Same certificate, different education path: does it matter for earnings?

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Geert Agteresch
Erasmus University Rotterdam
Stud. no.: 348667

Supervisor:
Prof. dr. H.D. Webbink
Erasmus University Rotterdam

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Abstract

In the Dutch education system students are tracked at the age of twelve. This early tracking system has raised concerns about negative long run outcomes for students starting in low tracks. However, students in low tracks can still reach higher education by taking a longer education path: graduating subsequently in higher education levels that were previously not feasible. In this paper, using cohort data over the period 1993-2012, we first investigate which type of students typically take a longer education path. It appears that those students have on average lower test scores and come from a lower socioeconomic background. Second, we investigate whether these differences translate into earnings differences in later life. It appears that students from longer education paths earn on average the same as students that follow the shortest path. IV-estimates, using regional differences in the supply of secondary schools as an instrumental variable, confirm these findings. These results provide evidence that longer education paths are an effective instrument to increase the amount of human capital of students that start in low tracks.

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1. INTRODUCTION

In the Netherlands, students are tracked relatively early, typically when they enter secondary education at an age of twelve or within the two years thereafter. However, over the past years, it has been convincingly shown that early tracking can affect the performance of students negatively (e.g. Van der Steeg, 2011; Van Elk et al., 2011). Educational systems that feature early tracking have been shown to reduce educational performance and labour market chances for especially lower-skilled students and thus increase inequality. It is believed that students that are tracked at a lower level, for example because of an early deficiency, have limited options to catch up the deficiency and reach higher education. Therefore, organisations such as the OECD repeatedly have asked attention for the possible detrimental effects of early tracking in the Netherlands (OECD, 2007; OECD 2011).

However, government officials in Netherlands frequently respond that, although students are tracked early in secondary education, in principle every student can reach higher education by successively completing different education levels that give access to higher education levels (Ministry of Education, Science and Culture, 2015; Education Council [Onderwijsraad], 2005). Every particular secondary education track provides students with access to a certain level of post-secondary or higher education[1]. However, when there initial secondary education track does not qualify for higher education, students can choose to obtain a higher level of secondary education and then continue studying in higher education. Moreover, also certificates of the highest levels of post-secondary vocational education qualify for higher education. In this way, in theory every student is able to reach the highest education level.

For example, a twelve year old student is tracked at a low secondary education track. Hence, he will not be able to continue studying directly in higher education after obtaining his secondary education certificate. But by obtaining a second, higher-level secondary education certificate or an intermediate vocational education certificate, the student can still enrol in higher education. In the end, he will end up at the same level as someone who was tracked at a higher secondary education level, although with a few years delay. In the Netherlands this is commonly referred to as 'stacking diplomas'. A key characteristic here is that students with their 'stacked diploma' attend a level of education which they were not qualified for with their previous diploma.

This possibility to 'stack diplomas' makes the Dutch educational system a fairly comprehensive system, featuring different secondary education tracks that give access to different levels of further education or qualify at a certain level for the labour market. Van Wijk, Van den Dungen and Fleur (2012) calculate that theoretically, within the first six years around 7.000 different education paths are possible, although most of them are only 'walked on' by a single student. Therefore, given a certain certificate, we can distinguish between the shortest possible path to reach that certificate, and paths which are longer than the shortest possible path, because additional 'steps' (certificates) are taken. It is this practice of 'stacking diplomas' that is commonly seen as an important remedy to dampen the detrimental effects of early selection in the Netherlands (Van den Dungen et al., 2012).

Whereas the longer education paths are regarded as an important instrument to facilitate equal chances in education and society, it is remarkable that there is hardly any empirical evidence on the

[1] For a detailed description, see section 3.2 on the Dutch education system.

effects of this instrument on labour market outcomes. By far the largest share of empirical research on longer education paths consists of reports investigating how students from longer education paths perform in education. There are only few studies that (partially) investigate labour market effects of students from longer education paths, and these generally feature some empirical shortcomings. In this study we aim to fill this gap by investigating the labour market situation of students that started in secondary education in 1993 and by either following the shortest or a longer education path ultimately graduated in higher vocational education. Therefore, our main research question is: conditional on a certificate, does the length of the education path matter for earnings and other labour market outcomes? In the first part of the study we investigate what are characteristics of students that typically follow a longer education path, and in the second part we then investigate whether differences in characteristics have any implications for labour market outcomes.

It appears that students that follow a longer education path are different on a number of characteristics from students that follow the shortest education path. They have on average lower test scores and a lower socioeconomic status. There are also differences between students from different longer education paths, although those are smaller. However, it follows from OLS regressions that these differences do not translate into significant wage differences between the students from the different education paths. Using the relative rate of schools that defer early tracking with one year in a municipality as an instrument, IV regressions confirm the absence of significant wage differences. Income levels are slightly heterogeneous among different types of students: for males the effect turns out to be consistently more negative than for females. Furthermore, there are differences between the different sectors of higher vocational education the students graduated in.

Additional analyses show that there are also no significant differences in labour market status (being employed, self-employed or receiving a social security benefit), so that the absence of significant wage differences are not driven by selection processes on the labour market, for example because students from longer education paths are less employed. Also, the OLS earnings estimates of longer education paths tend to be fairly constant over the time period 2006 till 2012.

Therefore, we conclude that in general the results tend to support the hypothesis that longer education paths are an effective instrument to boost the human capital of students that, for whatsoever reason, are not able to take the shortest education path. The absence of significant wage and labour market differences suggests that, on average, students from shorter and longer education paths in the end have acquired similar amounts of human capital and hence reached similar productivity levels.

We proceed this paper as follows. Section two briefly introduces the economics of education literature with a focus on what prior research found about longer education paths. In section three we explain what economic theory would predict on the differences in labour market outcomes between students from the shortest and longer education paths and subsequently explain the Dutch education system so it becomes clear which students follow the shortest and which a longer education path. Section four explains the empirical approach we use to answer our research questions. In section five we introduce the data we use and subsequently illustrate differences between students from the shortest and longer education paths by providing descriptive statistics. In section six we then present the main estimation results and some heterogeneity analyses, and in section seven some sensitivity analyses of the results. Section eight concludes and discusses the findings.

2. LITERATURE STUDY

2.1. Economics of education

2.1.1. Human capital versus screening theories

Since the 1960s, economists have been studying the costs and benefits of education. Education provides people with skills and knowledge (human capital) which increase their productivity and thus at the macroeconomic level education provides a source of long-term economic growth, although the causal link is difficult to identify (Hanushek & Woessmann, 2012). On a micro level, investing in education is convincingly shown to pay off generously to students in the form of higher earnings (e.g. Psacharopoulos and Patrinos (2004) and Harmon, Oosterbeek and Walker (2003)). Furthermore, education is persistently associated with outcomes such as better health conditions (Groot & Maassen van den Brink, 2007; Cutler & Lleras-Muney, 2010) and lower crime rates (Lochner & Moretti, 2004; Groot & Maassen van den Brink, 2010). These effects are regarded as externalities of education, and should be included in calculations of the true social returns of education. However, in our study we focus solely on the monetary effects of extra years in school for individuals, i.e. the effect of a longer education path on notably income. We thus refrain from the mentioned externalities, which nevertheless can be present.

The academic literature on the returns to education is for a large share devoted to the discussion whether education either directly increases your productivity or only provides future employers with a signal that you have a high potential productivity. The first view is called the human capital theory. It regards all knowledge and skills of individuals as their human capital, which is used on a job and as such, the stock of human capital determines your productivity. Therefore, all investments in education, which increases the stock of skills and knowledge, directly increase the productivity. Diplomas and certificates in this model prove that a well-defined amount of human capital is acquired.

The second view is called the signalling or screening theory. According to model, the level of education, visible by obtained diplomas, reveals information on the innate ability of individuals. Innate ability reflects potential ability, but these are both private information and hence not available to employers. Therefore, employers use public information on education achievements to select employees with the required level of ability. In the most stringent version of the theory, education does not directly increase the productivity students, but is only used as a signalling device. As such, it is a costly method to differentiate higher productive individuals from lower productive ones (Riley, 1976).

The different theoretical models were tested numerous times empirically. To mention just one, Ferrer and Craig Riddell (2002) for instance find that in Canada both years of education and holding a degree, conditional on the years of schooling, are associated with an increase in wages. The authors argue that an increase of wages because of having a degree could be efficient in the presence of unobserved, productivity-related characteristics such as motivation or perseverance which are correlated with having a degree. Holding a degree in this case reveals you have obtained

such characteristics and this is rewarded by employers with a higher wage, whereby the degree functions as a signalling device.

2.1.2. Mincer equations

For a long time evidence for the different models was sought in Mincer wage equations, based on the famous work of Mincer (1958; 1974). The first model of Mincer (1958) regards earnings differences as the result of compensating wage differentials. In this model, individuals are *ex ante* identical in their abilities but occupations differ in the amount of education required. Because individuals give up income when they are in education, they demand a wage premium, which explains the relationship between earnings and education. However, most studies use the second, widely recognized human capital model of Mincer (1974). It employs basically the same econometric framework, but the economic theory emphasizes the lifecycle dynamics of observed and potential earnings and human capital investments. It models wage differences as a linear function of accumulated human capital (for instance represented by years of attained education) and a quadratic function of labour market experience.

In the economics of education literature, Mincer equations have been used numerous times to estimate the private returns to education. Psacharopoulos and Patrinos (2004) provide an overview of a large number of international estimations of Mincer returns, and conclude that the estimates suggest that an extra year of education yields on average ten percent extra wage. Furthermore, returns seem to be higher for lower education levels, less-developed countries and for women.

Groot & Oosterbeek (1994) investigate by means of Mincer wage equations the effects of non-standard education paths. They distinguish between actual and effective years of education. Effective years are the nominal years needed to graduate for a certain diploma, but these might differ from actual years because of skipping or repeating years of education, inefficient education tracks (not taking the shortest routes through the education system, i.e. longer education paths) and dropout years (years of education which don't lead to a formal qualification). They find strong support in favour of the human capital theory. Skipping a year of education (i.e. performing faster than the nominal track) is associated with a lower wage. This is in accordance with the human capital theory which predicts that fewer years of education means less investments in productivity and hence a lower wage. The screening hypothesis would predict that skipping a year of education is rather rewarded with a higher wage, as employers regard this as a signal of a high ability. Furthermore, the fact that class-failing has no effect and the positive association of dropout years with wage provide similar evidence[1].

However, when the field of economics developed further, it was acknowledged that Mincer models can suffer from severe estimation biases, for example selection bias. Because of unobserved characteristics that might affect both education and measured outcomes, Mincer equations fail to reveal the true magnitude of the causal effect of education. Harmon et al. (2003) demonstrate that,

[1] The arguments underlying these results are comparable to the previous: the human capital model predicts that class-failing could yield a positive effect on wages (because it means an extra year of education) or at least no effect (because the taught material is the same as the previous year, so in the end the same amount of human capital is acquired), whereas the screening model predicts a negative result because it signals employers with an ability that is lower than the average of the students with this particular diploma. Similarly, the human capital model predicts that drop out years will be rewarded with a higher wage because they reflect additional received education (even though it was not rewarded with a formal qualification) but the screening model regards them as useless because they do not signal a higher ability. Thus, in the end Groot and Oosterbeek's findings are most in line with the human capital model.

although there appears to be a strong causal impact of education on wages, the precise magnitude of the estimate is very sensitive to the chosen estimation approach. In general, the strategy of estimating relationships by means of OLS models with control variables is criticized because it is generally impossible to adequately control for all relevant background variables (Angrist & Krueger, 1999).

Moreover, it appeared that Mincer models have some severe structural weaknesses. Heckman, Lochner and Todd (2006) argue that the Mincer equations of returns to education are subject to stringent assumptions which are not likely to be met. Mincer models do not include important factors like forgone earnings because of extra education years, education costs and indirect effects like health, criminality, longevity and the length of working life which are correlated with education decisions. Hence, outcomes of Mincer equations can in most cases not be interpreted as internal rates of returns, but merely as the price of schooling from a hedonic market wage equation or a growth rate of market earnings with years of schooling.

2.1.3. Estimating causal effects

When the failures of traditional OLS models and strategies based on adding control variables to obtain causal estimates became more pronounced, policy economists explored other methods to reveal causal effects of policy interventions. Researchers started to pay careful attention to the *identification strategy* (Angrist & Krueger, 1999). Specifically, this is done by seeking situations where it is presumable that omitted variables are uncorrelated with the variables of interest. In the first place, this occurs in case the researcher can randomly assign treatments in social experiments, but this is not always feasible. Therefore, economists try to find situations in which assignment is nearly random, caused by forces of nature or human institutions. For example, one well-known strategy is to exploit differences between twins. In a classical twin study, Ashenfelter and Krueger (1994) conclude by exploiting education differences between similar twins that the economic returns to schooling are underestimated by Mincer models. According to their estimations, each year of education increases earnings with on average 12 – 16 percent.

Over time, three identification strategies proved to be particular appropriate and useful in trying to estimate causal effects: instrumental variables models, regression discontinuity models and difference-in-differences or fixed effect models[2] (Angrist & Krueger, 1999). Also in the field of economics of education, researchers started to look for causal effects by employing clear identification strategies. Hartog, Odink and Smits (1999) review the existing literature for estimates of the return to education in the Netherlands. They find that instrumental variables estimates are generally lower than OLS estimates, which is in line with the economic literature.

A minor concern when using IV is that the estimate is only valid for the subgroup that is affected by the policy change because IV uses this exogenous variation to estimate the effect[3] (Harmon et al., 2003). This is important for the external validity of the effect.

[2] For an extensive but useful description of these methods, together with examples and applications, see Angrist & Pischke (2009).

[3] Therefore it is called a *local average treatment effect*. We will come back to this problem in the explanation of empirical approach in section 4.2.

2.2. Evidence on longer education paths in the Dutch educational context

2.2.1. Early tracking

In the Netherlands, pupils are tracked early, generally when they enter secondary education at an age of twelve[4]. It is shown that this is beneficial for students with an above average skills (Van der Steeg, 2011). However, it is also known that there are detrimental effects of early tracking. The OECD for example repeatedly asked attention for the effects of early tracking on the participation in higher education (OECD, 2007) and equal chances for students in education system (OECD, 2012). In the economic literature, the majority of evidence indeed suggests that early tracking has a detrimental effect on education outcomes or attainment for especially students at the lower end of the intelligence distribution. Exploiting variation in the Dutch context by means of an instrumental variables approach, Van Elk, Van der Steeg and Webbink (2011) find that in the Netherlands, delaying tracking with one or two years increases the participation in higher education significantly. The positive effects are largest for students with relative high ability and students from a higher socioeconomic background, whereas there are no negative effects for high ability students in comprehensive classes. Mühlenweg (2007) finds partially the same evidence for Germany (although there can be doubts on the used identification strategy): tracking students after six years of education (i.e. at an age of twelve) instead of four years yields no negative effects for high ability students, but significant benefits in the form of higher test scores on later age for lower performers. In this study, the benefits are largest for the most weak performing students.

Moreover, the negative effects of early tracking seem to be largest for certain groups, notably weak performing students and students from lower socioeconomic backgrounds (OECD, 2012). Hanushek and Woessmann (2006) argue that, because early tracking negatively affects the performance of low ability students relatively more than high ability students, it basically increases inequality in the education system. Meghir and Palme (2005) show, exploiting exogenous variation caused by a large educational reform in Sweden that was implemented gradually in different regions, that early tracking increases education differences and in the end contributes to larger inequality on the labour market. An example of people that are relatively much affected by early tracking regimes are immigrants. Immigrants come more often than average from lower socioeconomic backgrounds and additionally often suffer from deficiencies such as a language deficiency. The OECD (2006) therefore warns that early tracking makes it difficult to reduce early disadvantages especially for immigrants. Mühlenweg (2007) also finds empirical evidence that it are especially immigrants that greatly benefit from a delay of early tracking in Germany.

2.2.2. Policy on longer education paths

Whereas the downside of early tracking in the Netherlands is known, longer education paths are currently widely regarded as an instrument to dampen the aforementioned detrimental effects of early selection (Van den Dungen et al., 2012; Ministry of Education, Science and Culture, 2015; Education Council, 2005). However, throughout the Dutch educational policy history, longer education routes have been regarded as both desirable and inefficient (Dekker, Van Esch, Van Leenen & Krooneman, 2008). In the 70s and 80s of the previous century, it was quite common to follow a longer education path and proceed with a detour through the education system. However,

[4] For details on the education system, see section 3.2.

in the early 90s this was regarded as inefficient and a waste of resources. Herweijer (2002) implicitly labels the practice of 'stacking diplomas' as an inefficiency in the Dutch education system when he argues that after a reform in secondary education, the efficiency of the Dutch education system improved because the use of longer education paths declined in subsequent years. The ministry of education judged that students as much as possible should follow the shortest path through education, referred to as 'the Royal route'. Therefore institutional changes with a strong focus on efficiency in educational tracks were implemented and consequently the number of students following a longer education path declined. Since the first years of the current millennium longer education paths were promoted again as a useful instrument to exploit the full talents of the population and increase the share of higher educated in the Netherlands. Consequently the number of students using a longer education path was increasing slightly since 2002. Since the last few years however, the number of students following a longer education path is declining again, presumably as a negative effect of a continued focus on efficiency in the education system. This happens despite of recommendations of several organisations to reinforce the opportunities to take longer education paths (Education Council, 2005). In particular it is stressed that longer education paths are necessary dampen the detrimental effects of early tracking and is beneficial for certain groups like children with a lower socioeconomic background and immigrants.

Indeed, it is true that longer education paths are relatively more often used by immigrants and ethnic minorities such as Turkish students than Dutch natives to obtain a higher education degree (Dekker et al., 2008; Crul et al., 2009). Often it is argued that this is because these students often enter the primary school with a language deficiency, which they have to catch up during the first years in the education system. Given that tracking in the Dutch education system occurs relatively early, this means that those students initially study at a lower level than their full potential but catch up by taking a longer education path. Consequently, this suggests that longer education paths are indeed effective in boosting education and labour market chances for immigrant students.

Dekker et al. (2008) furthermore investigate possible institutional barriers or obstacles caused by non-matching curricula for longer education paths in the Dutch education system. They conclude that there are hardly any juridical barriers but it are mainly curricular mismatches that impede the possibility to continue studying at a higher level after obtaining a certificate, for instance missing courses or shortcomings in the levels of math necessary to be admissible at some levels of education. This picture also emerges from student surveys, which reveal that students perceive the transfer from intermediate vocational education (mbo, which qualifies for the labour market) to higher vocational education (hbo) in terms of the curriculum as less smooth than the transfer from higher secondary education (havo) to hbo (which is the nominal and shortest path to higher education) (Jansen & Kamphorst, 2007).

2.2.3. Education achievements and labour market outcomes

Whereas it is clear that in the Netherlands longer education paths are regarded as an important instrument to dampen the detrimental effects of early tracking and decrease inequality in society, it is remarkable that there is hardly any empirical evidence on the effects of this instrument on education achievements and labour market outcomes. The largest share of empirical research consists of reports investigating how students from longer education paths perform in school. It appears that students from longer education paths are far from always successful: the share of students leaving education is almost three times as large as of students from the shortest path, as well as the share of students that, after obtaining a diploma, continue studying on a lower level than

that they are admissible to. More specific, Dekker et al. (2008) find that only sixty percent of the students after obtaining a stacked diploma indeed continues studying at the education level they are entitled to, while at least twenty percent continues studying at a level that they were already admissible to *without* obtaining the stacked diploma. Hence this can be regarded as inefficient years of longer education: the profit of the extra education years is not cashed in the form of a higher level certificate. Van Esch and Neuvel (2009) estimate that 74 percent of the students of one of the most popular longer education paths in the end obtain their desired diploma[5]. For comparison: for students that obtain the same certificate via the shortest path this percentage is 86 percent. The chance of obtaining the desired diploma decreases substantially with age and boys have lower chances on graduating than girls. Furthermore, the share of students dropping out during their 'stacked education level' is relatively higher for lower levels of vocational education (Visser & Van Wijk, 2011). The larger dropout share of students from longer education paths undermine the effectivity of longer education paths to increase the amount of human capital of students.

Using survey data, Van den Dungen et al. (2012) study differences in skills and labour market outcomes of the same education paths as we study, although they combine two paths that we distinguish between. They find moderate differences between the self-reported skills and labour market outcomes of students from the two education paths. More specific, they find that students from a popular longer education path find a job more quickly, more often work full-time and work in small and medium sized enterprises (SMEs). Moreover, students from longer education paths report significantly more often that they (partially) fall short in the skills that are necessary for their job. While this study resembles ours, it observes short term effects (1.5 years after graduating) and medium term effects (5 years after graduating) and uses self-reported data, whereas we study longer term labour market effects using observed data with richer family and background variables.

Groot and Oosterbeek (1994) study labour market effects of education path choices by estimating wage equations, and our present study mostly resembles theirs. In their earlier mentioned estimations of 'actual' and 'effective' education years, they also estimate the effect education years caused by a longer than the shortest possible path through the education system, which they describe as 'inefficient routing'. They do not find a significant effect of inefficient routing on wages. Exactly like their results on skipping and repeating years in school and drop out years favour the human capital model, the result of no significant wage effect of a longer education path is in line with the theoretical predictions of the human capital model. In the end students have all acquired the same amount of human capital so should earn the same wage.

Whereas this study is most related to our estimations, our study improves theirs in three ways. First, while we use observed data, Groot & Oosterbeek use survey data from people reporting their educational career almost thirty years before, which can bias the results due to weak memorizing. Second, there is a gap of around thirty years between the children entering secondary school and the date of the survey. Because employers gain information about the productivity over the working years, the explanatory power of the education history declines over the number of working years. Third, instead of only using basic Mincer wage equations we try to find a causal effect of longer education paths by using a rich set of control variables and instrumental variables models.

[5] For those known with the Dutch context: it concerns students that that continue studying at the havo after obtaining a vmbo degree and finally graduate (see also section 3.2).

3. THEORY AND BACKGROUND INFORMATION

3.1. Theoretical predictions of the effect

What does the economic theory of the previous chapter predict about the effect of taking a longer education path on earnings? Both the human capital model and the screening model provide a prediction of the sign of the effect. The human capital theory regards education as an investment in human capital. Therefore, conditional on the education level, extra education years caused by a longer path through education *ceteris paribus* means that additional human capital is accumulated which should be rewarded with a higher income in later years. The ceteris paribus condition means that we refrain from any observable or unobservable characteristics that differ between students that follow longer education paths and those that follow the shortest path that might bias our wage estimations, such as cognitive skills, motivation or socioeconomic differences such as the education level of the parents.

However, it is apparent that this ceteris paribus condition does not hold in this case, i.e. students from shortest and longer education paths significantly differ from each other. Those students that take a longer education path to a particular diploma are for instance less able and therefore need more time to reach this level than those that take the shortest path. But in the end, they both reach the same education level, so they both accumulate the same amount of human capital, although the rates of accumulation differed. Therefore, following the presumptions of the human capital theory, we should find no significant differences in wages between students from the shortest and longer education paths.

The screening model on the other hand predicts the opposite. It regards the level of education completed as a signal of ability and potential productivity. When employers are faced with uncertainty about the ability of applicants for a job, they will regard a higher completed education level as a signal of a higher potential productivity because of a higher ability or motivation. Therefore, *ceteris paribus* they will consider students from the shortest education path and longer education paths as equally productive.

However, employers also observe that applicants took a longer education path before graduating at the final level. According to the screening model, they could interpret this a signal that such students are on average less able or less motivated and potentially less productive, and therefore they prefer students from the shortest education path. Consequently students from longer education paths will sort into lower quality jobs, earn a lower wage and we should find a negative wage difference when not correcting for observable and unobservable differences. Correcting for these differences should then reduce the wage difference.

3.2. The Dutch education system

3.2.1. Secondary, post-secondary education and higher education

In the Dutch education system, students are tracked in principle at an age of twelve, when they transfer from primary school to secondary education. At the time of our cohort study, students would enter in of the four different secondary education tracks: 'vbo' (prevocational education, also

available as 'ivbo'[1]), 'mavo' (lower general education), 'havo' (higher general education) or 'vwo' (pre-academic education). In the economics of education literature, this is regarded as 'early tracking', although tracking does not occur as early as in Germany for example, where students are already tracked at an age of ten (Driessen, 2007). However, tracking in Dutch education can be delayed by one or two years when pupils enter 'comprehensive classes' that combine for example the 'havo' and 'vwo' tracks or even 'mavo', 'havo' and 'vwo' (Van Elk et al., 2011).

After secondary education, students continue studying in 'mbo' (intermediate vocational education) or higher education, depending on the level of completed secondary education. Mbo is offered at four different levels which were accessible for students with either a 'vbo' or 'mavo' diploma[2]. Different mbo levels gave access to higher mbo levels so that a higher level can be reached by accumulating or 'stacking' mbo diplomas. The highest mbo level gave access to the vocational part of higher education ('hbo'). Hbo is taught at universities of applied science and accessible for students from the havo, vwo or the highest mbo level (level four). Next to that, higher education contains also a more research oriented part, called 'wo' (university or academic education) which is offered at research universities and available for students from vwo or a hbo degree. Table 3.1 shows the distribution of the students over the different types of education by the diploma they obtained. Because students that get multiple diplomas are also included, the numbers of diplomas obtained are larger than the total number of students in our cohort. We can only to some extend distinguish between students that dropped from our sample for various reasons but are likely to have obtained a diploma, and students that really did not get a diploma., and therefore we present them as one category. The high number of sample dropouts is worrying, especially for post-secondary and higher education.

TABLE 3.1 – DISTRIBUTION OF OBTAINED DIPLOMAS IN THE VOCL 1993 COHORT

Secondary education			Post-secondary and higher education		
Category	**Nr. of students**	**% obtained S.E. diplomas[1]**	**Category**	**Nr. of students**	**% obtained P.S.E. and H.E. diplomas[2]**
Ivbo	1,087	6.6 %	Mbo-1	38	0.4 %
Vbo	5,219	31.8 %	Mbo-2	573	5.7 %
Mavo	4,829	29.4 %	Mbo-3	400	4.0 %
Havo	3,030	18.4 %	Mbo-4	3,455	34.6 %
Vwo	2,267	13.8 %	Hbo	3,556	35.6 %
No diploma/ unknown	3,246	-	Wo	1,968	19.7 %
			Leerlingwezen	3,269	-
			No diploma/ unknown	6,645	-

[1] Percentage of total number of obtained diplomas in secondary education in the VOCL 1993 cohort, so without the category 'no diploma/ unknown'.

[1] Individualized prevocational education (ivbo), which is a special form of 'vbo' which was meant for students with a lower cognitive skills or socio-emotional problems, providing these students with extra support and more individual attention.

[2] We describe the structure of the mbo as it functioned as of 1997, because in that year the structure of the mbo sector changed, which slightly troubled our construction of comparable education paths. Whereas the mbo currently consists of four levels with different study lengths, before 1997 there were short mbo programs ('K-mbo') and longer programs ('L-mbo'), not completely comparable to the current system. We coded the mbo tracks of the former system into the new classification based on the recommendations of the Dutch statistical office CBS. Former short mbo programs (K-mbo) are classified as current mbo level 2, and long mbo programs (L mbo) are labeled at mbo level 4. Because the changes took place in 1997, only a few students of our cohort were enrolled in mbo at that time.

[2] Percentage of total number of obtained diplomas in post-secondary education and higher education in the VOCL 1993 cohort, but without students enrolled in leerlingwezen.

In the column of post-secondary and higher education, there is one extra category: the 'leerlingwezen' system. This was the apprenticeship training system, offered at levels comparable with the different mbo levels. From 3,269 students in our cohort it is known that they continued their education in the leerlingwezen system. Whereas the current apprenticeship training sector is included in the intermediate vocational education (mbo) sector (as 'bbl'), the former leerlingwezen was not part of the regular intermediate vocational education sector. Therefore, students in the leerlingwezen in our cohort were not followed over the years but at the moment they started in training in leerlingwezen it was registered that they left the (regular) education system.

3.2.2. Possible longer education paths

Reaching a higher education level is possible by 'stacking diplomas' *in* and *after* secondary education. In secondary education this works as follows: a vbo diploma gives access to the fourth year of the mavo, a mavo diploma gives access to the fourth year of havo and a five-year havo diploma gives access to the fifth year of vwo. In this way, all students are theoretically able to reach the highest level of secondary education and then continue directly studying in university. Table 3.2 shows the numbers of students of different education paths in our sample. It appears that six percent (182 of 3,030) of the students that graduate from the havo continue studying in vwo, which slightly above the national average (four to five percent[3]). The same applies to the mavo, where eleven percent (534 of 4829) continues studying at the havo (current flow of graduates from the vmbo[4] to havo equals approximately nine percent[3]).

TABLE 3.2 – FREQUENCIES OF EDUCATION PATHS IN THE VOCL 1993 COHORT

Education path							'Stacking' in type of education		Nr. of students
Secondary education				Further education			Secondary	Further	
vbo	mavo	-	-	-	-	-	✓		21
vbo	-	-	-	mbo	hbo	-		✓	200
-	mavo	havo	-	-	-	-	✓		534
-	mavo	havo	-	-	hbo	-	✓		↳ 312
-	mavo	havo	vwo	-	-	-	✓		12
-	mavo	-	-	mbo	hbo	-		✓	732
-	mavo	-	-	mbo	hbo	wo		✓	↳ 32
-	-	havo	-	-	hbo	-			1370
-	-	havo	vwo	-	-	-	✓		182
-	-	havo	vwo	-	-	wo	✓		↳ 112
-	-	havo	-	-	hbo	wo		✓	190
-	-	-	vwo	-	-	wo			1213

However, a higher education level can also be reached by obtaining successive degrees *after* secondary education, by completing the different mbo levels up to level four, hbo and university. For convenience, we label the education options after secondary education as 'further education'. The table indicates whether the longer education path was followed through either secondary education (vbo, mavo, havo and vwo) or through further education (mbo, hbo and wo). It appears

[3] Source: own calculation from CBS Statline (statline.cbs.nl).

[4] Since 1999 the higher (theoretical) tracks of the new education category 'vmbo' (preparatory intermediate vocational education) replace the mavo, and the lower tracks replace the vbo.

that the longer education path through further education is used more often than through secondary education: of the 3,556 total graduates of hbo, 732 (20.6 percent) initial mavo-students reach hbo by first completing mbo education, and 312 (8.8 percent) by obtaining a havo diploma. This difference is also present in graduates from university, although somewhat less pronounced: from the 1,968 university graduates, 190 (9.7 percent) initial havo students graduate from university after obtaining a hbo degree, and 112 (5.7 percent) by first completing vwo.

In this study we focus on the difference in wages between students that graduate from the hbo but followed different paths towards this certificate. We distinguish between students following the shortest path (havo – hbo) and students that graduate from the hbo that did follow a longer path, which can be either mavo – havo – hbo ('secondary education path') or mavo – mbo – hbo (the 'vocational column path').

Our definition of education paths improves on the study of Van Dungen et al. (2012), which only distinguishes between havo – hbo and mbo – hbo students. Hence, in their study, mavo – havo – hbo students and havo – hbo students are combined. However, we think distinguishing between those two groups is important because there are substantial differences between those two groups as section 5.1 demonstrates.

3.2.3. Costs and benefits of an education system with longer education paths

What are the benefits and costs of providing the opportunity to take longer education paths in the education system? From the government perspective, a main advantage is that it decreases inequality in the chance to achieve a high level of education, especially in education systems with early tracking such as the Netherlands. Promoting equal chances and decreasing inequality in the education system and society are valued by the government as an important goal as such. Students differ in their abilities and hence in the time they need to obtain a certain diploma. Moreover, children from certain disadvantaged groups, that lag behind in cognitive development or language skills when they enter education, often first need to catch up this lag by studying initially at a lower level than their potential. By providing the opportunity to take a longer education path, it is nevertheless possible for such students to graduate in higher education. Next to that, longer education paths are also an important instrument for the government to achieve the policy goal of increasing the share of higher educated people in the Netherlands (Rinnooy Kan, 2014). From the perspective of students a longer education path, when indeed used to obtain a higher level of education than obtainable without taking a longer education path, is beneficial because a higher level of education yields, *ceteris paribus*, a higher wage. The government therefore also receives extra tax revenues as a result of higher wages. Finally, as is noted in the literature chapter, higher education is also consistently associated with better health and less criminality.

However, providing the opportunity to take longer than nominal education paths also comes with some direct and indirect social and private costs. First, the government funds the additional years of education of the longer education path[5]. Besides that, students join the labour force at a later age which yields indirect costs for both students and the government. The first sacrifice wages during the extra years they are in education and the latter misses income tax payments over these wages[6].

[5] These direct costs amount almost 7.800 euros per year (Ministry of Education, Culture and Science, 2014).
[6] To illustrate: assuming that a student that graduates in higher vocational education (hbo) by taking a longer education path earns the same amount as a student that graduates from the shortest route, every extra education year the student sacrifices 36.000 euros of gross income (De Mooij et al., 2012). Assuming an average income tax rate of forty percent, the student misses 21.600 euros disposable income and the government 14.400 euros. Thus, the indirect costs of extra education years are larger than the direct costs.

Next to that, in the literature chapter we discussed some empirical evidence that the share of students not succeeding to graduate is higher among students from longer education paths than among students from the nominal paths. This also causes direct and indirect costs for both students and the government. The student has to pay tuition fees and misses income over the extra years he is in education whereas the government bears the direct costs of education and indirect costs of missed tax revenues. However, because Groot and Oosterbeek (1994) find that the extra education years of students that dropped out before graduating still yield a positive wage premium, it follows that there is also a (small) benefit of these 'dropout years'.

Finally, it is possible that lazy students underperform during their educational career by dedicating less effort to their study and study at a lower than their potential level because they know that they will be able to catch up later on by taking a longer education path. In this case, there are no benefits of but costs are incurred (again the direct education costs and missed wage and tax revenues over the extra education years), so that this possible behavioural response decreases the benefits of the possibility to take longer education paths.

4. EMPIRICAL APPROACH

4.1. OLS estimations

The most straightforward approach for estimating the effect of longer education paths on wage would be to regress the wage of the former students on a dummy variable denoting that a student takes a longer education path. This means that in the OLS regression equation,

$$\ln wage_i = \alpha + \beta\, E_i + \varepsilon_i \tag{5.1}$$

in which ln $wage_i$ denotes the log of the wage level for student i, E_i equals a dummy variable indicating that an individual takes a long education path and ε_i equals an error term, β would yield the OLS point estimate of a longer education path. Because we take the log of wages, the coefficient estimates can be interpreted as percentage changes. However, in this case we implicitly assume that students from the shortest path and students from longer education paths are similar. Although it is obvious that this assumption does not hold, we do still repeatedly estimate this model as a benchmark model, and call it 'model one'.

The reason that the above assumption does not hold is that students from the shortest and longer education paths differ from each other in a number of ways. This causes *omitted variable bias*[1]: an relevant variable is correlated with both the dependent and the independent variable but omitted from the estimations, so that part of the effect of this omitted variable is captured by estimate of the variable of interest and wrongly interpreted as the causal effect of the variable of interest. This is solved by including the relevant omitted variables in the estimations. Following Groot and Oosterbeek (1994) we correct for actual working experience in the first place, because we want to estimate the sheer effect of the longer education path corrected for differences in working experience. Hence, we add the variable with actual working experience and the square of working experience of the students to the regression[2]:

$$\ln wage_i = a + \beta\, E_i + \delta_1\, L_i + \delta_2 L_i^2 + \varepsilon_i \tag{5.2}$$

where L_i denotes the number of working years of individual i. Basically, this model is the standard *Mincer wage equation*[3] and therefore we estimate is after the naïve model and call it 'model two'.

A second source of omitted variable bias is that students that take a longer route are probably less smart. This creates a downward bias of our estimates: because students that follow the shortest

[1] It can also be regarded as *selection bias* in policy treatments: the 'treated' students (those who do go through a longer education path) do not randomly select into this 'treatment group', but differ from the 'non-treated' (students from the shortest path) because they select into this group because of certain characteristics and hence their incomes cannot be compared directly. Comparing the income of the treated students in case they had not been treated with the untreated students does yield the causal effect of a longer education path, but this *counterfactual* is unknown.

[2] Adding the square of a variable corrects for the concavity of the effect. In the case of working years: wages do increase with years of working experience, but the effect diminishes with the number of years.

[3] See the literature discussion in chapter two. A Mincer equation includes a variable measuring the amount of human capital and the variables working experience and its square. When a longer education paths indeed causes differences in human capital gathered in education, the dummy variable represents the potential differences in amounts of human capital gathered as in a Mincer equation.

path are smarter, they will probably earn more in the future because cognitive abilities are rewarded in the labour market but this is not the effect of the length of the education path. Therefore we correct for this by including measures of ability in our model, so that estimate β in the equation becomes

$$\ln wage_i = \alpha + \beta\, E_i + \delta_1\, L_i + \delta_2 L_i^2 + \delta_3 A_i + \varepsilon_i \tag{5.3}$$

where A_i denotes the ability of individual *i*. This subsequent model is called 'model three'.

However, there are still more observable factors, such as the socioeconomic background, that affect both the probability of taking a longer education path and wage. Assuming that we can include all these (including ability) in a vector of background characteristics X_i we obtain the equation

$$\ln wage_i = \alpha + \beta\, E_i + \delta_1\, L_i + \delta_2 L_i^2 + \delta_4 X_i + \varepsilon_i \tag{5.4}$$

After the model three with ability control variables, we estimate model four with solely socioeconomic background variables and the working experience variables to isolate the effect of socioeconomic status variables on the estimation results. Finally, in the fifth model we include the full set of control variables.

We thus estimate five models in which we successively correct for different observables. More specific, in the first model we only include a dummy variable for taking a longer education path without any covariates. In the second model we add a variable indicating the years of working experience and its square. In the third model we add test scores as a proxy of ability, a motivation test score and a variable denoting the primary school advice for the secondary education track, which, next to the test scores, contains relevant information on the ability of the students. In the fourth model we include socioeconomic status (SES) variables which are, but no ability variables and in the fifth model we cumulate all control variables.

First, we estimate the effect of longer education paths by pooling the students of the two longer education paths (i.e. mavo – havo – hbo and mavo – mbo – hbo). However, because we expect that estimates might differ between the two paths, we subsequently estimate the effect for the two paths separately by including separate dummies for both paths. In some heterogeneity analyses we explore differences in the effect for subgroups. Furthermore, in the sensitivity analysis section we look whether other labour market outcomes affect the results and whether the effect is constant over time. We apply the method of adding subsequently different sets of control variables to all OLS regressions throughout the study to ensure the comparability of the results. Finally, in all OLS estimations standard errors are clustered at the school level.

4.2. Instrumental variables estimation

4.2.1. Instrumental variables models

Although we are able to include a fairly rich set of control variables in our OLS models, it may well be that there are still other, unobserved characteristics of students that take a longer education path (for example time preferences) that bias our estimations. To correct for this, we employ a different estimation technique to obtain the true causal effect: instrumental variables models. An instrumental variables estimation exploits variation in the endogenous variable of interest that is caused by an exogenous variable that is only correlated with the outcome variable through the

endogenous variable (Angrist & Krueger, 2001). Remember equation 4.4, which we generalise here to a treatment D,

$$Y_i = \alpha + \beta D_i + \delta X_i + \varepsilon_i \tag{5.5}$$

where Y_i is the outcome variable, a is a constant, X_i is a vector of background characteristics and D_i is a dummy indicating whether a person i is treated or not so that β is the estimate of the causal variable of interest. In case of selection bias, D_i is correlated with the error term ε_i (i.e. the variable is endogenous) and therefore the causal effect β is not estimated consistently.

Suppose now we have a variable, Z_i that is correlated with the treatment variable D_i but not related to the outcome variable Y_i, so uncorrelated with the error term ε_i. So, the effect of Z_i on Y_i works solely through D_i, i.e. the variable Z_i causes exogenous variation in D_i. This exogenous variation is now exploited to calculate the causal effect of D_i on Y_i. We do this following the method of *two-stage least squares* (2SLS). In the so-called first stage regression, we regress the endogenous variable D_i on the instrument Z_i and the other covariates. In the second stage regression, we regress the dependent variable on the covariates but replace the actual values of the endogenous variable with the fitted values of the first stage regression. In mathematical terms, we can write the first stage as

$$D_i = a + \gamma Z_i + \delta X_i + \nu_i \tag{5.6}$$

and the second stage as

$$Y_i = a + \beta D_i + \delta' X_i + \varepsilon_i \tag{5.7}$$

so that the instrumental variables estimate of the causal effect of interest equals

$$Cov\,(Y_i, Z_i) / Cov\,(D_i, Z_i). \tag{5.8}$$

The key assumption or *exclusion restriction* of an IV regression is that the instrument only affects the outcome variable Y_i through the instrument D_i. The other important assumption is that the instrument is sufficiently strong to estimate the causal effect, i.e., there is sufficient correlation between Z_i and D_i. Whereas the second assumption can be checked empirically, the first cannot, so we have to rely on our institutional knowledge to argue whether this assumptions holds.

Moreover, interpreting the results can be troubled because not all people respond to the instrument (Angrist & Krueger, 2001). The treatment effect is in fact estimated using only the variation of those people whose behaviour is affected by the instrument (the so-called 'compliers') but not of those who do not respond to the instrument – people that always take the treatment ('always-takers') and those who never take the treatment ('never-takers'). Therefore the effect is called a *local average treatment effect* (LATE). In case the effect is homogeneous for all groups of people there is no problem: the compliers are representative for the whole sample and the LATE is valid for all groups. However, in case of heterogeneous treatment effects, the validity of the LATE is limited to the subgroup of compliers.

4.2.2. Supply of tracking schools

We exploit exogenous variation induced by the relative supply of tracking schools by using this relative supply measure at municipal level as an instrument, i.e. the share of tracking schools in the

total number of schools available for a given municipality. More tracking schools in a municipality means more tracking schools in the choice set of students[4] living in that municipality, which should cause more students to go to tracking schools. We need a solid theoretical foundation for this channel, because an IV model can demonstrate an effect to be statistically significant, but it does not explain *why* this effect works in the real world[5].

We think attending a tracked class might therefore influence the chance to follow a longer education track through two channels. First, students deliberately might go to a tracked class at a lower track level than their potential level because of travel distance reasons, i.e. when the nearest tracking school is more nearby than the nearest non-tracking schools. Borghans et al. (2014) show that for the Netherlands proximity, next to school quality information and school denomination, is still a strong determinant of parental school choice, especially for lower educated parents. Refraining from other school characteristics, students trade off the disadvantage of a lower track level against the benefit of smaller traveling distance. It is likely that (dependent on how students weigh the costs and benefits) for some this trade-off is positive. But the lower track level means that the student has to follow a longer education path and stack diplomas when he wants to reach higher education.

Second, there might be students that have chosen to go to a tracked class at a track level from which they expected that it would meet their potential level. However, in the first two years they find that their ability enables them to do a higher track. In theory they have opportunities to switch tracks during the years in education, but students might experience barriers in doing that withhold them from switching, for instance losing friends or switching to another school location. The school location argument is indeed mentioned in Dekker et al. (2008) as a fact that can either stimulate or discourage taking a longer education path. But again, after obtaining their certificate, these students have to follow a longer education path to reach higher education. When these students would have been in a comprehensive class, they would have streamed easily into the right track when comprehensive classes are split up into different tracks after one or two years.

We develop the instrument as follows. We observe for all students which school they attended, based on a unique school code and if they were in a tracked or non-tracked class. We mark a school as a 'tracking school' when at least 25 percent of the students on that school is in a tracked class in 1993, the first year of the cohort. Next, by matching the cohort data with register data, we observe the municipality where the students lived in 1995. Then, we look which schools students from a particular municipality attend, which we define as the choice set of schools for students in that municipality. Finally, we calculate the share of tracking schools of the total school choice set for every municipality.

We also investigate whether the share of students that was in a tracked class in 1994 can be used to identify tracking and non-tracking schools. It appears that the number of students in a tracked class in 1994 is much higher than in 1993. This is because in many schools students are only in the first grade in a comprehensive class and tracked from the second grade onwards, so a large share of these students is not on a real tracking school. Therefore, the use of 1994 by creating our instrument adds no value compared to 1993. Finally, as in the OLS estimations, in all IV models we cluster the standard errors at the school level.

[4] We acknowledge that in reality it are both parents and students that together choose a secondary school, but for expositional reasons we mention the student as sole decision maker.

[5] Or, as Angrist and Pischke (2009, p.156) say: "There is nothing in IV formulas to explain *why* Vietnam-era service [this refers to the instrument they use, GA] affects earnings; for that, you need a theory."

As explained above, the most important assumption when using instrumental variables is the *identifying assumption*: the effect of the instrument on the dependent variable runs only through the endogenous variable of interest, i.e. the instrument Z_i is not correlated with the error term ε_i. When using our instrument, this means that the share of tracking schools only affect income through students that take longer education paths by this decision get a different income. Tracking schools should have no effect on earnings by themselves, for example because there are quality differences between those schools. We check this assumption by looking at characteristics of the students of both types of schools in the descriptive statistics (section 5.2.2).

Related to this is the issue that IV produces a *LATE*, as is explained above. This means that the effect of a longer education path is estimated for the group of students that is indeed induced by the high relative supply of tracking schools to follow a longer education path and stack diplomas. If these students (the 'compliers') are for whatsoever reason different from the other students, our IV results could be not internally valid for all mavo students that end up in hbo.

5. DATA

5.1. Datasets used

5.1.1. VOCL '93 panel data

The panel data on the educational paths and background characteristics of the students comes from the Secondary Education Pupil Cohort 1993 (VOCL 1993)[1]. The cohort consists of 20,059 students that were in the educational year 1993/1994 in the first grade of secondary education, and after that were followed through the education system until 2012. Each year was investigated if the students were still enrolled in the education system and if so, in which type and grade they were enrolled, if they took a final examination and if they graduated. Next to the educational career component, there were ability and personality tests conducted in the first year of secondary education and interviews conducted with both the students and their parents.

From this survey data we use the information on education careers, first year ability and motivation test scores, the primary school advice for the secondary education track and relevant socioeconomic status variables. The test scores for math, language and information processing come from a standardized, low stakes test which was conducted halfway the first grade of secondary education. It is a shorter version of the high stakes *CITO test* which is conducted in the eighth grade of primary schools in the Netherlands. The motivation test is a 21-item test that was also conducted in the first year of the survey. The primary school advice for the secondary education track is an important determinant for the definitive choice at which secondary education track the student is placed, because it contains the assessment of the primary school teacher of the capabilities of the child, and therefore provides broader information on the abilities of children than just test scores. The socioeconomic status variables concern the variables sex, the level of urbanization of the secondary school region, the ethnicity of the student and the education and professional level of parents.

To calculate the number of years of (potential) working experience, we take the year students graduate from their last type of education as the starting point for their working life. We thus are able to use the actual number of years the students were on the labour market, instead of using the nominal years of schooling for different education tracks which is often done in other studies.

5.1.2. Data on income and labour market position

Next to the panel data, we use administrative data on income, the labour market position and addresses of the former students over 2012 from various sources that belong to the Dutch Social

[1] The different VOCL cohorts were primarily intended to evaluate an educational policy change called the 'basisvorming' (basic education) (Hustingx et al., 2005). The VOCL 1989 cohort served as a baseline study, whereas the 1993 wave was used to evaluate the policy change, which sought to provide all students in the first years of secondary education with the same educational curriculum, irrespective of the level of education. For details about the dataset, research design and sampling, see Brandsma et al. (1997) and Hustinx et al. (2005). The data has been used frequently to estimate the (combined) effects of education, cognitive skills and family and socioeconomic background characteristics of children on short term (Traag et al., 2004) and the long term (Traag et al., 2006) and the effects of early tracking in the Dutch education system (Van Elk et al., 2011).

Statistical Database of Statistics Netherlands[2]. We use earnings data over October 2012 from monthly administrative data ('polis data') because October is regarded as a relatively representative month of the year (Deelen and Euwals, 2014). Furthermore, we choose 2012 because this is twenty years after the students enrolled in the first year of secondary education in 1993 so generally all students should have left the education system[3]. In fact, most of them already work for about six or seven years. Because students were around twelve years old when they entered secondary education, most of the people are around 32 years old at the time of the income data collection.

In the case of the income data, we sum gross wages, special wages (e.g. bonuses, gifts) and overtime wage and reduce it with paid pension premiums to obtain the gross wage. The polis data also provides us with the reported monthly hours worked, so gross wage per hour is calculated by dividing this amount by the sum of regular and overtime working hours. We drop 90 observations for which negative incomes are reported.

From the full sample, we are able to match 15.123 of the 20.059 observations with the income data. In the preparation of the raw data, we drop 29 students who died during sample period and 170 whom were reported to have a serious illness[4]. 160 students left the sample because they emigrated. Although we are able to match 113 of them again with the income data, we still drop all of them because we are not sure whether they have been in education abroad.

5.1.3. Imputing missing observations

For around twenty percent of the students, there are missing values for a number of control variables. Because dropping these observations would greatly reduce our sample size, we impute the missing data. For categorical variables (nationality, degree of urbanization, professional level of the parents, primary school advice) we simply add an extra category 'missing'. For continuous variables (test scores) we add a dummy variable that is 1 if a student misses this variable and then replace the variable with the mean of the variable of all students. It is desirable that in our regressions the missing categories and the dummies indicating a missing observation are insignificant, because this means that the observations are missing at random.

5.2. Descriptive statistics

5.2.1. Students of shortest versus longer education paths

We will now investigate what type of student typically choose to follow the shortest and which type a longer education path Therefore, we compare students from the havo – hbo path to students from mavo – havo – hbo and mavo – mbo – hbo paths on a large number of observable characteristics. Table 5.1 displays the sample statistics for the three groups, together with tests on the significance of the differences.

[2] The Social Statistical Database (SSB) of Statistics Netherlands (CBS) is a comprehensive system of inter-linked micro-databases that contains register and survey data on the demography, incomes, jobs, benefits and residence of virtually all individuals and households in the Netherlands. We use two sources of administrative income and tax data from the tax authorities, employers and the Employee Insurance Agency (UWV) and register data on their labour market status and the location of residence of students and their homes.

[3] We drop 22 students that nevertheless are registered as still or again being in education.

[4] It is remarkable that being severely ill occurs relatively more often among students with higher secondary education levels (havo, vwo). However, the dropout rate by illness (0.8 percent, 170 students) is too small to seriously bother our results by selection effects.

TABLE 5.1 – DESCRIPTIVE STATISTICS OF THE TOTAL SAMPLE

Variable	Havo – hbo[1]	Mavo – havo – hbo[1]	*p*-Value[2]	Mavo – mbo – hbo[1]	*p*-Value[2]	*p*-Value[3]
Number of pupils	1,369	311		730		
Personal and family characteristics						
Female (%)	56.5	53.4	0.311	50.4	0.007	0.872
Dutch nationality (%)	98.7	97.7	0.105	97.0	0.004	0.669
Father Dutch (%)	98.9	97.4	0.049	97.8	0.032	
Mother Dutch (%)	98.7	98.2	0.011	98.1	0.036	
Profession level parents			0.344		0.000	0.219
Worker (%)	17.8	19.3		25.9		
Self-employed (without personnel) (%)	6.6	8.6		6.7		
Self-employed (with personnel) (%)	9.8	12.3		9.3		
Lower vocation (%)	12.3	11.5		13.8		
Intermediate vocation (%)	30.5	25.7		25.8		
Higher vocation (%)	22.9	22.7		18.1		
Urbanization level school			0.864		0.028	0.310
Not urbanized (%)	24.1	23.7		29.9		
Lowly urbanized (%)	27.9	27.8		26.2		
Average urbanized (%)	19.6	22.4		19.8		
Highly urbanized (%)	21.5	20.3		19.3		
Very highly urbanized (%)	6.9	5.8		4.9		
Ability/ personality						
Total test score	43.9 (6.2)	38.6 (6.9)	0.000	36.8 (7.0)	0.000	0.000
Math test score	14.5 (3.2)	12.5 (3.5)	0.000	12.0 (3.7)	0.000	0.064
Language test score	14.6 (2.6)	12.8 (2.8)	0.000	12.2 (2.8)	0.000	0.000
Information processing test score	14.8 (2.7)	13.3 (2.9)	0.000	12.6 (2.9)	0.000	0.000
Motivation test score	2.86 (0.34)	2.89 (0.37)	0.136	2.83 (0.37)	0.168	0.030
Primary school advice for secondary education track						
Vbo (%)	0.2	1.1	0.000	3.7	0.000	0.000
Vbo – mavo (%)	0.5	6.7		10.2		
Mavo (%)	12.2	53.7		60.2		
Mavo – havo (%)	19.4	24.2		16.9		
Havo (%)	34.0	10.9		6.7		
Havo – vwo (%)	26.5	2.8		2.1		
Vwo (%)	7.2	0.7		0.2		
Labour market outcomes						
Working years since graduating	7.6 (2.1)	6.9 (2.1)	0.000	6.7 (1.8)	0.000	0.071
Mean gross yearly income (euro)	47,499 (21,995)	47,402 (21,566)	0.791	46,471 (20,467)	0.409	0.853
Mean net yearly income (euro)	38,281 (17,359)	38,261 (17,111)	0.727	37,693 (16,224)	0.458	0.964
Hours worked per month	145.5 (39.0)	151.2 (34.7)	0.060	148.8 (41.5)	0.096	0.657
Reported overwork hours per month	0.4 (4.2)	0.3 (1.9)	0.683	0.9 (5.7)	0.031	0.078

[1] Standard deviations in parentheses.
[2] *p*-Values of a chi-square/ two-tailed t-test on the difference with the havo – hbo sample of students.
[3] *p*-Values of a chi-square/ two-tailed t-test on the difference between the mavo – havo – hbo and the mavo – mbo – hbo samples.

In general, it seems that mavo – mbo – hbo students are more different from havo – hbo students than mavo – havo – hbo students. For example, regarding the profession level of the parents, relatively many parents of students from the mbo route have the profession level 'worker', and

relatively few a higher vocation, whereas parents of havo – hbo students are labelled less often as worker and havo – mavo – hbo students take a middle position. Remarkable is that parents from students of the havo path tend to be relatively often self-employed. Next to that, students of the mbo route tend to come relatively more often from less urbanized regions while this is not the case for students from the havo route.

Regarding basic personal and family characteristics, it appears that the share of female students studying at hbo in our sample is larger than the share of boys, although the difference is tiny for the mavo – mbo – hbo route. Unfortunately, the cohort is not representative with respect to the share of students with a non-Dutch nationality, which means that we cannot investigate the stylized fact that immigrants in the Netherlands relatively more often use a longer education path to reach higher education. 94.5 percent of the students has a Dutch nationality, whereas nationwide on average around twenty percent of the students in secondary education is non-Dutch[5]. Though the percentage non-Dutch students in the longer education paths is higher than in the shortest route (the difference being significant for the mavo – mbo – hbo path), it is still too close to zero to be representative for Dutch education.

Regarding ability test scores, both groups of students from the longer paths differ significantly from students from the shortest path, whereas it is again visible that the difference is largest for students from the mavo – mbo – hbo path. Furthermore, differences are largest for math test scores. From the motivation test which was conducted in grade one it seems that students from the mavo – havo – hbo path are slightly more motivated than students from the mavo – mbo – hbo path. The differences in the advice of the primary school for the level secondary education track are as expected: whereas most students from the shortest path have a havo advice, a mavo advice occurs most among students from the two mavo paths. Next to that, the difference in ability between the mavo – havo – hbo and the mavo – mbo – hbo group is again visible: the latter more often have a mavo advice or even a vbo advice.

For the labour market outcomes, we surprisingly find no statistical significant differences in wage levels of the three groups of students, even while in this descriptive part we have not corrected for any differences in ability, motivation or socioeconomic states. Mavo – mbo – hbo students earn on average the least and havo – hbo students the most, but the differences are almost negligible small.

Regarding the reported working hours per month, students from the two longer education paths seem to work somewhat more hours, although the differences are small. As expected, students from the shortest education path have more years of working experience since graduating than students from longer education paths. Nevertheless, it is remarkable that the difference is less than one. One would expect that the difference is larger, because (assuming nominal study lengths) when a student continues studying in havo grade four after graduating from the mavo, he needs at least two extra years to graduate from the hbo compared to a student from the shortest path (havo – hbo).

[5] Source: own calculations from CBS Statline (statline.cbs.nl).

TABLE 5.2 – DESCRIPTIVE STATISTICS OF MAVO STUDENTS IN TRACKED VERSUS COMPREHENSIVE CLASSES

Variable	Comprehensive class[1]	Tracked class[2]	*p*-Value[3]
Number of pupils	549	377	
Personal and family characteristics			
Female (%)	48.6	53.9	0.119
Dutch nationality (%)	96.5	98.4	0.085
Father Dutch (%)	86.9	92.3	0.009
Mother Dutch (%)	87.3	92.0	0.021
Profession level parents			0.558
Worker (%)	24.7	22.7	
Self-employed (without personnel) (%)	6.1	8.2	
Self-employed (with personnel) (%)	9.4	9.7	
Lower vocation (%)	13.1	14.8	
Intermediate vocation (%)	27.1	23.6	
Higher vocation (%)	19.2	21.0	
Urbanization level school			0.374
Not urbanized (%)	28.1	30.0	
Lowly urbanized (%)	26.1	26.7	
Average urbanized (%)	19.1	21.3	
Highly urbanized (%)	22.0	16.6	
Very highly urbanized (%)	4.8	5.5	
Ability/ personality			
Total test score	37.1 (7.4)	37.7 (6.7)	0.182
Math test score	12.2 (3.7)	12.2 (3.5)	0.879
Language test score	12.3 (3.0)	12.4 (2.8)	0.519
Information processing test score	12.6 (3.1)	13.2 (2.8)	0.006
Motivation test score	2.83	2.89	0.027
Primary school advice for secondary education track			0.000
Vbo (%)	4.3	1.4	
Vbo – mavo (%)	9.7	7.6	
Mavo (%)	39.7	83.7	
Mavo – havo (%)	28.9	5.2	
Havo (%)	12.6	2.2	
Havo – vwo (%)	4.3	0.0	
Vwo (%)	0.6	0.0	
Labour market outcomes			
Working years since graduating	6.6 (	6.9 (	0.005
Mean gross yearly income (euro)	47,252 (21,489)	45,664 (21,133)	0.262
Mean net yearly income (euro)	38,251 (17,004)	37,028 (16,870)	0.277
Hours worked per month	149.7 (36.5)	149.1 (37.1)	0.831
Reported overwork hours per month	0.49 (2.7)	0.72 (4.4)	0.445

Standard deviations in parentheses.
[1] Sample of students that graduated from the mavo but started in secondary education in a comprehensive class.
[2] Sample of students that graduated from the mavo but started secondary education in a tracked mavo class.
[3] *p*-Values of a chi-square/ two-tailed t-test on the difference with students which were in 1993 in a tracked class versus students which attended a comprehensive class.

5.2.2. Students in tracked versus comprehensive classes

In this section we will investigate whether there is any selection on observables among the students that attend a tracked class and students that attend a comprehensive class in the first year of secondary education. In case there is any selection, for example because students from tracked

classes have *ex ante* a higher (lower) ability, our IV estimates will be biased upwards (downwards). As explained in section 4.2, the effect of being in a tracked class on taking a longer education path must work only through relative supply of tracked classes and not through any selection effects.

The share of mavo students being tracked is much larger than the share of havo students being tracked. This is because in the Netherlands there exist many so-called 'categorical mavo's', which supply only the mavo track of secondary education, whereas the havo track is more often part of a comprehensive school where also the vwo track and other tracks are supplied. This causes that simply comparing tracked versus non-tracked students would yield biased estimates because the majority of havo students (which differ significantly from mavo students) would be in the comprehensive class group. For this reason, we restrict the below comparison to mavo students only, i.e. those who stack diplomas, which can be both via the havo or mbo.

Table 5.2 shows the sample statistics of the two groups, together with tests on the significance of the difference. It appears that the two groups are almost similar in terms of ability and socio-economic status, except for some relative minor differences in ethnicity and a higher score of tracked students on the information processing test.

However, a difference that matters is observed in the primary school advice for the secondary education track. By far the largest share of students that attend a tracked mavo class indeed got an advice for the mavo track from their primary school. For the students from comprehensive classes (which are only mavo students too, because of our selection) there are also students with a mavo – havo, havo or even a vwo advice. This could suggest that the two groups are not similar in terms of ability but the very similar test scores reveal that this is not the case.

6. RESULTS

6.1. Earnings effects of taking a longer education path

6.1.1. OLS estimations

Now we have a clear image of the characteristics of students from the different education paths, we will investigate if these characteristics yield an effect on wages in later life. Initially, we do not distinguish between the two different longer education paths. As explained in the empirical approach section, in different models we subsequently add different numbers of control variables: model one regresses the log of gross wages on just one dummy indicating that a student has taken one of the two longer education paths. Model two adds the number of working years and number of working years squared and can be regarded as a Mincer wage equation. Model three adds ability and motivation controls, which are the first year test scores on math, language and information processing skills, a score on a motivation test and the primary school advice for the type of the secondary education track. Model four controls for socioeconomic status by including sex, the urbanization level of the secondary school region, ethnicity of the student and the education level and profession level of parents. Model five cumulates all controls variables to obtain the full model. We cluster the standard errors at the school level in all models. Because the dependent variable is the log of wages, the point estimates of the independent variables can be interpreted as percentage changes.

TABLE 6.1 – OLS ESTIMATIONS OF TAKING A LONGER EDUCATION PATH

	Model 1	Model 2	Model 3	Model 4	Model 5
Longer education path	-0.008	-0.032	0.018	-0.022	0.004
	(0.022)	(0.022)	(0.026)	(0.021)	(0.026)
Working years		0.150***	0.144***	0.123***	0.120***
		(0.032)	(0.033)	(0.031)	(0.032)
Working years squared		-0.011***	-0.011***	-0.008***	-0.008***
		(0.002)	(0.002)	(0.002)	(0.002)
R^2	0.000	0.020	0.054	0.158	0.167
Number of observations:	2076	2076	2076	2076	2076
Ability and motivation controls	–	–	✓	–	✓
SES controls	–	–	–	✓	✓

OLS estimations on the sample of havo – hbo, mavo – havo – hbo and mavo – mbo – hbo students together, whereby taking a longer education path is indicated by the dummy variable *longer education path*. Ability and motivation controls include first year test scores on math, language and information processing skills, the primary school advice for secondary education and a score on a motivation test. Socio-economic status (SES) controls include sex, the level of urbanization of the secondary school region, the ethnicity of the student and the highest education level and profession level of parents. Standard errors are in parentheses. *,** and *** denote a significant difference from zero on the 10%, 5% and 1% level respectively.

Table 6.1 shows the results of the estimations of attending a longer education paths on income in later life. It appears that taking a longer education path on average has no significant effect on wages. As expected, the initial negative but small effect estimate disappears and even turns positive when we control for ability differences. Including SES controls has a smaller effect on the estimate. The observed large increase of R^2 when SES variables are included in model four is mainly due to

adding the variable sex, which has a large explanatory power for income. In the full model the estimated effect is basically zero.

6.1.2. Instrumental variables estimations

To obtain the true causal effect of a longer education on wages, we also estimate IV regressions. The methodology and the set-up of the instrument were explained in chapter 4. Based on our assumption that a school is a tracking school when at least 25 percent of the students is in a tracked class, we mark 21.8 percent of the schools in our sample as a tracking school. There is a clear relationship between the share of tracking schools and children being tracked. In the group of tracked students, the share of tracking schools in municipalities is on average 40.8 percent, whereas this share is only 27.7 percent for students which are not tracked. Furthermore, a regression of a dummy denoting that a student used a longer education path on the supply rate of tracking schools in a municipality yields a highly significant estimate. This suggest that the supply of tracking schools is indeed a factor of consideration in the decision-making of prospective secondary education students.

A common concern when using instrumental variables estimations is the use of a weak instrument, in which case the correlation between the instrument and the endogenous variable is too low. In other words, the instrument does not cause enough exogenous variation in order to firmly establish the causal effect of the endogenous variable on the dependent variable. In the instrumental variables literature, it is common to regard the *F-value* on the excluded instrument in the first stage regression as a signal of the strength of the instrument, whereby values above ten are regarded as a sign of a substantial strength of the instrument (Staiger and Stock, 1997).

Table 6.2 displays the estimation results of the IV regressions. The (negative and large) results appear to be highly insignificant, with large standard errors. Peculiar is that the F-value decreases, and the point estimate and the corresponding standard error increase substantially after including the variable with the primary school advice for the level of secondary education in models three and five, an issue which we will further investigate in section 7.4. In general, we conclude from this section that we have no evidence that taking a longer education path has a negative effect on later wages. OLS regressions yield no significant results and IV regressions neither.

TABLE 6.2 – IV ESTIMATIONS OF TAKING A LONGER EDUCATION PATH

	Model 1	Model 2	Model 3	Model 4	Model 5
First stage					
F-value instrument	17.02	16.32	11.70	15.19	12.33
Supply rate of tracking schools	0.531***	0.495***	0.195***	0.494***	0.198***
	(0.105)	(0.101)	(0.055)	(0.107)	(0.61)
Partial R^2	0.032	0.031	0.008	0.030	0.008
Second stage					
Longer education path	-0.230	-0.280	-0.541	-0.255	-0.536
	(0.171)	(0.185)	(0.469)	(0.162)	(0.403)
Working years		0.183***	0.200***	0.149***	0.172**
		(0.055)	(0.076)	(0.052)	(0.069)
Working years squared		-0.015***	-0.017**	-0.011**	-0.014**
		(0.005)	(0.007)	(0.005)	(0.006)
Number of observations	1275	1275	1275	1275	1275
Ability and motivation controls	–	–	✓	–	✓
SES controls	–	–	–	✓	✓

OLS estimations on the sample of havo – hbo, mavo – havo – hbo and mavo – mbo – hbo students together, whereby the two longer tracks are together indicated by the dummy variable 'longer education path'. Ability and motivation and SES controls are the same as in the main OLS model (table 6.1). Standard errors are in parentheses. * and ** denote a significant difference from zero on the 10% and 5% level respectively.

6.2. Earnings effects for different longer education paths

6.2.1. OLS estimations

Whereas it appeared from the descriptive statistics section that there are significant differences between students from the two different longer education paths, in the previous section we included both longer education paths (mavo – havo – hbo and mavo – mbo – hbo) in a single dummy variable indicating a longer education path,. Therefore, in this section we distinguish between those two paths by including two dummies, one for each longer education path. Table 6.3 shows the results of the OLS estimations estimated in the same models as in the previous section. The estimated effect of the mavo – havo – hbo path is positive but fairly small and in none of the models significantly different from zero. It ranges from a 0.7 percent increase of wages in the basic Mincer model to a 4.5 percentage increase when ability controls are included. This increase is again in line with the observed significant lower test scores from students from the mavo – havo – hbo track compared to students from the shortest path.

The estimates of the mavo – mbo – hbo path are consistently negative. In the simple Mincer model with only years of working experience as covariates, it is estimated that students from the mavo – mbo – hbo path earn on average 5.7 percent less than students from the shortest path, whereby the difference is significant at the five percent level. When ability and motivation controls are added the effect size drops to 1.3 percent, losing its significance. The point estimate decreases slightly when SES variables are included and is significant at the five percent level. In the full model, the estimate is again not significant.

TABLE 6.3 – OLS ESTIMATIONS FOR TWO DIFFERENT LONGER EDUCATION PATHS

	Model 1	Model 2	Model 3	Model 4	Model 5
Mavo-havo-hbo	0.019	0.007	0.047	0.014	0.032
	(0.030)	(0.029)	(0.030)	(0.028)	(0.029)
Mavo-mbo-hbo	-0.028	-0.057**	-0.013	-0.044**	-0.022
	(0.024)	(0.025)	(0.029)	(0.023)	(0.028)
Working years		0.154***	0.150***	0.126***	0.125***
		(0.032)	(0.032)	(0.031)	(0.032)
Working years squared		-0.012***	-0.011***	-0.008***	-0.008***
		(0.002)	(0.002)	(0.002)	(0.002)
R^2	0.001	0.022	0.057	0.159	0.168
Number of observations:	2076	2076	2076	2076	2076
Ability and motivation controls	–	–	✓	–	✓
SES controls	–	–	–	✓	✓

OLS estimations on the sample of havo – hbo, mavo – havo – hbo and mavo – mbo – hbo students, where there are two dummies for each single longer education path. Control variables are the same as in the basic model (table 6.1). Standard errors in parentheses. *,** and *** denote a significant difference from zero on the 10%, 5% and 1% level respectively.

6.2.2. Instrumental variables estimations

Now we estimate the causal effect of different longer education paths by estimating IV regressions. Because we only have one instrument – the supply rate of tracking schools in the municipality of students in 1993 – and two endogenous variables – the two longer education paths – we have to estimate the effects of both education paths separately: once a estimation with students from the mavo – havo – hbo path and the havo – hbo path and once with students from the mavo – mbo – hbo path and the havo – hbo path. Nevertheless we use the same models with covariates as in the main models of the previous section.

Table 6.4 displays the estimated effect of the education path mavo – havo – hbo on wages. It appears that for this group the instrument is too weak to obtain accurate estimates, because the F-values of the instrument are beneath ten. This also appears from the large standard errors. Table 6.5 shows the estimated effect of the mavo – mbo – hbo path. For this group, the F-values on the excluded instrument are well above ten, so at the instrument is strong enough. The point estimates of the earnings effect are far from significant because the standard errors are large.

Therefore, we conclude from this section that the differences in characteristics between students from different education paths as they were observed above, do not translate into differences in earnings in later life, also not when we distinguish between different longer education paths. This result can be interpreted as evidence in favour of the human capital theory: students in the end seem to have accumulated the same amount of human capital, irrespective how long their education path was, consequently the reach similar levels of productivity and this is rewarded by employers with on average equal wages.

An minor issue that needs attention when using this instrument in estimating the earnings effect of longer education paths is that the variable primary school advice for secondary education level substantially weakens the strength of the instrument for the mavo – mbo – havo sample, whereas it does not weaken the instrument in the mavo – havo – hbo sample. Thus it follows that the weakening of the instrument that was observed in model three of the IV regressions in section 6.1.2 can be fully attributed to the mavo – mbo – hbo group of students. We will further discuss the sensitivity of the estimations to the variable school advice in section 7.4.

TABLE 6.4 – IV ESTIMATIONS FOR THE MAVO-HAVO-HBO PATH

	Model 1	Model 2	Model 3	Model 4	Model 5
First stage					
F-value instrument	1.76	1.83	2.82	2.22	3.06
Supply rate of tracking schools	0.250*	0.253*	0.191*	0.279*	0.203*
	(0.150)	(0.149)	(0.099)	(0.144)	(0.113)
Partial R^2	0.008	0.008	0.006	0.010	0.007
Second stage					
Mavo-havo-hbo	-0.432	-0.414	-0.484	-0.180	-0.167
	(0.538)	(0.508)	(0.657)	(0.394)	(0.551)
Working years		0.162**	0.162**	0.124**	0.123*
		(0.067)	(0.069)	(0.078)	(0.066)
Working years squared		-0.013**	-0.013**	-0.008	-0.008
		(0.006)	(0.006)	(0.005)	(0.006)
Number of observations	860	860	860	860	860
Ability and motivation controls	–	–	✓	–	✓
SES controls	–	–	–	✓	✓

IV estimations on the sample of havo – hbo and mavo – havo – hbo students only. Ability and motivation and SES controls are the same as in the main OLS model (table 6.1). Standard errors are in parentheses. * and ** denote a significant difference from zero on the 10% and 5% level respectively.

TABLE 6.5 – IV ESTIMATIONS FOR THE MAVO-MBO-HBO PATH

	Model 1	Model 2	Model 3	Model 4	Model 5
First stage					
F-value instrument	19.27	18.75	16.44	17.21	16.13
Supply rate of tracking schools	0.586***	0.531***	0.231***	0.511***	0.217***
	(0.109)	(0.102)	(0.055)	(0.098)	(0.060)
Partial R^2	0.042	0.038	0.013	0.036	0.011
Second stage					
Mavo-mbo-hbo	-0.158	-0.219	-0.393	-0.188	-0.378
	(0.156)	(0.174)	(0.399)	(0.159)	(0.377)
Working years		0.174***	0.184**	0.141**	0.155**
		(0.060)	(0.075)	(0.059)	(0.075)
Working years squared		-0.015***	-0.015**	-0.010**	-0.012*
		(0.005)	(0.007)	(0.005)	(0.007)
Number of observations	1109	1109	1109	1109	1109
Ability and motivation controls	–	–	✓	–	✓
SES controls	–	–	–	✓	✓

IV estimations on the sample of havo – hbo and mavo – mbo – hbo students only. Ability and motivation and SES controls are the same as in the main OLS model (table 6.1). Standard errors are in parentheses. *, ** and *** denote a significant difference from zero on the 10%, 5% and 1% level respectively.

6.3. Heterogeneity analyses

6.3.1. Sex and ability subsamples

Whereas the previous results showed that on average there are no earnings effects of taking a longer education path, we will now look whether there are earnings differences between certain subgroups by estimating OLS regressions. The results of these estimations are shown in table 6.6. Because it appeared above that in a number of cases, our instrument is too weak to yield valid estimates we do not show the instrumental variables regressions on these samples.

From the estimations for males and females separately, it appears that there are substantial differences between the effect for men and women, especially for mavo – havo – hbo students. For males the estimates of the mavo – havo – hbo path, which were previously positive, become consistently negative although they remain insignificant. Estimates for females are substantially higher across the whole range of models. The negative estimates of the mavo – mbo – hbo path become slightly larger, and are close to the usual significance levels. This suggests that for males taking a longer education path can be less beneficial in financial terms than for females. A possible explanation for this fact could be that females are on average more risk-averse than males (Borghans et al., 2009) and tend to assess negative risks larger and positive probabilities smaller than males (Harris et al., 2006). In this way female mavo students might assess the probability of successfully completing a successive higher education level lower than men assess their chance, and hence only females with an above average ability continue studying in a longer education path. However, in this case we should observe ability differences between men and women and the difference between men and women should decrease when we correct for ability differences, but this is not the case. Therefore, a selection of more intelligent females because of their more conservative risk assessments is not likely to be the true explanation of the observed wage gap.

TABLE 6.6 – OLS ESTIMATIONS OF LONGER EDUCATION PATHS FOR SUBSAMPLES

		Model 1	Model 2	Model 3	Model 4	Model 5
1. Male students	# obs	953	953	953	953	953
	Mavo-havo-hbo	-0.040	-0.017	-0.032	-0.023	-0.038
		(0.035)	(0.034)	(0.041)	(0.035)	(0.041)
	Mavo-mbo-hbo	-0.060*	-0.055	-0.069	-0.063*	-0.074
		(0.033)	(0.034)	(0.045)	(0.036)	(0.047)
2. Female students	# obs.	1123	1123	1123	1123	1123
	Mavo-havo-hbo	0.057	0.048	0.095**	0.048	0.089**
		(0.040)	(0.040)	(0.042)	(0.041)	(0.042)
	Mavo-mbo-hbo	-0.027	-0.042	-0.022	-0.037	0.019
		(0.033)	(0.035)	(0.045)	(0.034)	(0.043)
3. High ability students	# obs.	1074	1074	1074	1074	1074
	Mavo-havo-hbo	0.033	0.026	0.040	0.032	0.029
		(0.041)	(0.040)	(0.042)	(0.038)	(0.041)
	Mavo-mbo-hbo	-0.029	-0.050	-0.036	-0.041	-0.039
		(0.042)	(0.041)	(0.048)	(0.038)	(0.045)
4. Low ability students	# obs.	1002	1002	1002	1002	1002
	Mavo-havo-hbo	0.033	0.009	0.060	-0.005	0.044
		(0.042)	(0.041)	(0.042)	(0.040)	(0.041)
	Mavo-mbo-hbo	-0.002	-0.046	0.004	-0.046	-0.006
		(0.030)	(0.032)	(0.035)	(0.031)	(0.036)
	Ability and motivation controls	–	–	✓	–	✓
	SES controls	–	–	–	✓	✓

OLS estimations on different sub-samples of the total sample of havo – hbo, mavo – havo – hbo and mavo – mbo – hbo students. Ability and motivation and SES controls are the same as in the main model (table 6.1). Standard errors are in parentheses. * and ** denote a significant difference from zero on the 10% and 5% level respectively.

Moreover, it is remarkable that males are the only group for which the estimate does not become more positive when we correct for ability differences, but even more negative. This contradicts our theory and earlier findings that students that follow longer education paths on average have a lower ability so that wage estimations typically become more positive when we correct for ability differences. We have no convincing explanation for this fact.

Besides looking at gender differences, we also look at possible differences between relative lower and higher ability students. We therefore construct two groups of students: one with a relative high and one with a relative low ability, based on the total test score of the three-part ability test. The mean and median of this variable for the whole sample equals 41. Therefore we define high ability students as students with a total test score above, and low ability students below or equal to 41. From the mavo – havo – mbo students, 37 percent is considered as high ability students and from the group of mavo – mbo – hbo students 26 percent.

In contrast to an apparent gender difference, there is no substantial difference in the earnings effect of following a longer education path between high and low ability students. All point estimates are insignificant. As can be expected, correcting for ability differences affects the estimates more for the relative low ability students.

6.3.2. Different Hbo sectors

Additionally to gender and ability subsamples, we now investigate whether the effect of a longer education path is possibly different for different fields of study in the higher vocational education (hbo). In the Dutch higher vocational education sector, seven different fields of study are distinguished: technical, agricultural, healthcare, economic and business, social, art and pedagogical studies. Table 6.7 displays OLS estimations of the effects these different study fields.

When we split our sample into seven different study fields most of the samples naturally become too small to yield reliable estimates, which causes larger standard errors. Only for the field of economic and business studies the standard errors are convincing because they are in line with previous estimations (roughly below 0.050). For technical studies and pedagogical studies the standard errors are slightly higher but nevertheless these results can be interpreted with care.

It appears that for economic and business studies, in contrast with earlier findings, longer education paths have a negative earnings effect. It is especially interesting that the effect of the mavo – havo – hbo path is more negative than the mavo – mbo – hbo path (which is more in line with previous results). However, the large initial effect by and large fades away once we control for ability. Apparently students that follow the mavo – havo – hbo path to economic and business studies are on average less talented than those from other fields. We have no convincing explanation for this result: it is true that there are relatively more men in economic studies (for which we also find small negative effect of the mavo – havo – hbo path) but their share is only 56 percent. Moreover, students from the mavo – havo – hbo path in economic studies do not significantly differ in ability from the other mavo – havo – hbo students, as appears from similar average test scores and primary school advice.

For technical studies the effect is more or less in line with the average effects. For pedagogical studies, the sign of the effect is in line with previous results (positive for mavo – havo – hbo, negative for mavo – mbo – hbo), but the size of the effect is much larger (eight to ten percent for mavo – havo – hbo, and nine to fourteen percent for mavo – mbo – hbo). Therefore, the effect is even significant from zero when we control for ability differences. On average, all students in the pedagogical field of study have somewhat lower test scores, especially for math and information processing, but no lower primary school advice.

TABLE 6.7 – OLS ESTIMATIONS OF LONGER EDUCATION PATHS FOR DIFFERENT HBO SECTORS

		Model 1	Model 2	Model 3	Model 4	Model 5
1. Technical studies	# obs.	383	383	383	383	383
	Mavo-havo-hbo	0.049	0.096	0.114	0.097	0.126
		(0.063)	(0.068)	(0.075)	(0.071)	(0.077)
	Mavo-mbo-hbo	-0.085*	-0.067	-0.023	-0.039	0.018
		(0.048)	(0.046)	(0.052)	(0.053)	(0.057)
2. Agricultural studies	# obs.	56	56	56	56	56
	Mavo-havo-hbo	-0.016	0.021	0.006	-0.149	0.071
		(0.268)	(0.285)	(0.284)	(0.386)	(0.354)
	Mavo-mbo-hbo	0.040	0.102	0.024	-0.002	-0.015
		(0.115)	(0.131)	(0.136)	(0.156)	(0.274)
3. Healthcare studies	# obs.	165	165	165	165	165
	Mavo-havo-hbo	0.123	0.136	0.128	0.010	-0.014
		(0.124)	(0.131)	(0.154)	(0.154)	(0.155)
	Mavo-mbo-hbo	0.087	0.098	0.124	0.067	0.115
		(0.081)	(0.089)	(0.112)	(0.090)	(0.104)
4. Economic studies	# obs.	749	749	749	749	749
	Mavo-havo-hbo	-0.113	-0.115	-0.055	-0.090	-0.060
		(0.044)**	(0.043)***	(0.046)	(0.039)**	(0.043)
	Mavo-mbo-hbo	-0.059	-0.063	-0.011	-0.057	-0.026
		(0.032)*	(0.035)*	(0.042)	(0.034)*	(0.042)
5. Social studies	# obs.	248	248	248	248	248
	Mavo-havo-hbo	0.053	0.033	0.036	0.021	0.025
		(0.075)	(0.076)	(0.093)	(0.077)	(0.098)
	Mavo-mbo-hbo	0.020	0.000	-0.017	-0.017	-0.031
		(0.061)	(0.061)	(0.091)	(0.063)	(0.094)
6. Art studies	# obs.	49	49	49	49	49
	Mavo-havo-hbo	0.120	0.292	-0.290	0.348	-0.091
		(0.147)	(0.181)	(0.361)	(0.423)	(0.775)
	Mavo-mbo-hbo	-0.103	0.046	-0.138	0.144	-0.078
		(0.345)	(0.324)	(0.581)	(0.311)	(0.886)
7. Pedagogical studies	# obs.	426	426	426	426	426
	Mavo-havo-hbo	0.137	0.094	0.110	0.087	0.093
		(0.045)***	(0.043)**	(0.056)*	(0.049)*	(0.060)
	Mavo-mbo-hbo	-0.066	-0.147	-0.120	-0.104	-0.093
		(0.054)	(0.055)***	(0.071)*	(0.055)*	(0.073)
	Ability and motivation controls	–	–	✓	–	✓
	SES controls	–	–	–	✓	✓

OLS estimations on sub-samples based on the field of higher vocational study of the total sample of havo – hbo, mavo – havo – hbo and mavo – mbo – hbo students. Ability and motivation and SES controls are the same as in the main model (table 6.1). Standard errors are in parentheses. *, ** and *** denote a significant difference from zero on the 10%, 5% and 1% level respectively.

7. SENSITIVITY ANALYSES

7.1. Labour market effects of taking a longer education path

In this section we briefly investigate possible effects of following a longer education path on other labour market outcomes, namely the share of former students that is an employee, self-employed or receives some social benefit. Employment differences can be the result of a selection process that conceals existing wage differences. It might for example be that from the students of the longer education path, only the high skilled manage to get a job whereas the low skilled stay unemployed. If this is the case, if all students of longer education paths would have a job, the average wage rate of these students would be lower than students from the shortest path and we would see a wage difference. More or less the same holds for self-employed which are also not included in previous estimations. If it is so that either high skilled or low skilled select into self-employment, than this channel might also conceal the wage differences. However, in this case it is necessary to know something about the average wage level of self-employed.

Table 7.1 displays the labour market status for students from the different education paths. It appears again that there are rather small differences. The vast majority of the students has a paid job. The share of self-employed[1] is slightly higher among students from the shortest path than the two other paths. The share of former students with an unemployment benefit is low – 1.2 percent for the havo – hbo path – and slightly higher for students from longer education paths – 0.4 percent higher for the mavo – havo – hbo path and 0.8 percent higher for the mavo – mbo – hbo path. Other differences are negligibly small. Therefore it seems that taking a longer education path in the end has no effect on labour market status.

TABLE 7.1 – LABOUR MARKET STATUS OF STUDENTS FROM THE SHORTEST AND LONGER EDUCATION PATHS

	Havo – hbo		Mavo – havo – hbo		Mavo – mbo – hbo	
Employee	1.039	87.53%	222	89.2%	583	88.2%
Self-employed[1]	72	6.1%	13	5.2%	34	5.1%
Unemployment benefit	14	1.2%	4	1.6%	13	2.0%
Disability benefit	6	0.5%	2	0.8%	5	0.8%
Social assistance	4	0.3%	1	0.4%	3	0.5%
Other social benefits	6	0.5%	0	0.0%	4	0.6%
No registered income	46	3.9%	7	2.8%	19	2.9%
		100 %		100 %		100 %
Unknown	182		51		69	

Labour market status of the sample of havo – hbo, havo – mavo – hbo and mavo – mbo – hbo students for which data is available. The percentages denote shares of students from which the data are available, so *without* the bottom-line unknown-category.
[1] This category includes both self-employed without personnel ('zzp-ers') and director-major shareholders ('dga's').

However, we additionally want to test our hypothesis of no labour market status effect with a formal test. Table 7.2 shows the results of our usual OLS models on our sample of hbo students in which the dependent variable is a dummy that indicates whether a student is 'active on the labour market' or not. We define 'active on the labour market' as being both employee or self-employed

[1] In the category self-employed we include both self-employed without personnel ('zzp-ers') and director-major shareholders, that typically own larger firms ("dga's").

(the two top rows of table 7.1), otherwise the students receive either an unemployment or social benefit or have no registered income. Again, we include two dummies that denote the two selected longer education paths. In case of absence of a significant labour market effect of taking a longer education path, we expect insignificant effects of these dummies. This hypothesis is strongly confirmed by the estimation results[2].

TABLE 7.2 – OLS ESTIMATIONS OF THE EFFECT OF LONGER EDUCATION PATHS ON LABOUR MARKET STATUS

	Model 1	Model 2	Model 3	Model 4	Model 5
Mavo-havo-hbo	-0.011	-0.017	-0.006	-0.016	-0.005
	(0.014)	(0.014)	(0.015)	(0.014)	(0.015)
Mavo-mbo-hbo	-0.006	-0.017	-0.003	-0.016	-0.002
	(0.010)	(0.010)	(0.013)	(0.011)	(0.013)
Number of observations:	2399	2399	2399	2399	2399
Ability and motivation controls	–	–	✓	–	✓
SES controls	–	–	–	✓	✓

OLS estimations of a dummy variable indicating that an individual is active on the labour market (as either an employee, self-employed or a dga) on two dummies denoting the two longer education paths and our usual sets of control variables (for details, see table 6.1).

A last possible difference could be the quality of the businesses of self-employed. When we study the incomes of self-employed it appears that self-employed students from longer education paths earn on average more than self-employed that followed the shortest education path. However, these income differences are also not significant.

7.2. Earnings differences over time

In all previous estimations, we use income data from 2012. However, it is important to know whether the results are stable over time. Therefore, we will now check the sensitivity of the results to using other years. We are able to use earnings data over the period 2006 till 2012 and from every year we use the October month to ensure comparability. For all of these years, we estimate the same OLS models as in the previous sections, with the same set of observations and control variables.

Table 6.10 shows the point estimates for group of mavo – havo – hbo students for the full period 2006 – 2012. It appears that the results are fairly constant over time. In the naïve model one there are some negative estimates that are significant on the five or ten percent level, but the results turn insignificant when control variables are added. The results are evidence that there are no significant income differences between students of the nominal path and the mavo – havo – hbo path over time.

Table 6.11 shows the estimation results for the mavo – mbo – hbo path. Also here the estimation results appear to be relatively constant over time. Some results appear to be significant on the five or ten percent level but there emerges no clear pattern and the significance generally is reduced when control variables are added. Therefore these results support the conclusion that there are no significant income differences for the mavo – mbo – hbo path over the years either.

[2] This conclusion is moreover strongly confirmed by logistic regression estimations, which correct for the fact that the dependent variable is a binary variable (people are either active on the labour market or not).

TABLE 7.3 – OLS ESTIMATES MAVO – HAVO – HBO PATH OVER THE PERIOD 2006-2012

Year	Model 1	Model 2	Model 3	Model 4	Model 5
2006	-0.124**	-0.021	-0.024	-0.028	-0.031
	(0.061)	(0.054)	(0.063)	(0.054)	(0.062)
2007	-0.106**	-0.039	-0.032	-0.043	-0.037
	(0.050)	(0.043)	(0.048)	(0.043)	(0.048)
2008	-0.047	-0.032	-0.016	-0.036	-0.021
	(0.038)	(0.034)	(0.041)	(0.034)	(0.042)
2009	-0.031	-0.032	-0.028	-0.033	-0.034
	(0.039)	(0.036)	(0.039)	(0.037)	(0.040)
2010	-0.070*	-0.073*	-0.049	-0.074*	-0.061
	(0.041)	(0.040)	(0.042)	(0.039)	(0.041)
2011	-0.003	-0.004	0.019	-0.006	0.007
	(0.037)	(0.036)	(0.039)	(0.035)	(0.037)
2012	0.022	0.012	0.040	0.012	0.023
	(0.033)	(0.032)	(0.033)	(0.033)	(0.033)
Number of observations	1,830	1,830	1,830	1,830	1,830
Ability and motivation controls	–	–	✓	–	✓
SES controls	–	–	–	✓	✓

OLS-estimates of the effect of the mavo – havo – hbo path on income over the period 2006-2012. Ability and motivation and SES controls are the same as in all previous models (see table 6.1). Standard errors are in parentheses. * and ** denote a significant difference from zero on the 10% and 5% level respectively.

TABLE 7.4 – MAVO – MBO – HBO PATH

Year	Model 1	Model 2	Model 3	Model 4	Model 5
2006	-0.133***	-0.006	-0.012	-0.011	-0.014
	(0.036)	(0.035)	(0.044)	(0.037)	(0.047)
2007	-0.034	0.046	0.059*	0.044	0.059*
	(0.029)	(0.028)	(0.033)	(0.029)	(0.034)
2008	-0.026	-0.006	0.015	-0.013	0.008
	(0.023)	(0.024)	(0.034)	(0.023)	(0.034)
2009	-0.055**	-0.065**	-0.057*	-0.057**	-0.052
	(0.028)	(0.027)	(0.033)	(0.028)	(0.035)
2010	-0.035	-0.051**	-0.011	-0.050**	-0.019
	(0.024)	(0.025)	(0.027)	(0.024)	(0.027)
2011	-0.004	-0.014	0.018	-0.014	0.007
	(0.023)	(0.024)	(0.030)	(0.023)	(0.029)
2012	-0.026	-0.050*	-0.013	-0.040	-0.021
	(0.025)	(0.027)	(0.032)	(0.025)	(0.032)
	1,830	1,830	1,830	1,830	1,830
Ability and motivation controls	–	–	✓	–	✓
SES controls	–	–	–	✓	✓

OLS-estimates of the effect of the mavo – mbo – hbo path on income over the period 2006-2012. Ability and motivation and SES controls are the same as in all previous models (see table 6.1). Standard errors are in parentheses. *, ** and *** denote a significant difference from zero on the 10%, 5% and 1% level respectively.

7.3. Weaknesses of the instrument

Although in the results chapter it appears that the instrument is valid because the F-values are in most models above ten, there are still some weaknesses that we need to discuss. The first drawback of our model is that our endogenous variable is a binary variable: either the student did take a longer education path, or he or she did not. In 2SLS the first stage is a linear model, but this will not fit our binary endogenous variable (which is the dependent variable in the first stage) very well. Still, Angrist & Krueger (2001) argue that this is not a huge problem because in 2SLS estimations,

the consistency of the second stage regression estimates does not solely depend on getting the first stage functional form right.

A second problem stems from the different collection years of our datasets. We use the student and school data from the starting year of the cohort study in 1993, when the students were in the first grade of secondary education. However, we were able to obtain information about their location of residence only of January 1, 1995[3]. It is probably that some students have moved within those years, which creates some noise on our instrument. However, we assume that moving did not occur selective among our sample (i.e. students from longer education paths did not move more or less often than students from the nominal path) so that our estimations are not biased systematically.

A third problem is that for two reasons we do not catch the exact choice set of all individuals. First, the students in our survey are selected by means of two-stage sampling: in the first stage, schools throughout the country are selected at random, and in the second stage students are selected randomly from the selected schools. This means that there is a substantial share of schools that is not in our sample, but still in the neighbourhood of the students and hence in their school choice set. Second, the choice sets on different locations in a large city might be different. For example, for a student in the north of a city it might be feasible to attend a school in a town that is nearby the north of that city, whereas that school is too far away for a student in the south of that city. This problem is therefore correlated with the size of cities: in larger cities the choice sets will differ more, whereas in small villages the choice set will not differ between students from different locations. These issues again create noise on our instrument: in the first stage, the relationship between the dependent variable (taking a longer education path) and the independent variable (the supply of schools that track early) is less strong than when we had perfect information on the choice set of all individuals. This results in a weaker relationship between the endogenous variable and the dependent variable in the second stage and therefore less precise estimation results. However we think that this will not systematically bias our results positively or negatively.

7.4. Exogeneity of the instrument

In section 5.2.2 we check whether there are significant differences between students from comprehensive and tracked classes. It appeared that in general they do not differ much (except for the information processing test score). However, there is a large difference in the primary school advice for the secondary education track which is worrisome.

Moreover, throughout all OLS and IV estimations the results appear to be particularly sensitive to this variable primary school advice. At first sight this is not strange, given that in the Netherlands the primary school advice is the most important factor for deciding at which secondary education track the student is placed, being more important than test scores. Therefore, in OLS models the primary school advice appears to make the wage estimates more positive, which is in line with expectations given that the primary school advice contains more and broader information on the ability and motivation of the student and thus corrects for ability differences between students.

However, in the IV estimations the variable also weakens the instrument substantially, which appears from decreasing *F*-values on the excluded instrument. Besides, the estimates of the instrument (supply rate of tracking schools in the municipality) in the first stage regressions decline too, although the standard errors also become smaller which reflects a higher precision. More

[3] The municipality coding is also only available from 1999 onwards, but it is not likely that the coding of municipalities has changed dramatically over the years so we assume that this will not bias our results.

specific, when the primary school advice is included in model three of the main model (table 6.2) the *F*-value decreases from 18.9 without the variable, to 11.7 with the variable school advice. Moreover, the point estimate and standard errors of the instrument in the first stage more than halve. In model five (full model) we see the same effect.

There are three possible explanations for the finding that the primary school advice differs so much between students from comprehensive and tracked classes. First, it might be that students from tracked classes are really different from students from comprehensive classes. In this way, for students from tracked classes a mavo advice would be considered as most appropriate, whereas students from comprehensive classes there are doubts whether the mavo or havo track is more appropriate so that the latter enter comprehensive classes. However, if this is the case it is peculiar that we find no differences in test scores. Second, it might be that primary schools partially adjust their advice to the local supply of schools. In this case, the demand for tracking schools responds to the supply. For example, when there is a so-called 'categorical mavo' in the neighbourhood (a school that only offers the mavo track), primary school teachers can be more inclined to give students a mavo advice. Third, reversely it might be that the supply of tracking schools responds to the supply of mavo students. For example, categorical mavo schools could settle in neighbourhoods where there are relatively more mavo students because this is a typical 'workers district', just as categorical vwo schools (lyceum, the highest secondary education track) settle in neighbourhoods with relatively many higher educated. These kinds of supply and demand dynamics raise doubts about the exogeneity of the instrument. The supply rate is then not something that is determined at random, but rather a result of historic and institutional features and the mentioned dynamics of the supply and demand of mavo education. In this way, our IV estimates can be biased.

8. CONCLUSIONS AND DISCUSSION

In this study, we empirically investigate whether the length of an education path matters for later income and labour market outcomes. We do this by using panel data from students that entered secondary education in 1993 and subsequently were followed throughout their education career until 2012, and combine these data with observed earnings and labour market data from 2012. More specifically, we select students that graduated from the hbo, and differentiate them between students from the shortest path (havo – hbo) and students that started at a lower secondary education level (mavo) and then followed one of the two most popular longer education paths (mavo – havo – hbo or mavo – mbo – hbo). We employ both OLS regressions with an extensive set of control variables and IV regressions to obtain causal estimates of the effect of a longer education path on earnings and other labour market outcomes.

From the OLS regressions it turns out that there are no significant wage differences between the students from the different education paths. However, we do see that income levels are heterogeneous among different types of students. For males the effect turns out to be consistently more negative than for females, but there are no differences between relatively high and low ability students. Furthermore we observe differences between the different sectors of higher vocational education the students graduated in.

We additionally present instrumental variables (IV) estimates, whereby we exploit the relative supply of schools that delayed early tracking with one or two years (so-called 'comprehensive classes') in a municipality as an instrument for the decision of students to take a longer education path. The IV estimates confirm the absence of significant earnings differences, although the instrument is not strong enough to produce estimates for the group of mavo – havo – hbo students.

Additional analyses show that there are also no significant differences in labour market status (being employed, self-employed or receiving a social security benefit), so that the absence of significant earnings differences are not driven by selection processes on the labour market. This could for example be the case when students from longer education paths are less employed, because only the relative high ability students from longer education paths can find a job, so that potential earnings differences are masked. Moreover, the OLS wage estimates of longer education paths appear to be fairly constant over the time period 2006 – 2012.

Therefore, we conclude that in general the results tend to support the human capital hypothesis: the absence of significant wage and labour market differences suggests that, on average, students from shorter and longer education paths in the end have acquired similar amounts of human capital and hence reached similar productivity levels, which is rewarded by employers with equal wages. An issue that partly undermines the effectivity of longer education paths is that the dropout share is higher than in the shortest education paths. Empirical evidence (Van Esch and Neuvel, 2009) however shows that the difference in dropout share is not so large to deny that longer education paths are an effective instrument to increase the human capital of students that, for whatsoever reason, are not able to take the shortest education path

Still, our estimations cannot be interpreted as the total private rate of return to a longer education path but merely as the direct monetary effects of such a path, because we do not account forgone income because of longer education years, education costs and indirect effects like health, criminality and the length of working life which may be correlated with education decisions (Heckman et al., 2006). Moreover we do not include the social costs, such as the education costs for the government and forgone tax revenues. Therefore, whereas longer education paths seem to be an *effective* instrument to boost the acquiring of human capital in society, we cannot conclude that it is the most *efficient* way of pursuing this goal.

Future research could investigate whether the effects are similar at other popular diploma longer education paths in the Netherlands, for example the 'havo – vwo – wo' and 'havo – hbo – wo' paths versus the shortest 'vwo – wo' path. It could be that the effects are more heterogeneous for higher or lower education levels. Next to that, it would be interesting to additionally assess the efficiency of the longer education path instrument, which requires a calculation of all costs and benefits involved, such as direct education costs, forgone earnings and tax revenues and longevity. Together with a calculation of the costs and benefits of early tracking in the Dutch education system, this could ultimately answer the highly policy-relevant question whether the Dutch system, with both early tracking and longer education paths, is an efficient system, or that it would be more efficient to delay tracking in secondary education, which would probably decrease the need for longer education paths.

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