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ABSTRACT

The Early Labour Market Effects of Generally and Vocationally Oriented Higher Education: Is There a Trade-off?*

This study investigates whether the choice for a vocationally versus a generally oriented higher education program entails a trade-off between higher employment chances and better matches at the start of the career (when opting for a vocational orientation) and a lower risk of bad match persistence later on (when opting for a general orientation). We rely on detailed early career spell data of Flemish graduates and assess the vocational orientation of their program by means of the presence of curriculum-based work placement. We model the program choice (vocationally versus generally oriented), the transition to a good match and the preceding transition to a bad match simultaneously. To account for non-random selection into vocational programs and into bad matches, the Timing of Events method is combined with an exclusion restriction. After accounting for unobserved heterogeneity, we do not find any evidence for a trade-off early in the career. This result contributes to the debate about the efficiency of vocationalising tertiary education programs through the implementation of work placement.

JEL Classification: I21, J24, J64, C21, C41

Keywords: vocational education, academisation, work placement, mismatch, underemployment, overeducation

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1. Introduction

Whether education should be vocationally or generally oriented has been at the core of the debate about educational reform for decades (see, e.g., Psacharopoulos, 1987; Hanushek et al., 2011). Vocational programs have long been praised for their success in easing school-to-work transitions. Indeed, they are often found to be associated with reduced youth unemployment levels (Müller and Gangl, 2003), higher starting salaries (e.g., Mane, 1999; Bishop and Mane, 2004) and better matches between acquired qualifications and the required qualifications in first jobs (e.g., Arum and Shavit, 1995; Heijke et al., 2003; Giret, 2011). However, despite these positive results in the short run, long-term effects may be rather negative (Goldin, 2001; Krueger and Kumar, 2004). Given the strong ties of the skills of vocationally educated individuals to a specific context, they risk to become obsolete. Particularly in times of rapid technological change, this is likely to be problematic. General education on the other hand, with its focus on broad knowledge and basic skills, facilitates learning in a changing context and reduces the costs of occupational mobility. Hence, as Hanushek et al. (2011) argue, policy makers face a trade-off between contrasting short-term and long-term effects. Relying on data for a large range of countries, they indeed found that the higher employment rate for individuals with a vocational orientation at younger ages comes at a cost of lower employment rates at older ages. Other studies found support for a similar trade-off in terms of earnings (Golsteyn and Stenberg, 2014; Stenberg and Westerlund, 2014).

While these long-term risks of vocationally oriented education are well documented, less emphasis is put on the fact that lack of flexibility may hinder vocationally educated individuals already much earlier. Could it be that vocationally educated labour market entrants have difficulties in escaping from bad matches already at the beginning of their career? Indeed, this is what descriptive evidence in a number of studies suggests. Pollman-Schult and Büchel (2004), for instance, found that young German workers with a low-quality vocational degree are no more likely to move to a skilled job than their unskilled colleagues. Verhaest and Van der Velden (2013) found that European graduates with a more vocationally oriented program are less likely to be overeducated for their first job than generally educated graduates are. However, if being overeducated for the first job, they were found to be more likely to stay overeducated. Finally, Verhaest et al. (2015) found Belgian secondary education graduates from the general track to be less likely to be persistently overeducated during the early career. The overall evidence thus suggests that, whereas initial mismatches may serve as a stepping to a more adequate job for more generally educated individuals (cf. Sicherman and Galor, 1990), vocationally educated individuals risk getting stuck already at the very beginning of their careers if they do not manage to find a matching job quickly.

In this paper, we investigate in more detail whether the choice for vocationally versus generally oriented education indeed implies a trade-off between on the one hand higher employment chances and better matches at the start of the career and on the other hand a lower risk of bad match persistence for those who nevertheless start their careers in a bad match. For this, we focus on Flemish (Belgian) higher education graduates and differentiate between vocationally and generally oriented programs on the basis of the presence of a significant component of curriculum-based work placement.

Our analysis adds in four main ways to the literature on the effects of vocational and general education. To begin with, we are the firsts to investigate the trade-off related to vocational versus general programs within one econometric framework. We simultaneously investigate the impact of vocational versus general education on entrance joblessness, the match status of the first job and the persistence of bad matches. Instead of modelling the transition

to any first job, we model both the transition to a bad match position and the transition to a good match. This allows to assess whether differences in joblessness duration between generally and vocationally educated individuals either result from differences in transitions to any job or rather from differences in transitions to good matches. The persistence of bad matches is investigated in this model by considering previous entrance into a bad match to be a determinant of the transition to a good match. This modelling aligns with the one in Baert et al. (2013), in which these authors investigated whether staying unemployed is a more or less optimal career strategy than accepting a bad match. Although we rely on a similar modelling approach and on a similar (and partially overlapping) dataset in this study, the focus is now rather on the question which educational program offers the best protection against a first bad match and against the persistence of this bad match.[4]

Secondly, we account for two types of selection on unobservables. As Ryan (2001) remarks, few studies account for non-random selection on unobservables in vocational education. That this may be important is illustrated by Malamud and Pop-Eleches (2010) who found that the estimated labour market effects of vocational versus general education on earnings and labour market participation disappear after accounting for selectivity by means of a regression discontinuity approach. We account for this type of selectively by modelling the transitions to bad and good matches simultaneously with the choice for a vocational versus general program and by adding an exclusion restriction, based on the orientation of the programs offered by colleges and universities within the vicinity of the home residence. Further, we also account for non-random selection in mismatch positions by applying the Timing of Events approach as developed by Abbring and van den Berg (2003).

Thirdly, we differentiate between effects immediately after graduation and effects after a period of joblessness. As noted by Ryan (2001), the most promising effects of vocational education apply to the dual apprenticeship system. This suggests institutional ties between education and employers to matter as well (van der Velden and Wolbers, 2003). Institutional ties are likely to be particularly helpful immediately after graduation. The work placement of the graduates, for instance, may be followed by a regular employment relationship within the same firm or colleges may provide information to their graduates regarding employment opportunities from tied employers. However, the longer the elapsed time since graduation, the less one is likely to gain from these ties to find a first job. Therefore, eventual remaining employment effects of vocational versus general education beyond the first few months after graduation are more likely to be attributed solely to differences in the skills acquired.

Finally, there is our focus on higher education graduates and work placement. This focus is interesting for two main reasons. On the one hand, the bulk of the research on the labour market effects of vocationally oriented programs focuses on secondary education. Studies focussing on tertiary education graduates remain scant (e.g., Giret, 2011; Humburg et al., 2012; Verhaest and Van der Velden, 2013) and, hence, more research is needed to reassure that the aforementioned conclusions also apply to them. On the other hand, sorting along general and vocational tracks in secondary education is often based on family background and ability (Brunello and Checchi, 2007). This may generate negative signalling effects that also affect the more able. Moreover, in response to this sorting, also the difficulty of the program may be reduced. Within Flanders, for instance, the vocational secondary education program is generally perceived to be of a lower level and to be less prestigious. Hence, differences in

[4] Given this alternative focus, there are also several other differences with the analysis in Baert et al. (2013) (cf. infra). For instance, given that the focus is less on job search strategies and more on the labour market effects of educational choices, we investigate joblessness spells instead of unemployment spells and estimate a more extended model.

labour market outcomes between vocational and general tracks may not just reflect a difference in orientation, but also differences in level and prestige. This problem is not resolved by accounting for unobserved heterogeneity. In higher education, a similar sorting between programs with and without work placement is much less present. Hence, the estimated effects related to differences between both types of higher education programs are much more likely to reflect differences in the orientation instead of variations in level and prestige.

The remainder is structured as follows. First, we give a brief overview of the institutional setting regarding higher education in Flanders. Next, we present our data and variable measurements. Thereafter, we outline our econometric model. Further, we present our estimation results. We end with a discussion and conclusions.

2. Background: Higher education in Flanders

In the pre-Bologna era, which applies to the analysed sample in this study, Flemish higher education[5] was structured along three main tracks: (i) a short-term non-university track (lasting three years), (ii) a long-term non-university (lasting four years or more) and (iii) a university track (lasting four years or more)[6]. The first two tracks were offered by colleges ("Hogescholen") and were generally perceived to be rather labour market and vocationally oriented; the last one was offered by universities and perceived to be more general and academic (Verhoeven et al., 2000). Consistent with the aforementioned potential virtues of more vocationally oriented education, individuals from the short-term non-university track experienced on average more short periods of entrance unemployment and lower levels of mismatches in their first jobs in comparison to those from the university track (Vanoverberghe et al., 2008).

A major problem with these conclusions regarding the performance of college and university programs is the selectivity along the tracks in Flanders (see Verhoeven et al., 2000). The lower the performance record in secondary education, the more often students opt for a college track and the more often they start in the short-term program. The same is true for students from the less prestigious vocational and technical (as opposed to the general) secondary education track. This may explain to some extent the mixed performance of the long-term college track. Similarly, the performance of the short-term track may be even underestimated. Further, the focus on higher education tracks masks substantial heterogeneity in the degree to which programs are rather vocational or general. This is clearly illustrated by the extent to which work placement is part of the curriculum. Within each track, this provision largely diverges across fields of study. In the university track, for instance, most programs indeed provide in no (e.g., Philosophy) or only a short-term (e.g., Business) work-placement experience. Yet, there are several exceptions, with work-placements ranging from a couple of months (e.g., in psychology) to even several years (e.g., in medicine). And also within fields of study, there is heterogeneity depending on the specific focus of the program, the specific college or university or even the individual student (e.g., because work placement is only elective). Hence, a critical assessment of the virtues of vocationally oriented higher education in Flanders requires

[5] In Belgium, education is a regional duty.

[6] In the long-term college track and the university track, individuals were already awarded a so-called candidate degree after two years. However, this degree was not intended to be a terminus and almost all students proceeded thereafter with at least two more years of education to achieve their licentiate degree.

to take this heterogeneity into account.

An inquiry into the merits and pitfalls of vocational and general education in Flanders is particularly interesting in view of a number of recent reforms resulting from the implementation of Bologna regulations. One of the main reforms was the so-called 'academisation' of the long type non-university programs. These programs had to integrate more scientific research into education and, from 2013 on, were transferred to the classic universities. These universities now bear full responsibility over all long programs and only award so-called academic bachelor and master's degrees. Within fields of study such as business and engineering, they now offer programs that are similar in content but somehow different in orientation. Against a background of budgetary constraints, universities may want to rationalise and merge some of these programs. Our analysis may provide some advice regarding the best way to follow. The colleges remain responsible for the original short-type programs that now lead to a so-called professional bachelor degree. Because of the introduction of more flexibility, however, an increasing number of students use these professional bachelor programs as an intermediate stop towards an academic degree. This may indeed be a good option if this additional academic education provides them with useful generic skills that foster long-term career development.

3. Data and descriptive statistics

Data and sample

Our analysis relies on data from representative samples of three birth cohorts (birth years 1976, 1978 and 1980) in Flanders. The data result from the so-called SONAR surveys, which were conducted each among 3000 individuals at age 23. We also use data from follow-up surveys, conducted at age 26 for the 1976 and 1978 cohorts and at age 29 for the 1976 and 1980 cohorts. Response rates for these follow-ups range between 60% and 70%.

The SONAR surveys focused on the transition from school to work and collected detailed information on both school and work transitions. Regarding the school career, the data contain essential information such as the level of attained education, the type of the program, field of study, the presence of work placement in the curriculum and the geographical location of the school or university. Labour market histories are registered on a monthly basis and provide information such as changes in working status (working or jobless), employer or bundle of tasks (also with the same employer). For each function, also information regarding the tasks that were executed is available, enabling to assess the quality of the match. Further, the data distinguish between standard jobs and jobs that are related to the educational career such as apprentice jobs, work placement or student jobs.

We focus our analysis on individuals with a higher-education degree. Among the 9007 individuals in the overall sample, 3858 individuals (42.8%) had a higher-education degree at the time they first left education[7]. After further exclusion of individuals with missing values on any of the variables used in the analysis, we keep a final sample of 3551 individuals for our econometric analysis. For these individuals, we analyse the time between the date of leaving higher education and date they enter a job with a good match (cf. infra) for the first time.

[7] Another 29 individuals also had a higher-education degree without having yet left education at the time of the last interview.

Work-placement experience

As indicator for the vocational orientation of the program, we rely on the presence of work-placement experience in the curriculum. Of course, vocational education requires more than providing students with some practical experience. Yet, work placement entails substantial effort for higher education institutions in terms of the search to find suitable places, the guidance of the students and their evaluation. Hence, institutions that are not convinced about the value of vocationally oriented education are not likely to invest in work placement. In addition, work-related experience is the most visible aspect of vocationally oriented education and, in that way, may have a strong signalling value towards employers.

In the SONAR survey, individuals were asked whether they had participated in work placement during their higher education and, if so, for how much time. In order to distinguish between vocational and general education, we consider three alternative criteria. In our benchmark analysis, a student's program is considered to be vocational if she participated for at least three months in work placement. This delivers a fairly equal division of the graduates over the two types of programs (see table 1). As expected short programs are predominantly classified as being vocational, while long programs usually are more general. Nevertheless, also a significant minority of the students in the short track are classified as having had a more general program, while almost 30% of all long programs are classified as being vocational. We also execute some sensitivity analyses relying on two alternative criteria. The first alternative criterion defines programs to be vocationally oriented if they include already one month of work-placement experience, while the second alternative is more strict and uses four months of work-placement experience as criterion. According to these alternative definitions, respectively 74.3% and 39.1% of all programs are vocational.

Table 1: Orientation of study programs – sample distribution

	Overall sample	**Short programs**	**Long programs**
Vocational: Benchmark criterion	52.8%	69.6%	28.6%
Vocational: Alternative criterion 1	74.3%	92.9%	47.6%
Vocational: Alternative criterion 2	39.1%	50.5%	22.6%

Notes. Data source: SONAR, own calculations; N = 3680.

Joblessness spells

We analyse the duration between the time of leaving the educational system and the time of entrance into a good match. By taking the time of leaving education as point of departure, we focus rather on joblessness instead of unemployment as indicator for youth employment problems (cf. Rees, 1986; Ryan 2001). The reason is threefold. First, in the period under investigation, Flemish youth entering the labour market only became entitled to unemployment benefits after a period of nine months. Hence, many young labour market entrants do not register for unemployment. Particularly for higher education graduates, who have relatively good employment opportunities, this lowers the incentive to register at the employment service. Second, we do not have administrative data and have to rely on the assessment of the respondents for the measurement of the unemployment status. For individuals, it may not be clear what the subtle difference is between being unemployed and being out of work. Thirdly, young people may become discouraged when they face problems to find jobs,

pushing them into inactivity. As Rees (1986) argues, this may be as or even more problematic than being unemployed since also these individuals do not invest in their human capital and risk to become permanently detached from the labour market.

Mismatch indicators

We measure match quality by means of the correspondence between the graduates' education and the education required for the job, with those having excess education being considered to have a bad match. Although this is just one way to define match quality, this educational mismatch is found to be predictive for a large number of other negative outcomes, such as lower wages, lower job satisfaction and less on-the-job training participation (Hersch, 1991; Hartog, 2000; McGuinness, 2006). For our baseline analysis, we rely on an objective indicator. In the SONAR data, each position has been coded on the basis of the Standard Occupation Classification of Statistics Netherlands (CBS, 2001). This classification considers five functional levels, with each a corresponding level of required education: elementary (the required level is at least ISCED 0 and 1), lower (ISCED 2), intermediate (ISCED 3 and 4), higher (ISCED 5 – Bachelor) and scientific (ISCED 5 – Master). We consider those with a long-term higher education degree to have a bad match if employed at any level below the scientific level; those with a short-term degree are assumed to have a bad match if they are employed at a level below the higher functional level. Those with a short term degree who are employed at the scientific level are thus also considered to have a good match. Given that it is usually found that these so-called undereducated workers earn at least as much as those with an educational level that adequately educated workers (Hartog, 2000), this seems valid.

While objective educational mismatch measures have some advantages over more subjective ones, such as being less prone to social desirability bias or relying on uniform coding instructions, there are also several disadvantages[8]. In particular, these objective measures are often criticised on the fact that they are rather static and insufficiently take into account that educational requirements within occupations may change over time. Moreover, the decisions of job seekers are likely to be driven rather by their subjective assessments of the quality of their match than about objective job quality. Therefore, in a sensitivity analysis, we also investigate the impact of the orientation of higher education on subjective educational mismatch. Subjective mismatch is usually derived from a survey question regarding the educational requirements for one's job. Such information is available in the SONAR data for the first job of the individuals born in 1978 (in the survey at age 23) and 1980 (in the survey at age 23 and 29). These individuals got the following question: "What is (was), according to your own opinion, the most appropriate educational level to execute your job?". Given that this question was not posed to all individuals and not for later jobs, we develop the following procedure. In a first step, we compute the median subjectively assessed required level of education within each occupation. This delivers an alternative, more subjective assessment of the functional level for each occupation. In a second step, we assess for every individual and for every job whether someone was subjectively mismatched by comparing the attained level of education with this alternative functional level.

[8] For discussions on this issue, see, amongst others, Hartog (2000) and Leuven and Oosterbeek (2011).

Descriptive analysis

Before we present our econometric model, we report some general descriptive evidence on the difference in labour market transition between generally and vocationally educated graduates. We focus on our benchmark definition for vocational programs (i.e. three months of work-placement experience) to distinguish between general and vocational degrees and measure mismatch by means of the objective indicator.

Table 2: Descriptive statistics on the transition from education to work by orientation (benchmark crit.)

	General		**Vocational**		**Log rank test**
	Median	Mean	Chi²	Mean	Chi²
Months until first job	3	4.4	2	3.7	16.9***
Months until first good match (objective)	50	72.0	5	44.3	127.3***
Months since entry into bad match until first good match (objective)	-	108.5	-	92.9	8.4***

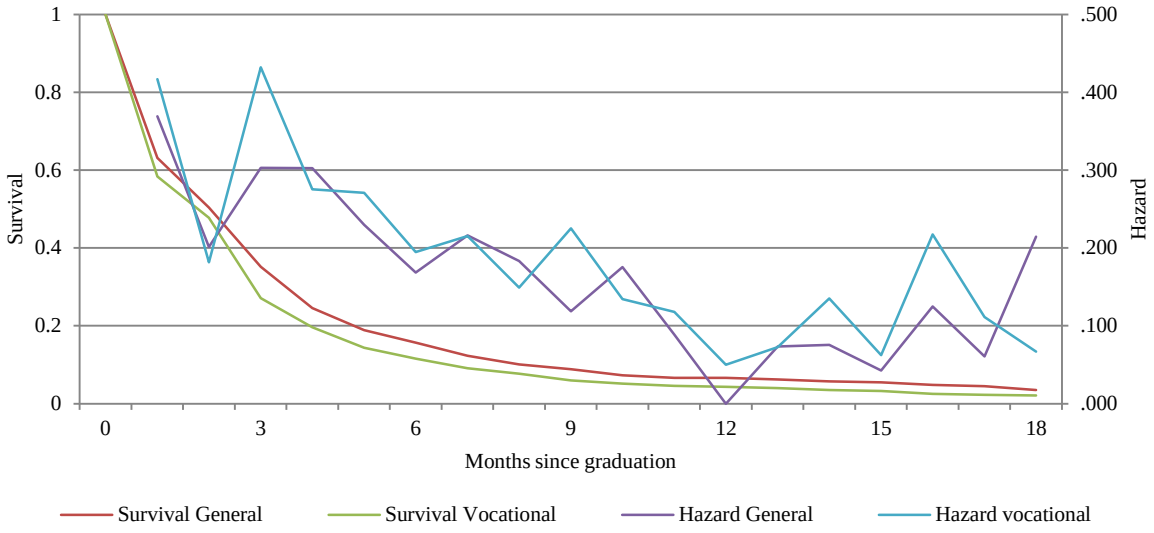
Notes. Data source: SONAR, own calculations. The log rank test tests the equality of the survival distributions.

In figure 1, we present Kaplan-Meier estimates of the monthly transition to any first job after graduation (i.e. irrespective of the quality of the match). Consistent with previous findings in the literature, we find that vocationally educated individuals enter more quickly into their first job than generally educated individuals. However, the difference is rather moderate. While the median joblessness period is three months for generally educated individuals, it is only two months for vocationally educated ones (see Table 2). The average durations are 4.4 and 3.7 months respectively. This seems to be predominantly explained by higher hazard rates during the first and the third month after graduation.

Figure 2 presents Kaplan-Meier estimates of the number of months that it takes to find a first objective good match. The transition to a good match occurs at a much slower rate than the transition to any job, indicating that many young workers start their career in a bad match (cf. Baert et al., 2013). More importantly, we find that the restriction to good matches delivers a much more pronounced difference between the two types of education. While the median duration until a good match amounts only five months for vocationally educated individuals, generally educated individuals have a median duration of 50 months (see table 2). Also this fits with previous findings in the literature. These differences are predominantly explained by differences in hazard rates during the first half year after graduation. Beyond the first year, hazard rates seem to be similar.

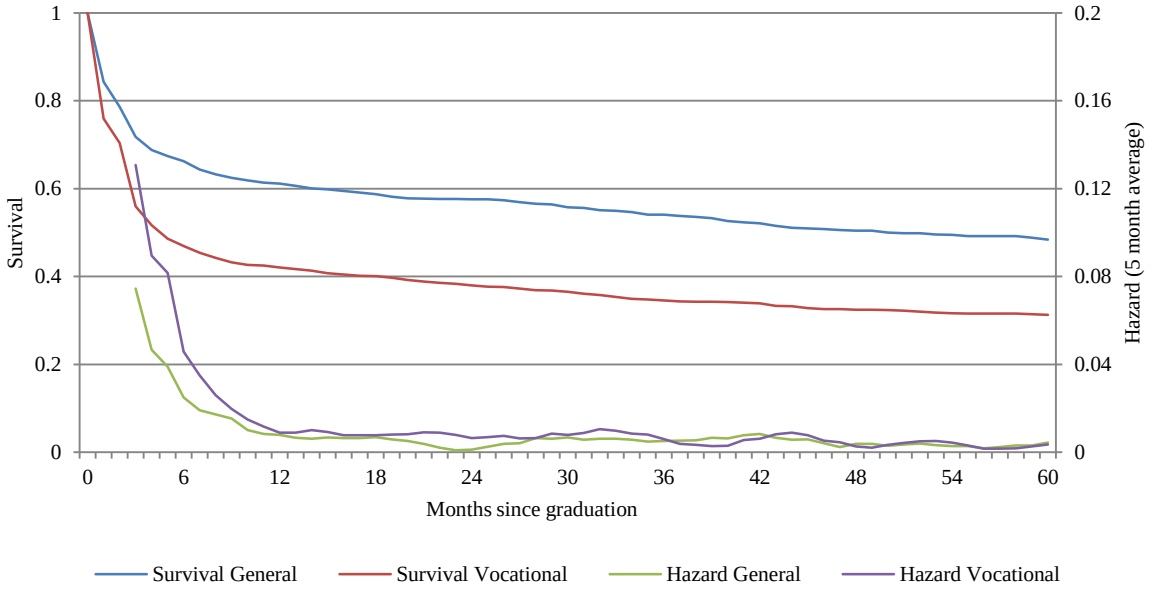
Finally, we assess the persistence of bad matches by means of the duration between the start of a bad match and entry into a first good match (Figure 3). Conversely to expectations, vocational programs are not outperformed by general ones. On the contrary, during the first two and a half year, vocational programs are on average associated with a higher hazard regarding indirect entry into a good match. Beyond the first two and a half years, general programs seem to perform similar to vocational programs. This is not consistent with the hypothesis that there is a short term trade-off in the choice between vocational and general education. However, since this descriptive analysis does not take into account any difference in observed and unobserved heterogeneity, it is too early to make a final conclusion.

Figure 1: Kaplan-Meier estimates – duration between date leaving education and entry in first job by orientation (benchmark definition)



Notes. Data source: SONAR, own calculations. N = 3680.

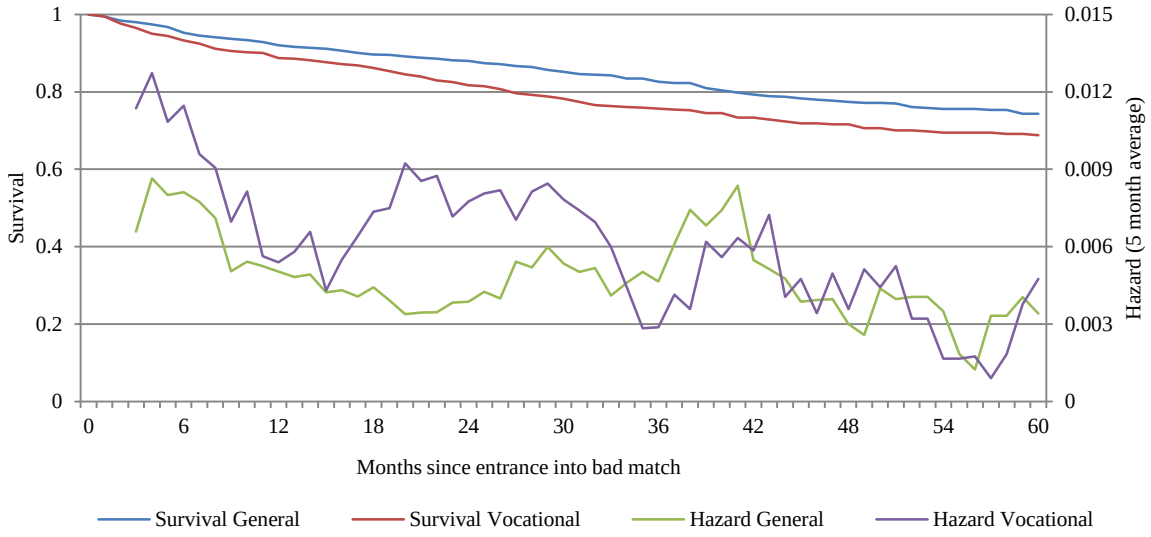
Figure 2: Kaplan-Meier estimates – duration between date leaving education and entry in first good match (objective) by orientation (benchmark criterion)



Notes. Data source: SONAR, own calculations. N = 3680.

In Appendix A, we also report some descriptive statistics relying on other vocational orientation and mismatch indicators. When relying on alternative criteria to distinguish between general and vocational programs, conclusions are largely similar. Relying on our alternative indicator for mismatch, we find substantial shorter spells to a first good match in comparison to the benchmark case. This indicates that the perceived match quality of jobs is, on average, better than the match quality as measured by our objective method. However, also this measure delivers shorter durations to a first match for vocationally than for generally educated individuals.

Figure 3: Kaplan-Meier estimates – duration between start bad match and entry in first good match (objective) by orientation (benchmark criterion)



Notes. Data source: SONAR, own calculations. N = 1719.

4. Econometric model

Selection problems

With our analysis, we aim to identify to what extent graduates with a vocational degree differ from their generally educated counterparts in their transition to a job with a good match. We consider that these individuals have two options when they search for a good match: either they search for a good match while staying jobless or they accept a bad match and proceed with their job search while being employed. Hence, we investigate to what extent the orientation of the program influences the following three types of transitions: (i) the transition to a bad match, (ii) the direct transition to a good match and (iii) the transition to a good match conditional on having entered in a bad match previously.

When analysing differences in the aforementioned transitions, we face several selection problems. The first two selection problems are related to the modelling of the labour market transitions, and are similar to those solved by the model of Baert et al. (2013), on which we build. First, we face a classic selection problem with respect to the inflow of individuals in good and bad matches. Individuals who are more likely to accept bad matches may have a systematically lower (or higher) likelihood of finding an adequate job than those who are less likely to accept these jobs. Ignoring this first selection problem may result in a downward (upward) bias of the overall transition rate from a bad match to a good match. Second, a so-called dynamic selection problem may emerge, even if the unobserved determinants of entry into a bad match are not systematically related to those of entry into a good match. This results from the fact that individuals may only enter into a bad match if they did not find a good match beforehand. This biases the estimated effect of accepting a bad match on the transition to a good match towards zero (see Lancaster, 1990). To take into account these two sources of bias, we build on the Timing of Events method as developed by Abbring and van den Berg (2003). Within this approach, the transitions to a good and a

bad match are jointly modelled allowing correlation between the unobserved time-constant individual determinants of both transitions. In addition, the entrance in a bad match is considered to be a treatment that may or may not affect the transition to a good match.

Another selection problem, which is not there in Baert et al. (2013), is related to the non-random assignment of individuals to vocational and general programs. While part of this heterogeneity may be captured by observable variables such as social background and secondary education background, individuals who choose for a vocational instead of a general program may also be different in terms of unobservables such as innate ability and motivation. Hence, the effect of a vocational program on the likelihood to find a job will be upwardly (downwardly) biased if the more able and the more motivated choose more (less) often for a vocational program. We solve this problem by modelling the transitions to bad and good matches simultaneously with the choice for a vocational versus general program, allowing the unobserved time-constant individual determinants of this choice to be correlated with the unobserved determinants of flowing into good and bad jobs. To further control for the selection effect, we add an exclusion restriction, i.e. a variable that influences the program choice, but has no impact on the transition to jobs. For this, we rely on the relative supply of vocational programs in the vicinity of the home residence (cf. infra). In a later subsection, we come back to the identifying assumptions of this exclusion restriction and of the Timing of Events method in the context of our particular model.

General model specification

Our econometric model consists of three equations, two duration equations representing the transition to a bad match (indicated by index *b*) and a good match (indicated by index *g*) respectively, and one representing the choice for a vocational or general degree. The respective hazard rates $\vartheta_b\left(t\middle|x,V_b\right)$ and $\vartheta_g\left(t\middle|t_b,x,V_g\right)$ are modelled according to the following Mixed Proportional Hazard (MPH) form:

$$\begin{cases}\ln\vartheta_b\left(t\middle|x,V_b\right)=\ln\lambda_b\left(t\right)+\alpha_b y+x'\beta_b+V_b\\ \ln\vartheta_g\left(t\middle|t_b,x,V_g\right)=\ln\lambda_g\left(t\right)+\alpha_g y+x'\beta_g+\delta\left(t\middle|t_b,y,x\right)1\left(t>t_b\right)+V_g\end{cases},$$

where t is the elapsed duration since the individual left the educational system, while t_b represents the realised joblessness duration at the time of entry into a bad match. Both hazard rates are modelled as a function of the orientation of the program y (y=1 if vocational), a vector of other observed characteristics x, and transition-specific unobservable components V_b and V_g. In addition, the hazard rate regarding the transition to a good match is also modelled as a function of previous entry into a good match. This is represented by indicator function 1(.), which is one if the argument is true and zero otherwise.

δ thus represents the treatment effect of a bad match on the transition rate to a good match. It measures to what extent acceptance of a bad match accelerates ($\delta > 1$) or delays ($\delta < 1$) the transition to a good match. This effect can be modelled as any function of t, t_b, y and x. In our benchmark analysis, we allow the treatment effect to depend on the elapsed joblessness duration at the time of entry into a bad match t_b and the orientation status y:

$$\delta\left(t\middle|t_b,y\right)=\delta_0+\delta_1\cdot(t_b)+\delta_2\cdot(t_b)^2+\delta_3\cdot y\,.$$

The dependence on the elapsed joblessness duration is in line with Baert et al. (2013), who found that the delay in transition to a good match is stronger if a bad match is accepted more early in the unemployment spell. With the

dependence on the orientation of the study program, we aim to test whether bad matches are more persistent for vocationally educated than for generally educated graduates. Note that $\delta_3 < 0$ is not a sufficient condition to conclude that a vocational program slows down the transition to a good match conditional on previous entry into a bad match. This would only indicate that the delay (acceleration) in transition to a good match by looking for a job while being in a bad match instead of being jobless is less (more) pronounced for generally than for vocationally educated individuals. To the extent that generally educated individuals may have a lower direct transition rate to a good match ($\alpha_g > 0$), bad matches may be still more persistent for them. In order to conclude that bad matches are less persistent for generally educated individuals, it is required that $\alpha_g+\delta_3 < 0$.

Regarding the baseline hazards $\lambda_b(t)$ and $\lambda_g(t)$, we follow the literature and specify them as piecewise constant:

$$\begin{cases} \ln \lambda_b(t) = \alpha_m^b \\ \ln \lambda_g(t) = \alpha_m^g \end{cases},$$

for $t \in [t_{m-1}, t_m)$, where m is an indicator of the time interval and where in the application $m \leq 4$ and $t_0 = 1$, $t_1 = 3$, $t_2 = 5$, $t_3 = 10$, $t_4 = +\infty$.

As indicated in our descriptive analysis, the difference in transition rates between generally and vocationally educated individuals seems to differ depending on the elapsed duration since labour market entry. In line with the hypothesis that the effect of vocational education is partly the result of the institutional ties between higher education institutions and employers, the difference seemed to be more pronounced during the first months after graduation. Therefore, in a more extended specification, we also include interaction terms between the baseline hazard and our program dummy:

$$\begin{cases} \ln \vartheta_b(t|x,y,V_b) = \ln \lambda_{b,c}(t) + \ln \lambda_{b,y}(t) \cdot y + \alpha_b y + x'\beta_b + V_b \\ \ln \vartheta_g(t|t_b,x,y,V_g) = \ln \lambda_{g,c}(t) + \ln \lambda_{g,y}(t) \cdot y + \alpha_g y + x'\beta_g + \delta(t|t_b,y,x)1(t > t_b) + V_g \end{cases}.$$

Finally, we model the probability of choosing for a vocational vis-à-vis general program. For this, we assume the following logistic specification:

$$Pr(y = 1|x,z,V_h) = \frac{exp(x'\gamma + \varphi z + V_h)}{1 + exp(x'\gamma + \varphi z + V_h)},$$

where z represents a variable affecting program choice but not any of the transitions, and where V_h represents an unobserved heterogeneity term.

The model is estimated by Maximum Likelihood estimation techniques. To obtain the likelihood contributions, we integrate the individual contributions related to the Mixed Proportional Hazard model (with respect to the labour market outcomes) and to the logistic model (related to the program choice) over the unobserved heterogeneity distribution. More concretely, we adopt a discrete non-parametric distribution in the spirit of Heckman and Singer (1984). We estimate, by analogy with van den Berg et al. (2002), our model for an optimal (according to an appropriate information criterion) and a priori unknown number K of heterogeneity types. Their proportions are specified as logistic transforms:

$$p_k = \frac{\exp(q_k)}{\sum_{j=1}^{K} \exp(q_j)},$$

with $k=[1,K]$ and q_k parameters to be estimated (q_1 normalized to 0). In addition to the estimation of these type probabilities, this approach is based on the estimation of one mass point for V_b, V_g and V_h for each heterogeneity type (with the mass points for the first type normalised to 0).

Control variables

To account for differences between graduates from the two different types of programs and between those entering into bad matches and those staying unemployed, we control for a large subset of observables (x'). These variables are dummies for gender (1 dummy), foreign background (1), province of residence (4), degree of urbanisation of the home municipality (3), educational track in secondary education (3), master programs (1), broad field of study (6), mark in final year of higher education (1), participation in student work during higher education (1), and month of leaving the educational system (1). As continuous variables, we include the level of education of the father, the minimum duration of the program (in the case of a master program) and the youth unemployment rate at labour market entry. Descriptives on these control variables are reported in Appendix B.

The inclusions of the higher education track (short-term non-university, long-term non-university and long-term university) and the field of study as control variables requires further clarification. As discussed in section 2, the degree of vocationalisation largely differs between higher education tracks and between fields of study. On the one hand, by including these variables in the model, we risk picking up part of the effect of vocational programs because employers may use the track and field of study as signal for the vocational character of the job seekers' education. On the other hand, differences in labour market transitions between alternative tracks and fields of study also result from differences in demand and supply conditions on the labour market. The better performance for the short track in comparison to the long tracks for instance may result from a higher demand for labour at the higher functional level in comparison to the scientific functional level. Similarly, the better performance for those with a medicine degree may result from labour shortages in the medical sector. Therefore, regarding the track, we opt to control for the level of the degree (master versus bachelor), but not for the type of institution (college versus university). Further, we only account for broad fields of study. Within each broad field of study, individuals may serve as imperfect substitutes and hence the most significant differences in demand and supply should be captured. Nevertheless, there remains substantial variation in the vocational degree of the programs within these fields to identify its effect.

Identification of the selection effects

In the Timing of Events approach, identification of the selection effect regarding entry into a bad match relies on the idea that unobserved time-invariant individual determinants of the transition to a good match affect this transition from the moment of leaving education while entry into a good match may only affect this transition from the moment at which this entry occurs. While this identification does not require exclusion restrictions, there are several identifying assumptions (Abbring and van den Berg, 2003). For a discussion of these assumptions within the context of the impact of accepting bad matches on the subsequent probability to find a good match, we refer

to Baert et al. (2013).

As mentioned before, we extend Baert et al. (2013) by simultaneously modelling the program decision. To control for the endogeneity of this decision with respect to later labour market outcomes, we add an exclusion restriction, i.e. a variable that influences the program choice, but has no impact on the transition to jobs. In the spirit of Card (1995), our exclusion restriction is based on the relative supply of vocational programs in the vicinity of the home residence. As for other countries, evidence shows participation in tertiary education in Belgium to depend on the proximity of colleges and universities (Duchesne and Nonneman, 1998). Our supply variable r^v is derived from additional information in the SONAR data regarding the address of the higher education institution of the graduate. Firstly, we estimated the overall supply of educational services at a particular postcode by the number of students in the SONAR data that followed their program in an institution located at that postcode (s_p). Secondly, we assessed the degree to which the programs offered at the postal code were rather general or vocational. For this, we relied on our benchmark criterion regarding three months of work placement experience and computed the proportion of the degrees awarded at a particular postcode that are assessed to be vocational (voc_p). Thirdly, we weighted the supply of vocational programs by the distance between each location with at least one higher education institution and the location of the residence. [9] For this we relied on the following distance weighting function: $exp(-(d_{pi}/40)^3)$ with d_{pi} the distance in kilometres between postal code p with an institution and the home residence of individual i. On the basis of this function, the weight strongly decreases for programs beyond 40 km from the home residence. Our variable that measures the relative supply of vocational programs for individual i is then measured in the following way:

$$r_i^v = \frac{\sum_{p=1}^{m} voc_p \cdot s_p \cdot \exp(-(d_{pi} / 40)^3)}{\sum_{p=1}^{m} s_p \cdot \exp(-(d_{pi} / 40)^3)},$$

with m = the number of locations with a supply of tertiary education. The denominator represents the distance-weighted overall higher education supply for the individual, while the numerator represents the distance-weighted vocational higher education supply. The ratio then measures the relative importance of vocational programs in the vicinity of the home residence.

Exclusion restrictions based on college and program proximity are widely used in the literature on the impact of educational choices.[10] Nonetheless, they are not uncontested since individuals living near (particular) colleges may perform different on the labour market in comparison to others. While we cannot completely rule out that our

[9] While information on the home address ideally corresponds to the situation at the start of graduation (mostly age 18 to 20), we only have information on the official address at age 23. For several reasons, the number of individuals with a (substantial) change in the geographical location of their official address is likely to be small. At age 23, individuals in our sample only recently graduated or were still at college or university. Further, while many students rent a room near college or university, almost all students in Flanders turn home during the weekend. Parents also get child benefits for children officially residing at their address up to 12 months after graduation (conditional on not having a job with a standard labour contract). Hence, it is usual in Belgium to keep the official address unchanged up until a significant period after graduation. Also overall geographical mobility is considered to be low in Flanders (Estevão, 2002).

[10] Recent application are, amongst others, those by Carneiro et al. (2011), Kämhofer and Schmitz (2015), Kolstad and Wiig (2014) and Reynolds (2012).

exclusion restriction is not valid, we are confident that this problem is limited in our study and, at least, no more severe than in other studies relying on similar exclusion restrictions. In what follows, we will argue why this is the case.

A first problem may be that the relative supply of programs is geographically not evenly spread across the region and, hence, may capture local labour market effects. In Flanders, universities are indeed more concentrated in the big cities and in three of the five provinces. Also the extent to which colleges and universities include work placement in the curriculum may differ across Flanders. However, by controlling for province of residence and the degree of urbanisation of the home municipality, we aim at solving this problem.

A related problem is that firms may base their location in function of the nearness of particular higher education institutions. However, this is only problematic if firms not only account for the location of colleges and universities and the programs they offer in terms of level and field of study, but also for the extent to which these programs include work placement. Although we cannot exclude that a few firms account for this, we consider it unlikely to be a decisive location factor. Moreover, even if firms would be willing to take this into account, the number of colleges and universities are limited and, hence, there is often no real choice. The opposite, with higher education institutions letting depend the orientation of their programs on the availability of firms, may be more likely. For instance, the extent to which colleges are willing to include work placement in their curricula may depend on the availability of firms and organizations in their vicinity that are willing to collaborate. Hence, a high relative supply of vocational programs within a certain field of study may also indicate the presence of firms and organizations that employ workers in matching occupations. This should only be a problem as long as a significant fraction of the potential jobs in the graduate's job search area are offered by firms and organizations located near higher education institutions. Although this cannot be ruled out for those residing close to these institutions, this should not be the case for most of the graduates.

Further, our variable on the supply of programs may capture rather the supply of graduates in one's region. However, for several reasons, our supply variable has little to say about the number of competitors for graduates with respect to the labour market. First of all, individuals choosing for the same college or university may reside in districts that are geographically largely distinct. This is in particular the case for Flanders, which is a highly densely populated region. The overlap of the geographical area in which individuals from the same institution look for jobs may thus be limited. Moreover, this overlap may even be absent since job opportunities are much more well spread across the country than colleges and universities. Secondly, we rely on a distance function rather than on separately delineated districts. Hence, even within a district and among graduates applying for similar jobs, the relative supply of programs differs depending on the postal code of one's residence. Thirdly, our supply variable is measured relying on the programs of individuals across all age cohorts, while graduates above all compete with graduates entering the labour market at the same time. Given that labour market entrance of the graduates in our sample is spread over a period of about one decade, this divergence is likely to be strong. Fourthly, the supply is measured in relative instead of absolute terms and, hence, a higher value on this variable does not necessarily indicate a larger number of graduates. Finally, we condition on the level and field of study of the program and thus investigate the impact of the orientation of the program assuming they are in the same labour market segment. Hence, even if our program supply variable is positively correlated with the absolute number of graduates with a vocational degree, a higher relative supply of graduates with a vocational degree should not indicate a higher

number of graduates with which they have to compete.

Finally, individuals may choose their residence in function of the supply of educational services. This may be a problem if this is relatively more the case for families with more able and more motivated children (Card, 1995). However, even if parents take into account the overall availability of colleges and universities and their supply in terms of fields of study when deciding on the family residence, it is unlikely that they also account for the extent to which they include work placement in their programs. After all, at the time the family residence is chosen, parents usually have little or no information about their children's specific preferences regarding this issue. And even if so, this problem is further accounted for by the fact that we control for the educational level of the father and the track choice in secondary education at age 16.

5. Estimation Results

Benchmark model

In Table 3, we report the main estimation results on our benchmark model, with three months of work-placement as criterion to distinguish between vocational and general programs and relying on the objective mismatch indicator. We report results on both models without and with unobserved heterogeneity being taken into account. The full estimation results regarding the model that accounts for unobserved heterogeneity are reported in Appendix C. On the basis of the Akaike Information Criterion, we retain seven heterogeneity types for this model. However, most of the individuals seem to pertain to three classes, with respective probabilities of the points of support of 65.9%, 20.2% and 7.6%.

We first focus on the estimates that are based on the model that does not take into account unobserved heterogeneity (Table 3, Model (1)). Regarding the program equation, the main variable of interest is the variable that measures the relative supply of vocational programs within the vicinity of the home residence. The coefficient of this variable has the expected sign and is statistically significant ($\varphi > 0$). The higher the relative supply of vocational programs in one's region, the more likely one is to participate in a vocational program. Regarding the hazard to a bad match, we find the expected negative sign for the effect of having a vocational degree (α_b). However, this effect is not statistically significant. Regarding the hazard to a good match, the effect of a vocational degree is positive and statistically significant ($\alpha_g > 0$). This was expected and implies that those with a vocational degree have a higher transition rate to a first good match if there was no prior entrance into a bad match. The estimate is equivalent to an increase in the direct monthly transition rate by 16.2% for vocational degrees as opposed to general degrees.[11] Further, in line with previous evidence, we find a negative treatment effect of previous entrance into a bad match for entrance into a good match ($\delta_0 < 0$), although the effect seems to diminish with the duration between labour market entry and entrance into a bad match ($\delta_1 > 0$). Finally, as expected, the treatment effect of previous entrance into a bad match is found to be more negative for vocationally than for generally educated individuals ($\delta_3 < 0$). However, this difference is not statistically significant. Hence, we cannot conclude on the basis of this specification that a bad match delays the transition to a good match more profoundly for vocationally educated individuals than for generally educated individuals. Further, these estimates suggest that

[11] Exp(0.150)-1=0.162.

both programs are similar in terms of conditional transition rates to a bad match since the negative (insignificant) treatment interaction effect more or less balances out the positive direct effect of having a participated in a vocational program ($\alpha_g+\delta_3$=0.150-0.144). Hence, bad matches seem to be equally persistent for both types of programs.

Once we account for unobserved heterogeneity (Table 3, Model (2)), we find a somewhat stronger effect for vocational programs on the transition to a bad match. However, the coefficient remains statistically insignificant. Moreover, we no longer find that those with a vocational degree have a higher transition rate to a good match if there was no prior entrance into a bad match. One explanation may be that, conditional on observed characteristics, those who participate in vocational programs have unobserved characteristics that increase the likelihood to start in a job that matches with one's education. However, to the extent that the coefficient of the orientation dummy only reflects a weighted average of local average treatment effect for those being affected by the instrument (Imbens and Angrist, 1994), also other factors may explain this difference in outcome. Again, a difference in treatment effect between generally and vocationally educated individuals cannot be detected. Neglecting statistical significance, we even find a less negative treatment effect for vocationally than for generally educated individuals. Consequently also these estimates do not indicate that bad matches are more persistent for vocationally educated individuals than for generally educated individuals.

Extended model

We also estimate a more extended specification, in which we interact the baseline hazard with the program choice dummy (see Table 4, Model (1)). Regarding the transition to a bad match, these interactions are not statistically significant. Regarding the transition to a good match, however, we find the impact of the program orientation to depend on the elapsed duration. First of all, the baseline effect for vocational programs is found to be negative (α_g > 0), although the effect is only statistically significant at the 10% level. This is equivalent to a decrease in thedirect monthly transition rate by 16.6% for vocational degrees as opposed to general degrees.[12] Further, we find positive and statistically significant interaction effects between the program orientation and the period between three and nine months after entering the labour market. To conclude that the direct monthly transition rates during this period is higher for those with a vocational than for those with a general programs, the sum of the baseline effect and the respective interaction effect needs to positive and statistically significant as well ($\alpha_g + \ln\lambda_{g,y}(t) > 0$). This is the case both for the period of three to four months after graduation (significant at the 5% level) and the period of five to nine months after graduation (significant at the 10% level).[13] These effects are equivalent to an increase in the monthly transition rate by 55.0% and 38.8% respectively in the case of vocational degrees as opposed to general degrees.[14] Although the interaction between the treatment effect and the program dummy now again has the expected negative sign, it is also statistically insignificant in this case. Also the differences in indirect monthly

[12] Exp(-0.181)-1=-0.166

[13] The estimated effect for t = [3,4] is equal to -0.181+0.619=0.438 and has a Chi² value of 6.199; the estimated effect for t = [5,9] is equal to -0.181+0.509=0.328 and has a Chi² value of 2.922.

[14] Exp(0.438)-1=0.550; exp(0.328)-1=0.388.

transition rates are statistically insignificant for any elapsed duration since labour market entry. [15]

Table 3: Benchmark model – Main estimation results

	(1)		(2)	
	Coeff.	SE	Coeff.	SE
Probability to participate in a vocational program				
φ: relative supply of vocational programs	4.187 ***	(1.571)	10.037 ***	(3.534)
Hazard to bad match				
α_b: vocational program	-0.072	(0.057)	-0.134	(0.084)
Hazard to good match				
α_g: vocational program	0.150 **	(0.062)	0.013	(0.088)
δ_0: treatment effect – constant	-2.670 ***	(0.125)	-7.332 ***	(0.274)
δ_1: treatment effect – interaction with t_b	0.640 ***	(0.192)	2.588 ***	(0.304)
δ_2: treatment effect – interaction with t_b^2	-0.175 *	(0.096)	-0.226 *	(0.134)
δ_3: treatment effect – interaction with vocational program	-0.144	(0.116)	0.091	(0.140)
Model diagnostics				
Log-Likelihood	-12499.756		-12064.039	
AIC	25179.512		23900.078	
Number of heterogeneity types	1		7	
Parameters	90		114	
Model specification and measurement				
Accounting for unobserved heterogeneity	No		Yes	
Match quality measure	Objective		Objective	
Vocational education indicator (months of work placement)	3 Months		3 Months	

Notes. ***(**)((*)) indicates significance at the 1% (5%) ((10%)) level. N = 3551.

[15] The effects on the indirect transition rates are equal to the sum of the baseline effect (α_g), the interaction effect between the treatment effect and the vocational program dummy (δ_3) and, eventually, the interaction between the baseline hazard and the vocational program dummy ($\ln\lambda_{g,y}(t)$). Test results on the statistical significance of these effects are available upon requests.

Table 4: Extended model and sensitivity analyses – Main estimation results

	(1)		(2)		(3)		(4)	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Probability to participate in a vocational program								
φ: relative supply of vocational programs	9.938 ***	(3.508)	12.791	(9.117)	13.204 **	(5.414)	9.907 ***	(3.419)
Hazard to bad match								
α_b: vocational program	-0.053	(0.096)	0.095	(0.109)	-0.026	(0.100)	-0.180 *	(0.109)
ln $\lambda_{b,y}$ (t): t = [3,4] x vocational program	-0.046	(0.126)	-0.069	(0.139)	-0.063	(0.144)	-0.008	(0.149)
ln $\lambda_{b,y}$ (t): t = [5,9] x vocational program	0.128	(0.121)	0.049	(0.133)	0.117	(0.140)	0.198	(0.140)
ln $\lambda_{b,y}$ (t): t > 10 x vocational program	0.110	(0.158)	0.333	(0.251)	0.127	(0.163)	0.074	(0.172)
Hazard to good match								
α_g: vocational program	-0.181 *	(0.099)	-0.466 ***	(0.122)	-0.013	(0.096)	-0.136	(0.088)
ln $\lambda_{g,y}$ (t): t = [3,4] x vocational program	0.619 ***	(0.191)	0.836 **	(0.334)	0.396 ***	(0.148)	0.557 ***	(0.172)
ln $\lambda_{g,y}$ (t): t = [5,9] x vocational program	0.509 ***	(0.190)	0.438 *	(0.239)	0.292 *	(0.164)	0.386 **	(0.153)
ln $\lambda_{g,y}$ (t): t > 10 x vocational program	0.376	(0.229)	0.492	(0.376)	-0.059	(0.169)	0.319	(0.216)
δ_0: treatment effect – constant	-7.180 ***	(0.294)	-6.971 ***	(0.360)	-6.967 ***	(0.275)	-6.714 ***	(0.271)
δ_1: treatment effect – interaction with t_b	2.682 ***	(0.305)	2.508 ***	(0.295)	2.394 ***	(0.298)	1.962 ***	(0.271)
δ_2: treatment effect – interaction with t_b^2	-0.277 **	(0.132)	-0.277 **	(0.126)	-0.231 *	(0.129)	-0.019	(0.125)
δ_3: treatment effect – interaction with vocational program	-0.206	(0.250)	0.137	(0.292)	0.226	(0.243)	0.111	(0.240)
Model diagnostics								
Log-Likelihood	-12052.848		11752.158		-11996.276		11368.314	
AIC	24329.696		-23280.316		24216.552		-22504.628	
Number of heterogeneity types	5		5		5		6	
Parameters	112		112		112		116	
Model specification and measurement								
Accounting for unobserved heterogeneity	Yes		Yes		Yes		Yes	
Match quality measure	Objective		Objective		Objective		Subjective	
Vocational education indicator (months of work placement)	3 months		1 month		4 months		3 months	

Notes. ***(**)((*)) indicates significance at the 1% (5%) ((10%)) level. N = 3551.

Sensitivity analyses

We end with a number of sensitivity analyses. First, we re-estimate our extended model relying on one month of work placement as alternative criterion to distinguish between vocational and general programs. We now find a more pronounced baseline effect of vocational programs on the transition to a good match (α_g). This effect is equivalent to a decrease of the direct monthly transition rate to a good match during the first two months after graduation by 37.2% for those having participated in a vocational instead of a general program. However, the impact of the relative supply variable on the probability to participate in a vocational program is not statistically significant in this case. Hence, the validity of the estimates for this alternative indicator is questionable. Second, we also estimate our model relying on a more strict definition of four months of work placement experience to categorise programs as vocational. Conversely to the aforementioned results, these estimates do not indicate that those with a vocational program have a lower direct monthly transition rate to a good match during the first two months after graduation. The estimated differences in direct monthly transition rates during the period of three to four months after graduation and the period of five to nine months after graduation are similar to those on the basis of the benchmark indicator for vocational programs. The treatment effect for previous entrance into a bad match is again not found to be statistically different between the two programs. Third, we also estimate our extended model relying on a more subjective indicator for match quality. Regarding the transition to a bad match, we now find some limited evidence that those with a vocational degree have a lower transition rate to a bad match during the first months after graduation. The estimated effect is equivalent to a decrease in the monthly transition rate by 16.5% for those with a vocational program in comparison to those with a general program.[16] Regarding the transition to a good match, however, conclusions are again largely similar to those on the basis of the objective indicator.

6. Discussion

The hypothesis that the choice between vocational and general higher education implies a trade-off already at the beginning of the career is clearly refuted by our results. Neither clear evidence for a higher direct transition rate to a good match nor for a lower indirect transition rate to a good match for vocationally educated individuals can be detected. Although some evidence is found on a higher direct transition rate between month three to nine after graduation for those with a vocational degree, we also find some limited evidence on a lower direct transition rate during the first two months. Moreover, no evidence is found for a difference in transition rate behind the period of nine months after graduation.

Simulations

The lack of substantive difference between both groups of programs in the transition from higher education to work is also apparent on the basis of Table 5, which reports some simulated durations based on the estimates for our benchmark measures for match quality and vocational programs. We conducted simulations for the following four types of durations: (1) until any job, (2) until a bad match assuming no one finds a good match, (3) until a

[16] Exp(-0.180)-1=0.165

good match assuming no one accepts a bad match and (4) until a good match assuming everyone starts in a bad match right after graduation. For each duration, we report the median and third quartile duration, on the one hand assuming everyone is vocationally educated and on the other hand assuming everyone is generally educated. The simulated durations hardly differ between the two programs. The median duration to any job, for instance, is estimated to be equal to 1.7 months in the case of vocational programs and 1.6 months in the case of general programs. Similarly, both types of programs are estimated to have a median duration to a good match of 2.5 months, assuming that no one accepts a bad match.

Table 5: Simulated durations (months)

	Assuming everyone is …	
	Vocationally educated	**Generally educated**
Median duration until…		
any job	1.7	1.6
bad match, assuming no one finds a good match	2.6	2.5
good match, assuming no one accepts a bad match	2.5	2.5
good match, assuming everyone starts in bad match right after graduation	135.5	> 142
Third quartile duration until…		
any job	3.2	3.4
bad match, assuming no one finds a good match	4.8	4.8
good match, assuming no one accepts a bad match	4.5	4.5
good match, assuming everyone starts in bad match right after graduation	> 142	> 142

Notes. simulations based on the extended model specification, with the objective match indicator and 3 month of work placement as indicator to distinguish between vocational and general programs (results reported in Table 4, column (1)).

Unobserved heterogeneity

Our findings that vocational and general programs do not differ in terms of the duration until the first job and in terms of the match quality of the first job contrast with those from many other studies that found favourable short-run effects of vocational education. One explanation may be that these earlier findings are, at least partly, attributed to unobserved heterogeneity. Consistent with this, we found a higher direct transition rate to a first good match for those with a vocational degree if selectivity was not accounted for. This suggests that those having a vocational degree are positively selected in terms of unobservable characteristics that have a positive impact on the transition to a good match. The latter contradicts with the general perception that those with lower abilities and less favourable social backgrounds are more likely to choose for a vocational program (Ryan, 2001). However, part of this type of selectivity should already be captured by a number of control variables in our analysis, such as the level of the program, the track in secondary education and the educational level of the father. Moreover, as explained in the introduction, the often-mentioned negative selectivity in terms of abilities for vocational programs usually refers to the tracks within secondary education. Within tertiary education, such selectivity in terms of abilities is much less apparent once the level of the program (Master versus Bachelor) is accounted for. Some vocational programs, for instance within the domain of Medicine, are even among the most prestigious programs at Belgian universities. Finally, the unobserved component does not just capture ability, but also other factors such

as motivation to find a job. It is not unlikely that those with a vocational degree, probably being more labour-market oriented, are more motivated job seekers.

Note however that our assessment regarding the role of unobserved heterogeneity is a bit blurred by the fact that, by relying on an exclusion restriction, our estimates resemble rather a weighted average of local average treatment effects. Some individuals are likely to be more strongly influenced by the relative supply of programs in the proximity of their residence than others. For instance, proximity of the college and university may matter more for graduates from lower social backgrounds than for others. Similarly, the composition of the programs may have a stronger influence for those residing closer to college and university campuses. While we cannot rule out that the absolute value of the treatment effect on the transition to a good match is lower for these two groups than for the full sample, also the opposite may be the case. For instance, since graduates from lower social backgrounds are likely to have parents with less extended and influential professional networks, they are likely to gain more from the institutional ties between their higher education institution and firms. Similarly, jobs offered by tied firms, which are more likely to be located in the region of the higher education institution, will be more attractive for those residing nearby. Hence, unobserved heterogeneity, for instance related to motivation, may matter even more than what is suggested on the basis of a simple comparison of the model that does and the one that does not account for selectivity.

The correctness of our interpretation also crucially depends on the validity of our exclusion restriction. As explained before, using geographical proximity of colleges and programs as exclusion restriction is often criticized on the grounds that this proximity may be correlated by regional labour market conditions. By controlling for province of residence and degree of urbanization, we aimed at accounting for this. However, we cannot rule out that this is not sufficient to warrant correct identification. A particular concern is that colleges and universities may only include work placement in their curricula if a sufficient number of firms are available in their vicinity to cooperate with. If so, a high proportion of vocational programs offered at the college and university campuses within a district may also indicate high local labour demand. Hence, whatever the orientation of their program, graduates residing in such a district may be more likely to find a matching job. As a consequence, the impact of vocational programs on the transition to a good match may be overestimated. However, given that we didn't detect any significant effect, this eventual bias cannot explain why our conclusions on the short-run effects for vocational programs are less favourable than those made in other studies on this topic.

From an overall point of view, our results are consistent with those of Malamud and Pop-Eleches (2010), who did not find much evidence for differences in labour market returns either once accounting for selectivity in terms of unobservables. More recently, however, Golsteyn and Stenberg (2014) did find a trade-off in terms of earnings for secondary education graduates even after controlling for GPA and family fixed effects. Further, after having executed a number of robustness checks by including additional controls and conducting propensity-score matching, also Hanushek et al. (2011) concluded that their findings on a trade-off in terms of employment are not driven by selectivity. Hence, the fact that we account for unobserved heterogeneity is unlikely to be the only explanation why our conclusions differ from those in many other studies on the labour market effects of vocational programs.

Other explanations

Several other reasons can be advanced why no evidence was found in our study for a trade-off effect between on the one hand higher employment chances and better matches at the start of the career and on the other hand a higher risk of bad match persistence. A first explanation may be provided by the average length of the observed period after graduation in this study. Golsteyn and Stenberg (2014) found a turning point in terms of earnings for men about eight years after graduation. In their basic analysis, Hanushek et al. (2011) even noted a turning point in terms of employment only around the age of 50. In contrast, we focussed on the first years on the labour market – the observation period was on average about four years. While this length cannot explain why no effects were observed regarding the length of the first unemployment spell and the quality of the match in the first job, it may explain why no evidence was noted regarding differences in bad match persistence. Probably, just like regarding earnings and employment, it takes much more time for general education to deliver an advantage.

Another explanation may be that, even if the curriculum includes a substantial component of work placement, most of these tertiary education programs remain sufficiently general not to generate any adverse persistence effects. Also the institutional ties, which may help explaining the often-found reduction in entrance joblessness in other studies, may remain limited in this case. At least, we did not find that the effect of vocational education is the most pronounced immediately after graduation, what could have been expected if institutional ties indeed are important. The explanation that only more extreme types of vocational education result in a trade-off would also be consistent with Hanushek et al. (2011), who found the most pronounced trade-off effects in terms of employment for countries with strongly developed apprenticeship systems. Similarly, the aforementioned research of Golsteyn and Stenberg (2014) focussed on vocational programs in secondary education spending half or even up to four fifths of the class hours on pure vocational subjects.

A related argument is that, even if work placement is the most visible component of vocational programs within tertiary education, programs may differ in many more dimensions. Work placement is a critical indicator for the extent to which a program includes practice-based learning. However, vocationally oriented programs are also often associated with strong specialisation in terms of the number of subjects and with a stronger focus on specific instead of general skills. That each of these dimensions should not necessary have the same implications for labour market outcomes is illustrated by Dolton and Vignoles (2002), who found a strong impact of mathematics A levels on earnings but not of a broader curriculum. Similarly, Humburg et al. (2012) found both analytical thinking skills and mastering one's own field to be associated with lower degrees of overeducation among graduates. Probably, each of these dimensions also have different short-run and more long-run labour market implications. This argument seems consistent with the fact that Verhaest and Van der Velden (2013), who used an indicator covering several dimensions, did find a trade-off effect in terms of mismatch early in the career of tertiary education graduates. However, since their analysis did not account for unobserved heterogeneity, caution regarding this conclusion is recommended.

Finally, as opposed to our study, most of the literature on the effects of vocational education focusses on programs within secondary education. For several reasons, results may differ for tertiary education graduates. First of all, minimum wages are not likely to be binding for tertiary education graduates. Consequently, differences in productivity at the start of the career are less likely to be translated in differences in joblessness spells. More importantly, the jobs of high-skilled workers are much less routinised and much less standardised than those of

medium- and low-skilled workers. Technological changes in the past decades may even have further intensified this difference between both types of workers (Autor et al., 2003). Within such a context, shaping programs that provide each tertiary education graduate with the specific skills needed in her first job becomes a much more difficult task. Moreover, even if useful specific skills can be acquired through work placement, further training will in general still be necessary. Hence, the comparative advantage of graduates with work placement may be rather limited or even absent.

7. Conclusion

We investigated whether the choice a more vocationally-oriented educational system implies a trade-off between on the one hand higher employment chances and better matches at the start of the career and on the other hand a higher risk of bad match persistence for those who nevertheless start their careers in a bad match. For this, we relied on data for Flemish tertiary education graduates and differentiated between vocational and general programs on the basis of the presence of curriculum-based work placement. To account for selection on unobservables in vocational programs, we relied on an exclusion restriction. Selection on unobservables in bad matches was accounting for by means of a the Timing of Events model. Once accounting for selectivity, we found no evidence on the aforementioned trade-off. A potential explanation may be that, due to the complex and unstandardised character of high-skilled jobs, work placement offers little comparative advantages to tertiary education graduates.

From a policy point of view, our results contribute to the debate about the efficiency of work placement and vocationally oriented programs in higher education. In general, vocational programs are considered to be more costly than general programs (Psacharopoulos, 1987; Ryan, 2001). In the case of work placement, colleges and universities need to invest in the matching between students and jobs and in individual guidance. Also the evaluation of students may be more time-consuming. Particularly in the case of short work placement durations, the fixed costs involved may exceed reduced classroom instruction costs. If work placement indeed delivers no direct short-run benefit, it may therefore be efficient for colleges and universities to skip work placement from their curricula. However, this reasoning neglects that individuals may differ depending on their comparative advantage for different learning methods and program orientations. Even if both types of programs are on average as effective, some individuals may benefit most from a practice-based learning environment while others may realise higher skill gains through class-room instruction and more academic learning methods. If so, a rationalisation could reduce the opportunities for those having a comparative advantage in vocational programs and, hence, the best option could nevertheless be to maintain both types of programs.

We should also point out that more research on this issue is required to establish a final conclusion. In particular studies focusing on other institutional contexts, relying on other dimensions of vocational programs and also those covering more extremely vocationalised programs are needed. Also research tracking individuals beyond the first four years after graduation is needed to allow a more complete assessment regarding the impact of the program on the persistence of mismatches. Further, given that complete validity of exclusion restrictions cannot be ruled out, also studies relying on alternative identification strategies would be welcome. Finally, also more research focusing on the impact of vocationalised higher education programs on other match quality indicators and on other labour market outcomes such as wages would enrich this discussion.

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Appendix A: Descriptive statistics alternative criteria and measures

	General		Vocational		Log rank test
	Median	Mean	Median	Mean	Chi²
Benchmark criterion (3 months of work place)					
Months until first job	3	4.4	2	3.7	16.9 ***
Months until first good match (objective)	50	72.0	5	44.3	127.3 ***
Months since entry into bad match until first good match (objective)	-	108.5	-	92.9	8.4 ***
Months until first good match (subjective)	10	57.9	3	22.0	204.5 ***
Months since entry into bad match until first good match (subjective)	-	105.4	-	66.9	15.1 ***
Alternative criterion 1 (1 month of work place)					
Months until first job	3	4.9	2	3.8	21.6 ***
Months until first good match (objective)	54	72.0	9	50.9	38.7 ***
Months since entry into bad match until first good match (objective)	-	115.2	-	96.0	12.5 ***
Benchmark criterion (4 months of work place)					
Months until first job	3	4.4	2	3.7	16.1 ***
Months until first good match (objective)	40	67.9	4	34.4	119.2 ***
Months since entry into bad match until first good match (objective)	-	106.9	-	74.4	7.0 ***

Notes. Data source: SONAR, own calculations. The log rank test tests the equality of the survival distributions. ***(**)((*)) indicates significance at the 1%(5%)((10%)) significance level.

Appendix B: Descriptive statistics on the control variables

	General		Vocational		Significance of difference
	Mean	SD	Mean	SD	t value
Foreign	0.022	0.145	0.021	0.143	0.170
Male	0.516	0.500	0.332	0.471	11.315 ***
Father's educational level	7.224	3.327	6.680	3.193	4.963 ***
Province: Antwerp	0.279	0.449	0.253	0.435	1.787 *
Province: Flemish Brabant	0.201	0.401	0.184	0.388	1.217
Province: West-Flanders	0.174	0.379	0.181	0.385	0.594
Province: East-Flanders	0.213	0.409	0.239	0.427	1.894 *
Province: Limburg	0.134	0.341	0.142	0.350	0.718
Degree of urbanisation: high	0.082	0.275	0.070	0.256	1.333
Degree of urbanisation: middle-high	0.477	0.347	0.456	0.498	1.254
Degree of urbanisation: middle-low	0.140	0.500	0.132	0.339	0.620
Degree of urbanisation: low	0.302	0.459	0.342	0.474	2.549 **
School orientation at age of 16: General track	0.790	0.408	0.681	0.466	7.361 ***
School orientation at age of 16: Technical track	0.187	0.390	0.295	0.456	7.506 ***
School orientation at age of 16: Arts track	0.017	0.128	0.009	0.092	2.222 **
School orientation at age of 16: Vocational track	0.006	0.077	0.015	0.123	2.693 ***
Higher education: Master	0.620	0.486	0.223	0.417	26.185 ***
Higher education: With (great/highest) honours	0.498	0.500	0.482	0.500	0.949
Subject higher education: Linguistics, history and philosophy	0.081	0.274	0.009	0.095	10.774 ***
Subject higher education: Economics, business and law	0.457	0.498	0.254	0.435	12.977 ***
Subject higher education: Behavioural sciences	0.040	0.195	0.155	0.362	11.644 ***
Subject higher education: Health and (para)medicine	0.021	0.143	0.197	0.398	17.103 ***
Subject higher education: Natural sciences and engineering	0.306	0.461	0.149	0.356	11.434 ***
Subject higher education: Arts	0.032	0.175	0.010	0.100	4.578 ***
Subject higher education: Education	0.063	0.243	0.226	0.418	13.977 ***
Higher education: minimal duration of study	3.779	0.703	3.346	0.757	17.608 ***
Student work	0.888	0.315	0.894	0.308	0.591
Leaving school in June	0.523	0.500	0.590	0.492	3.974 ***
Relative supply of vocational programs	0.413	0.039	0.418	0.042	3.702 ***
Unemployment rate at start spell	17.350	3.213	17.139	3.179	1.969 **
N	1670		1881		

Notes. Data source: SONAR, own calculations. ***(**)((*)) indicates significance at the 1%(5%)((10%)) significance level.

Appendix C: Full estimation results – Benchmark model

	Hazard rate into adequate job			Hazard rate into overeducation			Probability to choose for vocational program		
	Coeff.	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value
Treatment effect									
Delta_0	-7.332***	0.274	0.000						
Delta_1	2.588***	0.304	0.000						
Delta_2	-0.226*	0.134	0.093						
Delta_3	0.091	0.140	0.515						
Explanatory variables									
Constant	-1.948***	0.384	0.000	1.011**	0.429	0.019	-28.922***	7.126	0.000
Foreign	-0.565**	0.233	0.015	-0.841***	0.231	0.000	-0.251	0.659	0.703
Male	0.094	0.074	0.205	-0.006	0.077	0.940	-0.422**	0.208	0.042
Father's educational level	-0.003	0.011	0.747	-0.025**	0.011	0.025	0.042	0.030	0.159
Province: Flemish Brabant	0.004	0.105	0.970	0.053	0.108	0.624	0.580**	0.285	0.042
Province: West-Flanders	0.091	0.111	0.413	-0.078	0.120	0.518	-0.941**	0.418	0.024
Province: East-Flanders	0.084	0.097	0.385	-0.091	0.100	0.362	0.789***	0.272	0.004
Province: Limburg	-0.083	0.117	0.475	-0.104	0.125	0.403	-0.123	0.338	0.716
Degree of urbanisation: high	-0.066	0.140	0.635	-0.006	0.137	0.967	-0.409	0.404	0.311
Degree of urbanisation: middle-high	-0.067	0.108	0.534	-0.064	0.111	0.563	0.098	0.292	0.737
Degree of urbanisation: low	0.005	0.081	0.950	0.004	0.087	0.960	0.041	0.226	0.855
School orientation at age of 16: General secondary education	0.194**	0.087	0.026	-0.341***	0.091	0.000	0.071	0.208	0.732
School orientation at age of 16: Arts secondary education	-0.298	0.404	0.461	-0.295	0.307	0.337	-1.699	1.527	0.266
School orientation at age of 16: Vocational secondary education	0.118	0.354	0.738	0.248	0.338	0.462	-0.400	1.020	0.695
Higher education: Master	-1.946***	0.163	0.000	0.061	0.173	0.727	-21.778***	5.247	0.000
Higher education: With (great/highest) honours	0.518***	0.070	0.000	0.149**	0.072	0.038	0.677***	0.196	0.001
Subject higher education: Linguistics, history and philosophy	0.359*	0.191	0.060	-0.176	0.168	0.295	-5.883*	3.247	0.070

Subject higher education: Behavioural sciences	-0.148	0.120	0.215	-0.439***	0.126	0.000	10.721***	3.184	0.001
Subject higher education: Health and (para)medicine	1.543***	0.132	0.000	0.826***	0.146	0.000	15.473***	3.436	0.000
Subject higher education: Natural sciences and engineering	0.082	0.093	0.380	-0.273***	0.098	0.005	0.334	0.241	0.166
Subject higher education: Arts	-1.624***	0.498	0.001	-0.067	0.208	0.748	-2.111	3.233	0.514
Subject higher education: Education	0.420***	0.116	0.000	-1.310***	0.146	0.000	4.153***	1.417	0.003
Higher education: minimal duration of study	0.669***	0.100	0.000	-0.257**	0.117	0.028	7.923***	2.254	0.000
Student work	-0.002	0.106	0.987	0.220**	0.110	0.044	0.029	0.287	0.921
Leaving school in June	-1.867***	0.088	0.000	-1.632***	0.092	0.000	0.011	0.192	0.956
Vocational higher education	0.013	0.088	0.884	-0.134	0.084	0.108			
Relative supply of vocational programs							10.037***	3.534	0.005
Unemployment rate	-0.020**	0.010	0.033	0.005	0.011	0.661	0.008	0.030	0.793
Duration dependence									
t = [1,2]									
t = [3,4]	1.450***	0.086	0.000	1.089***	0.093	0.000			
t = [5,9]	2.002***	0.158	0.000	1.819***	0.159	0.000			
t > 10	1.847***	0.201	0.000	2.473***	0.260	0.000			
Unobserved heterogeneity: estimates									
v2	-2.040***	0.146	0.000	-1.486***	0.158	0.000	20		
v3	-5.200***	0.886	0.000	-6.499***	1.548	0.000	-20		
v4	3.687***	0.222	0.000	6.523***	1.820	0.000	-20		
v5	-20			-20			50		
v6	-20			-4.861**	2.021	0.016	50		
v7	-4.320***	0.321	0.000	-3.641***	0.285	0.000	-3.203	2.861	0.263
q2				-1.180***	0.076	0.000			
q3				-3.641***	0.549	0.000			
q4				-2.885***	0.200	0.000			
q5				-5.975***	1.213	0.000			

q6	-4.562***	0.844	0.000
q7	-2.161***	0.167	0.000
Unobserved heterogeneity: resulting probabilities			
p1	0.659		
p2	0.202		
p3	0.017		
p4	0.037		
p5	0.002		
p6	0.007		
p7	0.076		
Log-likelihood	12064.039		
Akaike Information Criterion	-23900.078		
Hannan-Quinn Information Criterion	-22264.182		
Bayesian Information Criterion	-23196.130		
Parameters	114		
N	3551		

Notes. ***(**)((*)) indicates significance at the 1%(5%)((10%)) significance level. Standard errors are in parentheses. Some heterogeneity parameters are estimated as a very large negative (positive) number causing a 0 (1) probability with respect to the related hazard rate or chance on vocational higher education for a subset of individuals. This is numerically problematic. When we face this problem, in the spirit of Gaure et al. (2007), we stick it to -20 (20), or -50 (50) if needed, and keep it out of further estimation.