Does the higher education expansion in the UK reduce the returns to education?

Huang, Bin; Xu, Lei; Zhu, Yu

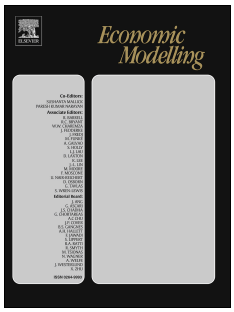
Published in:
Economic Modelling

DOI:
10.1016/j.econmod.2019.01.012

Publication date:
2019

Document Version
Peer reviewed version

Accepted Manuscript



Does the higher education expansion in the UK reduce the returns to education? A comparison of returning-from-work versus fresh out-of-school graduates

Bin Huang, Lei Xu, Yu Zhu

PII: S0264-9993(18)31164-7

DOI: https://doi.org/10.1016/j.econmod.2019.01.012

Reference: ECMODE 4813

To appear in: *Economic Modelling*

Received Date: 13 August 2018

Revised Date: 18 January 2019

Accepted Date: 19 January 2019

Please cite this article as: Huang, B., Xu, L., Zhu, Y., Does the higher education expansion in the UK reduce the returns to education? A comparison of returning-from-work versus fresh out-of-school graduates, *Economic Modelling* (2019), doi: https://doi.org/10.1016/j.econmod.2019.01.012.

Does the higher education expansion in the UK reduce the returns to education? A comparison of returning-from-work versus fresh out-of-school graduates

Bin Huang[a], Lei Xu[b,*] and Yu Zhu[c]

[a] School of Public Administration, Nanjing University of Finance and Economics, Nanjing, China
[b] National Institute of Economic and Social Research, London, UK
[c] School of Business, University of Dundee, Dundee, UK

Corresponding Author: Lei Xu, 2 Dean Trench Street, Smith Square London, SW1P 3HE, United Kingdom, E-mail: l.xu@niesr.ac.uk. Tel: 07482574654.

Acknowledgements: We would like to thank participants at the Work, Pensions and Labour Economics Study Group (WPEG) meeting for helpful comments. In particular, we are indebted to Paul Allanson, Dooruj Rambaccussing, Paul Seaman and Alexandros Zangelidis for feedback on earlier versions of the paper. We are also grateful to the two editors, and three anonymous referees, for constructive suggestions which help to improve the paper. We also thank the UK Data Service for access to the UK Quarterly Labour Force Survey and Understanding Society.

Declaration of Interest: none.

Abstract

Using the Quarterly Labour Force Survey, we examine the effect of the higher education expansion following the Education Reform Act 1988 on the returns to education in the United Kingdom. Compared to previous studies, we make the distinction between fresh out-of-school students and returning-from-work students who typically have rather lower prior educational attainment but more work experience. We find that fresh university students have experienced larger declines in lower secondary-school educational attainment while the returning university students have grown significantly in shares as a result of the expansion. After accounting for the compositional changes, the Matching Difference-in-Differences results suggest that the expansion has significantly reduced the returns to education for fresh students, but not for returning students. Our findings imply that government policy to enrol increasingly academically weaker students into universities could be misleading. On the other hand, university education might continue to be an efficient pathway for some low school-achievers to obtain more education and enhance their productivity, provided they have some relevant work experience and favourable non-cognitive skills.

JEL Classification: I23, I26

Keywords: education expansion, returning students, Matching Difference-in-Differences, unobservable selection sensitivity

1. Introduction

Following the 'Education Reform Act 1988', the UK Higher Education (HE) sector has experienced substantial expansion. The HE participation rate increased from around 17% in 1988-1989 to 34% in 1997-1998 (Hodgson and Spours, 2000 and Mayhew et al. 2004). Moreover, the average years of education of the labour force has also increased rapidly in the following decades. A number of studies have exploited this reform to estimate the returns to education, see e.g. Walker and Zhu (2008) and Devereux and Fan (2011), in which they don't find significantly negative effect of education expansion. In addition, there is a growing literature arguing that there is a great dispersity in the results of return to a degree (Lindley and McIntosh, 2015; Walker and Zhu, 2018). The expansion might enable more people with substantial work experience following secondary education to enrol in HE and lead to the greater heterogeneity in the return to a degree. Compared to their fresh out-of-school counterparts, these returning-from-work students are not only older and have more work experience by definition, but also tend to differ in other key characteristics.[1] Invariably the previous literature focuses on the comparison of pre-expansion and post-expansion cohorts as a whole, with insufficient attention to the growing heterogeneity among graduates as a result of the HE expansion.

Our interests lies in the following two aspects. Firstly, higher education has long been regarded as an effective pathway to significantly raise individual productivity and earnings. However, a substantial HE expansion over a short period of time may potentially reduce the economic returns through an oversupply of graduates. Given that higher education is a costly investment for both students and the government, it is important to estimate the impact of the expansion on the returns to education after accounting for the compositional changes. Secondly, encouraging disadvantaged students to obtain more education has been one of the primary educational policy objectives of successive UK governments in order to increase the earnings of low achievers (Department for Education, 2018). However, little evidence has been found regarding the return to a degree for low achievers. With the substantial expansion, an acute policy concern about HE is whether it can still effectively help returning students obtain useful skills and increase their earnings.

[1] For instance, they are more likely to have lower secondary education attainment as measured by A(dvanced)-Level results or have pursued the vocational education track. MillionPlus/NUS (2012) and MillionPlus (2018) present descriptive evidence that mature students are disproportionately from disadvantaged backgrounds with non-traditional qualifications and more likely to study part-time at less prestigious universities, compared to young students.

This paper adds to the evidence of how the HE expansion affects the heterogeneity of the wage premium in the UK. We start by estimating a simple Difference-in-Differences (DID) model, which assumes a common trend and no compositional change for both the treatment and control groups, for fresh out-of-school students and returning-from-work students separately, relative to a common control group of non-graduates. We define returning students as those whose age of obtaining the highest qualification is greater than the age of leaving continuous full-time education while treating the remainder as fresh out-of-school students.[2] In the following, we use the terms returning and fresh students respectively as a shorthand. To the extent that returning students accounts for a much larger share of university graduates post-expansion, this important compositional change could be a driver of the heterogeneous effect of HE which has been largely overlooked by the literature.

Despite the strong evidence of growing heterogeneity in the returns to a university degree arising from the expansion of the HE sector in the UK and other developed countries, there is very little systematic study of returning students in relation to fresh students, see e.g. Hallsten (2012) Bockerman, et al (2015), and Rzepka (2018). Our paper aims to fill the gap in our understanding of this highly policy-relevant topic in the UK. Specifically, we contribute to the returns to education literature in two ways. First of all, we document a significant increase in the share of returning students following the HE expansion. This finding implies that the conventional DID estimates will be biased due to the violations of the key identifying assumptions. Secondly, we apply Matching Difference-in-Differences (MDID) to correct for the bias arising from changing ability distribution due to the HE expansion (Walker and Zhu, 2008). We estimate the probability of attending university using both Propensity Score Matching (PSM) and Coarsened Exact Matching (CEM). To best account for the heterogeneous effect, we divide the birth cohorts into three periods: pre-expansion (1965-1969), during-expansion (1970-1975) and post-expansion (1976-1979), following Devereux and Fan (2011). Consistent with earlier studies (e.g. Crawford, 2014), we find large differences in the returns among university graduates in favour of fresh students which can be attributed to differences in their background before joining university. More importantly, after correcting for the innate ability bias and changing composition, our MDID results show that the HE expansion significantly reduces the returns for fresh students, but not for returning students.

[2] In the survey, respondents are told to allow up to one year gap when they self-report age left continuous full-time education.

The remainder of the paper is organised as follows. Section 2 presents the background of the HE expansion. Section 3 briefly reviews the relevant literature. Section 4 discusses the methodology. Section 5 presents the data and the descriptive statistics. In Section 6, the empirical analyses are presented and discussed. Finally, Section 7 concludes.

2. Background

The Educational Reform Act 1988 was designed to widen access to a historically elitist system in the UK, with selection at an early age and students of different academic abilities sitting different national public exams at the end of the compulsory schooling. The introduction of an inclusive GCSE (General Certificate of Secondary Education) as the school leaving qualification significantly raised the staying-on rate at 16 and increased achievement as measured by formal academic qualifications. In 1992, polytechnics which used to focus on vocationally oriented HE were given full university status. In the meantime, the UK went through a rapid period of marketization of HE. It includes relaxing the requirements of getting into universities, increasing the autonomy of universities, reducing public funding for the teaching, and charging students increasingly higher tuition fees which can be financed by income contingent student loans. All these measures contribute to the marketization and substantial expansion of the HE sector over a relatively short period (see e.g. Hodgson and Spours, 2000; and Hansen and Vignoles, 2005). For such a sharp increase in the enrolment of university students over a very short period of time, the HE expansion is plausibly exogenous to the labour market, and hence helps to identify the returns to university education.

According to Hodgson and Spours (2000), there are 5 routes towards HE in the UK, of which the traditional general education track through A-Level has always accounted for more than two-thirds of all entrants. This pattern is consistent with the lower prestige and lower returns to vocational qualifications compared to their academic counterparts at the same notional level (Dearden et al 2002 and McIntosh 2006). One of the most remarkable changes arising from the HE expansion was the increase in the mature entry to universities, from about 10% in 1980 to 30% in 2009-10 (Million+/NUS 2012). In UK official statistics, a mature student is defined as someone who is aged 21 or over on 30 September of the academic year in which they start a degree course. Unfortunately, in the QLFS data we use, the age starting the undergraduate degree course is not available, even though we know the age completed continuous full-time education for everyone. However, we take advantage of the variable of

age/year obtained highest qualification which is available from 2002 onwards in the QLFS and construct an indicator for returning-from-work. Obviously, there is a lot of overlap with the definition of mature students.[3]

3. Literature Review

It has been around a quarter of a century since the HE expansion in the late 1980s and early 1990s, following the "Education Reform Act 1988". This expansion has been the subject of a growing number of studies by sociologists, education researchers and economists. Broadly speaking, we can distinguish between two strands of literature.

The first strand focuses on unequal access, income inequality, HE funding and student finance, as well as intergenerational mobility issues. For instance, Hodgson and Spours (2000) explore the HE participation trends around the HE expansion in the context of possible routes to HE expansion. They highlight the weak supply of qualified young applicants and the lack of demand from employers for adult learners with degree-level skills as the two major obstacles for further expansion of HE. Mayhew et al. (2004) study the causes of the HE expansion with reference to personal rates of return and public funding, and show that the proportion of students from modest social backgrounds did not change much after the expansion. Moreover, Beladi et al. (2016) propose a theoretical model which allows more present-oriented individuals to be less likely to attend colleges in developing countries. The relevant insight for our work here is that heterogeneity in risk attitudes may drive the differences between fresh students and returning students in terms of unobserved factors. On the other hand, Boliver (2011) focuses on the social class inequalities in HE access using the British Household Panel Survey. Despite the dramatic expansion, she finds that social class inequalities remain largely unchanged, especially with regard to enrolling into the higher status "Old" universities. Using longitudinal data from three time periods, Blanden and Machin (2004) highlight the educational inequality in term of parental incomes and present compelling evidence that HE expansion disproportionately benefited children from richer families.

Another strand of research focus on the returns to education exploiting the HE expansion as an exogenous source of variation in the supply of HE. Using the Quarterly Labour Force

[3] Note that the End-User-Licence LFS we use does not contain month of birth, which is required to define a mature student. Moreover, even if we had month of birth, the imputed year of starting HE could still be measured with error due to part-time studies or repeated years in HE.

Survey (QLFS), Walker and Zhu (2008) show no robustly negative effects on returns for new graduates and even marginal positive effect on the returns for women using a difference-in-differences (DID) approach.[4] Subsequently, Devereux and Fan (2011) present a Two-Stage Least Squares (TSLS) estimate of 6% for both men and women also using the QLFS.

Beyond the study of the impact of the HE expansion, there is a wider literature focusing on the heterogeneity among university graduates. Walker and Zhu (2011) show that the returns vary a lot by subjects and the rise of tuition fees has relatively little effect on the overall return for a student in the UK. Using variance analysis, Lindley and McIntosh (2015) find that the widening variance of the test score is due to the differential admission rules among universities. They argue that the large income inequalities among graduates are mostly due to the differences within a subject rather than between subjects. They also show the relation between relaxed university entry requirements and large wage variation. Naylor et al. (2016) examine the heterogeneous graduate returns by the classes of degree. Their results suggest that there is a wide spread around the average graduate premium. Walker and Zhu (2018) find that around half of the variation in graduate wages across institutions of varying prestige could be explained by the difference in course (i.e. institution*subject) selectivity - once they allow for course selectivity the effects of attending the most prestigious HEIs is around 10 percentage points lower than otherwise. In addition, with the increasing supply of university graduates, few studies have been carried out to examine the returning students. Hallsten (2012) examine the returns to tertiary degrees obtained in ages above 30 and argue that the late degrees could increase employment and earnings between 10% and 20%. Bockerman et al (2015) examine the returns to vocational postsecondary education in Germany and found sizeable returns for individuals who have substantial working experiences and return to polytechnics for bachelor's degrees. Rzepka (2018) suggest that the returning students have higher cumulative earnings than those who don't enrol to colleges, but they also face a large degree of uncertainty in the career.

4. Methodology

One might be concerned that graduates who entered universities post-reform have lower innate personal ability on average compared to their pre-expansion counterparts, as the expansion allowed universities to relax the enrolment requirements. In this paper, we present

[4] They point out that failure to control for innate personal ability might bias the results. They also examine the heterogeneity using quantile regression.

the heterogeneous returns between returning and fresh students, allowing for selection on observables using the MDID method. However, due to data limitations, we cannot examine all the determinants of pursuing a degree for returning students, which presumably will lead a potential selection-on-unobservables bias in estimating the returns. Addressing this requires a very rich dataset which includes comprehensive background on prior educational attainment, work history and family circumstances. Moreover, to best account for the potential bias, we will conduct sensitivity tests to show the extent of the selection-on-unobservables that is required to render our results statistically insignificant would need to be implausibly large.

4.1. Benchmarking against the existing literature

To validate our results and examine the difference in returns between fresh students and returning students, we compare with the previous study by following Devereux and Fan (2011) which estimate the return to additional years of education as a result of the HE expansion in the UK. In order to compare with the difference between fresh and returning students, we follow their method, using the same variables and same weights.

$$lny_i = \widehat{edu_\iota} + g(birth_i) + m(age_i) + u_i \quad (1)$$

$$edu_i = \sum_{m=1970}^{1979} birth_i + g(birth_i) + m(age_i) + v_i \quad (2)$$

where $birth_i$ is used as instrument to estimate the probabilities of enrolling in a university. lny_i denotes the log of individual's earning. $g(birth_i)\ and\ m(age_i)$ denote the function of age and birth cohorts respectively. We add quartic terms to control for the age and cohorts effects. u_i and v_i are the idiosyncratic errors. In order to estimate the differences in return between fresh students and returning students, we estimate them in subgroups.

4.2. Difference-in-Differences (DID) and Matching Difference-in-Differences (MDID)

The 2SLS shows the difference in returns to the additional years of education between the two types of students. After comparing the results with the previous literature, we employ the DID to estimate the effect of supply of university graduates. Due to the fact that universities have relaxed the entry requirements, the university graduates who matriculated before the education expansion may have different innate personal ability compared to the graduates who matriculated after it. The simple DID may be biased if one fails to control for those compositional changes which may enter the group-specific effects.

MDID is a promising method originally developed by Heckman et al (1997, 1998) to tackle

this problem, although it still requires variables determining the compositional change before they take the treatment (degree), such as scores or numbers of A-level.[5] Whereas the pre-treatment variables will not be affected by the reform, after the matching, the treatment group and control group would be balanced in terms of the pre-treatment variables.[6] However, we are aware that employing the matching strategy could be ambiguous and Iacus et al (2012) argue that the PSM can not guarantee any level of imbalance reduction in any cases. In this paper, we apply PSM and CEM to validate the effects.[7]

In this paper, the university graduates are the treated individuals, denoted as $D_i = 1$. Others remain in the control group, denoted as $D_i = 0$. Y_{it} denotes the outcome of individual i in time t, before the reform. $Y_{it'}$ denotes the outcome of individual i in time t', after the reform. The birth cohorts, the numbers of A-levels and GCSEs are used as instruments to model the probability of attending universities. The instruments are exogenous or predetermined with regard to HE enrolment. The Average Treatment Effect (ATE) is given by:

$$ATE = E(Y_1|X_1, U_1) - E(Y_0|X_0, U_0) \tag{3}$$

$$Bias = E(U_1) - E(U_0)$$

And the bias will become zero when treatment assignment is independent of outcomes conditional on X.

$$Y_1, Y_0 \perp D \mid X$$

That means $E(Y_1|X_1, D = 0) = E(Y_0|X_0, D = 1)$

Given the assumption of "Strong Ignorability" proposed by Rosenbaum and Robin (1985), 0<P(D=1|X)<1. Together with the former two equations, that implies the following,

$$(Y_0, Y_1) \perp D \mid P(X)$$

$$E(Y_1|P(X), D = 0) = E(Y_0|P(X), D = 1) \tag{4}$$

However, matching is still a "selection-on-observables" method. The common support problem can be eliminated if matching is performed over the common support. The

[5] The common support may bring additional bias if treatment effect is heterogeneous among a treated group (Blundell et al, 2005).

[6] Some papers have implemented the matching method on the basis of pre-treatment variables to remove the systematic differences between treatment and control group (Dehejia and Wahba, 2002; Halla and Zweimueller, 2013).

[7] We think the pre-treatment variables may not affect enrolment in the same direction. The CEM is a matching method known as Monotonic Imbalance Bounding, which assumes that adjusting the imbalance on one covariate does not affect the balance of any other.

Conditional Independence Assumption (CIA) does not hold when the un-observables affect the outcome even with the control of propensity score. MDID relaxes the CIA from single observation to pair-wise. In this setting, we only need the CIA to hold in the first difference equation. Then, the simple DID setting is below:

$$Y_{it} = a + t + D_i + t * D_i + X_{it} + \varepsilon_{it} \quad (5)$$

where t equals to t or t' to denote before or after the program. In a simple DID, the causal effect can be identified if the below condition is satisfied:

$$E(Y_{0t} - Y_{0t'}|X, D = 0) = E(Y_{0t} - Y_{0t'}|X, D = 1) \quad (6)$$

Together with the index sufficiency and the simple DID, the MDID condition becomes

$$E(Y_{0t} - Y_{0t'}|P(Z), D = 0) - E(Y_{0t} - Y_{0t'}|P(Z), D = 1) \quad (7)$$

4.3. Limitations.

Due to data limitations, there are several potential issues in the results. First, the definition of the returning student is still arbitrary to some extent. We differentiate between returning students and fresh students based on their self-reported continuous years of education and age when completed continuous full-time education. It is possible that this classification may still contain some measurement errors. For instance, while people are likely to correctly report their "university" status given the current classification, their self-reported age when completed continuous full-time education might fail to include the years spent in the university. Moreover, there might be some part-time students who take more time to complete a degree compared to a full-time degree. We will undertake robustness checks at the end of the empirical analysis. Second, due to the limitation of the data, we might not fully capture the compositional changes. Although we use pre-treatment variables to capture the compositional changes, we are not sure we capture all the mechanisms of self-selection as returning students conditional on not continuing into HE immediately after completing secondary education in the first place and we suspect that there are other unobservable (to us) factors which drive the compositional changes. A dataset with richer information regarding prior educational attainment, family background and employment history is needed to understand the mechanisms. Third, the results could be heterogeneous since the programs which those graduates attended could be very different in terms of the types of qualification, the quality of the programs, the reputation of the institutions, and so on. Some returning

students may take a part-time degree that can't be captured in our data (Walker and Zhu, 2011). The quality of education plays an important role in the productivity (Benos and Karagiannis, 2016). Finally, since we include relatively long periods of birth cohorts, we expect that the changes in skill demand may play a role in the wage determination. There is a substantial literature on how skill-biased technology change affects wages. And, since the returning students may have more working experiences, the results don't account for the impact of working experiences.

5. Data and descriptive analysis.

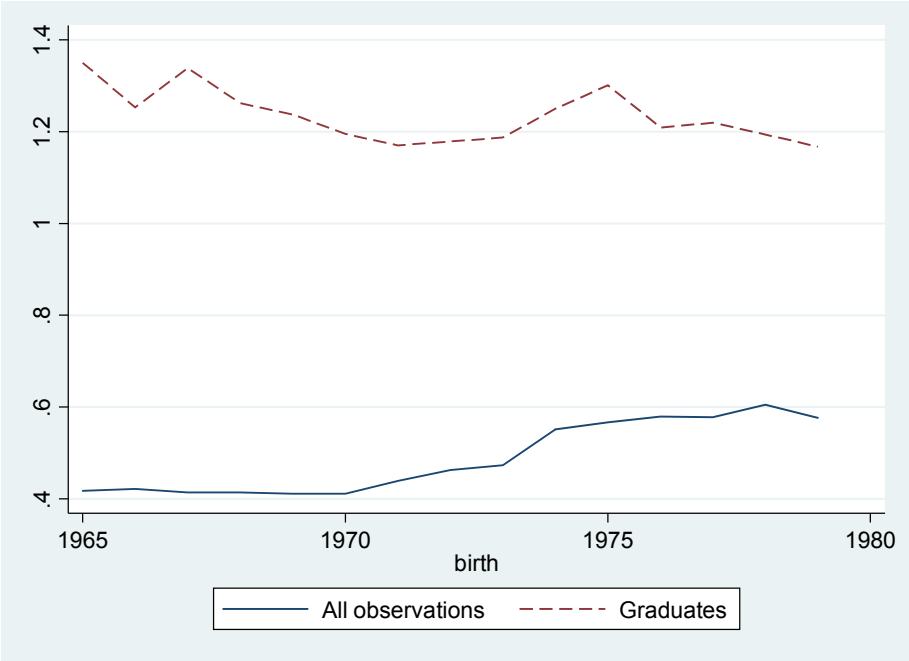
The primary data is drawn from the 2002 to 2013 Quarterly Labour Force Survey. The QLFS is the largest nationally representative micro survey data in the UK with detailed information on education, employment and earnings since 1992. However, information on age or year obtained highest qualification is only available from 2002 onwards. The birth cohorts are from 1965-1979 and age range of the sample is from 33 to 43 years-old since observations are only matched in this age band, as shown in Figure A1.[8] This feature has an advantage that it allows us to examine the full potential returns when they are in the middle of their career (Blundell et al, 2000). Another big advantage is the number of observations is large in QLFS. However, the QLFS doesn't contain information regarding the exact numbers of A-level or the grades at A-levels.

One of the limitations of QLFS is it doesn't include rich information regarding the backgrounds of students and we are aware of that both fresh students and returning students may experience the compositional changes compared to the previous graduates. To show an intuitive understanding of the compositional change in graduate's background, we have drawn on Understanding Society (US) wave A to wave E. The US is the largest longitudinal household survey in the UK dating from 2009, with very rich information on parental qualification. The age range we select is from 25 to 50 years-old and the birth cohorts are from 1960-1980. However, the Understanding Society contains much fewer observations compared to QLFS and the educational attainment is not as comprehensive as QLFS. Since we employ the matching strategy to address the compositional change and it normally needs large numbers of observations, we mainly examine the effect based on QLFS.

The mean numbers of individuals who have A-levels are shown in Figure 1. The categorical

[8] This study focuses on the effects in England and Wales.

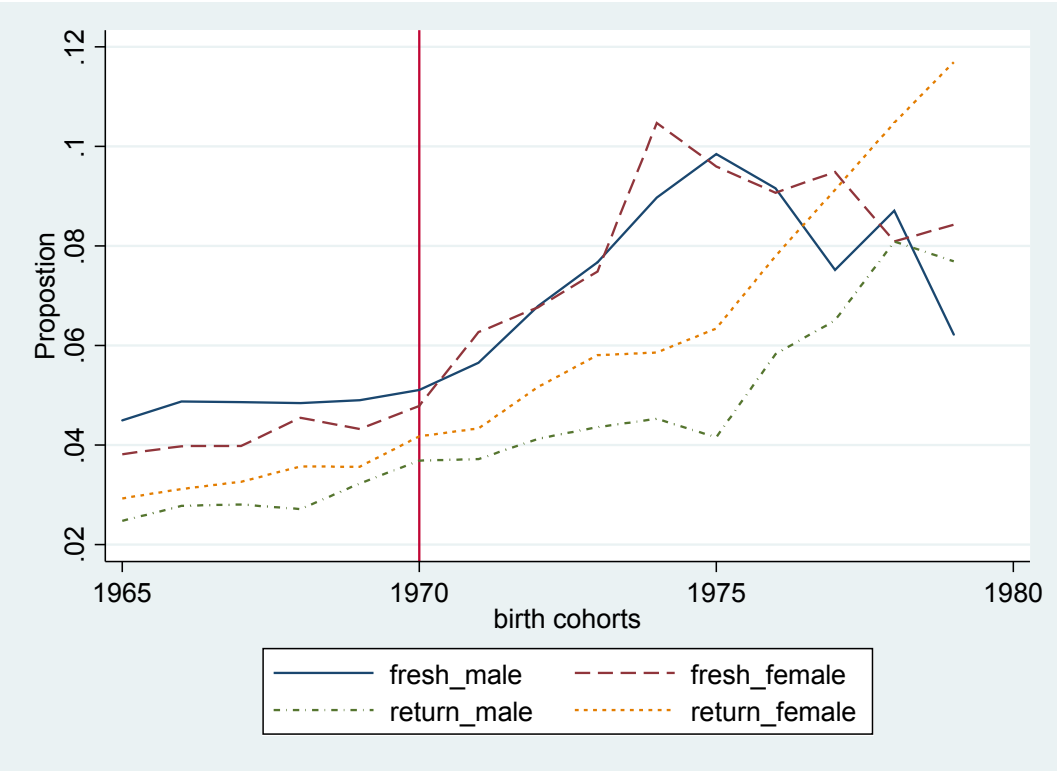
variable in QLFS indicates if an individual has one, two or more, or no A-levels. The vertical axis shows the mean numbers of A-level which individual holds for different birth cohorts. The solid line presents the average number of A-levels for the whole sample while the dashed line presents the average the number of A-levels among graduates. It clearly shows that while the HE expansion has pushed the students to get more A-levels, the mean number of A-levels among the graduates actually decreased over time, indicating that there is a compositional change among the university graduates.



Notes: Number of A-Levels is top coded at 2. Sources: QLFS.

Figure 1. Mean number of A-levels given birth cohorts

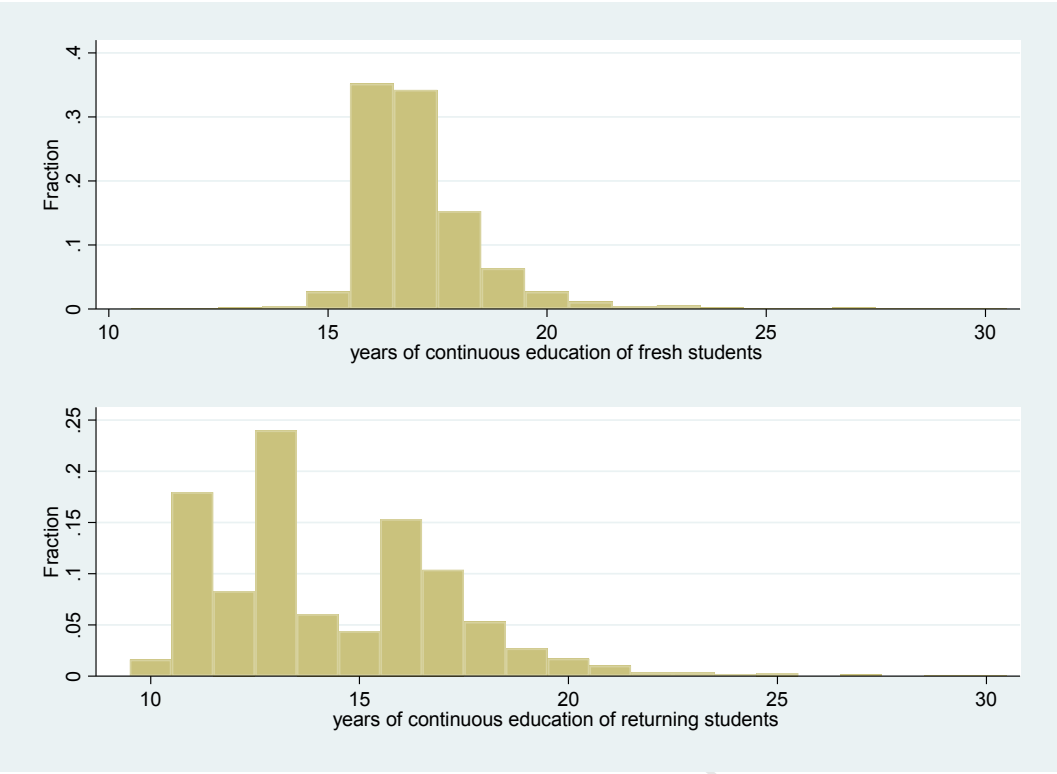
The innate personal ability change may cause a bias in the simple DID results. Previous literature neglects the compositional change among university graduates, which turns out to be significant during the HE expansion. Figure 2 shows the share of fresh and returning students by birth cohorts. After the 1970 year of birth, the number of university graduate of fresh students increased immediately. On the other hand, the number of returning students tend to grow at a more modest pace till 1975, when it started to increase very rapidly. The proportion of the returning students among university graduates is higher than the fresh students after 1978. That may explain why there are robust heterogeneous returns among the graduates and the returns to degree in the 1976-1979 are significantly lower compared to the period between 1970 and 1975.



Notes: Y-axis represents the proportion of graduates among all qualifications on the basis of birth cohorts. The sample includes all observations. Sources: QLFS

Figure 2. Proportion of graduates by type and birth cohorts

Figure 3 shows the proportions of fresh and returning student's full-time education before obtaining the highest qualifications. Most of fresh students will have 16 or 17 years of continuously full-time education. In words, most of fresh students will obtain their degree at age 21 or 22. On the other hand, around 42% of university graduates can be classified as returning students, who have a gap of at least one year between completing secondary education and enrolling in HE. Among them, there is a significant proportion of students who have at least 15 (i.e. 20-5 as age starting school is 5) years of continuous education before becoming university graduates. Most of the returning students have around 11 years, 13 years, and 16 years full-time education. Those may correspond to GCSE level, A-level, and HNC/HND level respectively.



Notes: Fraction leaving continuous full-time education by age - 5, fresh and returning university graduates. Sources: QLFS.

Figure 3. Years of schooling of fresh and returning students among university graduates

6. Empirical results.

6.1. Heterogeneity among university graduates.

The above panel of Table 1 shows a simple breakdown by the types of university graduate. It describes the average years of continuous full-time education and the proportions with various numbers of A-levels and GCSEs before and after the HE. For university graduates, the average years of education of the fresh university graduates remain relatively constant compared to returning students. The results also show that the newly recruited fresh graduates have lower numbers of A-levels compared to previous graduate cohorts. On the other hand, for the returning university graduates, the average years of continuous full-time education increase massively compared to the fresh graduates. There is also a significant change in the composition of GCSEs. The proportion of returning university graduates who have no GCSE increases significantly after the HE expansion, implying that the returning students are more likely to have followed the vocational track. The bottom panel of Table 1 shows the summary statistics of non-graduates. In order to have a coherent control group in regressions, we don't differentiate the types of non-university graduates. In this paper, the control group of DID

consists of individuals who don't have a degree. The characteristics of non-university graduates don't change significantly except for the average education, which is presumably driven by the introduction of the GCSE in 1986.

Table 1. Statistic summary

	Fresh students				Returning students			
	Before reform(Born <1970)	After reform(Born>=1970)	diff	t-tests	Before reform(Born<1970)	After reform(Born>=1970)	diff	t-tests
Graduates								
Sample size	2686	4961	2275		1840	3542	1702	
Years of education	17.03	17.14	0.11**	2.33	13.38	14.67	1.29***	16.23
0 A-level	0.20	0.24	0.04***	3.31	0.51	0.53	0.02	1.16
1 A-level	0.05	0.06	0.01***	3.77	0.08	0.07	-0.01*	-1.84
2+ A-level	0.75	0.70	-0.05***	-5.04	0.40	0.40	0	-0.19
0 GCSE	0.10	0.11	0.01	1.19	0.15	0.25	0.10***	8.69
5- GCSE	0.04	0.04	0.00	-0.73	0.16	0.10	-0.06***	-5.70
5+ GCSE	0.85	0.84	-0.01	-0.65	0.69	0.64	-0.05***	-3.60
Non-graduates								
Sample size	25442	25689	247					
Years of education	12.07	12.29	0.22***	12.22				
0 A-level	0.85	0.86	0.01***	2.93				
1 A-level	0.04	0.03	-0.01***	-4.41				
2+ A-level	0.11	0.11	0	0.67				
0 GCSE	0.35	0.33	-0.02***	-2.89				
5- GCSE	0.26	0.27	0.01	1.39				
5+ GCSE	0.39	0.40	0.01	1.55				

Notes: The upper and bottom panel summarize individual's characteristics for university graduates and non-graduates, respectively. "# A-level" and "# GCSE" are categorical variables which indicate rough numbers of A-level or GCSE. Sources: QLFS. Two-sample t-tests of equality of sample means. ***, ** and * indicate statistically significant at 1%, 5% and 10% respectively.

One of the concerns of performing simple DID is the compositional change in innate personal abilities. To have a better understanding of the compositional change arising from the HE expansion, we take advantage of the US data which includes parental qualifications. Table 2 shows the changes in the proportions of parental qualifications among university graduates before and after the HE expansion using the US data. The fresh and returning students follow a similar pattern. Among the university graduates, the proportion of parents who have a degree increased significantly as a result of the HE and the fraction of parents with no qualifications dropped. The graduates whose parents have a post-graduate qualification are less likely to attend university. That might be because those parents are more likely to have

vocational backgrounds. In general, the figure suggests that the parents of the newly recruited university graduates have higher levels of education.

Table 2. Compositional change among university graduates

		Fresh students				Returning students			
		before	after	diff	t-test	before	after	diff	t-test
father	degree	0.210	0.230	0.020	1.67	0.095	0.228	0.133***	7.06
	Further qualifications	0.339	0.291	-0.048***	-3.66	0.408	0.314	-0.094***	-3.91
	Some qualification	0.192	0.278	0.086***	6.98	0.197	0.221	0.024	1.18
	no qualification	0.246	0.194	-0.052***	-4.47	0.291	0.218	-0.073***	-3.32
	no education	0.012	0.007	-0.005	-1.72	0.009	0.017	0.008	1.45
mother	degree	0.099	0.154	0.055***	5.58	0.090	0.107	0.017	1.11
	Further qualifications	0.262	0.256	-0.006	-0.52	0.169	0.312	0.143***	6.62
	Some qualification	0.386	0.383	-0.003	-0.2	0.415	0.395	-0.020	-0.82
	no qualification	0.240	0.175	-0.065***	-5.69	0.288	0.173	-0.115***	-5.55
	no education	0.010	0.031	0.021***	4.69	0.038	0.012	-0.026***	-3.35

Source: Understanding Society wave A-E. "Some qualifications" indicate gained some qualifications or certificates upon leaving school. "Further qualifications" indicate further qualifications or certificates after leaving school (but below degree level) such as apprenticeship, or nursing/teaching qualifications. Two-sample t-tests of equality of sample means. ***, ** and * indicate statistically significant at 1%, 5% and 10% respectively.

Table 3 shows the 2SLS results of returns to additional education for the fresh students and the returning students separately on the basis of the periods of attending universities. In order to compare and differentiate the results from the previous results, we employ the same instruments and variables in the 2SLS strategy following Devereux and Fan (2011). The instruments are the dummy variables for those birth cohorts 1970 or later which are affected by the education. The signs of the fresh students are quite similar to Devereux and Fan (2011), but the magnitude of female fresh students is slightly higher than theirs. And we only find significant effect for male returning students, but not female returning students. But the result of male returning graduates is not as robust as fresh students. In the DID and MDID results below, we further uncover and address the compositional change as a result of the HE expansion.

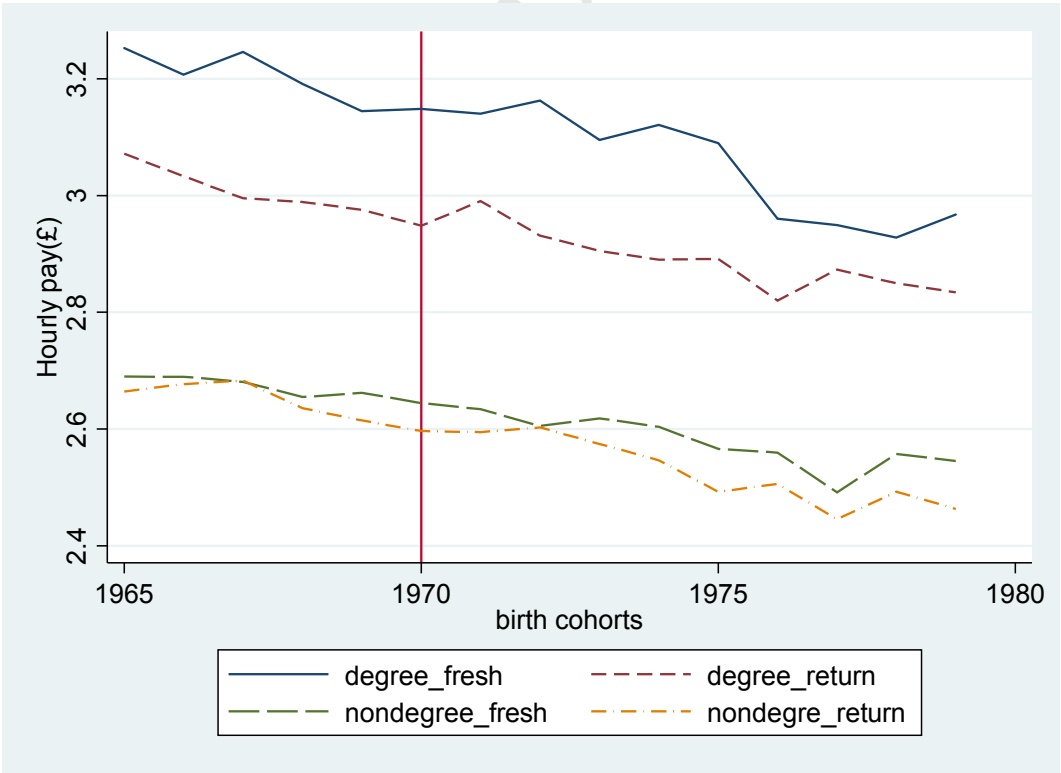
Table 3. Return to Additional Education

VARIABLES	(1) males_fresh	(2) males_return	(3) females_fresh	(4) females_return
edu (OLS)	0.0794***	0.0804***	0.0912***	0.0947***
	(0.0010)	(0.0017)	(0.0009)	(0.0015)
edu_hat (2SLS)	0.0650***	0.0778**	0.0700***	0.0127
	(0.0221)	(0.0375)	(0.0191)	(0.0398)
Observations	33,568	27,010	39,911	29,894

Notes: The 2SLS results follows Devereux and Fan (2011), which include only British born individuals between 25 and 50 years old. The birth cohorts are from 1958 to 1982, the same as the previous study. The results are based on the quartic function of year-of-birth, a quartic function of age, white, unemployment rate, dummy for being white, dummy for being Scottish, and cohort size. All regressions are weighted by the inverse of numbers of observations on that individual in the regression. The results are robust to various age and cohort specifications. The first stage is represented in the appendix. ***, ** and * indicate statistically significant at 1%, 5% and 10% respectively.

6.2 DID and MDID.

Figure 4 shows a crude wage differences given years of birth between university graduates and non-university graduates. It clearly shows that the hourly pay for the graduates decreased, especially after 1975. On the other hand, the hourly pay of fresh non-graduates remained constant during this period. But the hourly pay of returning non-graduates decreased. Intuitively, this may contribute to the insignificant DID results.



Sources: QLFS.

Figure 4. Returns over birth cohorts for males

The first two columns of Table 4 present the results of DID and MDID for the male fresh and the returning graduates respectively on the basis of different education expansion periods. Propensity Score Matching (PSM) and Coarsened Exact Matching (CEM) are used to balance the compositional changes. The propensity score of PSM is estimated by "Probit" model, based on year of birth and sex. The DID results show significantly negative effects on the returns to the fresh university graduates in the post-expansion period and marginal negative effects on the returning students in the same period. For the MDID results, the significantly negative effect only concentrates on the fresh students in the post-expansion period. The negative impact on the fresh students in the post-expansion period is also found in the CEM, but the magnitude is smaller than PSM.

The third and fourth columns of Table 4 present the results for females. Compared to males, the HE expansion has larger and more significant impacts on females. The negative effects are also concentrated on the fresh students in both periods compared to the results of males. We also find that there exists negative effect for female returning students in the post-expansion.

In this paper, we can't pick up the mechanisms of entering universities especially for returning students which the compositional changes might be more complex. In order to check the robustness of the results, we exclude observations who are traditionally regarded as not eligible for entering universities, such as having less than 10 years of education, without any GCSEs. The results are shown in Table A2. The results are very similar to the Table 4, but we think the results are sharper.

<Table A2 Here>

In the results, the negative effects mainly exist in the post-expansion period suggesting that the quantitative effect is driving the negative effect of the HE with the increasing numbers of university graduates. The results may suggest that we can increase HE enrolment rate without decreasing the returns significantly with moderate levels of HE expansion. On the other hand, the results also suggest that oversupply of graduates does not significantly decrease the returns of returning students, showing that the returning students have more stable returns. That may be because the returning students tend to have clear purposes before deciding to pursue a degree.

Table 4. Effect of HE on the returns to degree

	Males		Females	
	Fresh students	Returning students	Fresh students	Returning students
DID				
during-expansion	-0.019	-0.027	0.096***	-0.015
	(0.017)	(0.022)	(0.018)	(0.019)
N	24998	23555	28148	27288
Post-expansion	-0.078***	-0.065*	0.074***	-0.062*
	(0.029)	(0.035)	(0.027)	(0.029)
N	15498	14767	17351	17076
MDID (PSM)				
during-expansion	-0.010	-0.009	0.068***	-0.010
	(0.013)	(0.013)	(0.013)	(0.012)
Post-expansion	-0.093***	-0.003	0.081***	-0.052***
	(0.019)	(0.018)	(0.017)	(0.016)
MDID (CEM)				
during -expansion	0.012	0.001	0.065***	0.008
	(0.017)	(0.023)	(0.018)	(0.020)
Post-expansion	-0.061**	-0.057	-0.049*	-0.045
	(0.027)	(0.035)	(0.026)	(0.029)

Notes: During-expansion cohorts were born in 1970-1975 and post-expansion cohort are born in 1976-1979. All coefficients are relative to the pre-expansion cohorts which were born in 1965-1969. The sample includes observations which are between 33 and 43 years old and are born between 1965 and 1979. The control variables are numbers of A-level, numbers of GCSE, experiences, squared of experiences, years of tenure, have job training, disability, marriage, work in London, full-time job, year, industry and subject in university. The following results include the same control variables. ***, ** and * indicate statistically significant at 1%, 5% and 10% respectively.

6.3. Sensitivity test.

To show the robustness of the results, we perform the sensitivity test on the basis of a relatively new technique. One of the major concerns regarding return to education is the selection on un-observables. Altonji et al (2005) develop a method to test the magnitude of selection on un-observables. Oster (2017) proposed a new sensitivity test using the idea that the coefficient of determination R^2 should be taken into consideration since the coefficients would not change massively when an uninformative control is included. She proposes a method to derive a range from a controlled treatment effect to an unbiased treatment effect, taking into account the R^2 compared to the Altonji et al (2005). More importantly, she has demonstrated the robustness of the methodology by replicating a large number of studies published in top journals.

Table 5 shows the sensitivity of the CEM-DID results for men in the QLFS. The columns

differ in the matching variables used, which are all pre-determined with regard to HE enrolment. We perform the Oster (2017) sensitivity test for the significant results in Table 4 in order to show the robustness of the results. The maximum of R^2 are assumed to be 1, or twice $\tilde{R}^2$ or 1.25 times $\tilde{R}^2$, where $\tilde{R}^2$ is the R^2 of a fully controlled regression. In each weighted regression, the control variables are the same. Only the pre-treatment variables are different. We check the sensitivity of the results only in the post-expansion period since the results are seemingly more significant in Table 4. We only test the results using CEM since the pre-treatment variables may affect the university enrolment in different ways and the Monotonic Imbalance Bounding method may perform better in this case. The 95% confidence intervals of the true treatment effect are well below 0 for fresh students regardless of the maximum R^2 allowed. On the other hand, the 95% confidence intervals span 0 for returning students in all specifications.

Table 5. Sensitivity of the CEM-DID results by matching variables, QLFS for males

Matching variables	Birth cohorts (1)	Birth cohorts + A-levels (2)	Birth cohorts+Alevels+GCSEs (3)
Post-expansion (Fresh)	-0.080***	-0.061**	-0.065**
R squared	0.33	0.30	0.28
PSACALC (Rmax=1)	[-0.857, -0.080]	[-1.187, -0.061]	[-0.748, -0.065]
PSACALC (Rmax=2*R^2)	[-0.437, -0.080]	[-0.401, -0.061]	[-0.230, -0.065]
PSACALC (Rmax=1.25*R^2)	[-0.144, -0.080]	[-0.129, -0.061]	[-0.098, -0.065]
Post-expansion (Mature)	-0.051	-0.057	-0.057
R squared	0.28	0.28	0.26
PSACALC (Rmax=1)	[-0.021, 93.071]	[-0.057, 77.647]	[-0.057, 80.838]
PSACALC (Rmax=2*R^2)	[-0.021, 23.796]	[-0.057, 24.646]	[-0.057, 20.289]
PSACALC (Rmax=1.25*R^2)	[-0.021, 0.183]	[-0.057, 0.269]	[-0.057, 0.146]

Notes: The weights are estimated with different pre-treatment variables. Birth cohorts, A-levels, GCSEs, education are pre-treatment variables. We use the "*psacalc*" command in STATA to test the robustness of the sensitivity test. "Rmax" in the PSACALC test is 1 which is the R squared. Sources: QLFS. ***, ** and * indicate statistically significant at 1%, 5% and 10% respectively.

Table 6 presents the corresponding sensitivity analyses for women in QLFS. These results are broadly consistent with the results for men.

Table 6. Sensitivity of the CEM-DID results by matching variables, QLFS for females

Matching variables	Birth cohorts (1)	Birth cohorts+A-levels (2)	Birth cohorts+A-levels+GCSEs (3)
Post-expansion (Fresh)	-0.074***	-0.049*	-0.047*
R squared	0.34	0.31	0.30
PSACALC (Rmax=1)	[-1.251, -0.074]	[-1.868, -0.049]	[-1.565, -0.047]
PSACALC (Rmax=2*R^2)	[-0.648, -0.074]	[-0.649, -0.049]	[-0.533, -0.047]
PSACALC (Rmax=1.25*R^2)	[-0.170, -0.074]	[-0.156, -0.049]	[-0.124, -0.047]
Post-expansion (Mature)	-0.054**	-0.045	-0.033
R squared	0.30	0.29	0.28
PSACALC (Rmax=1)	[-0.054, 53.826]	[-0.045, 42.612]	[-0.033, 41.842]
PSACALC (Rmax=2*R^2)	[-0.054, 11.308]	[-0.045, 10.228]	[-0.033, 5.926]
PSACALC (Rmax=1.25*R^2)	[-0.054, 0.023]	[-0.045, 0.117]	[-0.033, 0.042]

Note: Sources: QLFS. ***, ** and * indicate statistically significant at 1%, 5% and 10% respectively.

7. Conclusions.

Although the effect of the higher education (HE) expansion on returns in the UK has been extensively studied, the results are still ambiguous to some extent partly due to measurement error and compositional changes. In this study, we apply Matching Difference-in-Differences (MDID) to examine the heterogeneous returns to university graduates and highlight the differences in the returns between the fresh out-of-school students and the returning-from-work students who have had gaps between completing secondary education and enrolling in HE.

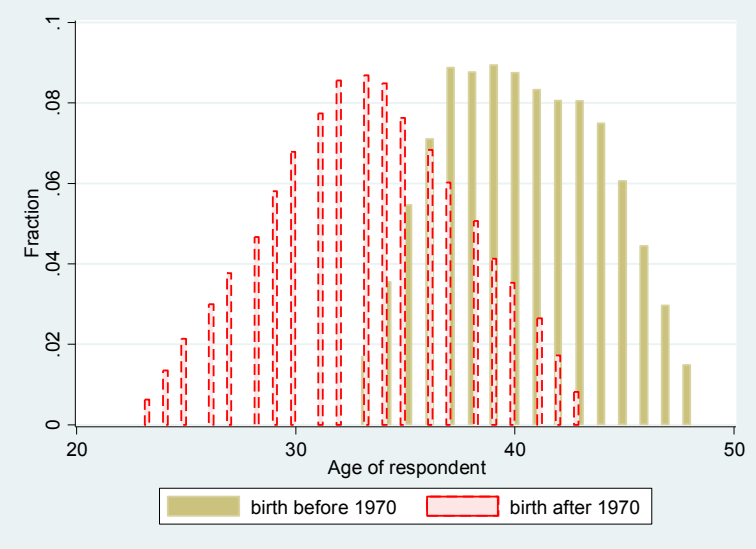
The first contribution of the paper is to document a growing share of returning students after the HE expansion in the UK and show that their returns differ from those for fresh students. Second, after accounting for the compositional change by exploiting the variation in educational backgrounds, the MDID estimates indicate that the HE expansion has induced a significant penalty for fresh students relative to their pre-expansion counterparts, for both PSM-DID and CEM-DID results. The penalties are more pronounced in the post-expansion periods than during the transition period. The concentration of the wage penalty on fresh students rather than returning students might be due to more fresh students with weaker academic backgrounds enrolling in HE in the post-expansion period. The sensitivity tests

show that the penalties for those fresh students are rather robust even as R^2 approaches one, suggesting that selection on unobservables would have to be implausibly large to render the penalties statistically insignificant.

Given the results, there are good reasons to believe that it may be not a good idea to push more and more fresh students into universities, regardless of their prior educational attainment. Young individuals who have weak educational backgrounds and no labour market experience should be more cautious about HE participation. However, university education might still be a potentially efficient path for some low school-achievers to obtain more education and enhance their skills to make themselves more productive, provided they have some relevant work experience and favourable non-cognitive skills.

Our study has a couple of limitations due to data availability issues. Firstly, the definition of the returning students is still ambiguous to some extent, and the results may still be biased due to our inability to account for the self-selection as returning students conditional on not continuing into HE immediately after completing secondary education in the first place. A dataset with richer information regarding prior educational attainment, family circumstances and full employment history might be needed to uncover the mechanisms. Moreover, there is a lack of detailed information regarding the prior academic attainment, such as the subject and grades of both A-levels and GCSEs, which would significantly improve the matching results.

Appendix:



Notes: Proportion of observations born in different years, divided by born before and after 1970. Sources: QLFS.

Figure A1. Proportion of age band before and after the reform

Table A1. First stage of 2SLS results

VARIABLES	(1) males_fresh	(2) males_return	(3) females_fresh	(4) females_return
age	-1.189	-1.284	-0.259	0.254
	(1.550)	(1.151)	(1.324)	(1.093)
age2	0.0461	0.0652	0.00902	-0.00136
	(0.0640)	(0.0469)	(0.0546)	(0.0446)
age3	-0.000776	-0.00133	-0.000123	-9.14e-05
	(0.00116)	(0.000838)	(0.000986)	(0.000797)
age4	4.82e-06	9.65e-06*	6.42e-07	1.14e-06
	(7.73e-06)	(5.53e-06)	(6.58e-06)	(5.27e-06)
employment	6.114*	15.06***	2.461	15.76***
	(3.316)	(2.423)	(2.837)	(2.263)
size_cohort	4.18e-05	-0.000122*	6.16e-05	-3.08e-05
	(9.91e-05)	(7.01e-05)	(8.35e-05)	(6.69e-05)
white	-0.645***	-0.417***	-0.685***	-0.368***
	(0.0698)	(0.0556)	(0.0610)	(0.0473)
scottish	-0.128**	-0.0321	-0.0354	-0.0937**
	(0.0542)	(0.0382)	(0.0446)	(0.0370)
birth	-	-	-	-
birth2	-	-	-	-
birth3	-9.33e-08	6.88e-07**	9.21e-08	2.66e-07
	(3.66e-07)	(2.72e-07)	(3.12e-07)	(2.56e-07)
birth4	0	-2.61e-10**	-0	-1.01e-10
	(1.39e-10)	(1.04e-10)	(1.19e-10)	(9.76e-11)
birth1970	0.127	-0.190***	0.212**	-0.129*
	(0.0963)	(0.0690)	(0.0823)	(0.0662)
birth1971	0.427***	-0.0891	0.452***	-0.0759
	(0.0981)	(0.0716)	(0.0841)	(0.0683)
birth1972	0.661***	0.0400	0.564***	0.0305
	(0.111)	(0.0808)	(0.0958)	(0.0772)
birth1973	0.877***	-0.00811	0.954***	0.120
	(0.137)	(0.0987)	(0.117)	(0.0943)
birth1974	1.187***	0.0126	1.304***	0.202*
	(0.156)	(0.113)	(0.133)	(0.108)
birth1975	1.318***	-0.0110	1.383***	0.260*
	(0.202)	(0.147)	(0.174)	(0.139)
post	1.319***	0.370**	1.530***	0.445***
	(0.207)	(0.150)	(0.178)	(0.142)
Constant	200.1	-1,320**	-184.6	-523.9
	(698.4)	(519.7)	(596.0)	(489.0)
Observations	34,202	27,691	40,685	30,776
R-squared	0.035	0.032	0.085	0.028

Note: ***, ** and * indicate statistically significant at 1%, 5% and 10% respectively.

Table A2. DID and MDID for males (after trimming the sample)

	Males		Females	
	Fresh students	Returning students	Fresh students	Returning students
DID				
during-expansion	-0.016	-0.029	0.098***	-0.025
	(0.019)	(0.025)	(0.020)	(0.021)
Post-expansion	-0.067**	-0.027	0.087***	-0.051
	(0.032)	(0.040)	(0.030)	(0.033)
MDID (PSM)				
during-expansion	-0.011	0.000	0.076***	-0.007
	(0.016)	(0.016)	(0.015)	(0.014)
Post-expansion	-0.107***	0.020	0.102***	-0.032
	(0.024)	(0.022)	(0.020)	(0.020)
MDID (CEM)				
during -expansion	-0.002	-0.007	0.077***	-0.002
	(0.019)	(0.026)	(0.020)	(0.023)
Post-expansion	-0.071**	-0.029	-0.059**	-0.020
	(0.029)	(0.040)	(0.028)	(0.033)

Notes: Table A2 excludes observations which receive either less than 10 years full-time education or do not have any GCSEs. Those individuals are considered as not eligible for getting into universities. ***, ** and * indicate statistically significant at 1%, 5% and 10% respectively.

References:

Altonji, J. G., Elder, T, E., Taber, C.R., 2005. Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools. *Journal of Political Economy* 113(1), 151-184.

Beladi, H., Sinha, C., Kal, S., 2016. To educate or not to educate: Impact of public policies in developing countries. *Economic Modelling*, 56, 94-101.

Benos, N., Karagiannis, S., 2016. Do education quality and spillovers matter? Evidence on human capital and productivity in Greece. *Economic Modelling*, 54, 563-573

Blanden, J., Stephen, M. 2004. Educational Inequality and the Expansion of UK Higher Education. *Scottish Journal of Political Economy* 51(2), 230-249.

Blundell, R., Dearden, L., Goodman, A., Reed, H., 2000. The Returns to Higher Education in Britain: Evidence from a British Cohort. *The Economic Journal* 110(461), F82-F99.

Blundell, R., Dearden, L., Sianesi, B., 2005. Evaluating the effect of education on earnings: models, methods and results from the National Child Development Survey. *Journal of Royal Statistics Society A* 168(3), 473-512.

Bockerman, P., Jepsen, C., Haapen, M., 2015. Back to school? Labor-Market returns to vocational postsecondary education. *IZA Discussion Paper*, 9079.

Boliver, V., 2011. Expansion, Differentiation, and the Persistence of Social Class Inequalities in British Higher Education. *Higher Education* 61, 229-242.

Crawford, C. 2014. Socio-economics differences in university outcomes in the UK: drop-out, degree completion and degree class*, Institute of Fiscal Studies Working Paper*, 14/31, London.

Hehejia, R, H., Wahba, S., 2002. Propensity score-matching methods for nonexperimental causal studies. *The Review of Economics and Statistics*, 84(1), 151-161.

Department for Education. 2018. Post-16 education: outcomes for disadvantaged students. Research Report.

Devereux, P, J., Fan, W., 2011. Earnings returns to the British education expansion. *Economics of Education Review* 30(6), 1153-1166.

Halla, M., Zweimuller, M., 2013. The effect of health on earnings: Quasi-experimental evidence from commuting accidents. *Labour Economics*, Vol (24), 23-38.

Hallsten, M., 2012. Is it ever too late to study? The economic returns on late tertiary degrees in Sweden. *Economics of Education Review*, Vol. 31(1), 179-194.

Hansen, K., Vignoles, A., 2005. The United Kingdom Education System in a Comparative Context. In (Stephen, M., Vignoles, A) eds: *What's the Good of Education*? Princeton University Press. Princeton.

Heckman, J, J., Ichimura, H., Todd, P. E., 1997. Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme. *The Review of Economic Studies* 64(4), 605-654.

Heckman, J, J., Ichimura, H., Smith, J., Todd, P, E., 1998. Characterizing Selection Bias Using Experimental Data. *Econometrica* 66(5), 1017-1098.

Heckman, J, J., Vytlacil, E., 2005. Structural equations, treatment effects, and econometric reform evaluation. *Econometrica* 73(3), 669-738.

Hodgson, A., Spours, K., 2000. Expanding Higher Education in the UK: from 'System Slowdown' to 'System Acceleration'. *Higher Education Quarterly* 54(3), 295-322.

Iacus, S, M., King, K., Porro, G., 2012. Causal inference without balance checking: Coarsened exact matching. *Political Analysis*, Vol (1), 1-24.

Lindley, J., McIntosh, S., 2015. Growth in within graduate wage inequality: The role of subjects, cognitive skill dispersion and occupational concentration. *Labour Economics* 37, 101-111.

Mayhew, K., Deer, C., Dua, M., 2004. The Move to Mass Higher Education in the UK: Many Questions and Some Answers. *Oxford Review of Education* 30(1), 65-82.

MillionPlus / NUS (National Union of Students). 2012. Never Too Late to Learn - Mature students in higher education. *Research Report*.

MillionPlus. 2018. Forgotten Learners: Building a System that Works for Mature Students. *Research Report*.

Naylor R., Smith, J., Telhaj, S., 2016. Graduate returns, degree class premia and higher education expansion in the UK. *Oxford Economic Papers*, 68 (2), 525-545.

Oster, E, F., 2017 (online first). Unobservable Selection and Coefficient Stability: Theory and Validation. *Journal of Business & Economic Statistics*. DOI: 10.1080/07350015.2016.1227711.

Rzepka, S., 2018. Labor market returns to college education with vocational qualifications. *Education Economics*, Vol. 26(4), 411-431.

Walker, I., Zhu, Y., 2008. The University Wage Premium and the Expansion of Higher Education in the UK. *Scandinavian Journal of Economics* 110(4), 695-709.

Walker, I., Zhu, Y., 2011. Differences by degree: Evidence of the net financial rates of return to undergraduate study for England and Wales. *Economics of Education Review* 30(6), 1177-1186.

Walker, I., Zhu, Y., 2018. University selectivity and the relative returns to higher Education: Evidence from the UK. *Labour Economics* 53, 230-249.

We apply Matching MDID to estimate the wage effects of higher expansion.

- The paper documents growing share of returning students after UK higher education expansion.
- The expansion only reduces the returns of fresh students but not returning students.

Oster test suggests that results are robust to potential selection on unobservables

Higher Education could be an effective route for low school achievers with work experience.