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IZA DP No. 10536

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University Selectivity and the Graduate Wage Premium: Evidence from the UK

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ABSTRACT

University Selectivity and the Graduate Wage Premium: Evidence from the UK*

We study the relative labour market wage outcomes of university graduates in the UK using the Labour Force Survey (LFS), matched to mean standardised admission scores at the institution*subject*cohort level using data on high school achievement scores of students admitted to these courses. Unlike earlier UK studies, we are able to consider the effect of differences in undergraduate degree subjects, degree class, and in particular the selectivity of the subject at the Higher Education Institution (HEI) attended. Our results show that selectivity of undergraduate degree programmes plays an important role in explaining the variation in the graduate wage premium across HEIs and subjects. In fact, much of the observed differential in relative wage outcomes across institutions*subjects is due to the quality of students that HEIs select.

JEL Classification: I23, I26
Keywords: college selectivity, graduate wage premium

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1. Introduction

Higher education (HE) selectivity, often referred to as college selectivity in the US, is concerned with the quality of the students that attend Higher Education Institutions (HEI). HE selectivity is typically measured by the average characteristics of classmates, such as the mean Standard Aptitude Test (SAT) scores in the US or the "A-level" score in the UK. The strong correlation between HE selectivity and the labour market success of the college graduates is firmly established (e.g. Solomon (1975) and Wise (1975)). However, the extent to which attendance at a higher ranked HEI improves one's productivity and wages in a causal sense is a more ambitious question for empirical researchers. Using innovative methods and better quality data, recent literature on college selectivity attempts to identify the causal effect of college selectivity on graduate earnings. However, the findings seem to be rather mixed. Moreover, most of the empirical literature comes from the United States. There are very few UK studies that focus on this important topic, mostly due to data limitations. The UK is a good laboratory for addressing this topic because of the relatively homogeneous nature of the HE landscape in the UK, apart from the degree of institutional selectivity. Degrees focus mostly on a single subject (major) with little diversification. Most students apply during the final year of high school and, if successful, move straight from school to university without a significant gap. Completion rates are very high – typically over 90% and most drop-outs occur close to the start of their studies.

In this paper, we build on Walker and Zhu (2013) to study the labour market earnings of graduates in the UK using the Quarterly Labour Force Survey (LFS, broadly equivalent to the US CPS data), matched to mean standardised scores on national examinations at the end of High School for the institution-subject-cohort level from the Higher Education Statistics Agency (HESA). The subject is defined by the Joint Academic Coding System (JACS) and we use a level of aggregation that yield 16 subjects.[1] Unlike earlier UK studies, we are able to consider the effect of differences across undergraduate degree subjects, degree class, and in particular the selectivity of the subject at the institution attended. To the best of knowledge, we are the first UK study combining a nationally representative survey data (LFS) with mean standardized A-level scores by undergraduate (UG) entry year, the HEI, and the subject studied. Our results show that undergraduate degree programme selectivity plays an

[1] We omit nursing. Sadly, this JACS grouping places Economics in with the rest of Social Studies and we are not able to separate them out. The results in Britton et al (2016) suggest that the annual earnings of Economics

important role in explaining the graduate wage premium, and the returns to obtaining post-graduate degrees.

The remainder of the paper is organized as follows. Section 2 briefly reviews the literature. Section 3 introduces the data. Section 4 presents the results. Finally, Section 5 concludes.

2. Literature Review

The literature on college selectivity can be classified into two strands. The first is concerned with the relationship between college selectivity and students' college choice and performance; while the second is concerned with the estimation of returns to college selectivity. Davies and Guppy (1997), using the US NLSY data, find that socio-economic status (SES) predicts entry into selective colleges, but subject studied does not do so directly - except for the lucrative ones within selective colleges. Moreover, men were more likely to enter fields of study with higher economic returns than women. Hoxby (2009) reviews the trend in college selectivity in the US over the past four decades: she finds that US colleges are *not* getting more selective, except at the very top end; and changes in selectivity are mostly due to the falling costs of distance and information. Descriptive analysis by Chetty et al (2017) of US college students since 1999 suggest that, while students from high income backgrounds are much more likely to attend highly selective colleges, the earnings of low and high income background students have similar earnings condition on college attended. Smith (2013), using a large twins dataset with application and enrolment information from the US, finds that a student's probability of bachelor's degree completion within four years increases by 5 percentage points by choosing an institution with a median SAT score 100 points higher than the alternative. However, one should be cautious in interpreting the twins fixed-effect estimates as causal because these twins, not all identical, are unlikely to be as good as randomly assigned to different institutions. Indeed, Goodman et al. (2015) find that one's own college choice is partially affected by the college choice made by one's older sibling. Nonetheless, Smith found that methodology made little difference to the results.

While earlier studies on returns to college selectivity are by and large descriptive in nature, the more recent literature pays more attention to data quality and methodological issues in order to minimize the bias in the estimates. Loury and Garman (1995) present a model where human capital depends on both performance at college (e.g. GPA) and college selectivity. Using the National Longitudinal Study (NLS) of the High School Class of 1972,

they show that omitting college performance overstates the effect of college selectivity for Whites and understates it for Blacks. However, black students with below median SAT scores of the college they attend have lower probability of graduation.

Causal estimation of the effect of college selectivity on earnings may also be biased by selection on unobservables, as elite colleges assess applicants on characteristics that are related to future earnings but, in general, would be unobservable to the econometrician. In order to eliminate this bias, Dale and Krueger (2002) match students who applied, and were accepted with those rejected by the same set of colleges. Using the College and Beyond data set and the National Longitudinal Study (NLS) of the High School Class of 1972, they find little evidence of returns to attending more prestigious colleges for students with same ability. Similarly, after partially adjusting for unobserved student ability by controlling for the average SAT score of the colleges that students applied to, Dale and Krueger (2014) conclude that estimates of the effects of college characteristics fall substantially and are generally indistinguishable from zero, except for students from disadvantaged background.[2]

There are very few studies on HE selectivity in the UK. Chevalier and Conlon (2003) is the first UK study on the subject. Using exit surveys of three UK graduate cohorts, known as the Destinations of Leavers from Higher Education (DLHE). They find that attending Russell Group universities leads to a 6% wage premium, compared to "New" (post-1992) universities. But wages were observed soon after graduation when wages are very noisy and little other information will be available to the employer. Their Propensity Score Matching estimates are imprecise because of thin common support. Hussain et al. (2009) use four graduate cohort studies and five different measures of HEI quality including the total tariff score[3] at admission. They also find a positive return to attending a higher quality institution, of about 6% earnings difference for one standard deviation increase in the composite HEI quality index that they construct. Again this study uses only recent graduates where employers may depend heavily on the quality signal associated with HEI reputation.

[2] Brewer et al. (1999) find significant returns to attending elite private HEIs in the US even after accounting for selection using tuition fees and financial aid. Chen et al. (2012) also find substantial returns to MBA programmes selectivity using the Dale and Krueger method.

[3] We use the variable that HESA labels "Total Tariff (average pre-university test score – A-level or equivalent)". This is missing for a large minority of cells because there is a variety of alternative qualifications that might be regarded as equivalent to a specific A-level score. This is unimportant provided the A-level score still provides a measure of the degree of selectivity.

Most recently, Britton et al. (2016) have examined the annual earnings of English domiciled graduates up to 10 years after graduation, allowing for HE selectivity using the HESA data in the same way as used here. Their data comes from the Her Majesty's Revenue & Customs (HMRC, the UK tax authority) merged with Student Loan Company (SLC) data on graduates. SLC debt repayments in the UK are linked to earnings and is administered by HMRC through the Pay-As-You-Earn (PAYE) system. They find substantial annual earnings premia for Medicine, Economics, Law, Maths and Business relative to the excluded category – which broadly reflect our results. Moreover, they find large differences associated with a (relatively crude) measure of family background on median graduate earnings– a raw gap of 25% in favour of students from higher income families: but this fails to be statistically significant (at the 5% level) in their multivariate analysis which accounted for HEI attended and subject chosen.[4]

Their study differs from ours in four important ways. First, their data is annual earnings, while we focus on hourly wages - which we feel is likely to be a better measure of productivity. Secondly, the LFS interviews all cohorts each year (although we can only include those for which HESA data is available which limits our data to entry cohorts from 1992[5]) so our sample contains few observations with more than 20 years of post-graduation work experience. In contrast, their HMRC data is restricted to individuals who are in the SLC scheme from 1998 and so have no more than 10 years of work experience[6]. Thirdly, our sample cover all graduates working as employees, not just student loan borrowers. On the one hand, our LFS data includes only employees; on the other, the HMRC data includes only those who choose to take out a loan.[7] Finally, the HMRC data is the universe of students and is much larger than our survey-based data, and this will adversely affect the precision of our estimates, relative to theirs.

[4] Walker and Zhu (2013) analysis of QLFS 1993 to 2010 cannot distinguish between HEI types due to data limitations prior to 2011.

[5] In fact, we restrict the data to entry cohorts from 1992/93 because this is when the "binary divide" (between universities and "polytechnics") was abandoned. Moreover, HESA data only became available for entry cohorts from 2000/01. However, we believe that relative admission "tariffs" changed little over time and we use STATA's extensive missingness capabilities to allow us to retain data back to the end of the binary divide.

[6] Whether one can extrapolate from the HMRC data to cover the whole of the working lifecycle is a question that we try to pursue later here.

[7] While many law, accounting, and accounting graduates become self-employed this is not typical early in the lifecycle and we find only 12% of the working graduates in the LFS cohorts that we use are self-employed. We know little about selection into loans, but the means-tested nature of the loan repayments mechanism suggests that those with higher rates of return will be less likely to participate in the programme because they would enjoy lower subsidies.

3. Institutional Background and Data

Higher education in the UK is almost universally provided by publicly funded universities. Over the past half century, the UK HE sector has experienced several rounds of expansion, the most recent of which took place in the early 1990s. The 1992 Higher Education Act granted university status and degree awarding power to all higher education institutions, including ex-polytechnics – who responded to changing their names to replace the title polytechnic, with university. In some of our analysis, we group HEIs into the three primary types in descending order of selectivity — the Russell Group, which is the self-selected "elite" research intensive universities and include Oxford and Cambridge; pre-1992 "Old" universities outside the Russell Group; and the post-1992 "New" universities which were formerly polytechnics prior to the end of the "binary divide" that existed between universities and polytechnics.[8]

There is a single portal that is used to apply to all HEIs and the same information is circulated to all HEIs that a student applies to. Applications, limited to just five, are usually made at the beginning of the final year of high school and offers are made to applicants that are usually "conditional" on the achievements made in the national exit examinations taken at the end of senior high (A-levels). Students study a relatively narrow curriculum in senior high – typically studying just three or four subjects in depth. Most universities offer a wide range of majors. Undergraduate majors in the England, Wales and Northern Ireland are typically of three years duration (many students in Scottish HEIs study for a duration of either 3 or 4 years and we drop Scottish HEIs for this reason). Professional subjects are offered as undergraduate majors in the UK – for example Law, Architecture, Medicine and Dentistry although only the first is available as a three-year degree. Many of the less selective institutions will not offer these professional majors, although they do tend to offer a wider range of more vocational subjects that do not feed into the traditional "professions". Universities will have pre-requisites for entry into many majors - for example, Science A-levels are required for entry to Medicine students; Maths is required for science, technology, engineering, maths and most Economics majors; while modern languages is a requirement for most modern language majors. The narrow nature of the high school curriculum and the use of pre-requisites for many subjects implies that students, effectively constrain their university major at the age of 16. It is our understanding that this is reflected in choice of major and the

[8] We use New, Old and RG as short-hand hereafter.

result is that students choice of major is effectively done at 16 and they apply for a range of HEIs at age 18 that offer the narrow range of major(s) that might be open to them. The range of HEIs that a student applies to will be driven, in part, by their expectations of their likely achievement at the end of high school.

Those who satisfy their conditional offers are admitted to their most preferred HEI, and students who do not are passed to their second most preferred HEI. Students who fail to meet either conditional offer can apply through a "clearing" mechanism that matches such students to remaining vacant places in that entry year. A large majority of students move straight from high school to university although many of the less selective institutions admit a large number of "mature" students and students with unconventional entry qualifications.

The LFS data is a short rotating panel and we first construct a sample of employees aged 20 to 60 years old, who hold at least a first (undergraduate) degree, in Waves 1 and 5 (the waves that which contain earnings and data) of QLFS 2012_{Q1}-2015_{Q2} inclusive, for which the information on HEI attended, and subject studied, was available.[9] We exclude Scottish HEIs because of their different secondary school qualifications and their distinctive four year duration. We also exclude all post-1992 universities that are not also ex-polytechnics, since these are very new HEIs with very few observations in our data. We also exclude subjects allied to medicine.[10] There are 20,597 observations in our graduate sample. Table 1 shows the frequencies by broad (JACS) subject area.

Table 2 shows the mean log real gross hourly wages[11] for each cell of the data.[12] Russell Group (RG) graduates, both men and women, earn 0.11-0.12 log points more than graduates from Old (pre-92 non-Russell) universities; who in turn earn 0.06-0.07 log points more than graduates from New (post-1992) universities. Across subjects, graduates in Medicine and Dentistry (excluding graduate nurses) have the highest wages, followed by

[9] The data is readily available from the UK DataService, subject to registering with them and undertaking some training. The data it is potentially highly disclosive data and can only be used via Citrix server within the UK Data-Service's Secure Data Lab. Our own STATA code is available to researchers who wish to explore the data.

[10] This group is dominated by nursing, a non-traditional graduate discipline. Moreover, many (of the higher earning) doctors have some self-employed income that is not recorded in our data. Indeed, many doctors who are in General Practice (ie physicians who work in the community) are entirely self-employed.

[11] We only observe wages for those who are employees. Our inability to analyze the self-employed is a major drawback of the LFS data and is likely to bias estimated subject effects because of the large proportion of self-employed who study Accountancy, Law, and Medicine/Dentistry.

[12] Table A1 in the Appendix shows the log real weekly earnings by subject, HEI type and gender. Table A2 show log real gross hourly wages and log real gross weekly earnings by region of place of work and gender.

Business and Administrative Studies, Social Studies (which includes Economics), Law, and then most of the Science, Technology, Engineering and Maths (STEM) subjects. The subjects with the lowest wages tend to be Arts and Humanity disciplines such as Creative Arts and Design, Mass Communication, Languages, and Agriculture.

The UK HE sector underwent a major expansion around 1992. An increasing minority of students also have post-graduate qualifications Therefore, in Table 3 we compare log hourly wages and log weekly earnings by postgraduate (PG) status, gender, and whether the graduate entered HE by 1992. One picture that emerges is that for both genders, the unconditional PG premium in both wages and earnings, seems to have widened substantially after the HE expansion, although this could be partly due to the fact that post-HE expansion cohorts are still at an early stage of their career. In our subsequent analysis, we will look at the effect of (undergraduate) college selectivity on the PG premium directly. Figure A1 in the Appendix shows mean log real hourly wage by age for men and women holding undergraduate degrees only, and those that also have higher degrees. For all four demographic groups, the age-wage profiles are very steep until the early 30s and, in the case of men, keep rising to about age 40. This suggests that an exclusive focus on the early career might lead to biased results. Figure A2 shows the corresponding life cycle weekly earnings pattern by gender and PG status. While the age-earnings profiles for men are rather similar as those for the age-wage profiles, the age-earnings profiles for women turn out to level out sooner, at around age 30, presumably due to lower hours of work associated with child-bearing and child rearing.[13] All of our analysis is conditional on being employed and our data is not able to credibly allow for non-random selection into employment.

The HESA data we use is based on the individual student records of all A-level tariff scores for Full-Person Equivalents (FPE) of UK domiciled, full-time, first degree (which excludes a relatively small minority of student who study a Foundation Year degree that combine academic and workplace skills) students studying at UK HE providers - but only for the entry years 2000/01-2013/14. We derive standardised A-level tariff scores by UG entry cohort, HEI and subject after normalization (with zero mean and unity standard deviation) within each cohort.

[13] Figure A3 and A4 in the Appendix show the age-wage profiles by birth cohorts for male and female undergraduate respectively. Note that the 1973-82 and 1983-92 cohorts correspond to pre and post-HE expansion. Of these, the 1983-1992 cohorts use actual HESA A-Level scores, while the 1973-82 birth cohorts use imputed A-Level scores. The lack of any discontinuity in the age profiles across birth cohorts suggests that the results can be generalised to other cohort/ages for which we do not have A-Level scores.

Table 1: Frequencies by subject, HEI type and gender, graduate sample

	Men				Women			
	New	**Old**	**RG**	**Total**	**New**	**Old**	**RG**	**Total**
JACS Subject Area								
Medicine & dentistry	10*	31	118	159	24	41	173	238
Biological/Veterinary	200	184	242	626	335	307	380	1,022
Agriculture & related	46	28	33	107	42	37	54	133
Physical sciences	189	248	431	868	135	133	211	479
Maths & computing	374	285	417	1,076	96	88	164	348
Engineering & tech	523	327	473	1,323	53	32	69	154
Architect/build/plan	247	55	87	389	69	13	51	133
Social studies	258	240	344	842	442	332	357	1,131
Law	117	61	131	309	207	118	136	461
Bus/admin studies	634	275	252	1,161	645	249	229	1,123
Mass comms & docs.	119	33	41	193	138	55	58	251
Languages	41	94	153	288	146	261	330	737
Historical/philosophic	83	168	226	477	102	140	272	514
Creative arts & design	260	76	67	403	338	103	102	543
Education	221	121	185	527	636	382	445	1,463
Combined	536	398	457	1,391	641	589	500	1,730
Total	3,858	2,624	3,657	10,139	4,049	2,880	3,531	10,460

Note: *: cell size rounded. full graduate sample (see sample note for details). New universities refer to ex-polytechnics which became universities post-1992. Old universities refer to universities founded pre-1992 which are not in the Russell Group (RG) of elite pre-92 institutions. RG universities refers to the association of 24 (as of 2012) public research-intensive universities, including Oxford and Cambridge.

Table 2: Log real gross hourly wages by subject, HEI type and gender, graduate sample

	Men				Women			
	New	**Old**	**RG**	**Total**	**Old**	**New**	**RG**	**Total**
JACS Subject Area								
Medicine & dentistry	2.93	3.25	3.33	3.29	2.91	3.20	3.14	3.13
Biological/Veterinary	2.73	2.79	3.02	2.86	2.66	2.68	2.83	2.73
Agriculture & related	2.86	2.71	2.99	2.86	2.64	2.54	2.73	2.65
Physical sciences	2.91	2.95	3.06	3.00	2.68	2.71	2.83	2.75
Maths & computing	2.86	3.00	3.15	3.01	2.74	2.88	2.98	2.89
Engineering & tech	3.03	3.10	3.19	3.10	2.75	2.93	2.88	2.85
Architect/build/plan	2.98	2.94	2.98	2.98	2.72	2.47	2.87	2.75
Social studies	2.81	2.93	3.05	2.94	2.66	2.68	2.84	2.72
Law	2.78	2.95	3.17	2.98	2.65	2.81	2.92	2.77
Bus/admin studies	2.95	3.10	3.11	3.02	2.75	2.82	2.92	2.80
Mass comms & docs.	2.61	2.73	2.80	2.67	2.67	2.53	2.70	2.65
Languages	2.86	2.79	2.93	2.88	2.65	2.67	2.78	2.71
Historical/philosophic	2.71	2.80	2.87	2.82	2.60	2.74	2.70	2.69
Creative arts & design	2.68	2.88	2.69	2.72	2.45	2.54	2.57	2.49
Education	2.90	2.87	2.98	2.92	2.74	2.82	2.86	2.80
Combined	2.89	2.95	3.04	2.95	2.64	2.70	2.85	2.72
Total	2.88	2.95	3.06	2.96	2.67	2.73	2.85	2.75

Note: April 2012 constant prices. See note Table 1.

Table 3: Summary stats by PG, HE-expansion cohorts and gender, graduate sample

		Pre-92 UG entry cohorts			Post-92 UG entry cohorts		
		No PG	PG	Total	No PG	PG	Total
Male	Log hourly wage	3.09	3.16	3.11	2.78	2.93	2.81
	Log weekly earnings	6.75	6.79	6.76	6.43	6.57	6.46
	Age	48.5	49.1	48.7	31.3	32.5	31.5
	Obs	3627	1561	5188	4007	942	4949
Female	Log hourly wage	2.79	2.97	2.85	2.6	2.82	2.66
	Log weekly earnings	6.17	6.37	6.24	6.08	6.29	6.13
	Age	48.4	48.7	48.5	30.7	32.4	31.1
	Obs	3160	1622	4782	4276	1402	5678
Total	Log hourly wage	2.95	3.06	2.99	2.69	2.86	2.73
	Log weekly earnings	6.48	6.58	6.51	6.25	6.4	6.28
	Age	48.5	48.9	48.6	31	32.4	31.3
	Obs	6787	3183	9970	8283	2344	10627

Note: Full graduate sample (see sample note for details). Monetary variables in April 2012 prices.

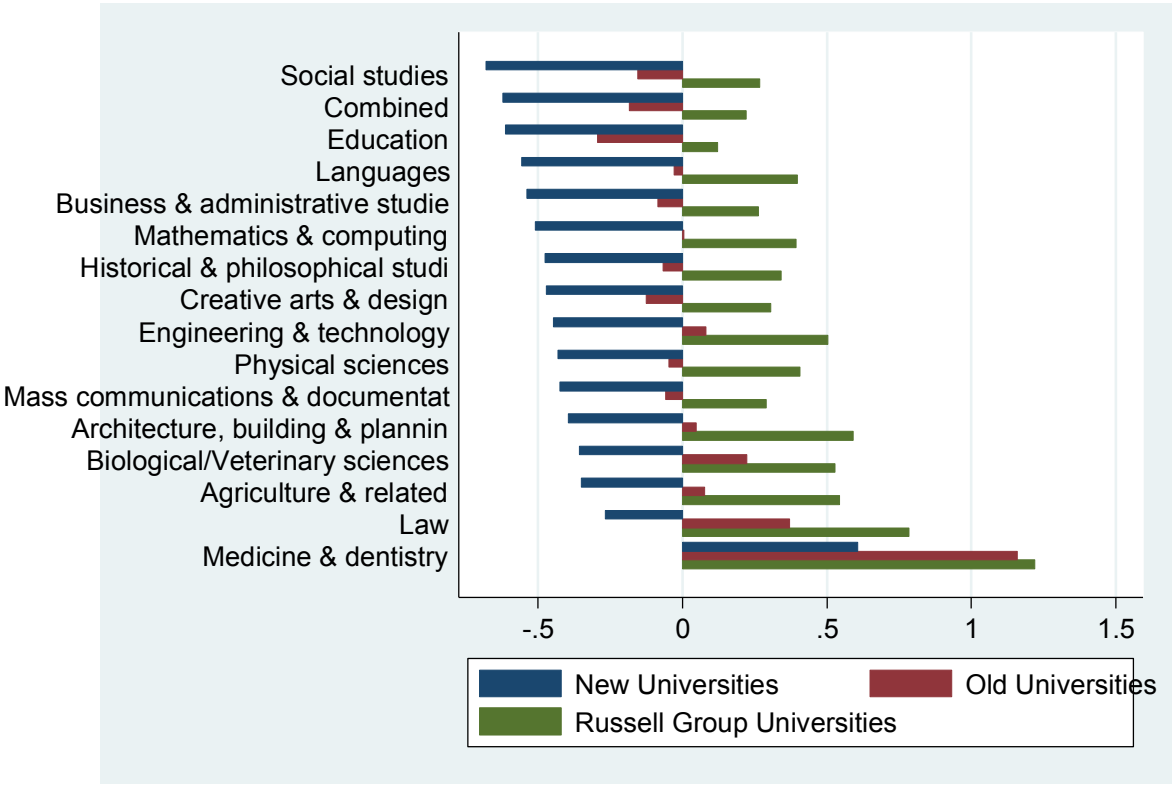
Figure 1 summarises the mean standardized A-Level tariff scores by subject and HEI type. There is overwhelming evidence of systematic selectivity across HEI types, within each subject. Russell Group universities are the most selective in terms of A-Level entry scores, followed by Old universities; and then New university students usually have weaker prior academic attainment – the mean difference in A-Level scores between Russell Group and New university student is over 0.9 of a standard deviation. Medicine and Law are highly selective and there is a more pronounced pattern of declining selectivity across groups in New HEIs.

The merged LFS-HESA sample contains 10,627 graduates who entered HE in 1992 or later, with mean standardised A-Level entry scores matched at the HEI-subject (JACS) level for post-2002 UG entry cohorts.[14] For 1992-2001 UG entry cohorts, which is around half of our data, we impute the missing standardized A-Level scores.[15]

[14] HESA data for 2000/01-2001/02 entry cohorts cannot be used because of inconsistencies in the A-Level tariff score calculations.

[15] We test for the robustness of results with respect to the inclusion of the 1992-2001 UG entry cohorts in Section 4. The pre-1991cohorts are not used in the main analysis as they pre-date the major HE expansion which gave ex-polytechnics university status.

Figure 1: Mean standardized A-Level scores by subject and HEI type



4. Empirical Results

Before we turn to the effect of HE selectivity, we first present conventional wage equations, for men and women separately, using the full graduate sample as a benchmark in Table 4. In columns (1) and (4), we control for age, age squared, immigrant status (born outside the UK), non-white, decades of birth, year and wave of survey, region of residence, country of birth (within the UK), HEI type, and country of location of the HEI attended. In columns (2) and (5), we additionally control for degree subjects. Finally, in columns (3) and (6), we further add family circumstance controls such as partnership status, if any; and number of dependent children and age of the youngest child, if any. We resist controlling for PG qualifications so these results should be interpreted as including the option value of the possibility of pursuing PG studies.

The wage coefficients for attending Russell Group are robust across different specifications: at around 10% for men and 11% for women relative to New university graduates. Old university, relative to new, are similarly stable across specifications and are approximately 7% for men and 5% for women and these estimates are statistically significantly different to both RG and New. The subject differentials reflect those in Walker and Zhu (2013) with large positive effects for Medicine/Dentistry, Law, Social Studies, a Maths, relative to the

Languages omitted subject; and large negative ones for other Arts subjects, and even for Business and Administrative Studies. There are strong and conventional regional (of employment) differentials; conventional coefficients; and on family background variables.[1617] Estimates of the effects of on age and age-squared reflect the young nature of the data.

In order to assess the value-added of HEIs, we construct two residual wages measures, obtained from the results in Table 5. First, a selectivity-unadjusted residual wage is derived by regressing log hourly wages on gender, age, age squared, Non-White, dummies for year, wave, and region of residence in col 1. These residuals capture the effects of omitted subject and HEI. The corresponding selectivity-adjusted residual wage is derived by regressing log hourly wage on the same set of regressors, as well as the mean standardized A-Level score of the observed subject*HEI*cohort in col 2. The latter, roughly speaking, can be interpreted as the value added, or net return to a degree, after accounting for HE selectivity. The difference between these two residuals is the wage differential due to HEI selectivity. Col 2 of Table 5 highlights the important role of HEI*subject selectivity on wages – increasing standardized A-Level tariff scores by one standard deviation (slightly larger than the average difference between the selectivity of Russell Group and New universities) will lead to a wage increase of 0.133 log points. Note that the other coefficients are very stable.[18]

Figure 2 presents scatter plots of unadjusted and selectivity-adjusted residual wages by standardized A-Level scores, for all subjects pooled together. Each dot represents a unique HEI with a given mean A-Level admission score on the horizontal axis, and the mean unadjusted (for both HEI and subject) wage on the vertical axis; and the size of the bubble is

[16] Table A3 present the corresponding wage equations with additional controls for types of PG qualifications and degree class of the first degrees. Again, the results suggest that coefficients on HEI type, PG type and UG degree class are insensitive to controls for degree subject and family circumstances.

[17] We compare estimates with and without the imputed A-Levels, in Table A4, which includes controls for major and HEI type. The results are again very similar reinforcing the idea that including cohorts with imputed A-Level scores is acceptable.

[18] Appendix Table A5 shows that comparing the estimates using imputed selectivity for all UG entry cohorts (see col 1 and 2 of A5) with the post-2002 cohorts where actual A-Level tariff points is used to measure selectivity (see col 3 and 4) makes very little difference. In particular, with the smaller sample of more recent graduates, one standard deviation increase in A-Level tariff scores will lead to an increase in wages by approximately 12.7%, which is statistically insignificant from the 13.3% effect we have in Table 5 using the wider sample with imputed A-Level scores.

Table 4: Wage equations without PG and degree class controls, various specifications, full graduate sample

	Men			Women		
	Baseline	+Subject	+Family	Baseline	+Subject	+Family
	(1)	(2)	(3)	(4)	(5)	(6)
Age	0.140***	0.134***	0.114***	0.128***	0.124***	0.122***
	(0.006)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
Age squared	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Born outside of the UK	0.009	0.009	0.005	0.021	0.016	0.024
	(0.027)	(0.027)	(0.027)	(0.026)	(0.025)	(0.025)
Non-white	-0.090***	-0.116***	-0.113***	-0.029*	-0.050***	-0.039**
	(0.019)	(0.018)	(0.018)	(0.017)	(0.016)	(0.016)
Born in 1950s	-0.005	0.006	0.007	-0.037	-0.024	-0.011
	(0.050)	(0.049)	(0.048)	(0.050)	(0.049)	(0.049)
Born in 1960s	-0.070**	-0.055*	-0.045	-0.136***	-0.129***	-0.059**
	(0.031)	(0.030)	(0.030)	(0.031)	(0.030)	(0.030)
Born in 1970s	-0.037**	-0.028	-0.026	-0.071***	-0.064***	-0.026
	(0.018)	(0.018)	(0.018)	(0.017)	(0.017)	(0.017)
year2013 =1	0.063***	0.062***	0.063***	0.033***	0.033***	0.035***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
year2014 = 1	0.082***	0.082***	0.085***	0.057***	0.058***	0.061***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
year2015 = 1	0.096***	0.095***	0.097***	0.070***	0.069***	0.074***
	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Wave 5 =1	0.004	0.004	0.004	0.004	0.002	0.003
	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
London	0.280***	0.298***	0.301***	0.280***	0.295***	0.293***
	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)	(0.012)
Southeast	0.084***	0.083***	0.083***	0.059***	0.061***	0.062***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)
Wales	-0.067**	-0.062**	-0.063**	0.006	0.003	0.008
	(0.028)	(0.028)	(0.028)	(0.028)	(0.027)	(0.027)
Scotland	0.080**	0.081**	0.075**	0.021	0.030	0.032
	(0.036)	(0.034)	(0.034)	(0.035)	(0.034)	(0.034)
NI	-0.116*	-0.111*	-0.118**	-0.105**	-0.090*	-0.092*
	(0.061)	(0.058)	(0.059)	(0.051)	(0.051)	(0.051)
Born in Scotland	-0.001	-0.010	-0.007	0.038	0.034	0.036
	(0.032)	(0.030)	(0.030)	(0.032)	(0.032)	(0.032)
Born in Wales	0.024	0.012	0.016	0.010	0.012	0.008
	(0.026)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Born in Northern Ireland	0.018	-0.004	-0.013	-0.008	-0.016	-0.010
	(0.048)	(0.046)	(0.047)	(0.045)	(0.045)	(0.045)
Born in UK (unspecified)	-0.027	-0.043	-0.066	0.062	0.096	0.080
	(0.092)	(0.094)	(0.092)	(0.065)	(0.065)	(0.059)
Old university	0.060***	0.067***	0.068***	0.046***	0.047***	0.043***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
RG university	0.097***	0.090***	0.087***	0.119***	0.105***	0.107***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Welsh university degree	-0.016	-0.015	-0.018	-0.006	-0.014	-0.012
	(0.021)	(0.020)	(0.020)	(0.022)	(0.022)	(0.022)
NI university degree	-0.067	-0.054	-0.043	-0.002	0.000	0.010
	(0.055)	(0.053)	(0.054)	(0.046)	(0.046)	(0.045)

Table 4: Continued

	Men			Women		
	Baseline	+Subject	+Family	Baseline	+Subject	+Family
	(1)	(2)	(3)	(4)	(5)	(6)
Biological/Veterinary sci.		-0.024	-0.026		0.016	0.013
		(0.021)	(0.021)		(0.018)	(0.018)
Agriculture & related		-0.066	-0.074		-0.056	-0.061
		(0.047)	(0.046)		(0.038)	(0.039)
Physical sciences		0.024	0.023		0.006	0.000
		(0.021)	(0.021)		(0.023)	(0.023)
Mathematics & computing		0.094***	0.097***		0.126***	0.127***
		(0.020)	(0.020)		(0.027)	(0.027)
Engineering & technology		0.147***	0.144***		0.085**	0.068*
		(0.019)	(0.019)		(0.037)	(0.036)
Architecture/build/plan		0.064***	0.064***		-0.006	-0.005
		(0.024)	(0.024)		(0.040)	(0.039)
Social studies		0.093***	0.090***		0.080***	0.081***
		(0.028)	(0.028)		(0.025)	(0.025)
Law		0.129***	0.123***		0.087***	0.081***
		(0.020)	(0.020)		(0.018)	(0.018)
Business & admin studies		-0.135***	-0.130***		-0.043	-0.049*
		(0.033)	(0.033)		(0.028)	(0.028)
Mass comm. & document.		-0.079***	-0.078***		-0.065***	-0.063***
		(0.029)	(0.028)		(0.020)	(0.020)
Historical/philosophical		-0.128***	-0.125***		-0.063***	-0.068***
		(0.025)	(0.025)		(0.023)	(0.023)
Creative arts & design		-0.123***	-0.123***		-0.153***	-0.161***
		(0.026)	(0.026)		(0.021)	(0.021)
Education		-0.026	-0.041*		0.058***	0.059***
		(0.023)	(0.022)		(0.016)	(0.015)
Combined subjects		0.022	0.025		-0.005	-0.004
		(0.019)	(0.019)		(0.016)	(0.016)
Partner present			0.120***			0.060***
			(0.011)			(0.010)
Any dependent children in family aged <19			0.047*			-0.111***
			(0.024)			(0.023)
Number of dependent children in family <19			0.005			-0.055***
			(0.009)			(0.010)
Age youngest child in family under 19			0.001			-0.010***
			(0.001)			(0.001)
Constant	-0.273***	-0.193**	0.098	-0.094	-0.021	0.162*
	(0.099)	(0.098)	(0.108)	(0.089)	(0.088)	(0.098)
Observations	10137	10137	10137	10460	10460	10460
R^2	0.276	0.309	0.322	0.211	0.240	0.254

Note: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Full graduate sample (see sample notes for details). Omitted category: New (post-1992) universities; attended English University; Languages degree; born in the 80's or 90's; survey year = 2012. Education is for those with undergraduate degrees in Education. Many will be teachers, although most teachers will have a Post Graduate teaching qualification as well as an undergraduate degree in some specific subject.

Table 5: Wage equations controlling for age, race, region and gender, without and with A-Level scores

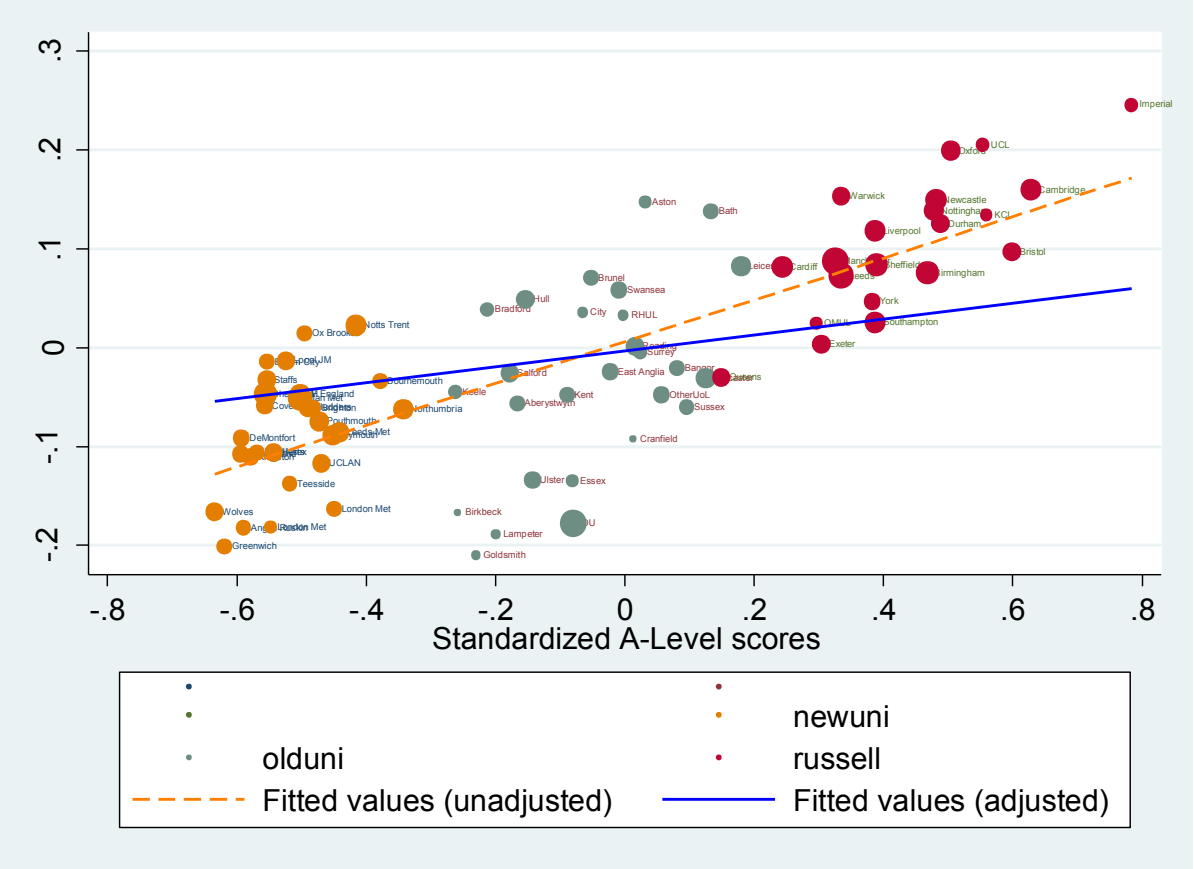
	(1) No selectivity control	(2) With selectivity control
Age of respondent	0.189***	0.188***
	(0.009)	(0.009)
Age squared	-0.002***	-0.002***
	(0.000)	(0.000)
Non-white	-0.068***	-0.057***
	(0.015)	(0.014)
Year 2013	0.040***	0.038***
	(0.010)	(0.010)
Year 2014	0.073***	0.068***
	(0.010)	(0.010)
Year 2015	0.082***	0.079***
	(0.012)	(0.012)
Wave 5 = 1	0.009	0.004
	(0.008)	(0.008)
London	0.320***	0.307***
	(0.010)	(0.010)
Southeast	0.101***	0.096***
	(0.011)	(0.011)
Female	-0.121***	-0.120***
	(0.008)	(0.008)
Mean Standardized A-Level score	-	0.133***
		(0.006)
Constant	-0.880***	-0.874***
	(0.138)	(0.136)
Observations	10627	10627
R^2	0.314	0.341

Note: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Merged LFS/HESA graduate sample (see sample notes for details). Residuals from the two specifications are used as unadjusted and (A-Level) adjusted residual wages in Figures 2 and 3 below.

proportional to the number of graduates from that HEI in the sample.[19] The A-Level scores on the x-axis, shows that graduates from more selective HEI's (that demand higher scores) earn significantly more than graduates of less selective HEI's that demand lower grades (the dashed orange line, with a slope of 0.197 and a standard error of 0.018, reflects a weighted least square regression of the unadjusted residual wages on standardized entry scores) – there would *appear* to be a large return to attending a more selective HEI. In contrast, when we control for selectivity, using institutional admission standards, we find much lower wage differentials, on average (the solid blue line is much flatter with a slope of 0.069 and a standard error of 0.018, reflects a weighted least square regression of the selectivity-adjusted residual wages on standardized entry scores). The difference between the slopes of these lines is reflected in the 0.133 coefficient on the standardised score in Table 5. Failing to control for

[19] We exclude HEIs with fewer than 15 graduates from the graph.

Figure 2: Scatter plots of unadjusted and (A-Level) adjusted residual wages by standardized A-Level scores, all subjects

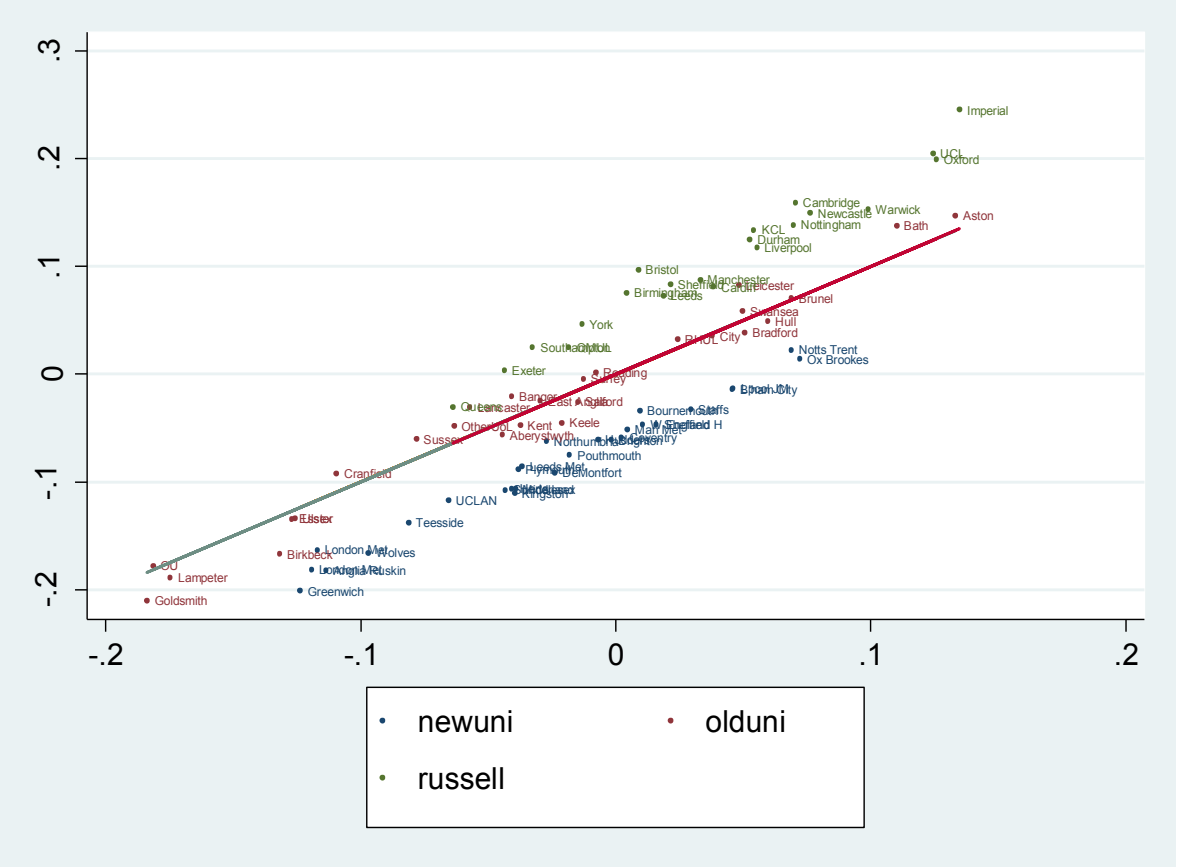


Note: Merged LFS/HESA graduate sample (see sample notes for details). Size of the bubble is proportional to cell size. Unadjusted residuals are derived from log wage equations on age, age squared, non-White, London and Southeast regions (place of work), gender, and interview year and wave dummies. Adjusted residuals are derived from log wage equations with the same set of regressors plus HEI-subject mean standardised A-Level entry scores. Both come from Table 5.

HEI selectivity gives the mistaken impression that more selective HEIs add more value, when in fact much of this is due to their greater selectivity. However, there is still considerable variation in value added across HEIs.

Figure 3 shows the scatter plots of unadjusted versus selectivity-adjusted residual wages with a 45^{o} line. HEIs above the 45^{o} line have predicted wages, without adjusting for selection, that exceed what would be predicted allowing for the selectivity of the course (the value added by the course relative to other courses). According to this figure, Aston University and Imperial College (and Oxford and Cambridge), for example, have roughly the same value-added, as measured by the selectivity adjusted residual wages on the horizontal axis while the unadjusted residual (vertical) differences are very large. Therefore, the substantial difference in the (unadjusted residual) wages between these institutions is almost entirely due to selectivity. To focus minds, a student who could have been admitted to

Figure 3: Scatter plots of unadjusted vs. (A-Level) adjusted residual wages with 45-degree line, all subjects



Note: Merged LFS/HESA graduate sample (see sample notes for details). Unadjusted residuals are derived from log wage equations on age, age squared, non-White, London and Southeast regions (place of work), gender, and interview year and wave dummies. Adjusted residuals are derived from log wage equations on the same set of regressors as well as HEI-subject mean standardised A-Level entry scores.

Imperial but instead goes to Aston does, on average, equally as well in the labour market. Similarly, a student who could have attended Cambridge would, on average, do just as well if she attended Oxford Brookes. Note that ALL of the RG HEIs are above the 45^{o} line, while ALL of the New HEIs are below.

Figures 4A-4C presents the same information in a different way. They show the unadjusted and adjusted residual wages of HEIs, ranked by the unadjusted residual wages, for New, Old and Russell Group universities respectively. We can again see that the New universities always fare better on the value-added measure, given that the adjusted residual wages always dominate the unadjusted residuals, while the converse is true for Russell Group universities. For Old universities, the pattern is mixed.

Figure 4A: Unadjusted and (A-Level) adjusted residual wages by HEI, in order New universities

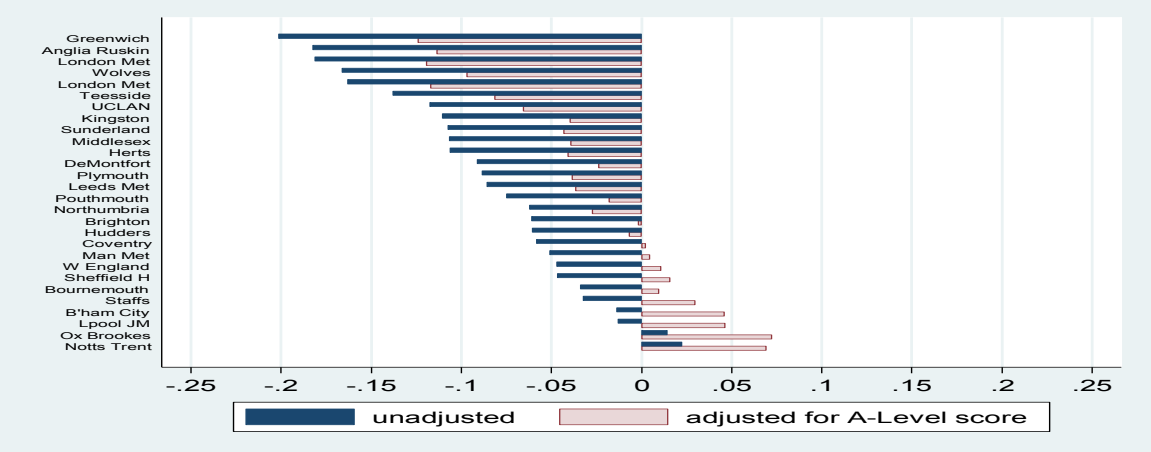


Figure 4B: Old universities

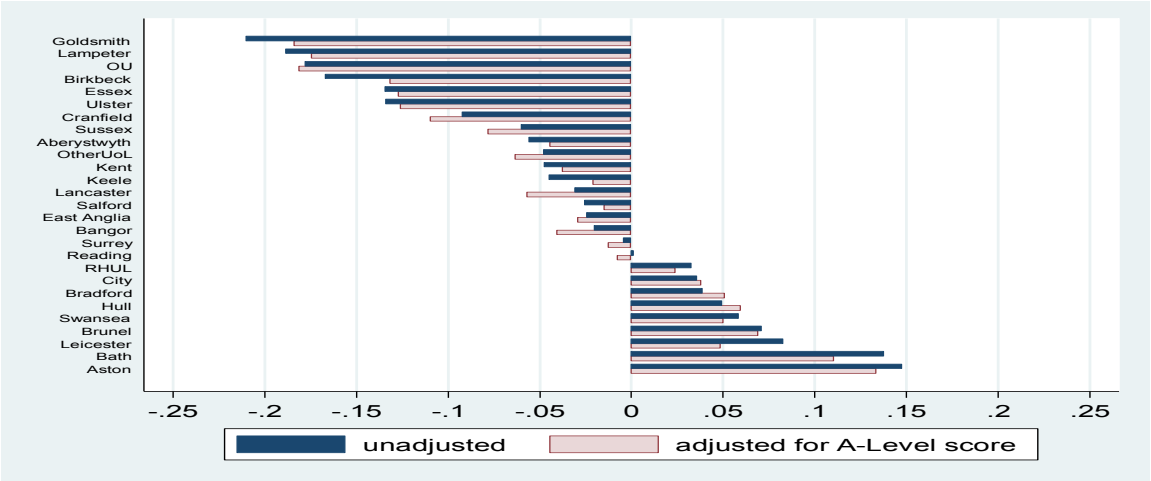
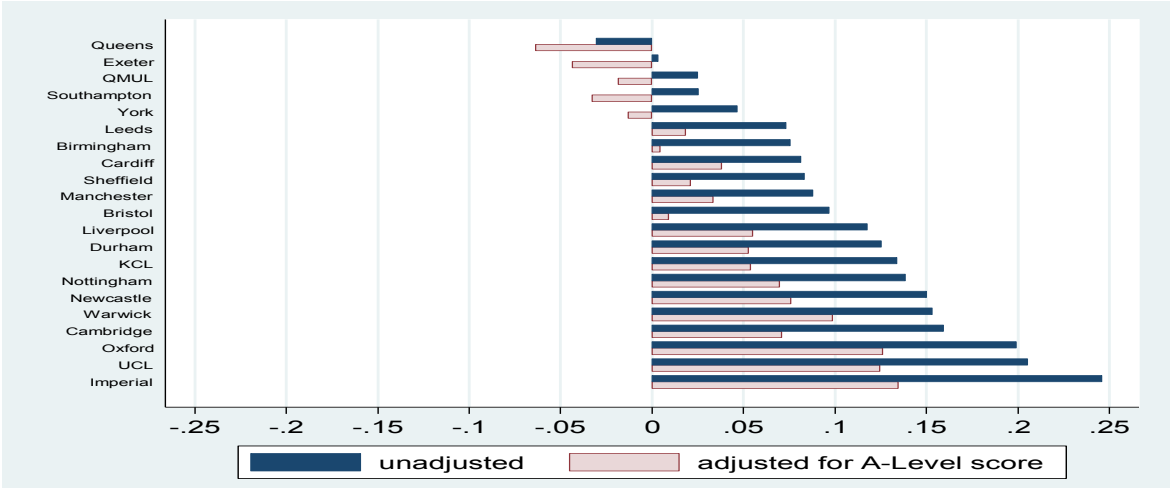
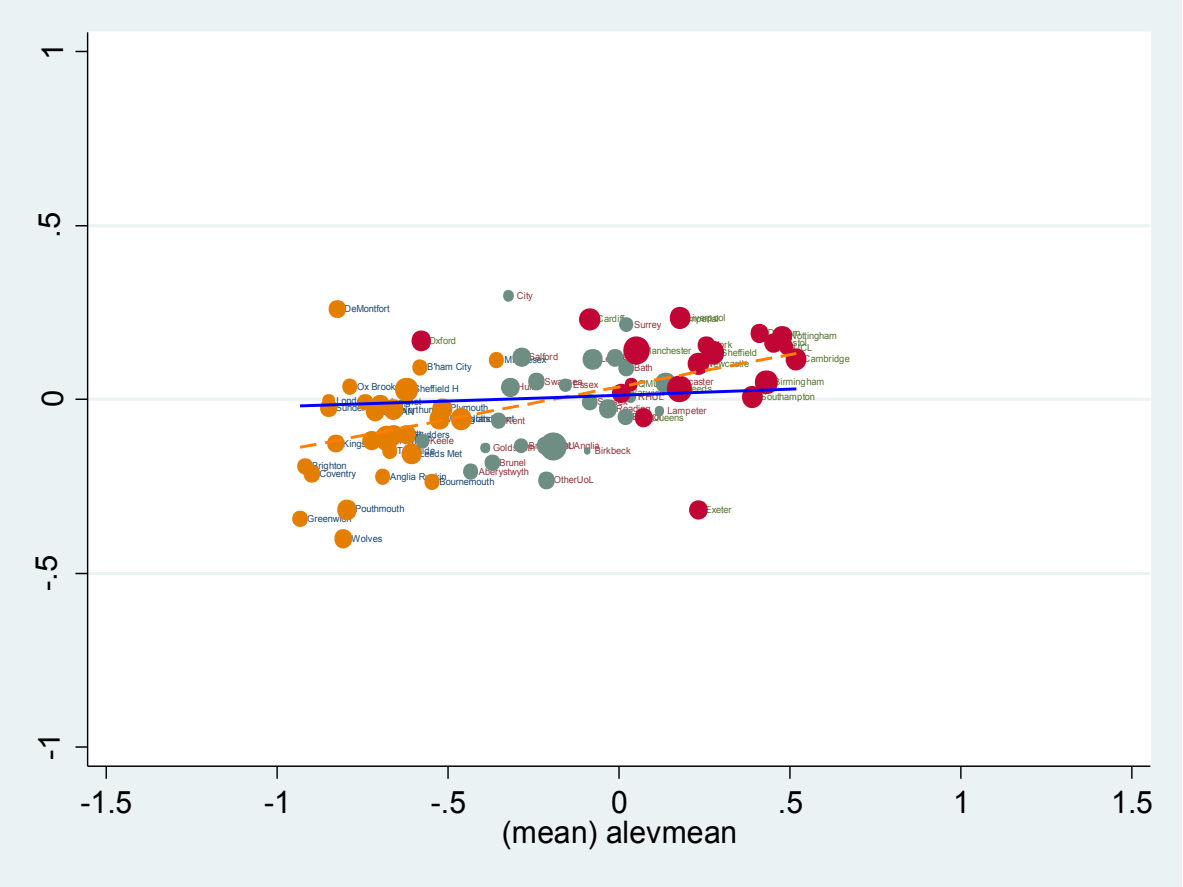


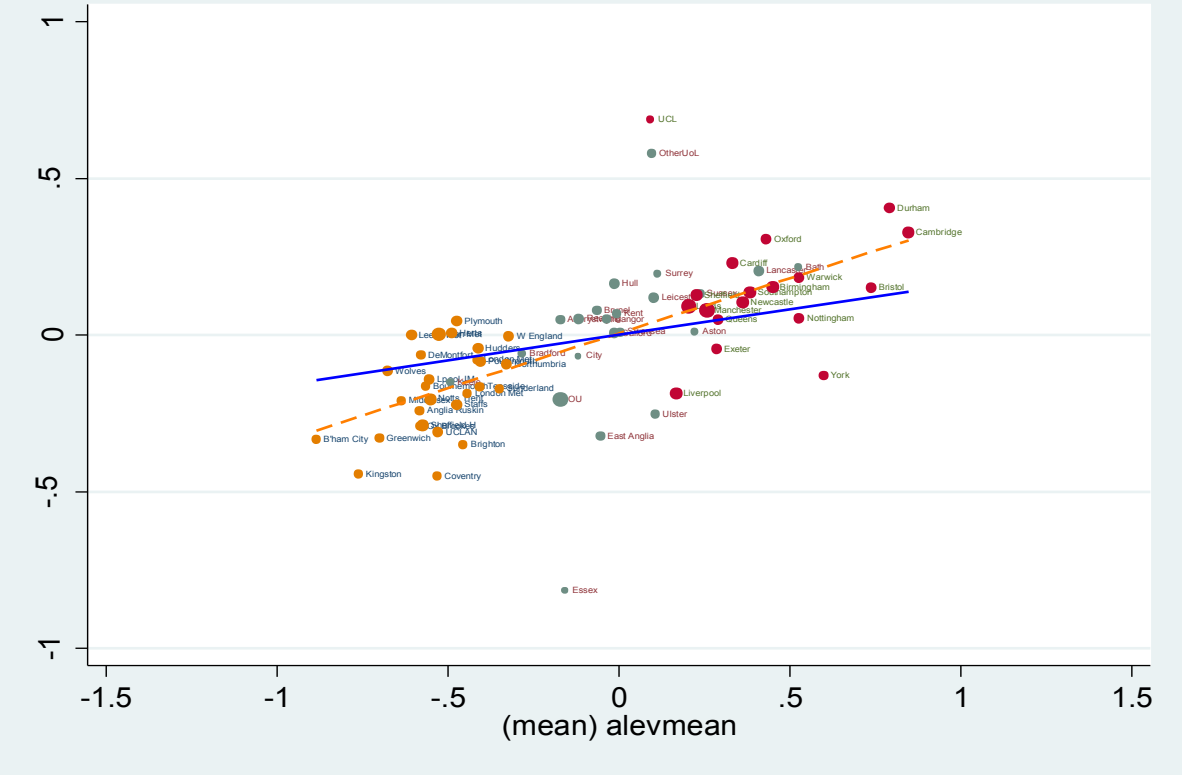
Figure 4C: RG universities



Note: Merged LFS/HESA graduate sample (see sample notes for details). Unadjusted residuals are derived from log wage equations on age, age squared, non-White, London and Southeast regions (place of work), gender, and interview year and wave dummies. Adjusted residuals are derived from log wage equations on the same set of regressors as well as HEI-subject mean standardised A-Level entry scores**.**

Figure 5: Comparing Social Studies (top) vs Maths/Computing (bottom)





The extent to which selectivity affects wages might also vary across degree subjects. In Figure 5, we compare plot residuals by institution for students of Maths & Computing (bottom panel) to Social Studies (top panel) as an example. While the fitted lines for the unadjusted residuals wages are positive for both disciplines, the fitted lines for the selectivity adjusted residual wages are all flatter indicating that selectivity matters in both disciplines. Moreover, the fitted line for the selectivity adjusted residual wage for Social Studies is virtually flat, implying that after accounting for selectivity, there is very little difference in the value added across different HEIs for this subject – for Social Studies it hardly matters at all (for wages) which university one actually attends, of those that one could attend. Put another way, given one's prior academic attainment, it does not matter which university one chooses to study Social Studies, as far as wages are concerned. On the other hand, it appears that it still pays to go a more selective university to study Maths & Computing, even conditional on entry requirements.

Figure 6 shows how the effect of A-level scores on wage differentials due to HE selectivity (by estimating the slopes for all subjects separately), i.e. how the gap between the unadjusted and adjusted residual wages, varies across subjects obtained from estimating Table 5 separately for each subject. For subjects like Law or Maths/Computing, a one SD difference scores could explain over 0.19 log points differences in the wage differential; while, at the other extreme, Architecture is very insensitive– a one SD difference in A-Level scores only explains 0.04 log points difference in the wage differential. There are large differences in the extent to which selectivity matters.

Figure 6: Effect of Standardized A-Level score on difference between (A-Level) unadjusted and adjusted residual wages, by subject and for whole

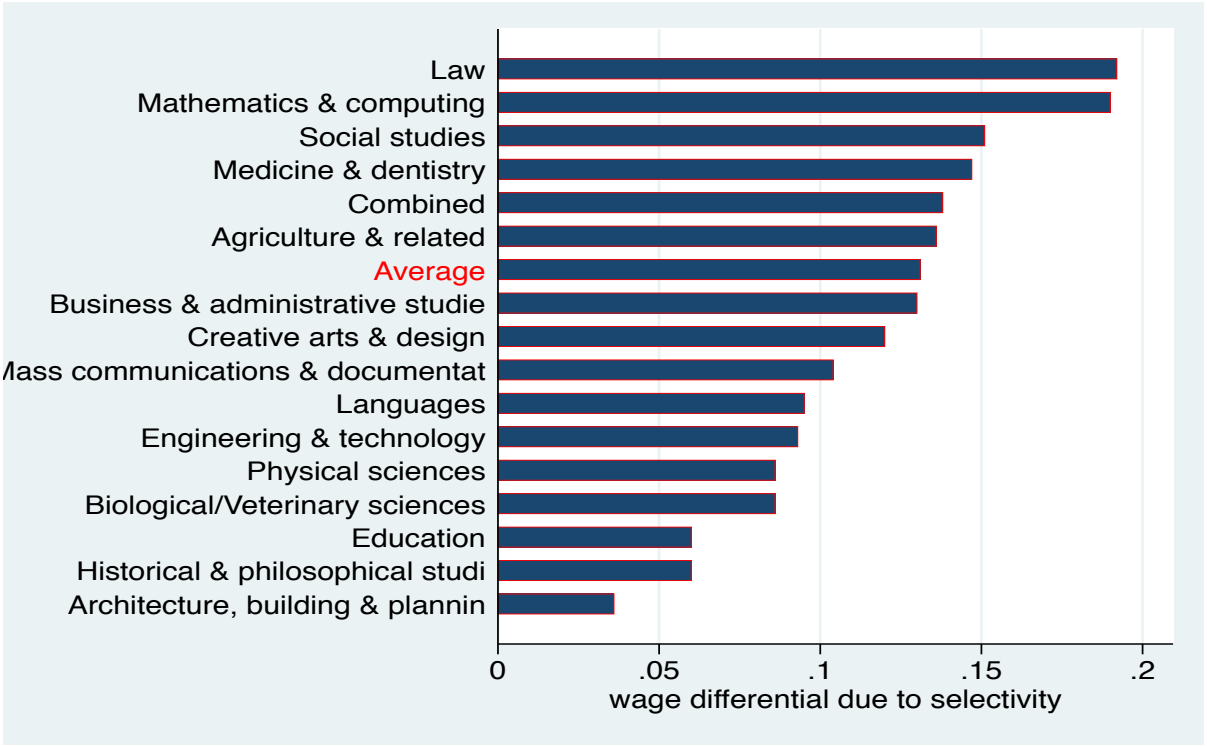


Table 6 assesses the sensitivity of returns to HEI types and subjects with respect to institutional selectivity, without and with controlling for post-graduate degrees (we group all such degrees together for the purpose of this table), and degree class (we code "First" and "Upper Second", that around half of students achieve, as "good" compared to the lower classifications). Columns (1) and (4) show baseline estimates, without controls for A-Level scores. The wage premia for studying languages (the reference subject) at Russell Group universities as opposed to New universities are substantial, at more than 0.16 log points for both men and women. Controlling for A-level tariff points in columns (2) and (5) reduce the Russell Group premia by about one third for both gender, while one standard deviation increase in A-Level tariff scores would increase wages by 0.07 and 0.06 log points for men and women respectively. In columns (3) and (6), we add controls for a PG qualification and having a good UG degree, both have positive and significant effects on wages. It turns out that additionally controlling for PG degrees and obtaining a good UG degree further reduces the Russell Group premia to just over half the size of the baseline estimates for both men or women, but makes no difference to the A-Level score effect. Similarly, the returns to attending Old versus New universities are approximately halved when entry scores are taken into account, even without controls for PG and good degrees. In the case of women, controlling for HEI selectivity renders the Old university premium statistically insignificant.

Table 6: Wage equations without and with PG and degree class controls, without and with A-Level scores

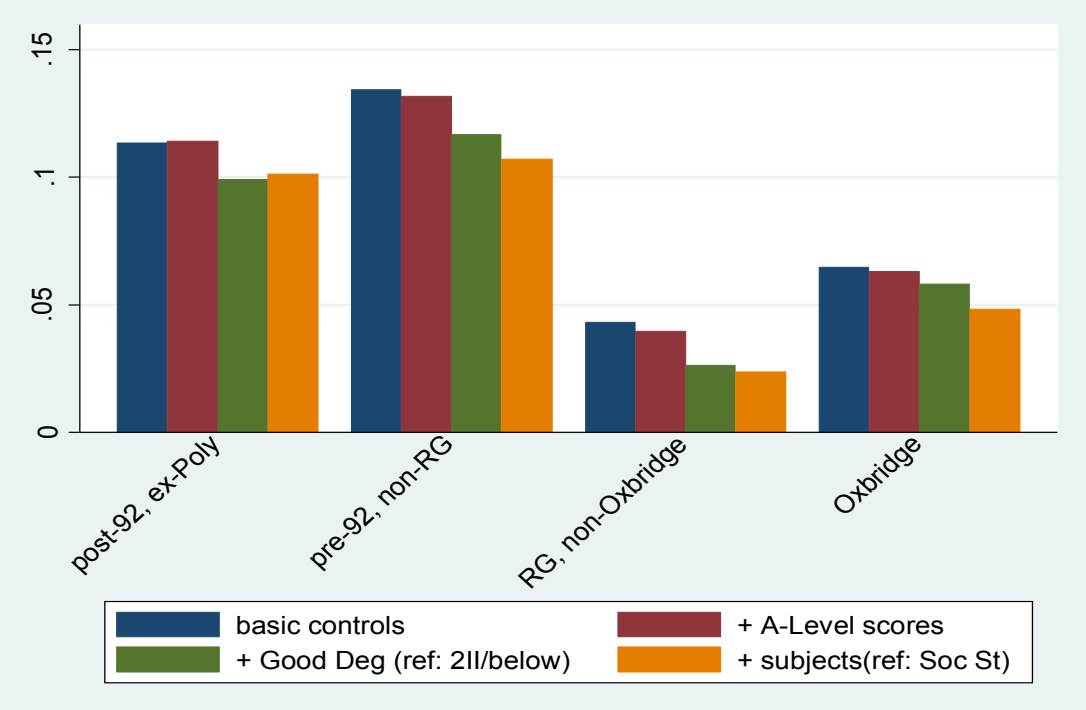
	Men			Women		
	Baseline	+ A-Level	+ PG & Good Degree	Baseline	+ A-Level	+ PG & Good Degree
	(1)	(2)	(3)	(4)	(5)	(6)
Old universities	0.080***	0.047***	0.044***	0.049***	0.022	0.005
	(0.014)	(0.015)	(0.015)	(0.013)	(0.015)	(0.014)
Russell universities	0.168***	0.105***	0.092***	0.164***	0.111***	0.083***
	(0.013)	(0.018)	(0.018)	(0.012)	(0.017)	(0.017)
Medicine & dentistry	0.195***	0.114**	0.142***	0.356***	0.294***	0.324***
	(0.044)	(0.047)	(0.047)	(0.033)	(0.036)	(0.037)
Bio/Vet science	-0.072***	-0.096***	-0.089***	0.018	-0.000	-0.011
	(0.026)	(0.027)	(0.026)	(0.022)	(0.022)	(0.021)
Agriculture & related	-0.058	-0.080	-0.074	-0.069	-0.082*	-0.068
	(0.058)	(0.058)	(0.056)	(0.045)	(0.045)	(0.045)
Physical sciences	-0.014	-0.027	-0.022	0.028	0.020	0.007
	(0.027)	(0.027)	(0.027)	(0.028)	(0.029)	(0.028)
Maths & computing	0.070***	0.056**	0.065***	0.165***	0.161***	0.156***
	(0.025)	(0.025)	(0.025)	(0.034)	(0.034)	(0.034)
Engineering/technology	0.099***	0.081***	0.076***	0.105**	0.092*	0.078
	(0.025)	(0.025)	(0.025)	(0.051)	(0.051)	(0.050)
Architecture, build/plan	0.048	0.026	0.010	0.025	0.009	-0.014
	(0.031)	(0.031)	(0.031)	(0.050)	(0.050)	(0.050)
Social studies	0.051	0.015	0.016	0.113***	0.088***	0.080***
	(0.034)	(0.034)	(0.034)	(0.028)	(0.029)	(0.029)
Law	0.081***	0.074***	0.074***	0.118***	0.115***	0.112***
	(0.025)	(0.025)	(0.025)	(0.023)	(0.023)	(0.023)
Business & admin studies	-0.139***	-0.150***	-0.152***	0.015	0.007	-0.006
	(0.039)	(0.038)	(0.038)	(0.034)	(0.034)	(0.034)
Mass comm. & document.	-0.106***	-0.115***	-0.126***	-0.010	-0.017	-0.021
	(0.038)	(0.038)	(0.038)	(0.025)	(0.025)	(0.025)
Historical & philosophical	-0.137***	-0.146***	-0.161***	-0.034	-0.041	-0.044
	(0.032)	(0.032)	(0.032)	(0.029)	(0.029)	(0.028)
Creative arts & design	-0.110***	-0.120***	-0.123***	-0.119***	-0.127***	-0.121***
	(0.031)	(0.031)	(0.031)	(0.026)	(0.026)	(0.025)
Education	0.001	0.006	-0.011	0.096***	0.098***	0.045**
	(0.032)	(0.032)	(0.033)	(0.021)	(0.021)	(0.022)
Combined	-0.008	-0.009	0.001	0.027	0.028	0.049**
	(0.024)	(0.024)	(0.024)	(0.021)	(0.021)	(0.021)
Mean A-Level scores		0.072***	0.070***		0.060***	0.059***
		(0.013)	(0.013)		(0.013)	(0.012)
PG indicator			0.037***			0.119***
			(0.014)			(0.013)
Good Degree (I/2I)			0.104***			0.089***
			(0.011)			(0.011)
Observations	4949	4949	4949	5678	5678	5678
R^2	0.381	0.385	0.397	0.327	0.330	0.348

Note: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Merged LFS/HESA graduate sample (see sample notes for details). Omitted category: New (post-1992) universities; Lower Second Class or Below (2II) degree; Languages.

Controlling for HEI selectivity has also the effect of narrowing the wage gap between different subjects. For instance, the returns to studying the Medicine & Dentistry, the most financially lucrative subject, would be reduced by about two fifths for men and one sixth for women.

Figure 7 shows the estimates for the Master Degree wage premium by UG HEI types under various sets of controls. Under the most basic controls, the returns to obtaining a Master's Degree is the highest for Old universities, closely followed by New universities, with non-Oxbridge (i.e. Oxford or Cambridge) Russell Group having the lowest returns. Taking into account the variation in A-Level tariff scores of one's UG HEI turns out to have virtually no difference on the Master Degree wage premium for any HEI type. Further controlling for good degree and degree subjects appear to have similar effect on all HEI types, hence does not fundamentally change the overall pattern.[20]

Figure 7: Master Degree Premium by UG HEI type, various controls



Note: Wage premium for Master's Degree as opposed to UG degree only. Merged LFS/HESA graduate sample (see sample notes for details). Basic controls include age, age squared, non-White, London and Southeast regions (place of work), gender, and interview year and wave dummies. Adjusted residuals are derived from log wage equations on the same set of regressors as well as HEI-subject mean standardised A-Level entry scores. Post-92 ex-poly universities refers to ex-polytechnics which became universities post-1992.

[20] Figure A5 presents the corresponding graph for the PG premium, which includes other PG qualifications such as PGCE, doctoral and other (professional) qualifications. The patterns are broadly similar.

5. Conclusions

We study the graduate wage premium in the UK using the Secure Lab Quarterly Labour Force Survey, matched by mean standardised A-Level scores at the institution-subject (JACS) level from HESA. Unlike earlier UK studies, we are able to consider the effect of differences in undergraduate degree subjects, degree class and in particular the selectivity of the subject at the institution attended. This is important, as earlier studies from the US (e.g. Loury and Garman 1995) have shown that omitting university performances might lead to biased estimates of the effects of college selectivity.

Our results show that undergraduate degree programme selectivity, as proxied by A-Level tariff scores of the degree programme attended, plays an important role in explaining the variation in the graduate wage premium across HEI types and subjects. Moreover, the extent to which more selective institutions add value varies substantially by subject. However, conditional of undergraduate HEI type, HE selectivity does not appear to affect the returns to postgraduate qualifications.

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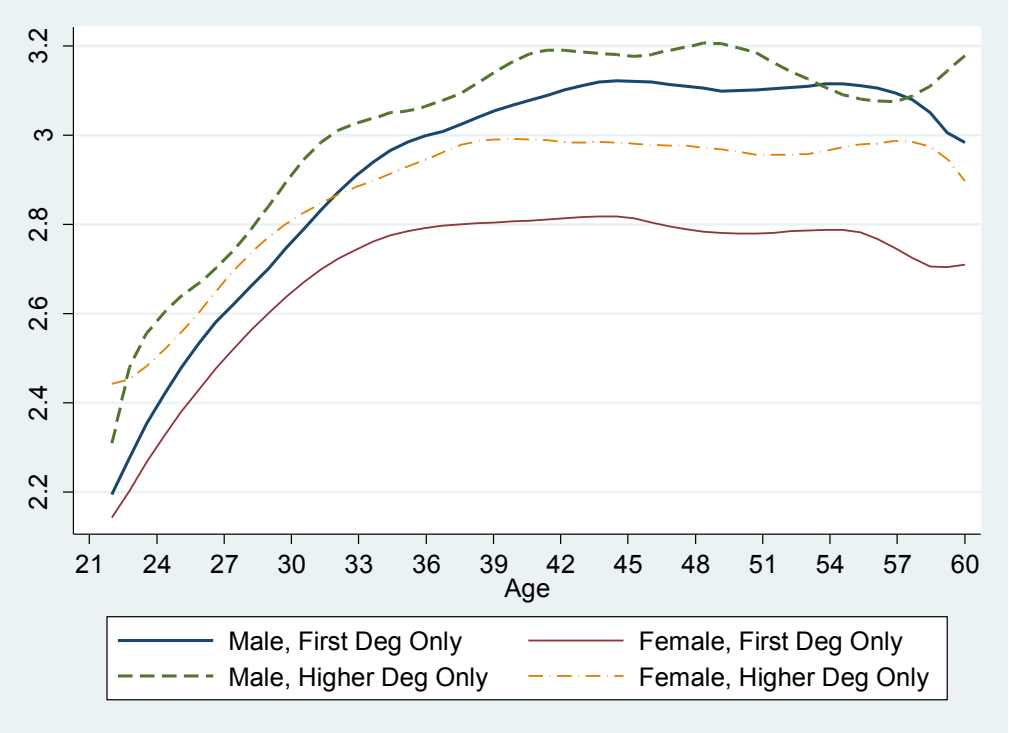
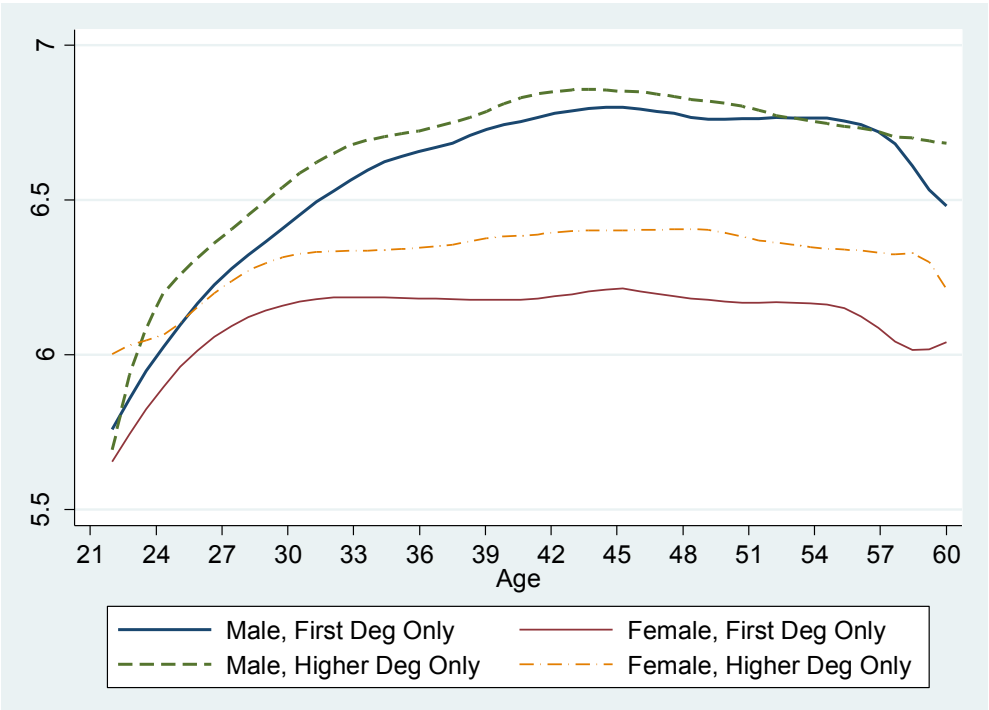
Appendix

Figure A1: Age-wage profile by sex and PG status



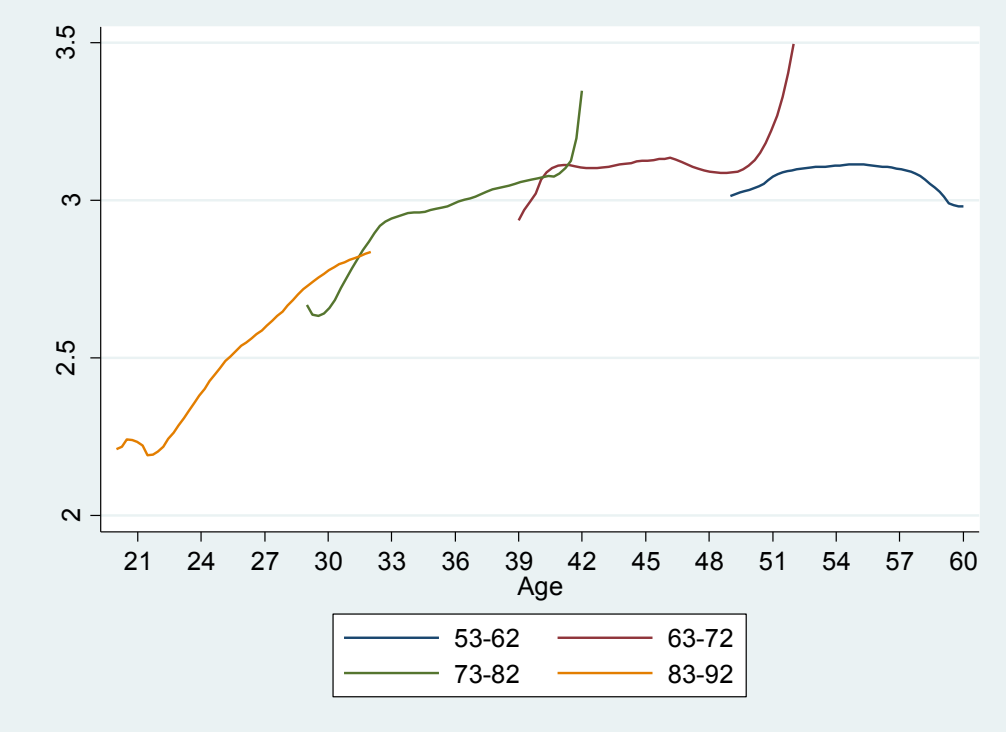
Note: smoothed Epanechnikov kernel-weighted local polynomial regression of log real gross hourly wage (April 2012 constant prices) on age. Full graduate sample (see sample notes for details).

Figure A2: Age-earnings profile by sex and PG status



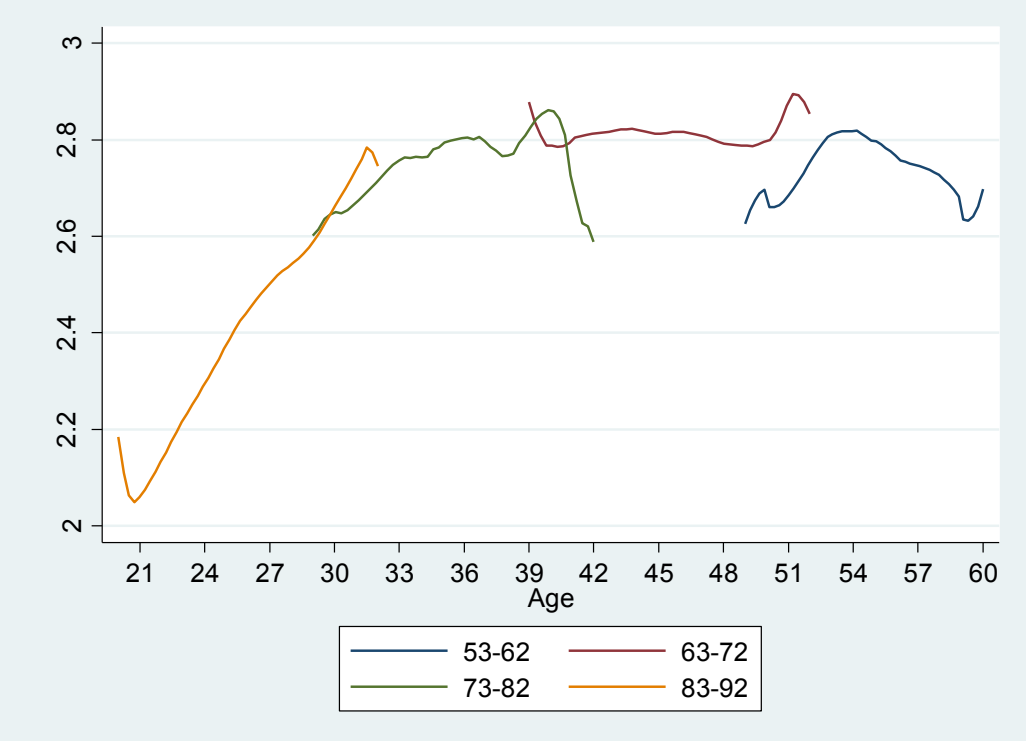
Note: smoothed Epanechnikov kernel-weighted local polynomial regression of log real gross weekly earnings (April 2012 constant prices) on age. Full graduate sample (see sample notes for details).

Figure A3: Age-wage profile by birth cohorts: male undergraduates only



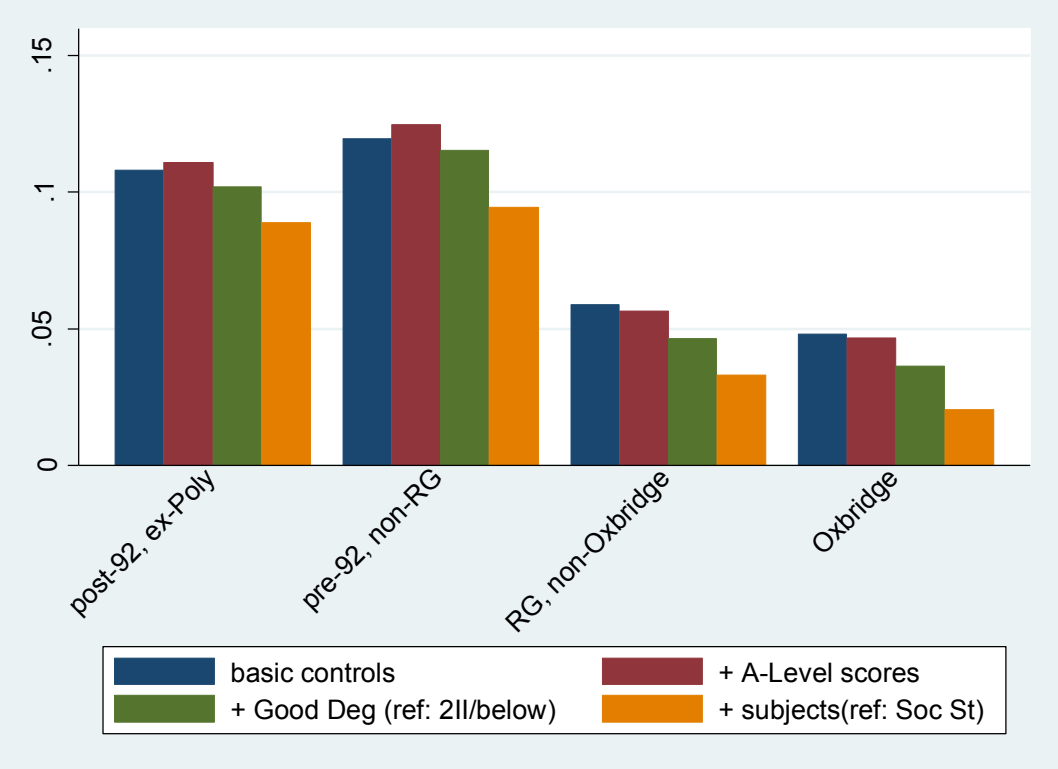
Note: smoothed Epanechnikov kernel-weighted local polynomial regression of log real gross hourly wages (April 2012 constant prices) on age. Full graduate sample (see sample notes for details).

Figure A4: Age-wage profile by birth cohorts: female undergraduates only



Note: smoothed Epanechnikov kernel-weighted local polynomial regression of log real gross hourly wages (April 2012 constant prices) on age. Full graduate sample (see sample notes for details).

Figure A5: PG Premium by UG HEI type, various controls



Note: PG includes all post-graduate qualifications. Merged LFS/HESA graduate sample (see sample notes for details). Basic controls include age, age squared, non-White, London and Southeast regions (place of work), gender, and interview year and wave dummies. Adjusted residuals are derived from log wage equations on the same set of regressors as well as HEI-subject mean standardised A-Level entry scores. Post-92 ex-poly universities refers to ex-polytechnics which became universities post-1992. Pre-92 non RG universities refers to pre-1992 universities which are not Russell Group. RG non-Oxbridge universities refers to the association of 24 public research universities known as the Russell Group (as of 2012) excluding Oxford and Cambridge. Oxbridge refers to Oxford and Cambridge universities.

Table A1: Log real gross weekly earnings by subject, HEI type and gender, graduate sample

	Men				Women			
	New	Old	RG	Total	New	Old	RG	Total
JACS Subject Area (numerical)								
Medicine & dentistry	6.67	7.04	7.16	7.11	6.39	6.60	6.74	6.68
Biological/Veterinary sciences	6.37	6.39	6.65	6.49	6.13	6.11	6.27	6.18
Agriculture & related	6.54	6.47	6.72	6.58	6.06	6.00	6.26	6.13
Physical sciences	6.55	6.60	6.72	6.65	6.13	6.13	6.26	6.19
Mathematics & computing	6.50	6.64	6.79	6.65	6.14	6.34	6.36	6.29
Engineering & technology	6.70	6.76	6.86	6.77	6.08	6.38	6.44	6.30
Architecture, building & planning	6.65	6.63	6.62	6.64	6.22	5.89	6.35	6.24
Social studies	6.45	6.57	6.71	6.59	6.11	6.13	6.26	6.17
Law	6.42	6.59	6.80	6.61	6.07	6.31	6.43	6.24
Business & administrative studies	6.61	6.77	6.75	6.68	6.24	6.29	6.43	6.29
Mass communications & docs	6.22	6.34	6.42	6.29	6.13	5.91	6.19	6.10
Languages	6.42	6.37	6.61	6.51	6.05	6.01	6.17	6.09
Historical/philosophical studies	6.33	6.48	6.48	6.45	5.97	6.16	6.19	6.14
Creative arts & design	6.30	6.48	6.26	6.33	5.85	5.94	5.97	5.89
Education	6.49	6.49	6.61	6.53	6.17	6.23	6.24	6.21
Combined	6.53	6.60	6.69	6.60	6.09	6.08	6.28	6.14
Total	6.52	6.60	6.72	6.61	6.11	6.14	6.29	6.18

Note: full graduate sample (see sample note for details). April 2012 constant prices. New universities refer to ex-polytechnics which became universities post-1992. Old universities refer to pre-1992 universities which are not Russell Group. RG universities refers to the association of 24 public research universities known as the Russell Group (as of 2012).

Table A2: Log real gross hourly wages and log real gross weekly earnings by region (of place of work) and gender, full graduate sample

	Log gross hourly wage		Log gross weekly earnings	
	Men	Women	Men	Women
Region of Place of Work				
Tyne & Wear	2.78	2.67	6.42	6.11
Rest of Northern	2.80	2.65	6.45	6.12
South Yorkshire	2.81	2.69	6.43	6.14
West Yorkshire	2.89	2.69	6.52	6.14
Rest of Yorks &	2.84	2.63	6.48	6.06
East Midlands	2.89	2.71	6.55	6.14
East Anglia	2.91	2.66	6.57	6.07
Central London	3.22	3.06	6.90	6.62
Inner London	3.14	2.89	6.77	6.39
Outer London	3.03	2.84	6.66	6.28
Rest of South Ea	3.00	2.76	6.66	6.15
South West	2.94	2.68	6.58	6.09
West Midlands Me	2.95	2.77	6.61	6.22
Rest of West Mid	2.92	2.68	6.57	6.03
Greater Manchest	2.89	2.70	6.52	6.16
Merseyside	2.83	2.74	6.47	6.19
Rest of North We	2.91	2.66	6.55	6.09
Wales	2.85	2.73	6.49	6.14
Strathclyde	3.04	2.83	6.71	6.33
Rest of Scotland	3.07	2.76	6.71	6.13
Northern Ireland	2.76	2.58	6.44	6.06
Total	2.96	2.75	6.61	6.18

Note: full graduate sample (see sample note for details). All monetary variables in April 2012 constant prices

Table A3: Wage equations with PG and degree class controls, various specifications, full graduate sample

	Men			Women		
	Baseline	+subject	+Family	Baseline	+subject	+Family
	(1)	(2)	(3)	(4)	(5)	(6)
Pre-92 universities	0.056***	0.065***	0.065***	0.026**	0.028**	0.024**
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Russell Group universities	0.080***	0.074***	0.072***	0.093***	0.090***	0.092***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
First degree from Welsh uni	-0.018	-0.018	-0.021	-0.008	-0.012	-0.011
	(0.021)	(0.020)	(0.020)	(0.022)	(0.022)	(0.022)
First degree from NI uni	-0.066	-0.061	-0.049	-0.007	-0.009	0.002
	(0.053)	(0.051)	(0.051)	(0.045)	(0.045)	(0.044)
Master's	0.058***	0.054***	0.054***	0.156***	0.152***	0.145***
	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Doctorate	0.081***	0.105***	0.104***	0.211***	0.215***	0.212***
	(0.020)	(0.020)	(0.020)	(0.024)	(0.024)	(0.024)
PGCE	-0.067***	-0.032	-0.033	0.103***	0.092***	0.094***
	(0.017)	(0.023)	(0.023)	(0.012)	(0.015)	(0.015)
PG type other or don't know	0.022	-0.003	0.007	0.207***	0.175***	0.173***
	(0.027)	(0.027)	(0.027)	(0.023)	(0.023)	(0.023)
Degree Class: Distinction	0.097***	0.088***	0.091***	0.144***	0.139***	0.136***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Degree Class: Merit (2I)	0.078***	0.086***	0.086***	0.110***	0.109***	0.110***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Degree Class: Third class	-0.044**	-0.057***	-0.052***	-0.048*	-0.046*	-0.040
	(0.019)	(0.019)	(0.019)	(0.026)	(0.026)	(0.026)
Degree Class: Pass	-0.107***	-0.118***	-0.110***	0.025	0.014	0.010
	(0.026)	(0.026)	(0.026)	(0.029)	(0.029)	(0.030)
Degree Class: Other	-0.003	-0.049	-0.047	0.285***	0.187***	0.186***
	(0.050)	(0.048)	(0.048)	(0.035)	(0.035)	(0.035)
Degree Class: unknown	-0.048*	-0.069**	-0.081***	0.110***	0.089***	0.084***
	(0.029)	(0.028)	(0.028)	(0.030)	(0.029)	(0.029)
Medicine Pass degree	0.485***	0.221***	0.209***	0.494***	0.254***	0.265***
	(0.048)	(0.060)	(0.060)	(0.048)	(0.056)	(0.056)
Born 50s * good degree	-0.070**	-0.084***	-0.084***	-0.068**	-0.069**	-0.081***
	(0.031)	(0.031)	(0.031)	(0.030)	(0.030)	(0.030)
Born 60s * good degree	-0.036	-0.040*	-0.047**	-0.107***	-0.112***	-0.105***
	(0.022)	(0.022)	(0.022)	(0.023)	(0.023)	(0.023)
Born 70s * good degree	-0.021	-0.023	-0.028	-0.033	-0.027	-0.028
	(0.020)	(0.020)	(0.020)	(0.021)	(0.021)	(0.021)
Medicine & dentistry		0.323***	0.311***		0.263***	0.258***
		(0.040)	(0.039)		(0.032)	(0.033)
Biological/Veterinary sci.		-0.031	-0.032		0.000	-0.002
		(0.021)	(0.021)		(0.017)	(0.017)
Agriculture & related		-0.049	-0.057		-0.056	-0.060
		(0.046)	(0.046)		(0.038)	(0.038)
Physical sciences		0.024	0.022		-0.006	-0.012
		(0.021)	(0.021)		(0.023)	(0.022)
Mathematics & computing		0.105***	0.108***		0.127***	0.127***
		(0.020)	(0.020)		(0.027)	(0.027)
Engineering & technology		0.155***	0.152***		0.065*	0.049
		(0.019)	(0.019)		(0.038)	(0.037)
Architec,building & planning		0.064***	0.062**		-0.036	-0.034
		(0.024)	(0.024)		(0.039)	(0.039)
Social studies		0.102***	0.098***		0.077***	0.077***
		(0.028)	(0.028)		(0.025)	(0.024)

Table A3: Continued

	Men			Women		
	Baseline	+subject	+Family	Baseline	+subject	+Family
	(1)	(2)	(3)	(4)	(5)	(6)
Law		0.131***	0.125***		0.080***	0.074***
		(0.020)	(0.020)		(0.018)	(0.018)
Business & administrative		-0.141***	-0.138***		-0.064**	-0.070**
studies		(0.033)	(0.033)		(0.028)	(0.028)
Mass comm. & document.		-0.081***	-0.080***		-0.053***	-0.052***
Historical & philosophical st.		-0.135***	-0.132***		-0.059***	-0.064***
		(0.025)	(0.025)		(0.023)	(0.023)
Creative arts & design		-0.121***	-0.120***		-0.142***	-0.150***
		(0.026)	(0.026)		(0.021)	(0.021)
Education		0.011	-0.003		0.032*	0.031*
		(0.027)	(0.027)		(0.017)	(0.017)
Combined		0.037*	0.039**		0.027*	0.027*
		(0.019)	(0.019)		(0.016)	(0.016)
Observations	10137	10137	10137	10460	10460	10460
R^2	0.291	0.321	0.334	0.249	0.266	0.279

Note: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Full graduate sample (see sample notes for details). Omitted category: New (post-1992) universities; English University Degree; Lower Second Class (2II) degree; Languages.

Table A4: Wage equations, with and without imputed A-Level scores

	With imputed A-Levels		Without imputed A-Levels	
	Men	Women	Men	Women
Old universities	0.044***	0.005	0.046*	0.053**
	(0.015)	(0.014)	(0.027)	(0.024)
Russell Group unis	0.092***	0.083***	0.071**	0.110***
	(0.018)	(0.017)	(0.029)	(0.026)
Medicine & dentistry	0.142***	0.324***	0.119*	0.237***
	(0.047)	(0.037)	(0.062)	(0.044)
Biol/Vet sciences	-0.089***	-0.011	-0.155***	-0.075***
	(0.026)	(0.021)	(0.036)	(0.027)
Agriculture & related	-0.074	-0.068	-0.168*	-0.103
	(0.056)	(0.045)	(0.092)	(0.093)
Physical sciences	-0.022	0.007	-0.056	-0.017
	(0.027)	(0.028)	(0.042)	(0.042)
Maths & computing	0.065***	0.156***	0.041	0.174***
	(0.025)	(0.034)	(0.036)	(0.044)
Engineering & Tech	0.076***	0.078	0.048	0.009
	(0.025)	(0.050)	(0.038)	(0.072)
Architecture, build/plan	0.010	-0.014	0.014	-0.119*
	(0.031)	(0.050)	(0.057)	(0.065)
Social studies	0.016	0.080***	-0.090*	-0.011
	(0.034)	(0.029)	(0.047)	(0.036)
Law	0.074***	0.112***	0.014	0.068**
	(0.025)	(0.023)	(0.035)	(0.031)
Business & administrative studies	-0.152***	-0.006	-0.144***	0.014
	(0.038)	(0.034)	(0.052)	(0.050)
Mass comm. & docs	-0.126***	-0.021	-0.101**	-0.096***
	(0.038)	(0.025)	(0.045)	(0.033)
Historical & philosophical st.	-0.161***	-0.044	-0.134***	-0.046
	(0.032)	(0.028)	(0.044)	(0.036)
Creative arts & design	-0.123***	-0.121***	-0.118***	-0.168***
	(0.031)	(0.025)	(0.041)	(0.032)
Education	-0.011	0.045**	0.097	0.099***
	(0.033)	(0.022)	(0.072)	(0.036)
Combined	0.001	0.049**	0.000	0.000
	(0.024)	(0.021)	(.)	(.)
Mean A-Level scores	0.070***	0.059***	0.083***	0.064***
	(0.013)	(0.012)	(0.021)	(0.019)
PG indicator	0.037***	0.119***	0.016	0.071***
	(0.014)	(0.013)	(0.025)	(0.022)
Good Degree (I/2I)	0.104***	0.089***	0.110***	0.111***
	(0.011)	(0.011)	(0.019)	(0.019)
Observations	4949	5678	1425	1664
R^2	0.397	0.348	0.369	0.394

Note: Robust standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Merged LFS/HESA graduate sample. Omitted category: New universities; Lower Second Class or Below (2II); Languages.

Table A5: Estimation of residual wages, without and with imputed A-Level scores

	Using imputed A-Levels		Without imputed A-Levels	
	No A-Level control	A-Level control	No A-Level control	A-Level control
	(1)	(2)	(3)	(4)
Age of respondent	0.189***	0.188***	0.219***	0.213***
	(0.009)	(0.009)	(0.049)	(0.048)
Age squared	-0.002***	-0.002***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.001)	(0.001)
Non-white	-0.068***	-0.057***	-0.063***	-0.050**
	(0.015)	(0.014)	(0.024)	(0.023)
year2013	0.040***	0.038***	0.042**	0.047***
	(0.010)	(0.010)	(0.017)	(0.017)
year2014	0.073***	0.068***	0.061***	0.062***
	(0.010)	(0.010)	(0.017)	(0.017)
year2015	0.082***	0.079***	0.098***	0.098***
	(0.012)	(0.012)	(0.020)	(0.019)
wave5ind	0.009	0.004	0.020	0.012
	(0.008)	(0.008)	(0.013)	(0.012)
London	0.320***	0.307***	0.297***	0.270***
	(0.010)	(0.010)	(0.016)	(0.015)
Southeast	0.101***	0.096***	0.105***	0.093***
	(0.011)	(0.011)	(0.017)	(0.017)
Female	-0.121***	-0.120***	-0.078***	-0.078***
	(0.008)	(0.008)	(0.012)	(0.012)
Mean Standardized A-Level score		0.133***		0.127***
		(0.006)		(0.010)
Constant	-0.880***	-0.874***	-1.241**	-1.171*
	(0.138)	(0.136)	(0.621)	(0.611)
Observations	10627	10627	3089	3089
R^2	0.314	0.341	0.280	0.316

Note: Robust Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Columns (1) and (2) copied from Table 5. Merged LFS/HESA graduate sample (see sample notes for details). Residuals from the two specifications used as unadjusted and (A-Level) adjusted residual wages in Figures 2 and 3.