Overeducation among Dutch higher vocational education graduates and its consequences for their wages

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Abstract

The number of Dutch hbo-graduates increased from approximately 60.000 per year in 2000 to 68.000 per year in 2010. Recently, Dutch popular media reported that more and more hbo-graduates are working in mbo-level jobs: *overeducation* thus seems to be an increasing phenomenon among Dutch hbo-graduates. In this paper we focus on the economic effects of overeducation, our research question is twofold: 1) What is the extent of overeducation, that is, the difference in wages earned by hbo-graduates in jobs at and below their education level? 2) How did this wage differential develop over time and how can we explain this development? We find that there is a large wage penalty to being overeducated: from 17 up to 37 percentage points. A substantial part of this wage penalty can be explained by the fact that overeducated hbo-graduates are truly overskilled for their (temporary) job. The incidence of overeducation among hbo-graduates increased over time and we find the same increasing trend for the wage penalty to being overeducated. We find evidence that there is an oversupply of hbo-graduates in the short run: overeducated hbo-graduates are working in increasingly 'bad' jobs, but labor market frictions also play an important role in explaining the increasing trend in the wage penalty.

1 Introduction

In 2000 the Dutch government agreed within the European Union to aim for becoming one of the strongest knowledge economies in the world. The Dutch government aimed to have at least 50% of the Dutch population complete some form of higher education by 2010. In December 2005 only 24% percent of the Dutch population held a diploma from university or higher vocational education (hbo) (Onderwijsraad, 2005). However, the number of hbo-graduates per year did increase sharply between 2000 and 2010: from approximately 60.000 per year in 2000 to approximately 68.000 per year in 2010 (HBO-Raad, 2013).

Recently Dutch popular media reported that more and more hbo-graduates are occupying jobs on mbo-level ('middelbaar beroepsonderwijs'): it thus seems that hbo-graduates have a hard time finding a job that matches their educational level (RTL, 2013). In academic terms, these hbo-graduates are *overeducated* for the job they are currently in (Leuven & Oosterbeek, 2011). In this paper we focus on the economic effects of overeducation, our research question is twofold: 1) What is the extent of overeducation, that is, the difference in wages earned by hbo-graduates in jobs at and below their education level? 2) How did this wage differential develop over time and how can we explain this development?

By employing different HBO-Monitor datasets, we are able to study how being overeducated affects the wages of hbo-graduates. For our main analysis of the wage-effects of being overeducated, we use the 2011 version of this dataset. We employ the 2007-2010 versions of the HBO-Monitor dataset to investigate whether overeducation among Dutch hbo-graduates is just a temporary friction or a more serious economic problem. Our specifications without controls show that hbo-graduates that work in a job that minimally requires havo/vwo/mbo (20% of the subjects) earn approximately a 17 percentage point lower hourly wage and hbo-graduates that work in a job that requires vmbo or less (2% of the subjects) earn approximately a 37 percentage point lower wage than subjects that work in a hbo-job. While, as expected, the introduction of subject and firm characteristics reduces the wage penalty to being overeducated, we find that job specific mechanisms are relatively important: overeducated hbo-graduates are in general truly overskilled for the job they are in and are often working under a temporary contract (via an employment agency). We show that the number of hbo-graduates increased sharply between 2001 and 2010: from 60.000 to almost 68.000 per year. We find that hbo-graduates have a relatively difficult time finding a job and from the comparison of the different HBO-Monitor datasets we learn that the incidence of overeducation among hbo-graduates increased over time. We find

that the wage penalty to being overeducated also increased over time. We look at different possible explanations for these findings and conclude that it is likely that the increasing incidence in skill mismatch and labor market frictions can explain the observed trends. We find evidence for an oversupply of hbo-graduates in the short run, but we are unable to make robust statements about the long run.

The remainder of this paper is structured as follows. In section 2 we give an overview of influential and relevant literature on the topics of 'the private returns to education' and 'over- and undereducation'. In section 3 we give a description of our dataset and methodology, while we present and discuss our empirical results in section 4. Section 5 concludes.

2 Literature review

2.1 Literature on the private returns to education

Why would an inidividual invest in (more) schooling? While the benefits one can think of are legio, the reason that makes most sense from the perspective of the *homo economicus*, is that of an expected increase in future (hourly) earnings.

The study of Bonjour *et al.* (2003) looks at the financial returns to education by using differences in attained years of education between a 1999 sample of 214 identical female twins in the United Kingdom. The dependent variable is an estimation of the hourly wages. While taking the differences in years of education between identical twins corrects for genetic ability and family background, the authors also investigate the possibility that there are other forms of ability bias that might influence their empirical results. Bonjour *et al.* (2003) find that there is a significant correlation between average family education and average family characteristics like job type, marital status and adult reading score. However, Bonjour *et al.* (2003) find no significant within-twin correlation between differences in education and differences in certain characteristics of the twins. This makes it unlikely that the results are influenced by some form of ability bias. To control for the possibility that subjects might be tempted to state a higher qualification than they actually completed, the authors also use the reported qualification of the subjects twin as an IV-estimator. Bonjour *et al.* (2003) conclude that there is a private return of approximately 7.7 percentage points increase in the hourly wage per extra year of education attained.

The research of Leigh & Ryan (2008) is interesting due to the fact that the authors use two different econometric techniques to estimate the returns to education in Australia. When estimating a simple OLS-model of log annual pre-tax income on years of education, the authors find that an extra year of education results in an approximate increase of 13 percentage points in annual pre-tax income. However, this methodology does not control for ability bias. To control for ability bias, Leigh & Ryan use two instruments for years of schooling: month of birth[1] and changes in school-leaving laws[2].

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[1]Australian school entry laws require that children have reached a certain age before they are allowed to enter primary school: differences in month of birth result in differences in years of schooling, while month of birth is uncorrelated with ability (Leigh & Ryan, 2008, p.153).

[2]Increases in compulsory schooling are found to boost school attendance: subjects of all levels of ability are required by law to stay in school longer. Taking differences in school-leaving laws between regions is thus a decent instrument for educational attainment (Leigh & Ryan, 2008, p.155).

When using month of birth as an instrument, Leigh & Ryan (2008) find that the return to an extra year of education is now on average approximately 8 percentage points. When using changes in school-leaving laws as an instrument, they find a rate of return to an extra year of education of approximately 12 percentage points. The authors compare their results with studies that look at the return of education by using differences in years of education between identical twins: these studies find on average a rate of return to education of approximately 10 percentage points. Leigh & Ryan (2008) state that their results are in line with results from studies based on data from Britain, Canada, the Netherlands, Norway and the United States (Leigh & Ryan 2008, p.149).

Even though the discussed studies show that an extra year of education results in an increase of hourly earnings of somewhere between 7 and 12 percentage points, there still can be substantial wage differences between subjects that finished the same level of education. One of the most powerful explanations for this observation is found in the literature on 'over- and undereducation', which is the central topic of our paper: obtaining a certain degree of education does not automatically imply that one will be able to find a job that matches this degree. For a clear summary of the found wage effects of over- and undereducation in the literature, we refer the reader to the recent literature review of Leuven & Oosterbeek (2011). We will limit the discussion of the literature on the subject of over- and undereducation to some influential papers that are of particular relevance for our empirical approach.

2.2 Literature on over- and undereducation

By using a sample of 4344 individuals from the *German Socio-Economic Panel* for the years 1984-1998, Bauer (2002) is able to control for unobserved heterogeneity via random effects and fixed effects models. Over- and undereducation is measured as the differential between the years of schooling that a subject attained and the years of schooling that are minimally required for the subject's current job. The dependent variable is the log of real hourly wage, while Bauer (2002) controls for tenure (squared), firm size, region and industry. A standard pooled OLS estimation shows that overeducated male workers earn 10.6 percentage points less and undereducated male workers earn 8 percentage points more than male workers that are working in a job for which they have the matching years of schooling (Bauer 2002, p.225). Bauer concludes that these estimations are in line with previous studies that use the same specification (Bauer 2002, p.225). However, when using random effects and fixed effects models, i.e. when correcting for unobserved heterogeneity, the estimated effects of over- and undereducation become smaller and in most specifications disappear completely (Bauer 2002, p.228). The conclusion derived from this paper is that it is important to control for the possibility that certain subject characteristics, the most intuitive being ability, make subjects more or less likely to be over- or undereducated and thus making it more or less likely that subjects have a relatively low or high hourly wage. It is for this reason that we include relevant subjectl characteristics and a control for the quality of the 'skill match' to our empirical specifications. The paper by Bauer (2002) is of value added due to the fact that it is one of the first papers on this subject that corrects for unobserved heterogeneity of subjects. A shortcoming of this paper is that it does not explain where the found wage differential due to over-and undereducation comes from: is it due to skill mismatches and/or are other factors at play?

The fact that a subject attained a certain level of education, does not necessarily indicate that this subject is also of a certain type of ability: over-schooled workers may actually have lower (relevant) skill levels than workers that are adequately matched (Leuven & Oosterbeek, 2011, p.13). Green & Mcintosh (2007, p.432) call this the 'heterogeneous skill within qualification levels' theory, which they contrast to the 'mismatch theory'[3]. Green & Mcintosh (2007) are able to make the distinction between the situation in which a subject is 'overeducated' and/or 'overskilled' for their current job, because their sample drawn from the *2001 UK Skills Survey* contains information on the extent to which the subject's current job uses his/her skills. Subjects

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[3]A mismatch occurs when a worker simply does not have the right skills for his/her current job.

that indicate that their current job poorly uses their skills and knowledge are classified as being 'overskilled'. Green & Mcintosh (2007, p.432) find a small, but statistically significant positive correlation coefficient of 0.2 between their 'over-skilled variable' and their 'over-qualification variable'. When regressing the logarithm of hourly wages on their 'over-qualification variable' and a couple of controls, Green & Mcintosh find that overqualified subjects earn on average 18% less than individuals working in jobs for which they have attained the matching level of education. When the 'overskilled-variable' is introduced, the coefficient of the 'over-qualification variable' drops by only 2-4 percentage points and this decline is not statistically significant (Green & Mcintosh, 2007, p.436). The conclusion of Green & Mcintosh is thus that the wage penalty to being overeducated can only be marginally explained by the actual under-utilization of the skills of an overeducated subject. It could be that subjects that are overeducated have relatively low unobserved skills and abilities or that overeducated subjects predominantly have skills that are of limited usefulness on the labor market (Green & Mcintosh, 2007, p.438). The findings of Green & Mcintosh are in line with earlier research on Dutch data by Allen & van der Velden (2001). Allen & Van der Velden (2001, p.444) conclude in their paper that: "only a small part of the effects of over- and undereducation on hourly wages is accounted for by skill mismatches: educational mismatches seem to be much more important than skill mismatches." The papers by Allen & Van der Velden (2001) and Green & Mcintosh (2007) show that it is important to investigate the origin of a (possible) wage penalty to being overeducated: is there a wage penalty due to underutilization of skills and/or are other factors at play? For possible policy recommandations the distinction between a subject being 'overeducated' and (also) being 'overskilled' is important: one would expect that the overeducated are also overskilled for their job. If this is not the case, i.e. a subject is overeducated but not overskilled for his/her job, then this *might* be an indication that there is something wrong with the quality of (higher) education. In order to investigate the importance of skill mismatch in explaining wage differentials due to under- and overeducation, we add a similar 'utilization of skills variable' to our empirical specifications.

Nordin *et al.* (2010) study the effect of *horizontal* mismatches, that is a mismatch between the field of study completed and the occupation the subject is currently in, on annual income per year for university graduates aged 28-39 in Sweden. Since Sweden is a country with an educational system with relatively specialized fields of education (Nordin *et al.* 2010, p.1048), the authors expect that a horizontal mismatch results in poor usage of specific skills and thus in a relatively large wage penalty for a mismatched subject. By combining information on educational attainment with information about

the type of job the subject is currently in, Nordin *et al.* (2010) classify the education-occupation match in the categories 'matched', 'weakly matched' or 'mismatched'. When incorporating the typical Mincer-type controls, a control for ability and a dummy indicating the subjects field of study, Nordin *et al.* (2010, p.1055) find that a horizontal mismatched male subject suffers an income penalty of approximately 20 percentage points, while a mismatched female subject sufffers an income penalty of approximately 12 percentage points. Nordin *et al.* find that this income penalty decreases when (potential) work experience increases: on-the-job-training and gaining specific skills via education are found to be substitutes (Nordin *et al.* 2010, p.1054). From this paper we can conclude that we should not only look at the vertical component of job match[4] when explaining wage differentials, but also at the horizontal component of job match[5]. The number of Dutch hbo-studies has increased with approximately 30 percentage points between 2000 and 2010 (Dullaert, 2010), thus resulting in a more specialized hbo-system. This makes it more likely that the quality of the horizontal match plays an (increasingly) important role in explaining wage differences between hbo-graduates. In our empirical specifications we correct for the quality of the horizontal match by including variables that indicate the quality of the match between a subject's (field of) education and the requirements for his/her current job.

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[4]Over- or undereducation.

[5]Does the field of study match the field of study required for the current job?

3 Data & Methodology

3.1 Description of the data

For our empirical analysis we employ different versions of the HBO-Monitor dataset. The HBO-Monitor datasets are created by The Research Centre for Education and the Labour Market (ROA) under the supervision of the HBO-Raad. On average about 85% of the Dutch hbo-institutions participate in this survey. Every autumn, hbo-graduates that graduated in the previous academic year are being surveyed via the Internet. This means that the survey takes place about 18 months after graduation from hbo (ROA, 2011). The HBO-Monitor datasets contain on average information about 20.000 hbo-graduates, but due to the application of necessary restrictions and missing data, the number of subjects included in our empirical analysis is substantially less.

In order to make sure that hbo is the highest level of public education that a subject attained, we exclude subjects that indicate that they attended more public education after obtaining their hbo-degree. Doing so resulted in a loss of approximately 6400 subjects (30% of the subjects in the dataset). We also restrict our sample to subjects that indicate that their current status is 'work': this guarantees that we exclude subjects that are currently studying or are on a long holiday (with a side-job). Doing so resulted in a loss of approximately 4700 subjects (24% of the subjects in the dataset). Note that the two implied restrictrions show substantial overlap: if a subject is following fulltime wo-education at the time of the questionnaire, then he/she did attend public education after obtaining his/her hbo-degree and his/her current status also differs from 'work'.

The HBO-Monitor datasets contain a wide variety of information: we are mainly interested in subject characteristics, their earnings and the characteristics of their education, firm and job. Table 1 presents a descriptive overview of the variables from the 2011 HBO-Monitor dataset that will be used in our empirical analysis. From Table 1 one can observe that 77% of the hbo-graduates in this dataset are working in a job that minimally requires a hbo-diploma, approximately 20% of the hbo-graduates work in a job that minimally requires a havo/vwo/mbo-diploma, 2% of the subjects work in a job that minimally requires vmbo-education or less and only 1% of the subjects work in a wo-level job. The average age of the subjects is 28[6], the male-female ratio is 2/3 and the mean gross hourly wage is somewhat higher than 17 euro.

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[6]Note that it is possible that subjects have been active on the labor market before entering their hbo-education.

Table 1 Descriptive statistics of the variables used from the 2011 HBO-Monitor

Variable	Categories	Observations	Frequency	Mean	Standard Deviation	Minimum	Maximum
age		12130		28	7.4	19	62
appointment type	1 (b): permanent	6375	56.95				
	2: temporary, 1. possible	3581	31.99				
	3: temporary	1239	11.07				
education-job match	1: poor	762	6.60				
	2: mediocre	1934	16.76				
	3 (b): sufficient	5049	43.74				
	4: good	3797	32.90				
education required	1: wo	151	1.28				
	2 (b): hbo	9117	77.05				
	3: havo/vwo/mbo	2332	19.71				
	4: vmbo or less	232	1.96				
employment agency	0: no	10905	93.40				
	1: yes	771	6.60				
firmsize	0 (b): 1 - 24 employees	2615	22.14				
	1: 25 - 99 employees	2020	17.10				
	2: 100 - 999 employees	3760	31.83				
	3: 1000 or more employees	3418	28.93				
field hbo	10 categories based on *http://profielkeuze.qompas.nl/studierichtingen.html*						
field required	1: only mine	3635	30.75				
	2 (b): mine or similar	5968	50.48				
	3: totally different field	462	3.91				
	4: no specific field	1758	14.87				
firm education	0: not attained	6443	53.20				
	1: did attain	5669	46.80				
gender	0: male	5155	42.50				
	1: female	6975	57.50				
geographic reach firm	1 (b): local	2387	21.01				
	2: regional	3547	31.22				
	3: national	2469	21.73				
	4: international	2957	26.03				
graduation grade	0 (b): 6 - 7	5723	48.45				
	1: 7.5 - 8.5	5791	49.03				
	2: 9 - 10	297	2.51				
hbo duration		11352		46	15	3	120
highschool diploma	0: none obtained	2541	20.91				
	1: vmbo	2544	20.93				
	2 (b): havo	5370	44.18				
	3: vwo	1699	13.98				
management postion	0: no	9603	81.90				
	1: yes	2122	18.10				
part-time job	0: no	8294	68.24				
	1: yes	3860	31.76				
prior tertiary education	0 (b): none	6202	51.03				
	1: mbo	4421	36.37				
	2: other hbo	1531	12.60				
second generation	0: both parents born in NL	10167	83.65				
	1: at least one not born in NL	1987	16.35				
sector firm							
skill-job match	1: not at all	352	3.02				
	2	1214	10.43				
	3 (b): neutral	2854	24.52				
	4	5377	46.20				
	5: very strong	1841	15.82				
unemployment duration		12026		1.1	2.8	0	36
wage		7459		17.3	19.4	0	450

10

3.2 Description of the methodology

In the literature a subject is generally defined as being overeducated (undereducated) when he/she has attained more (less) years of schooling than is strictly necessary for their current job. There are three ways to measure the difference between the attained and necessary schooling (Leuven & Oosterbeek, 2011, pp. 9-13): it can be derived from a workers' self-assessment, it can be derived from information contained in occupational classifications and it can be derived from realized job-worker matches. The data from the HBO-Monitor datasets is purely based on the self-assessment of subjects. The advantage of data based on self-assessment is that it is in principle based on all relevant information[7], but this method also has some disadvantages: subjects might have the tendency to tell *their* truth and subjects might be poorly informed about the relevant counterfactuals (Leuven & Oosterbeek, 2011, p.10)

We classify a subject as being overeducated, when he/she indicates that the minimal level of education that is required for his/her current job is lower than hbo (i.e. havo/vwo/mbo or vmbo or less). A subject is classified as being undereducated, when he/she indicates that the minimal educational level required for his/her current job is 'wetenschappelijk onderwijs' (wo). Gross hourly wages are estimated by dividing total gross monthly earnings by total workhours per week times four.

Our empirical analysis is of value added to the existing literature due to our stepwise approach: our data allows us not only to estimate the wage differential due to over- and undereducation, but it also enables us to investigate the (relative) importance of the *why*[8] and the *how*[9] behind this wage differential. In order to analyze the effect of overeducation on gross hourly wages, we will first regress the logarithm of gross hourly wages on the minimal educational level required for a subjects current job: what is the wage penalty when a hbo-graduate is working in a job that requires an educational level that is lower than hbo (and/or a wage premium when he/she is working in a wo-level job)? If we indeed find such a wage differential, the next step is to explain *why* we find this: it might simply be due to different types of 'discrimination' that occur on the Dutch labor market. The data in the HBO-Monitor datasets allow us to control for this possibility, since the datasets contain information on different (fixed) subject characteristics like age, gender and the place of birth of the subject's parents (second generation). In

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[7]The researcher does not have to combine information from different sources: the subject is able to deliver the required information.

[8]The influence of subject characterics.

[9]The influence of firm and job characteristics.

order to correct for possible between-subject variation in labor market experience before graduation from hbo, we add the square of a subject's age to our specifications. We control for the 'educational history' of a subject by including a variable that indicates the level of the obtained high school diploma and a variable that indicates whether a subject followed tertiary education prior to graduating from hbo. We also control for a subjects average hbo graduation grade and by using the starting date and the graduation date of a subjects hbo-education we are able to control for the duration of a subjects hbo-education in months. Do relatively bright hbo-graduates earn higher (gross) hourly wages? The duration of unemployment before entering the first job after graduation is expected to have an ambiguous effect on a subjects hourly wage. The duration of unemployment might have a positive effect on the hourly wage due to the possibility that a subject might have been waiting for the 'perfect' job match. However, a relatively long spell of unemployment might give a negative signal to possible employers about the ability of a subject. In order to control for a possible non-linear effect of the duration of unemployment before entering the first job after graduation, we also add the square of this variable to our specifications.

Our third step is to control for different 'how-factors': overeducated hbo-graduates might sort into certain firms and/or jobs and this could explain how being overeducated affects their wages. We make the distinction between *firm* and *job specific mechanisms*. Since it is often found that larger firms pay higher wages (see for example Chatterji *et al.*, 2003), we add a control for the size of the firm. The variable 'geographic reach firm' controls for the geographic reach of the activities of the firm: it is likely that a multinational company on average pays higher wages than a firm that is operating on the local level. We control for possible wage-differentials between sectors via the inclusion of the variable 'sector firm': this variable is categorized based on the first digit of the *SBI-2008 code* of the firm. The information in the HBO-Monitor datasets allows us to control for the match between a subjects capacities and the requirements of his/her job via the question: "To what extent are your capacities used in your current job?" (skill-job match). This variable enables us to make the distinction between a subject being 'overeducated' and/or 'overskilled' for his/her current job in the same way as done by Allen & Van der Velden (2001) and Green & McIntosh (2007). We use the survey-questions "how is the connection between your hbo-education and the current job?" (education-job match) and "which field of education was required by the employer for your current job?" (field required) as indicators for the quality of the horizontal match between the subject and his current job. We control for the possibility that a subject followed education financed by the firm and for the possibility that average hourly wages differ between

those working fulltime (36 hours per week or more) and those working part-time. Our last specification includes a categorical measure of the field of study a subject graduated in, because it could be that the average (labor market relevant) ability of hbo-graduates differs per field of study.

After we have explained the *why* and *how* behind the wage differential due to over- and undereducation, we compare the results from the 2011 HBO-Monitor dataset with results obtained from the 2007-2010 HBO-Monitor datasets in order to determine whether educational mismatch among Dutch hbo-graduates is just a short-term friction or a more serious economic problem related to an oversupply of hbo-graduates observed over time. Is there a trend in the number of hbo-graduates that are working in jobs for which they are overeducated and/or the wage penalty to being overeducated? If there is such a trend, how can we explain it?

4 Results

4.1 Analysis of the 2011 HBO-Monitor dataset

4.1.1 How over- and undereducation affects the gross hourly wage

The results from our most basic regression specification of the natural logarithm of wage on education required, as presented in Table 2, show that there is a large negative wage penalty for hbo-graduates that are overeducated for their job: hbo-graduates that work in a havo/vwo/mbo-job earn on average approximately 17 percentage points lower hourly wages than hbo-graduates that work in a hbo-job, this while hbo-graduates that work in a job that minimally requires vmbo or less earn on average approximately 37 percentage points less per hour than hbo-graduates working in a hbo-job. We find that there is a wage premium for hbo-graduates that work in a wo-job: their hourly earnings are on average approximately 13 percentage points higher than the hourly wages of subjects working in a hbo-job.

The second specification controls for fixed subject characteristics. In accordance with earlier results in the literature (see for example Bonjour *et al.*, 2003), we find that there is a concave relation between age and earnings per hour: wages first increase with age due to the fact that a subject gains more and more experience on the labor market, but at a certain age productivity starts to diminish and the hourly wage starts to decline. We find that relatively young female hbo-graduates (below 20) earn more than their male counterparts.[10] However, when these women get older, they tend to earn *increasingly less* than their male counterparts. The finding that woman earn on average less than their male counterparts, is a general finding in the literature (see for example: Leigh & Ryan 2008). We find that hbo-graduates that have at least one parent born in a country different from the Netherlands, earn on average approximately 4 percentage points less than hbo-graduates that have parents that are both born in the Netherlands. Note that the wage penalty to being overeducated did not change much due to the introduction of the fixed subject characteristics. However, the wage premium to working in a wo-job sharply decreases and becomes insignificant when controlling for fixed subject characteristics.

In the third specification other subject characteristics are also included. We find that the 'educational history variables' do not have much explanatory power: they are insignificant and the coefficients are relatively small. We do find that subjects with a relatively high average graduation grade receive an approximate wage premium of 3.5 to 5 percentage points: striving

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[10]Note that it is rare that a subject graduates from hbo at an age below 20.

Table 2 Regression specifications of ln(wage) on education required (when controlling for subject characteristics)

Variable (b/se)	(Category)	Specification 1	Specification 2	Specification 3
education required	1. wo	0.1296** (0.05)	0.0651 (0.04)	0.0365 (0.05)
	2. havo/vwo/mbo	-0.1721*** (0.01)	-0.1436*** (0.01)	-0.1313*** (0.01)
	3. vmbo or less	-0.3730*** (0.04)	-0.3399*** (0.04)	-0.2995*** (0.04)
age			0.0511*** (0.00)	0.0474*** (0.01)
age squared			-0.0004*** (0.00)	-0.0003*** (0.00)
female			0.1576*** (0.04)	0.1561*** (0.04)
female*age			-0.0076*** (0.00)	-0.0079*** (0.00)
second generation			-0.0418*** (0.02)	-0.0270* (0.02)
highschool diploma	1. vmbo			-0.0177 (0.02)
	3. vwo			-0.0000 (0.01)
prior tertiary education	1. mbo			0.0029 (0.02)
	2. other hbo			0.0088 (0.02)
graduation grade	1. 7.5 - 8.5			0.0347*** (0.01)
	2. 9 - 10			0.0500 (0.03)
hbo duration				-0.0004 (0.00)
unemployment duration				-0.0241*** (0.00)
unemployment duration squared				0.0007*** (0.00)
CONSTANT		2.7630*** (0.01)	1.6743*** (0.08)	1.7743*** (0.09)
R-squared		0.0356	0.1505	0.1616
F-statistic		83.6119	215.4183	90.4934
N		7424	7403	6771

* p<0.1, ** p<0.05, *** p<0.01

15

for a relatively high graduation grade thus seems to be worth the effort. The variable 'hbo duration' has the intuitive sign, but it is insignificant and has a relatively small coefficient. Interesting are the signs of the coefficients of the significant variables 'unemployment duration' and 'unemployment duration squared': while the duration of unemployment after finishing hbo has a negative effect on a subject's current wage, we find that this effect is decreasing when the duration of unemployment increases and becomes positive after approximately 18 months of unemployment. This concave effect of unemployment after graduation on the current wage can be explained by two conflicting effects. There is the negative effect of the so called 'lemon principle': an employer might be reluctant to hire a subject that has been unemployed for a relatively long time and if he/she does hire such a subject, the employer offers him/her a relatively low wage (Akerlof, 1970). And there can be a positive effect, since a longer duration of unemployment after graduation might imply that a subject had more time to find a relatively good job match and thus a relatively high wage (see for example Caliendo *et al.*, 2009). Adding the extra subject controls to our specification again has a small decreasing effect on the with of the wage interval of education required.

4.1.2 Results when also correcting for firm and job specific mechanisms

Specifications 4-7 (Table 3) also control for firm and job specific mechanisms. In accordance with the general finding in the literature (see for example Chatterji *et al.*, 2003), we find that larger firms pay higher (gross) hourly wages[11]: firms with 1000 or more employees pay 8-10 percentage points higher hourly wages than firms with a maximum of 9 employees. The geographic reach of a firm has the intuitive positive sign: firms that have a larger geographic reach pay higher hourly wages, but the coefficients of geographic reach firm are relatively small and insignificant.[12] We find that controlling for the sector in which the firm is active is important: there are large differences in average wages paid per sector. However, note that the wage interval of education required has not decreased much due to the introduction of firm specific characteristics. This seems to indicate that it is not the case that subjects that are over- or undereducated sort into certain *types of firms*.

Still, it is possible that over- or undereducated subjects sort into certain *types of jobs*. We find evidence that this is indeed the case: the width of the wage interval of education required sharply decreases when we control for job characteristics and for the quality of the job match. We find that there is a large negative wage penalty to working in a temporary job without the foresight of a permanent contract: a hbo-graduate that works in such a job earns a 10-14 percentage points lower hourly wage than a hbo-graduate with a permanent contract. We also find that subjects that indicate that they work in a job that poorly uses their skills earn on average 10-13 percentage points per hour less than hbo-graduates that indicate that they work in a job that has an average fit with their capacities/ability. These results seem to indicate that a decent part of the wage penalty to overeducation can be explained by poor utilization of a workers skills (i.e. a skill mismatch). This is contrary to what other authors have found (see for example Allen & Van der Velden, 2001 and Green & McIntosh, 2007). This contradicting result can be explained by the fact that our data is quite different from the data used by Allen & Van der Velden and Green & McIntosh. Allen & Van der Velden (2001, p.437) use data from questionnaires that are held among Dutch graduates from tertiary education approximately 7 years after graduation:

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[11]In the literature this general finding is explained in different ways: it could be that workers demand a wage premium for working in a big impersonal firm. Another explanation is that monitoring workers is relatively difficult and thus costly in a big firm: in order to reduce the incentive to shirk, workers receive a wage premium (Chatterji *et al.*, 2003).

[12]There could be some multicollinearity here: international firms are also more likely to be relatively large firms.

Table 3 Regression specifications that also control for firm and job specific mechanisms

Variable (b/se)	(Category)	Specification 4	Specification 5	Specification 6	Specification 7
education required	1. wo	0.0308 (0.05)	0.0152 (0.05)	0.0158 (0.05)	0.0232 (0.06)
	2. havo/vwo/mbo	-0.1349*** (0.01)	-0.1096*** (0.01)	-0.1059*** (0.01)	-0.1062*** (0.02)
	3. vmbo or less	-0.2649*** (0.04)	-0.1589*** (0.06)	-0.1530*** (0.06)	-0.1326* (0.07)
age		0.0427*** (0.01)	0.0400*** (0.01)	0.0406*** (0.01)	0.0428*** (0.01)
age squared		-0.0003*** (0.00)	-0.0003*** (0.00)	-0.0003*** (0.00)	-0.0003*** (0.00)
female		0.1183*** (0.04)	0.1178*** (0.04)	0.1119*** (0.04)	0.1107** (0.05)
female*age		-0.0069*** (0.00)	-0.0071*** (0.00)	-0.0070*** (0.00)	-0.0065*** (0.00)
second generation		-0.0238 (0.02)	-0.0188 (0.02)	-0.0189 (0.02)	-0.0237 (0.02)
highschool diploma	0. none obtained	-0.0007 (0.02)	0.0020 (0.02)	0.0014 (0.02)	0.0243 (0.02)
	1. vmbo	-0.0137 (0.02)	-0.0039 (0.02)	-0.0007 (0.02)	0.0171 (0.02)
	3. vwo	0.0050 (0.02)	-0.0004 (0.01)	-0.0035 (0.02)	0.0005 (0.02)
prior tertiary education	1. mbo	0.0063 (0.02)	-0.0046 (0.02)	-0.0103 (0.02)	-0.0446* (0.02)
	2. other hbo	0.0084 (0.02)	0.0014 (0.02)	-0.0001 (0.02)	-0.0017 (0.03)
graduation grade	1. 7.5 - 8.5	0.0333*** (0.01)	0.0279** (0.01)	0.0255** (0.01)	0.0267** (0.01)
	2. 9 - 10	0.0597* (0.03)	0.0614* (0.04)	0.0605* (0.04)	0.0639 (0.04)
hbo duration		-0.0002 (0.00)	-0.0002 (0.00)	-0.0002 (0.00)	-0.0003 (0.00)
unemployment duration		-0.0237*** (0.00)	-0.0128*** (0.00)	-0.0122*** (0.00)	-0.0147*** (0.00)
unemployment duration squared		0.0007*** (0.00)	0.0003 (0.00)	0.0003 (0.00)	0.0004* (0.00)
firmsize	1. 25 - 99 employees	0.0109 (0.02)	0.0197 (0.02)	0.0229 (0.02)	0.0324* (0.02)
	2. 100 - 999 employees	0.0412* (0.02)	0.0482*** (0.02)	0.0527*** (0.02)	0.0422** (0.02)
	3. >1000 employees	0.0786*** (0.02)	0.0903*** (0.02)	0.0971*** (0.02)	0.0915*** (0.02)
geographic reach firm	2. regional	0.0260* (0.01)	0.0210 (0.01)	0.0197 (0.01)	0.0284* (0.02)
	3. national	0.0097 (0.02)	0.0068 (0.02)	0.0103 (0.02)	0.0129 (0.02)
	4. international	0.0150 (0.02)	0.0150 (0.02)	0.0177 (0.02)	0.0205 (0.02)
sector firm		included	included	included	included
appointment type	2. temporary, permanent possible		-0.0498*** (0.01)	-0.0413*** (0.01)	-0.0369*** (0.01)
	3. temporary		-0.1464*** (0.02)	-0.1087*** (0.02)	-0.1049*** (0.03)
management position			0.0196 (0.02)	0.0216 (0.02)	0.0234 (0.02)
field required	1. only mine		-0.0089 (0.01)	-0.0132 (0.01)	0.0045 (0.01)
	3. totally different from mine		0.0113 (0.03)	0.0072 (0.03)	0.0227 (0.04)
	4. no specific field required		-0.0332* (0.02)	-0.0309* (0.02)	-0.0275 (0.02)
firm education			0.0292***	0.0267***	0.0342***
education-job match	1. poor		-0.0285 (0.03)	-0.0202 (0.03)	-0.0206 (0.04)
	2. mediocre		-0.0010 (0.02)	-0.0007 (0.02)	-0.0022 (0.02)
	4. good		-0.0007 (0.01)	-0.0017 (0.01)	0.0007 (0.01)
skill-job match	1. not at all		-0.1141** (0.05)	-0.1085** (0.06)	-0.1315* (0.07)
	2.		-0.0296 (0.02)	-0.0245 (0.02)	-0.0215 (0.02)
	4.		0.0232* (0.01)	0.0224* (0.01)	0.0174 (0.02)
	5. very strong		0.0148 (0.02)	0.0144 (0.02)	0.0125 (0.02)
part-time job			0.0669*** (0.01)	0.0654*** (0.01)	0.0791*** (0.02)
employment agency				-0.1254*** (0.03)	-0.1337*** (0.03)
field hbo					included
CONSTANT		1.6983*** (0.11)	1.8065*** (0.10)	1.7992*** (0.11)	1.7311*** (0.12)
R-squared		0.1780	0.2134	0.2179	0.2150
F-statistic		56.4751	50.1340	49.0454	36.5606
N		6521	6014	5914	4819

*p<0.1, ** p<0.05, *** p<0.01

18

our data is based on questionnaires under hbo-graduates held approximately 18 months after graduation. Subjects in the dataset of Allen & Van der Velden thus had much more time to find a decent job match, making it less likely that a subject is, at the time of the questionnaire, in a job that poorly matches his/her skills. The data used by Green & Mcintosh is representative for all British workers, while our data is only representative for Dutch hbo-graduates: being overskilled is a phenomenom that is in particular relevant to subjects that have completed higher levels of education and it is thus not strange that this phenomenom plays a more prominent role in our analysis.

Another explanation for the importance of the skill-job match is that overskilled subjects (temporarily) work via an employment agency: wage is measured as gross hourly earnings of the worker and since the mediating employment agency wants to make a profit, it is expected that workers that work via an employment agency earn a relatively low (gross) hourly wage. The dummy variable 'employment agency' controls for this mechanism: working via an employment agency results in a wage penalty of approximately 13%, but including this dummy variable does not drastically change the size of the coefficients or their significance of the variables 'skill-job match' and 'appointment type'.

We do not find strong evidence that the quality of the horizontal job match is an important determinant for the height of the (gross) hourly wage: the coefficients of field required and education-job match are relatively small and often insignificant. We find that hbo-graduates in a part-time job earn higher hourly wages than hbo-graduates working in a fulltime-job. This is contrary to what is generally found in the literature (see for example: Bonjour *et al.*, 2003 and Green & McIntosh, 2007). The same holds for subjects that work in a job for which they followed job specific education: hbo-graduates that followed job specific education earn on average wages that are approximately 3 percentage points higher.

The last specification presented in Table 3 also corrects for the field of study a hbo-graduate graduated in. We find that correcting for the field of study does not have a significant influence on the wage interval of education required or on the signs of any of the other explanatory variables included in our specification.

4.1.3 Conclusion after the analysis of the 2011 HBO-Monitor dataset

Figure 1 gives a graphical summary of the results from our empirical analysis based on the 2011 HBO-Monitor dataset. It shows the width of the wage interval of education required (i.e. the differential between the upper and the lower category of this variable) when using different sets of control variables. Figure 2 displays the wage penalty to working in a job that minimally requires havo/vwo/mbo: almost all of the overeducated hbo-graduates work in these jobs (20% of the 22% overeducated hbo-graduates in the dataset).

Figure 1 The relative importance of the different groups of control variables
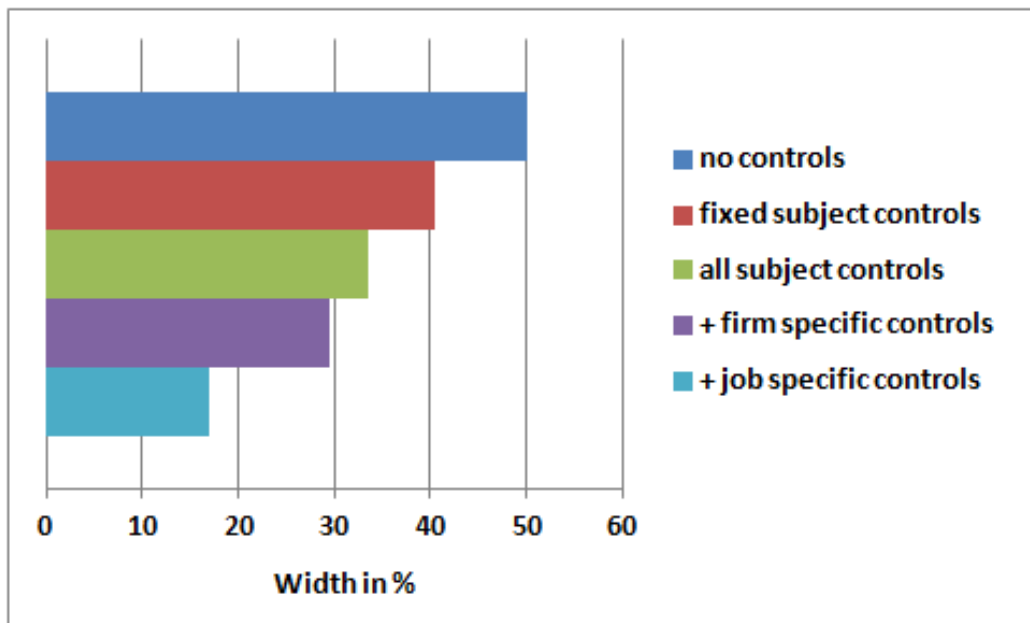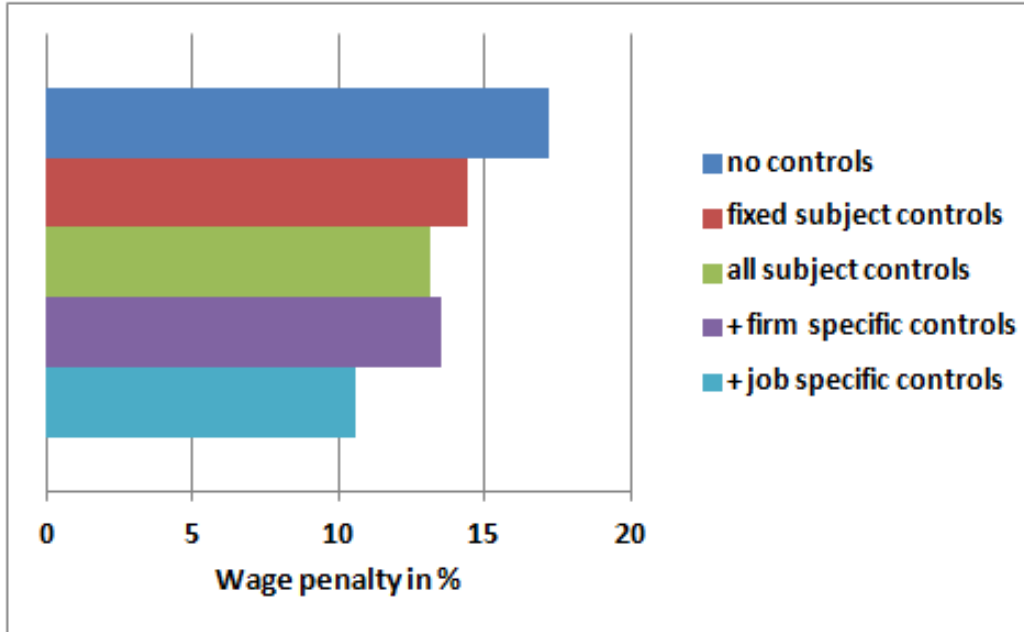
Figure 2 The wage penalty to working in a havo/vwo/mbo-job

Our most basic specification shows that over- and undereducation is a powerful factor in explaining wage differentials between hbo-graduates: we find that the width of the wage interval of education required is approximately 50 percentage points. The introduction of subject characteristics sharply reduces the positive wage premium to undereducation and reduces the negative wage penalty to working in a havo/vwo/mbo-job from 17.2 to 14.4 percentage points. The introduction of variables that control for firm specific mechanisms do not substantially alter our results: the interval of education required hardly changes when we control for firm specific mechanisms and the wage penalty to working in a havo/vwo/mbo-job actually increases somewhat. Controlling for job specific mechanisms *does* result in a sharp decrease in the negative wage penalty to being overeducated: the wage penalty to working in a havo/vwo/mbo-job is reduced by 3 percentage points. This reduction is mainly due to the correction for the skill match and the type of contract subjects are working under: working in a temporary job that poorly uses your capacities/ability can explain approximately half of the found wage interval of education required. Still, this leaves open the question whether overeducation is just a temporary phenomenom or a more serious economic problem: what is the trend in the incidence of overeducation in the population of hbo-graduates and how did the wage interval of education required develop over time? How can we explain these trends?

4.2   Analysis of the 2007-2011 HBO-Monitor datasets

4.2.1   Is there an oversupply of hbo-graduates?

One reason why certain hbo-graduates are working in a job below their educational level could be that there are simply not enough hbo-level jobs: the number of hbo-graduates that enter the labor market every year might be higher than the number of vacant hbo-jobs. McGuinness (2007, p.147) warned for this scenario by writing: "over-education incurs significant wage costs on the individual and productivity costs on the economy that may well rise if higher education participation continues to expand without a corresponding increase in the number of graduate jobs."

If there indeed is an oversupply of hbo-graduates, (certain) hbo-graduates have a difficult time finding a (decent) job and these hbo-graduates are more or less forced to work in jobs below their educational level. Figure 3 gives an overview of the number of hbo-graduates per year. The number of hbo-graduates per year has sharply increased in the period 2001-2010: from almost 60.000 hbo-graduates per year in 2001 to almost 68.000 hbo-graduates per year in 2010.

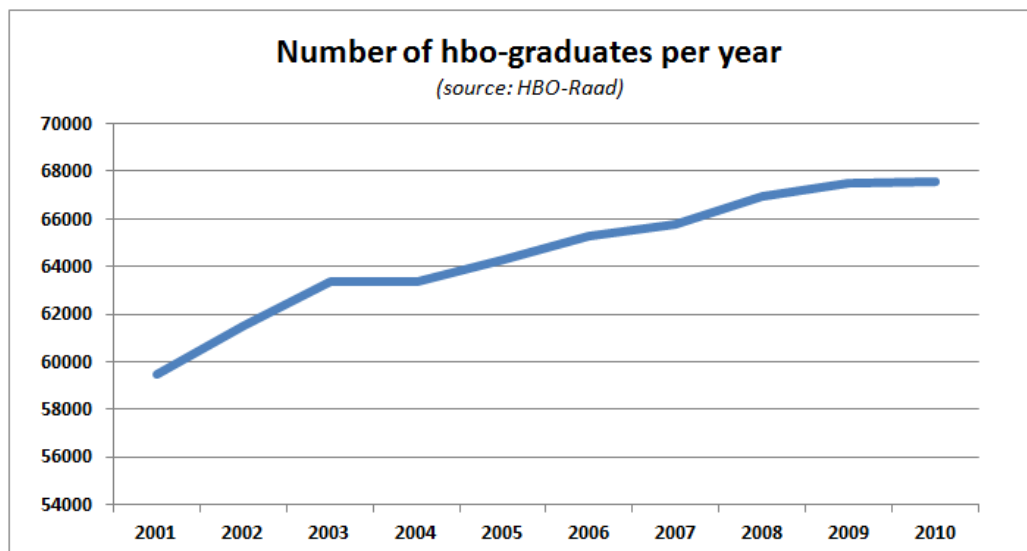Figure 3 The number of hbo-graduates per year

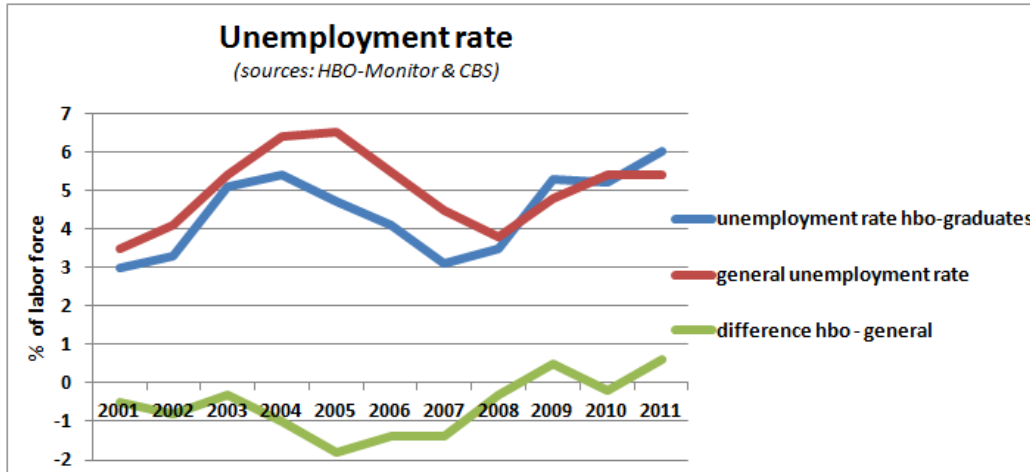Figure 4 The (relative) unemployment rate of hbo-graduates

Figure 4 shows the development of the unemployment rate of hbo-graduates: the sharp increase in the number of hbo-graduates per year did not result in a complementing sharp increase in the unemployment rate among hbo-graduates. However, note that the unemployment rate of hbo-graduates was lower than the general unemployment rate in the years 2001-2008, but after 2008 we see that the unemployment rate of hbo-graduates converges to and in some years (2009 & 2011) is above the general unemployment rate. This seems to imply that from 2008 onwards hbo-graduates had a relatively difficult time finding *a job* and this might be an indication for an oversupply of hbo-graduates.

However, unemployment rates do not tell the complete story: we should also investigate the *type of jobs* hbo-graduates are in. If there is an oversupply of hbo-graduates, then we expect that an increasing number of hbo-graduates are overeducated for the job they are in at the time of the questionnaire. Table 4, showing the distribution of education required in the different HBO-Monitor datasets, presents evidence for an oversupply of hbo-graduates: in the 2007 HBO-Monitor dataset 16.5 percent of the subjects are overeducated for their job, this while in the 2011 HBO-Monitor dataset 21.7 percent of the subjects are overeducated for their job. However, from this analysis we cannot conclude that there is a structural economic problem: the increase in the incidence of overeducation under hbo-graduates could also simply be a result of the most recent economic downturn.

Notice that every (analyzed) year 16-22% of the hbo-graduates work in a havo/vwo/mbo-job, this while on average only 1-2% of the hbo-graduates are working in a job that requires vmbo or less or a wo-job approximately 18 months after graduation. An incidence of overeducation of 16-22% is rela-

Table 4 The distribution of education required in the different HBO-Monitor datasets

education required (%)	2007	2008	2009	2010	2011
wo	120 (1.18)	124 (1.16)	147 (1.55)	127 (1.24)	151 (1.28)
hbo	8351 (82.28)	8801 (82.54)	7643 (80.54)	7999 (77.79)	9117 (77.05)
havo/vwo/mbo	1579 (15.56)	1625 (15.24)	1513 (15.94)	2007 (19.52)	2332 (19.71)
vmbo or less	99 (1)	113 (1.06)	187 (1.97)	150 (1.46)	232 (1.96)
total	10149 (100)	10663 (100)	9490 (100)	10283 (100)	11832 (100)

tively low when compared to what is generally found in the literature: Leuven & Oosterbeek (2011, p.15) conclude that the mean incidence of overeducation in existing studies is 30% of the subjects in the sample.

We thus find some evidence that there is an oversupply of hbo-graduates when investigating the *extensive margin*[13]. However, if there is an actual oversupply of hbo-graduates, then this should also show on the *intensive margin*[14] : it could be that the sharp increase in the number of hbo-graduates per year has resulted in downward pressure on the wages of hbo-graduates that are overeducated for their job. To investigate this possibility, we start with estimating and comparing basic regression specifications of the estimated hourly wage on education required for the 2007-2011 HBO-Monitor datasets.

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[13]When looking at the labor market participation of subjects.

[14]When investigating how an oversupply of hbo-graduates affects subjects that are already active on the labor market.

4.2.2 The wage differential between hbo-graduates over time

Table 5 shows the results of the most basic regression specification for the different HBO-Monitors. Note that that there is an increasing trend in the width of the wage interval of education required: for the 2007 HBO-Monitor dataset the estimated width of the wage interval of education required is approximately 29 percentage points, this while we find a wage interval with a width of approximately 50 percentage points for the 2011 HBO-Monitor dataset. Note that the regression on the 2010 HBO-Monitor dataset is an extreme case due to the relatively high returns to being undereducated (working in a wo-job).Trying to explain this outlier seems not that useful, since undereducation among hbo-graduates is quite uncommon (only 1-2 % of the subjects are undereducated for their job). Note that the wage penalty to working in havo/vwo/mbo-job increased from 8.7 in 2007 to 17.2 percentage points in the 2011 HBO-Monitor. While, as expected, controlling for subject characteristics (Table 6) reduces the width of the wage interval, it does not remove the increasing trends in the interval of education required and the wage penalty to working in a havo/vwo/mbo-job.

This increasing trend in the wage interval of education required can be explained in different ways. One explanation is that there is a general tendency for the income inequality between educational groups to increase, for example as a consequence of skilled biased technological change and/or globalization (DNB, 2008). Unfortunately, investigating the development of Dutch income inequality indicators like the Gini-coefficient is of little value added: all publicly available data on Dutch income inequality is measured after tax and redistributions. Since the Netherlands is known for its relatively strong income redistribution policies, it makes little sense to analyze this data (DNB, 2008). For an overview of the effects on wage inequality and a review of the evidence for the 'skilled biased technological change hypothesis', we refer the reader to the paper of Card & Dinardo (2002).

Another explanation for the increasing trend in the wage interval of education required is a possible development that hbo-graduates that cannot find a job on hbo-level work in *increasingly bad* jobs. The specification presented in Table 6 corrects for this possibility via the inclusion of the variables 'education-job match' and 'skill-job match'. If there indeed is such a development, then we expect that the negative effect of education-job match and skill-job match becomes stronger over time.

When looking at the coefficients of skill-job match that indicate a poor job match, we find some evidence for the possbility that overeducated hbo-graduates work in increasingly bad jobs: there is an increasing trend in the size of the coefficient of the categories of skill-job match that indicate a poor

Table 5 Regression specifications that also control for subject characteristics

Variable (b/se)	(Category)	2007	2008	2009	2010	2011
education required	1. wo	0.0615 (0.07)	0.0708 (0.05)	0.0270 (0.07)	0.1957*** (0.06)	0.0365 (0.05)
	3. havo/vwo/mbo	-0.0777*** (0.01)	-0.1034*** (0.01)	-0.1251*** (0.02)	-0.1160*** (0.02)	-0.1313*** (0.01)
	4. vmbo or less	-0.1724*** (0.07)	-0.2315*** (0.04)	-0.2324*** (0.03)	-0.2928*** (0.04)	-0.2995*** (0.04)
age		0.0532*** (0.01)	0.0678*** (0.01)	0.0597*** (0.01)	0.0689*** (0.01)	0.0474*** (0.01)
age squared		-0.0004*** (0.00)	-0.0007*** (0.00)	-0.0005*** (0.00)	-0.0007*** (0.00)	-0.0003*** (0.00)
female		0.1811*** (0.04)	0.1356*** (0.04)	0.1274*** (0.04)	0.0782 (0.05)	0.1561*** (0.04)
female*age		-0.0083*** (0.00)	-0.0074*** (0.00)	-0.0065*** (0.00)	-0.0053*** (0.00)	-0.0079*** (0.00)
second generation		0.0049 (0.02)	-0.0084 (0.01)	-0.0089 (0.01)	0.0014 (0.01)	-0.0270* (0.02)
highschool diploma	0. none obtained	-0.0109 (0.02)	-0.0293* (0.02)	-0.0221 (0.02)	0.0144 (0.02)	-0.0059 (0.02)
	1. vmbo	-0.0375** (0.02)	-0.0383** (0.01)	-0.0082 (0.02)	0.0006 (0.02)	-0.0177 (0.02)
	3. vwo	0.0118 (0.01)	0.0007 (0.01)	-0.0260** (0.01)	0.0132 (0.02)	-0.0000 (0.01)
prior tertiary education	1. mbo	-0.0070 (0.02)	0.0133 (0.02)	-0.0227 (0.02)	-0.0176 (0.02)	0.0029 (0.02)
	2. other hbo	0.0182 (0.02)	0.0270 (0.02)	-0.0066 (0.02)	0.0377* (0.02)	0.0088 (0.02)
graduation grade	1. 7.5 - 8.5	0.0129 (0.01)	0.0210** (0.01)	0.0049 (0.01)	-0.0083 (0.01)	0.0347*** (0.01)
	2. 9 - 10	0.0224 (0.03)	-0.0115 (0.03)	-0.0067 (0.03)	0.0002 (0.03)	0.0500 (0.03)
hbo duration		-0.0001 (0.00)	-0.0004 (0.00)	-0.0009** (0.00)	-0.0006 (0.00)	-0.0004 (0.00)
unemployment duration		-0.0140*** (0.00)	-0.0219*** (0.00)	-0.0165*** (0.00)	-0.0171*** (0.00)	-0.0241*** (0.00)
unemployment duration squared		0.0002*** (0.00)	0.0008*** (0.00)	0.0005 (0.00)	0.0004* (0.00)	0.0007*** (0.00)
CONSTANT		1.5797*** (0.10)	1.4181*** (0.09)	1.5888*** (0.10)	1.4748*** (0.12)	1.7743*** (0.09)
R-squared		0.1208	0.1298	0.1222	0.1326	0.1616
F-statistic		70.1907	77.1212	77.1434	57.8919	90.4934
N		8336	8659	7750	5762	6771

*p<0.1, **p<0.05, ***p<0.01

Table 6 Regression specifications that also control for the quality of the job match

Variable (b/se)	(Category)	2007	2008	2009	2010	2011
education required	1. wo	0.0542 (0.07)	0.0667 (0.05)	0.0264 (0.07)	0.1972*** (0.06)	0.0386 (0.05)
	3. havo/vwo/mbo	-0.0599*** (0.01)	-0.0890*** (0.01)	-0.0960*** (0.02)	-0.0799*** (0.02)	-0.0927*** (0.01)
	4. vmbo or less	-0.1442** (0.07)	-0.1709*** (0.05)	-0.1491*** (0.04)	-0.1965*** (0.05)	-0.1882*** (0.05)
age		0.0543*** (0.01)	0.0685*** (0.01)	0.0610*** (0.01)	0.0702*** (0.01)	0.0478*** (0.01)
age squared		-0.0005*** (0.00)	-0.0007*** (0.00)	-0.0006*** (0.00)	-0.0007*** (0.00)	-0.0003*** (0.00)
female		0.1705*** (0.04)	0.1322*** (0.04)	0.1212*** (0.04)	0.0680 (0.05)	0.1451*** (0.04)
female*age		-0.0081*** (0.00)	-0.0073*** (0.00)	-0.0064*** (0.00)	-0.0051*** (0.00)	-0.0076*** (0.00)
second generation		0.0061 (0.02)	-0.0040 (0.01)	-0.0078 (0.01)	0.0058 (0.02)	-0.0227 (0.02)
highschool diploma	0. none obtained	-0.0122 (0.02)	-0.0320* (0.02)	-0.0250 (0.02)	0.0183 (0.02)	-0.0089 (0.02)
	1. mavo	-0.0396** (0.02)	-0.0409*** (0.02)	-0.0115 (0.02)	0.0042 (0.02)	-0.0218 (0.02)
	3. vwo	0.0127 (0.01)	-0.0016 (0.01)	-0.0284** (0.01)	0.0105 (0.02)	0.0009 (0.02)
prior tertiary education	1. mbo	-0.0080 (0.02)	0.0126 (0.02)	-0.0216 (0.02)	-0.0215 (0.02)	0.0077 (0.02)
	2. other hbo	0.0157 (0.02)	0.0301* (0.02)	-0.0074 (0.02)	0.0392* (0.02)	0.0136 (0.02)
graduation grade	1. 7.5 - 8.5	0.0119 (0.01)	0.0198** (0.01)	0.0035 (0.01)	-0.0094 (0.01)	0.0305*** (0.01)
	2. 9 - 10	0.0220 (0.03)	-0.0099 (0.03)	-0.0121 (0.03)	-0.0026 (0.03)	0.0521 (0.03)
hbo duration		0.0001 (0.00)	-0.0003 (0.00)	-0.0008** (0.00)	-0.0006 (0.00)	-0.0004 (0.00)
unemployment duration		-0.0135*** (0.00)	-0.0212*** (0.00)	-0.0125*** (0.00)	-0.0138*** (0.00)	-0.0220*** (0.00)
unemployment duration squared		0.0002*** (0.00)	0.0008*** (0.00)	0.0003 (0.00)	0.0003 (0.00)	0.0006*** (0.00)
education-job match	1. poor	-0.0463** (0.02)	-0.0604** (0.03)	-0.0597 (0.04)	-0.0644*** (0.02)	-0.0605** (0.03)
	2. mediocre	-0.0040 (0.01)	-0.0195 (0.01)	-0.0000 (0.01)	-0.0193 (0.02)	0.0002 (0.02)
	4. good	0.0155 (0.01)	0.0041 (0.01)	0.0154 (0.01)	0.0001 (0.01)	0.0022 (0.01)
skill-job match	1. not at all	0.0121 (0.04)	-0.0790 (0.05)	-0.0627* (0.03)	-0.0854** (0.04)	-0.1139** (0.05)
	2. -	-0.0103 (0.02)	-0.0381** (0.02)	-0.0421** (0.02)	-0.0079 (0.02)	-0.0378** (0.02)
	4. -	0.0249** (0.01)	-0.0135 (0.01)	0.0196 (0.01)	0.0425*** (0.02)	0.0316** (0.01)
	5. very strong	0.0399** (0.02)	0.0098 (0.02)	0.0322** (0.01)	0.0545** (0.02)	0.0324* (0.02)
CONSTANT		1.5422*** (0.10)	1.4167*** (0.09)	1.5508*** (0.10)	1.4282*** (0.12)	1.7510*** (0.09)
R-squared		0.1261	0.1319	0.1258	0.1341	0.1674
F-statistic		51.7230	56.9082	59.1619	42.7467	71.2552
N		8241	8522	7617	5625	6642

*p<0.1, ** p<0.05, *** p<0.01

job match (skill-job match = 1 or 2). This while the coefficients of the variable education-job match are relatively stable. Note that the trend in education required is sharply reduced when the job match variables are introduced: this seems to confirm our earlier conclusion that the quality of the job match is an important factor to take into account when explaining how under- and overeducation affect the hourly wage. The importance of skill mismatch in explaining the wage penalty to overeducation is cleary illustrated in Figure 5, which shows the (almost) similar evolution of the percentage of overeducated subjects that indicate that they are in a job that poorly uses their skills and the wage penalty to working in havo/vwo/mbo-job (no controls) over time.

Figure 5 The evolution of skill mismatch and the wage penalty to working in a havo/vwo/mbo-job
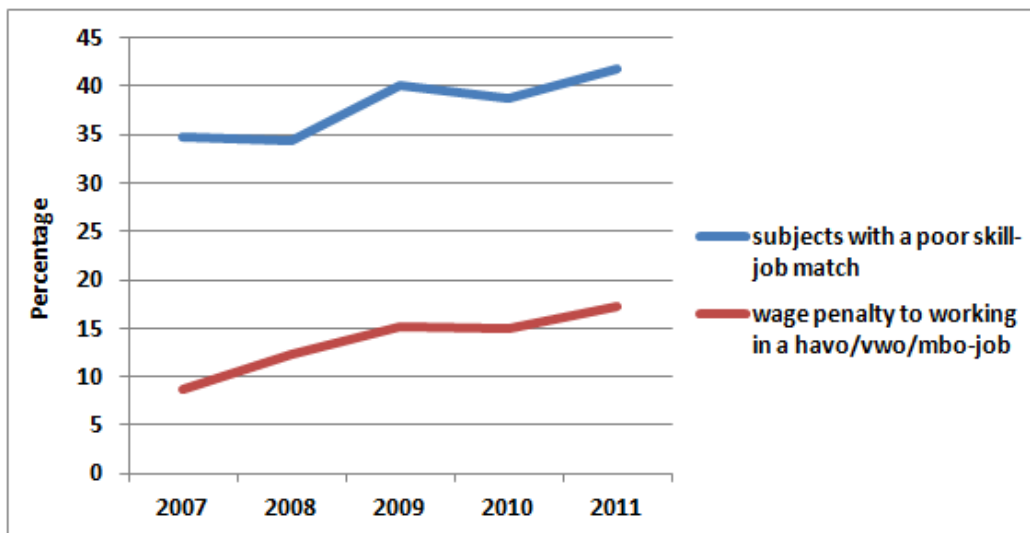

Table 7 shows the distribution of the variable 'skill-job match' for the different HBO-Monitor datasets. Note that an increasing number of hbo-graduates that are overeducated for their job state that they work in a job that poorly uses their capacities/skills: approximately 35% of the overeducated subjects in the 2007 and 42% of the overeducated subjects in the 2011 HBO-Monitor dataset. However, the same tendency can be observed when analyzing subjects that work in a job that minimally requires hbo or wo-level education (a 'good' job): from 6.5% in the 2007 to 7.4% in the 2011 HBO-Monitor dataset. This is evidence for the theory that hbo-graduates that are overeducated work in increasingly bad jobs, but we cannot rule out the possibility that there are other explanations than an oversupply of hbo-graduates for this finding: for example, it could be that in general hbo-graduates have

become more critical about their job(match).

Finally, it could also be the case that labor market frictions are to blame for the increase in the wage interval of education required. Table 8 presents the results of the wage regressions when controlling for the available subject, firm and job characteristics. Note that that the trend in education required has almost completely disappeared. We again find that the variables 'appointment type' and 'employment agency' are important in explaining wage-differentials between hbo-graduates: working in a temporary job (via an employment agency) has a clear negative effect on the height of the hourly wage. Note that the wage penalty to working in a temporary job has increased somewhat over time.

Table 9 shows that an increasing number of hbo-graduates that are formally overeducated for their job, are working in a temporary job. However, note that this same tendency can be observed for hbo-graduates working in a job on hbo or wo-level. It is thus not unlikely that this observation is caused by the economic situation and it does thus not per se imply that there is a *structural* oversupply of hbo-graduates.

If we look at the duration of unemployment before entering the first job (Table 10), we observe that there is a difference between hbo-graduates that are overeducated for their job and hbo-graduates that are in a 'good job': the mean duration of unemployment before entering the first job after graduation increased for the overeducated, but we do not observe the same trend for hbo-graduates that are in a 'good job'. However, note that duration of unemployment before entering the first job after graduating is measured in months and that a difference between 1 and 1.6 month of unemployment is very marginal.

Table 7 The distribution of the variable 'skill-job match'

skill-job match (if below hbo-level job)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)
1. not at all	168 (9.13)	193 (10.04)	272 (14.16)	321 (13.41)	423 (15.04)
2. -	472 (25.65)	469 (24.39)	498 (25.92)	607 (25.37)	751 (26.71)
3. neutral	633 (34.40)	594 (30.89)	601 (31.29)	798 (33.35)	846 (30.09)
4. -	465 (25.27)	563 (29.28)	445 (23.17)	569 (23.78)	664 (23.61)
5. strong	102 (5.54)	104 (5.41)	105 (5.47)	98 (4.10)	128 (4.55)
sum	1840 (100)	1923 (100)	1921 (100)	2393 (100)	2812 (100)
skill-job match (if hbo or wo-level job)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)
1. not at all	89 (0.78)	109 (0.87)	113 (1.04)	106 (0.94)	139 (1.13)
2. -	658 (5.77)	769 (6.15)	663 (6.09)	699 (6.23)	771 (6.26)
3. neutral	2536 (22.24)	2754 (22.02)	2362 (21.70)	2472 (22.03)	2753 (22.36)
4. -	5947 (52.16)	6443 (51.52)	5597 (51.42)	5687 (50.67)	6321 (51.34)
5. strong	2172 (19.05)	2340 (19.43)	2149 (19.74)	2259 (20.13)	2327 (18.90)
sum	11402 (100)	12505 (100)	10884 (100)	11223 (100)	12311 (100)

Table 8 Regression specifications that control for subject, firm and job characteristics

Variable (b/se)	(Category)	2007	2008	2009	2010	2011
education required	1. wo	0.0381 (0.07)	0.0492 (0.05)	0.0022 (0.07)	0.1907*** (0.07)	0.0082 (0.05)
	3. havo/vwo/vmbo	-0.0620*** (0.01)	-0.1023*** (0.01)	-0.1100*** (0.02)	-0.0991*** (0.02)	-0.1054*** (0.01)
	4. mbo or less	-0.1467** (0.07)	-0.1114*** (0.04)	-0.1599*** (0.04)	-0.2328*** (0.03)	-0.1576*** (0.06)
age		0.0464*** (0.01)	0.0609*** (0.01)	0.0542*** (0.01)	0.0589*** (0.01)	0.0403*** (0.01)
age squared		-0.0004*** (0.00)	-0.0006*** (0.00)	-0.0005*** (0.00)	-0.0006*** (0.00)	-0.0003*** (0.00)
female		0.1894*** (0.04)	0.1584*** (0.04)	0.0961** (0.04)	0.0538 (0.06)	0.1112*** (0.04)
female*age		-0.0091*** (0.00)	-0.0082*** (0.00)	-0.0058*** (0.00)	-0.0055*** (0.00)	-0.0070*** (0.00)
second generation		-0.0025 (0.02)	-0.0095 (0.01)	-0.0076 (0.01)	0.0071 (0.01)	-0.0233 (0.02)
highschool diploma	0. none obtained	-0.0077 (0.02)	-0.0233 (0.02)	-0.0266 (0.02)	0.0180 (0.02)	-0.0013 (0.02)
	1. vmbo	-0.0330* (0.02)	-0.0389*** (0.01)	-0.0094 (0.02)	0.0003 (0.02)	0.0016 (0.02)
	3. vwo	0.0092 (0.01)	0.0016 (0.01)	-0.0277** (0.01)	0.0193 (0.01)	-0.0039 (0.01)
prior tertiary education	1. mbo	-0.0177 (0.02)	0.0100 (0.01)	-0.0160 (0.02)	-0.0079 (0.02)	-0.0148 (0.02)
	2. other hbo	0.0251 (0.02)	0.0388** (0.02)	0.0084 (0.02)	0.0513** (0.02)	-0.0024 (0.02)
graduation grade	1. 7.5 - 8.5	0.0122 (0.01)	0.0201** (0.01)	0.0058 (0.01)	-0.0125 (0.01)	0.0267** (0.01)
	2. 9 - 10	0.0173 (0.03)	-0.0093 (0.03)	0.0041 (0.03)	0.0211 (0.02)	0.0564 (0.04)
hbo duration		0.0000 (0.00)	0.0000 (0.00)	-0.0005 (0.00)	-0.0001 (0.00)	-0.0003 (0.00)
unemployment duration		-0.0125*** (0.00)	-0.0205*** (0.00)	-0.0096** (0.00)	-0.0061 (0.00)	-0.0114*** (0.00)
unemployment duration squared		0.0001*** (0.00)	0.0008*** (0.00)	0.0001 (0.00)	0.0000 (0.00)	0.0002 (0.00)
firmsize	1. 25 - 99 employees	0.0197 (0.02)	0.0402** (0.02)	0.0128 (0.02)	0.0061 (0.02)	0.0187 (0.02)
	2. 100 - 999 employees	0.0482*** (0.01)	0.0764*** (0.01)	0.0577*** (0.01)	0.0555*** (0.02)	0.0515*** (0.02)
	3. 1000 or more employees	0.0915*** (0.02)	0.1051*** (0.01)	0.0927*** (0.02)	0.0787*** (0.02)	0.0985*** (0.02)
sector		included	included	included	included	included
appointment type	2. temporary, permanent possible	-0.0154 (0.01)	-0.0358***(0.01)	-0.0190* (0.01)	-0.0282** (0.01)	-0.0415*** (0.01)
	3. temporary	-0.0960*** (0.02)	-0.0354 (0.02)	-0.0602*** (0.02)	-0.0615*** (0.02)	-0.1172*** (0.02)
management position		0.0243* (0.01)	0.0022 (0.01)	0.0159 (0.01)	-0.0012 (0.02)	0.0189 (0.02)
field required	1. only mine field	-0.0151 (0.01)	-0.0024 (0.01)	-0.0142 (0.01)	0.0106 (0.01)	-0.0114 (0.01)
	3. totally different field	-0.0456 (0.03)	0.0004 (0.02)	0.0238 (0.03)	-0.0181 (0.02)	0.0076 (0.03)
	4. no specific field	-0.0311*** (0.01)	-0.0294** (0.01)	-0.0153 (0.02)	-0.0744*** (0.03)	-0.0325* (0.02)
firm education		-0.0102 (0.01)	0.0236*** (0.01)	0.0106 (0.01)	0.0126 (0.01)	0.0241** (0.01)
education-job match	1. poor	-0.0461** (0.02)	-0.0478 (0.03)	-0.0528 (0.04)	-0.0209 (0.02)	-0.0205 (0.03)
	2. mediocre	-0.0018 (0.01)	-0.0177 (0.01)	0.0028 (0.01)	-0.0064 (0.02)	-0.0004 (0.02)
	4. good	0.0106 (0.01)	0.0080 (0.01)	0.0185* (0.01)	-0.0012 (0.01)	0.0032 (0.01)
skill-job match	1. not at all	0.0377 (0.04)	-0.0925* (0.05)	-0.0544 (0.04)	-0.0369 (0.03)	-0.1094** (0.05)
	2. -	0.0001 (0.02)	-0.0296* (0.02)	-0.0302* (0.02)	0.0045 (0.02)	-0.0239 (0.02)
	4. -	0.0246** (0.01)	-0.0107 (0.01)	0.0101 (0.01)	0.0258 (0.02)	0.0204 (0.01)
	5. very strong	0.0487*** (0.02)	0.0127 (0.01)	0.0312** (0.01)	0.0298 (0.02)	0.0114 (0.02)
part-time		0.1070*** (0.01)	0.1005*** (0.01)	0.0764*** (0.01)	0.0866*** (0.01)	0.0642*** (0.01)
employment agency		-0.0524* (0.03)	-0.0368* (0.02)	-0.0570* (0.03)	-0.1056*** (0.03)	-0.1235*** (0.03)
CONSTANT		1.4699*** (0.12)	1.2665*** (0.10)	1.7211*** (0.13)	1.5603*** (0.14)	1.8248*** (0.10)
R-squared		0.1519	0.1655	0.1545	0.1677	0.2147
F-statistic		35.9810	43.4176	38.0017	35.2493	51.7544
N		7724	8006	7132	5167	6049

* p<0.1, ** p<0.05, *** p<0.01

Table 9 The distribution of variables that control for labor market frictions

if in a below hbo-job	Category	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)
appointment type (if below hbo-job)	1. permanent	1146 (65.22)	1197 (65.27)	1079 (58.45)	1262 (55.13)	1418 (52.81)
	2. temporary, permanent possible	435 (24.76)	464 (25.30)	520 (28.17)	690 (30.14)	787 (29.31)
	3. temporary	176 (10.02)	173 (9.43)	247 (13.38)	337 (14.72)	480 (17.88)
	sum	1757 (100)	1834 (100)	1846 (100)	2289 (100)	2685 (100)
employment agency	0. no	1670 (89.83)	1733 (88.78)	1690 (86.36)	2101 (85.93)	2430 (85.50)
	1. yes	189 (10.17)	219 (11.22)	267 (13.64)	344 (14.07)	412 (14.50)
	sum	1859 (100)	1952 (100)	1957 (100)	2445 (100)	2842 (100)
if in a hbo or wo-job						
appointment type (if hbo or wo-job)	1. permanent	7518 (66.76)	7967 (65.81)	6543 (62.26)	6408 (59.53)	6607 (56.61)
	2. temporary, permanent possible	3051 (27.09)	3386 (27.97)	3188 (30.34)	3325 (30.89)	3683 (31.55)
	3. temporary	692 (6.15)	753 (6.22)	778 (7.40)	1032 (9.59)	1382 (11.84)
	sum	11261 (100)	12106 (100)	10509 (100)	10765 (100)	11672 (100)
uitzendbaan (if below hbo-job)	0. no	10917 (95.20)	11826 (95.26)	10245 (94.48)	10536 (93.75)	11408 (92.79)
	1. yes	551 (4.80)	589 (4.74)	598 (5.52)	702 (6.25)	886 (7.21)
	sum	11468 (100)	12415 (100)	10843 (100)	11238 (100)	12294 (100)

Table 10 Statistics on the months of unemployment before entering the first job

	below hbo-level job					hbo or wo-level job				
	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
N	1882	1968	1993	2484	2875	11735	12592	11042	11412	12482
mean	1.0	1.0	1.3	1.5	1.6	0.8	0.6	0.6	0.9	0.9
std. dev.	2.7	3.0	3.5	3.7	3.8	2.4	2.0	2.0	2.8	2.6
min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75max	21.0	36.0	25.0	35.0	27.0	75.0	60.0	60.0	99.0	36.0

4.2.3 Conclusion after the analysis of the 2007-2011 HBO-Monitor datasets

The number of hbo-graduates per year increased sharply in the period 2001-2010 and we find some indications for an oversupply of hbo-graduates: from 2007 onwards hbo-graduates have a relatively difficult time finding *a job*, we find that there is a small increasing trend in the incidence of overeducation under hbo-graduates and we showed that the width of the wage interval of education required increased from 29% in the 2007 to 50% in the 2011 HBO-Monitor dataset. Figure 6 gives a graphical impression of the relative importance of the different groups of factors when explaining wage differences between hbo-graduates, where Figure 7 shows the development of the wage penalty to working in a havo/vwo/mbo-job.

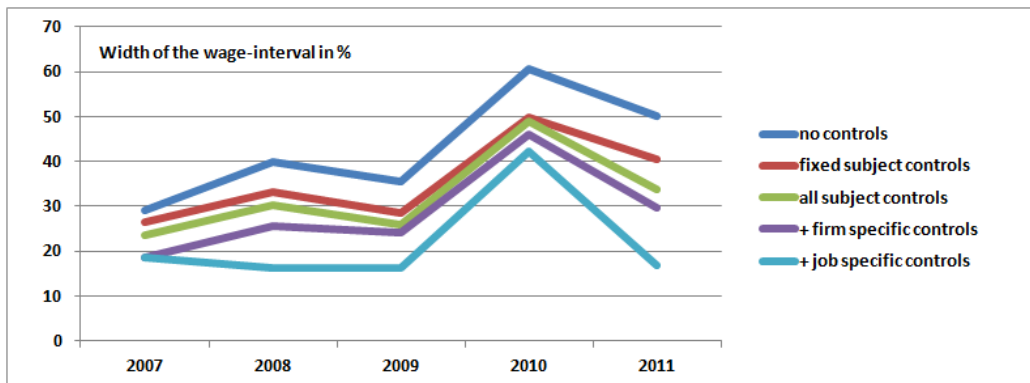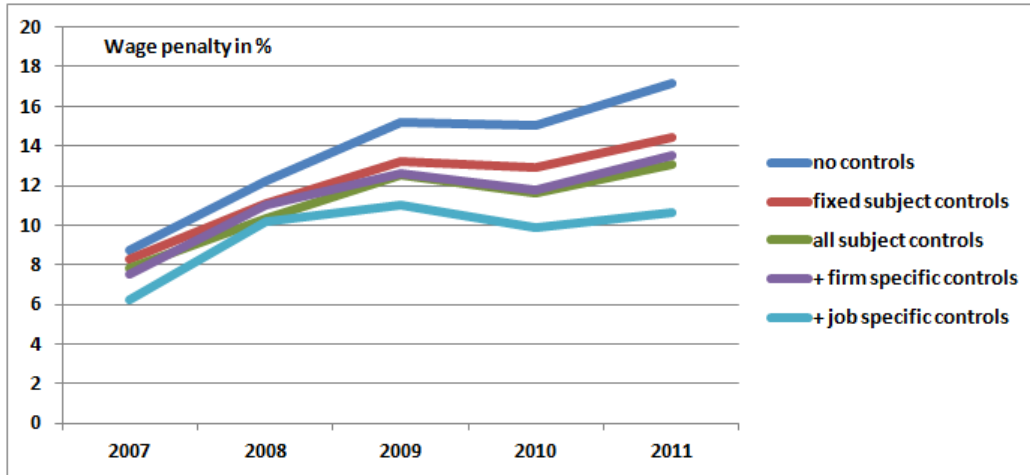Figure 6 Showing the relative importance of the different categories of control variables

Figure 7 The wage penalty to working in a havo/vwo/mbo-job over time

We studied different possible explanations for the found increasing trend in the wage interval of education required: we find evidence for the theory that overeducated hbo-graduates are working in increasingly bad jobs, but labor market frictions also play an important role. Our findings imply that there indeed is an oversupply of hbo-graduates in the short run: since we find the same trends in the skill-job match and labor market frictions when looking at hbo-graduates that are in 'good' jobs, we cannot rule out the possibility that our findings are (also) a result of the business cycle. Time-series data is needed to be able to make robust statements about a possible structural oversupply of hbo-graduates.

4.3 Are overeducated hbo-graduates 'wasting' their human capital?

We found that every (analyzed) year 16-22% of hbo-graduates work in jobs for which they are overeducated and that there is a significant wage penalty to doing so: are these hbo-graduates, from a societal perspective, 'wasting' their human capital?

One can calculate the total 'social costs' of overeducated hbo-graduates by multiplying the percentages of the distribution of the variable 'education required' with the obtained regression coefficients for the different categories of this variable. We use the coefficients from the regression specification that only controls for subject fixed characteristics, since the mechanisms we have included in the broader specifications are likely to be 'consequences' of overeducation: these 'consequences' should be taken into account when calculating the total social costs of overeducation. The 95% confidence intervals are obtained via the *delta method*.[15] The results are presented in Table 11.

Table 11 The calculated 'waste of human capital'

Hbo-Monitor	lower	mean	upper
2007	-0.018	-0.014	-0.010
2008	-0.022	-0.019	-0.015
2009	-0.031	-0.025	-0.020
2010	-0.033	-0.027	-0.022
2011	-0.040	-0.034	-0.029
average	-0.029	-0.024	-0.019

Note that the calculated 'waste of human capital' is increasing over time. We see that the average 'waste of human capital' for the analyzed years is approximately 2.4% of the accumulated earnings of hbo-graduates. While this is definitely a large number when expressed in absolute terms, in relative terms it is not that shocking. For comparison: in 2012 the inflation rate in the Dutch economy was approximately 2.5%. Besides the fact that the 'waste' of human capital is small in relative terms, the term 'waste' is not very appropriate in this context. In order to say something about a possible 'waste' of human capital, we need a counterfactual: the fact that a hbo-graduate is overeducated for the job he/she is currently working in and the possibility that he/she could have earned more when he/she would have worked in a hbo-job, does not per se imply that the public money spend on

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[15]The delta method, in its essence, expands a function of a random variable about its mean, usually with a one-step Taylor approximation, and then takes the variance.

this subject's hbo-education is wasted. We simply do not know what the labor market position of this subject would have been when he/she had not obtained an hbo-degree: it could have been far worse. We also do not know whether an overeducated hbo-graduate could have found a better job match: the term 'waste' implies that an overeducated hbo-graduate could have done better, but what if there simply are not enough hbo-level jobs?

Another important remark is that education is shown to have all kinds of positive external effects which should be taken into account when calculating the social returns to education. For example, Dee (2004) found that schooling increases voter participation, newspaper readership and support for free speech. Other research shows that there is a postive relation between the level of education and health (Cutler & Lleras-Muney, 2006; Zubanov *et al.*, 2013) or can be used as a tool to reduce crime rates (Lochner & Moretti, 2004).

5 Conclusion

To recall, our research question is twofold: 1) What is the extent of overeducation, that is, the difference in wages earned by HBO graduates in jobs at and below their education level? 2) How did this wage differential develop over time and how can we explain this development?

We observed that 22% of the subjects in our dataset are overeducated for their job and that there is a large negative wage penalty: subjects in a job that minimally requires havo/vwo/mbo-level earn a gross hourly wage that is approximately 17 percentage points lower, where subjects working in jobs requiring vmbo or less earn a gross hourly wage that is approximately 37 percentage points lower than the wage earned by a subject that works in a job that minimally requires hbo. Where correcting for subject characteristics and firm mechanisms results in a relatively small decrease in the wage penalty to being overeducated, we find that correcting for the quality of the job match and the type of contract a subject works under substantially reduces the wage penalty to being overeducated: working in a temporary job that poorly uses your capacities/ability can explain approximately half of the found wage interval of education required. This finding seems to indicate that the majority of the overeducated hbo-graduates in our sample are actually overskilled for the job they are in and this finding contradicts with the conclusions of Allen & Van der Velden (2001) and Green & Mcintosh (2007). This contradiction can be explained by the fact that our dataset is quite different from the one used by these authors.

We find some evidence for an oversupply of hbo-graduates on the extensive margin: we observe that hbo-graduates have a relatively difficult time finding *a job* and the number of hbo-graduates that are overeducated for their job increased from approximately 16% in the 2007 to 22% of the subjects in the 2011 HBO-Monitor dataset. When studying the intensive margin, we find that the wage penalty to being overeducated increases over time: the estimated width of the wage interval of education required is approximately 29 percentage points in the 2007 HBO-Monitor dataset and approximately 50 percentage points in the 2011 HBO-Monitor dataset. We find indications that this increase in the wage interval of education required is caused by the trend that overeducated hbo-graduates work in increasingly bad jobs, but labor market frictions also play an important role. Our findings indicate that there is an oversupply of hbo-graduates in the short run. To be able to make robust statements about the long run, time-series data is required. Formulating policy recommendations based on our research is thus difficult. But even if there is a structural oversupply of hbo-graduates, it remains to be seen whether the Dutch government should take measures: in order to

say something about a 'waste of human capital' due to overeducation among hbo-graduates, a counterfactual is needed. Besides, (higher) education has substantial positive external effects, which are hard to measure, but should be taken into acccounting when making policy recommendations.

6 Bibliography

6.1 Data

The HBO-Monitor datasets are created by the *Research Centre for Education and the Labour Market (ROA)* of the Maastricht University School of Business and Economics. The datasets are publicly available via *http://www.dans.knaw.nl/*

6.2 Literature

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