INCENTIVE EFFECTS IN HIGHER EDUCATION: AN IMPROVED FUNDING MODEL FOR UNIVERSITIES

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Abstract
We examine the incentive effects of risk-sharing between student and university in the English higher education system. The 'graduate premium' has been widely reported and has been used to justify rising higher education participation and increased individual or governmental expenditure. But this premium is simply the mean of a wide distribution, varying, inter alia, by subject, institution, year of graduation and individual. We assume that universities exist in a state of monopolistic competition and are subject to a budget constraint. Using US college data we find evidence suggesting that a funding model which incorporates risk-sharing improves the efficiency of educational delivery while maintaining subject diversity and access.

JEL codes: I22, I23, I26, I28.

Keywords: graduate premium; higher education policy; risk-sharing; student finance; universities.

1. Setting the scene

The expansion in the proportion of the UK population attending university has been driven by the belief that graduates are guaranteed higher earnings. It has led to an increase in the participation rate for full-time entrants[1] from 36 per cent in 2006–07 to 42 per cent in 2013–14 (Department for Business, Innovation & Skills 2015, table 1). This greater rate of attendance, however, stands in contrast to the falling probability that, having graduated, employment justifying the additional years of education will be found. Office for National Statistics (ONS) data show that more than one third of graduates are still in non-graduate level employment[2] five years after completing their studies (Figure 1). Despite the economic recovery following the 2008–09 crisis, the latest survey (ONS 2016a) shows that this figure continues to rise.

A new study (Britton et al. 2016) for the Institute for Fiscal Studies (IFS), which, for the first time, had access to individual earnings reports from Her Majesty's Revenue and Customs (HMRC), concluded that, at 23 out of 175 UK higher education providers, the median male graduate was earning less than the median non-graduate ten years after graduation. For women, this was the case with graduates of nine institutions.

Were it the case that unemployment generally was high, or there was a clear surplus of skilled workers, it would be possible to attribute these outcomes to broader economic factors outside the control of the university sector. But unemployment, having risen to a peak of 8.5 per cent at the end of 2011 following the 2008 crisis, has since been falling steadily, standing at 5.7 per cent at the end of 2014 and in 2016 is down to 4.9 per cent, a ten-year low (ONS 2016b, p. 3). At the same time, businesses complain of skill shortages, with 58 per cent saying in 2014 that they were not confident they would be able to recruit enough high-skill employees (CBI 2015). Meanwhile, the government facilitates the visa application process for foreign workers with skills in the nearly 200 job categories that are included on its 'shortage occupations list' (Migration Advisory Committee 2013).

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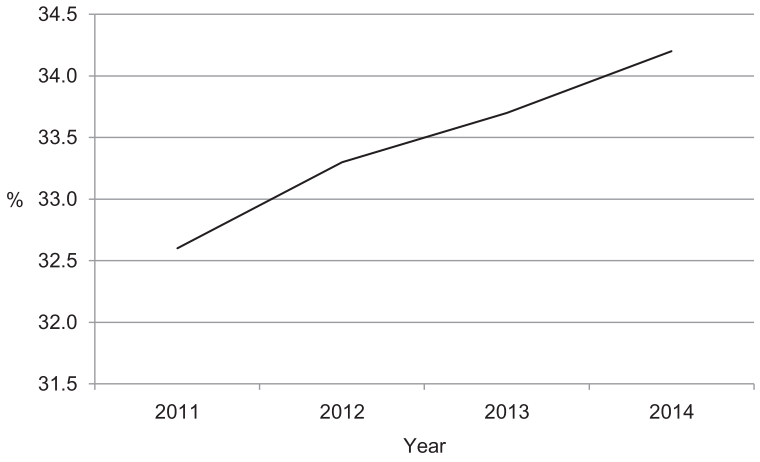

Figure 1: Percentage of graduates in non-graduate level employment five years after graduation, 2011–2014.
Source: ONS (2016a).

Working Futures 2014–2024, a publication of the UK Commission for Employment and Skills, reports on trends in the occupational structure of employment (UKCES 2016). Its data depict a continuing change in favour of white-collar and higher-skilled jobs, suggesting significant employment growth for higher-level occupations such as managers and most professional and associate professional and technical jobs. On the other hand, job losses are projected in administrative and secretarial, skilled trades, and process, plant and machine workers. Figure 2 shows the forecast changes in the share of each category of occupation from 2014 to 2019 and 2024.

As entry to the higher-skilled occupations for which employment demand is expected to increase is usually through a university degree, the demand for graduates should grow, supporting expansion of the higher education sector. That, however, assumes that universities succeed in raising the skill level of students so that they are able to fill these roles.

There can be no argument that education is good in itself. But few can be sanguine about a system where such a large number of young people are finding themselves no better off than if they had not sacrificed three years of potential earnings – and taken on a substantial repayment liability – by opting for a university degree. The sector is failing to produce sufficient numbers of the skilled employees that industry needs now and will need more of in future. Britain is relying on large-scale immigration to fill skill gaps while its own graduates languish in low-paid, less skilled work.

The large number of graduates in non-graduate jobs also damages the career prospects of non-graduates, who find themselves crowded out of jobs they are perfectly capable of doing. Employers, quite rationally, purchase the best-qualified staff for the price (salary/wages) regardless of whether or not their qualifications are strictly necessary. Competent non-graduates then lose out to graduates with identical relevant competence but the positional advantage of a degree.

Professor Alison Wolf (2015, p. 76) has summarised the situation:

> In post-19 education, we are producing vanishingly small numbers of higher technician level qualifications, while massively increasing the output of generalist bachelor's degrees and low-level vocational qualifications. We are doing so because of the financial incentives and administrative structures that governments themselves have created, not because of labour market demand, and the imbalance looks set to worsen yet further.

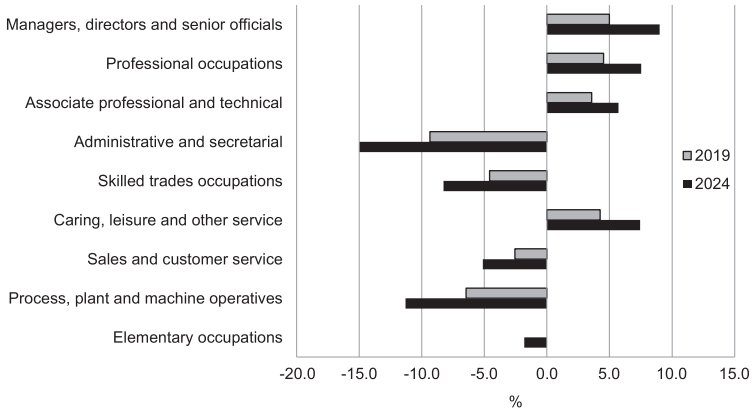

Figure 2: Forecast percentage growth in share of skilled occupations, measured from 2014.
Source: UKCES (2016).

This article aims to show how the incentives facing universities lead to the consequences set out above, and proposes a market reform that would alter the incentive structure to align the interests of universities with the long-term interests of students. It then demonstrates that such reform can deliver improved employability without affecting access or narrowing the range of courses on offer.

2. Analysis of the current incentive structure

Despite their non-profit-making charitable status, universities must generate an excess of revenue over costs in order to pay their staff, maintain their facilities and continue to operate. If they are to update the services they provide, or expand, they must generate a bigger surplus to finance such growth.

As the tuition fee per student has been largely fixed by government at £9,000 per annum,[3] a university must seek to ensure it recruits a sufficient number of students, while limiting the average cost per student, in order to continue to operate. This cost will, in the short term, be a function of the number of students as, after some 'efficient' level has been reached, in a conventional residential university, it is progressively more costly to attract and teach a larger number of students. The university will seek to maximise its surplus and its optimisation problem may be stated as follows.

$$\sum_{t=1}^{T} \delta^{t-1}(p_t - c_t(n_t))n_t \rightarrow \max_{n_t,T}!$$

$$\text{subject to } p_t > c_t;\ n_t > 0;\ T \leq \overline{T}$$

where p_t is the fixed tuition fee per student in year t, n_t the number of students in year t, c_t the average cost of recruiting/retaining and teaching a student in year t, T the duration of study in years (up to a maximum of $\overline{T}$) and δ an annual discount factor.

As long as tuition fees exceed the cost of teaching students, $p_t > c_t$, it is in the university's interest to offer degree programmes and to seek to retain students for the maximum duration of study $T = \overline{T}$.

The key factors that encourage students to apply to a given university include its reputation, the courses it offers and comfort factors such as location, quality of accommodation and extra-curricular activities (Callendar 1997, ch. 2). Some weight is attached to the reported graduate employment rate, but this is only a very short-term binary indicator and has little relevance to graduates' long-term employment prospects, the improvement of which is the primary motivation of two-thirds of students for attending university (Complete University Guide 2016).

Consequently universities, in developing their offering in order to attract the desired level of attendance, may redistribute resources to seek to enhance their reputation, align the range of courses on offer with student demand, improve the comfort factors or help graduates into first jobs. It would be irrational, however, for them to devote resources to anything that delivers better long-term employment outcomes for their students as they have no way of getting compensated or recognised for it.[4]

If p_t is fixed at $p_t = p$ and the average cost per student is essentially a function of the number of students, then the key variable driving university finances, and which the university will seek to influence, is n_t. As described above, it will do this through the channels of reputation r, subject and course offering s, comfort factors including location l and assistance with first job j.

$$n_t = n_t(r, s, l, j).$$

Notably absent from the factors determining n_t is long-term earnings w. The number of students is not a function of w and the universities, therefore, will not take account of w in their planning.

Another factor that will not be taken into account is the cost to the student of attending university. Tuition fees and some maintenance costs can be covered by government-funded income-contingent loans. However, while these are low-risk, they are not free. The graduate will pay an incremental marginal tax rate of 9 per cent for up to 30 years. The rate is charged in excess of a hurdle set at an arbitrary standard level. This will in only a few cases represent the counterfactual level of income – what that individual would have earned had they not attended university – so for many the charge will be a real cost not in proportion to value added or benefit gained.

In addition, students generally give up three years of potential earnings while at university, and their living costs will often exceed the maintenance loan due to the greater cost of living away from home. These factors would lead many students to want to acquire their education in the least possible time and in a manner that enables them to carry out some work while studying or to continue to live at home. These factors will be especially relevant for less well-off students and for those with dependants.

The university's interests are in conflict with those of such students. The university's revenue is a function of the years of study so it will prefer, for example, three-year courses over two-year programmes. Once a given course has been approved by the Quality Assurance Agency (QAA) as being of degree standard, its value to the university is improved the greater is the time commitment placed on the student for the course's completion. The government regulates the annual charge, not the charge for value added, so the duration must be maximised to raise revenue.

Further, to the extent that the course content can be simplified so that a fourth year of study, perhaps in the form of a master's degree, is required to acquire career-enhancing skills, the university has a financial incentive to make undergraduate courses as simple as is compatible with a QAA

stamp of approval, and offer a master's qualification as an extra. Finally, the institution's scheduling and some communication costs are lower if students are on hand on campus, and so it may prefer residential courses to distance-learning provision.[5]

None of this suggests that those working at universities do not care what happens to their graduates in the long term. Rather, it explains that this cannot be the primary focus of the institution as the economic incentives presented to it oblige it to act with other priorities in mind in the first instance. As Professor Wolf (2015) implied, the existence of a large proportion of degrees that do not lead to graduate-level employment flows directly from the incentives and administrative structures put in place by government.

3. Proposals

3.1. Human capital contracts

Although described as a tuition fee loan, when English students seek financial support from the state in payment of their tuition fees, the contract they enter into is not a debt agreement. There is no fixed obligation to repay a defined amount of money. Instead, students enter into something akin to a human capital contract whereby their obligation to pay is in proportion to their earnings. A human capital contract has some similarities to income tax in that the citizen's liability is greater the more financially successful they are.

The idea of a human capital contract as a means for paying for a university education can be traced back to Milton Friedman (1962, p. 103) who, noting the uncertain earnings outcome from attending university, wrote that:

> The device adopted to meet the corresponding problem for other risky investments is equity investment… The counterpart for education would be to 'buy' a share in an individual's earning prospects; to advance him the funds needed to finance his training on condition that he agree to pay the lender a specified fraction of his future earnings.

While similar to income tax, a key distinction between a private human capital contract and a tax is that, with a contract, the terms would be disclosed at the outset of the agreement and could not then be varied other than in accordance with those terms. The terms of a tax, on the other hand, are at the discretion of government and may be varied at any time.

In this regard, the 'student loans' that are taken out to finance tuition fees in England are in fact a tax as the government reserves the right to change at will any of the terms – the level of the hurdle, the proportion of earnings due, and the length of time for which the obligation must be paid.

Such uncertainty about the obligation one is incurring when considering university is harmful. It discourages participation and could be seen to be very unfair if the terms were changed to increase the monetary burden post-graduation. It could be particularly problematic at election time when parties, seeking the youth vote, might make promises to prospective students, who could react by deferring their applications in the expectation that future terms will be better.[6] That could be damaging for some universities, which might experience a sharp drop in applications for a given year.

The first market reform proposed is, therefore, that the current government-controlled 'student loan agreement' be replaced with a regulated private contract between the student and the university attended. This would create certainty about the form and terms of the obligation, and reduce the scope for political interference.

There is growing interest in using private human capital contracts to finance education in the US. Lumni has financed nearly 7,000 students over the past decade in Chile, Colombia, Mexico and Peru in addition to the US.[7] Purdue University in Indiana has recently announced the launch of a scheme whereby students can apply for education funding in exchange for a percentage of their future earnings (Purdue University 2016). US Senator Marco Rubio and Representative Tom Petri introduced legislation in 2014 to clarify the legal framework for human capital contracts and establish standards that would set the maximum length of a contract at 30 years and cap the income-based payments at 15 per cent.[8]

Since UK contracts, as in the US, are based on common law principles, what works in US law will work in English law, with little need for special legislation. Nevertheless, it would be useful to have parliament clarify marginal issues such as the treatment of the contract in a bankruptcy, and there would be advantages in a regulatory framework to standardise contracts and prevent their terms being onerous.

There is no reason why private contracts between each student and their university should not be administered by a single organisation such as, in the UK, the Student Loans Company (SLC). This means that a switch to regulated private contracts would place no additional administrative burden on the sector. Collection would be facilitated by the fact that a degree has positional value which could be made conditional upon payment; the contracts would state that the award of the degree would be revoked in the event of failure to pay the agreed share of earnings.

While private contracts between student and university would create more certainty about the student's obligations, they would do nothing to alter the incentives facing the university. If the government continues to control the maximum amount payable and takes responsibility for any defaults, the universities will have no financial incentive to ensure their graduates develop skills that will ease their way into high-skilled employment, or adjust the way courses are delivered to meet the needs of the widest possible range of prospective students.

3.2. Aligning interests of student and university

The second proposed market reform addresses the incentive problem. It will, in due course, absolve government of liability for all defaults. The SLC, or some other administrator of the scheme, would instead charge failed payments back to the university that wrote the contract. This rearrangement of responsibilities would make the universities and their students true partners. They would both share in the risk that a student does not prosper after graduation. With this reform, the long-term interests of a university and its students are aligned.

Following this reform, when designing a course or piloting a student through their time at university, the university's focus will be on how to deliver what most helps the student to succeed in the world of high-skilled work, in the most cost-effective fashion.

Now that the university's income is not simply a function of the number of students multiplied by the number of years of study, it will have an interest in developing more efficient means of delivery. While Massive Open Online Courses (MOOCs) are no panacea, they are a very efficient means of

delivering high-quality lecture content at a time that suits the student and of a length fitting the complexity of the content. They also offer attractive learning features not feasible in a residential setting. Requiring students to mark each other's work – something that can more readily be contemplated only where the students do not know each other – is not only a cheap and quick way to generate useful feedback, it also has learning value as each student gains from an appreciation of the achievements and errors of others.

Under risk-sharing, universities have an incentive to use MOOCs in a blended offering (a mix of online and in-person tuition) of courses that would be financially attractive to and practical for, in particular, less well-off students and those with dependants, so improving access. Risk-sharing would also create a motivation for the university to watch over its alumni for many years after graduation, supporting those who have difficulty gaining or maintaining employment worthy of their education.

A student's future earnings would be a function of the strategy that the university chooses for graduate employability e, as well as a range of other factors[9] ε. The average discounted future earnings stream for a graduate of the university can be stated as

$$W = \sum_{t=T+1}^{L} \delta^{t-1} w_t(e, \varepsilon) n_T.$$

The university's optimisation problem now reflects tuition financing through a share of graduate earnings at a rate of x instead of the fixed tuition fee:

$$x \sum_{t=T+1}^{L} \delta^{t-1} w_t(e, \varepsilon) n_T - \sum_{t=1}^{T} \delta^{t-1} c_t(n_t) n_t \rightarrow \max_{e,L,n_t,T,x}!$$

where L is the year in which the contract expires.

The university has a direct incentive to enhance the employability of its graduates through its strategy e in addition to its incentive to influence the number of its students n_t. It will offer contracts in line with its programmes of study where the proportion of earnings it receives x and the length of the contract L are set against the duration of studies T.

This risk-sharing element is the unique aspect of the proposed market reform. No other funding model gives universities a direct stake in their graduates' employability. Yet without this incentive any other proposed reform is unlikely to achieve the key objective of significantly reducing the proportion of graduates who end up in low-skilled employment.

Eliminating tuition fees simply enriches the wealthy, who derive the greatest financial benefit from university (Britton et al. 2016). Using a wide panoply of metrics to allow price increases in a largely fixed-fee regime, as proposed in the government's White Paper *Success as a Knowledge Economy* (Department for Business, Innovation & Skills 2016), would tie the sector up in red tape as each institution struggled to optimise ('game') its score on each measure. While it is proposed to include measures of employability in the data set, it would be historic, not forward-looking, information and would be merely one among many tests buried beneath a subjective overlay. Rather than encourage innovation, the White Paper proposes to extend government control of degree content to new entrants so that the state would be determining both the price and the design of the degree product across the sector. That is a recipe for stifling creativity, and means institutions may focus more on lobbying the officials at the new Office for Students than on improving the outcomes for their graduates.

A full analysis of the government's proposals is beyond the scope of this article, but, in summary, it relies on a range of metrics and targets and subjective judgement to drive behaviour. There are no known examples of this type of bureaucratic control being more efficient at achieving a desired objective than a system that directly aligns financial incentives.

Employability is the main motivation for attending university for the majority of students and, thanks to the linking of the student loan database with HMRC tax records, a comprehensive and objective measure of it could be made available with monthly updates. The key practical reason for not tying university finances to their employability effectiveness has fallen away.

If universities become liable for underpayments but are not rewarded when a student is very successful, they will most likely get into financial difficulties. The cost of eventual defaults on the current student 'loan' book as a proportion of the amount in tuition fees that have been paid to the universities can only be estimated, as the present scheme is so new. However, currently the expected levels of default are between 30 per cent and 43 per cent (Britton and Crawford 2015). Even at the lower end of this range the losses – equivalent to the university having to repay nearly £3,000 on every £9,000 tuition fee charged – would be far greater than all but the best-endowed members of the sector could survive.

3.3. Deregulation

The third proposed market reform would address this by substantially deregulating the sector. The notional tuition fee[10] for any course would be wholly at the discretion of the university. As it is likely to be the offspring of the wealthy who would pay upfront rather than enter into an earnings-linked agreement, sticker prices[11] should take account of the probability that the future earnings of the privileged are greater than those of students from more modest backgrounds. For example, a university might establish that the mean excess earnings[12] of those likely to pay upfront was X per cent. The rational pricing policy would then be to set up-front tuition fees at just less than X per cent above the expected present value of the earnings stream from those likely to take out the earnings-linked agreements. The discount would take account of the reduction in risk and the lower collection costs, but there should still be a premium to fairly take account of the advantage of family wealth.

Having accepted the risk that graduates may not benefit financially from their education, universities are entitled to a reward where a graduate has exceptional good fortune. This freedom would make it possible for growth in the provision of subjects that are expensive to teach, if we assume that such courses were generally successful in leading to high-skilled employment. With much higher tuition fee levels, the sector would not be so dependent on high fee-paying international students and would be able to collect much more in income from successful English graduates to cover their losses from those who, despite the reforms, are still unfortunate.

Deregulation would also mean that universities would be free to design courses as they saw fit. As they are sharing in the risk that a course does not add employment value, that financial incentive is sufficiently powerful to ensure that courses are worthwhile. New universities would be able to gain degree-awarding status immediately. So long as they were sharing in the risk that the education they provided was valuable, there would be little need for oversight. It would not make any business sense to offer courses that did not give the students a significant improvement in their employment prospects.

Finally, universities could be allowed to manage admissions at their exclusive discretion. Each could target students most likely to benefit from the particular type of education it offered, while the

sector as a whole would be incentivised to expand to offer a university education to all who might get a substantial benefit from one.

There is one new rule that should be introduced. Any student to whom a university offers a place must be free, if they so wish, to enter into a risk-sharing contract with the university in payment of their fees. So, although a university can set a tuition fee at any level, it would, most likely, be paid only by international students, the wealthy and any student who is both highly confident of their future prospects and able to raise conventional loan finance in place of the income-contingent scheme. Any other student could opt for an agreement much like the present one, where their liability is expressed as a proportion of earnings over some hurdle.

A particular effect of this reform is that the wealthy – including both those whose families can afford to pay a fixed fee upfront and those who have very high earnings later in life and have entered into a risk-sharing contract – would make a significantly greater contribution to the financing of higher education than they do at present. This factor contributes to social justice and addresses to an extent the wider problem of growing income inequality.

The reforms liberate the universities subject to their sharing in the risk that the education they provide may fail to lift their students into suitably skilled employment.

3.4. Tax treatment of human capital

The cost of a higher education designed to increase one's human capital, in the form of income-contingent loan repayments, must currently be made out of post-tax income. This is anomalous by comparison with the typical treatment of corporate purchases of physical capital, which benefit from tax relief. In an age when human capital is increasingly important as a factor of production and as the basis of national economic growth, the final reform addresses this inconsistency by calling for the tax treatment of human capital and physical capital to be put on the same footing.

Such a change in tax treatment is affordable. The 'RAB charge' – the Resource Accounting and Budgeting estimate of the proportion of student loans that will never be repaid – is currently indicating a cost to the taxpayer of up to 45 per cent of the value of the monies advanced to higher educational institutions (House of Commons Business, Innovation and Skills Committee 2014, p. 11). As risk sharing saves the government the cost of defaults, it is appropriate that the presently hidden tax subsidy of higher education should be preserved but in a newly transparent form.[13]

3.5. Transitional policies

Although the simplicity of the reformed approach would be attractive to many in the sector, as they would have a much clearer and more rewarding objective – working with their students to equip them for the ever-changing demands of the workplace – if legislated with a 'big bang' approach the 23 universities referred to by Britton et al. (2016), in particular, would quickly get into financial difficulties. It would not be fair to penalise them as they cannot be blamed for having operated in a way which was rational under the prior incentive regime.

Consequently, the state should continue to pay an amount per annum per student to the universities and should initially bear most of the defaults. Only incrementally over time should it reward those whose graduates paid their obligations in full and penalise those whose graduates were more likely to default.

Longer term it would be possible for the upfront funding of universities to be achieved by the securitisation of the expected future cash flows from the risk-sharing contracts. Such cash flows would be attractive to pensioners newly liberated from the need to purchase an annuity. In a mutually beneficial inter-generational transfer, pensioners with capital would fund the education of the young in exchange for a future earnings-linked, and so inflation-hedged, income stream.[14]

Sharing with investors the risk that graduate earnings surprise on the downside would insulate universities from economic factors and government policies beyond their control. It would not, however, remove the incentive to enhance their students' long-term earnings prospects as investors would evaluate an institution's past success and future plans in this regard and pay more, or less, for their contracts accordingly.

Furthermore, investors would act as third party monitors of the success of a university's employability strategy. They would experience its effectiveness directly in the form of their monthly income receipts. Should these be disappointing they would have their own incentive for holding the institution to account.

To ensure that those with disadvantaged backgrounds have opportunities as good as those from more privileged backgrounds, the fixed amount the state pays per student could vary based on degree of disadvantage. This mimics the approach used with the pupil premium in publicly funded schools. The premium would be treated as a grant rather than as a debt, so making the recruitment of disadvantaged students financially attractive to universities. This is a more efficient way to ensure access than bureaucratic rule setting. There could also be a 'subject premium' should there be policy reasons for promoting the study of particular subjects.

4. Effects of market reform

The transitional policies outlined above would ensure that university finances would not face a sudden shock. But the motivation to reorient universities' service provision towards graduate employability would be instant and powerful.

A potential concern is that risk sharing would spur universities into focusing on a narrow range of subjects proven to generate high future earnings. If this occurred it could put at risk the cultural richness that results from a large body of students studying, for example, the humanities. This notion ignores the role that students themselves play in course offerings. A student is not obliged to study a particular subject. If they wish to study X, and X is on offer at University A but not at University B, that student will apply to A. The university that offers the wider range of courses will continue to be attractive to a wider range of prospective students.

The long-term nature of the risk sharing also has a beneficial impact on diversity in course provision. While earnings in a particular career may currently be very high, if the supply of graduates aiming for that career increases faster than the demand for employment in that career, in due course either that career will become less remunerative or many of the graduates trained for that career will have to take another where their education would be of less or no value. As the university's fortunes are tied to the graduate's for the long term, the prudent approach would be for it to offer a diverse range of courses in the expectation that, however the economy changes over time, the greater the differentiation in the career paths of its graduates the less likely it is that all would face adverse structural change at the same time. The long-term link also means universities would aim to provide

academic skills, such as the ability to acquire new knowledge, that protect against the risk that the value of a given set of knowledge may decline over time.

There remains the possibility that, even if there is student demand for a course, it offers such certain poor returns in employment that under risk sharing it would be rational for all universities to cease to offer it. The next section considers in more detail universities' rationale for adjusting their course mix.

5. Analysis of US college income data

To assess whether the proposed market reforms might lead to the elimination of certain lines of study, we draw on evidence from the United States to suggest what might happen in England if the proposals outlined above were implemented. The College Scorecard Data published online by the US Department of Education (2016) were used for our analysis. This is a data set of information about inputs and outputs for the US higher education sector. It spans nearly 20 years and contains a broad range of metrics on nearly 7,000 higher education institutions. While being US-focused, its particular advantage for this analysis is that it includes both compositional data on subjects of study (the percentage of students in each field of study) and the average graduate income ten years after enrolment for working graduates at three points in time (2007, 2009, 2011).

For each year it includes the proportion of students that studied for each of 38 main subject groups, the instructional expenditures per full-time equivalent student, the percentage of students who are financially independent, the proportion of students whose parents have post-secondary education and, for the years 2007, 2009 and 2011, the mean and median earnings of the graduates of each college ten years after enrolment (in constant 2014 dollar values), and the standard deviation of that mean.

As the data set includes all higher education institutions it was first necessary, for comparability purposes, to remove from the sample those colleges that did not offer bachelor's degrees, those that offered only graduate degrees[15] and those for which data were missing. There were also duplicates in the data where a university such as Phoenix reported the same mean and standard deviation of earnings for all its 72 campuses. This left a data set of 4,645 observations over the three years, representing just over 1,500 colleges.

The first topic to be investigated was the level of uncertainty associated with the mean earnings data. If certain subjects or institutions had more certain returns than others, this should show up in the data as a varying relationship between mean and standard deviation. However, as shown in Figure 3, the relationship varies little. If the universe is restricted to the 602 colleges with at least 1,000 students each, a linear regression of the 2011 data shows a strong relationship between mean and standard deviation with a coefficient of 1.02 and R-squared of 82 per cent.

The fact that the standard deviation is approximately equal to the mean across the board indicates that there is a very wide distribution of earnings outcomes regardless of subject or institution. Even those accepted for Harvard or Stanford (the two points to the extreme right) have a material risk of low earnings. Britton et al. (2016, p. 48) concur in relation to their analysis of UK data: 'In summary, we find a significant amount of variation in graduates' earnings by both subject and institution.'

The second analysis was a weighted least squares regression designed to provide greater insight into whether the particular mix of subjects offered by a college affected graduate earnings and whether there was sufficient justification for a change in subject mix should institution income be tied to graduate earnings.

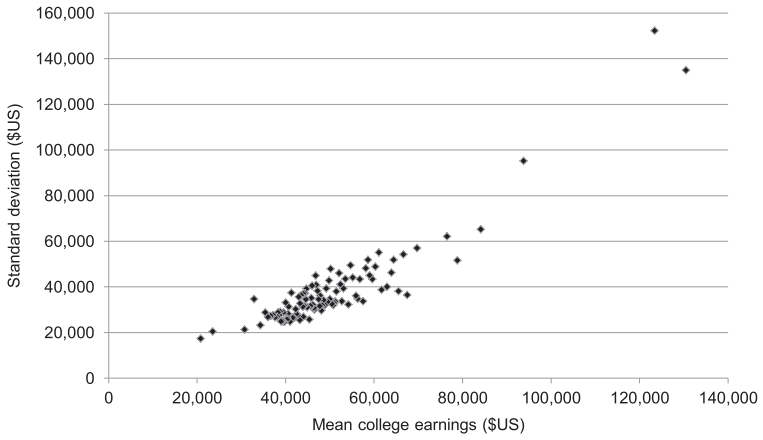

Figure 3: Mean and standard deviation of earnings by college, ten years after enrolment, in 100 representative institutions (US, 2011).
Source: US Department of Education (2016).

The ideal database would include individual graduates' income levels along with the name of the institution they attended and their field of study. Instead, we have aggregated data that can be interpreted as the income for a student who is a 'Jack of all trades' in the sense that their field of study encompasses a percentage of all fields. Thus, the analysis is limited to the impact on income for our student if they incrementally adjusted their educational emphasis in each of the fields of study. Since under the risk-sharing scheme the university shares in the graduate's income, if there is an incentive for the student to change their field of study there is similarly an incentive for the university to seek to alter the subjects studied by its students by, for example, restricting the fields of study on offer.

The fields of study (i.e. our independent variable, X), represent a 'compositional' data set in that they sum to 100 per cent. This presents a problem in that X is now singular in that any one column of X equals (1.0 minus (sum of all the other columns)). While there are many approaches to dealing with this compositional data problem, we opted to avoid the issue by dropping several columns of X. The subject fields we chose to drop included the 'multidisciplinary' field on the grounds of indeterminacy plus all other fields having fewer than 0.2 per cent of the total students, as set out in Table 1.

In addition, we included dummy variables for years 2007 and 2009 as students graduating at different points in the economic cycle may have higher or lower earnings over a ten-year period and utilise the following additional explanatory variables: (*a*) instructional expenditures per full-time equivalent student per annum ($), (*b*) the percentage of students who are financially independent, and (*c*) the percentage of students whose parents' highest educational level was some form of post-secondary education. These were used as measures of institution quality and student family background.

Table 1: Subjects excluded from analysis

Multi/Interdisciplinary Studies	Personal and Culinary Services
Science Technologies/Technicians	Construction Trades
Mechanic and Repair Technologies/Technicians	Precision Production
Military Technologies and Applied Sciences	Library Science
Communications Technologies/Technicians and Support Services	

All non-dummy explanatory variables were standardised by subtracting their mean and dividing by their standard deviation. As a result, the coefficients shown represent the impact of a standard deviation unit change, and all data have been included in one table to facilitate interpretation. The instructional expenditures data appear differently from the other variables as they are expressed in dollar terms rather than percentages. Thus, the interpretation is that we see a $1,671 increase in mean annual graduate income for a one standard deviation change in spending ($11,560) or a $0.14 increase in annual income for each additional dollar spent on instruction.

The regression was weighted by the number of students at the institution to reduce the impact of income outliers. Income distribution is characterised by an extreme right tail – top incomes are much higher than one would expect were incomes to follow a normal distribution. While a common approach to this problem is to use the natural logarithms of the values, this causes problems with interpretation. As the College Scorecard Data set only offers mean incomes in any case, it was felt that by further down-weighting the impact of small colleges any right skew effect would be sufficiently minimised. Retaining the original values would also make it easier to understand the meaning of the estimates produced, so the earnings numbers were used untransformed.

With 4,645 observations there were 4,610 error degrees of freedom. The regression returned a root-mean-squared error of 7.89e + 03 with *R*-squared of 0.553 and adjusted *R*-squared of 0.550. The *F*-statistic versus a constant model was 168 with *p*-value of .0001 but significant far beyond that level. The degree of multicollinearity (MC) in the regressors, rcond(X) = 1.2E – 3, which is significantly greater than the error precision of 1E – 14.

The regression returned an intercept value for income in the 2011 year of $50,454 and for each field reported a *t*-value indicating significance and the mean and standard deviation of that field that are associated with the regression coefficient. The results, ranked by number of students following a given course area, are shown in Table 2.

A large number of subject groups, including 'Education, and the Visual and Performing Arts', for example, show significant *t*-values and negative coefficients. This indicates that a college could, all other things being equal, increase mean earnings by reducing the proportion of students studying those subjects.

However, the estimated coefficients are low in relation to the intercept, and the standard deviations high relative to the means, suggesting that there may be no practical strategy for reducing subject choice that would materially increase mean earnings. To make the data easier to interpret and compare between subjects, Table 2 also shows the estimated change in mean earnings from a 1 per cent shift in the proportion of students studying a given subject.

Taking the two largest effects that are significant at 1 per cent, we see that a 1 per cent increase in the proportion of students studying 'Area, Ethnic, Cultural, Gender, and Group Studies' would increase mean earnings by $757 while a 1 per cent reduction in students studying 'Parks, Recreation, Leisure, and Fitness Studies' would help by $456. Given the intercept value is $50,454, these are powerful overall effects from such a small proportionate change, but nevertheless only marginal at the aggregate level.

Further, it is not possible to deduce that, say, a 10 per cent shift would have ten times the effect of the 1 per cent shift. The model is linear and is designed to estimate the change in mean earnings for a one standard deviation change in the proportion following a particular field of study. In the two examples above, less commonly studied areas, the standard deviations are 1 per cent and 2.14 per cent respectively, and the coefficient cannot safely be extended beyond these levels.

The more commonly studied subject areas, such as 'Business, Management, Marketing, and Related Support Services' and 'Education', are associated with smaller 1 per cent shifts of plus $98

Table 2: Weighted least squares analysis of College Scorecard Data, dependent variable: annual graduate income

Parameter	Total number of students	Mean (X)	SD (X)	Estimate ($)	Effect of 1% change ($)	t-value	Significant at 1%, 5% or 10% level
Intercept	2,313,731	–	–	50,454	–	435.74	1%
Year 2007	1,896,623	30.24%	45.93%	546	12	4	1%
Year 2009	2,060,888	32.86%	46.97%	271	6	2.05	5%
Instructional expenditures per full-time equivalent student	N/A	$6,705.93	$11,560.47	1,671	0	13.54	1%
The percentage of students who are financially independent	N/A	31.61%	20.69%	1,118	54	6.34	1%
Percentage of students whose parents' highest educational level was some form of postsecondary education	N/A	61.82%	10.11%	5,397	534	32.11	1%
Business, Management, Marketing, and Related Support Services	1,400,770	22.34%	16.46%	1,611	98	4.71	1%
Education	546,124	8.71%	9.07%	–2,397	–264	–11.25	1%
Health Professions and Related Programmes	483,137	7.70%	11.10%	1,574	142	6.24	1%
Social Sciences	418,484	6.67%	6.22%	1,675	269	7.97	1%
Psychology	340,265	5.43%	4.22%	–44	–10	–0.26	–
Computer and Information Sciences and Support Services	294,248	4.69%	9.29%	788	85	3.27	1%
Biological and Biomedical Sciences	274,722	4.38%	4.06%	–234	–58	–1.37	–
Visual and Performing Arts	258,156	4.12%	8.75%	–1,465	–167	–6.77	1%
Liberal Arts and Sciences, General Studies and Humanities	236,010	3.76%	8.40%	–616	–73	–3.05	1%
Engineering	233,291	3.72%	7.78%	2,504	322	11.9	1%
Communication, Journalism, and Related Programmes	233,115	3.72%	3.79%	–22	–6	–0.15	–
Engineering Technologies and Engineering-Related Fields	230,225	3.67%	10.53%	292	28	1.07	–
English Language and Literature/Letters	219,882	3.51%	2.98%	327	110	1.79	10%
Homeland Security, Law Enforcement, Firefighting and Related Protective Services	146,849	2.34%	4.58%	–608	–133	–3.94	1%
History	104,778	1.67%	1.61%	401	249	2.35	5%
Public Administration and Social Service Professions	104,070	1.66%	3.16%	–453	–144	–3.3	1%
Parks, Recreation, Leisure, and Fitness Studies	79,501	1.27%	2.14%	–978	–456	–7.22	1%
Physical Sciences	78,381	1.25%	1.36%	–340	–250	–2.29	5%
Family and Consumer Sciences/ Human Sciences	68,540	1.09%	2.11%	–779	–369	–5.91	1%
Agriculture, Agriculture Operations, and Related Sciences	62,941	1.00%	2.99%	–85	–29	–0.59	–
Foreign Languages, Literatures, and Linguistics	62,090	0.99%	1.34%	–36	–27	–0.23	–
Mathematics and Statistics	53,608	0.86%	0.90%	105	117	0.72	–
Natural Resources and Conservation	39,807	0.64%	2.10%	–596	–284	–4.68	1%
Theology and Religious Vocations	39,118	0.62%	5.76%	–1,016	–176	–6.16	1%
Philosophy and Religious Studies	34,194	0.55%	1.80%	–421	–234	–3.36	1%
Architecture and Related Services	33,714	0.54%	1.74%	154	88	1.19	–
Area, Ethnic, Cultural, Gender, and Group Studies	23,182	0.37%	1.00%	757	757	5.47	1%
Transportation and Materials Moving	15,412	0.25%	2.74%	367	134	2.83	1%
Legal Professions and Studies	15,162	0.24%	1.36%	–293	–216	–2.43	5%

and minus $264 respectively. Even were 'Education' to be eliminated from the subject mix entirely, on the assumption that the historic pattern holds, mean earnings would increase by just $2,299 (8.71 per cent multiplied by $264), an increase of 4.5 per cent.

An indication that what held in the past cannot be relied on in the future is shown by the estimates for the earlier years 2007 and 2009. In all cases mean earnings are in 2014 dollars, and are measured ten years after enrolment, so are directly comparable. But the outcomes by year suggest that graduate earnings are on a declining path, with the earlier years having the most positive coefficients. This could be the effect of the 2008 financial crisis as it would be absent from the 2007 data and would only marginally affect the 2009 cohort.

A more powerful result is in relation to 'Percent of students whose parents' highest educational level was some form of postsecondary education'. This has a significant $5,397 estimate with a standard deviation of 10 per cent. This indicates that 'middle class' students, from 'educated' families, have an earnings advantage regardless of other factors. It implies that, under a risk-sharing scheme, in the absence of state subsidies it would be rational for universities to pay attention to a student's parental educational background and either develop strategies to counter the disadvantage or offer lower-cost courses accordingly.

The positive estimate for 'Instructional expenditures per full-time equivalent student' might be considered a justification for increasing higher education expenditure. However, with an $11,560 increase in spending per annum, or $46,240 over a four-year course, resulting in just $1,671 additional mean earnings per annum, the rate of return is just 3.6 per cent. While positive, this may be insufficient taking account of risk and the implication is that it is possible that spending has gone beyond the point where an adequate rate of return is earned.

The field indicating the degree of financial independence of the student intake, an indicator of family wealth, is useful as it will adjust, to an extent, for the likelihood that the wealthiest students will go on, for reasons unrelated to their education, to have higher incomes. The positive coefficient suggests that better-off students are expected to earn more regardless of subject and institution.

The analysis shows that useful information about subject and other effects on subsequent earnings can be extracted from the College Scorecard Data set. Were it possible for an institution to rely on past subject–earnings relationships it suggests that a college could seek to increase the expected earnings of its graduate body by changing the subject mix. However, the expected effects on aggregate earnings for modest changes are small and cannot be relied on in the case of any significant change in subject mix. Without more detailed, comprehensive data that were able to take account of trends in earnings, a decision to change subject mix designed to enhance average earnings would be speculative.

6. Review

Recently a more comprehensive data set has become available in the UK. This database (Longitudinal Earnings Outcomes, LEO) links student loan data to HMRC tax records at the individual level. It has initially been made available to a team led by the Institute for Fiscal Studies. In their initial examination of the data Britton et al. (2015) confirm that the data are consistent with earlier survey data. Their second paper (Britton et al. 2016) examines broadly the same issues that are addressed here. In relation to subjects their results are consistent with the above, in that the raw data suggest that different subjects imply different earnings outcomes. But when they adjust for

institution and average student ability, which the College Scorecard Data does not allow, they conclude that for many subjects there is little significant variation in median earnings. They identify just two outlier subjects with the most statistically powerful positive earnings impacts, namely medicine for both men and women, and economics for men only.

In the UK medicine is a special case as the state regulates the number of places on offer and standardises salaries across the sector. Consequently, the apparently superior earnings could be considered an effect of government policy and not a free market effect. The current evidence that junior doctors are unhappy about their compensation suggests that policy may be changing to reduce the earnings of those who study medicine, so that even this statistically powerful result may not be a useful guide to the future.

That leaves economics for men as the only subject course where, using the LEO data, a university may have grounds for increasing provision under the proposed market reforms. This is consistent with our US results where both Social Sciences[16] and Business Studies had positive coefficients.

In a debate about the impact of subject studied on earnings, it is useful to consider the employers' perspective. The CBI/Pearson employers' survey reports that:

> Businesses look first and foremost for graduates with the right attitudes and aptitudes to enable them to be effective in the workplace – nearly nine in ten employers (89 per cent) value these above factors such as degree subject. (CBI 2015, p. 8)

Hence it may be a greater willingness to engage with the attitudinal requirements of business that is common to those who apply to read economics in England and Social Sciences/Business in the US, rather than the learned subject content, that leads to high earnings, given that it would be reasonable to assume a particular openness to the demands of business from someone interested in a strongly business-oriented discipline. Were it possible to adjust for that trait, the earnings enhancement implied from reading those subjects may then decline to statistical insignificance.

In summary, the weak subject–earnings link, the general uncertainty about future incomes, and businesses' expressed need for general work awareness skills suggests that the rational response to the proposed market reforms is not to alter the range of subjects on offer, but to ensure that all courses include some business- or work-oriented content designed to develop the desired attitudes and aptitudes.

As, under our risk-sharing reform, the financial nexus between student and university would continue long after graduation, it would also encourage institutions to provide 'after sales' support where a subject choice turns out to be suboptimal later in the graduate's career. Frey and Osborne (2013) estimated that 47 per cent of US jobs would be replaced with automation over the next two decades. Their analysis included professional work and they gave specific examples where tasks typically reserved for doctors, lawyers and financiers were being carried out more efficiently by expert systems. Given that a career can extend over four decades, this suggests that the probability that the knowledge gained at university will remain useful throughout a working lifetime is low.

Many, of course, will have learned how to learn and will adjust over time. But for those who suffer a more dramatic disruption to their career the fact that their fortunes are shared by their alma mater provides a form of insurance cover. On the assumption that the university feels that career guidance or training could help an unemployed graduate back into work, or an underemployed one into a higher-earning occupation, it will have a cost–benefit reason for helping. With median annual full-time earnings at £27,600 (ONS 2015, p. 2), for each month a university's support shrinks the time out

of employment there is a gain of over £2,000 to be shared. If the university's intervention could raise the earnings of the graduate in a low-skill job by just £1,000 per annum for a decade, there would be a gain of £10,000 to be shared.

This longer-term alignment of financial fortunes transforms the university from the provider of a one-off educational product into a lifetime career-support service. It becomes a utility, supplying 'educational insurance' and stepping in to update skills when needed. As university courses themselves face growing competition from cheap online provision, this extension of their offering to a more personal service would ensure they remain relevant and valued.

7. Conclusion

The data show that government policy should aim to raise the mean and median of graduate earnings – the most objective measures of employability – and to narrow the range at the lower end. The incentive and regulatory structure currently in place and planned does not link university income to that of its graduates, and as a consequence incentives are misaligned: too many graduates are not getting, and will not get, value from their investment in a higher education.

Now that the SLC (student loan) and HMRC income tax databases have been linked, there are adequate data to estimate fairly the success of each institution in helping its graduates into high-skilled employment and also the financial costs of disadvantage. It is therefore now practical to align incentives with the desired outcome by tying university finances directly to graduate earnings, a more objective measure of institutional effectiveness. These data are updated monthly with each payroll run, so universities will be able to keep a frequent watch on the long-term value of their employability strategy, developing changes if considered advantageous.

This change in the incentive structure would justify releasing universities from most other regulations, while using selective premiums in favour of disadvantaged students and certain subjects to achieve policy ends with minimal interference. With these new freedoms and a much clearer long-term objective, universities would be at liberty to experiment and learn what educational strategy delivers the best employability outcomes for their students.

Notes

1. The published measure reports on the rate for English-domiciled students attending a higher education institution anywhere in the UK.
2. Researchers with the project Researching Graduate Careers Seven Years On at the University of Warwick and the University of the West of England have defined a non-graduate role as one which is associated with tasks that do not normally require knowledge and skills developed through higher education to enable them to perform these tasks in a competent manner. Examples of non-graduate jobs include receptionists, sales assistants, many types of factory workers, care workers and home carers (Elias and Purcell 2004).
3. Note that this article concerns *English* higher education. Higher education is a devolved responsibility in the UK and the Scottish funding mechanism in particular is different from that in England.
4. For a mathematical treatment and demonstration of this point, see McKenzie and Sliwka (2011).
5. Where communication is face to face it is easier to arrange that at a time to suit the university if the students are full-time and local.
6. In the British Labour Party leadership election of 2016, one candidate (Owen Smith) proposed a graduate tax while the other (Jeremy Corbyn) offered to abolish fees altogether.
7. http://lumni.net/en/about
8. https://www.congress.gov/bill/113th-congress/house-bill/4436
9. The university cannot influence these other factors ε.

10. The university could also offer an earnings-linked repayment option in relation to essential living costs for students who cannot finance that element of a university education, though as the utility of accommodation and food is not subject to uncertainty they should be financed by a conventional loan where possible.
11. A sticker price is the advertised price, as in the case of a sticker in the windscreen of a car. It is not necessarily the actual price that will be paid. In the case of a car there may be other charges or discounts. In the case of university fees, as repayment is on an income-contingent basis the sticker price (currently typically £9,000 per annum) indicates the maximum price unadjusted for interest charges. With interest the total amount paid can exceed £9,000 by a margin that is a function of the rate of interest (where charged) and the time taken to extinguish the liability, or if income is insufficient the amount repaid could be substantially less than the sticker price and as low as zero.
12. The premium over the earnings of the less wealthy students.
13. There is no equivalent estimate of the cost to the US federal government from defaults on student loans. However, it was recently reported (Mitchell 2016) that 43 per cent of the 22m Americans with federal student loans were behind in their payments, suggesting a similar magnitude of loss.
14. The feasibility of this financial transaction will, like any other, depend in part on how the investors' receipts are treated for tax purposes.
15. A graduate degree in the US is broadly equivalent to a postgraduate degree in the UK.
16. Of which economics is one.

References

Britton, J. and C. Crawford (2015) *Estimating the Cost to Government of Providing Undergraduate and Postgraduate Education* (IFS Report 105). London: Institute for Fiscal Studies. http://www.ifs.org.uk/uploads/publications/comms/r105.pdf (accessed 16 August 2016).

Britton, J., N. Shephard and A. Vignoles (2015) Comparing Sample Survey Measures of English Earnings of Graduates with Administrative Data During the Great Recession. IFS Working Paper W15/28. London: Institute for Fiscal Studies.

Britton, J., L. Dearden, N. Shephard and A. Vignoles (2016) How English Domiciled Graduate Earnings Vary with Gender, Institution Attended, Subject and Socio-economic Background. IFS Working Paper W16/06. London: Institute for Fiscal Studies.

Callendar, C. (1997) Higher Education in the Learning Society. *Report 2, Full and Part-Time Students in Higher Education: Their Experiences and Expectations*. Leeds: Policy Studies Institute, University of Leeds. http://www.leeds.ac.uk/educol/ncihe/report2.htm (accessed 16 August 2016).

CBI (Confederation of British Industry) (2015) *Inspiring Growth: CBI/Pearson Education and Skills Survey 2015*. London: CBI.

Complete University Guide (2016) Choosing a university course: applicants' top five factors. http://www.thecompleteuniversityguide.co.uk/courses/choosing-a-course/choosing-a-university-course-applicants'-top-five-factors/ (accessed 16 August 2016).

Department for Business, Innovation & Skills (2015) Participation rates in higher education: academic years 2006 and 2007 to 2013 and 2014 (provisional) tables. https://www.gov.uk/government/statistics/participation-rates-in-higher-education-2006-to-2014 (accessed 16 August 2016).

Department for Business, Innovation & Skills (2016) *Success as a Knowledge Economy: Teaching Excellence, Social Mobility and Student Choice* (Cm 9258). London: Department for Business, Innovation & Skills.

Elias, P. and K. Purcell (2004) SOC (HE): A Classification of Occupations for Studying the Graduate Labour Market. Research Paper No. 6. Research Graduate Careers Seven Years On. Economic and Social Research Council and the Higher Education Careers Services Unit. http://www2.warwick.ac.uk/fac/soc/ier/research/completed/7yrs2/rp6.pdf (accessed 17 August 2016).

Frey, C. and M. Osborne (2013) The Future of Employment: How Susceptible Are Jobs to Computerisation? Working Paper. Oxford: Oxford Martin Programme on Technology and Employment. http://www.oxfordmartin.ox.ac.uk/downloads/academic/future-of-employment.pdf (accessed 16 August 2016).

Friedman, M. (1962) *Capitalism and Freedom*. Chicago, IL: University of Chicago Press.

House of Commons Business, Innovation and Skills Committee (2014) *Student Loans: Third Report of Session 2014–15* (HC 558). London: The Stationery Office. http://www.publications.parliament.uk/pa/cm201415/cmselect/cmbis/558/558.pdf (accessed 16 August 2016).

McKenzie, T. and D. Sliwka (2011) 'Universities as Stakeholders in their Student's Careers: On the Benefits of Graduate Taxes to Finance Higher Education', *Journal of Institutional and Theoretical Economics* 167(4), 726–742.

Migration Advisory Committee (2013) Shortage Occupation Lists. https://www.gov.uk/government/collections/migration-advisory-committee-recommended-shortage-lists (accessed 16 August 2016).

Mitchell, J. (2016) 'More Than 40% of Student Borrowers Aren't Making Payments', *Wall Street Journal*, 7 April.

ONS (Office for National Statistics) (2015) Statistical bulletin: Annual Survey of Hours and Earnings: 2015 Provisional Results. http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2015provisionalresults (accessed 16 August 2016).

ONS (2016a) Percentage of graduates working in non-graduate roles in London and the UK: 2011 to 2015. http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/adhocs/005742percentageofgraduatesworkinginnongraduaterolesinlondonandtheuk2011to2015 (accessed 22 August 2016).

ONS (2016b) Statistical Bulletin: UK Labour Market: July 2016. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/july2016#main-points-for-march-to-may-2016 (accessed 16 August 2016).

Purdue University (2016) 'Purdue Launches Innovative College Funding Model', *Purdue Today*, 4 April. http://www.purdue.edu/newsroom/purduetoday/releases/2016/Q2/purdue-launches-innovative-college-funding-model.html (accessed 16 August 2016).

UKCES (UK Commission for Employment and Skills) (2016) *Working Futures 2014–2024*. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/514285/Working_Futures_Headline_Report_final_for_web__PG.pdf (accessed 16 August 2016).

US Department of Education (2016) College Scorecard Data. https://collegescorecard.ed.gov/data/ (accessed 22 August 2016).

Wolf, A. (2015) *Issues and Ideas. Heading for the Precipice: Can Further and Higher Education Funding Policies be Sustained?* London: The Policy Institute, King's College London.