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The STEM subject push

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The STEM subject push

Successive British Governments have been keen to increase the number of STEM (science, technology, engineering and mathematics) students at British universities. Recent reforms to higher education protected public funding for STEM subjects, while cutting spending on other courses.

Employers and businesses welcome support for STEM subjects: the Confederation of British Industry (CBI) recently conducted a survey of its members and found that 43 per cent of respondents listed 'raising the numbers and quality of STEM graduates' as one of the top three priorities for the Government in this area. This figure increased to 63 per cent for manufacturing respondents and 83 per cent for science, engineering and IT firms.[1]

Other countries have fostered a similar commitment to STEM subjects. China and India each produce approximately half a million engineering graduates annually and both, along with other developed and developing Asian countries, are firm in emphasising the benefits that STEM graduates bring to the economy.[2]

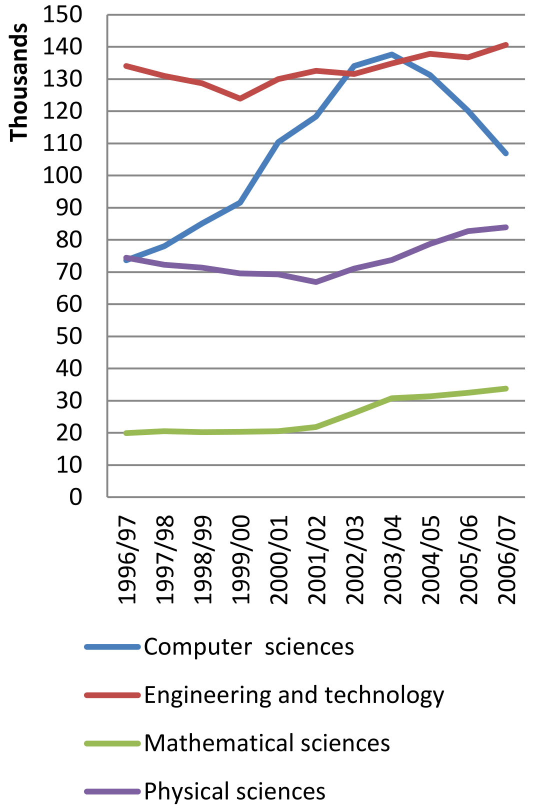
Why are governments, at home and abroad, so keen to encourage students to study STEM subjects? It is thought that the industries with the opportunities for the greatest increases in productivity and those which generate the highest amounts of added value employ a significant number of STEM graduates. STEM degrees are beneficial for graduates wishing to work in the manufacturing industry and the degradation of this sector over the course of the last few decades has weakened the British economy. The current government has recognised that the manufacturing sector must grow, or at the very least its decline must be halted. This is vital if Britain is to pay its way in the world: Britain ran a current account deficit of £15.5 billion in 2009[3] and the Government has realised that the country needs to increase exports, particularly goods exports, as the deficit can no longer be covered by borrowing or asset sales. Increasing manufacturing output will require STEM graduates and so ensuring an adequate supply is vital.

In terms of the benefit to the individual there is evidence that STEM graduates earn more than other graduates. The Department for Business Innovation and Skills and London Economics have estimated the 'graduate premium' for a range of subjects.[4] The report concluded that the graduate premium for engineering students is 38.1 per cent, 20.7 per cent for technology students, 27 per cent for physical and environmental sciences students and 41.1 per cent for mathematical and computer sciences students. The average graduate premium was estimated at 27.4 per cent. Therefore the graduate premiums associated with STEM subjects, apart from technology, are either above or around the average.

The growth in the number of STEM students

Statistics published by the Higher Education Statistics Agency (HESA)[5] suggest that British governments have had some success over the course of the last decade in increasing the number of STEM students in undergraduate and postgraduate higher education.

Figure 1: Number of STEM students 1996/97 - 2006/07[6]



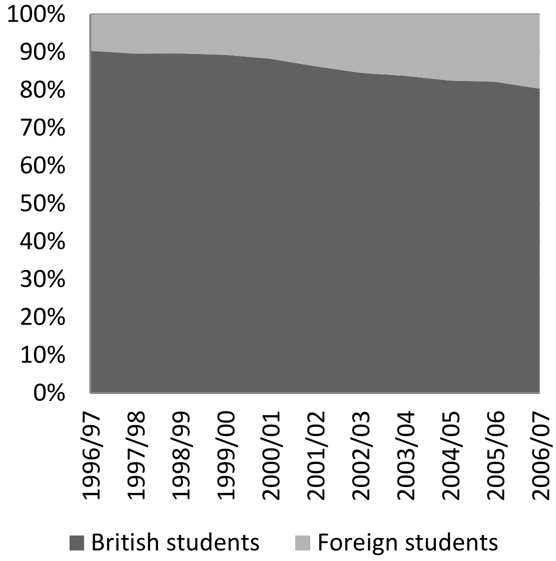
Source: HESA

Figure one indicates that four STEM subject groups (computer sciences, engineering and technology, mathematical sciences and physical sciences) have witnessed a growth in student numbers since 1996/97, although all subjects, excluding mathematical sciences, have seen a dip at some point. Taking just these figures the Government can perhaps be satisfied that the UK is producing more STEM graduates than it was a decade ago.

Who is taking STEM subjects?

A closer look at the statistics however reveals that a significant amount of the growth in student numbers is accounted for by the increase in overseas students.

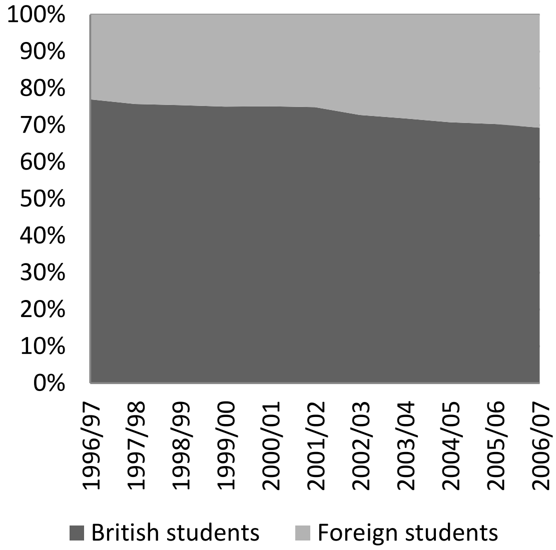
Figure 2: Overseas and British computer sciences students, 1996/97 - 2006/07



Source: HESA

Figure two indicates that the number of overseas computer sciences students has grown at a greater rate than the number of British computer sciences students. The result is that there were 33,298 more computer science students in 2006/07 than in 1996/97 and overseas students accounted for 41.7 per cent of this increase.

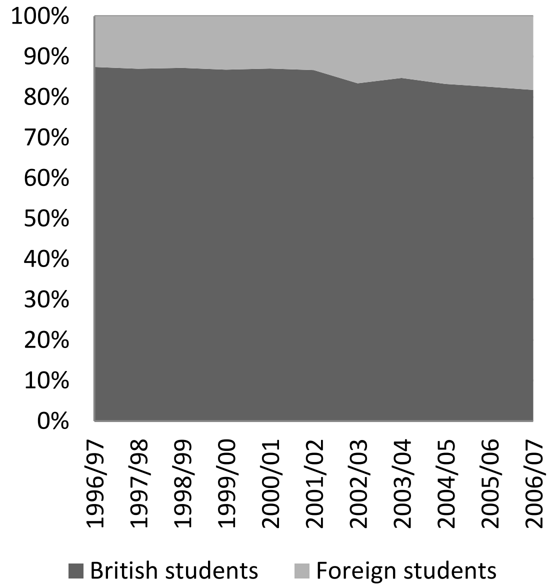
Figure 3: Overseas and British engineering and technology students, 1996/97 – 2006/07



Source: HESA

Figure three indicates that the number of overseas engineering and technology students has grown at a greater rate than the number of British engineering and technology students. The number of British engineering and technology students actually fell by 5,769 during the period, while the number of overseas students increased by 12,308. The result is that overseas students accounted for all the increase in engineering and technology students.

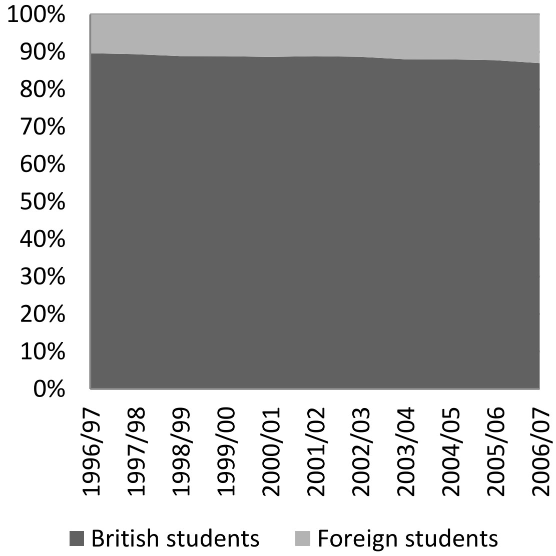
Figure 4: Overseas and British mathematical sciences students, 1996/97 – 2006/07



Source: HESA

Figure four indicates that the number of overseas mathematical sciences students has grown at a greater rate than the number of British mathematical sciences students. The result is that there were 13,882 more mathematical science students in 2006/07 than in 1996/97 and overseas students accounted for 26.4 per cent of this increase.

Figure 5: Overseas and British physical sciences students, 1996/97 – 2006/07



Source: HESA

Figure five indicates that the number of overseas physical sciences students has grown at a greater rate than the number of British physical sciences students. Although the physical sciences had the lowest differential growth rate between foreign and British students of the subjects examined, nevertheless there were 9,404 more physical science students in 2006/07 than in 1996/97 and overseas students accounted for 34 per cent of this increase.

Comparing STEM take-up with other subject areas

It is important to put these results in context. Between 1996/97 and 2006/07 the total number of students increased by 606,636. Overseas student numbers increased by 153,406 meaning that overseas students accounted for 25.3 per cent of the total increase.

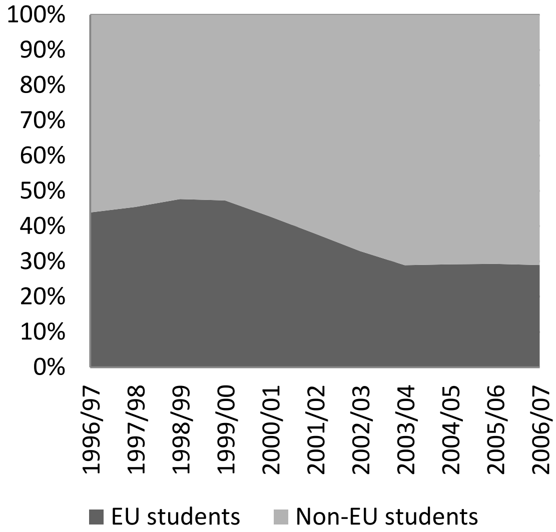
Clearly overseas student numbers have not increased equally across all subjects. As a fraction of growth in numbers, the 26.4 proportion of overseas students studying mathematical sciences is comparable to the average across all subjects of 25.3 per cent. However the proportions of overseas students in the growth of the other STEM subjects examined above, 34 per cent for the physical sciences, 41.7 per cent for computer science and over 100 per cent[7] for engineering and technology, were above the average.

The above-average increases in overseas students in the STEM subjects, mathematical sciences excluded, suggest that overseas students value such subjects to a greater degree than their British peers. The concern for the British Government is that the demand for STEM graduates in the future may not be met by British students. Can overseas students fill the demand?

EU and non-EU STEM students

Upon completing their studies overseas students may remain in the UK, or may return to their country of origin. EU students are allowed to remain in the UK if they choose, non-EU students do not have an automatic right to remain, although they may be permitted to take up residency in the UK if they are offered employment by a company approved by the UK Border Agency. It is difficult to assess whether a EU student or a non-EU student is more likely to remain in the UK, but all other things being equal it is probably fair to say that a EU student has the greater opportunity to remain. It is therefore worth examining how overseas students studying STEM subjects are broken down between EU and non-EU.

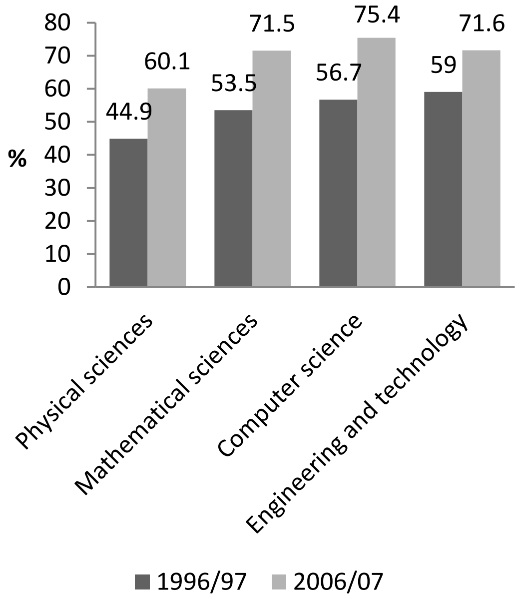
Figure 6: Foreign EU and non-EU students in computer sciences, engineering and technology, mathematical sciences and physical sciences, 1996/97 – 2006/07



Source: HESA

Figure six indicates that non-EU students increasingly accounted for a larger proportion of the overseas students taking STEM subjects between 1996/97 and 2006/07.

Figure 7: Non-EU students as a percentage of foreign students in 1996/97 and 2006/07



Source: HESA

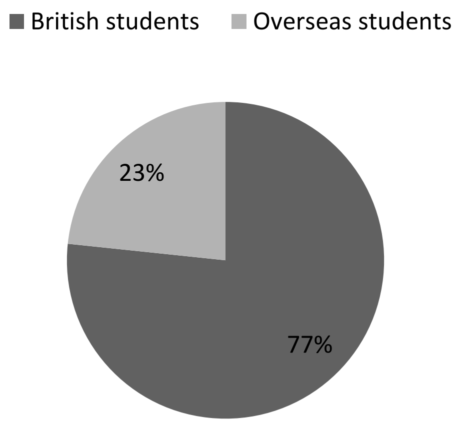
Figure seven indicates that all four subject groups saw similar proportional increases in non-EU students. This is perhaps unsurprising when one considers the vast increase in students from countries such as China, South Korea and other East Asian countries. One would perhaps expect those increasingly wealthy countries to send students to Britain at a higher rate than EU countries.

The possible ramifications of this are important. If a growing number of overseas students from outside the EU are filling an increasing proportion of STEM places in British universities and a significant proportion of them return home, the British economy will not get the long-term benefits of these students.

Which universities are overseas students attending?

Overseas students account for a greater proportion of STEM students in Britain's top universities.

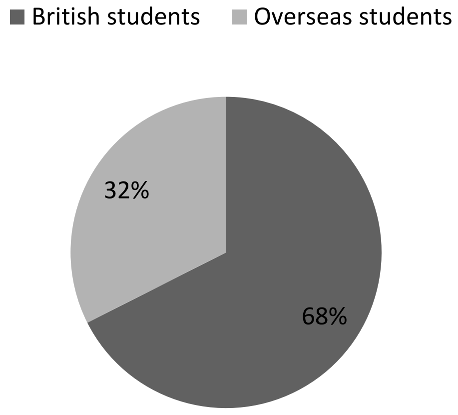
Figure 8: Overseas students as a percentage of STEM students at British universities in 2008/09



Source: HESA

Figure eight indicates that overseas (EU and non-EU) students accounted for 23 per cent of STEM students across all universities, of the four subject groups examined above, in 2008/09.

Figure 9: Overseas students as a percentage of STEM students at Britain's top 15 universities in 2009/10



Source: HESA, published by Unistats[8]

Figure nine indicates that overseas students accounted for 32 per cent of STEM students at Britain's top 15 universities in 2009/10.[9] It is worth pointing out that this figure refers to students in 2009/10 while the previous figure refers to students in 2008/09. This is because HESA did not publish free statistics broken down by subject and domicile in 2009/10.

This result is unsurprising if one reflects upon the fact that non-EU overseas students pay considerable fees to study in the UK. They may only think such fees are worth paying, if they attend one of the top universities. Nevertheless the ramifications of this are important. Business leaders have stressed the fact that the quality as well as the quantity of STEM graduates is important. If a significant proportion of STEM places at Britain's best universities are being filled by overseas students who choose to take their skills elsewhere, British businesses will not benefit.

Conclusion

This paper shows that:

- In all four groups of STEM subjects examined, overseas student numbers grew at a greater rate than British student numbers

- All four groups of STEM subjects examined, excluding mathematical sciences, witnessed above-average increases in overseas students.

- In engineering and technology the number of British students fell while the number of overseas students increased. This was despite the fact that there were 600,000 more students in higher education in 2006/07 than in 1996/97.

- The overseas students taking STEM subjects are increasingly from non-EU countries.

- Overseas STEM students disproportionally attend Britain's top universities.

The Government needs to take note of such developments and ask how they will impact upon the British economy. The Government's plan to 'rebalance' the economy through an increase in manufacturing output will fail if there are not sufficient numbers of STEM graduates who remain in the UK. Furthermore, and most worryingly, the number of British engineering and technology students fell during the period. In those 10 years when student numbers rose by 600,000, the number of British engineering and technology students fell by over 5,500. These developments may have a serious and negative effect upon the British economy, while other countries benefit. If British students become an ever-diminishing proportion of STEM students and if overseas students return home after studying, overseas countries, not Britain, will be the beneficiaries of our education system.

These results suggest that the Government needs to rethink its strategy for encouraging British students to take STEM subjects. Diverting public resources, and trying to channel British students towards STEM subjects is a laudable policy. Unfortunately this policy will not benefit the British economy in the long-run if overseas students who subsequently leave the UK are the ones taking up an increasing proportion of places on STEM courses. The Government needs to ensure that British students see the long-term benefits of taking STEM degrees and have the prerequisite A-levels so that they can do so.

Pursuing this goal does not mean dissuading talented foreign students from studying in the UK, Britain should be proud of its world-class universities. However the Government must bear in mind that STEM graduates will only benefit the economy in the long-run if they remain in Britain.

Notes

[1] CBI, *Building for Growth: business priorities for education and skills, Education and skills survey 2011*, 2011

[2] *The Telegraph*, 'James Dyson: China and India turn out 20 times more engineering graduates than UK', 15 Feb 2011

[3] The Office for National Statistics, *United Kingdom Balance of Payments - The Pink Book 2010*

[4] Department for Business Innovation and Skills, *The Returns to Higher Education Qualifications*, June 2011

[5] Higher Education Statistics Agency data can be found at: http://www.hesa.ac.uk/index.php/content/view/1973/239/

[6] 2006/07 is the last year for which comparable figures are available

[7] This can be over 100 per cent since UK numbers went down.

[8] Unistats data can be found at: http://unistats.direct.gov.uk/downloadSpreadsheet.do;jsessionid=CD800016D718FBDB4B3B0E335926F2EF.worker1

[9] Top 15 universities according to the Guardian's 'University guide 2012: University league table'.