,795	10,795	10,795
R^2	0.009	0.003	0.007	0.000
Mean dep. var.	0.068	0.029	0.031	0.008

Notes. Dependent variables are given by the column headers. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. t denotes the year of compulsory school graduation. Dropouts are defined as the students who did not graduate from high school in three years and were not enrolled in high school at $t+4$, and in this table, the definition extends to the students who never enrolled in high school. Prolonged schooling is an indicator for the students who did not graduate from high school at $t+3$, but were enrolled in school at $t+4$. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

DI take-up. However, it is worth noting that the choice of applying for DI for prolonged schooling is endogenous to the system. Without the additional channel, the youth awarded the DI benefit for prolonged schooling might have entered the system for declined work capacity. With that caveat in mind the findings emphasize on the importance of taking joint efficiency into consideration when designing different systems.

5.8 Gender heterogeneity

Lastly, the effects of restricted access to education are studied by gender. Table 10 shows that a large share of both boys and girls who did not meet the stricter high school eligibility requirements were excluded from vocational high school programs due to the reform. No change appeared in the high school enrollment rate for the affected girls. Most of them started their high school studies in introductory programs.

While starting high school studies in an introductory program is a negative outcome as it generally comes with much lower probability of high school completion than enrollment in vocational programs, the negative effects of the reform on boys seem to be more immediate. Boys are significantly more prone to opt out of school as a response to the reform. On average, 3.4% of all the boys in the main sample never enrolled in high school directly after compulsory school graduation during the pre-reform period, but for the boys excluded from regular high school programs after the reform, the share increased by 9.4

Table 10: Effects of GY2011 on various student outcomes, by gender

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Enrolled in vocational programs			Enter introductory programs			Not enrolled in high school		
	Girls	Boys	Diff.	Girls	Boys	Diff.	Girls	Boys	Diff.
Ineligible×Post	-0.610***	-0.584***	-0.026	0.636***	0.512***	0.124**	-0.001	0.094***	-0.094***
	(0.025)	(0.026)	(0.036)	(0.040)	(0.036)	(0.054)	(0.022)	(0.015)	(0.027)
Ineligible	-0.083***	-0.109***		0.056***	0.067***		0.031***	0.029***	
	(0.019)	(0.016)		(0.012)	(0.011)		(0.008)	(0.007)	
Post	0.137***	0.165***		0.025**	0.004		0.008	-0.005	
	(0.016)	(0.012)		(0.011)	(0.009)		(0.007)	(0.005)	
Observations	4,378	6,417		4,378	6,417		4,378	6,417	
R^2	0.061	0.079		0.157	0.109		0.005	0.016	
Mean dep. var.	0.666	0.675		0.077	0.096		0.034	0.034	

Notes. Dependent variables are given by the column headers. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 11: Effects of GY2011 on various outcomes, by gender

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A.	DI take-up at $t+3$			Labor earnings		
	Girls	Boys	Diff.	Girls	Boys	Diff.
Ineligible×Post	0.017	0.072***	-0.055	-4.733	-13.647***	8.914
	(0.030)	(0.026)	(0.039)	(4.917)	(3.338)	(5.943)
Ineligible	0.021**	0.020***		-5.528***	-4.026***	
	(0.009)	(0.007)		(1.437)	(1.496)	
Post	0.014	0.017**		12.733***	5.208***	
	(0.009)	(0.007)		(2.016)	(1.603)	
Observations	4,378	6,417		4,348	6,340	
R^2	0.003	0.009		0.019	0.006	
Mean dep. var.	0.051	0.040		25.130	29.323	

Panel B.	P(Employment)			P(Unemployment)		
	Girls	Boys	Diff.	Girls	Boys	Diff.
Ineligible×Post	-0.050	-0.141***	0.091	-0.067	-0.044	-0.023
	(0.048)	(0.033)	(0.058)	(0.048)	(0.039)	(0.063)
Ineligible	-0.054***	-0.035**		-0.005	-0.010	
	(0.017)	(0.015)		(0.019)	(0.017)	
Post	0.095***	0.040***		-0.069***	-0.047***	
	(0.020)	(0.015)		(0.020)	(0.016)	
Observations	4,378	6,417		4,378	6,417	
R^2	0.010	0.005		0.005	0.002	
Mean dep. var.	0.288	0.296		0.433	0.449	

Notes. Dependent variables are given by the column headers. Employment is defined as having worked for at least one hour a week in November. Registered unemployment is defined by being registered as open unemployed or participating in some labor market program in a particular year. All negative values of labor earnings are treated as missing and the variables (in thousands of Swedish kronor) is trimmed by 1% from both ends of the distributions. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. t denotes the year of compulsory school graduation. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

percentage points. The effect is at the same time temporary: most of the boys enroll in high school one year later. The share of students enrolled in high school for four years increased by the same magnitude for both boys and girls, whereas the high school dropout rate was unaffected by the reform for both groups (see Appendix Table A7).

Table 11 summarizes the findings of the reform effects on different economic outcomes by gender. The table suggests that the reform affected boys more severely than girls. The employment probability fell by 14.1 percentage points (48% of the mean employment before the reform) for boys. The decline in unemployment was 4.4 percentage points (10% of average unemployment before the reform). Although the latter estimate is imprecise, the findings suggest a large decline in the labor supply of the affected boys. The finding goes in hand with the 7.2 percentage point increase in the probability of being on DI at the age

of 19 for boys. In accordance with the results, boys' earnings were also more affected by the reform.[30] The effects on boys' outcomes at $t + 4$ (see Appendix Table A13) point at persistently large effects during the short follow-up period.

While having the same signs, albeit of lower magnitude, the reform effects on girls' outcomes are not statistically significant. Due to the noisy estimates, the differences between the outcomes of boys and girls are also insignificant. Despite the fact, the results suggest that boys were more affected by the reform both in the short-run through worsened employment prospects and (potentially) in the long-run through increased entry into the DI system which often leads to long benefit dependence. However, as noted above, more data are needed to study the extent to which the effects may be explained by prolonged schooling.

6 Conclusions

Although many studies point at the association between low level of education and enrollment in DI system, the paper is the first to estimate the causal effect of changes in the education system on DI participation. For that purpose, the effects of a Swedish high school reform that raised the high school eligibility requirements in 2011 were evaluated. Better understanding of the interactions between DI systems and educational institutions may provide policy makers with tools for controlling the inflow of youth into the DI system.

The findings first confirm that the reform prevented a set of low-skilled students from entering standard high school programs. Those with worse final grades from compulsory school were, as stipulated by the new rules, remarkably less likely to continue their studies in vocational high school programs than students meeting the new eligibility requirements. Instead, the students below the new eligibility threshold became more likely to start their high school studies in introductory programs that are generally characterized by much lower high school graduation rates. Boys responded relatively more to the reform by not enrolling in high school at all immediately after compulsory school graduation, but the effect is temporary; most of the boys enroll one year later.

The main results of the paper show that limited access to education affects the inflow of low-skilled youth into the DI system. The probability of being awarded the DI benefit more than doubled among the students who did not meet the stricter eligibility standards after the reform. Supplementary analyses suggest that the short-term labor supply of the affected students declined considerably due to the reform. The students left out of the vocational high school programs due to the stricter eligibility requirements are less likely to be both employed and registered unemployed. Their annual earnings are significantly

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[30]The effect of the reform on log earnings is 49.4% (s.e. 0.187) for boys and 27.9% (s.e. 0.198) for girls.

harmed as well. Since most of the affected students prolong their time in education due to the reform, it is important to follow up their outcomes in the long-run to see if these effects persist, or are explained by prolonged schooling.

All in all, the findings show that excluding low-skilled youth from vocational high school studies leads to potentially long-lasting detrimental consequences. Importantly, the effects are likely to go beyond the short-term effects on employment outcomes. Unlike previous studies, the paper highlights the increased probability of entering the DI system. While the results are analyzed within a short time-horizon, descriptive findings show that the early DI participation is highly persistent. Together with the auxiliary findings showing that the effect remains large during the short follow-up period, the immediate increase in DI take-up is likely to lead to a long-term benefit dependence. The adverse shock to the employment prospects may, as suggested by earlier studies, account for parts of the inflow into the DI system. Alternatively, the interaction between the institutional setup that allows for entry into the DI system for prolonged schooling and the reform that mechanically increased low-skilled students' time in education is likely accountable for (at least) parts of the change. Taken together, the paper shows unintended and potentially long-term effects of limiting low-skilled youths' access to vocational high school studies, and the findings emphasize on the importance of taking joint efficiency into consideration when designing different systems.

References

ABADIE, A., A. DIAMOND, AND J. HAINMUELLER (2010): "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program," *Journal of the American Statistical Association*, 105, 493–505.

ÅSLUND, O., H. GRÖNQVIST, C. HALL, AND J. VLACHOS (2018): "Education and Criminal Behavior: Insights from an Expansion of Upper Secondary School," *Labour Economics*, 52, 178–192.

AUTOR, D. H. (2011): "The Unsustainable Rise of the Disability Rolls in the United States: Causes, Consequences, and Policy Options," NBER Working Paper 17697, National Bureau of Economic Research.

AUTOR, D. H. AND M. G. DUGGAN (2003): "The Rise in the Disability Rolls and the Decline in Unemployment," *Quarterly Journal of Economics*, 118, 157–206.

BANKS, J., R. BLUNDELL, AND C. EMMERSON (2015): "Disability Benefit Receipt and Reform: Reconciling Trends in the United Kingdom," *Journal of Economic Perspectives*, 29, 173–90.

BEN-SHALOM, Y. AND D. C. STAPLETON (2015): "Young Social Security Disability Awardees: Who They Are and What They Do After Award," *Social Security Bulletin*, 75, 83.

BERTRAND, M., E. DUFLO, AND S. MULLAINATHAN (2004): "How Much Should We Trust Differences-In-Differences Estimates?" *Quarterly Journal of Economics*, 119, 249–275.

BLACK, D., K. DANIEL, AND S. SANDERS (2002): "The Impact of Economic Conditions on Participation in Disability Programs: Evidence from the Coal Boom and Bust," *American Economic Review*, 92, 27–50.

BRATSBERG, B., E. FEVANG, AND K. RØED (2010): "Disability in the Welfare State: An Unemployment Problem in Disguise?" IZA Discussion Papers 4897, Institute for the Study of Labor.

BREWER, M., T. F. CROSSLEY, AND R. JOYCE (2013): "Inference with Difference-in-Differences Revisited," Tech. Rep. 7742, Institute for the Study of Labor.

BRUNNER, E., S. DOUGHERTY, AND S. ROSS (2019): "The Effects of Career and Technical Education: Evidence from the Connecticut Technical High School System," EdWorking Paper 19-112.

CAMERON, A. AND D. MILLER (2015): "A Practitioner's Guide to Cluster-Robust Inference," *Journal of Human Resources*, 50, 317–372.

DOUGHERTY, S. M. (2018): "The Effect of Career and Technical Education on Human Capital Accumulation: Causal Evidence from Massachusetts," *Education Finance and Policy*, 13, 119–148.

FÖRSÄKRINGSKASSAN (2016): "Aktivitetsersättning vid nedsatt arbetsförmåga," Rättslig kvalitetsuppföljning 2016:6, Swedish Social Insurance Agency.

———— (2017): "Nybeviljande av sjukersättning och aktivitetsersättning," Rapport 013687-2017, Swedish Social Insurance Agency.

———— (2018a): "Aktivitetsersättning vid förlängd skolgång," Rättslig kvalitetsuppföljning 2018:3, Swedish Social Insurance Agency.

———— (2018b): "Aktivitetsersättning vid förlängd skolgång. En fördjupad bild av utvecklingen över tid och Försäkringskassans handläggning," Socialförsäkringsrapport 2018:7, Swedish Social Insurance Agency.

Gravseth, H. M., T. Bjerkedal, L. M. Irgens, O. O. Aalen, R. Selmer, and P. Kristensen (2008): "Influence of Physical, Mental and Intellectual Development on Disability in Young Norwegian Men," *European Journal of Public Health*, 18, 650–655.

Hassink, W. H., J. C. v. Ours, and G. Ridder (1997): "Dismissal Through Disability," *De Economist*, 145, 29–46.

Hjalmarsson, R., H. Holmlund, and M. J. Lindquist (2015): "The Effect of Education on Criminal Convictions and Incarceration: Causal Evidence from Micro-Data," *The Economic Journal*, 125, 1290–1326.

Huttunen, K., T. Pekkarinen, R. Uusitalo, and H. Virtanen (2019): "Lost Boys: Entry to Upper Secondary Education and Crime," IZA Discussion Paper. 12084, Institute for the Study of Labor.

ISF (2011): "Unga med aktivitetsersättning. Den senaste utvecklingen och hypoteser om orsakerna till utvecklingen," Rapport 2011:10, Swedish Social Insurance Inspectorate.

———— (2013): "Young Adults on Disability Benefits. A Study of Seven European Countries," Report 2013:7, Swedish Social Insurance Inspectorate.

Jacob, B. A. (2017): "What We Know About Career and Technical Education in High School," Tech. rep., Brookings Institution.

Johansson, E., O. Leijon, D. Falkstedt, A. Farah, and T. Hemmingsson (2012): "Educational Differences in Disability Pension Among Swedish Middle-Aged Men: Role of Factors in Late Adolescence and Work Characteristics in Adulthood," *Journal of Epidemiology & Community Health*, 66, 901–907.

Karnehed, N., F. Rasmussen, and K. Modig (2015): "Low IQ Has Become Less Important as a Risk Factor for Early Disability Pension. A Longitudinal Population-Based Study Across Two Decades Among Swedish Men," *Journal of Epidemiology & Community Health*, 69, 563–567.

Kemple, J. J. and C. J. Willner (2008): *Career Academies: Long-Term Impacts on Labor Market Outcomes, Educational Attainment, and Transitions to Adulthood*, MDRC New York, NY.

Koning, P. and M. Lindeboom (2015): "The Rise and Fall of Disability Insurance Enrollment in the Netherlands," *Journal of Economic Perspectives*, 29, 151–72.

Koning, P. and D. van Vuuren (2007): "Hidden Unemployment in Disability Insurance," *Labour*, 21, 611–636.

Korkeamäki, O. and T. Kyyrä (2012): "Institutional Rules, Labour Demand and Retirement Through Disability Programme Participation," *Journal of Population Economics*, 25, 439–468.

Kostol, A. R. and M. Mogstad (2014): "How Financial Incentives Induce Disability Insurance Recipients to Return to Work," *American Economic Review*, 104, 624–55.

Lochner, L. and E. Moretti (2004): "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports," *American Economic Review*, 94, 155–189.

OECD (2010): *Sickness, Disability and Work. Breaking the Barriers: A Synthesis of Findings Across OECD Countries*, OECD Publishing.

——— (2012): *Sick on the Job?: Myths and Realities About Mental Health and Work*, OECD Publishing.

——— (2014): *Mental Health and Work: Switzerland*, OECD Publishing.

——— (2015): *Fit Mind, Fit Job: From Evidence to Practice in Mental Health and Work*, OECD Publishing.

——— (2016a): *Investing in Youth: Sweden*, OECD Publishing.

——— (2016b): *Society at a Glance 2016*, OECD Publishing.

——— (2019): *Investing in Youth: Finland*, OECD Publishing.

Pearson, M. and C. Prinz (2005): "Challenging the Disability Benefit Trap Across the OECD," *Working Futures*, 135–51.

Poterba, J. M., S. F. Venti, and D. A. Wise (2017): "The Long Reach of Education: Health, Wealth, and DI Participation," NBER Working Paper 23307, National Bureau of Economic Research.

Prins, R. (2013): *Sickness Absence and Disability: An International Perspective*, New York, NY: Springer New York, 3–14.

Rege, M., K. Telle, and M. Votruba (2009): "The Effect of Plant Downsizing on Disability Pension Utilization," *Journal of the European Economic Association*, 7, 754–785.

Regeringen (2009): "Den nya skollagen – för kunskap, valfrihet och trygghet," Regeringens Proposition Prop 2009/10:165.

Riksrevisionen (2015): "Aktivitetsersättning – en ersättning utan aktivitet?" Granskningsrapport RiR 2015:7, Swedish National Audit Office.

Skolverket (2011): *Upper Secondary School 2011*, Swedish National Agency for Education.

——— (2014a): "Beskrivande data 2013. Förskola, skola och vuxenutbildning," Rapport 2014:399, Swedish National Agency for Education.

——— (2014b): "Uppföljning hösten 2014 av introduktionsprogrammens första kull," Beskrivande statistik 2014:55, Swedish National Agency for Education.

——— (2019): "Introduktionsprogram, eleverna och deras sysselsättning efteråt," Rapport 2019:484, Swedish National Agency for Education.

SOU (2016): "En gymnasieutbildning för alla – åtgärder för att alla unga ska påbörja och fullfölja en gymnasieutbildning," State Public Report SOU 2016:77.

VON WACHTER, T., J. SONG, AND J. MANCHESTER (2011): "Trends in Employment and Earnings of Allowed and Rejected Applicants to the Social Security Disability Insurance Program," *American Economic Review*, 101, 3308–3329.

Appendix

Table A1: Average DI take-up three years after compulsory school graduation among students enrolled in different high school programs or not enrolled in high school at all, full student population

	(1) Mean DI take-up	(2) S.e.	(3) N
Academic	0.006	0.000	409,169
Vocational	0.008	0.000	276,262
Introductory	0.056	0.001	69,485
No high school	0.092	0.002	13,480
Some other track	0.006	0.001	6,920

Table A2: Fraction of compulsory school graduates not meeting the persistent eligibility requirement, by cohort

Compulsory school graduation cohort	Fraction of graduates	Standard error
2007	0.117	(0.001)
2008	0.116	(0.001)
2009	0.117	(0.001)
2010	0.123	(0.001)
2011	0.124	(0.001)
2012	0.125	(0.001)

Table A3: Predetermined background characteristics in the sample and full student population

	(1)	(2)	(3)	(4)
	Sample		Population	
	Mean	S.e.	Mean	S.e.
Students' characteristics:				
Female	0.406	(0.005)	0.488	(0.001)
Not born in Sweden	0.076	(0.003)	0.077	(0.000)
Standardized result of national test in math	-0.413	(0.008)	0.002	(0.001)
Standardized result of national test in English	-0.295	(0.006)	0.003	(0.001)
Standardized result of national test in Swedish	-0.434	(0.007)	0.002	(0.001)
National test score in math missing	0.191	(0.004)	0.078	(0.000)
National test score in English missing	0.146	(0.003)	0.066	(0.000)
National test score in Swedish missing	0.144	(0.003)	0.058	(0.000)
Parents' characteristics:				
Father on DI	0.088	(0.003)	0.048	(0.000)
Mother on DI	0.142	(0.003)	0.078	(0.000)
At least one parent on DI	0.208	(0.004)	0.117	(0.000)
Father not employed	0.162	(0.004)	0.088	(0.000)
Mother not employed	0.197	(0.004)	0.105	(0.000)
Sum of parents' income (in hundreds SEK)	3,754.2	(26.3)	5,410.1	(4.8)
Mother – less than high school	0.209	(0.004)	0.109	(0.000)
Mother – high school or some post-secondary	0.666	(0.005)	0.649	(0.001)
Mother – tertiary education	0.098	(0.003)	0.216	(0.000)
Father – less than high school	0.241	(0.004)	0.152	(0.000)
Father – high school or some post-secondary	0.618	(0.005)	0.634	(0.001)
Father – tertiary education	0.060	(0.002)	0.157	(0.000)
Observations	10,795		689,069	

Table A4: Effects on probability of starting in high school at different points in time

	(1) All	(2) Boys	(3) Girls
Panel A.		*First enrolled at t+0*	
Ineligible×Post	-0.058***	-0.094***	0.001
	(0.019)	(0.026)	(0.025)
Ineligible	-0.030***	-0.029***	-0.031***
	(0.005)	(0.007)	(0.008)
Post	0.000	0.005	-0.008
	(0.004)	(0.005)	(0.007)
Observations	10,795	6,417	4,378
R^2	0.010	0.016	0.005
Mean of dependent variable	0.966	0.966	0.966
Panel B.		*First enrolled at t+1*	
Ineligible×Post	0.047***	0.075***	0.000
	(0.015)	(0.021)	(0.018)
Ineligible	0.009**	0.008	0.011*
	(0.004)	(0.005)	(0.006)
Post	-0.000	-0.005*	0.009
	(0.003)	(0.003)	(0.006)
Observations	10,795	6,417	4,378
R^2	0.006	0.012	0.002
Mean of dependent variable	0.016	0.016	0.016
Panel C.		*First enrolled at t+2*	
Ineligible×Post	-0.000	-0.001	0.002
	(0.005)	(0.005)	(0.009)
Ineligible	0.005***	0.005**	0.004
	(0.002)	(0.002)	(0.003)
Post	0.000	-0.000	0.001
	(0.001)	(0.001)	(0.002)
Observations	10,795	6,417	4,378
R^2	0.002	0.002	0.001
Mean of dependent variable	0.002	0.002	0.003
Panel D.		*Never enrolled in high school*	
Ineligible×Post	0.008	0.019	-0.010
	(0.011)	(0.016)	(0.013)
Ineligible	0.017***	0.017***	0.016***
	(0.004)	(0.005)	(0.006)
Post	0.000	0.001	-0.001
	(0.003)	(0.004)	(0.004)
Observations	10,795	6,417	4,378
R^2	0.004	0.005	0.003
Mean of dependent variable	0.016	0.015	0.016

Notes. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. *t* denotes the year of compulsory school graduation. Mean of dependent variable indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Effects on high school enrollment over time

	(1)	(2)	(3)
Panel A.		*In school at t+0*	
	All	Boys	Girls
Ineligible×Post	-0.058***	-0.094***	0.001
	(0.019)	(0.026)	(0.025)
Ineligible	-0.030***	-0.029***	-0.031***
	(0.005)	(0.007)	(0.008)
Post	0.000	0.005	-0.008
	(0.004)	(0.005)	(0.007)
Observations	10,795	6,417	4,378
R^2	0.010	0.016	0.005
Mean of dependent variable	0.966	0.966	0.966
Panel B.		*In school at t+1*	
	All	Boys	Girls
Ineligible×Post	0.000	-0.025	0.036
	(0.020)	(0.026)	(0.033)
Ineligible	-0.047***	-0.032***	-0.067***
	(0.007)	(0.009)	(0.012)
Post	-0.018***	-0.009	-0.032***
	(0.007)	(0.008)	(0.011)
Observations	10,795	6,417	4,378
R^2	0.006	0.004	0.011
Mean of dependent variable	0.929	0.933	0.924
Panel C.		*In school at t+2*	
	All	Boys	Girls
Ineligible×Post	0.002	0.022	-0.031
	(0.028)	(0.035)	(0.047)
Ineligible	-0.089***	-0.090***	-0.086***
	(0.010)	(0.014)	(0.016)
Post	-0.046***	-0.048***	-0.044***
	(0.010)	(0.012)	(0.016)
Observations	10,795	6,417	4,378
R^2	0.011	0.010	0.011
Mean of dependent variable	0.830	0.835	0.823

Table A5: Effects on high school enrollment over time (continues)

	(1)	(2)	(3)
Panel D.		*In school at t+3*	
	All	Boys	Girls
Ineligible×Post	0.125***	0.127***	0.125**
	(0.031)	(0.039)	(0.050)
Ineligible	0.003	-0.011	0.023
	(0.012)	(0.016)	(0.018)
Post	-0.075***	-0.081***	-0.065***
	(0.011)	(0.014)	(0.018)
Observations	10,795	6,417	4,378
R^2	0.005	0.005	0.005
Mean of dependent variable	0.328	0.333	0.321
Panel E.		*In school in t+4*	
	All	Boys	Girls
Ineligible×Post	0.041**	0.033	0.056*
	(0.018)	(0.022)	(0.032)
Ineligible	-0.000	-0.003	0.003
	(0.007)	(0.009)	(0.010)
Post	-0.023***	-0.024***	-0.022**
	(0.006)	(0.008)	(0.010)
Observations	10,795	6,417	4,378
R^2	0.001	0.001	0.002
Mean of dependent variable	0.079	0.080	0.077

Notes. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. t denotes the year of compulsory school graduation. Enrollment at $t + 3$ means that a student is enrolled in high school for fourth year. Mean of dependent variable indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A6: Effects on high school completion over time

	(1)	(2)	(3)
Panel A.		*Complete high school at t+3*	
	All	Boys	Girls
Ineligible×Post	-0.095***	-0.098***	-0.093**
	(0.023)	(0.030)	(0.036)
Ineligible	-0.097***	-0.086***	-0.111***
	(0.010)	(0.013)	(0.015)
Post	0.064***	0.071***	0.053***
	(0.012)	(0.015)	(0.019)
Observations	10,795	6,417	4,378
R^2	0.016	0.015	0.018
Mean of dependent variable	0.234	0.232	0.236
Panel B.		*Complete high school at t+4*	
	All	Boys	Girls
Ineligible×Post	0.071***	0.065***	0.084**
	(0.021)	(0.025)	(0.037)
Ineligible	-0.021***	-0.029***	-0.009
	(0.007)	(0.009)	(0.011)
Post	-0.010	-0.017*	0.001
	(0.007)	(0.009)	(0.012)
Observations	10,795	6,417	4,378
R^2	0.002	0.002	0.002
Mean of dependent variable	0.091	0.090	0.093
Panel C.		*Complete high school at t+5*	
	All	Boys	Girls
Ineligible×Post	0.003	0.004	0.001
	(0.011)	(0.014)	(0.018)
Ineligible	0.001	-0.001	0.004
	(0.004)	(0.006)	(0.007)
Post	-0.001	-0.003	0.002
	(0.004)	(0.005)	(0.007)
Observations	10,795	6,417	4,378
R^2	0.000	0.000	0.000
Mean of dependent variable	0.028	0.028	0.027

Notes. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. *t* denotes the year of compulsory school graduation. Mean of dependent variable indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

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Table A7: Effects on other educational outcomes

	(1)	(2)	(3)
Panel A.	*Probability of completing high school within five years*		
	All	Boys	Girls
Ineligible×Post	-0.020	-0.027	-0.007
	(0.030)	(0.037)	(0.049)
Ineligible	-0.116***	-0.116***	-0.116***
	(0.012)	(0.015)	(0.018)
Post	0.051***	0.049***	0.054***
	(0.012)	(0.016)	(0.020)
Observations	10,795	6,417	4,378
R^2	0.013	0.013	0.014
Mean dep. var.	0.353	0.350	0.357
Panel B.	*Probability of dropping out of high school*		
	All	Boys	Girls
Ineligible×Post	-0.026	-0.030	-0.020
	(0.032)	(0.041)	(0.052)
Ineligible	0.082***	0.085***	0.077***
	(0.013)	(0.017)	(0.019)
Post	0.011	0.010	0.013
	(0.012)	(0.016)	(0.020)
Observations	10,795	6,417	4,378
R^2	0.004	0.004	0.004
Mean dep. var.	0.426	0.422	0.430

Notes. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Dropouts are defined as students who did not graduate from high school three years after compulsory school graduation and who were not enrolled in any high school program four years after compulsory school graduation. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A8: Effects on DI take-up at different points in time

	(1) DI take-up at $t+2$	(2) DI take-up at $t+3$	(3) DI take-up at $t+4$	(4) DI take-up at $t+3$
Ineligible×Post	0.019*	0.051***	0.068***	0.034*
	(0.010)	(0.020)	(0.023)	(0.018)
Ineligible	0.002	0.021***	0.038***	0.019***
	(0.002)	(0.006)	(0.007)	(0.005)
Post	0.002	0.015***	0.022***	0.014***
	(0.002)	(0.006)	(0.007)	(0.005)
Observations	10,795	10,795	10,795	10,795
R^2	0.002	0.006	0.009	0.169
Mean dep. var.	0.008	0.044	0.068	0.044
Controls for lagged dep. var.	No	No	No	DI take-up at $t+2$

Notes. Dependent variables are given by the column headers. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. t denotes the year of compulsory school graduation. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A9: Event study specification of the main model

	(1) DI take-up at $t+3$	(2) DI take-up at $t+3$	(3) DI take-up at $t+4$
Ineligible×2007	0.010	0.009	0.016
	(0.016)	(0.016)	(0.020)
Ineligible×2008	0.021	0.020	0.003
	(0.017)	(0.017)	(0.020)
Ineligible×2009	0.021	0.018	0.049**
	(0.017)	(0.017)	(0.022)
Ineligible×2011	0.081***	0.081***	0.117***
	(0.029)	(0.029)	(0.035)
Ineligible×2012	0.046	0.044	0.046
	(0.030)	(0.030)	(0.035)
Observations	10,795	10,795	10,795
R^2	0.007	0.020	0.011
Mean dep. var.	0.008	0.044	0.068
Controls	No	Yes	Yes

Notes. Dependent variables are given by the column headers. The results are estimated by the model $Y_{iy} = \alpha + \sum_{y=2007, y\neq 2010}^{2012} \beta_y Ineligible_s \mathbb{1}\{year = y\} + \delta Ineligible_s + d_y + X'_{iy}\varphi + \epsilon_{iy}$. Model in column 2 controls for gender, migration status, and parental characteristics (DI take-up, income and education). As the data on national tests cannot be linked to the rest, the data are not used as controls. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. t denotes the year of compulsory school graduation. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A10: Event study specification of the models studying the effects of GY2011 on other outcomes at $t+3$, full sample

	(1) P(Employment)	(2) P(Unemployment)	(3) Length of unemployment	(4) Labor earnings	(5) Disposable income
Ineligible×2007	-0.019	0.049	7.923	1.513	2.777
	(0.032)	(0.036)	(10.651)	(3.070)	(2.867)
Ineligible×2008	0.021	0.036	6.259	2.743	2.241
	(0.033)	(0.037)	(11.320)	(3.162)	(2.892)
Ineligible×2009	-0.023	0.034	17.386	-3.825	-1.632
	(0.033)	(0.037)	(10.741)	(3.030)	(2.862)
Ineligible×2011	-0.090**	-0.014	3.186	-4.371	-2.953
	(0.041)	(0.047)	(15.631)	(4.350)	(3.882)
Ineligible×2012	-0.132***	-0.037	28.376	-16.195***	-11.621***
	(0.045)	(0.048)	(18.106)	(4.188)	(4.143)
Observations	10,795	10,795	4,628	10,688	10,578
R^2	0.008	0.005	0.010	0.013	0.007
Mean dep. var.	0.293	0.442	147.251	27.583	45.060

Notes. The results are estimated by the model $Y_{iy} = \alpha + \sum_{y=2007, y \neq 2010}^{2012} \beta_y Ineligible_y + \delta Ineligible_s \mathbb{1}\{year = y\} + \delta Ineligible_s + d_y + \epsilon_{iy}$. Dependent variables are given by the column headers. Employment is defined as having worked for at least one hour a week in November. Registered unemployment is defined by being registered as open unemployed or participating in some labor market program in a particular year. Length of unemployment stands for the total number of days registered in the two labor market schemes. All negative values of labor earnings and disposable income are treated as missing. Both of the variables (in thousands of Swedish kronor) are trimmed by 1% from both ends of the distributions. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. t denotes the year of compulsory school graduation. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A11: Effects of GY2011 on various labor market outcomes at $t+4$, full sample

Panel A.	(1) P(Employment)	(2) P(Unemployment)	(3) Length of unemployment	(4) Labor earnings	(5) Disposable income
Ineligible×Post	-0.104***	0.011	10.493	-21.861***	-12.858***
	(0.030)	(0.042)	(12.407)	(4.916)	(3.757)
Observations	10,795	9,627	5,132	10,634	10,562
R^2	0.011	0.003	0.011	0.014	0.010
Mean dep. var.	0.368	0.543	185.718	61.088	78.946
Panel B.	P(Employment)	P(Unemployment)	Length of unemployment	Labor earnings	Disposable income
Ineligible×2007	-0.065*	0.012	5.779	0.234	3.346
	(0.035)	(0.036)	(11.472)	(5.688)	(4.214)
Ineligible×2008	-0.042	0.007	11.783	5.740	7.163*
	(0.035)	(0.037)	(11.644)	(5.720)	(4.291)
Ineligible×2009	-0.046	-0.007	9.573	-2.288	0.244
	(0.035)	(0.037)	(11.372)	(5.543)	(4.164)
Ineligible×2011	-0.125***	0.015	17.728	-13.061*	-2.907
	(0.045)	(0.048)	(14.494)	(7.507)	(5.565)
Ineligible×2012	-0.162***			-30.410***	-19.103***
	(0.049)			(7.674)	(6.056)
Observations	10,795	9,627	5,132	10,634	10,562
R^2	0.012	0.004	0.013	0.017	0.012
Mean dep. var.	0.368	0.543	185.718	61.088	78.946

Notes. The results in panel B are estimated by the model $Y_{iy} = \alpha + \sum_{y=2007, y \neq 2010}^{2012} \beta_y Ineligible_s \mathbb{1}\{year = y\} + \delta Ineligible_s + d_y + \epsilon_{iy}$. Dependent variables are given by the column headers. Data on unemployment was available until 2015. Employment is defined as having worked for at least an hour a week in November. Registered unemployment is defined as being registered as open unemployed or participating in some labor market programs. Length of unemployment denotes the total number of days registered in the labor market schemes. Negative values of labor earnings and disposable income are treated as missing, and the variables (in thousands of Swedish kronor) are trimmed by 1% from both ends of the distributions. Ineligible is an indicator for not meeting the stricter high school eligibility requirements. t denotes the year of compulsory school graduation. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A12: Effects of GY2011 on additional labor market outcomes at $t + 3$, by gender

|	(1)	(2)	(3)	(4)	(5)	(6)
	Length of unemployment			Disposable income		
	Girls	Boys	Diff.	Girls	Boys	Diff.
Ineligible×Post	28.241	-7.741	35.983	-5.058	-9.681***	4.623
	(21.000)	(12.959)	(24.673)	(4.616)	(3.013)	(5.512)
Observations	1,823	2,805		4,317	6,261	
R^2	0.002	0.009		0.011	0.003	
Mean dep. var.	147.162	147.311		46.983	43.688	

Notes. Dependent variables are given by the column headers. Registered unemployment is defined by being registered as open unemployed or participating in some labor market program in a particular year. Length of unemployment stands for the total number of days registered in the two labor market schemes. All negative values of disposable income are treated as missing and the variable (in thousands of Swedish kronor) is trimmed by 1% from both ends of the distributions. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. t denotes the year of compulsory school graduation. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A13: Effects of GY2011 on various labor market outcomes at $t+4$, by gender

Panel A.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	P(Employment)			P(Unemployment)			Length of unemployment		
	Girls	Boys	Diff.	Girls	Boys	Diff.	Girls	Boys	Diff.
Ineligible×Post	-0.029	-0.149***	0.120*	-0.018	0.029	-0.047	25.535	2.126	23.409
	(0.051)	(0.036)	(0.062)	(0.066)	(0.054)	(0.085)	(21.415)	(15.132)	(26.219)
Observations	4,378	6,417		3,940	5,687		1,954	3,178	
R^2	0.014	0.010		0.002	0.003		0.007	0.014	
Mean dep. var.	0.366	0.370		0.505	0.569		184.021	186.781	

Panel B.

|	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Labor earnings			Disposable income			DI take-up		
	Girls	Boys	Diff.	Girls	Boys	Diff.	Girls	Boys	Diff.
Ineligible×Post	-5.865	-32.049***	26.184**	-5.236	-17.263***	12.027	0.028	0.091***	-0.063
	(8.307)	(6.061)	(10.282)	(6.410)	(4.576)	(7.875)	(0.036)	(0.030)	(0.047)
Observations	4,343	6,291		4,323	6,239		4,378	6,417	
R^2	0.018	0.013		0.014	0.009		0.005	0.014	
Mean dep. var.	56.453	64.395		81.452	77.153		0.076	0.063	

Notes. Dependent variables are given by the column headers. Employment is defined as having worked for at least one hour a week in November. Registered unemployment is defined by being registered as open unemployed or participating in some labor market program in a particular year. Length of unemployment stands for the total number of days registered in the two labor market schemes. All negative values of labor earnings and disposable income are treated as missing. Both of the variables (in thousands of Swedish kronor) are trimmed by 1% from both ends of the distributions. Ineligible is an indicator for not meeting the stricter high school eligibility requirements introduced in 2011. t denotes the year of compulsory school graduation. Mean dep. var. indicates mean of the dependent variable for pre-reform cohorts. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure A1: Changes in high school enrollment during the period 2007–2012
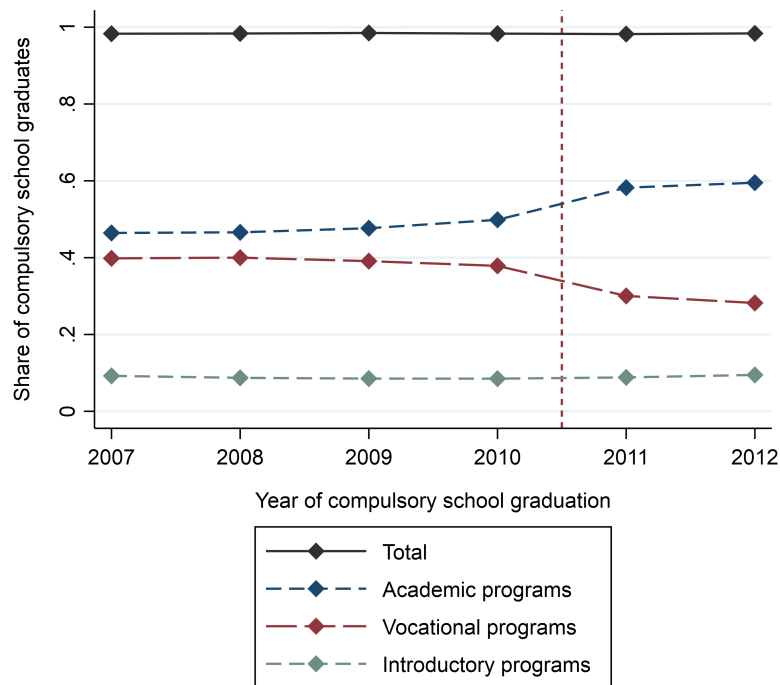
Notes. The figure shows the share of compulsory school graduates enrolling in high school (and in different high school programs) directly after compulsory school graduation. The figure (as well as the whole study) builds on data on students who obtained compulsory school education in Sweden and excludes, therefore, the majority of the students enrolled in the language introduction after the reform. The vertical dashed line marks the introduction of the stricter high school eligibility requirements.

Figure A2: Changes in high school enrollment during the period 2007–2012, full student population
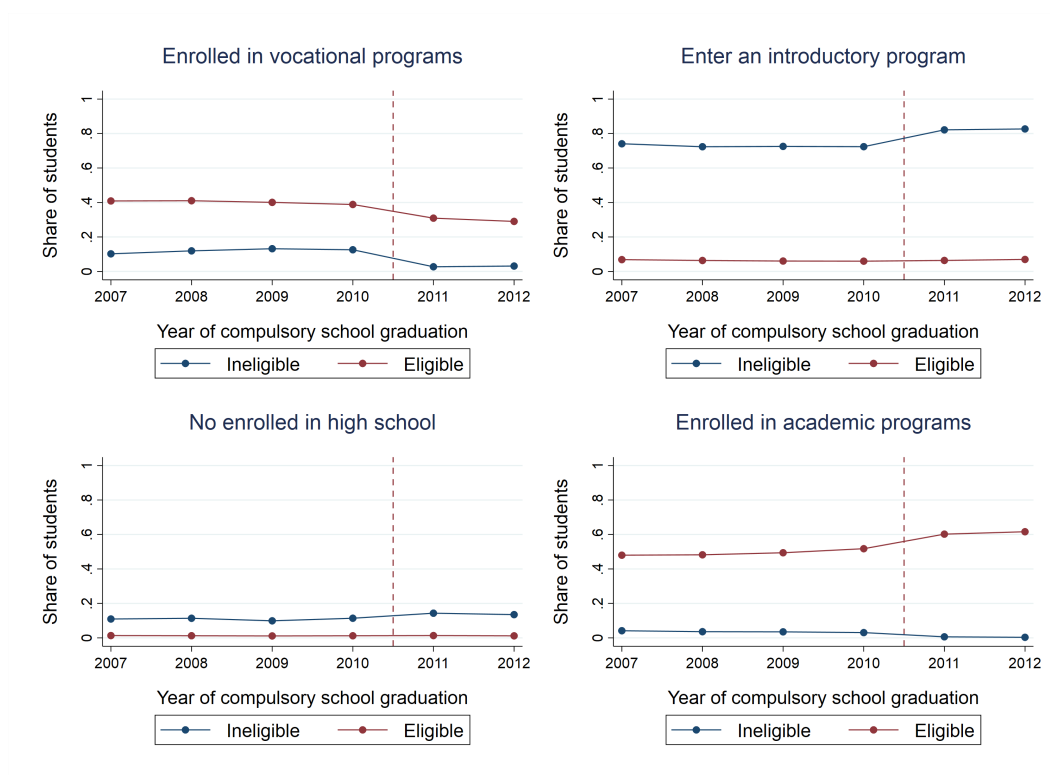
Figure A3: Survival estimates for adolescents' DI participation by the underlying reason of the DI award
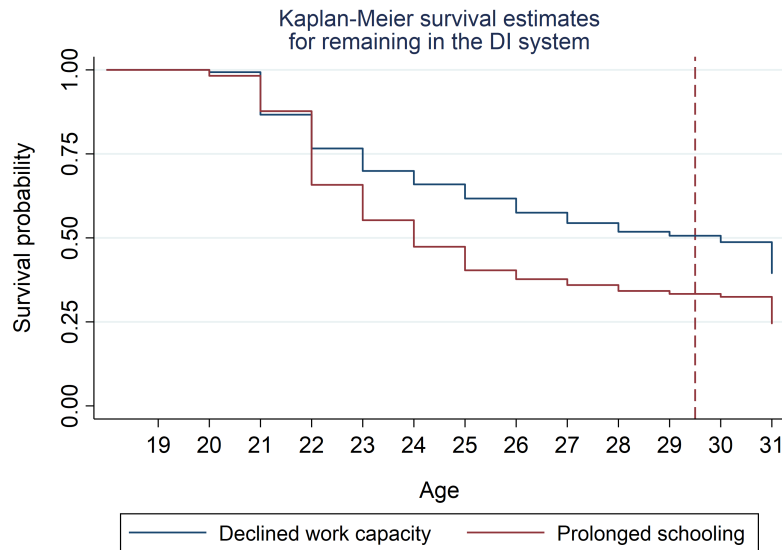
Notes. The figure plots 13 year survival estimates for remaining in the DI system for people who were awarded the activity compensation at age 19. Data for 19-year-olds in 2003–2005 are used. Only people with one continuous DI spell during the time period are included in the analysis (about 72% of all the 19-year-olds DI beneficiaries in 2003–2005). The vertical dashed line marks the end of the eligibility for the activity compensation and the beginning of the eligibility for the sickness compensation scheme for 30–64-year-olds. Students who did not graduate from high school in three years and were not enrolled in high school at $t + 4$, where t denotes the year of compulsory school graduation, are defined as high school dropouts. Students who did not graduate from high school at $t + 3$, but were enrolled in school at $t + 4$ are treated as students with prolonged schooling. Due to the lack of data on the underlying causes of the DI awards, these two categories are used as proxies for the causes. The dropouts are assumed to be more likely awarded the benefit for declined work capacity and students still in school at $t + 4$ for prolonged schooling.