WORKING PAPER

The causal relationship between education, health and health related behaviour: Evidence from a natural experiment in England

by
Nils Braakmann

University of Lüneburg
Working Paper Series in Economics

No. 190

November 2010

www.leuphana.de/institute/ivwl/publikationen/working-papers.html

ISSN 1860 - 5508

The causal relationship between education, health and health related behaviour: Evidence from a natural experiment in England

Nils Braakmann*

Newcastle University

[This version November 6th, 2010]

Abstract:

I exploit exogenous variation in the likelihood to obtain any sort of academic degree between January- and February-born individuals for 13 academic cohorts in England. For these cohorts compulsory schooling laws interacted with the timing of the CGE and O-level exams to change the probability of obtaining an academic degree by around 2 to 3 percentage points. I then use data on individuals born in these two months from the British Labour Force Survey and the Health Survey for England to investigate the effects of education on health using being February-born as an instrument for education. The results indicate neither an effect of education on various health related measures nor an effect on health related behaviour, e.g., smoking, drinking or eating various types of food.

Keywords: education, health, socio-economic gradient, education gradient

JEL Classification: I12, I20

Word count: 8,930 (including title page, references and tables)

* Nils Braakmann, Newcastle University, Business School – Economics, Newcastle upon Tyne, Tyne and Wear, NE7 1RU, United Kingdom, e-mail: nils.braakmann@ncl.ac.uk.

All analyses used Stata 11.1. Do-Files are available from the author on request. The data used in this study can be obtained from the Economic and Social Data Service, see www.esds.ac.uk/ for details. All analyses and opinions expressed in this paper as well as any possible errors are under the sole responsibility of the author.

I. Introduction

The social determinants of health have been a major focus of interest in recent years (see, e.g., Adams et al., 2003; Commission on Social Determinants of Health, 2008). A robust correlation has been found between individual education and individual health (see, e.g., Grossman, 2006, for a survey). Recent research (e.g., Cutler and Lleras-Muney, 2010) has started to investigate the channels driving that observed correlation.

In general, there are two broad explanations why education and health might be correlated: The first is that the observed positive correlation is spurious and in fact caused by underlying third variables like parental or family background, parental investments into their children or differences in non-cognitive traits or time preferences. A related argument would be a possible reverse causality stating that people who expect to have better health are willing to invest more into education as they expect to live longer, giving them more time to reap the returns to that investment. The second strand of arguments gives reasons for a possible causal link between education and health. A first potential causal link is a higher productivity of higher educated individuals that directly transfers into a higher level of health production given the same inputs (Grossman, 1972; Michael, 1973). This argument can be seen as an analogy to the well-known relationship between education and wages. Some evidence on this relationship is provided by Spandorfer et al. (1995) who show that low literacy goes hand in hand with a poor comprehension of hospitals' discharge instructions and by Goldman and Smith (2002) who find a relationship between education and compliance with medical treatments. A second argument brought forth by Goldman (1972) is that higher educated people might be better at allocating inputs such as time over health-relevant activities, e.g., through better information about medical treatments (see Glied and Lleras-Muney, 2003). Finally, higher educated individuals earn more than lower educated individuals, which may allow them to buy more expensive medical treatments, healthier foods or live in healthier regions.

Most recent papers investigating the second strand of arguments and trying to establish whether there is indeed a causal link between education and health have used changes in compulsory schooling laws. While comparisons of these studies are not easy as most papers use different outcome variables, results can generally considered to be very mixed: Spasojevic (2003) finds positive effects on a health index and BMI for 50 year olds in Sweden, Lleras-Muney (2005) finds large decreases in the 10 year mortality of the same age group in the USA. Similar results are found for 70 year olds in the USA by Glied and Llreas-Muney (2003). Finally, Oreopoulos (2006) finds positive effects on self-rated health and the occurrence of activity limiting disability for 25 to 84 year olds in the UK and the USA. However, an almost equal number of studies fail to find an effect using the same identification strategy: Arendt (2005) finds no effect on self-rated health, smoking and body mass index in Denmark, while Albouy and Lequien (2009) reach the same conclusion regarding mortality at 50 and 80 in France. On a somewhat related topic, Doyle et al. (2005) find no effect of parental education on the health of 8-year-old children in the UK. Finally, Adams (2002) finds mixed evidence depending on the outcome used for the USA.[1]

[1] There is also a variety of studies for various countries using other identification strategies or instruments, e.g., Berger and Leigh (1989), Kenkel (1991), Arkes (2003), De Walque (2003, 2004, 2007), Auld and Sidhu (2005), Cipollone et al. (2006), Kenkel et al. (2006), Groot and Massen van den Brink (2007) and Braakmann (2010). However, the picture that emerges from these studies is in no way clearer.

In this paper I exploit a natural experiment in England leading to differences in the likelihood of having obtained any degree between individuals born in January and February in the same birth cohort. Specifically, for the birth cohorts 1957 to (roughly) 1970 regulations regarding the time individuals reaching the minimum school leaving age could actually leave school interacted with the timing of the exams for the first degree that could be obtained in England (the "O-levels" and the "CSE"). To sketch these institutional details briefly (a full description can be found in section 2 of this paper): Unlike in the US, British children could not leave school at the day they reached the specific minimum school leaving age, but depending on their month of birth had to stay in school either until Easter or until the summer of the respective year. Specifically, individuals born between September 1 and January 31 could leave school at Easter while those born between February 1 and August 31 had to stay until the summer. For birth cohorts prior to 1957 who could leave school at the age of 15 these regulations only varied the length of education by one term (or by about two to three months). When the minimum school leaving age was raised to 16 – effective for birth cohorts from (September) 1957 onwards – however, this regulation began to influence the likelihood that individuals took the O-level and CSE exams. These were conducted each year in the summer and were normally taken at the age of 16. While the exams were open to all students regardless of whether they left school at Easter or stayed until the summer, the likelihood of having taken (and passed) the exams was much higher for individuals being born after the January-February-cut-off. For this group, we observe an approximately 2 to 3% higher probability of having obtained a degree. In Section 4 I will also provide some evidence that this effect only exists for the lowest possible degree, i.e., O-levels/CSE vs. no degree, while no differences exist for the probability of having passed A-levels or having a university degree.

This natural experiment creates two discontinuities in the probability of having obtained any degree. The first exists between individuals born in August or September, the second between individuals born in January and February. While these appear to be similar at first, there is one crucial difference: The August-September-cut-off creates differences *between* academic cohorts, while the January-February-cut-off operates *within* academic cohorts. Focussing on the January-February-discontinuity allows controlling for differences, e.g., in educational content, between individuals attending school in various years and allows for the comparison of individuals of the same age. In particular the latter is a big advantage over using increases in the school leaving age that always result in the comparison of individuals from different cohorts.

In what follows I will focus mainly on individuals being born in either January or February. A dummy for being born in February can then be used as an instrument for having obtained any degree in regressions using various health outcomes and health related behaviour as outcomes. It is important to stress that this instrument does not suffer from the same problems as the famous quarter of birth instrument used by Angrist and Krueger (1991). Firstly, as we will see, the instrument is generally much stronger, leading to an almost 3% increase in the likelihood of having obtained any academic degree and passing all usual weak instrument tests. Secondly, using January vs. February born as an instrument also avoids some of the potential endogeneity problems associated with quarter of birth instruments. To recall these briefly: There is recent evidence that the characteristics of women giving birth differ over the year, which may lead to unobserved differences in parental background for children born in different quarters (Buckles and Hungerman, 2008). Furthermore, the evidence presented against the validity of the quarter of birth in the seminal paper by Bound et al. (1995) documents small differences in school performance, mental and physical health as well as family income for individuals born in different seasons as well as regional differences in seasonal birth patterns. These problems can be expected to be much smaller when looking only at individuals born in two adjacent months. Firstly, while families can – at least to some extent – plan the season they want to give birth in, this is far less possible with respect to the exact month of birth. Secondly, while differences in maternal nutrition, weather conditions, sunlight exposure etc. may play a role for explaining differences in mental or physical health for children born in different seasons, these factors can be expected to be more or less equal for children born in either January or February. Taken together, these arguments suggest that the instrument is much stronger and much more likely to be truly exogenous than the well-known quarter of birth instrument.

Using data from the Labour Force Survey, I show that the higher likelihood of having obtained a degree did not lead to differences in various subjective and objective health outcomes. Although the individuals in the sample are of a similar age than those considered in the studies by Berger and Leigh (1989), Spasojevic (2003), Llleras-Muney (2005), Kenkel et al. (2006), or Cippolone et al. (2006), who all found effects of education on measures of health, one may object that the individuals affected by the natural experiment are still too young for any health effects to have materialized. To consider this possibility, I use data from the Health Survey for England to take a look at health related behaviour. However, the results also show no differences in the likelihood to smoke, drink heavily or eat various more or less healthy foods.

The following section presents the institutional background in greater detail, Section 3 describes the data and the general econometric approach. Results for objective health outcomes are presented in Section 4, results for health-related behaviour follow in Section 5. Section 6 concludes.

II. Institutional background

As already outlined in the introduction, the natural experiment in this paper arises through the interplay of compulsory schooling laws and the timing of the O-level and CSE exams – the first exams leading to a (possible) terminating degree in the UK – for individuals born between September 1957 and the early 1970s who were not yet affected by introduction of the GCSE exams in the late 1980s.

The education system in the UK is generally divided into three stages. Compulsory primary education is for children aged 5 to 10, followed by compulsory secondary schooling up to the respective minimum school leaving age and possibly ending with the (now abandoned) CSE and O-level exams or – under the current system – the GSCE. More academically inclined pupils can then continue into the so-called sixth form for two more years of full-time education ending with the A-levels that allow for entry into university education.

Children are admitted into school in the academic year they turn 5. Academic years begin on September 1st and run until August 31st of the following year. Each academic year is divided into three terms beginning in September, January and April respectively. The exact date of admission for children turning 5 during an academic year varies between local authorities. The most common system nowadays, covering roughly 50% of al children born between 1997 and 1999 (see Crawford et al., 2007), uses a single entry point for all children in September of the academic year they turn 5. Another popular system uses a triple-entry-point and admits children at the beginning of the term they turn 5. Both systems ensure that every child attends school once it turns 5. It is also important to stress that children born in January and February would generally be admitted at the same time regardless of the system that is locally operated, i.e., there is no difference in the duration of schooling between these two groups that is caused by a different beginning of their respective school careers (see Crawford et al., 2007, p. 13 for an overview of the different admission policies used in England).

A Minimum school leaving age

The minimum school leaving age for compulsory education was changed twice in recent times. The first change was due to the 1944 Butler Education act and changed the minimum school leaving age from 14 to 15 in April 1947. The second change was from 15 to 16 years, introduced in the Raising of School Leaving Age Order of 1972. It came into effect by September 1973, affecting children born from September 1957. This later increase is the one used in the study by Oeropoulos (2006).

In contrast to the US, children reaching the minimum school leaving age in the UK may not leave school immediately. Instead the following system, laid down in the Education Act of 1962, was in operation between 1962 and 1997: Children born between September 1st and January 31st were allowed to leave school at the end of the Spring term, i.e., directly before Easter. Children born between February 1st and August 31st, however, had to stay in school until the Friday before the last Monday in May. This system was abandoned in the 1996 education act that laid out a single school leaving date from 1998 onward. However, this later change does not affect the cohorts that will be investigated in this paper.

These regulations create two discontinuities in the compulsory duration of schooling. The first occurs between individuals born in August and September, the second between individuals born in January and February. While these two discontinuities appear to be similar at first, there is one crucial difference: The August-September-discontinuity occurs between academic cohorts, as September-born children will enter school at a later date. The second discontinuity, however, occurs within academic cohorts as children born in January and February will enter school at the same time, but differ in the earliest date they are allowed to leave school. The big advantage of focusing on the second discontinuity is thus that it allows us to control for possible differences in the content of education between academic cohorts as well as possible effects of the age at school entry, while still allowing for a full control of birth cohort effects. There is also a known difference between August-born and other children, analyzed by Crawford et al. (2007), which could invalidate the analysis if the August-September-cut-off was used, while no such differences exist between January- and February-born children.

B Interaction with the exams taken at age 16

In general, the discontinuities outlined above would only change the (compulsory) duration of education by one term (or roughly two months). However, for birth cohorts up to the early 1970s, whose first possible degree was the CSE or the O-levels, the school leaving date interacted with the timing of these exams that were taken at the age of 16 and that took place at the end of the summer term.

The CSE (Certificate of Secondary Education) was generally taken by less academically inclined students and was consequentially very often a terminal degree. O-level exams (General Certificate of Education Ordinary Levels), in contrast, were academically more demanding as can be seen by the fact that the highest grade of the CSE was equivalent to a pass grade on the O-levels. Both degrees were abandoned with the 1988 introduction of the GCSE (General Certificate of Secondary Education), which is a single subject exam taken in as many subjects as the student chooses. In this paper, I focus on the cohorts still facing the old CSE/O-level systems, as these groups are generally older, which makes it more likely to observe any health effects (the oldest cohorts facing the GCSE would still be in their twenties at the end of the observation period) and mixing groups facing different education systems could create other unknown problems and biases.

For students born before September 1957, who could leave school at the age of 15, the interaction with the timing of the exams is non-existent as individuals leaving school at the earliest occasion would leave school one year before the CSE and O-level exams and would consequently never take them. However, for individuals born between September 1957 and the early 1970s (I will generally use 1970 as a cut-off-date for reasons discussed in the data section below), the combination of the variation in school leaving dates and the timing of the exams creates large discontinuities in the likelihood of having obtained any degree between January- and February-born individuals. In all these cohorts individuals born in February are generally about 2 to 3% more likely to leave school with a degree than individuals born one month earlier. This is illustrated in Figure 1, which plots the share of individuals with a degree in the respective age cohort along with non-parametric regressions for both groups. Note that the large increase in individuals with a degree from in cohorts born around 1957 relative to earlier cohorts is a direct consequence of the increase in the minimum school leaving age and the associated higher likelihood of pupils taking the exams at 16.

(FIGURE 1 AROUND HERE.)

III. Data and general approach

I use data from two datasets representative of the English population: The British Labour Force Survey (LFS) and the Health Survey for England (HSE). The former provides a larger sample size and will be used for the analysis of the relationship between education and various objective measures of health, like specific diseases. The HSE will in turn be used for some complementary investigations on health related behaviour.

The LFS is a survey conducted by the Office of National Statistics since 1973. The data are representative for the population of households living at private addresses or National Health Service institutions. Data collection takes place quarterly since spring 1992. From 1992 to May 2006 data collection took place in a seasonal pattern with surveys being conducted in winter (December to February), spring (March to May), summer (June to August) and autumn (September to November). The current sample size is approximately 50,000 responding households in Great Britain with an additional 2,000 being added from Northern Ireland resulting in coverage of 0.1% of the target population. Each household is surveyed in five consecutive quarters in a rotating panel design. Since roughly one fifth of the respondents enter and leave each quarter there is an 80% overlap between two adjacent quarters. In this paper only the first observation for each individual will be used.

The LFS provides information on the labour market status and personal situation of individuals living in the UK during a reference period, usually a specific week. The questionnaire therefore encompasses information on employment, including information on the current employer, socio-demographic characteristics, education, and wages as well as information on the respective household.

I use data from the first quarter of 1998 to the last quarter of 2002. Until 1997 health related data was only collected if it affected an individual's work in some way. From that date onwards data on all health problems was collected. Month of birth, which is crucial to construct the instrument, is contained in the data only until the last quarter of 2002.

The HSE is an annual survey conducted since 1991 by the Joint Health Surveys Unit of the National Centre for Social Research and the Department of Epidemiology and Public Health, Royal Free and University College Medical School, London on behalf of the Department of Health. Sample sizes vary between 12,000 and 20,000 individuals depending on the year. The survey involves a questionnaire with a series of core questions as well as questions focusing on one specific topic each year and is accompanied by a nurse visit to the respondent's home for further medical tests. To be comparable with the LFS sample, I again use data from 1998 to 2002.

In this paper I focus on individuals born between September 1957 and 1970 living in England. The academic cohort entering school in September 1957 was the first to face the new minimum school leaving age of 16, which creates the interaction between month of birth and the CSE/O-level exams. For individuals born after 1970 the data increasingly shows individuals having taken the GCSE. These later cohorts are dropped for reasons for homogeneity.

Applying these restrictions leads to a sample of 55,154 individuals of which 8,971 are born in either January or February for the LFS. 22,270 are men (3,621 born in January or February) and 32,884 (5,350) are women. Using the same restrictions as above on the HSE leads to a sample of 15,822 individuals of which 2,683 are born in either January or February. 7,033 are men (1,179 born in January or February) and 8,789 (1,504) are women.

The main variable of interest in the following analysis is a dummy variable for having completed any sort of academic degree, i.e., CSE/O-levels and above. In the following section I will also briefly use a more detailed measure of education distinguishing between CSE/O-levels, A-levels and university degrees.

From the LFS, I take a variety of measures on objective health conditions, e.g., a dummy indicating whether an individual has any long-lasting health problem, whether this problems limits the activities the individual can do as well as information on a number of specific diseases. I also use a number of variables from the HSE on health related behaviour, i.e., whether an individual smokes, drinks more than the recommended limit or regularly eats various types of more or less healthy foods.

Table 1 contains basic descriptive statistics on all variables used in the analysis. Note that there is a considerable number of individuals with long-lasting health problems even though the sample is quite young on average. Looking at the results from the HSE reveals that the English do not lead a particularly healthy life: About 30% smoke, 22% drink over their weekly limits, only about one fifth eats fruits and vegetables somewhat regularly while about the same share of individuals eats chocolate, biscuits or crisps with the same frequency.

(TABLE 1 AROUND HERE.)

The main analysis consists of regressions of the form

$$H_{i(ct)} = \alpha + \beta_1 * age_{i(ct)} + \beta_2 * age^2_{i(ct)} + \beta_3 * age^3_{i(ct)} + \chi_c + \delta_t + \tau * degree_{i(ct)} + \varepsilon_{i(ct)}, \quad (1)$$

where $H_{i(ct)}$ is the respective health measure of individual *i* from cohort *c* observed in year *t*, χ_c and δ_t are birth cohort and year effects respectively and $degree_{i(ct)}$ is a dummy indicating whether individual *i* has completed any degree. Note that $H_{i(ct)}$ may be a dummy in which case equation (1) is a linear probability model. This fact, however, is not particularly problematic in this case as the instrument, the variable of interest as well as almost all control variables are dummy variables, which attenuates concerns regarding the linearity assumption (see Angrist, 2001). The only exception is age, which is entered as a high-order polynomial.

As outlined in the introduction $degree_{i(ct)}$ might be correlated with $\varepsilon_{i(ct)}$, if there are, for instance, common genetic other family background related factors influencing both an individual's health and its propensity to complete a first degree. This in turn would bias the estimate for τ in equation (1). To overcome this problem, I rely on the institutional features outlined in the preceding section and use a dummy for being February born as an instrument for having completed any degree. Most of the analysis will focus on individuals born either in January or February (henceforth called the discontinuity sample) although I will also present estimates based on the whole sample for comparison purposes. These estimates use being born between February and August (inclusively) as an instrument.

It should be kept in mind though that the instrument is much more likely to be truly exogenous when focussing only on January- and February-born individuals. From the discussion surrounding the famous quarter of birth instrument used by Angrist and Krueger (1991) it is well known that there is some evidence that the characteristics of women giving birth differ over the year, which may lead to unobserved differences in parental background for children born in different quarters (Buckles and Hungerman, 2008). Furthermore, the evidence presented against the validity of the quarter of birth in the seminal paper by Bound et al. (1995) documents small differences in school performance, mental and physical health as well as family income for individuals born in different seasons as well as regional differences in seasonal birth patterns. These problems can be expected to be less of concern when looking only at individuals born in two adjacent months, but they can be substantial when using the whole sample. Firstly, while families can – at least to some extent – plan the season they want to give birth in, this is far less possible with respect to the exact month of birth. Secondly, while differences in maternal nutrition, weather conditions, sunlight exposure etc. may play a role for explaining differences in mental or physical health for children born in different seasons, these factors can be expected to be more or less equal for children born in either January or February.

IV. Education and health outcomes

Table 2 presents first stage results for the February-born instrument using the LFS data. For almost all specifications, we observe a positive influence of being born after the January cut-off on the likelihood of having obtained an academic degree. Similar to the evidence in Figure 1, the results generally indicate that individual born after the cut-off raises the probability of having an academic degree by between 2 and 4.5%.

(TABLE 2 AROUND HERE.)

Restricting the sample to individuals born in January and February reduces the statistical power of the analysis to some extent. However, with one exception, the relationship between being February-born and having an academic degree becomes stronger, which is the result to be expected when the institutional explanation outlined in Section 2 is responsible for this relationship. Additionally, the first stage values of the F statistics generally confirm the absence of weak instrument problems. The one exception is the male discontinuity sample. However, even here the (insignificant) point estimate for being February-born indicates a large effect on the likelihood of having obtained any degree. The relative weakness of the instrument in that specification, which is also indicated by the low F statistics, is very likely due to the relatively small sample size in that group. While there is not much that can be done about that problem and while, e.g., Angrist and Pischke (2009) argue that weak instruments do not need to be a major problem in just identified models like the one used here, the potential problems in this sample should be kept in mind when discussing the main results.

(TABLE 3 AROUND HERE.)

Table 3 present some evidence on the changes the instrument causes in the educational distribution. The results are point estimates from regressions of the respective instrument and the control variables from equation (1) on dummy variables for various degrees, specifically for having completed university, A-levels or the CSE/O-levels. As can be expected for an instrument keeping individuals in school just long enough for them to take the first possible exam, we only see an influence on the probability of having completed the CSE/O-levels. Here, being February-born raises the probability of having completed that degree by between 1 and 4% with again weaker and insignificant results being found for the male discontinuity sample. The changes in the probability of having completed A-levels or a university degree, however, are close to zero in all samples and consequently always insignificant. These results strengthen the idea that the differences in educational attainment between January- and February-born individuals are indeed caused by the institutional setting described in Section 2.

Now consider the main analysis whose results are displayed in Tables 4a to 4c. Note first that the OLS results in the samples using all individuals and in the discontinuity samples are always very similar, which is a sign that individuals born in January and February are not that different from other individuals when it comes to the relationship between education and health. As one would expect the estimates support a positive relationship between education and health: Individuals with any degree are always much less likely to have a health problem and to be limited by it or to have any of the specific diseases that are considered in the analysis. These effects are also often economically large and always highly significant. They are also very similar between men and women, which means that the results from the pooled sample in Table 4a provide a good picture of the overall relationship.

(TABLES 4a, 4b and 4c AROUND HERE.)

This picture changes when looking at the IV-results: The pattern of point estimates in all samples becomes more erratic, suggesting a more or less random pattern of positive and negative relationships between education and the various health measures. [2] Additionally, all estimates are insignificant. Using Anderson-Rubin-tests that are robust to weak instruments does not change that picture, in fact p-values are generally almost identical. Note that these results are not simply a result of large standard errors rendering otherwise sensible estimates insignificant. To the contrary, the results show an almost equal number of positive and negative point estimates. In fact, the only subsample where the majority of point estimates show the "right" (negative) sign is the male discontinuity sample, in other words the sample

[2] These results are also confirmed when plotting the health outcomes of January and February-born individuals over birth-cohorts similarly to Figure 1.

where the instrumental variable analysis can be expected to be least reliable due to possible weak instrument problems.

Note that the difference between the OLS and the IV results is not surprising in itself as these two techniques estimate different effects. In particular, the IV-estimates are LATE-estimates for those individuals who changed their educational status due to the instrument, in other words the changes in health due to some individuals being nudged into completing a first degree by them being born in February. However, the IV results certainly do not provide much support for a causal relationship between education and health. These results are similar to a number of other studies, e.g., Arendt (2005), Doyle et al. (2005) and Albouy and Lequien (2009), using changes in compulsory schooling laws as well as to some of the studies using other identification strategies.

To sum up the current results: While the institutional setting described in Section 2 creates large discontinuities in education between January- and February-born individuals, there do not seem to be comparable discontinuities in various health measures. How can these results be explained? A first explanation is that there is indeed no causal relationship between education and health and that all observed health differences between individuals with different levels of education are caused by third factors like genetic endowments or family background.

A second and related explanation is that while there might a causal relationship between education and health, that relationship simply does not operate on the no degree/low degree margin. In fact, Cutler and Lleras-Muney (2010, p.3) point out that the relationship between education and health becomes stronger as one moves up the educational distribution. As the instrument used here is only informative about changes in the lower end of the educational distribution, this possibility cannot be ruled out in this paper.

Finally, there is one other possibility that can be tested using the HSE data – the individuals in the sample might simply be too young for any health effects to have materialised. This explanation is not necessarily likely as (a) health problems can be seen in the data and these are in fact correlated with education as demonstrated by the OLS estimates and (b) other studies that found evidence for a causal relationship between education and health, specifically Berger and Leigh (1989), Spasojevic (2003), Llleras-Muney (2005), Kenkel et al. (2006), or Cippolone et al. (2006), used samples from very similar age groups. However, as none of these arguments constitute a definite proof and as a possible relationship between education and health related behaviour is interesting in its own right, the following section provides further evidence on this possible connection.

V. Education and health related behaviour

Table 5 presents first stage results for the relationship between month of birth and education in the HSE. Given the smaller sample size I refrain from splitting the sample by gender and present only results for the whole sample. The results are generally very similar to the ones obtained using the LFS. Due the smaller sample sizes the first stage F-values are smaller and in fact slightly problematic in the discontinuity sample. This potential weak instrument problem should be kept in mind when looking at the results from the main analysis.

(TABLE 5 AROUND HERE.)

Turning to the analysis of interest in Table 6, we see the expected positive correlation between education and health related behaviour in the OLS estimates: Individuals with a degree are less likely to smoke or to drink excessively, eat less fried food and more vegetables and fruits than individuals without a degree. The only health related behaviour where the higher-educated fare worse is in their higher frequency to consume chocolate, biscuits and sweets.

(TABLE 6 AROUND HERE.)

Now consider the IV-estimates for both samples. The picture that emerges is again very similar to the one obtained in the previous section: The point estimates show again an erratic pattern of positive and negative results and are always significant.[3] In other words, the results show again no support for a causal relationship between education and health, although the caveats mentioned in the previous section should be kept in mind.

VI. Conclusion

In this paper, I used a natural experiment in England that created exogenous variation in the likelihood to obtain any sort of academic degree between January and February born individuals for 13 academic cohorts in England. For these cohorts compulsory schooling laws interacted with the timing of the CGE and O-level exams to change to probability of obtaining an academic degree by around 3 percentage points. Using data from the Labour Force Survey and the Health Survey for England, I then show that these within-cohort differences in education did not transform into corresponding differences in various objective health measures or in health related behaviour like smoking or drinking. While OLS

[3] This result is again robust to using Anderson-Rubin-tests.

estimates show the expected influence between having a degree and the outcomes in samples using all individuals as well as in a discontinuity sample using only individuals in January and February, this relationship disappears in both samples when instrumenting education by being February-born. The results consequently do not show support for a causal link between education and health – at least not for the individuals being affected by the particular intervention considered here. It is important to stress though that the results do not rule out a causal link between higher forms of education and health. As the institutional setting considered here only affect individuals at the margin of completing a first degree, no statements can be made regarding changes in the higher end of the educational distribution. However, the results are in line with some of the previous evidence using changes in compulsory schooling laws (Arendt, 2005; Doyle et al., 2005; Albouy and Lequien, 2009) and contradict some other studies using the same identification strategy (Spasojevic, 2003; Glied and Llreas-Muney, 2003; Lleras-Muney, 2005; Oreopoulos, 2006). In sum, the question whether there is a causal link between education and health seems to be open.

References

Adams, Scott J. (2002), “Educational attainment and health: evidence from a sample of older adults”, *Education Economics 10(1)*, pp. 97-109.

Adams, Peter, Hurd, Michael D., McFadden, Daniel, Merrill, Angela and Ribeiro, Tiago (2003), “Healthy, Wealthy, and Wise? Tests for Direct Causal Paths between Health and Socioeconomic Status”. *Journal of Econometrics 112(1)*, pp. 3-56.

Albouy, Valerie and Lequien, Laurent (2009). Does Compulsory Education Lower Mortality? *Journal of Health Economics 28(1)*, pp. 155-168.

Angrist, Joshua D. (2001), ““Estimation of Limited-Dependent Variable Models with Dummy Endogenous Regressors: Simple Strategies for Empirical Practice”, *Journal of Business and Economic Statistics 19(1)*, pp 2-28.

Angrist, Joshua D. and Krueger, Alan B. (1991), “Does Compulsory School Attendance Affect Schooling and Earnings”, *Quarterly Journal of Economics 106(4)*, pp. 979-1014.

Angrist, Joshua D. and Pischke, Joern-Steffen (2009), “*Mostly Harmless Econometrics – An Empiricist’s Companion*”, Princeton University Press.

Arendt, Jacob Nielsen (2005), “Education effects on health: a panel data analysis using school reform for identification”, *Economics of Education Review 24(2)*, pp. 149–160.

Arkes, Jeremy (2003), “*Does Schooling Improve Health?*”, Working paper, RAND Corporation.

Auld, M. Christopher and Sidhu, Nirmal (2005), “Schooling, cognitive ability, and health”, *Health Economics 14(10)*, pp. 1019–1034.

Berger, Mark C. and Leigh, J. Paul (1989), “Schooling, self-selection, and health.”, *Journal of Human Resources 24(3)*, 433–455.

Braakmann, Nils (2010), "*A note on the causal link between education and health – Evidence from the German short school years*", University of Lueneburg Working Paper in Economics 176.

Bound, John, Jaeger, David A. and Baker, Regina M. (1995): "Problems with Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogeneous Explanatory Variable is Weak", *Journal of the American Statistical Association 90(430)*, pp. 443-450.

Buckles, Kasey and Hungerman, Daniel M. (2008), "*Season of birth and later outcomes: Old questions, new answers*", NBER Discussion Paper 14573

Cipollone, Piero, Radicchia, Deborah, Rosolia, Alfonso (2006), "*The effect of education on youth mortality"*, Working paper, Bank of Italy.

Commission on Social Determinants of Health (2008), "*Closing the Gap in a Generation: Health Equity through Action on the Social Determinants of Health*", World Health Organization Final Report. Geneva.

Crawford, Claire, Dearden, Lorraine and Meghir, Costas (2007), "*When you are born matters: The impact of date of birth on child cognitive outcomes in England*", CEE Discussion Paper 93.

Cutler, David, & Lleras-Muney, Adriana (2010), "Understanding Differences in Health Behaviors by Education", *Journal of Health Economics 29(1)*, pp. 1-28.

DeWalque, Damien (2003), "*How Does Education Affect Health Decisions? The Cases of Smoking and HIV/AIDS*", Ph.D. Dissertation,University of Chicago, Department of Economics.

Doyle, Orla, Harmon, Colm, Walker, Ian (2005), "*The impact of parental income and education on the health of their children*", IZA Discussion Paper 1832.

Goldman, Dana P., Smith, James P. (2002), "Can patient self-management help explain the

SES health gradient?”, *Proceedings of the National Academy of Science 99(16)*, pp. 10929–10934.

Groot, Wim, Maassen van den Brink, Henriëtte (2007), “The health effects of education”, *Economics of Education Review 26(2)*, pp. 186–200.

Grossman, Michael (1972), “On the concept of health capital and the demand for health”, *Journal of Political Economy 70(2)*, pp. 223–255.

Grossmann, Michael (2006). Education and Nonmarket Outcomes. In Eric Hanushek and Finis Welch (eds.), *Handbook of the Economics of Education, Volume 1*. Amsterdam: North-Holland, Elsevier Science, pp. 577-633

Kenkel, Donald S. (1991), “Health behavior, health knowledge, and schooling”, *Journal of Political Economy 99(2)*, pp. 287–305.

Kenkel, Donald S., Lillard, Dean R., Mathios, Alan D. (2006), “The roles of high school completion and GED receipt on smoking and obesity”, *Journal of Labor Economics 24(3)*, pp. 635–660.

Lleras-Muney, Adriana (2005). The Relationship Between Education and Adult Mortality in the United States. *Review of Economic Studies 72(1)*, pp. 189-221.

Michael, Robert T. (1973), “Education in nonmarket production”, *Journal of Political Economy 81(2)*, pp. 306–327.

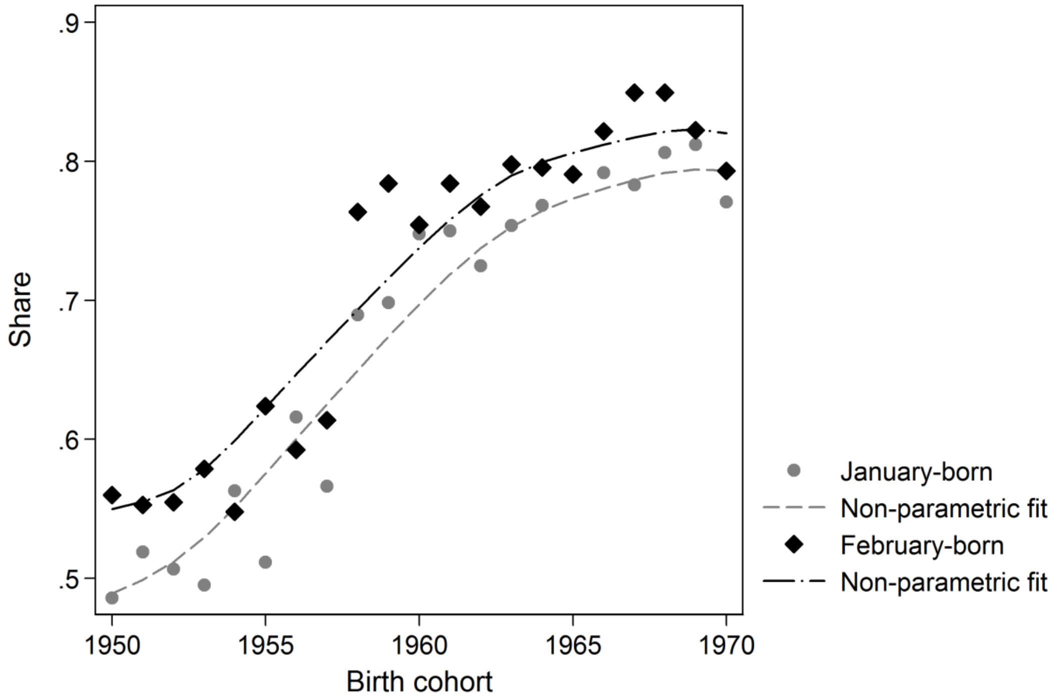
Oreopoulos, Philip (2006), “Estimating average and local average treatment effects of education when compulsory schooling laws really matter”, *American Economic Review 96(1)*, pp. 152–175.

Spandorfer, John M., Karras, David J., Hughes, Lynn A., Caputo, Craig (1995), “Comprehension of discharge instructions by patients in an urban emergency department”, *Annals of Emergency Medicine 25(1)*, pp. 71–74.

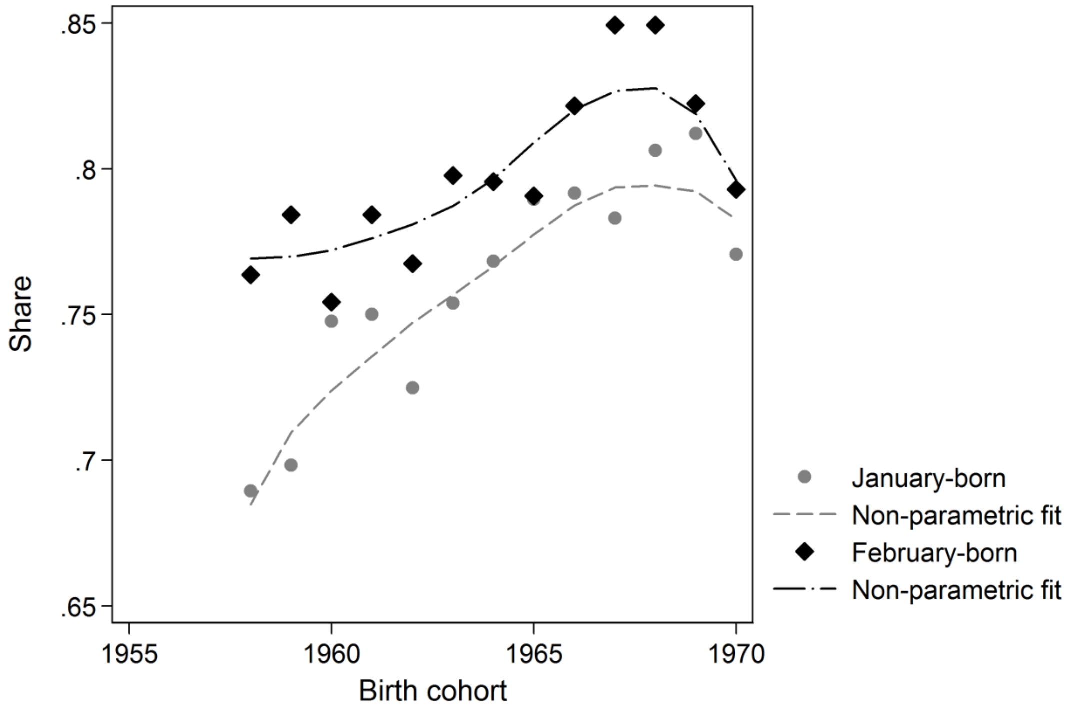
Spasojevic, Jasmina (2003), “*Effects of education on adult health in Sweden: results from a* *natural experiment*", Ph.D. Thesis. City University of New York Graduate Center.

Tables and Figures

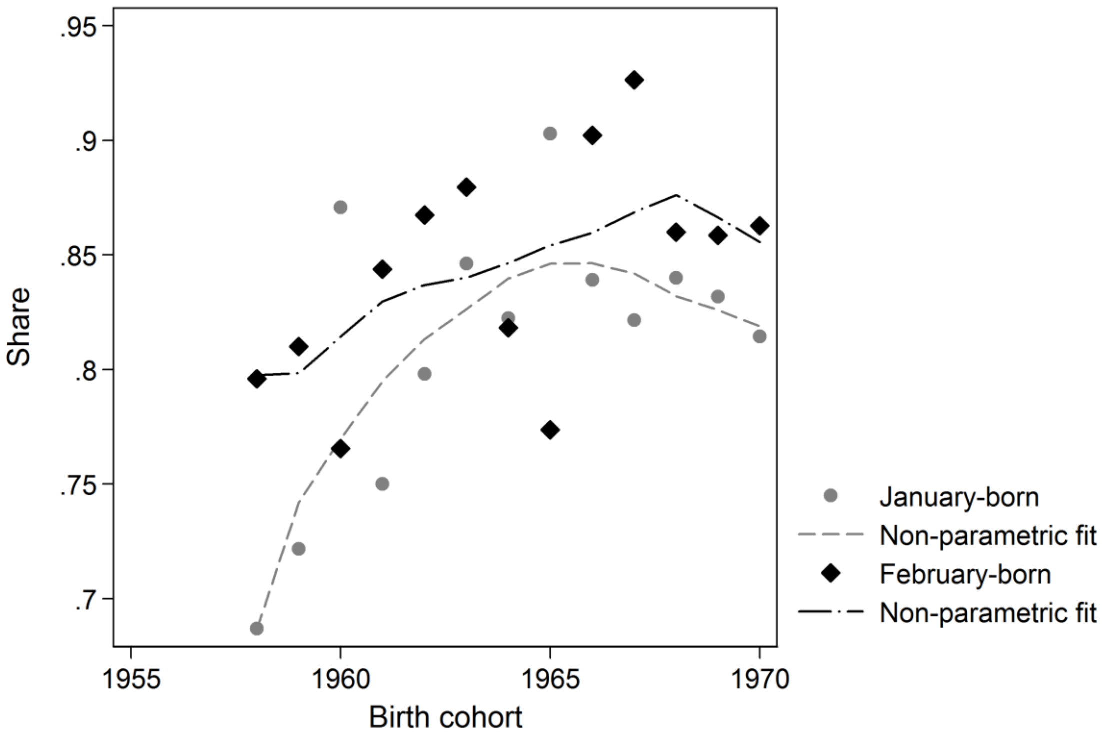
Figure 1: The relationship between month of birth and having obtained any degree, only January and February born individuals



Panel (a): Birth cohorts 1950 to 1970, cohorts are treated from 1957, Labour Force Survey



Panel (b): Treated cohorts only, Labour Force Survey



Panel (c): Treated cohorts only, Health Survey for England

Note: The increase in the share of individuals with degrees around 1957 is related to an increase in the minimum school leaving age for the later cohorts. Earlier cohorts could leave school at age 15, i.e., one year before exams for a first degree were taken, while later cohorts could leave at 16, i.e., in the year where exams were taken which resulted in a higher share of individuals obtaining a degree. Note that this fact has no consequences for the analysis in this paper that uses *within-cohort* variation for the cohorts leaving school at 16.

Table 1: Descriptive statistics, estimation sample

Variable	Observations	Mean	Standard deviation
Labour Force Survey			
Has any degree (1 = yes)	55154	0.7774	0.4160
Born February to August (1 = yes, vs. September to January)	55154	0.5853	0.4927
Born in February (1 = yes, vs. born in January)	8971	0.4861	0.4998
Age (years)	55154	35.6554	4.0259
University degree (1 = yes)	55154	0.1623	0.3688
A levels (1 = yes)	55154	0.1013	0.3017
O levels (1 = yes)	55154	0.5137	0.4998
Ever had health problem longer than 12 months (1 = yes)	55154	0.2553	0.4361
Health problem limited/ limits activity (1 = yes)	55154	0.1335	0.3401
Problems with hands, legs, back or neck (1 = yes)	55154	0.1043	0.3057
Difficulty in seeing or hearing (1 = yes)	55154	0.0181	0.1332
Disfigurement, skin conditions, allergies (1 = yes)	55154	0.0242	0.1536
Chest/breathing problems, asthma, bronchitis (1 = yes)	55154	0.0633	0.2435
Heart, blood pressure, blood circulation problems (1 = yes)	55154	0.0259	0.1588
Stomach, liver kidney, digestive problems (1 = yes)	55154	0.0313	0.1741
Diabetes (1 = yes)	55154	0.0082	0.0902
Depression, bad nerves, anxiety (1 = yes)	55154	0.0352	0.1844
Epilepsy, mental handicap, mental illness (1 = yes)	55154	0.0274	0.1631
M ale (1 = yes)	55154	0.4038	0.4907
Health Survey for England			
Has any degree (1 = yes)	15822	0.8420	0.3648
Born February to August (1 = yes, vs. September to January)	15822	0.5925	0.4914
Born in February (1 = yes, vs. born in January)	2683	0.4801	0.4997
Age (years)	15822	35.6211	3.9293
Smoker (1 = yes)	15822	0.3061	0.4609
Drinks over weekly limits (1 = yes)	15822	0.2220	0.4156
Eats fried food 6 times a week (1 = yes)	15822	0.0111	0.1049
Eats fried food at least 3 times a week (1 = yes)	15822	0.0610	0.2393
Eats fruit or vegetables 6 times a week (1 = yes)	15822	0.1857	0.3889
Eats fruits and vegetables at least 3 times a week (1 = yes)	15822	0.2167	0.4120
Eats chocolate, biscuits or crisps 6 times a week (1 = yes)	15822	0.1215	0.3267
Eats chocolate, biscuits or crisps at least 3 times a week (1 = yes)	15822	0.2241	0.4170
Male (1 = yes)	15822	0.4445	0.4969

Table 2: First stage results, Labour Force Survey, dependent variable: has any degree (1 = yes)

	Men and women		Men		Women	
	All individuals	**Only January and February born**	**All individuals**	**Only January and February born**	**All individuals**	**Only January and February born**
Born February to August (1 = yes)	0.0281*** (0.0038)		0.0332*** (0.0060)		0.0247*** (0.0049)	
Born in February (1 = yes)		0.0359*** (0.0089)		0.0221 (0.0141)		0.0457*** (0.0115)
Observations	55,154	8,971	22,270	3,621	32,884	5,350
R^2	0.0074	0.0087	0.0109	0.0122	0.0056	0.0109
Cragg-Donald Wald F statistic	54.30	16.66	30.52	2.48	25.12	16.38
Kleibergen-Paap Wald rk F statistic	53.61	16.62	30.16	2.49	24.80	16.20

Coefficients, robust standard errors in parentheses. */**/*** denote statistical significance on the 10%, 5% and 1% level. All estimations control for gender (where appropriate), a cubic polynomial in age and a full set of year of birth and year dummies.

Table 3: The relationship between time of birth and having obtained various degrees

	All Individuals			Only January and February born		
Dependent variable	University degree (1 = yes)	A levels (1 = yes)	O-levels (1 = yes)	University degree (1 = yes)	A levels (1 = yes)	O-levels (1 = yes)
Men and women						
Born February to August (1 = yes)	-0.0021	0.0015	0.0287***			
	(0.0034)	(0.0027)	(0.0046)			
Born in February (1 = yes)				0.0040	0.0023	0.0295***
				(0.0079)	(0.0066)	(0.0107)
Observations		55,154			8,971	
R^2	0.0043	0.0013	0.0048	0.0077	0.0023	0.0072
Men						
Born February to August (1 = yes)	0.0007	-0.0012	0.0337***			
	(0.0056)	(0.0042)	(0.0072)			
Born in February (1 = yes)				0.0023	0.0085	0.0113
				(0.0131)	(0.0100)	(0.0169)
Observations		22,270			3,621	
R^2	0.0016	0.0015	0.0047	0.0096	0.0047	0.0066
Women						
Born February to August (1 = yes)	-0.0038	0.0034	0.0251***			
	(0.0042)	(0.0036)	(0.0059)			
Born in February (1 = yes)				0.0053	-0.0019	0.0424***
				(0.0097)	(0.0087)	(0.0139)
Observations		32,884			5,350	
R^2	0.0014	0.0008	0.0038	0.0052	0.0045	0.0079

Each cell is from a different regression. Coefficients, robust standard errors in parentheses. */**/*** denote statistical significance on the 10%, 5% and 1% level. All estimations control for gender (where appropriate), a cubic polynomial in age and a full set of year of birth and year dummies.

Table 4a: The impact of a degree on health outcomes, Labour Force Survey, OLS and IV results, men and women

	Ever had health problem longer than 12 months	Health problem limited/ limits activity	Problems with hands, legs, back or neck	Difficulty in seeing or hearing	Disfigurement, skin conditions, allergies	Chest/breathing problems, asthma, bronchitis	Heart, blood pressure, blood circulation problems	Stomach, liver kidney, digestive problems	Diabetes	Depression, bad nerves, anxiety	Epilepsy, mental handicap, mental illness
OLS estimates: All individuals											
Any degree (1 = yes)	-0.1014***	-0.0934***	-0.0549***	-0.0116***	-0.0054***	-0.0294***	-0.0167***	-0.0119***	-0.0014	-0.0385***	-0.0373***
	(0.0047)	(0.0040)	(0.0035)	(0.0016)	(0.0017)	(0.0028)	(0.0019)	(0.0020)	(0.0010)	(0.0024)	(0.0022)
Observations	55,154	55,154	55,154	55,154	55,154	55,154	55,154	55,154	55,154	55,154	55,154
IV results: All individuals											
Any degree (1 = yes)	0.0675	0.0143	-0.0145	-0.0304	0.0044	-0.0501	0.0581	0.0310	0.0492	0.0244	0.0870
	(0.1426)	(0.1108)	(0.0990)	(0.0448)	(0.0500)	(0.0792)	(0.0523)	(0.0566)	(0.0300)	(0.0609)	(0.0548)
Observations	55,154	55,154	55,154	55,154	55,154	55,154	55,154	55,154	55,154	55,154	55,154
OLS estimates: Only January and February born											
Any degree (1 = yes)	-0.1162***	-0.1051***	-0.0628***	-0.0156***	0.0016	-0.0338***	-0.0192***	-00060	-0.0044*	-0.0420***	-0.0424***
	(0.0119)	(0.0100)	(0.0089)	(0.0042)	(0.0040)	(0.0070)	(0.0049)	(0.0048)	(0.0026)	(0.0062)	(0.0057)
Observations	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971
IV results: Only January and February born											
Any degree (1 = yes)	-0.0370	-0.2854	0.0397	-0.1189	0.0646	-0.0565	-0.0354	0.0968	0.0479	-0.1517	0.1269
	(0.2626)	(0.2060)	(0.1878)	(0.0848)	(0.0946)	(0.1460)	(0.0964)	(0.1074)	(0.0564)	(0.1190)	(0.1089)
Observations	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971	8,971

Each cell is from a different regression. Coefficients, robust standard errors in parentheses. */**/*** denote statistical significance on the 10%, 5% and 1% level. All estimations control for gender, a cubic polynomial in age and a full set of year of birth and year dummies.

Table 4b: The impact of a degree on health outcomes, Labour Force Survey, OLS and IV results, men

	Ever had health problem longer than 12 months	Health problem limited/ limits activity	Problems with hands, legs, back or neck	Difficulty in seeing or hearing	Disfigurement, skin conditions, allergies	Chest/breathing problems, asthma, bronchitis	Heart, blood pressure, blood circulation problems	Stomach, liver kidney, digestive problems	Diabetes	Depression, bad nerves, anxiety	Epilepsy, mental handicap, mental illness
OLS estimates: All individuals											
Any degree (1 = yes)	-0.1131***	-0.1027***	-0.0745***	-0.0100***	-0.0057**	-0.0202***	-0.0214***	-0.0128***	-0.0024	-0.0352***	-0.0406***
	(0.0075)	(0.0062)	(0.0059)	(0.0026)	(0.0025)	(0.0042)	(0.0030)	(0.0031)	(0.0016)	(0.0035)	(0.0035)
Observations	22,270	22,270	22,270	22,270	22,270	22,270	22,270	22,270	22,270	22,270	22,270
IV results: All individuals											
Any degree (1 = yes)	-0.0307	-0.1195	-0.1101	-0.0328	-0.0476	-0.0398	0.0458	0.1368*	0.0998**	-0.0287	0.0569
	(0.1893)	(0.1454)	(0.1404)	(0.0655)	(0.0650)	(0.1063)	(0.0670)	(0.0763)	(0.0439)	(0.0743)	(0.0742)
Observations	22,270	22,270	22,270	22,270	22,270	22,270	22,270	22,270	22,270	22,270	22,270
OLS estimates: Only January and February born											
Any degree (1 = yes)	-0.1201***	-0.1128***	-0.0783***	-0.0146**	0.0015	-0.0234**	-0.0258***	-0.0020	-0.0116**	-0.0285***	-0.0434***
	(0.0186)	(0.0155)	(0.0149)	(0.0072)	(0.0062)	(0.0105)	(0.0079)	(0.0066)	(0.0048)	(0.0087)	(0.0090)
Observations	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621
IV results: Only January and February born											
Any degree (1 = yes)	-0.7400	-1.4993	-0.4662	-0.3322	-0.0232	-0.0867	-0.0029	0.2707	0.3721	-0.4956	0.2356
	(0.7786)	(1.0201)	(0.5642)	(0.3060)	(0.2320)	(0.3766)	(0.2505)	(0.2943)	(0.2867)	(0.4032)	(0.3150)
Observations	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621

Each cell is from a different regression. Coefficients, robust standard errors in parentheses. */**/*** denote statistical significance on the 10%, 5% and 1% level. All estimations control for a cubic polynomial in age and a full set of year of birth and year dummies.

Table 4c: The impact of a degree on health outcomes, Labour Force Survey, OLS and IV results, women

	Ever had health problem longer than 12 months	Health problem limited/ limits activity	Problems with hands, legs, back or neck	Difficulty in seeing or hearing	Disfigurement, skin conditions, allergies	Chest/breathing problems, asthma, bronchitis	Heart, blood pressure, blood circulation problems	Stomach, liver kidney, digestive problems	Diabetes	Depression, bad nerves, anxiety	Epilepsy, mental handicap, mental illness
OLS estimates: All individuals											
Any degree (1 = yes)	-0.0934***	-0.0870***	-0.0415***	-0.0127***	-0.0052**	-0.0358***	-0.0134***	-0.0112***	-0.0006	-0.0409***	-0.0350***
	(0.0061)	(0.0051)	(0.0043)	(0.0020)	(0.0022)	(0.0037)	(0.0024)	(0.0026)	(0.0012)	(0.0032)	(0.0028)
Observations	32,884	32,884	32,884	32,884	32,884	32,884	32,884	32,884	32,884	32,884	32,884
IV results: All individuals											
Any degree (1 = yes)	0.1476	0.1352	0.0683	-0.0268	0.0521	-0.0597	0.0683	-0.0674	0.0045	0.0702	0.1133
	(0.2113)	(0.1679)	(0.1403)	(0.0610)	(0.0758)	(0.1158)	(0.0789)	(0.0862)	(0.0421)	(0.0955)	(0.0802)
Observations	32,884	32,884	32,884	32,884	32,884	32,884	32,884	32,884	32,884	32,884	32,884
OLS estimates: Only January and February born											
Any degree (1 = yes)	-0.1126***	-0.1001***	-0.0516***	-0.0161***	0.0010	-0.0413***	-0.0144**	-0.0089	0.0010	-0.0518***	-0.0419***
	(0.0155)	(0.0131)	(0.0110)	(0.0052)	(0.0053)	(0.0094)	(0.0062)	(0.0067)	(0.0028)	(0.0087)	(0.0073)
Observations	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350
IV results: Only January and February born											
Any degree (1 = yes)	0.2033	0.1160	0.1854	-0.0551	0.0933	-0.0501	-0.0466	0.0501	-0.0607	-0.0424	0.0948
	(0.2768)	(0.2140)	(0.1891)	(0.0755)	(0.0990)	(0.1484)	(0.0965)	(0.1151)	(0.0546)	(0.1233)	(0.1062)
Observations	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350	5,350

Each cell is from a different regression. Coefficients, robust standard errors in parentheses. */**/*** denote statistical significance on the 10%, 5% and 1% level. All estimations control for a cubic polynomial in age and a full set of year of birth and year dummies.

Table 5: First stage results, Health Survey for England, dependent variable: has any degree (1 = yes)

	Men and women	
	All individuals	**Only January and February born**
Born February to August (1 = yes)	0.0209***	
	(0.0063)	
Born in February (1 = yes)		0.0339**
		(0.0145)
Observations	15,822	2,682
R^2	0.0229	0.0474
Cragg-Donald Wald F statistic	11.26	5.18
Kleibergen-Paap Wald rk F statistic	11.02	5.22

Coefficients, robust standard errors in parentheses. */**/*** denote statistical significance on the 10%, 5% and 1% level. All estimations control for gender, a cubic polynomial in age and a full set of year of birth and year dummies.

Table 6: The impact of a degree on health related behaviour, Health Survey for England, OLS and IV results

	Smoker	Drinks over weekly limits	Eats fried food 6 times a week	Eats fried food at least 3 times a week	Eats fruit or vegetables 6 times a week	Eats fruits and vegetables at least 3 times a week	Eats chocolate, biscuits or crisps 6 times a week	Eats chocolate, biscuits and crisps at least 3 times a week
OLS estimates: All individuals								
Any degree	-0.1763***	0.0573***	-0.0165***	-0.0383***	0.0347***	0.0526***	0.0070	0.0364***
(1 = yes)	(0.0107)	(0.0083)	(0.0032)	(0.0060)	(0.0074)	(0.0078)	(0.0062)	(0.0072)
Observations	15,822	15,822	15,822	15,822	15,822	15,822	15,822	15,822
IV results: All individuals								
Any degree	-0.2068	0.3582	-0.1627*	-0.3017	-0.1033	0.1987	0.0963	0.3555
(1 = yes)	(0.3752)	(0.3469)	(0.0979)	(0.2061)	(0.2608)	(0.2710)	(0.2316)	(0.2723)
Observations	15,822	15,822	15,822	15,822	15,822	15,822	15,822	15,822
OLS estimates: Only January and February born								
Any degree	-0.1366***	0.0871***	-0.0237***	-0.0482***	0.0560***	0.0598***	-0.0009	0.0401**
(1 = yes)	(0.0250)	(0.0190)	(0.0088)	(0.0150)	(0.0175)	(0.0186)	(0.0144)	(0.0171)
Observations	2,682	2,682	2,682	2,682	2,682	2,682	2,682	2,682
IV results: Only January and February born								
Any degree	-0.1377	-0.4112	-0.0305	-0.0710	-0.2132	-0.0469	0.0812	-0.2667
(1 = yes)	(0.5289)	(0.5171)	(0.1324)	(0.2754)	(0.3809)	(0.3761)	(0.3170)	(0.3800)
Observations	2,682	2,682	2,682	2,682	2,682	2,682	2,682	2,682

Each cell is from a different regression. Coefficients, robust standard errors in parentheses. */**/*** denote statistical significance on the 10%, 5% and 1% level. All estimations control for gender, a cubic polynomial in age and a full set of year of birth and year dummies.

Working Paper Series in Economics

(recent issues)

No.189: *Dirk Oberschachtsiek and Britta Ulrich:* The link between career risk aversion and unemployment duration: Evidence of non-linear and time-depending pattern, October 2010

No.188: *Joachim Wagner:* Exports and Firm Characteristics in German Manufacturing industries, October 2010

No.187: *Joachim Wagner:* The post-entry performance of cohorts of export starters in German manufacturing industries, September 2010

No.186: *Joachim Wagner:* From estimation results to stylized facts: Twelve recommendations for empirical research in international activities of heterogenous firms, September 2010

No.185: *Franziska Dittmer and Markus Groth:* Towards an agri-environment index for biodiversity conservation payment schemes, August 2010

No.184: *Markus Groth:* Die Relevanz von Ökobilanzen für die Umweltgesetzgebung am Beispiel der Verpackungsverordnung, August 2010

No.183: *Yama Temouri, Alexander Vogel and Joachim Wagner:* Self-Selection into Export Markets by Business Services Firms – Evidence from France, Germany and the United Kingdom, August 2010

No.182: *David Powell and Joachim Wagner:* The Exporter Productivity Premium along the Productivity Distribution: First Evidence from a Quantile Regression for Fixed Effects Panel Data Models, August 2010

No.181: *Lena Koller, Claus Schnabel und Joachim Wagner:* Beschäftigungswirkungen arbeits- und sozialrechtlicher Schwellenwerte , August 2010

No.180: *Matthias Schröter, Markus Groth und Stefan Baumgärtner:* Pigous Beitrag zur Nachhaltigkeitsökonomie, Juli 2010

No.179: *Norbert Olah, Thomas Huth and Dirk Löhr:* Monetary policy with an optimal interest structure, July 2010

No.178: *Sebastian A. Schütz:* Structured Finance Influence on Financial Market Stability – Evaluation of Current Regulatory Developments, June 2010

No.177: *Franziska Boneberg:* The Economic Consequences of One-third Co-determination in German Supervisory Boards: First Evidence from the German Service Sector from a New Source of Enterprise Data, June 2010

No.176: *Nils Braakmann:* A note on the causal link between education and health – Evidence from the German short school years, June 2010

No.175: *Torben Zülsdorf, Ingrid Ott und Christian Papilloud:* Nanotechnologie in Deutschland – Eine Bestandsaufnahme aus Unternehmensperspektive, Juni 2010

No.174: *Nils Braakmann:* An empirical note on imitative obesity and a puzzling result, June 2010

No.173: *Anne-Kathrin Last and Heike Wetzel:* Baumol's Cost Disease, Efficiency, and Productivity in the Performing Arts: An Analysis of German Public Theaters, May 2010

No.172: *Vincenzo Verardi and Joachim Wagner:* Productivity premia for German manufacturing firms exporting to the Euro-area and beyond: First evidence from robust fixed effects estimations, May 2010

No.171: *Joachim Wagner:* Estimated capital stock values for German manufacturing enterprises covered by the cost structure surveys, May 2010

No.170: *Christian Pfeifer, Simon Janssen, Philip Yang and Uschi Backes-Gellner:* Training Participation of an Aging Workforce in an Internal Labor Market, May 2010

No.169: *Stefan Baumgärtner and Martin Quaas:* Sustainability Economics – general versus specific, and conceptual versus practical, May 2010
[forthcoming in: Ecological Economics]

No.168: *Vincenzo Verardi and Joachim Wagner:* Robust Estimation of Linear Fixed Effects Panel Data Models with an Application to the Exporter Productivity Premium, April 2010

No.167: *Stephan Humpert:* Machen Kinder doch glücklich? April 2010

No.166: *Joachim Wagner:* Produktivität und Rentabilität in der niedersächsischen Industrie im Bundesvergleich. Eine Benchmarking-Studie auf der Basis vertraulicher Firmendaten aus Erhebungen der amtlichen Statistik, April 2010
[erschienen in: Statistische Monatshefte Niedersachsen, Sonderausgabe "Kooperation Wissenschaft und Statistik - 20 Jahre Nutzung von amtlichen Mikrodaten", S. 30 - 42]

No.165: *Nils Braakmann:* Neo-Nazism and discrimination against foreigners: A direct test of taste discrimination, March 2010

No.164: *Amelie Boje, Ingrid Ott and Silvia Stiller:* Metropolitan Cities under Transition: The Example of Hamburg/ Germany, February 2010

No.163: *Christian Pfeifer and Stefan Schneck:* Relative Wage Positions and Quit Behavior: New Evidence from Linked Employer-Employee-Data, February 2010

No.162: *Anja Klaubert:* "Striving for Savings" – religion and individual economic behavior, January 2010

No.161: *Nils Braakmann:* The consequences of own and spousal disability on labor market outcomes and objective well-being: Evidence from Germany, January 2010

No.160: *Norbert Olah, Thomas Huth und Dirk Löhr:* Geldpolitik mit optimaler Zinsstruktur, Januar 2010

No.159: *Markus Groth:* Zur Relevanz von Bestandseffekten und der Fundamentalen Transformation in wiederholten Biodiversitätsschutz-Ausschreibungen, Januar 2010

No.158: *Franziska Boneberg:* Die gegen das Drittelbeteiligungsgesetz verstoßende Aufsichtsratslücke existiert. Replik zu „Das Fehlen eines Aufsichtsrates muss nicht rechtswidrig sein" von Alexander Dilger, Januar 2010
[erschienen in: Zeitschrift für Industrielle Beziehungen, 1 (2010)]

No.157: *Institut für Volkswirtschaftslehre:* Forschungsbericht 2009, Januar 2010

No.156: *Alexander Vogel, Joachim Wagner, Kerstin Brunken und Arno Brandt:* Zur Beschäftigungsentwicklung in der Region Hannover - Ein Vergleich mit 12 deutschen Verdichtungsräumen, Dezember 2009

No.155: *Nils Braakmann and Joachim Wagner:* Labor market adjustments after a great import shock: Evidence from the German clothing industry and the Multi-Fibre Arrangement, December 2009

No.154: *Joachim Wagner:* Zehn Jahre *European Data Watch*: Dokumentation von Datensätzen für die empirische Wirtschafts- und Sozialforschung und Zugangswegen zu den Daten, Dezember 2009
[erschienen in: AStA - Wirtschafts- und Sozialstatistisches Archiv 4(2010), 2, 141-149]

No.153: *Joachim Wagner:* Offshoring and work performance: Self-Selection, effects on performance, or both? December 2009
[revised version forthcoming in: Review of Word Economics]

No.152: *Christian Pfeifer:* Effective Working Hours and Wages: The Case of Downward Adjustment via Paid Absenteeism, November 2009

No.151: *Christian Pfeifer:* Adjustment of Deferred Compensation Schemes, Fairness Concerns, and Hiring of Older Workers, November 2009

No.150: *Franziska Boneberg:* Recht und Realität von Mitbestimmung im westdeutschen Dienstleistungssektor: 11 Fallstudien, November 2009

No.149: *Birgit Müller, Martin Quaas, Karin Frank and Stefan Baumgärtner:* Pitfalls and potential of institutional change: Rain-index insurance and the sustainability of rangeland management, November 2009

No.148: *Alexander Vogel, Florian Burg, Stefan Dittrich und Joachim Wagner:* Zur Dynamik der Export- und Importbeteiligung deutscher Industrieunternehmen – Empirische Befunde aus dem Umsatzsteuerpanel 2001-2006, Oktober 2009
[publiziert in: Wirtschaft und Statistik, Heft 11(2009), 1109-1116]

No.147: *Markus Groth:* Potentiale und Risiken der Nutzung von Methan aus Methanhydraten als Energieträger, Oktober 2009

No.146: *Sandra Derissen, Martin Quaas and Stefan Baumgärtner:* The relationship between resilience and sustainable development of ecological-economic systems, October 2009

No.145: *Anne-Kathrin Last und Heike Wetzel:* Effizienzmessverfahren – Eine Einführung, September 2009

No.144: *Horst Raff and Joachim Wagner:* Intra-Industry Adjustment to Import Competition: Theory and Application to the German Clothing Industry, September 2009
[published in: The World Economy 33 (2010), 8, 1006-1022]

No.143: *Nils Braakmann:* Are there social returns to both firm-level and regional human capital? – Evidence from German social security data. September 2009

No.142: *Nils Braakmann and Alexander Vogel:* How does economic integration influence employment and wages in border regions? The case of the EU-enlargement 2004 and Germany's eastern border, September 2009

No.141: *Stefanie Glotzbach and Stefan Baumgärtner:* The relationship between intra- and intergenerational ecological justice. Determinants of goal conflicts and synergies in sustainability policy. September 2009
[forthcoming in: Environmental Values]

No.140: *Alexander Vogel:* Exportprämien unternehmensnaher Dienstleister in Niedersachsen, September 2009

No.139: *Alexander Vogel:* Die Dynamik der Export- und Importbeteiligung niedersächsischer Industrieunternehmen im interregionalen Vergleich 2001-2006, September 2009

No.138: *Stefan Baumgärtner and Martin F. Quaas:* What is sustainability economics? September 2009
[published in: Ecological Economics 69 (2010), 3, , 445 - 450]

No.137: *Roland Olbrich, Martin F. Quaas and Stefan Baumgärtner:* Sustainable use of ecosystem services under multiple risks – a survey of commercial cattle farmers in semi-arid rangelands in Namibia, September 2009

No.136: *Joachim Wagner:* One-third codetermination at company supervisory boards and firm performance in German manufacturing industries: First direct evidence from a new type of enterprise data, August 2009

(see www.leuphana.de/institute/ivwl/publikationen/working-papers.html for a complete list)

Leuphana Universität Lüneburg
Institut für Volkswirtschaftslehre
Postfach 2440
D-21314 Lüneburg
Tel.: ++49 4131 677 2321
email: brodt@leuphana.de

www.leuphana.de/institute/ivwl/publikationen/working-papers.html