Skills for the nation: engineering undergraduates in the UK

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Royal Academy of Engineering

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Executive summary

There is good econometric evidence from the Royal Academy of Engineering *Jobs and growth* report[1] that the demand for graduate engineers[2] exceeds supply and the demand is pervasive across all sectors of the economy. The implication of this is that the economy needs more graduate engineers for both engineering and non-engineering jobs.

However, it is not immediately obvious where these will come from as UK engineering Higher Education is a complex structure of 182 independent institutions[3] that offer a wide variety of engineering programmes[4] and this landscape is poorly understood. This report provides a mapping of that landscape and a sense of how it has been changing over time.

UK engineering higher education enjoys a good reputation for quality, underpinned by an effective and internationally recognised system of accreditation undertaken by 22 of the professional engineering institutions licensed by the Engineering Council, the UK regulatory body for the engineering profession. As a result, UK engineering graduates should be seen as a valuable resource for the nation.

Undergraduate engineering in Pre'92[5] universities (46 in total accepting engineering students in 2012) is demonstrating characteristics of security and strength. UCAS tariffs for UK domiciled students are generally high and rising further. The number of acceptances have held steady over recent years whilst the ratio of acceptances to applications has been falling. This suggests strong demand. Engineering programmes in the UK's most established universities are attracting strong students for programmes that are generally acknowledged by observers to be high challenge programmes. In turn, students with lower prior attainment are less likely to gain a place on these programmes.

There are more Post'92 universities (63 in total) accepting undergraduate students to engineering programmes. However, the average number recruited per institution (150) is less than half that of Pre'92 universities (323) and acceptances to engineering programmes in Post'92 universities have fallen overall since 2010. This is despite many Post'92 universities having accredited degree programmes and the staff, facilities and resources that go with these. The average UCAS tariff remains 150 points lower than in Pre'92 universities despite rises at most Post'92 institutions and the proportion of students accepted through clearing is twice that found in Pre'92 universities. These factors are inhibiting Post'92 institutions from playing their full role in the supply of quality engineering graduates.

Provision in FE Colleges recruited through UCAS is currently less than 3% of the total for undergraduate engineering in the UK (although students are also recruited directly to Level 4+ programmes by Colleges themselves and these numbers are not included here) and the UCAS recruitment is currently highly dependent on recruiting students through the clearing process. The average number of UCAS recruited students per College is currently very low (less than 10). However, FE Colleges have been recruiting students with prior attainment almost as high as that of students recruited to Post'92 universities.

For the purposes of this report, the authors propose five indications of a healthy state for a subject in Higher Education:

- **(i) Professional accreditation of degree programmes.**
- **(ii) The ability to attract and recruit a consistent number of students.**
- **(iii) The ability to recruit a significant number of students with high levels of prior attainment.**
- **(iv) The ability to retain students to the completion of their degrees.**
- **(v) An admissions profile that is not dominated by admissions through clearing.**

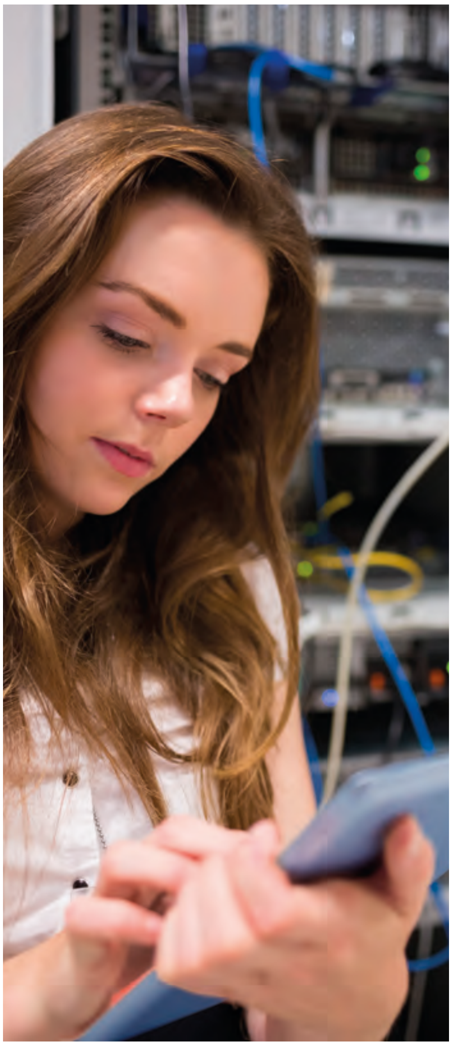
1 Matthew Harrison (2012), *Jobs and growth*, Royal Academy of Engineering

2 The term *graduate engineers* refers to people working in professional engineering occupations and holding engineering degrees. Its use here is not limited to recent graduates of engineering degree programmes.

3 Authors' calculation using UCAS acceptance data 2012

4 The term *programme* is used throughout to describe a taught curriculum of undergraduate study leading on completion to the award of a degree or Higher National Diploma. Programmes will generally comprise a number of *courses* or *modules*.

5 The year 1992 is used to delineate types of institution because that was the year that polytechnics in the UK became universities.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On the basis of these indicators, the findings and recommendations arising from this work are:

1. Provision in Post'92 universities looks more vulnerable than provision elsewhere. These more recent universities have been losing their share of engineering students to Pre'92 universities and it is important that they begin to grow once more in order to play their full role in the supply of quality graduates. Provision in Post'92 universities may also be threatened by FE Colleges able to recruit equally strong students and growing their provision (albeit from a very low base). **This should be investigated further and the state of engineering provision in Post'92 universities should be monitored closely by the Department for Business Innovation and Skills (BIS) and by the national HE funding agencies and action taken if further vulnerability is found.**

2. Provision in FE Colleges looks vulnerable in a different sense. It is growing overall, but the numbers recruited through UCAS at each individual institution are very small at present and highly reliant on the clearing system (although individual colleges also admit students to Level 4+ programmes directly and these numbers are not included in the analysis shown here). It is hard to provide a good engineering education with only a small income per institution. **The complete picture on admissions to engineering programmes in FE Colleges should be sought from the Association of Colleges. Outcomes from engineering programmes in FE Colleges should be monitored closely by BIS and the Association of Colleges until a critical mass of students is gained.**

3. Although undergraduate engineering provision in Pre'92 universities shows characteristics of security and strength overall, some engineering disciplines are weaker with falling applications and acceptances and attracting students with significantly lower prior attainment. **Electrical and electronic engineering and Manufacturing and production engineering are two subjects that should be monitored closely by BIS and the national HE funding agencies.**

4. At least 98% of engineering undergraduates with the highest prior attainment (measured by UCAS points on acceptance) continue to the second year of their chosen degree programme. For students with lower prior attainment the proportion can be as low as 83%. Continuation rates in engineering are lower than the average for Higher Education as a whole by up to two percentage points. **Reasons for this should be determined through further research.**

5. The demand for graduate engineers in the UK economy exceeds supply. The very high (and rising) average UCAS points held by UK domicile students on engineering programmes in Pre'92 universities might suggest that those programmes are now at capacity. **Any rapid growth in the number of engineering graduates will therefore require incentivising further growth in Pre'92 universities, reversing declines in Post'92 universities or greater support for the still fledgling growth in FE Colleges.**

Introduction

There is good econometric evidence from the Royal Academy of Engineering *Jobs and growth* report[6] that the demand for graduate engineers[7] exceeds supply and the demand is pervasive across all sectors of the economy. The implication of this is that the economy needs more graduate engineers for both engineering and non-engineering jobs. However, it is not immediately obvious where these will come from.

Some of the engineers required in the economy may be experienced recruits attracted to work in the UK from abroad. Employers in the UK are in a global competition for graduate talent and this is an important feature of an internationally competitive labour market. However, there are obvious advantages to the formation of a good number of engineers in the UK. One is making sure that UK citizens get their share of *good jobs*[8]. Another is assuring a pool of indigenous engineering skills as this is a pre-requisite for investment in productive industry in the UK and a requirement for national security. A third is retaining more of the *value* created by engineers within the UK economy: capital value, human capital and the intangible components of capital such as innovation.

UK engineering higher education enjoys a good reputation for quality, underpinned by an effective and internationally recognised system of accreditation undertaken by 22 of the professional engineering institutions licensed by the Engineering Council, the UK regulatory body for the engineering profession. As a result, UK engineering graduates should be seen as a valuable resource for the nation. However, UK engineering Higher Education is a complex structure of 182 independent institutions[9] that offer a wide variety of engineering programmes and this landscape is poorly understood. This report provides a mapping of that landscape and a sense of how it has been changing over time. Areas of strength and relative vulnerability are identified by the mapping.

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6 Matthew Harrison (2012), *Jobs and growth*, Royal Academy of Engineering

7 The term *graduate engineers* refers to people working in professional engineering occupations AND to people holding engineering degrees. Its use here is not limited to recent graduates of engineering degree programmes.

8 Francis Green (2009), *Job quality in Britain*, Praxis No 1, UKCES

9 Authors' calculation using UCAS acceptance data 2012

A review of the evidence on demand for engineering graduates

The evidence that the demand for graduate engineers in the UK exceeds supply can be seen in a persistent, sizeable wage premium for people holding engineering degrees and this premium has grown over the last 20 years[10]. There are also wage premia offered for other (but not all) STEM graduates but the size of the premium varies[11]. There is evidence that the demand for people in non-graduate SET occupations (such as technician roles) exceeds supply because wage premia are also offered for many of these occupations[12].

Surveys of the supply of UK educated and trained graduate engineers suggest that demand will exceed supply into the foreseeable future[13]. Independent models of future skills demand are predicting shortages of engineers for all occupational levels (particularly professional and skilled trade levels)[14,15] and the models agree that most of this is *replacement demand* due to skilled people leaving the labour market.

Therefore, even if economic growth in the UK remains sluggish for an extended period, and the demand for engineers remains mostly *replacement demand* rather than expansion demand in most sectors[16], it is important to ensure that the supply of graduate engineers from UK institutions is maintained to avoid serious skills shortages that can slow growth even further.

Maintaining, then expanding, the flow of UK educated engineering graduates requires two things. Firstly, young people need to be equipped with the school and college qualifications required as preparation for engineering degree programmes. Secondly young people actually have to want to become engineers. There are deep problems with both of these in the UK.

The Mathematics and Science learned at school provides the foundation for engineering theory and practice. However, only 50% of 16 year olds in England pass both Mathematics GCSE and at least two Science GCSEs at the age of 16[17]. In some Local Education Areas the proportion is much lower. In addition, progression rates to Mathematics A level for those who achieve a C grade at GCSE are just 1%. For a C grade in Science it is 7%[18]. These factors combine, such that 9 out of 10 young people stop progressing in science and mathematics at the age of 16. With this evidence, the reasons for the skills gap in engineering become obvious and are compounded by the lack of knowledge amongst young people of what an engineering career means – less than 20% of young people aged 12–16 know what engineers do and only 38% consider an engineering career to be desirable[19].

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10 Matthew Harrison (2012), *Jobs and growth*, Royal Academy of Engineering

11 Charley Greenwood, Matthew Harrison, Anna Vignoles (2011), Institute of Education / Royal Academy of Engineering **www.raeng.org.uk/news/releases/shownews.htm?NewsID=701**

12 **www.professional-technician.org.uk** (accessed July 2012)

13 Matthew Harrison (2012), *Jobs and growth*, Royal Academy of Engineering

14 UKCES (2011) *Working futures 2010–20*, UKCES, December 2011

15 Engineering UK (2013) *Engineering UK 2013*, Engineering UK

16 There are known exceptions to this such as the luxury vehicle market where jobs and growth are driving *expansion* demand.

17 Rhys Morgan (2012), *Ability of opportunity?*, E4E

18 DfE (2012), *Subject progression from GCSE to AS and continuation to A level*, DfE Research Report RR-195

19 Engineering UK (2013) *Engineering UK 2013*, Engineering UK

Despite these problems, engineering remains a significant component of Higher Education in the UK. Figure: 1 shows that engineering has been a little over 5% of the sector for the last years (taking a longer view, this has been as high as 6% but the proportion is remarkably consistent).

Consistency may be a manifestation of the problems around supply and demand discussed earlier because Higher Education as a whole has grown strongly over recent decades but engineering has not. Figure: 2 shows that the number of acceptances (all domiciles – home / UK, EU (non UK)

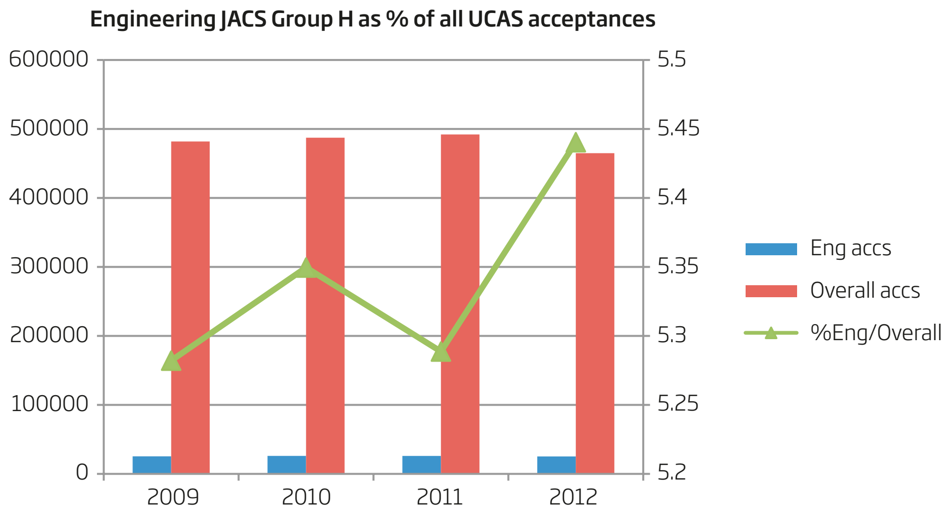


Figure: 1 Source: Authors' analysis of UCAS data – all domiciles. 'Accs' denotes 'acceptances'

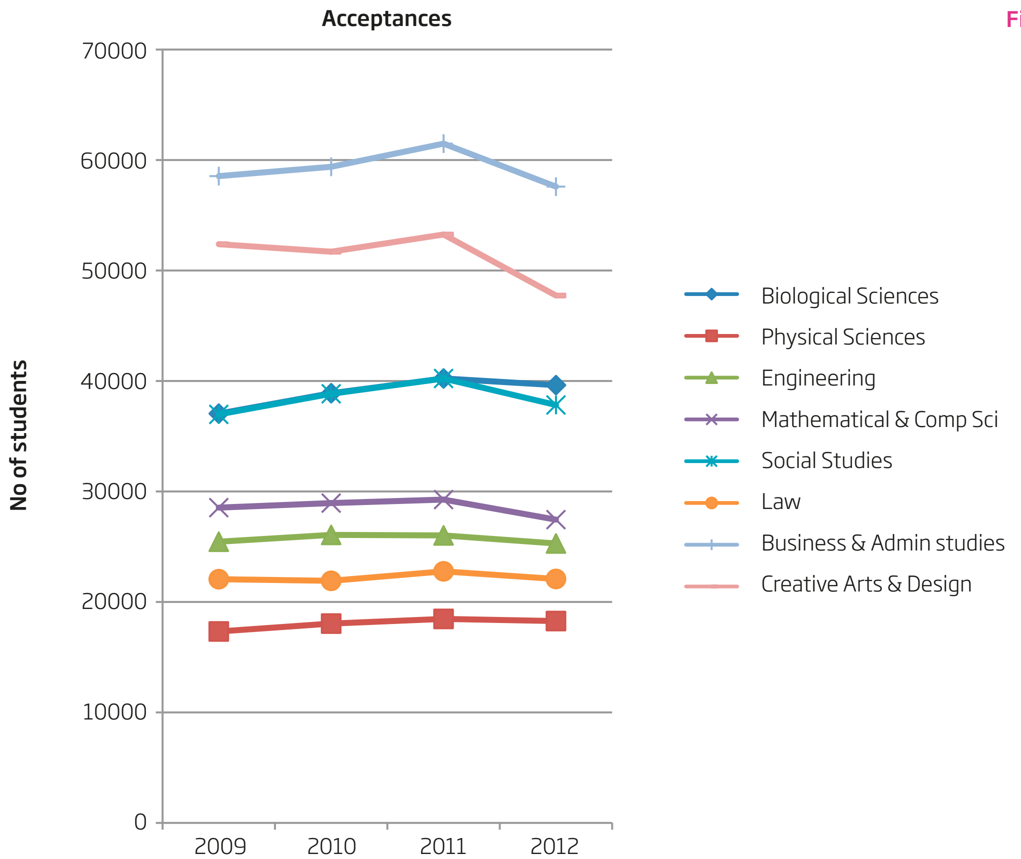
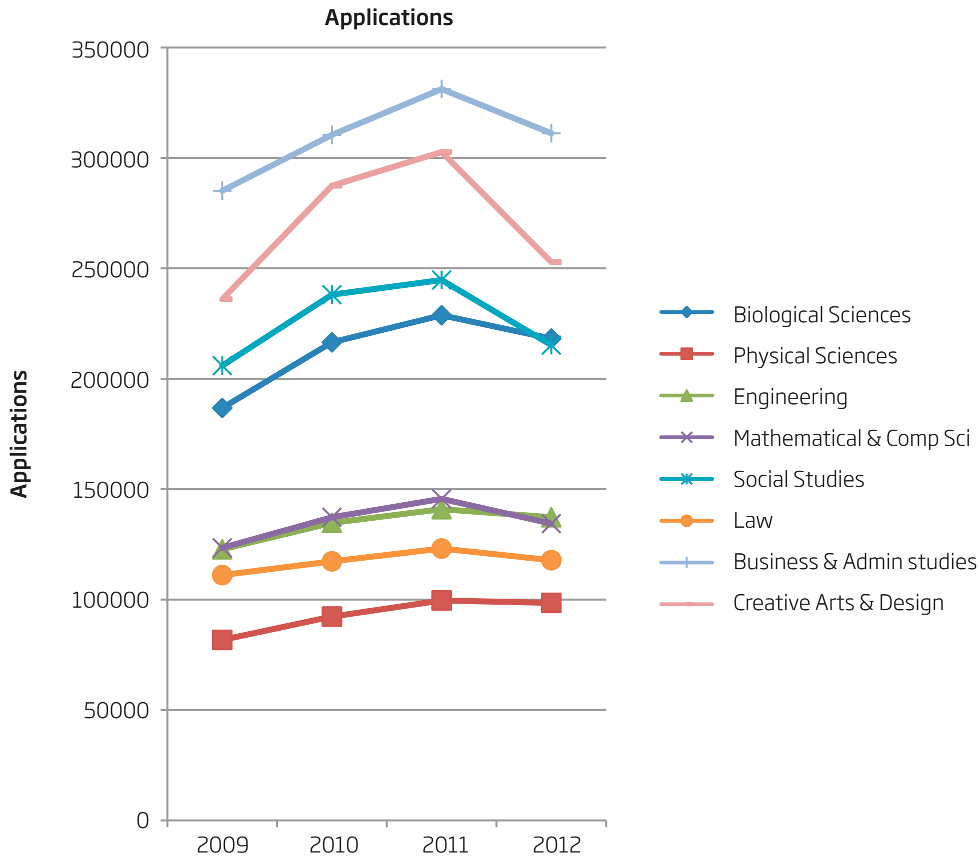


Figure: 2 Source: Authors' analysis of UCAS data – all domiciles and international) on all undergraduate engineering programmes (taken to be only those within JACS Group H) have hardly changed in recent years (nor actually have they changed much over a longer time frame[20]).

The number of applications to undergraduate engineering degrees have hardly changed in recent years either – Figure: 3

Figure: 3 Source: Authors' analysis of UCAS data – all domiciles



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20 HEFCE (2011), *Strategically important and vulnerable subjects: the report of the SIVS review group*, HEFCE

The breadth and depth of undergraduate engineering higher education in the UK

For this report 'undergraduate engineering Higher Education' is taken to be:

- All level 4+ programmes taken in universities, institutes of Higher Education and FE Colleges that had at least one acceptance through the UCAS applications system in 2012 and are in the 'H' group of JACS codes.

This includes Bachelor Degrees, integrated Masters (MEng)[21], Foundation Degrees, HND programmes and Foundation years. It includes programmes in England, Scotland, Wales and Northern Ireland.

The term 'applications' is taken to mean the number of applications received through the UCAS system for a given programme, noting that in recent years applicants could make up to 5 applications to different programmes in a year. Rising applications is taken as a proxy for rising popularity of a programme.

The term 'acceptances' is taken to mean the number of people accepting a place on an HE programme at the end of the UCAS cycle. It is taken as a proxy for the recruitment capacity of the HE system.

For this report, the number of acceptances relates to applicants from all domiciles: home (UK), EU (non-UK) and international recruited through the UCAS system.

The term 'engineering programme' is taken to mean a programme designated to be within the H Groups in the JACS coding system:

- **H1 General engineering**
- **H2 Civil engineering**
- **H3 Mechanical engineering**
- **H4 Aerospace engineering**
- **H5 Naval architecture**
- **H6 Electrical and electronic engineering**
- **H7 Production and manufacturing engineering**
- **H8 Chemical engineering**
- **HH Combinations with engineering (others)**

At this level of classification, there are 670 engineering entries in the 2012 UCAS database. There are 115 sub-classifications in the H group of JACS code and thousands of separate programmes.

There are subjects groupings that might be included in a wide definition of the term 'engineering':

- **JACS Group J – the technology group including materials, mining, ceramics, plastics, textiles, printing, marine and maritime technology, bio-technology, audio, energy, machinery.**
- **JACS Group K – the architecture group including building and planning**
- **JACS Group G – the mathematics and computing group**

To give a sense of relative scale, the number of acceptances (all domiciles) in 2012 were:

21 The integrated Masters (MEng) degree is classified as an undergraduate degree in the UK. It takes four or five years to complete . 31% of students accepted onto undergraduate engineering programmes in England are accepted onto MEng programmes. 72% of those students are UK domiciled – authors' calculations using data supplied by HEFCE.

- Engineering (H) - 24,900
- Technology (J) - 2,345
- Architecture (K) - 7,552
- Mathematics and computing (G) - 27,451 (19,353 of which were in computing)

Considering just engineering (JACS Group H) in 2012, undergraduate engineering programmes (all types) were offered in the following groupings of institutions:

- FE Colleges - 67 institutions
- Non-aligned - 30 institutions
- Million Plus - 28 institutions
- University Alliance - 20 institutions
- Russell Group - 19 institutions
- 1994 Group - 12 institutions
- Guild HE - 6 institutions

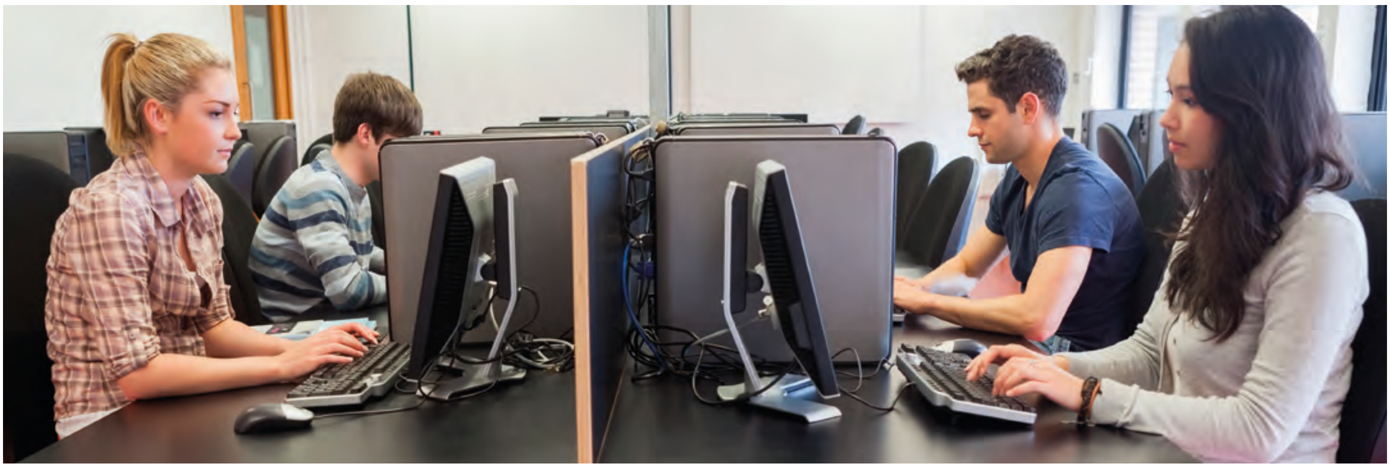
Combining these into three broad classifications:

- Pre'92 universities - 46 institutions and 14,867 acceptances (average of 323 per institution)
- Post'92 universities - 63 institutions and 9,430 acceptances (average of 150 per institution)
- FE Colleges - 73 institutions and 603 acceptances (average of 9 per institution)

Table 1 provides a breakdown according to broad subject classification. More than 50% of the undergraduate engineering provision in the UK is classified as mechanical, civil or electrical / electronic engineering. The distribution across subjects is similar for pre and Post'92 universities but somewhat different in FE Colleges.

Finally, Figures 3 and 4 show the distribution of applications and acceptances in engineering (H – all domiciles) in 2012.

Taking applications as a proxy for popularity and acceptances as a proxy for capacity it appears that engineering undergraduate programmes in pre-1992 universities have greater popularity than they have capacity. One possible interpretation of the proportions shown in these two figures is that applicants to pre-1992 programmes 'settle' for a place in a post-1992 university or in an FE College (noting that the analysis presented here does not include students recruited directly by institutions outside of the UCAS system). Another interpretation is that, on average applicants include more programmes at pre-1992 universities in their UCAS choices than programmes at other types of institution.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	All domiciles	
	No. students	%
Pre 1992 universities		
H3 Mechanical engineering	3727	25.1
H6 Electrical & electronic	2627	17.7
H2 Civil engineering	2376	16.0
H1 General engineering	1985	13.4
H8 Chemical engineering	1982	13.3
H4 Aerospace engineering	1375	9.2
HH Combinations with engineering	386	2.6
H7 Production & manufacturing	316	2.1
H5 Naval architecture	93	0.6
total	**14867**	
Post 1992 universities		
H3 Mechanical engineering	2628	27.9
H2 Civil engineering	1822	19.3
H6 Electrical & electronic	1763	18.7
H1 General engineering	1338	14.2
H4 Aerospace engineering	963	10.2
H7 Production & manufacturing	327	3.5
HH Combinations with engineering	320	3.4
H8 Chemical engineering	232	2.5
H5 Naval architecture	37	0.4
total	**9430**	
FE Colleges		
H6 Electrical & electronic	234	38.8
H3 Mechanical engineering	212	35.2
H1 General engineering	56	9.3
H4 Aerospace engineering	56	9.3
H2 Civil engineering	33	5.5
H8 Chemical engineering	7	1.2
H7 Production & manufacturing	5	0.8
H5 Naval architecture		
HH Combinations with engineering		
total	**603**	

Table: 1 Source: Authors' analysis of 2012 UCAS acceptance data - all domiciles

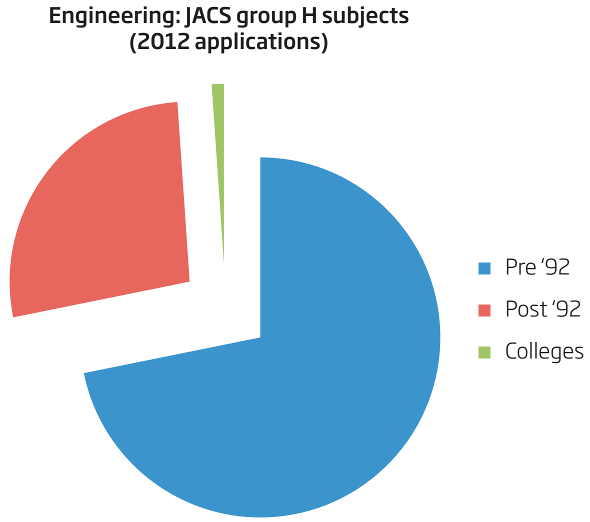


Figure: 3 Source: Authors' analysis of 2012 UCAS applications data - all domiciles

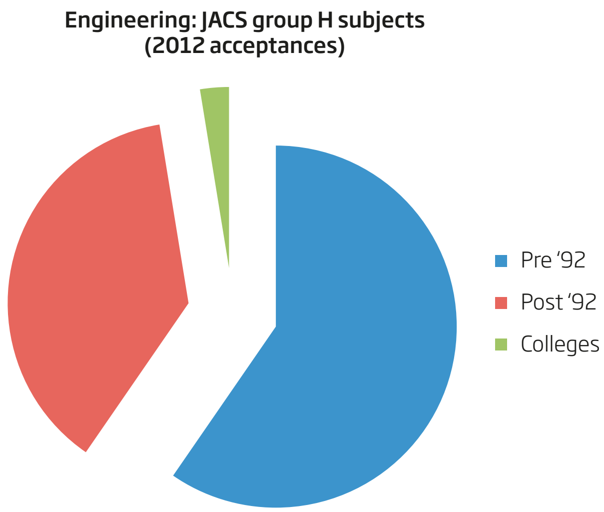


Figure: 4 Source: Authors' analysis of 2012 UCAS acceptance data - all domiciles

The health of undergraduate engineering Higher Education

The health of undergraduate engineering provision is bound up with the health of the HE sector in general. **In addition to the professional accreditation of degree programmes, one indicator of a healthy state is the ability to attract and recruit a consistent number of students.**

Figure: 5 shows the variation in applications and acceptances for undergraduate programmes across all subjects and all domiciles over the last few years. Figure: 6 shows the equivalent data for engineering (JACS group H). The fortunes of engineering closely follow that of the HE sector as a whole.

Figures 7 and 8 show that the fortunes of engineering provision do vary between types of institution. In particular, whilst applications to Post'92 universities have held or increased, acceptances have fallen since 2010. Acceptances in other types of institution have grown.

Figure 9 (a–c) shows the trends in applications and acceptances to JACS Group H subjects in different types of institution.

Figure: 5 Source: Authors' analysis of UCAS data – all domiciles, all subjects. 'Apps' denotes 'applications'. 'Accs' denotes 'acceptances'

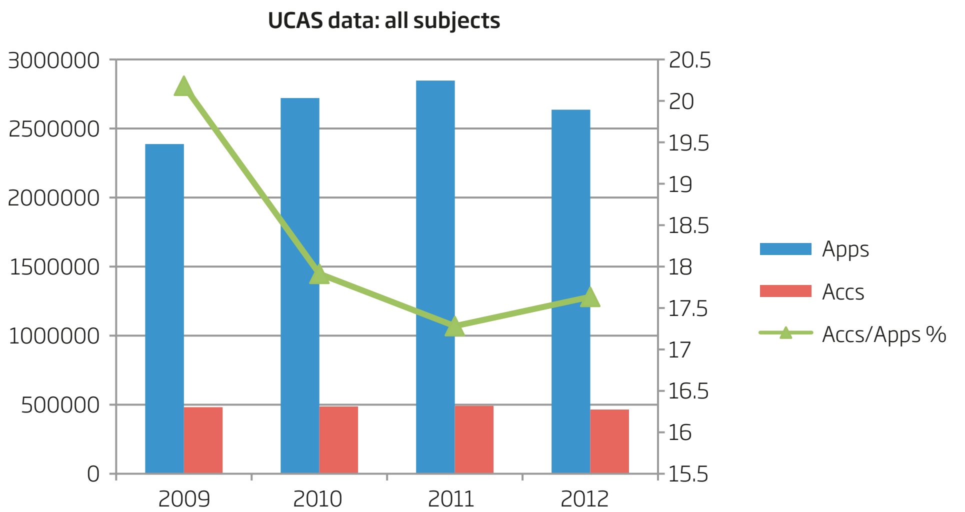
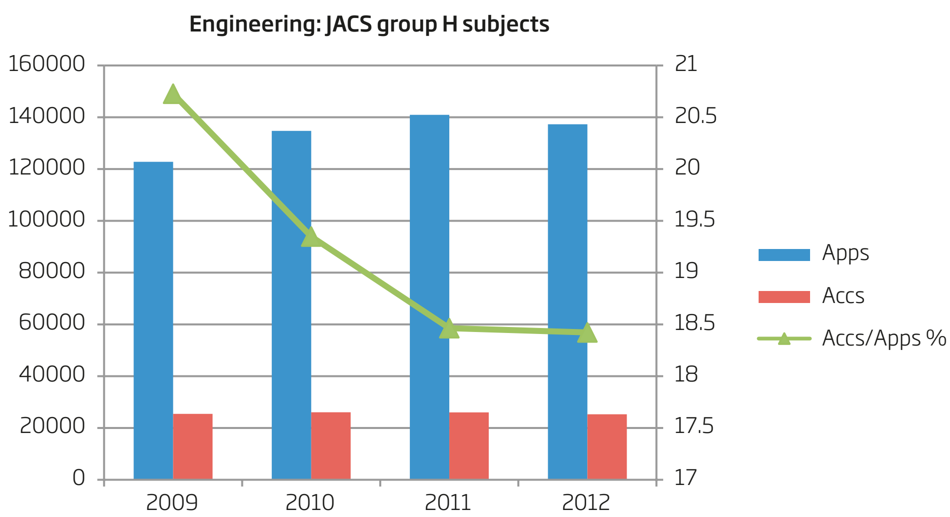


Figure: 6 Source: Authors' analysis of UCAS data – JACS Group H, all domiciles



A summary of the results - applications

- H1 General engineering – the trend has been generally up (but not in Post'92 universities)
- H2 Civil engineering – the trend shows a peak and then a fall. The peak came in 2010 for Pre'92 universities and a year later in other types of institution.
- H3 Mechanical engineering – the trend has been upwards in Pre'92 universities. Maxima were hit in 2011 and 2010 in Post'92 and FE Colleges respectively.
- H4 Aerospace engineering – overall, applications peaked in 2011 and have been falling since then (the trend in FE colleges is different but the numbers too small to be significant).
- H5 Naval architecture – applications are past their peak and now falling.
- H6 Electrical and electronic engineering – a maximum was hit in 2011 and now applications are falling (except in FE Colleges where growth is strong from a relatively low base).
- H7 Production and manufacturing engineering – applications peaked between 2010 and 2011 and are now falling.
- H8 Chemical engineering – the trend has been upwards since 2009.
- HH Combination – trend is generally upwards although they may have peaked in Pre'92 universities.

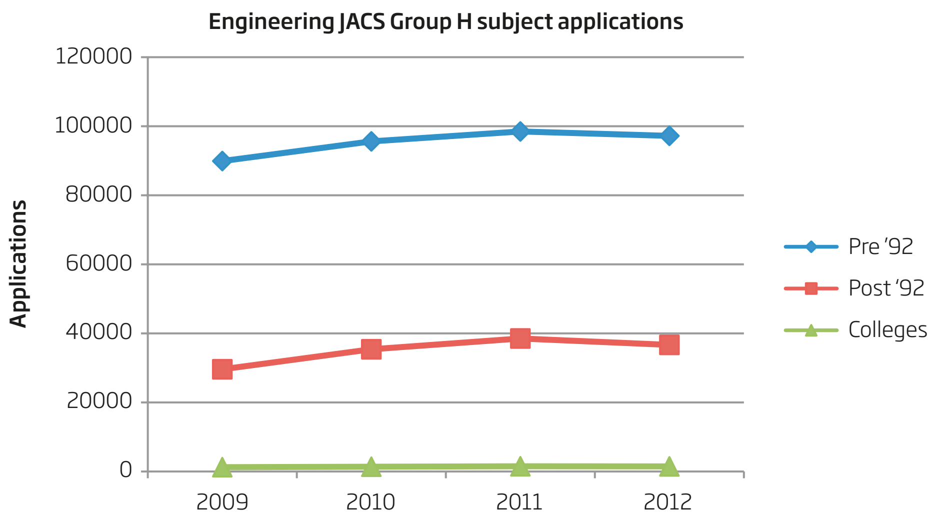


Figure: 7 Source: Authors' analysis of UCAS data - JACS Group H, all domiciles

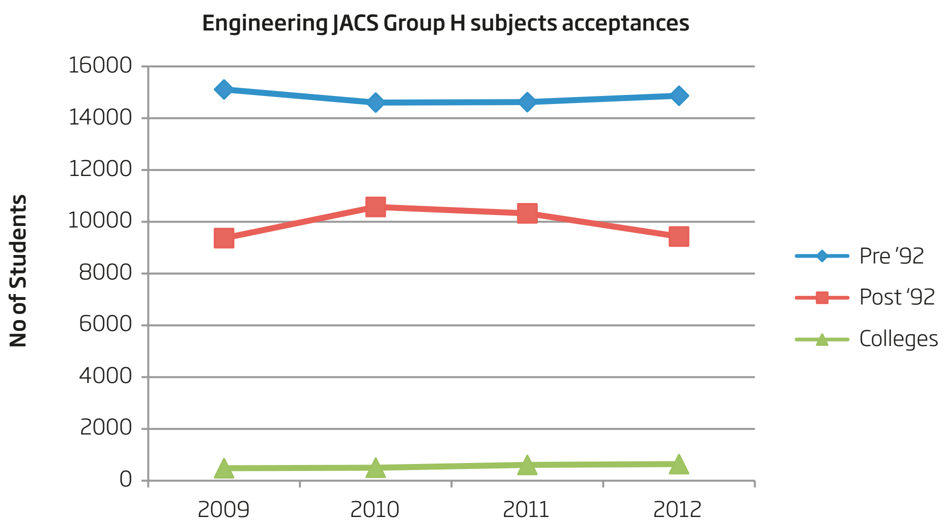


Figure: 8 Source: Authors' analysis of UCAS data - JACS Group H, all domiciles

Figure: 9a Authors' analysis of UCAS data. 'Apps' denotes 'applications'. 'Accs' denotes 'acceptances'

Figure: 9b Authors' analysis of UCAS data. 'Apps' denotes 'applications'. 'Accs' denotes 'acceptances'

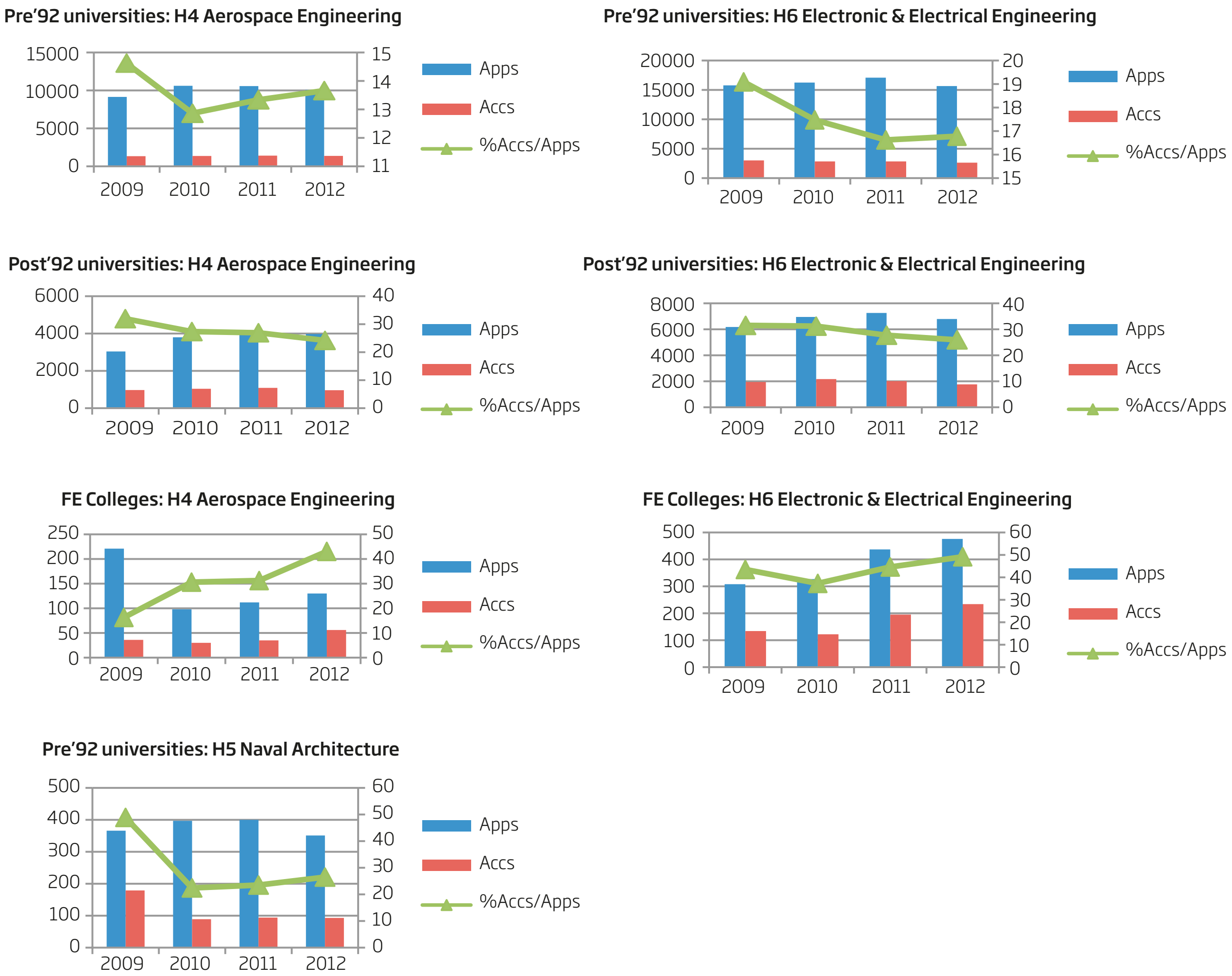


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Figure: 9c Authors' analysis of UCAS data. 'Apps' denotes 'applications'. 'Accs' denotes 'acceptances'

A summary of results – acceptances

The trends for acceptances generally follow those for applications although rises tend to be proportionally smaller and falls proportionally larger because the ratio of acceptances to applications in Pre'92 universities has generally been dropping in recent years (although an increase in 2012 can be seen in many cases). In sharp contrast, the ratios in Post'92 universities and in FE Colleges are much higher (almost twice and three times those in Pre'92 universities respectively) and often rising further with time.

Another indication of a healthy state for a subject in Higher Education is the ability to recruit a significant number of students with high levels of prior attainment

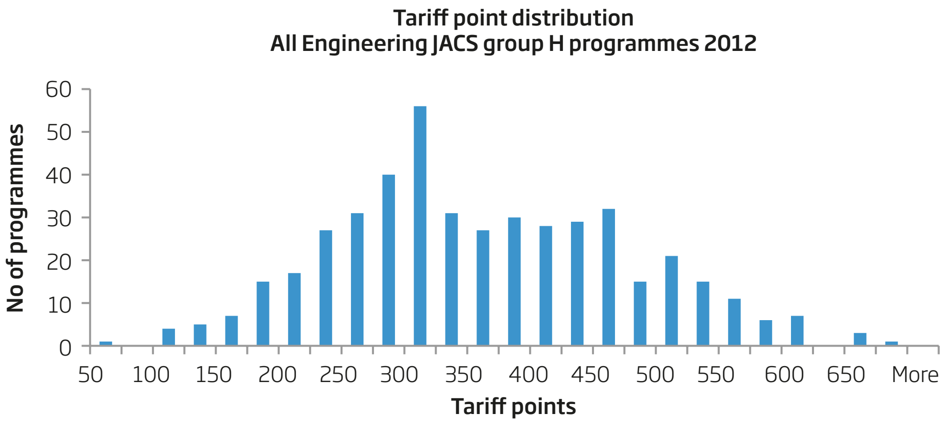

Figure: 10 Source: Authors' analysis of 2012 UCAS data - JACS Group H, UK domiciles only. Frequency count of the number of programmes in UCAS tariff bins according to average UCAS points held by those UK domiciled students accepted onto the programme.

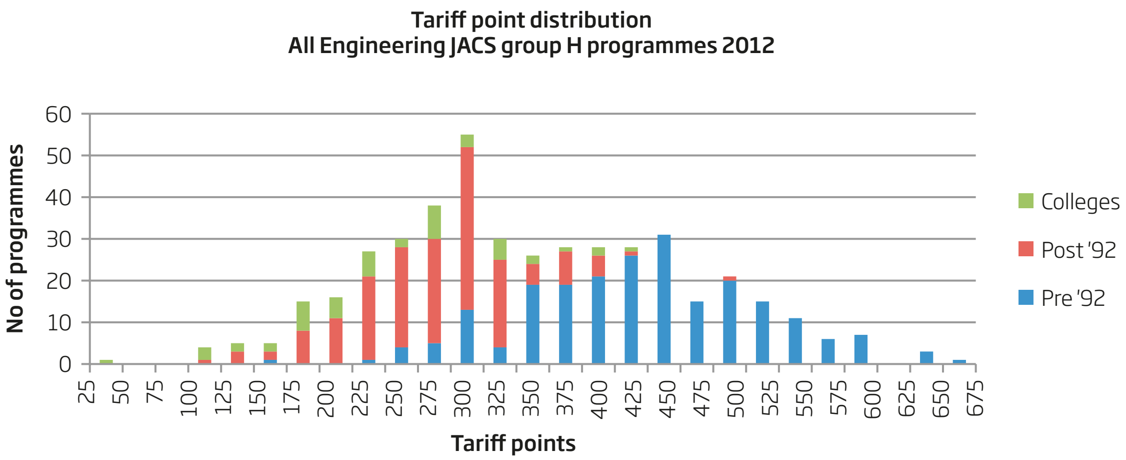

Figure: 11 Source: Authors' analysis of 2012 UCAS data - JACS Group H, UK domiciles only. Frequency count of number of programmes in UCAS tariff bins according to average UCAS points held by those UK domiciled students accepted onto the programme.

(taking UCAS tariff points as a proxy for prior attainment). Figure: 10 shows a frequency count of the number of programmes in UCAS tariff bins according to average UCAS points held by those UK domiciled students accepted onto the programme.

An A* at A level is 140 points. An A is 120 points, B - 100 points, C - 80 points. DDD in a Level 3 BTEC qualification is 360 points. Candidates are able to add up to 60 further points for AS levels not taken forward to A2 level. A Grade 8 in music would add up to 105 points and a Grade 8 in speech and drama 65 points.

The grades AAB in three A levels was of particular significance in 2012 as there were no student number controls imposed on English universities that year on the recruitment of students with those grades, or their equivalent (340 points), or higher.

There is a distinct peak at 300 points (*headline* grades – BBB or ABC[22]) in Figure 10. Inspection of Figure: 11 shows this is mostly due to programmes in Post'92 universities. There is a plateau in the range 300-360 (BBB-AAA) on Figure 10 which, as can be seen in Figure: 11, is due to the crossover between the most common average tariff in Post'92 universities (BBB[23]) and the most common in Pre'92 universities (AAA[24]). Using data from Figure: 4, it should be noted that the component of Figure: 11 marked in green represents approximately 2% of acceptances to engineering undergraduate programme in the UK made through the UCAS system. The component in red 38% and the component in blue 60%.

22 For simplicity of presentation, the impact of including UCAS points from AS levels and other qualifications is omitted. 300 points could also be achieved by a candidates with CCC at A level but an A* in a further AS level for example.

23 Which could be BCC at A level and a further C at AS level for example.

24 Which could be ABB at A level with a further C at AS level for example.

There are 16 programmes where the **average** UCAS points for UK domicile students equates to them holding at least 4 A* at A level[25]. 1430 students (all domiciles) were accepted onto those programmes in 2012. Acceptances to these programmes represent 5.7% of the total acceptances for engineering that year.

There are 21 programmes where the average UCAS points held by UK domicile students is less than 160 points (CC grades at A level). 681 students (all domiciles) were accepted onto those programmes. Acceptances to these programmes represent 2.7% of the total programmes represent 2.7% of the total acceptances for engineering that year.

In FE Colleges, the average UCAS points held by UK domiciled students is more evenly distributed than in other types of institutions (although the overall number of programmes is much lower). The median tariff is around CCC[26] at A level (PPP in a Level 3 BTEC National qualification).

Figure: 12 shows trend data for average UCAS points held by UK domiciled students on different JACS Group H programmes in different types of institution.

The average points per UK accepted applicant are shown in Table 2.

- The two disciplines with the lowest UCAS points are electrical and electronic engineering (known to have had long term difficulties with recruitment[27]) and manufacturing and production engineering (which has very small recruitment).
- Average UCAS points are uniformly high in pre 1992 universities across all subjects other than those mentioned above.
- The highest average UCAS points occur in pre 1992 universities for Naval architecture (a subject offered in only a very small number of institutions) and in Chemical engineering (the subject with the lowest ratio between acceptances in post 1992 universities and those in pre 1992 universities).
- The gap between average UCAS points in pre 1992 universities and those in post 1992 universities is very large (generally around 150 points).
- The gap between average UCAS points in post 1992 universities and FE Colleges is small by comparison (most frequently less than 60 points).

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25 This 540 points would also be reached with 3 A* grades at A level, a further A grade at AS level and Grade 7 music (practical and theory).

26 Which could be CDD at A Level with a further C at AS level

27 HEFCE (2013), *Higher education in England: impact of the 2012 reforms*, HEFCE

Figure: 12 shows that the average number of UCAS points held by UK domiciled students accepted on engineering programmes in pre 1992 universities has been rising steadily since 2009 in almost every case. The trend is similar for post 1992 universities although in FE Colleges trends are less obvious.

A further indication of a healthy state for a subject in Higher Education is the ability to retain students to completion of their degrees. Figure: 13 shows an analysis of non-continuation rates for UK domicile students one year after being accepted to a degree programme in 2008.

At least 98% of engineering undergraduates with the highest prior attainment (measured by UCAS points on acceptance) continue to the second year of their chosen degree programme. For students with lower prior attainment the proportion can

Figure: 12 Authors' analysis of UCAS data

Table: 2 Authors' analysis of 2012 UCAS data

	Number of acceptances - ALL domiciles	Average UCAS points for UK domiciles only
H1 General engineering		
Pre-92	1985	419
Post-92	1338	238
FE College	56	229
H2 Civil engineering		
Pre-92	2376	430
Post-92	1822	272
FE College	33	203
H3 Mechanical engineering		
Pre-92	3727	433
Post-92	2628	282
FE College	212	221
H4 Aerospace engineering		
Pre-92	1375	440
Post-92	963	270
FE College	56	250
H5 Naval architecture		
Pre-92	93	466
Post-92	37	234
FE College	-	
H6 Electrical & electronic		
Pre-92	2627	395
Post-92	1763	250
FE College	234	232
H7 Production & manufacturing engineering		
Pre-92	316	371
Post-92	327	279
FE College	5	180
H8 Chemical engineering		
Pre-92	1982	463
Post-92	232	290
FE College	7	
HH Combinations with engineering		
Pre-92	386	422
Post-92	320	255
FE College	-	
total across disciplines	**24900**	

be as low as 83%. Continuation rates in engineering are lower than the average for Higher Education as a whole by up to two percentage points. Reasons for this are not known but could be a consequence of the demanding nature of engineering programmes.

A final indication of the healthy state of a subject is to have a clearing system that works effectively and equitably but does not dominate admissions.

Figure: 14 shows that the proportion of acceptances to engineering programmes made through clearing is generally below 10% in pre 1992 universities and has been stable at that level for the last few years. Proportions in post 1992 universities can be up to 20% and are generally more variable between years.

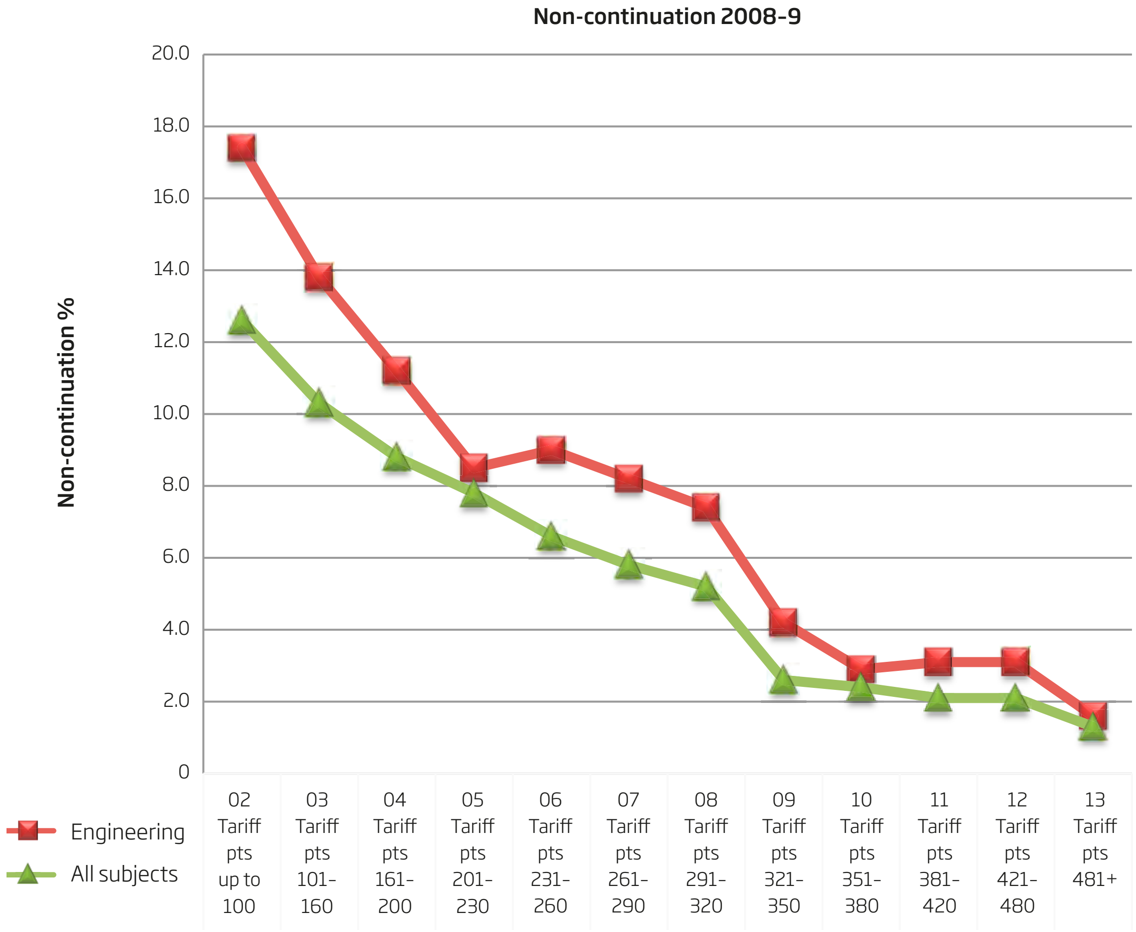

Figure: 13 Authors' analysis of 2012 UCAS data. UK Domiciles only.

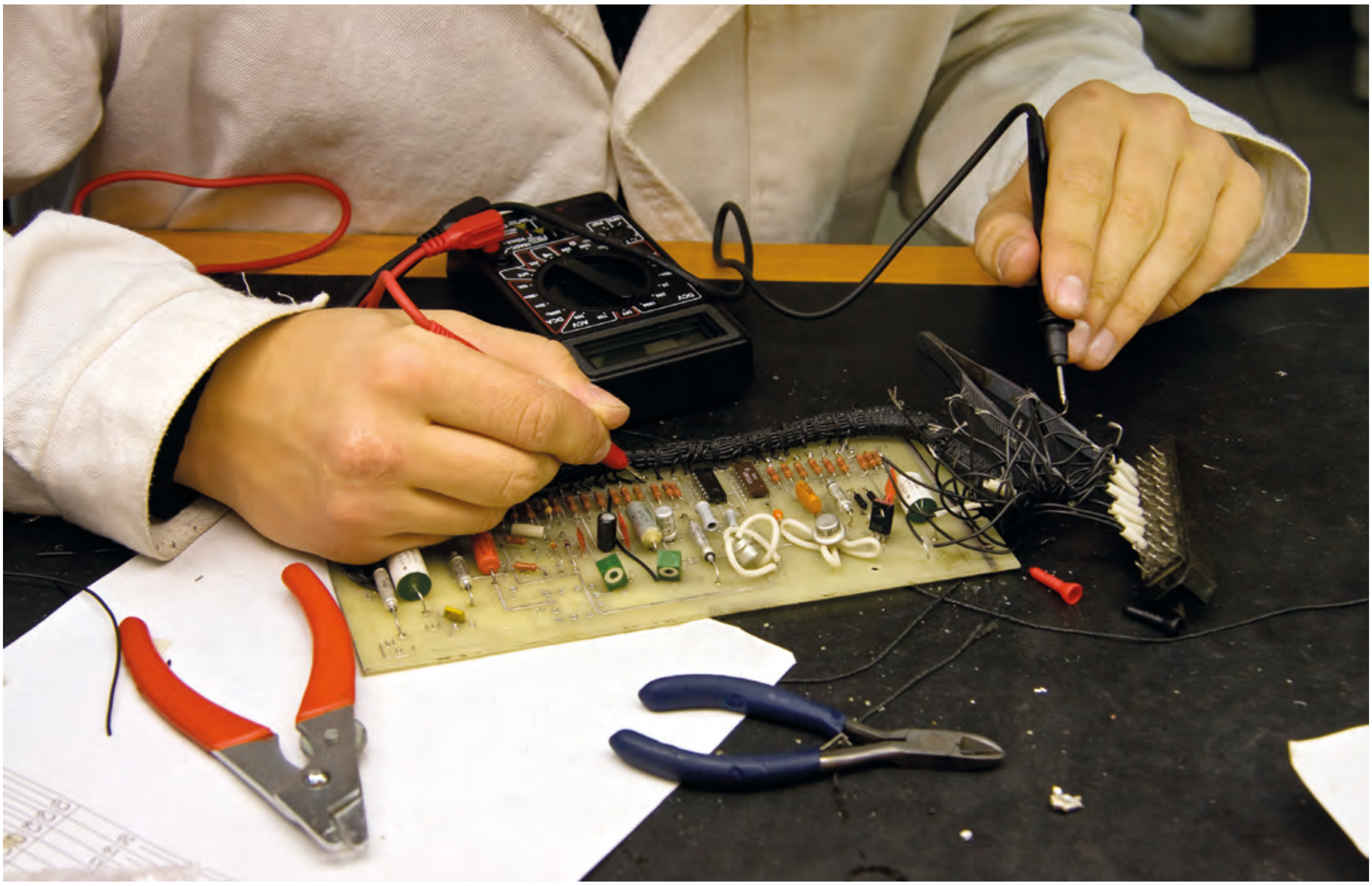

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Figure: 14 Author's analysis of UCAS acceptances data - all domiciles. H5 results omitted due to very small numbers

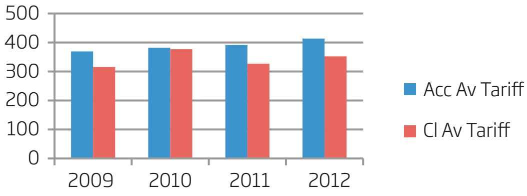
However, in FE Colleges the proportions can be very high with significant variability between years (although the variability may simply be due to the relatively small numbers involved or the influence of direct admissions outside of the UCAS system).

Figure: 15 (a–c) shows how average UCAS points for UK domiciled acceptances vary between direct applicants and those gaining acceptance through clearing. Those gaining acceptance to pre 1992 universities through clearing have lower UCAS points than those gaining through direct admission. Generally the difference is around 50 points or less (for example by gaining ABB at A level rather than AAA).

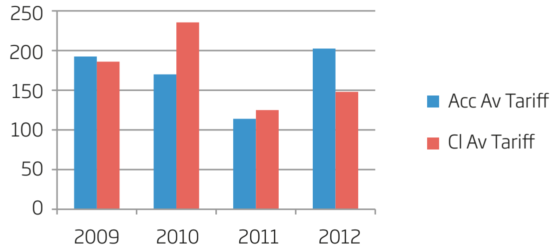
In post 1992 universities and in FE Colleges, those accepted through clearing can have comparable or even higher UCAS points than those accepted through direct application.

Figure: 15a Authors' analysis of UCAS acceptance data – UK domiciled students only

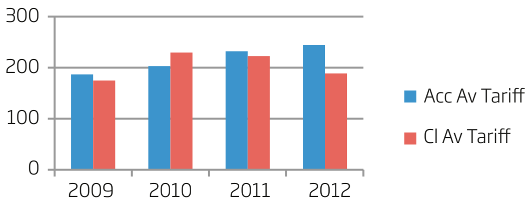
Pre '92 universities: H1 - General Engineering



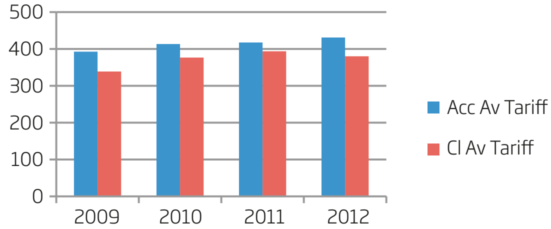
FE Colleges: H2 - Civil Engineering



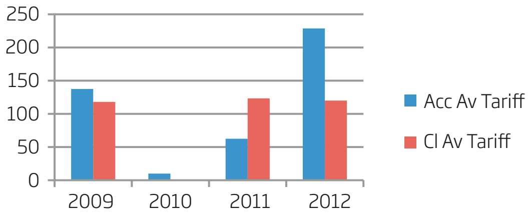
Post '92 universities: H1 - General Engineering



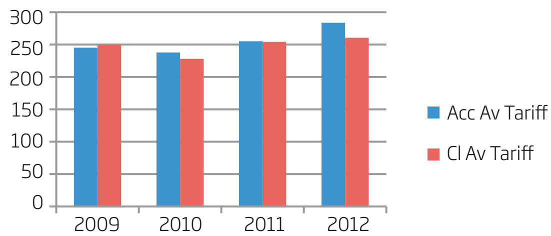
Pre'92 universities: H3 - Mech. Engineering



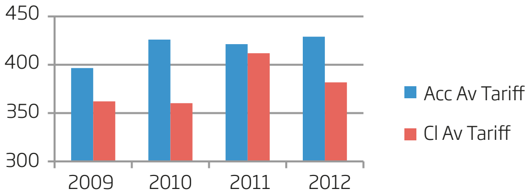
Average Tariff Scores - Colleges
H1 - General Engineering



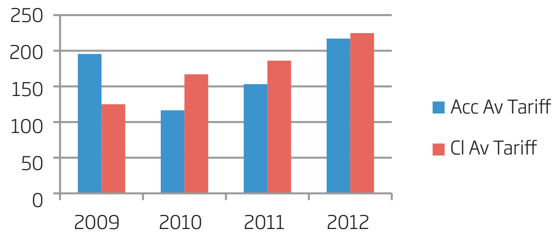
Post'92 universities: H3 - Mech. Engineering



Average Tariff Scores - Pre '92
H2 - Civil Engineering



FE Colleges: H3 - Mech. Engineering

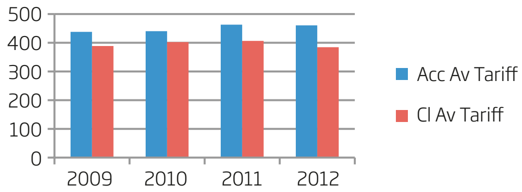


Average Tariff Scores - Post '92
H2 - Civil Engineering

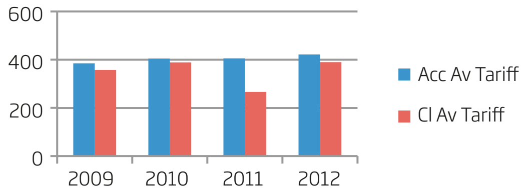
Figure: 15b Authors' analysis of UCAS acceptance data - UK domiciled students only

Figure: 15c Authors' analysis of UCAS acceptance data - UK domiciled students only

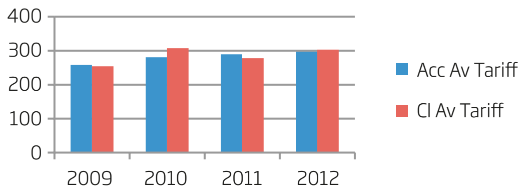
Pre '92 universities: H8 - Chem. Engineering



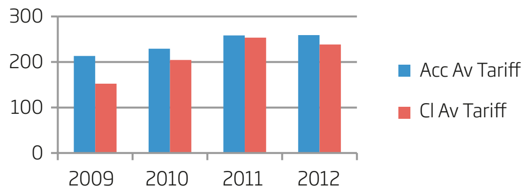
Pre-1992 universities: HH Combs within Engineering



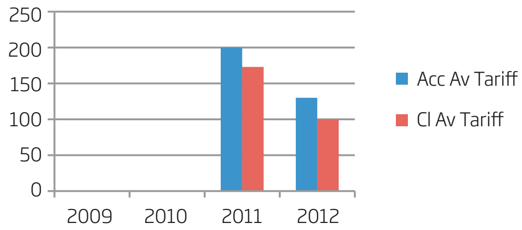
Post '92 universities: H8 - Chem. Engineering



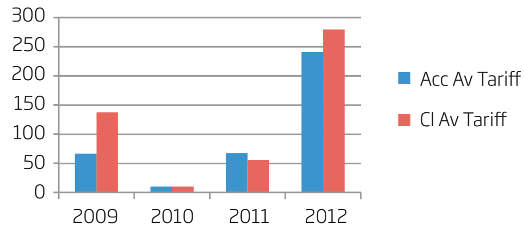
Post-1992 universities: HH Combs within Engineering



FE Colleges: H8 - Chem. Engineering



FE Colleges: HH Combs within Engineering



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Summary of findings and recommendations

This report provides a mapping of the complex landscape of undergraduate engineering education in the UK and provides a sense of how it has been changing over time.

Undergraduate engineering in Pre'92 universities (46 in total accepting engineering students in 2012) is demonstrating characteristics of security and strength. UCAS tariffs for UK domiciled students are generally high and rising further. The number of acceptances have held steady over recent years whilst the ratio of acceptances to applications has been falling. This suggests strong demand. Engineering programmes in the UK's most established universities are attracting strong students for programmes that are generally acknowledged by observers to be high challenge programmes. In turn, students with lower prior attainment are less likely to gain a place on these programmes.

There are more Post'92 universities (63 in total) accepting undergraduate students to engineering programmes. However, the average number recruited per institution (150) is less than half that of Pre'92 universities (323) and acceptances to engineering programmes in Post'92 universities have fallen overall since 2010. This is despite many Post'92 universities having accredited degree programmes and the staff, facilities and resources that go with these. The average UCAS tariff remains 150 points lower than in Pre'92 universities despite rises at most Post'92 institutions and the proportion of students accepted through clearing is twice that found in Pre'92 universities. These factors are inhibiting Post'92 institutions from

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playing their full role in the supply of quality engineering graduates.

Provision in FE Colleges recruited through UCAS is currently less than 3% of the total for undergraduate engineering in the UK (although students are also recruited directly to Level 4+ programmes by Colleges themselves and these numbers are not included here) and the UCAS recruitment is currently highly dependent on recruiting students through the clearing process. The average number of UCAS recruited students per College is currently very low (less than 10). However, FE Colleges have been recruiting students with prior attainment almost as high as that of students recruited to Post'92 universities.

For the purposes of this report, the authors propose five indications of a healthy state for a subject in Higher Education:

- **(i) Professional accreditation of degree programmes.**
- **(ii) The ability to attract and recruit a consistent number of students.**
- **(iii) The ability to recruit a significant number of students with high levels of prior attainment.**
- **(iv) The ability to retain students to the completion of their degrees.**
- **(v) An admissions profile that is not dominated by admissions through clearing.**

On the basis of these indicators, the findings and recommendations arising from this work are:

1. Provision in Post'92 universities looks more vulnerable than provision elsewhere. These more recent universities have been losing their share of engineering students to Pre'92 universities and it is important that they begin to grow once more in order to play their full role in the supply of quality graduates. Provision in Post'92 universities may also be threatened by FE Colleges able to recruit equally strong students and growing their provision (albeit from a very low base). **This should be investigated further and the state of engineering provision in Post'92 universities should be monitored closely by the Department for Business Innovation and Skills (BIS) and by the national HE funding agencies and action taken if further vulnerability is found.**
2. Provision in FE Colleges looks vulnerable in a different sense. It is growing overall, but the numbers recruited through UCAS at each individual institution are very small at present and highly reliant on the clearing system (although individual colleges also admit students to Level 4+ programmes directly and these numbers are not included in the analysis shown here). It is hard to provide a good engineering education with only a small income per institution. **The complete picture on admissions to engineering programmes in FE Colleges should be sought from the Association of Colleges. Outcomes from engineering programmes in FE Colleges should be monitored closely by BIS and the Association of Colleges until a critical mass of students is gained.**
3. Although undergraduate engineering provision in Pre'92 universities shows characteristics of security and strength overall, some engineering disciplines are weaker with falling applications and acceptances and attracting students with significantly lower prior attainment. **Electrical and electronic engineering and Manufacturing and production engineering are two subjects that should be monitored closely by BIS and the national HE funding agencies.**
4. At least 98% of engineering undergraduates with the highest prior attainment (measured by

UCAS points on acceptance) continue to the second year of their chosen degree programme. For students with lower prior attainment the proportion can be as low as 83%. Continuation rates in engineering are lower than the average for Higher Education as a whole by up to two percentage points. **Reasons for this should be determined through further research.**

5. The demand for graduate engineers in the UK economy exceeds supply. The very high (and rising) average UCAS points held by UK domicile students on engineering programmes in Pre'92 universities might suggest that those programmes are now at capacity. **Any rapid growth in the number of engineering graduates will therefore require incentivising further growth in Pre'92 universities, reversing declines in Post'92 universities or greater support for the still fledgling growth in FE Colleges.**

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