The Effect of Modular Education on School Dropout

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Modular education refers to the division of conventional courses into smaller components or modules. Each module enables the students to obtain a partial certificate that can be combined into a qualification. This paper evaluates whether modular education, which is widely used in secondary and tertiary education, has been effective in reducing school dropout. For this purpose, the study exploits a policy change in the Flemish Community of Belgium, which recently introduced modular education for some programs. Using a difference-in-differences framework with diverse adoption dates per school, the results indicate that modular education may significantly reduce school dropout by 2.5 percentage points, with largest effects on the foreign ethnicity students. Therefore, modular education is likely to be an effective policy to tackle school dropout and reduce the ethnic attainment gap. Additionally, students enrolled in modular education are more likely to be employed and to incur higher earnings on the labour market.

Keywords: School Dropout; Modular education; Ethnic Minorities; Labour Market Outcomes; Difference-in-Differences.

1. Introduction

School dropout is believed to instigate various undesirable social outcomes such as crime (Cook and Kang 2016, Merlo and Wolpin 2015), teenage pregnancy (Black, Devereux and Salvanes 2008), unemployment and employment instability (Cairo and Cajner 2018, M. Li 2006), lower wages (Devereux and Hart 2010, Dolton and Sandi 2017), lower health (Groot and Maassen van den Brink 2007), lower life expectancy and lower overall happiness (Oreopoulos 2007, Oreopoulos and Salvanes 2011). Similar social outcomes at the individual level may translate into a societal burden. Eurofound (2012) puts the annual costs of school dropout in the European Union at approximately 100 billion euros, which is almost 1.1% of its GDP.[1]

Over the last two decades, both the European Union and the United States have launched policy initiatives to reduce school dropout. The European Union set out objectives in the "Europe 2020" strategy with the aim to reduce the school dropout ratio to less than 10% by 2020. Similarly, the "Dropout Prevention Act" introduced in the United States in 2004 grants funding for dropout prevention programs aimed at reducing the school dropout rate. However, school dropout continues to be a major socioeconomic challenge of the current knowledge economy. According to Eurostat (2017), there were more than 5.6 million school dropouts (11%) in the European Union in 2015 within the age group 18-24. The corresponding statistics for school dropouts without a valid school-leaving credential[2] in the United States stand at 2.5 million (5.9%) within the age group 16-24 (U.S. Department of Education 2017).

In this paper, we estimate the causal effect of modular education on high school dropout, and provide evidence on the association between modular education and labour market outcomes. Modular education is already prevalent during tertiary education in most of the OECD countries. Lately, modular education has been gaining popularity as a dropout prevention policy in secondary education.[3] Modular education divides the educational program into smaller autonomous

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[1] Calculated based on youth Not in Education, Employment or Training (NEET).

[2] For the European Union, this is a diploma upper secondary education at ISCED (International Standard Classification of Education) Level 3 (Eurostat 2017). For the United States, a valid credential is either a secondary education diploma or an equivalent credential such as a GED certificate (U.S. Department of Education 2017).

[3] Modular secondary education has been introduced in France in 1978 (Cedefop 2015). Since then, modular education has been implemented in other EU countries such as the Netherlands (in 1979), United Kingdom (in 1986), Germany

components or *modules* that bundle a set of learning outcomes (knowledge, skills and/or competences). With the completion of each module, a partial certificate is granted which can subsequently be used in the labour market to gain employment. Completion of all the modules in an education program results in obtaining the traditional educational qualification. Although the learning objectives and the material taught through the modules remains analogous to the conventional linear education program, students enjoy an increased autonomy to choose among the modules.[4]

Previous studies that analyzed modular education mainly focused on general or pre-university education. The evidence on the association between modular education and student achievement is mixed. In a descriptive study, Taverner and Wright (1997) compared students who took A-levels in the United Kingdom through modular and through linear education. They found that students in modular education scored half a grade higher on A-level mathematics. By contrast, McClune (2001) found that students who took A-levels in Northern Ireland through modular education performed worse in physics than students who took the course through linear education. Finally, the results obtained by Vidal Rodeiro and Nádas (2012) suggest that the association of modular education and student achievement depends on the course. They observed that modular education was positively associated with General Certificate of Secondary Education (GCSE) grades in mathematics, but no association was found in English.

Although these studies provide important evidence on the association between modular education and student achievement in general and pre-university education, they do not consider vocational education. Nonetheless, most students actually drop out from vocational education (European Commission 2013). Moreover, dropout in vocational education is less unequivocally negative and more multi-dimensional than in general and pre-university education (De Witte, Cabus, et al. 2013). This is because students in vocational education are trained for a specific profession and to perform specific tasks. Therefore, students may drop out of school because they have an opportunity to work in the profession they are trained for. An interesting strand of literature

(in the early 1990s), Finland (in 1999), Italy (in 1999), Hungary (in 2006), Portugal (in 2007), Belgium (in 2008), and Latvia (in 2013).

[4] Various models of modular education exist based on the reasons for modularization activity, drivers and decision-making processes, intensity of modularization and forms of modular education in practice. However, these models are beyond the scope of this paper. For more information, see Pilz (2012), and Li and Pilz (2017).

compared the dropout risk and subsequent labour market outcomes of students in general and in vocational education (Dickson and Harmon 2011, Balestra and Backes-Gellner 2017, Mazrekaj, De Witte and Vansteenkiste 2019). For instance, in Flanders, Belgium (the region studied in this paper), Mazrekaj et al. (2019) found that the labour market outcomes of students with and without a diploma differ depending on the education track a student followed in secondary education (general or vocational education). Thus, as vocational education students often have different observed and unobserved characteristics than students in other educational tracks (Chankseliani, Relly and Laczik 2016), and as dropout is more multi-dimensional in vocational education, it is unclear whether results obtained in previous studies for general and pre-university education also hold for vocational education.

To the best of our knowledge, only two studies compared student outcomes in modular and linear programs in vocational education. Pelleriaux and De Rick (2004) analyzed a small pilot modularization project in 2000 that included 1,360 vocational education students in 40 schools in Flanders, Belgium. They found that the probability of high school dropout was twice as high in linear education than in modular education. The second study that compared student outcomes in modular and linear programs in vocational education is a descriptive study by Grebe and Ekert (2017) in Germany. They found that pre-vocational education students who were in modular education were more likely to progress to vocational education than pre-vocational education students in linear education. Although these studies provide first evidence on the potential effect of modular education on student outcomes in vocational education, they suffer from an important limitation. Namely, all the studies conducted about modular education, regardless of the track, suffer from omitted-variables bias and therefore produce only descriptive statistics or correlational estimates, rather than causal effects. Consequently, due to selection bias arising from students choosing a modular rather than a linear program, these estimates may be misleading.

Using a unique administrative panel dataset from the Flemish Ministry of Education we contribute to the literature in three ways. First, we study the effect of modular education in vocational education. As mentioned above, this is interesting as dropout in vocational education is multi-dimensional and vocational education students typically come from a disadvantaged background. Therefore, they are most prone to high school dropout. Second, we provide the first causal estimates of the impact of modular education on high school dropout rate. Using a difference-in-differences framework, we exploit the variation induced by the Flemish decree of 10

July 2008, which introduced modular education for a set of vocational programs at risk of school dropout.[5] More specifically, the Flemish Ministry of Education provided a specific list of vocational programs on their website which were to become modular (Flemish Ministry of Education 2015). Consequently, starting from school year 2008-2009 and during the following two school years 2009-2010, and 2010-2011, most schools (89%), have been offering both types of education programs.[6] Within these schools who offered both types of education programs, we compare student dropout in modular education with student dropout in linear education through different years of adoption. As a last contribution, we offer first estimates on the association between modular education and subsequent labour market outcomes. To the best of our knowledge, no study has quantitatively related modular education to labour market outcomes before.

The study thus addresses two main research questions: "Does modular education causally reduce high school dropout in vocational education?", and "Is modular education correlated with higher labour market outcomes in vocational education?" As part of these main research questions, we also aim to answer whether modular education has a heterogeneous effect on high school dropout and on students' labour market outcomes by students' gender and ethnicity.

The remainder of the paper is structured as follows. Section 2 informs about the Flemish education system with a particular emphasis on the policy reform that introduced modular vocational education. Section 3 outlines potential theoretical mechanisms through which modular education may influence high school dropout and labour market outcomes. Section 4 describes the data and sample restrictions. Section 5 formulates the difference-in-differences model. Section 6 presents the estimates of the effect of modular education on diploma attainment, addresses the Parallel Trends Assumption (PTA), and concludes with the internal validity testing of the estimates with a sensitivity, placebo and exact matching analysis. This section also presents evidence of the

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[5] A small pilot modularization project was implemented in Flanders in 2000 and has been analyzed in Pelleriaux and De Rick (2004). Therefore, some of the schools may have implemented modular education already in the experimental phase. We address this issue in Section 4.1.

[6] Around 11% of the schools included only modular or only linear programs. This was because the list of programs was determined by the ministry. Therefore, some schools simply did not offer any of the listed programs before the reform, while other schools only offered the listed programs before the reform. After the reform, then, the former schools would continue offering only linear programs, while the latter schools would be offering only modular programs. We address this point in Section 2.2.

effect of modular education on labour market outcomes. The paper ends with a discussion of the results and a policy conclusion in Section 7.

2. Background

2.1. Flemish Education System

The Flemish education system provides for compulsory education beginning at the age of six and continuing until the age of 18. Both primary (grades 1 to 6) and secondary (grades 7-12) education programs last for six years each.[7] At the age of 12, students enrol into a secondary education program based on a tracking system including four principal education tracks emphasizing on general, technical, vocational and arts education. Students are not allocated to a particular track based on standardized cognitive tests or catchment areas. At the end of primary education, they choose a school that offers one or more tracks of interest partly based on the advice given by the students' primary school teacher, and partly by the parents' own aspirations. General education (*ASO*) prepares the students for tertiary education while arts education (*KSO*) combines general education with arts. Technical education (*TSO*) is focused on imparting technical knowledge that may complement tertiary education or may lead to an immediate start of a professional career after graduation. Lastly, vocational education (*BSO*) focuses on professional life and prepares students for a certain occupation.[8]

Each track in secondary education is divided into three stages. The first stage (grades 7 and 8) includes a common core curriculum to provide time to students to think about a particular track to follow in the second stage. Thus, in the first stage, there are officially no tracks and in grade 7, the curriculum is the same for all tracks, except for five lessons per week. These five lessons depend on the tracks offered by a particular school in the next two stages (Van Houtte and Stevens 2015). As previously mentioned, students have already chosen a school that offers one or more tracks of their interest. In the second stage (grades 9 and 10), students choose a particular program within a track. In vocational education, the focus of this study, students can choose between programs such

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[7] Vocational education may include an additional seventh year, see further.

[8] The Flemish education system also allows students to combine working and studying from the age of 15 onwards. Students can choose between two tracks. In part-time vocational education (*DBSO*), students spend at least two days in education and spend the rest of the week working for an employer. In Learning Time (*Leertijd*), students spend only one day in education and four days working for an employer.

as construction, wood, textiles, sales, food, hair care, jewelry and others. In the third and last stage (grades 11 and 12), students usually continue with the program chosen in the second stage. Nonetheless, some programs further split into multiple programs, for instance the program "jewelry" in second stage becomes "diamong processing", "jewelry creation", "gold and jewelry", and "clockwork repair" in the third stage.

Students in general, technical, and arts education who successfully completed the second year in the third stage (grade 12) receive a secondary education diploma. These students can either enter the labour market or continue their studies in tertiary education. In tertiary education, students can choose between an Academic Bachelor's program at a university, a Professional Bachelor's program at a university college, or an Associate degree program at the Centre for Adult Education (CVO). In contrast to students in general, technical, and arts education, students in vocational education who successfully completed grade 12 receive a certificate. Although this certificate signifies the successful completion of a vocational program and gives students access to enrol into higher vocational education at a CVO, it prevents students from enrolling into tertiary education at a university or a university college. If vocational education students wish to continue studying in either of these two institutions, they have to enrol into an additional specialization year. Students who successfully complete this additional year receive a secondary education diploma as in other tracks.

The average high school dropout rate in Flanders was 10.4% in 2016 (Flemish Ministry of Education 2018). The highest dropout rate is found in vocational education (15.5%),[9] followed by arts education (12.8%) and technical education (7.3%). Lowest school dropout rate was recorded for general education (2.5%). Upon graduation, most general education students enter tertiary education (94.6%), followed by arts education (84.9%) and technical education students (77.1%). By contrast, it is rather uncommon for vocational education graduates to continue their studies in tertiary education with only 21% enrolling for a tertiary education program.

Given the highest dropout rate and the lowest enrolment into tertiary education, vocational education track is perceived to be the least prestigious track (Van Houtte and Stevens 2015). Nonetheless, students can freely choose any track in Flanders given that the Flemish education

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[9] It should be noted that this dropout rate is observed in vocational education in 2016. In the period of study, however, namely 2005-2012, the dropout rate in vocational education was around 25%.

system does not hold entrance exams for secondary education. This often results in many students degrading between tracks during the first years of secondary education. Nonetheless, it is uncommon for students to degrade from general education track all the way to the vocational education track. Further, it has been observed that the mobility to a higher track is in practice rather exceptional in case of vocational education.

2.2. Policy Reform in Vocational Education

Before the introduction of modular education in 2008, all secondary education students followed a traditional linear education program regardless of the track. Under the linear education system, the program consisted of several courses given each year, all of which had to be successfully completed before receiving a credential for the program at the end of secondary education. For instance, a student wishing to become a hair dresser would follow the linear vocational program "hair care" in the second and third stage of vocational education and would have to complete all 8 courses in this program[10] given each year to receive a vocational education certificate. Any student dropping out of secondary education before the completion of each of the courses would therefore be forced to enter the labour market without a credential for the completion of the education program.

In 2008, however, the Flemish government started implementing modular education in the second (grades 9 and 10) and the third stage (grades 11 and 12) of secondary vocational education. The main goals of the policy were to reduce school dropout and decrease labour market mismatch by departing from the conventional all-or-nothing education programs based on large linear courses only awarding the credentials after the successful completion of the entire program. Modular education consists of many small modules in each program instead of several large courses. These modules start at any point during a school year and typically last for a period of 12 to 21 weeks. The students of modular education then choose modules that best fit their interests. For instance, the linear program "hair care" was now divided into many small modules such as "hair styling", "hair colouring", and "hair salon management". This way, students were given the freedom to choose their educational path as a student wishing to become a hair dresser for a large hair dressing company would not choose the module "hair salon management", while a student who aims to

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[10] Bio-esthetics, hair cutting for men and women, Dutch, French, religion, physical education, arts education, and applied economics.

open his own hair salon would. Moreover, the completion of each module leads to a credential. This credential has value on the labour market. A combination of several credentials eventually leads to a formal qualification.[11] Although the organisation of the systems is different, the learning objectives and the materials taught under the different education systems are analogous as defined in the standards set by the central government. Moreover, the teachers who taught linear education programs typically also taught the newly constructed modules under the modular education programs.[12]

The reform was implemented for all schools offering vocational education in Flanders. The Ministry of Education provided a specific list of 39% of the vocational programs that were to become modular[13] based on the high dropout rates in these programs (therefore, not on the dropout trends, see Section 6.2). These programs were all situated in the second and the third stage of vocational education. Therefore, modular education was not gradually introduced by grade, but rather immediately in grades 9 to 12 at the same time. The exact modules were provided by the ministry highlighting the contents of each module as well as the time duration for each module (Flemish Ministry of Education 2015). The implementation of the reform was monitored by the government through the education inspectorate and schools received no additional funding.

This process of modularization started in school year 2008-2009 and stopped in school year 2010-2011. By then, 89% of the schools were offering both modular and linear programs. Some of the schools, however, offered only modular programs (2%) or only linear programs (9%). This was because the list of programs was determined by the ministry. Therefore, some schools simply did not offer any of the listed programs before the reform, while other schools only offered the listed programs before the reform. After the reform, the former schools would continue offering only linear programs, while the latter schools would be offering only modular programs. In **Table A1** in the Appendix, we compare schools that offered only linear education or only modular education

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[11] It should be noted that under a modular system, there are also requirements on the combination of modules that constitutes a formal qualification. However, most modules are elective modules, which leads to a much higher flexibility of modular education compared to linear education.

[12] It is possible that teachers did not fully adapt to the new system. This would lead to our model underestimating the true causal effect of modular education on school dropout.

[13] This list includes various vocational programs in the following fields of study: construction, mechanics-electricity, bodily care, wood, food, textile, caretaking, auto, cooling and heat, commerce, and graphical techniques.

with schools that offered both linear and modular education on several school characteristics. We find that schools that offered only linear education were typically smaller and comprised mostly socioeconomically advantaged students who were less likely to drop out compared to schools that offered both linear as modular education. By contrast, schools that offered only modular education were typically larger and comprised mostly socioeconomically disadvantaged students at risk of school dropout. This also suggests that modular education was mainly used in programs with more disadvantaged students who typically have lower diploma attainment, as was intended by the policy.

In our analysis, we compare, within schools, students in modular education with students in linear education before and after the reform. In other words, the variation stems from the difference in dropout rates between students in modular and in linear education before and after the reform, within schools. Therefore, we focus on the majority of schools that offered both linear and modular education, and exclude schools that offered only linear or only modular education. Although this slightly reduces the external validity of the estimates, 89% of the schools offered both types of education.

In almost half of the schools that eventually offered both types of education, modular education was introduced during the school year 2008-2009 (45% of the schools). In school year 2009-2010, modular education was implemented by 36% of the schools. The remaining 19% of the schools implemented modular education during school year 2010-2011. No other significant reforms were implemented during this period. If a student was enrolled in a linear program in school year 2007-2008 and the school implemented modular education in school year 2008-2009 for this program, this student would be following a modular program in school year 2008-2009. Given that the list of programs that were imposed by the Ministry to be modular did not change over time, the difference in implementation rate is due to schools introducing modular education at a different rate. In **Table A2** in the Appendix, we present school characteristics per implementation school year. It appears that the implementation started in larger schools with a higher share of disadvantaged students, which are typically the schools with the highest dropout rates. This is intuitive given that the intervention aimed to reduce school dropout. However, as will be discussed in the next section, this does not threaten the internal validity of the analysis as we estimate the effect of modular education on school dropout within schools.

Theoretically, it is possible for a student to switch from a linear program to a modular program after the reform and vice-a-versa. If high performing students were more likely to switch from a linear to a modular program, the effect of modular education on school dropout would be overestimated, while the reverse is true if students who switched were low performing students. In practice, however, movement between modular and linear is uncommon in vocational education. Our data indicate that only 3.22% of students who were first enrolled in a linear program switched later on to a modular program or vice-a-versa. Therefore, sorting after first enrolment is unlikely to be an issue. Nonetheless, as a robustness test in Section 6.3, we perform the analysis with students who switched between the two education types excluded.

Modular education applied to incumbent students already enrolled in the second or third stage as well as to new entrants. Upon successful completion of the first stage, a student can opt for a modular program in the second stage. Thus, although sorting after first entry is unlikely to be an issue as stated above, sorting may occur at the moment that the program choice has to be made for the first time, namely at the end of first stage. Students who would have chosen for one system in the absence of the reform might now make another choice because of the reform. This is however unlikely to be the case in the Flemish setting. First, our data indicate that the share of students in (to become) modular education has remained stable throughout the school years at about 46% before and after the introduction of modular education, which started in school year 2008-2009 (see **Figure A1** in the Appendix). Second, as students are already enrolled in the first stage, schools in Flanders cannot be selective in whom they admit to participate in the modular system in the second stage. Students can freely choose a program as long as they successfully completed the first stage. Lastly, in Section 6.3, we conduct a placebo test in which we compare students enrolled in linear vocational education to students in technical vocational education which was also linear. If sorting was taking place, the composition change of students in linear vocational education should have induced a placebo treatment effect relative to those in technical education. We find that this is not the case. Consequently, we conclude that sorting of new entrants is unlikely to be driving our results.

3. Theoretical Mechanisms

3.1. Modular Education May Influence High School Dropout

Most countries have introduced modular education primarily based on the premise that modular education reduces high school dropout rate.[14] This reduction in high school dropout as a result of modular education is assumed based on four theoretical mechanisms. First, students may enjoy increased flexibility under the modular system as they have more autonomy in choosing modules (Ertl 2000). Especially in vocational education, students are overwhelmingly heterogeneous. They range from students who have a clear picture of the career they want to pursue to students who have no clear idea of their working future, and from low- to high ability students (de Bruijn and Howieson 1995, Chankseliani, Relly and Laczik 2016). It is argued that modular education allows students to choose modules that provide higher intrinsic motivation enabling them to choose a career path based on their abilities. Moreover, as programs include smaller modules that typically last a few months, switching within modular programs may be easier than switching within linear programs. This may help students who feel they made a wrong initial choice to get back on the right educational path. As a result, the flexibility of modular education may reduce the risk of high school dropout.

A second theoretical mechanism through which modular education may reduce high school dropout is partial certification. In particular, students in modular education obtain a partial certificate after the completion of each module. This partial certification may facilitate the experience of success by students and increased feedback on a regular basis, which in turn provides an increased extrinsic motivation to the students to continue the pursuance of a high school degree (Hattie and Timperley 2007). For instance, Hodgson and Spours (2003) observed that students generally like modular courses and use feedback from partial examinations to adapt to assessments in other modules.

Further, it can be argued that it is easier to accomplish a series of small short-run goals such as the completion of each module than one complex long-run goal such as the attainment of a diploma

[14] Other reasons for modular education are a better match with the labour market (see below), increased adaptability of the school system to a changing labour environment (modules are easier to update than conventional courses), increasing the (often low) status of vocational education, and promoting mobility within the EU (for more information, see Pilz, Li, Canning, and Minty (2018)).

(Locke and Latham 2002). Moreover, as modules are typically short and are assessed at the end of the module, students in modular education have an incentive to work throughout the entire school year. By contrast, students in linear education may reduce their effort in the beginning of the school year and increase their effort towards the end to improve their grades (Hayward and McNicholl 2007). For some students, however, this strategy may lead to poor results. Therefore, setting small short-run goals through modular education may lead to an increased overall effort and to a reduced risk of high school dropout.

Finally, modules are easier to update than conventional courses. Consequently, it is argued that students in modular education are less influenced by economic fluctuations than students in linear education (Pilz, Li, et al. 2018). To the extent that these economic fluctuations increase high school dropout, students in modular education may leave education at a lower rate.

The previous four theoretical mechanisms may lead to a reduction in the high school dropout rate through desirable mechanisms. However, modular education may also reduce high school dropout through an arguably undesirable mechanism. Specifically, modular education may lead to fragmentation of knowledge due to students purposely choosing for rather easy modules in order to obtain a high school diploma (Hayward and McNicholl 2007). This problem was recognized by Rust (2000) who found that pupils tend to enrol into modules just to "tick them off" instead of gaining additional knowledge about a topic. Moreover, Hennessy, et al. (2010) estimated that 46.4% of the surveyed students opted for a particular module because they thought it would be an easy option. Although this theoretical mechanism predicts that modular education may reduce high school dropout, it may also lead to a drop in educational quality.

Four other theoretical mechanisms predict that modular education may increase high school dropout. Similar to the mechanism above, modular education may lead to fragmentation of knowledge due to students being provided with insufficient or partial information and thus choosing poorly compatible modules. As a result, students may have a poor overview of the subjects and weak connection between different areas of knowledge, which may decrease their motivation for continuing education (Wilde, et al. 2006). Consequently, students may choose to drop out of high school.

A second theoretical mechanism through which modular education may exacerbate high school dropout is increased examinations. Specifically, modular education may increase teacher workload due to increased examinations and reduce teacher quality. Surveying Welsh science teachers,

Thomas (1993) found that 95% of the teachers agreed with the proposition that "illness of pupils and teachers causes greater problems under the modular system than under previous systems". Moreover, 83% were in agreement with the proposition that "it is difficult to complete the work contained in a module in the time allocated". As a result, teachers may resort to teaching to the test under the modular system, leading to a loss of learning due to exam preparation and exam taking at the end of each module (Priestley 2003). This test-oriented approach may result in test anxiety, subsequent student demotivation, and ultimately high school dropout (Cassady and Johnson 2002).

Further, it is possible that modular education increases high school dropout due to the "pull" mechanism of the labour market. Students may acquire certain skills (and partial certificates) through specific modules and deem them sufficient to enter and reside in the labour market. This way, students may complete a set of modules which they find important for a particular job, but they may not necessarily obtain a high school diploma. In addition, students may leave school because they have an opportunity to work in the profession they are trained for. Consequently, this may increase high school dropout. However, it is important to note that this increase in high school dropout may not necessarily be bad for students. Students who would have left school regardless may actually benefit from a modular system as they would now have acquired a specific set of skills which they wouldn't have acquired under a linear curriculum. Thus, although modules may increase high school dropout through this "pull" mechanism of the labour market, an increased match between education and the labour market, combined with the acquired skills through modules, may actually be positive for these school dropouts. This is why it has been argued in the literature that dropout in vocational education is less unequivocally negative and more multi-dimensional (De Witte, Cabus, et al. 2013). Finally, as mentioned above, it is argued that students in modular education may be less influenced by economic fluctuations than students in linear education due to increased adaptability of modules to economic fluctuations. Although this may lead to a lower probability of high school dropout in some situations, it may lead to an increased risk of high school dropout in other situations. If a specific economic shock increases (or decreases) high school dropout, modular education may lead to a lower (or higher) probability of high school dropout, as modules can be adapted accordingly.

3.2. Modular Education May Influence Labour Market Outcomes

Modular education may increase students' labour market outcomes in three ways. First, as stated previously, modular education may decrease high school dropout. In turn, lower high school dropout may reduce the probability of unemployment and employment instability (Cairo and Cajner 2018, M. Li 2006) and increase the probability of receiving higher wages (Devereux and Hart 2010, Dolton and Sandi 2017). Therefore, modular education may increase students' labour market outcomes through its influence on high school dropout.

Modular education may also increase students' labour market outcomes through partial certification. As described by the signalling theory of Spence (1973), employers pay a wage premium to employees with a high school diploma over the employees without a high school diploma. Not having a diploma, therefore, signals a lack of competence to a potential employer. Through partial certification obtained after the completion of each module, even the dropout students without a complete high school diploma can signal their obtained competences.[15] Consequently, modular education may lead to higher employment and earnings. Finally, signalling through partial certification under a modular system may also provide a better match between the employer and the employee. This may lead to a high satisfaction of employees with their jobs, subsequent higher productivity, and higher earnings (Somers, et al. 2019).

These potential benefits of modular education notwithstanding, modular education may also decrease students' labour market outcomes in a similar way. First, modular education may decrease students' labour market outcomes through its influence on high school dropout. Analogous to the argument made above, modular education may increase high school dropout and subsequently increase the probability of unemployment and employment instability (Cairo and Cajner 2018, M. Li 2006) and decrease the probability of receiving higher wages (Devereux and Hart 2010, Dolton and Sandi 2017). Second, as stated previously, students may choose poorly compatible modules either inadvertently or on purpose and therefore fragment their knowledge by acquiring occupation-specific skills which are unrelated. This fragmentation may lead to a larger mismatch between the employee and the employer, subsequent lower productivity, and lower earnings (Somers, et al. 2019). In sum, the influence of modular education on students' labour market outcomes mainly

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[15] Although the signalling value of modules may depend on the labour market restrictions in different countries.

depends on its influence on high school dropout and on the match between the employee and the employer.

4. Data

4.1. Dataset Construction

Data for this study come from administrative records collected by the Flemish Ministry of Education. We observe enrolment in primary and secondary education of all students in Flanders from school year 2005-2006 until school year 2011-2012. Therefore, we observe three pretreatment school years (2005-2006, 2006-2007, and 2007-2008) and four posttreatment school years (2008-2009, 2009-2010, 2010-2011, and 2011-2012). Moreover, this administrative panel dataset also includes information on the program followed and the obtained qualification. To determine whether a program would become modular, we consulted the list of modular programs provided by the Flemish Ministry of Education on their website (Flemish Ministry of Education 2015). In addition to school information, we also observe quarterly labour market outcomes from Quarter 3 in 2011 until Quarter 4 in 2013 (earnings and employment) for school leavers (graduates and school dropouts) in school year 2010-2011.

To study the effect of modular education on high school dropout, we restrict the sample in three ways. First, we solely focus on students in full time secondary vocational education. Students in part-time vocational education have been removed from the analysis. As almost all part-time vocational education programs have been modularized, including these students would lead to a comparison of students from part-time modular education with students from full time linear education. This is, however, not a proper comparison as students in part-time vocational education differ significantly from students in full-time vocational education in Flanders. In particular, they typically have a lower socioeconomic background and higher dropout rates and would be biasing our estimates downward (De Witte and Mazrekaj 2016). Therefore, to avoid endogeneity issues arising from unobserved heterogeneity bias, we have removed these students from the analysis.

As a second sample restriction, we do not include about 40 schools that participated in the pilot scheme that introduced modular vocational education in 2000. Given that these schools were already modular in the experimental phase and our dataset starts in school year 2005-2006, we would have no pre-treatment observations to analyze for these schools. As a result, we cannot perform a difference-in-differences strategy for these schools (see Section 5). Although this

restriction slightly reduces the external validity of the results, our dataset remains large, including information for 400 schools. Lastly, because we estimate the effect of modular education on school dropout, students who were in the process of obtaining a credential have been removed from the analysis as they have no outcome.

4.2. Variables Construction

Modular Education. The policy variable of interest is modular education. We construct this variable as an indicator given value of 1 if a student was enrolled into a modular program in a given school after the policy change. In an additional estimation (see Section 5), we also consider interactions between modular education and indicators for school years. This allows us to estimate how differences between modular and linear education evolve over time as well as to test whether the Parallel Trends Assumption (PTA) is likely to hold (see Section 6.2).

Outcome Variables. The outcome of interest is a high school diploma. This variable is measured as an indicator given value of 1 if a student obtained a vocational education qualification certificate and 0 if a student was a high school dropout. We define a high school diploma as a vocational education qualification certificate that students obtain at the end of the second year of third stage, in grade 12. This certificate is used by the Flemish Ministry of Education to distinguish between high school graduates and high school dropouts in vocational education (Flemish Ministry of Education 2018). Students in linear education obtain this certificate by completing all the courses, students in modular education obtain this certificate by completing a sufficient number of modules. Although a high school diploma in vocational education is technically only obtained after the completion of an additional specialization year after the 12th grade, in practice, the certificate at the end of 12th grade serves to signify a successful completion of a vocational education program and closely resembles a diploma in other tracks. Therefore, we consider the vocational education certificate to be the outcome of interest. We will refer to this outcome as diploma in the remainder the paper.

To construct the high school diploma variable, we observe the educational path of each student. First, we determine whether a student obtained a vocational education qualification certificate. This student receives a value of 1 for the high school diploma variable. Students who did not obtain this qualification are considered high school dropouts and receive a value of 0 for the high school diploma variable. Second, we determine the exact year a student left secondary education, either

as a high school graduate or as a high school dropout. Lastly, we collapse the dataset to the year of school leaving. Thus, although the study initially draws on panel data to observe the entire educational path of students, due to the nature of the outcome variable, we ultimately study a repeated cross sectional dataset in which each student is either considered a high school graduate or a high school dropout.

It should be noticed that we observe whether students dropped out before the 12th grade. If this is the case, these students receive a value of 0 for our high school diploma outcome dummy. Similarly, if students repeated a grade and obtained a diploma after compulsory education (e.g., at Age 20), these students receive a value of 1 for our high school diploma outcome.[16] Finally, we also observe changes between programs. Thus, if students changed between programs, we keep following them in the new program and subsequently observe whether these students obtained a vocational education qualification certificate or not.

For school leavers (graduates and school dropouts) in school year 2010-2011, we also observe quarterly labour market outcomes (employment and earnings). We construct employment as an indicator given value of 1 if an individual was employed and 0 if an individual was unemployed or inactive. Further, quarterly earnings are observed to fall within narrow intervals in euros. Following Trostel, Walker, and Woolley (2002), we therefore perform the analyses on the logarithm of the midpoints of the intervals.

Control Variables. Our data include three individual level characteristics that we include as control variables. These characteristics are gender, ethnicity, and mother's degree. Gender is coded as an indicator given value of 1 if the student was male and 0 if the student was female. We include this variable as gender may be an important moderator of the effect of modular education on both school outcomes and labour market outcomes. For instance, McClune (2001) found that the association between modular education and student achievement was less pronounced for boys than for girls. In addition, the literature has found that the risk of dropout is likely to be higher for boys (Almas, et al. 2016, Murnane 2013). However, boys appear to be earning more than girls (Blau and Kahn 2017).

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[16] We decided not to control for grade retention because (a) it may be endogenous to the treatment and (b) it is unclear what grade retention would mean in a modular system as a student cannot "repeat grade", only a module.

Further, we include two variables to proxy students' socioeconomic status. First, ethnicity is an indicator given value of 1 if the student was of a foreign ethnicity and 0 if the student was of a Belgian ethnicity. This is calculated based on four characteristics: (1) current nationality, (2) nationality of birth, (3) father's nationality, and (4) mother's nationality. If the answer to one of these traits is *foreign* and not *Belgian*, the student is given value of one on the ethnicity dummy. Second, we include an indicator given value of 1 if the student's mother did not finish high school and 0 if she did. We include these variables because socioeconomic status may be associated with both modular education and outcomes. On the one hand, students in modular education are likely to have a lower socioeconomic status (see Pelleriaux & De Rick (2004) for evidence in Flanders). On the other hand, socioeconomic status in general has been found to influence high school dropout and subsequent labour market outcomes (De Witte, Cabus, et al. 2013, Holmlund, Lindahl and Plug 2011, Murnane 2013, Rumberger and Palardy 2005). Therefore, to avoid selection bias on observable characteristics, it is important to control for socioeconomic status when relating modular education to school and labour market outcomes.

4.3. Descriptive Statistics

Descriptive statistics are presented in **Table 1**. The final dataset includes 95,850 students out of which 51,652 students (53.89%) were enrolled in linear programs and 44,198 students (46.11%) were enrolled in programs that were modularized starting from school year 2008-2009. As previously mentioned, we also observe gender, ethnicity, and mother's degree as covariates. As expected, the results indicate that (to become) modular programs included more students at risk of dropout than linear programs both before as after the reform. More specifically, (to become) modular programs included more males, foreign ethnicity students and students whose mother did not finish high school. We correct for these covariates in our model. Finally, before the reform, students in programs that will become modular had a lower diploma attainment rate than students in programs that will remain linear, amounting to about 1.8 percentage points. This is expected as the ministry composed the list of programs to be modularized based on the high dropout rates in these programs. However, after the reform, it appears from **Table 1** that although the diploma attainment rate in linear education only slightly increased, the attainment rate in modular education rose sharply. In particular, students in modular education significantly outperformed students in linear education by about 3 percentage points. Thus, our descriptive analysis seems to suggest that

modular education had a positive influence on diploma attainment. In the next section, we turn to the difference-in-differences model that aims to establish causality.

TABLE 1 – DESCRIPTIVE STATISTICS

	Before the reform			After the reform		
	To become modular education	Linear education	Difference (T-test)	Modular education	Linear education	Difference (T-test)
Control variables:						
Gender (1=male)	0.537	0.469	0.068*** (0.010)	0.530	0.473	0.056*** (0.007)
Ethnicity (1=foreign)	0.121	0.102	0.019*** (0.006)	0.117	0.108	0.009** (0.004)
Mother's degree (1=no high school)	0.564	0.522	0.042*** (0.008)	0.556	0.519	0.037*** (0.005)
Outcome:						
Diploma[a]	0.701	0.719	-0.018*** (0.005)	0.753	0.725	0.028*** (0.005)
Students			95,850			
		44,198 in modular education and 51,652 in linear education				
Programs			335			
Schools			400			

Notes. Standard errors are in parentheses.
a Diploma (1 is diploma, 0 is school dropout) is defined as a vocational education certificate received after successfully completing 6 grades in linear education or all the required modules in modular education.
*** Significance at the 1% level.
** Significance at the 5% level.

5. Difference-in-Differences

A difference-in-differences identification strategy is employed to compare the differences in diploma attainment among students enrolled in programs that were modularized with students in programs that remained linear, before and after the reform period, within schools. Our variation stems from the population of high schools that have been offering both conventional linear programs and modular programs after 2008. The modularization reform was implemented either immediately in school year 2008-2009 or in consequent school years 2009-2010 or 2010-2011. Given that we consider the differences within schools, we do not include schools that have been offering only one type of educational program. This is because within the schools that offered only one type of program, there is no comparison group to compare the outcomes against. Thus, as there is no variation in the variable of interest within these schools, they are not picked up by the difference-in-differences model. Drawing on Bertrand, Duflo, and Mullainathan (2004), the difference-in-differences model is formulated as follows:

$$(1) \qquad y_{ispt} = \alpha_s + \theta_p + \gamma_t + \beta M_{spt} + \delta X_{ispt} + \varepsilon_{ispt}$$

where y_{ispt} is an indicator for diploma attainment (1 is high school diploma, 0 is school dropout) of student i, in school s, program p, and school year t. The variable of interest is M_{spt}, given value of 1 if a student was enrolled into a modular program in a given school after the reform. Said otherwise, M_{spt} is an indicator for whether modular education has affected program p in school s in school year t. Thus, the coefficient β estimates the Average Treatment Effect on the Treated (ATT): the within school difference in diploma attainment between students in modular and linear education before and after the reform. Depending on the specification, we also include an indicator for gender (1 is male, 0 is female), an indicator for ethnicity (1 is foreign ethnicity, 0 is Belgian ethnicity) and an indicator for whether the student's mother did not finish high school (1 is no high school diploma, 0 is otherwise) as part of X_{ispt} in **Equation (1)**.[17] Finally, α_s, θ_p, and γ_t are vectors of school, program,[18] and school year fixed effects, respectively.[19] We cluster standard errors at the school level to account for dependence of students' outcomes within schools. Nonetheless, clustering at the program level yields analogous results.

Two points about **Equation (1)** are worth mentioning. First, we compare diploma attainment between vocational students in programs that were modularized and programs that remained linear before and after the reform, per school. For this purpose, we exploit the variation induced by 89% of the schools offering both modular and linear education simultaneously post reform. Consequently, given that we include school fixed effects, external shocks during this period would need to have a differential impact on modular and linear programs within schools. Van Landeghem et al. (2012) found that the 2008 financial crisis reduced the risk of high school dropout in Flanders as the labour market prospects for students were lower. Although it is unlikely that the financial crisis had a differential impact on modular and linear programs, even if this was the case, modular education may dampen the reduced risk of high school dropout as modular programs are likely less

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[17] We did not include an indicator for birth year due to potential collinearity with the school year fixed effects. Nonetheless, including an indicator for birth year does not affect the results.

[18] The results are also robust to the inclusion of school by program fixed effects

[19] Estimating the model including district fixed effects leaves the results virtually unchanged.

influenced by economic fluctuations than linear programs (see Section 3.1). Thus, we would expect that students in linear education benefit more from the financial crisis in terms of a reduction in high school dropout than students in modular education. As we estimate that modular education reduces high school dropout (see Section 6.1), our effect would likely be even higher in the absence of the financial crisis. In addition, Van Landeghem et al. (2012) find that although the financial crisis may reduce the risk of high school dropout for boys, girls appear to be unaffected. By contrast, our results indicate that modular education reduces high school dropout for both boys and girls.

Second, 45% of the schools implemented the reform in school year 2008-2009 (36% of the schools in school year 2009-2010 and 19% in school year 2010-2011). Given that we observe students until school year 2011-2012, students were able to react to the policy change. Therefore, it is useful to estimate the impact of modular education in the years after (and before) the policy change. In a subsequent analysis, we include leads and lags in our model and estimate the following equation (Autor 2003):

$$(2) \quad y_{ispt} = \boldsymbol{\alpha}_s + \boldsymbol{\theta}_p + \boldsymbol{\gamma}_t + \sum_{t=-q}^{-1} \beta_i \, M_{spt} + \sum_{t=0}^{m} \beta_i M_{spt} + \delta \boldsymbol{X}_{ispt} + \varepsilon_{ispt}$$

where q represents the number of leads or anticipatory effects (school years before the reform) and m represents the number of lags or post treatment effects (school years after the reform). **Equation (2)** is equivalent to using interactions between our variable of interest, modular education, and indicators for school years (Autor 2003). This allows us to estimate how differences between modular and linear education evolve over time. It should be noted that the model in **Equation (2)** also assesses the Parallel Trends Assumption (PTA). If the effect is close to zero in the years before the reform, this suggests that the PTA holds (see Section 5.2).

6. Results

This section consists of four subsections. First, we present our difference-in-differences estimates for the effect of modular education on school dropout. In addition to the overall sample, separate estimates for male and female students, on the one hand, and foreign ethnicity and native Belgian students, on the other hand, are presented to relate the results to gender and ethnicity. Second, we estimate the effect of modular education on school dropout by school year and address the Parallel Trends Assumption (PTA) underlying the difference-in-differences model. Third, to test the permeability of the results, we have estimated several alternative specifications and conducted a placebo analysis including a fabricated treatment group. Finally, we estimate the effect of modular education on subsequent labour market outcomes for a part of our sample.

6.1. The Effect of Modular Education on Diploma Attainment

Table 2 presents the results on the effect of modular education on diploma attainment. In column (1), we estimate the baseline model without controls. The results suggest that after modular education was implemented, the overall diploma attainment increased by 2.4 percentage points (from mean diploma attainment of 72%). This suggests a significant positive impact of modular education on diploma attainment. In column (2), we add control variables, namely gender, ethnicity, and mother's education. All the coefficients have the expected signs. Male students, foreign orign students, and students whose mother did not finish high school have a significantly lower probability of obtaining a vocational education diploma. Nonetheless, the modular education coefficient only slightly increases to 2.5 percentage points. Therefore, we perform the rest of the analysis on the full model with control variables.

In columns (3) to (6), we estimate our difference-in-differences model for males and females, and students of a foreign and of a Belgian ethnicity separately to capture whether the effect of modular education differs by gender and/or by ethnicity. On dividing the sample based on gender, as depicted in columns (3) and (4), it is observed in column (3) that modular education has a significantly positive effect on male students amounting to 2.4 percentage points. The effect of modular education on female students appears larger at 3.5 percentage points. However, a test of equality does not reject the hypothesis of equality of coefficients ($p = 0.376$). Thus, it appears that modular education had a similar significantly positive effect on male and female students.

In columns (5) and (6), we divide the sample by ethnicity. Column (5) indicates that modular education has a large significant positive impact on diploma attainment of students of a foreign ethnicity amounting to 7.7 percentage points (from a disturbingly low mean of 58%). Although the effect of modular education on Belgian students is also positive (2 percentage points from a mean of 77%), it is not as pronounced as the effect on students of a foreign ethnicity.[20] Thus, it appears from an analysis of the impact of modular education on diploma attainment based on ethnicity as in columns (5) and (6) that modular education may reduce the educational attainment gap between foreign ethnicity students and their native Belgian peers. Given the very low average attainment of foreign ethnicity students, it seems that modular education particularly targets the population of students that are most in need of dropout prevention policy.

TABLE 2 – THE EFFECT OF MODULAR EDUCATION ON DIPLOMA ATTAINMENT

	Full sample		Males	Females	Foreign	Belgian
	(1)	(2)	(3)	(4)	(5)	(6)
Modular education	0.024***	0.025***	0.024***	0.035***	0.077***	0.020***
	(0.007)	(0.007)	(0.008)	(0.010)	(0.022)	(0.006)
Gender (1=male)		-0.116***			-0.131***	-0.114***
		(0.006)			(0.019)	(0.006)
Ethnicity (1=foreign)		-0.133***	-0.113***	-0.151***		
		(0.009)	(0.010)	(0.012)		
Mother's degree		-0.084***	-0.088***	-0.078***	-0.043***	-0.088***
(1=no high school)		(0.003)	(0.005)	(0.005)	(0.012)	(0.003)
Fixed effects:						
School year	Yes	Yes	Yes	Yes	Yes	Yes
Program	Yes	Yes	Yes	Yes	Yes	Yes
School	Yes	Yes	Yes	Yes	Yes	Yes
Students	95,850	95,850	50,452	45,398	10,233	85,617
Mean diploma in linear education	0.72	0.72	0.69	0.75	0.58	0.77

Notes. The table reports difference-in-differences estimates. Standard errors clustered at the school level are in parentheses.
*** Significance at the 1% level.

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[20] A test of equality of coefficients for foreign ethnicity and native Belgian students rejects the null hypothesis of equality of coefficients ($p = 0.009$).

6.2. Parallel Trends Assumption and Treatment Effect by School Year

This difference-in-differences identification strategy mainly relies on the Parallel Trends Assumption (PTA).[21] This ensures that the difference in diploma attainment of the vocational students before and after modularization reform is exclusively a result of the implemented educational reform and not a direct consequence of any other observed or unobserved factors. Stated differently, in the absence of the intervention, the dropout rate of the two groups would evolve analogously. We assess the PTA empirically. For this purpose, we include leads (anticipatory effects) and lags (post treatment effects) in the model as in equation (2) presented in Section 4. In the analysis, we omit school year 2005-2006 as the reference school year.

Figure 1 displays the results. We find no evidence of anticipation effects during the pre-reform period. As the coefficients in school years 2006-2007 and 2007-2008 (prior to the reform) are small and not significantly different from zero, they suggest that the Parallel Trends Assumption is likely to hold. Further, modular education appears to positively affect diploma attainment in the school year of adoption, 2008-2009. This significantly positive effect of modular education persists in the following three school years. In particular, we observe a significantly positive effect ranging from 2.4 to 3.2 percentage points for the post-reform period. In the first and the last observed post-reform school years, the positive effect of modular education appears to be smaller. However, these effects are not significantly different from the other two post-treatment effects ($p = 0.319$). Summarily, we assert on the basis of our findings that the Parallel Trends Assumption is likely to hold and that the positive effect of modular education persists in the years after the introduction of modular education.

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[21] It should be noted that the PTA is a necessary condition to identify the causal effect of modular education on school dropout. To be sufficient, it is needed that no relevant time-varying unobserved heterogeneity is present. However, as already stated, no other relevant policies occurred simultaneously. Moreover, we are not aware of any time-varying factors that could influence modular and linear education differently within schools. Therefore, we assume that this condition is likely to hold.
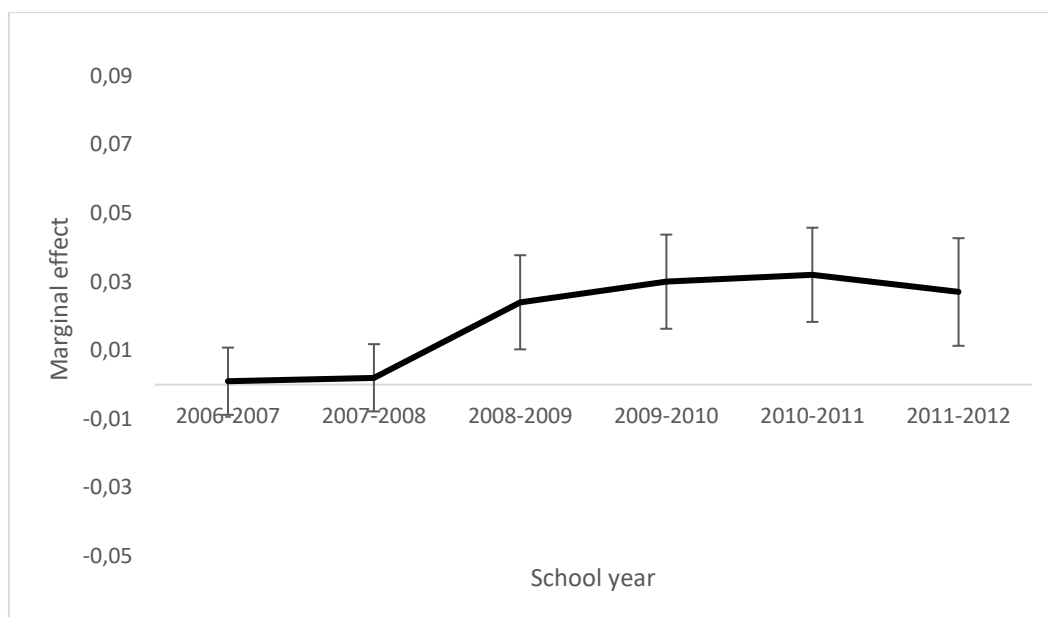
FIGURE 1 – ESTIMATED IMPACT OF MODULAR EDUCATION ON DIPLOMA ATTAINMENT FOR YEARS BEFORE, DURING, AND AFTER ADOPTION OF MODULAR EDUCATION

Notes. School year 2005-2006 has been omitted as the reference school year. Vertical bands represent +/- 1.96 times the standard error of each point estimate. The figure shows no anticipation effect in the school years prior to the reform (2006-2007 and 2007-2008), a positive effect in the school year of adoption (2008-2009) and a persistent positive effect in subsequent school years 2009-2010, 2010-2011 and 2011-2012.

6.3. Alternative Specifications

In **Table 3**, we estimate several alternative specifications to verify the internal validity of our results. First, we include program-specific time trends. Given that modular education was adopted at different points in time, we might wonder whether the treatment effect we observe has absorbed differences between treated units due to an underlying time trend (Besley and Burgess 2004). The effect of 2.4 percentage points in column (1) indicates that the inclusion of program-specific time trends does not alter the significantly positive effect of modular education on diploma attainment amounting to 2.5 percentage points obtained in **Table 2**.

In the second specification, we consider solely the students who did not switch from modular to linear education or vice-a-versa. As previously mentioned, movement within programs is uncommon in vocational education. Only 3.22% of students who were first enrolled in a (to become) modular program later on switched to a linear program or vice-a-versa. Consequently, the compliance rate to the new reform was likely to be very high. Nonetheless, in column (2) we estimate the difference-in-differences model without the switchers. The effect of modular

education on school dropout is at 2.3 percentage points very similar to the effect of 2.5 percentage points obtained in the full sample.

A third robustness test includes a placebo analysis to assure that our results are not spurious. A placebo analysis is commonly performed in two distinct ways - by introducing a simulated treatment prior to the real treatment date or by constructing a placebo treatment group. Given that the treatment happened at different points in time, we solely perform the second type of placebo analysis, i.e. we construct a placebo treatment group. If the placebo difference-in-differences estimate is significantly different from zero, the assumptions made are not valid and the difference-in-differences estimates obtained previously are likely to be biased. Consequently, we construct the placebo treatment group by first removing all students enrolled in modular education in the first place. Next, we treat all vocational education students enrolled in linear education as the treatment group. As a control group, we consider students from technical education.[22] These students were not subjected to modular education. Consequently, it should be noted that none of the students included in both groups actually received the treatment. In practice, they were all enrolled in linear education. Lastly, we estimate the difference-in-differences model in column (3). As expected, the impact of modular education on diploma attainment using a placebo treatment group which in practice was not enrolled in modular education turns out to be close to zero and statistically insignificant. This result also provides a case against sorting of new entrants. If sorting was taking place, the composition change of students in linear vocational education should have induced a placebo treatment effect relative to those in technical education. Our results suggest that this is not the case.

Finally, in the last specification, we perform exact matching before estimating the difference-in-differences model as suggested by Abadie (2005). This technique selects every student who was subjected to modular education (as part of the treatment group), and a corresponding student from the control group not subjected to modular education but having exact same values on certain observed characteristics. Thereby, exact matching is applied on variables used in the initial analysis, namely gender, ethnicity and mother's education as well as on school. We are able to find multiple exact matches for 96% of the students from the treatment group. Column (4) indicates that exact matching produces a similar effect to the initial result of 2.5 percentage points.

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[22] Note that the variation stems from schools who offered both the vocational as the technical track.

TABLE 3 – ALTERNATIVE SPECIFICATIONS

	Program-specific time trend	Without switchers[a]	Placebo[b]	Exact matching[c]
	(1)	(2)	(3)	(4)
Modular education	0.024***	0.023***	0.004	0.030***
	(0.007)	(0.006)	(0.003)	(0.004)
Gender (1=male)	-0.116***	-0.115***	-0.101***	
	(0.006)	(0.006)	(0.005)	
Ethnicity (1=foreign)	-0.133***	-0.137***	-0.130***	
	(0.009)	(0.009)	(0.007)	
Mother's degree	-0.084***	-0.083***	-0.086***	
(1=no high school)	(0.003)	(0.003)	(0.003)	
Fixed effects:				
School year	Yes	Yes	Yes	
Program	Yes	Yes	Yes	
School	Yes	Yes	Yes	
Students	95,850	92,762	143,305	83,201

Notes. The table reports difference-in-differences estimates. Standard errors clustered at the school level are in parentheses.
[a] Switchers are students who moved from a linear to a modular program or vice-a-versa.
[b] The placebo analysis compares vocational education students in linear programs (treatment group) with technical education students in linear programs (control group). Both groups were not subjected to modular education.
[c] Exact matching is performed on control variables used in the initial analysis, namely gender, ethnicity, and mother's education, as well as on school.
*** Significance at the 1% level.

6.4. The Effect of Modular Education on Labour Market Outcomes

In this section, we investigate the impact of modular education on labour market outcomes of students in vocational education after leaving school. However, the impact of modular education on labour market outcomes is solely calculated for school leavers in school year 2010-2011 (we only possess labour market data for these students). As mentioned in Section 4.1, these individuals are either dropouts or graduates who were enrolled in vocational education in school year 2010-2011 but were no longer enrolled in secondary education in school year 2011-2012. The labour market outcomes are observed for each quarter after school leaving starting from Quarter 3 in 2011 (as for the first two quarters of 2011, an individual is still in education) until Quarter 4 in 2013.

The results are summarized in **Table 4**. It appears from column (1) that students enrolled in modular education programs are 7.1 percentage points more likely to be employed than students enrolled in linear education (from a baseline employment rate of 67%). Moreover, students enrolled in modular education incur 5.5% more earnings once employed. In the Appendix, we present the effect of modular education on labour market outcomes by quarter. In general, the effect of modular education on employment (**Figure A2**) remains significantly positive throughout the quarters with

a decreasing trend. The effect of modular education on earnings (**Figure A3**) also shows a decreasing trend, but loses significance in the last quarter.[23]

By gender, we find significantly positive effect of modular education on both employment as earnings for both males in column (2) and females in column (3). Although the effect appears to be larger for males, it is only significantly larger for earnings at the 10% level ($p = 0.072$), and not significantly larger for employment ($p = 0.365$). By ethnicity, columns (4) and (5) show positive coefficients on both employment and earnings for both foreign ethnicity as native Belgian individuals. However, the effect on earnings is only significant for natives. This is likely a consequence of the lower sample of foreign ethnicity individuals as a test of equality of coefficients does not reject the null hypothesis of equal coefficients ($p = 0.478$). In sum, the results suggest that modular education has a positive impact on employment and earnings in the two years after leaving high school.

TABLE 4 – THE EFFECT OF MODULAR EDUCATION ON QUARTERLY LABOUR MARKET OUTCOMES FOR 2010-2011 VOCATIONAL EDUCATION SCHOOL LEAVERS

	Full sample	Males	Females	Foreign	Belgian
	(1)	(2)	(3)	(4)	(5)
Outcomes[a]:					
Employment (1=employed)	0.071***	0.081***	0.057***	0.072***	0.074***
	(0.014)	(0.020)	(0.019)	(0.026)	(0.015)
Log gross earnings	0.055***	0.081***	0.040**	0.035	0.054***
	(0.013)	(0.020)	(0.016)	(0.025)	(0.016)
Fixed effects:					
Year x quarter	Yes	Yes	Yes	Yes	Yes
School	Yes	Yes	Yes	Yes	Yes
Additional controls[b]	Yes	Yes	Yes	Yes	Yes
Individuals[c]	14,387	8,023	6,364	3,528	10,859

Notes. The table reports regression estimates. Standard errors clustered at the school level are in parentheses. Modular education is measured as an indicator given value of 1 if a student was enrolled in modular education and 0 if a student was enrolled in linear education.
[a] Outcomes are observed by quarter, from Quarter 3 in 2011 until Quarter 4 in 2013 (as for the first two quarters of 2011, an individual is still in education).
[b] Control variables include age, gender (1=male), ethnicity (1=foreign), and mother's education (1=no high school diploma).
[c] Earnings are estimated for the sample of employed individuals.
*** Significance at the 1% level.
** Significance at the 5% level.

[23] It should be noted, however, that sample sizes may differ by quarter as the model has been estimated for the sample of employed individuals. Moreover, multiple testing phenomenon may play a part. These results should therefore be interpreted with caution.

It should be noted that these results are merely suggestive as we only possess labour market outcomes for individuals who left education in school year 2010-2011. We are, therefore, unable to perform the difference-in-differences analysis as in previous sections. Moreover, as displayed in **Figure 1**, the effect of modular education is likely to be higher in 2010-2011 than in the initial school year of adoption (2008-2009). Finally, our results show that the introduction of modular education improved the probability of obtaining a diploma, which may itself lead to higher labour market outcomes. Overall, these results should be interpreted with caution.

7. Discussion

This paper estimates the effect of modular education on high school dropout. Modular education has been widely used in vocational education and training programs based on the premise that it significantly reduces school dropout rate. Our results validate and justify this claim as the current findings suggest that students enrolled in modular education have a lower probability of dropping out than students enrolled in linear education by 2.5 percentage points from a baseline dropout rate of 28%. Thus, our results are in line with most of the previous descriptive and correlational literature that estimated a positive association between modular education and student achievement in general and pre-university education (Taverner and Wright 1997, Vidal Rodeiro and Nadas 2012). Moreover, the positive effect of modular education is also similar to the results obtained by Pelleriaux and De Rick (2004) who studied a small pilot project in Flemish vocational education in 2000.

Although the effect appears to be positive for both boys and girls as well as foreign and native Belgian ethnicity students, this positive effect on the school dropout rate is largest for the foreign ethnicity students. In particular, we find that modular education decreases the school dropout rate by 2 percentage points for the native Belgian students and by as much as 7.7 percentage points for the foreign ethnicity students (from a disturbingly high baseline dropout rate of 42% for foreign ethnicity students). Consequently, our results propose that modular education may be an important tool to enable students of a foreign ethnicity – who are typically vulnerable to school dropout (Baert and Cockx 2013) – to come at par with the native Belgian students (without exacerbating the dropout rate of the latter). Modular educational reforms could successfully reduce the large gap in diploma attainment between the foreign ethnicity students and the local students. Lastly, this study

also provides suggestive evidence that modular education has a positive impact on students' employment and earnings up to two years after leaving high school.

The mechanisms that may explain the positive impact of modular education on diploma attainment are increased flexibility in choice of modules, partial certification, and goal-setting. First, in modular education, students enjoy greater flexibility to choose their own educational path in accordance to their interests. Modular education allows students to choose modules that provide them the highest intrinsic motivation, such that the risk of school dropout is likely to reduce significantly. Second, partial certification may lead to a more frequent experience of success and more feedback, resulting in an enhanced extrinsic motivation for students to continue pursuing a high school degree (Hattie & Timperley, 2007). This also may explain why the results are primarily driven by the reduction in dropout rates of foreign ethnicity students. These students typically face a difficult socioeconomic home and school environment. A feeling of success induced by partial certification in modular education may increase these students' self-confidence and reduce their dropout significantly. Third, the psychological literature on goal-setting suggests that it may be easier to accomplish a series of short-run goals such as the completion of each module than one complex long-run goal such as the attainment of a diploma.

Although the above mechanisms suggest that the reduction in high school dropout is likely to be beneficial, this may not necessarily be the case for two reasons. First, students may have purposely chosen for easier modules to obtain a high school diploma and have therefore fragmented their knowledge, resulting in lower educational quality. Second, dropout in vocational education is multi-dimensional and students may be leaving school because they have an opportunity to work in the profession they are trained for. By leading to a reduction in high school dropout, modular education may have actually reduced the match between students and their subsequent jobs. Nonetheless, both these mechanisms are unlikely to play a role in our setting. In addition to the effect of modular education on high school dropout, we also estimated the association between modular education and students' labour market outcomes. As we found that modular education increases labour market outcomes, it is likely that the reduction in school dropout was beneficial for students.The present study suffers from three main limitations. First, we only possess labour market outcomes for individuals who left education in school year 2010-2011. We were therefore unable to perform the difference-in-differences analysis for labour market outcomes due to data limitations unlike for school dropout. Moreover, we did not possess any data on labour market

mismatch that modular education typically attempts to reduce as well. Further, we only possess quantitative data with no complementary qualitative data pertaining to the reasons for such an occurrence. Thus, additional qualitative data should be gathered by means of surveys and interviews with students and staff to investigate the underlying causes of this positive effect. In addition, the relationship between modular education, the financial crisis, and high school dropout should be further analyzed. Finally, we studied the effect of modular education in vocational education. It would be interesting to investigate whether this effect differs in other educational tracks. Further research should address these issues.

Appendix

TABLE A1 – SCHOOL CHARACTERISTICS BY TYPE OF EDUCATION OFFERED

	Modular and linear	Only modular	Only linear
	(1)	(2)	(3)
Number of students	543	639*	477*#
Students with mother without degree	0.362	0.410*	0.274*#
Students who do not speak Dutch at home	0.134	0.299*	0.073*#
Students with social assistance	0.335	0.404*	0.288*#
Students from poor neighbourhood	0.287	0.401*	0.227*#
Diploma attainment	0.727	0.592*	0.753*#
Number of schools	400	10	42

Notes.
* The coefficient is significantly different from the baseline coefficient of modular and linear education in column (1) at the 5% level using a t-test.
# The coefficient is significantly different from the baseline coefficient of only modular education in column (2) at the 5% level using a t-test.

	2008-2009	2009-2010	2010-2011
	(1)	(2)	(3)
Number of students	595	530*	476*[#]
Students with mother without degree	0.396	0.353*	0.301*[#]
Students who do not speak Dutch at home	0.182	0.145*	0.101*[#]
Students with social assistance	0.340	0.336	0.323*[#]
Students from poor neighbourhood	0.312	0.295*	0.269*[#]
Diploma attainment	0.698	0.731*	0.755*[#]
Number of schools	179	144	77

Notes. These schools offered only linear programs before the reform, and both linear as modular programs after the reform.

* The coefficient is significantly different from the baseline coefficient of school year 2008-2009 in column (1) at the 5% level using a t-test.

[#] The coefficient is significantly different from the baseline coefficient of school year 2009-2010 in column (2) at the 5% level using a t-test.
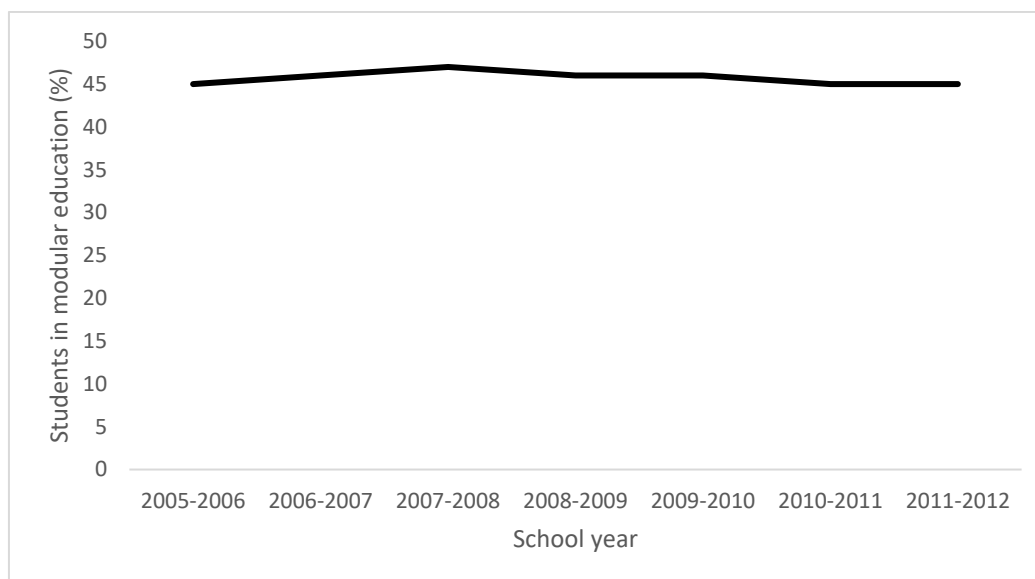
FIGURE A1 – STUDENTS IN (TO BECOME) MODULAR EDUCATION BY SCHOOL YEAR
Notes. The figure shows that the share of students in (to become) modular education has remained stable at about 46% before and after the introduction of modular education, which started in school year 2008-2009.
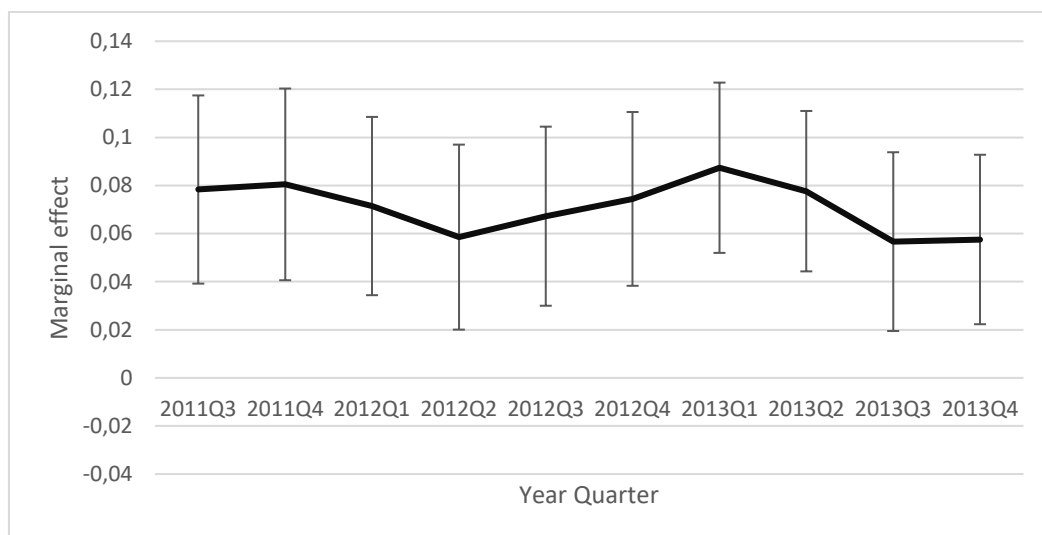
FIGURE A2 – THE EFFECT OF MODULAR EDUCATION ON EMPLOYMENT FOR 2010-2011 VOCATIONAL EDUCATION SCHOOL LEAVERS BY QUARTER

Notes. The figure reports regression estimates. Vertical bands represent +/- 1.96 times the standard error of each point estimate. Modular education is measured as an indicator given value of 1 if a student was enrolled in modular education and 0 if a student was enrolled in linear education. Employment is measured as an indicator given value of 1 if the individual was employed and 0 otherwise. The model includes school and year by quarter fixed effects as well as controls for gender, ethnicity and mother's education.
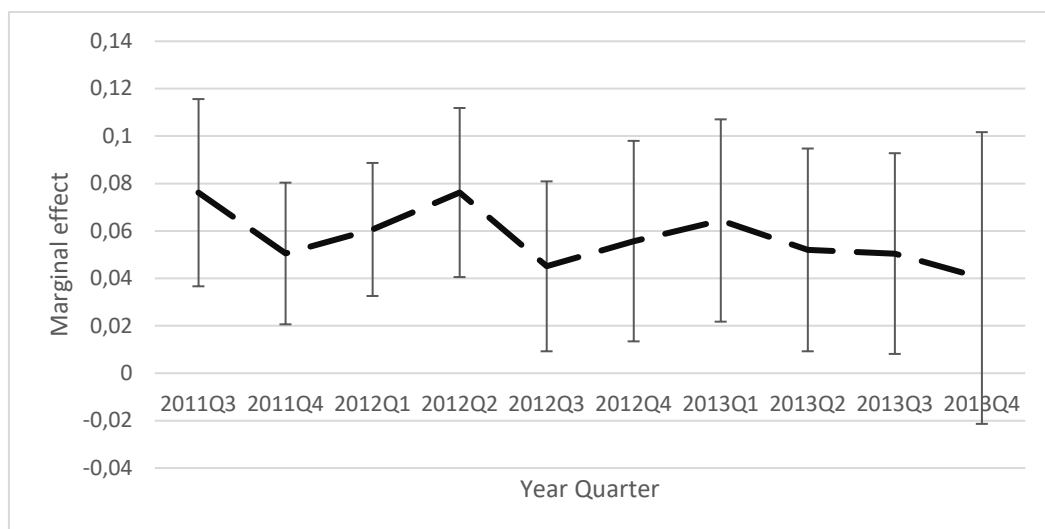
FIGURE A3 – THE EFFECT OF MODULAR EDUCATION ON LOG GROSS EARNINGS FOR 2010-2011
VOCATIONAL EDUCATION SCHOOL LEAVERS BY QUARTER

Notes. The figure reports regression estimates. Vertical bands represent +/- 1.96 times the standard error of each point estimate. Modular education is measured as an indicator given value of 1 if a student was enrolled in modular education and 0 if a student was enrolled in linear education. The model includes school and year by quarter fixed effects as well as controls for gender, ethnicity and mother's education. The model is estimated for the sample of employed individuals.

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