Assessing the economic returns to Level 4 and 5 STEM-based qualifications

Final Report for the Gatsby Foundation

LE London Economics

June 2017

About London Economics

London Economics is one of Europe's leading specialist economics and policy consultancies. Based in London and with offices and associate offices in five other European capitals, we advise an international client base throughout Europe and beyond on economic and financial analysis, litigation support, policy development and evaluation, business strategy, and regulatory and competition policy.

Our consultants are highly-qualified economists who apply a wide range of analytical tools to tackle complex problems across the business and policy spheres. Our approach combines the use of economic theory and sophisticated quantitative methods, including the latest insights from behavioural economics, with practical know-how ranging from commonly used market research tools to advanced experimental methods at the frontier of applied social science.

We are committed to providing customer service to world-class standards and take pride in our clients' success. For more information, please visit www.londoneconomics.co.uk.

Head Office: Somerset House, New Wing, Strand, London, WC2R 1LA, United Kingdom.

w: londoneconomics.co.uk
t: +44 (0)20 3701 7700
e: info@londoneconomics.co.uk
f: +44 (0)20 3701 7701
: @LondonEconomics
@LE_Education

Acknowledgements

We would like to acknowledge the useful guidance and feedback provided by the Gatsby Foundation, in particular Ginny Page, Nigel Thomas, and Jennifer Allen throughout this research. Despite the assistance, responsibility for the contents of this report remains with London Economics.

Authors

Dr Gavan Conlon, Partner, +44 (0) 20 3701 7703, gconlon@londoneconomics.co.uk

Ms Maike Halterbeck, Senior Economic Consultant, +44 (0) 20 3701 7724; mhalterbeck@londoneconomics.co.uk

Cover picture credit: Digital Storm /Shutterstock

Table of Contents

Executive Summary

What is the rationale for promoting higher technical education?

In its recent **Industrial Strategy** Green Paper[1], the Department for Business, Energy and Industrial Strategy highlighted a range of long-term challenges to the UK economy, as well as its proposed approach to tackling these challenges in order to improve living standards and economic growth across the country. One of the strategy's **key ten pillars** relates to **developing skills**, particularly technical skills:

> *"While our higher education system has its strengths, our poor performance in basic and technical skills is key to the UK's persistently lower levels of productivity compared with other advanced economies. […] We face particular shortages in sectors that depend on science, technology, engineering and maths (STEM) skills."*

The Government's **Post-16 Skills Plan**[2] further emphasised the particular requirement for technical education at higher levels, and the need for higher education programmes to be re-designed to ensure that students are well-prepared for entry into the skilled labour market. The overall shortage of technical skills has prompted the recent independent assessment of technical education as part of the **Sainsbury Review**[3], which has proposed a range of reforms to establish a labour market-orientated system of technical education in England.

Sub-degree qualifications constitute an important element of the UK higher education offering. With the majority of students undertaking these qualifications engaged in STEM subjects, higher education qualifications at Levels 4/5 qualifications already contribute to the UK's technical skills base. However, since the increase in higher education tuition fees in England in 2012/13, there has been a **significant decline** in the number of students undertaking sub-degree qualifications.

What are the labour market returns to higher technical education?

To explore potential reasons for and measures to address this decline, we undertook an econometric analysis of the returns associated with higher education qualifications at Levels 4 and 5 (relative to possession of Level 3 qualifications), and compared these to the corresponding returns associated with undergraduate degrees (Level 6). The analysis focused on English-domiciled students who started prescribed degree or sub-degree qualifications at HEIs or FECs in England in 2016/17, and was undertaken separately for both STEM-based and non-STEM-based subjects for men and women separately.

Assessing the net graduate premium

In terms of the net **monetary benefits** to students from the acquisition of STEM-based sub-degree qualifications, in general, the analysis indicates that the **net graduate premiums** associated with HE qualifications at Level 4/5 are **lower** than the corresponding net graduate premiums achieved by students completing undergraduate degrees. However, there is **significant variation** in these premiums by qualification, gender, study mode and subject group.

- For **full-time students**, the analysis suggests that the net benefits to students undertaking specific STEM-based qualifications at Level 4/5 are substantial (and generally larger than the returns associated with non-STEM-based subjects). The analysis indicates that there are

[1] See Department for Business, Energy and Industrial Strategy (2017).
[2] See Department for Business, Innovation and Skills and Department for Education (2016).
[3] See Independent Panel on Technical Education (2016).

particularly high net graduate premiums achieved by *males* undertaking *HNCs/HNDs* in STEM-based subjects (**£100,000** per student) and *females* undertaking *HE Diplomas* in STEM-based subjects (**£57,000**). The corresponding net benefits to undergraduate degree students in STEM-based subjects were estimated to be **£166,000** and **£106,000** for men and women, respectively.

- Reflecting the general fact that **part-time students** tend to undertake their qualifications later in life, the net lifetime benefits accrued by these students are typically lower than the benefits to full-time students. However, again, we found that there are relatively high net graduate premiums accrued by men undertaking STEM-based HNCs/HNDs (**£66,000** per student) and by women undertaking STEM-based HE Diplomas (**£23,000**). As with full-time students, these estimates are (in this case, marginally) smaller than the corresponding premium to undergraduate degree students in STEM-based subjects (**£69,000** and **£26,000** per male and female undergraduate student, respectively).

The analysis further suggests that the net benefits to the **public purse** are roughly equal to (full-time students) or larger (part-time students) than the corresponding net graduate premiums, indicating that there are substantial financial returns to the public purse associated with all forms of higher education qualification attainment.

Assessing the internal rate of return to students

Measuring *only* the absolute return associated with higher education qualification attainment can be misleading. To assess the **profitability** or **yield** of HE qualification attainment from an investment perspective, and to facilitate the comparison across different qualification levels (by taking account of the **relative size and timing of the benefits as compared to the initial costs incurred**), we also estimated the **internal rate of return (IRR)** to students associated with undertaking Level 4, 5 (and 6) HE qualifications.

The analysis indicates that, although the internal rates of return are again unevenly distributed across the different qualifications, **in some instances, the IRR to students undertaking STEM-based Level 4/5 qualifications are significantly higher than, or equal to, the returns associated with undergraduate degrees**. This partly reflects the differences in the level of initial 'investment' required, where the direct and indirect costs to students undertaking higher education at Levels 4/5 qualifications are typically lower than the costs to undergraduate degree students at Level 6.

- Specifically, for **full-time students**, reflecting their high net graduate premium, there are particularly large rates of return achieved by men undertaking STEM-based HNCs/HNDs (**24.8%**) and women completing STEM-based HE Diplomas (**16.6%**). These compare to an IRR of **19.5%** and **17.1%** posted by men and women undertaking undergraduate degrees in STEM-based subjects.
- For **part-time students**, there are also instances where the internal rates of return to Level 4/5 qualifications exceed the returns to undergraduate degrees to an even greater extent. Here, again, very substantial rates of return are accrued by males studying STEM-based HNC/HNDs (**25.3%**) and females undertaking STEM-based HE Diplomas (**13.0%**). This compares to internal rates of return to undergraduate degree level students in STEM-based subjects of **15.1%** and **10.2%** for men and women, respectively.

Addressing the decline in students undertaking sub-degree qualifications

The analysis indicates that although there are strong positive returns to some higher technical education, there is some variation across qualifications, gender, study mode and subject area. In particular, while the returns to some specific qualifications, particularly in STEM-based subjects, are substantial and often larger than the respective returns to undergraduate degrees, in other

instances, Level 4/5 qualifications lag behind the returns accrued by degree-level students. This suggests three potential approaches to tackling the recent decline in enrolments at sub-degree level qualifications.

- In choosing their educational path, it might be the case that potential students are either unaware of *any* financial returns associated with different qualifications, or they consider only the *absolute* financial returns to these qualifications (i.e. the net graduate premium) – which are larger for undergraduate degrees than for sub-degree qualifications.

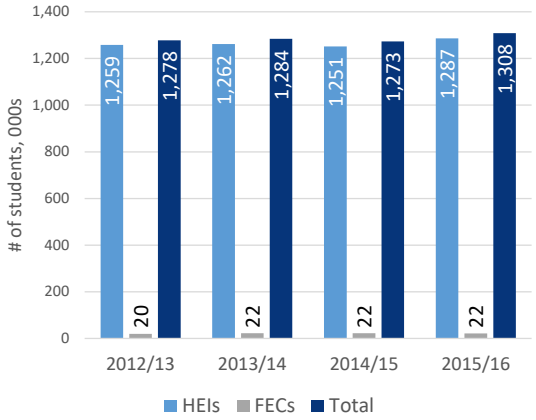
  However, from an investment perspective, it is crucial to also consider the *internal rate of return* to qualification attainment, taking into account the lower levels of investment required to enrol in Level 4/5 learning as compared to Level 6. This points to the importance of the **provision of appropriate information, advice and guidance** in ensuring that potential students can make informed choices throughout their educational journey – including an understanding of both the absolute monetary benefits *as well as* the potential 'profitability' of their HE investment. While financial returns should certainly **not** be the only criterion in the decision to enrol in higher education, it is crucial that potential students are provided with reliable and comprehensive information on the options available to them.
- Mirroring recommendations made by the Sainsbury panel on technical education, a second key policy response – both to increase currently low returns where they exist, and to maintain the returns where they are currently high – would be to adopt additional measures to enhance the **quality** of Level 4/5 HE provision. This would ensure that students are endowed with the skills and knowledge **relevant to employers**, so that they benefit from higher earnings and employment returns in the labour market.
- However, the availability of improved information and guidance and/or an increase in the quality of Level 4/5 HE provision might not be sufficient to deliver a significant boost in the number of students undertaking Level 4/5 qualifications (particularly in the short-run). In this respect, the uptake of such qualifications might be further incentivised by increasing the amount of **financial support** provided to students undertaking these Level 4/5 qualifications. This would result in an increase in the internal rate of return to students, but would also address the credit constraints associated with the costs associated with higher education qualification attainment.

1 Introduction

1.1 Background and objectives

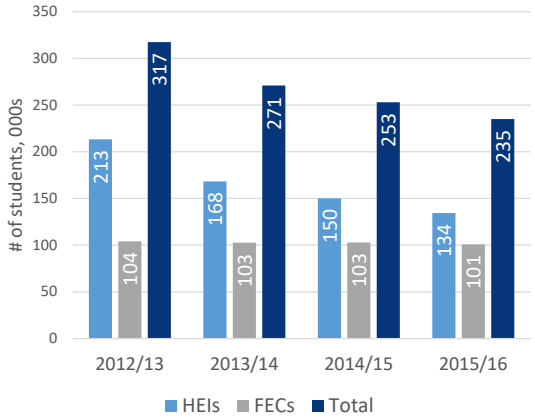
Since the increase in higher education tuition fees in England in 2012/13, although there has been a marginal increase in the number of first degree students enrolled at public providers[4] in England (Figure 1), there has been a marked decline in the number of students undertaking other undergraduate qualifications (Figure 2). Whereas the number of first degree students increased by **2%** over the period (from **1.28 million** in 2012/13 to **1.31 million** in 2015/16), the number of other undergraduate students declined by a total of **26%** (from **317,000** in 2012/13 to **235,000** in 2015/16). The decrease in other undergraduate student enrolments was particularly pronounced within Higher Education Institutions (HEIs). HEIs experienced a **37%** decline in students over the period compared to a **3%** decrease within Further Education Colleges (FECs).

Figure 1 First degree students enrolled at HE providers in England (000s), by provider type and year



Note: Includes both Higher Education Institutions and Further Education Colleges.
Source: London Economics' analysis of Higher Education Statistics Agency (2015, 2017a)

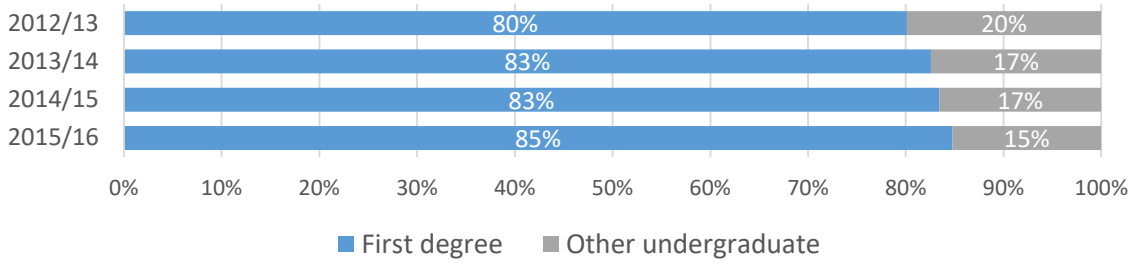
Figure 2 Other undergraduate students enrolled at HE providers in England (000s), by provider type and year



Note: Includes both Higher Education Institutions and Further Education Colleges.
Source: London Economics' analysis of Higher Education Statistics Agency (2015, 2017a)

As a result of these trends, the proportion of undergraduate students undertaking qualifications other than first degrees has declined from **20%** of the total in 2012/13 to **15%** in 2015/16 (Figure 3).

Figure 3 Distribution of undergraduate students enrolled at HE providers in England by qualification level



Source: London Economics' analysis of Higher Education Statistics Agency (2017, 2015).

[4] This includes both Higher Education Institutions (HEIs) and Further Education Colleges (FECs). HEIs include all publicly funded HE providers (including The Open University) and the (privately funded) University of Buckingham. FECs include Further Education Colleges and other private and independent UK HE colleges (see Higher Education Statistics Agency (2017a)).

The **composition** of the student body has also changed substantially over the period with a substantial long-term decline in part-time student enrolments. For instance, a recent report for the Higher Education Policy Institute (2015) illustrated that between 2001/02 and 2013/14, compared to a 23% increase in the number of full-time undergraduates over the period, the number of part-time undergraduates has declined by 42%. Although the decline in part-time enrolments clearly cannot be attributed *solely* to the 2012 changes to student finance available to part-time students, the HEPI (2015) analysis suggests that the different personal characteristics of part-time learners (compared to full-time students) compound the relative importance of wider macro-economic conditions on enrolment decisions.

Scope of analysis

Despite their declining prevalence, sub-degree qualifications constitute an important element of the higher education system (both within England and across the UK as a whole). With the majority of students undertaking these qualifications in **science, technology, engineering and maths (STEM) subjects**, sub-degree qualifications already provide a key contribution to the UK's **technical skills** base. In addition, these programmes play a crucial role in **widening access** to higher education to students from non-traditional educational backgrounds, broadening the range of choices available to individuals wishing to engage in higher and technical learning.

To understand the economic benefits associated with sub-degree qualifications, London Economics were commissioned by the Gatsby Foundation to undertake an analysis of the lifetime labour market returns (to the individual and the public purse) associated with higher education qualifications at Levels 4 and 5[5], focusing on:

- **Higher National Certificates** (HNCs)/**Higher National Diplomas** (HNDs) (Level 4/5);
- **Foundation Degrees** (Level 5);
- **Certificates of Higher Education** (HE Certificates) (Level 4); and
- **Diplomas of Higher Education** (HE Diplomas) (Level 5).

To put the estimates into context, in each instance, the returns to the various sub-degree qualifications were compared to the returns to undertaking traditional undergraduate degrees (at Level 6).

The returns to HE qualification attainment are captured in terms of:

- The net additional lifetime benefits to the **individual** (through enhanced earnings and employment, net of tax and tuition fee costs – the **net graduate premium**), and
- The **net public purse benefit** (through enhanced tax revenues, net of student support and other costs of teaching provision).

In addition to these benefits in monetary terms, to facilitate comparison across the different qualifications, the analysis estimates the **internal rate of return (IRR)** associated with each qualification. The IRR provides a measure of the **profitability** or **yield** of an investment, and takes into account the **relative size and timing of the economic benefits as compared to the initial costs incurred**, thus facilitating comparisons across the different qualification levels considered.

[5] i.e. Levels 4 and 5 of the Regulated Qualifications Framework for England, Wales and Northern Ireland (see HM Government, no date).

1.2 Structure of this report

The remainder of this report is structured as follows. In **Section 2**, we summarise the methodological approach to estimating the net graduate premium, public purse benefit and internal rate of return, based on an assessment of the lifetime benefits and costs associated with higher education attainment. **Section 3** presents the resulting estimates of the returns to Level 4, 5 and 6 qualifications, separately by subject group (i.e. comparing STEM subjects with other (non-STEM) subjects), gender, and mode of study. Finally, **Section 4** summarises our main findings.

2 Methodological approach

Atkinson's (2005) report to the Office for National Statistics was tasked with determining the appropriate methodology to be used when assessing the economic impact of a range of public sector activities. Traditionally, to estimate the value associated with **education outcomes**, straightforward 'input-output' analysis has been used. This approach simply asserts that the value of inputs into the education system essentially equals the value of outputs associated with educational attainment. However, this approach in no way captures the productivity or growth impacts associated with having a more highly educated workforce, and as such undervalues the productivity benefits associated with higher education qualification attainment. Although there are many non-economic benefits associated with higher education, Atkinson stated that the economic value of education and training is essentially the **value placed on that qualification as determined by the labour market**.

In this section, we detail the methodological approach to estimating the returns associated with Level 4/5 qualifications (as well as Level 6, for comparison), by considering the **labour market benefits associated with enhanced qualification attainment and skills acquisition – to both the individual and the public purse.**

2.1 Definitions and scope

The fundamental objective of the analysis is to generate the **net graduate premium** to the individual, the **net benefit to the public purse**, and the **internal rate of return** (to the individual) associated with higher education qualification attainment (at Levels 4, 5 and 6). These concepts are defined in Box 1, with a more detailed graphical presentation of their specific components presented in Figure 4.

Box 1 Key definitions

Gross and net graduate premium and public purse benefit

The ***gross* graduate premium** associated with qualification attainment is defined as the **present value** of **enhanced after-tax earnings** (i.e. after income tax, National Insurance and VAT are removed, and following the deduction of any foregone earnings) relative to an individual in possession of the counterfactual qualification.

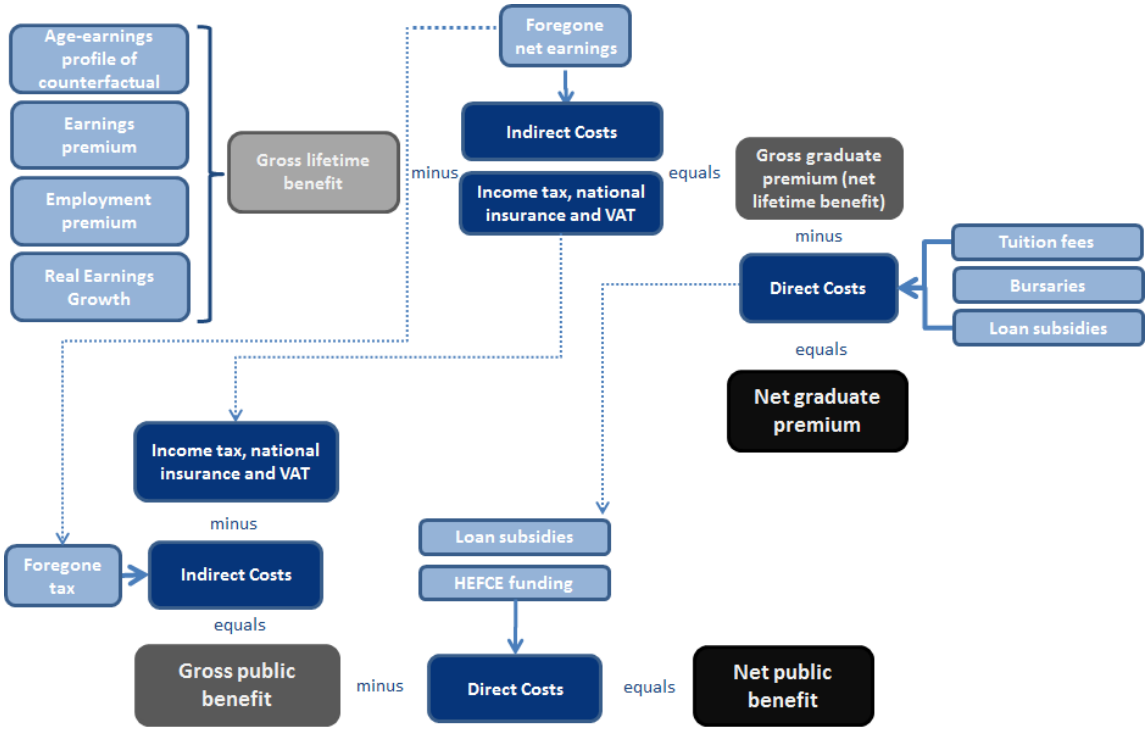
The ***gross* benefit to the public purse** is defined as the **present value** of **enhanced taxation** (i.e. income tax, National Insurance and VAT, following the deduction of the costs of foregone tax earnings) relative to an individual in possession of the counterfactual qualification.

The ***net* graduate premium** is defined as the gross graduate premium *minus* the present value of the direct costs associated with qualification attainment. Similarly, the ***net* benefit to the public purse** is defined as the gross benefit *minus* the direct costs of provision during the period of attainment.

Internal rate of return

From an investment perspective (either the individual of the Exchequer), the **rate of return** is a means of comparing alternative investment decisions. In economic terms, the **internal rate of return** is the usual metric adopted, which is the **discount rate** at which the present value of all cash flows (both the costs and benefits) associated with an investment project equals zero (i.e. the **present value of the costs equals the present value of the benefits)**. If it is the case that the present value of the benefits exceeds the present value of the costs, then the discount rate can be increased to the point at which the net present value equals zero; this corresponds to the internal rate of return.

Figure 4 Overview of gross and net graduate premium and public purse benefit



Source: London Economics' analysis of Department for Business, Innovation and Skills (2011)

Throughout the analysis, to ensure comparability and consistency across estimates, we focus on **English-domiciled students** who **started** undergraduate higher education qualifications (at Level 4, 5 or 6) at Higher Education Institutions or Further Education Colleges in **England** in the **2016/17** academic year[6] [7].

In terms of institutions, please note that, apart from the University of Buckingham (which is typically included throughout any higher education data published by the Higher Education Statistics Agency), the analysis excludes any alternative providers[8].

Further, in terms of qualifications undertaken at FECs, the analysis focuses exclusively on **prescribed higher education provision**. In this respect, HE courses taught in Further Education Institutions are divided into either *prescribed provision* or *non-prescribed provision*. Prescribed HE programmes are funded by HEFCE, either through a direct funding arrangement or indirectly through a franchising agreement with a Higher Education Institution. In contrast, non-prescribed HE in England is under the funding remit of the (former) Skills Funding Agency – where the Agency has the ability but *not*

[6] Note that there are significant differences in the way in which higher education is funded across the Home Nations, both in terms of the teaching grants provided to institutions by the respective Higher Education Funding Councils (i.e. the Higher Education Funding Council for England (HEFCE), the Higher Education Funding Council for Wales, the Scottish Funding Council, or the Department for Employment and Learning for Northern Ireland), as well as the tuition fee, maintenance and other student support paid directly to the student by the Student Loans Company (SLC) and the Student Awards Agency for Scotland. For a more detailed explanation of the differences, see London Economics (2015).

[7] Please note that, in general, the information available on higher education students in Further Education Colleges is very limited. As a result, there are only relatively few instances (e.g. in terms of tuition fee rates and bursaries) where we were able to include specific data relating to these students to arrive at an average across both Higher Education Institutions and Further Education Colleges. In all other instances, it was necessary to base the assumptions on the respective information for students studying at Higher Education Institutions only.

[8] Based on the definition used by the Higher Education Funding Council for England, alternative providers are HE providers that do not receive funding from the higher education funding councils, do not receive any other types of annual public funding, and are not Further Education Colleges. For more information, see Higher Education Funding Council for England (2017).

the obligation to fund such non-prescribed programmes. Given these differences, while both prescribed and non-prescribed HE cover regulated qualifications at Level 4 and above, non-prescribed HE is mostly professional in nature[9]. Although a large volume of consistent data is collected on prescribed HE (from the Higher Education Statistics Agency), only very limited information exists in the public domain in terms of the student body and funding levels associated with non-prescribed higher education. Given this, the latter has been excluded from the analysis.

Further, to ensure greater comparability between the estimates and to provide a more granular understanding of the returns to different qualification levels, the analysis is broken down into **STEM-based** and **non-STEM-based ('other') subjects**, using the categorisation presented in Table 1. In this respect, in contrast to the more common STEM subject definition, our group of STEM-*based* subjects used throughout this analysis also includes medicine and dentistry, medical related subjects and architecture. While our definition is slightly wider than the traditional STEM subject group, throughout the following, any further reference to 'STEM' subjects refers to the wider group of 'STEM-based' subjects.

Table 1 Categorisation of subjects into STEM and non-STEM groups

Code	Subject category	Subject group[1]
(1)	Medicine and dentistry	STEM-based
(2)	Medical related subjects	
(3)	Biological Sciences[2]	
(4)	Agricultural Sciences	
(5)	Physical/Environmental Sciences	
(6)	Mathematical Sciences & Computing	
(7)	Engineering	
(8)	Technology	
(9)	Architecture and related studies	
(10)	Social Studies	Non-STEM-based
(11)	Law	
(12)	Business & Financial studies	
(13)	Mass Communications and Documentation	
(14)	Linguistics, English, Celtic and Ancient	
(15)	European Languages	
(16)	Eastern, Asiatic, African, American, and Australasian Languages, literature	
(17)	Humanities	
(18)	Arts	
(18)	Education	

Note: Based on Labour Force Survey (LFS) variable SNGDEGB (single subject of degree (banded)). Note that we have also included individuals who studied combined (rather than single) subjects, where an individual studying any of the above-listed STEM subjects as part of their combined subjects was categorised into the STEM group. Further note that, whereas the categories presented in the table focus on undergraduate degrees only, a similar subject variable (and associated categorisation into STEM/non-STEM) applies to students in possession of sub-degree qualifications as their highest level of learning (based on variable SUBCODE).

[1] Note that the non-STEM subject category includes individuals whose subject was recorded as 'no answer' or 'does not apply'.

[2] In contrast to the standard Joint Academic Coding System (JACS) used by HESA to classify students' subjects, where veterinary sciences are classified into a separate category, the LFS includes any veterinary sciences in biological sciences – i.e. veterinary sciences are included in the STEM subject group.

Source: London Economics, based on Office for National Statistics (2017) and categorisation provided by the Gatsby Foundation

Using this categorisation, Table 2 presents information on the number of undergraduate students enrolled at UK Higher Education Institutions in the 2015/16 academic year, broken down into STEM and non-STEM subjects (as well as by gender and level)[10]. Further, Figure 5 and Figure 6 present the

[9] For more information, see Skills Funding Agency (2016) and Higher Education Funding Council for England (no date).

[10] Note that, in contrast to the scope of this analysis, the table includes both UK and non-UK domiciled students, new and continuing students as well as providers located in and outside of England, and excludes students enrolled at Further Education Colleges – all for 2015/16. The available HESA data did not contain the information required to provide similar information for 2016/17 (i.e. the academic

breakdown of these students by qualification level, gender and individual subject within each group[11].

Table 2 Undergraduate students enrolled at UK Higher Education Institutions in 2015/16, by level, gender and subject group

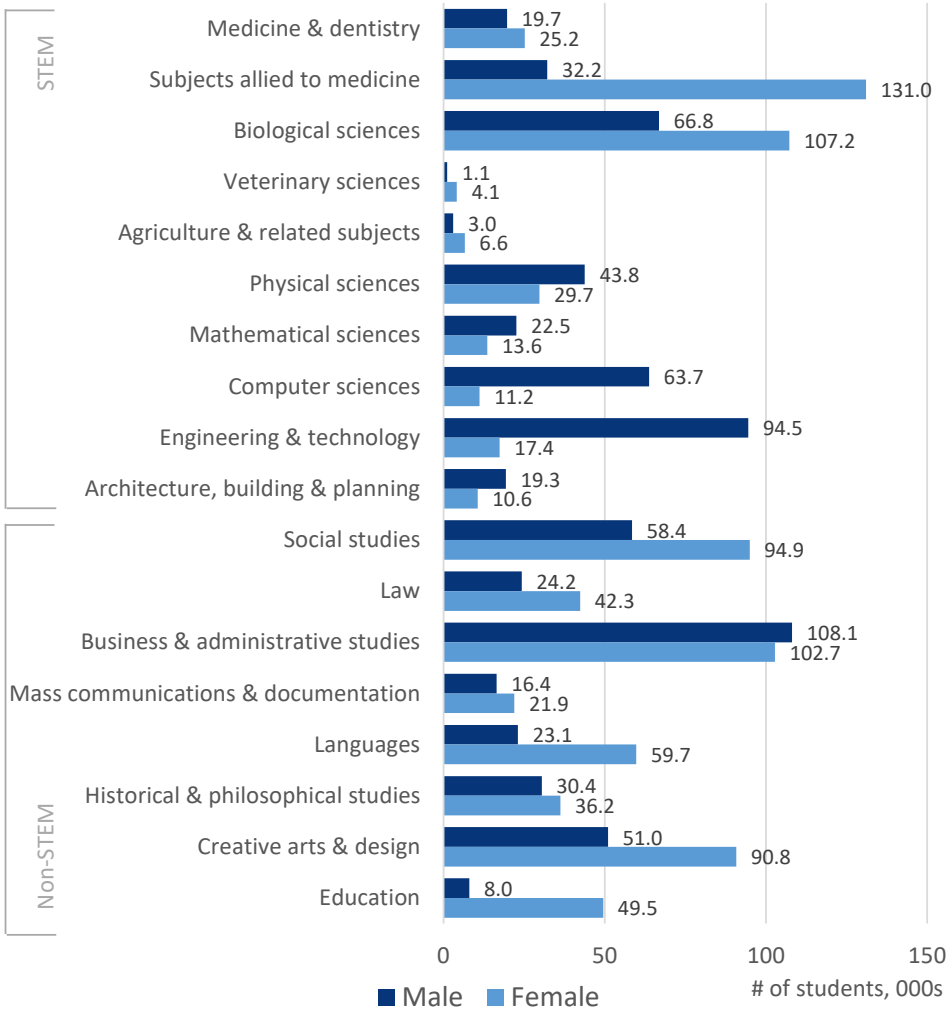
Level and subject group	Number (000s)			%		
	Male	Female	Total	Male	Female	Total
First degrees						
STEM	367	356	**723**	53%	42%	**47%**
Non-STEM	320	498	**818**	47%	58%	**53%**
Total	**686**	**855**	**1,541**	**100%**	**100%**	**100%**
Other undergraduate qualifications						
STEM	35	56	**92**	58%	53%	**55%**
Non-STEM	26	49	**75**	42%	47%	**45%**
Total	**61**	**105**	**167**	**100%**	**100%**	**100%**

Note: Includes both new and continuing UK and non-domiciled students enrolled at UK HEIs in 2015/16. Excludes a total of approximately 40,000 students studying combined subjects. ***Source: London Economics' analysis of HESA (2017b).***

year of interest) for Further Education Colleges; the relevant breakdowns to limit the information to new students from England studying in England only; or a breakdown of the 'other undergraduate' category into the Level 4/5 qualifications of interest.

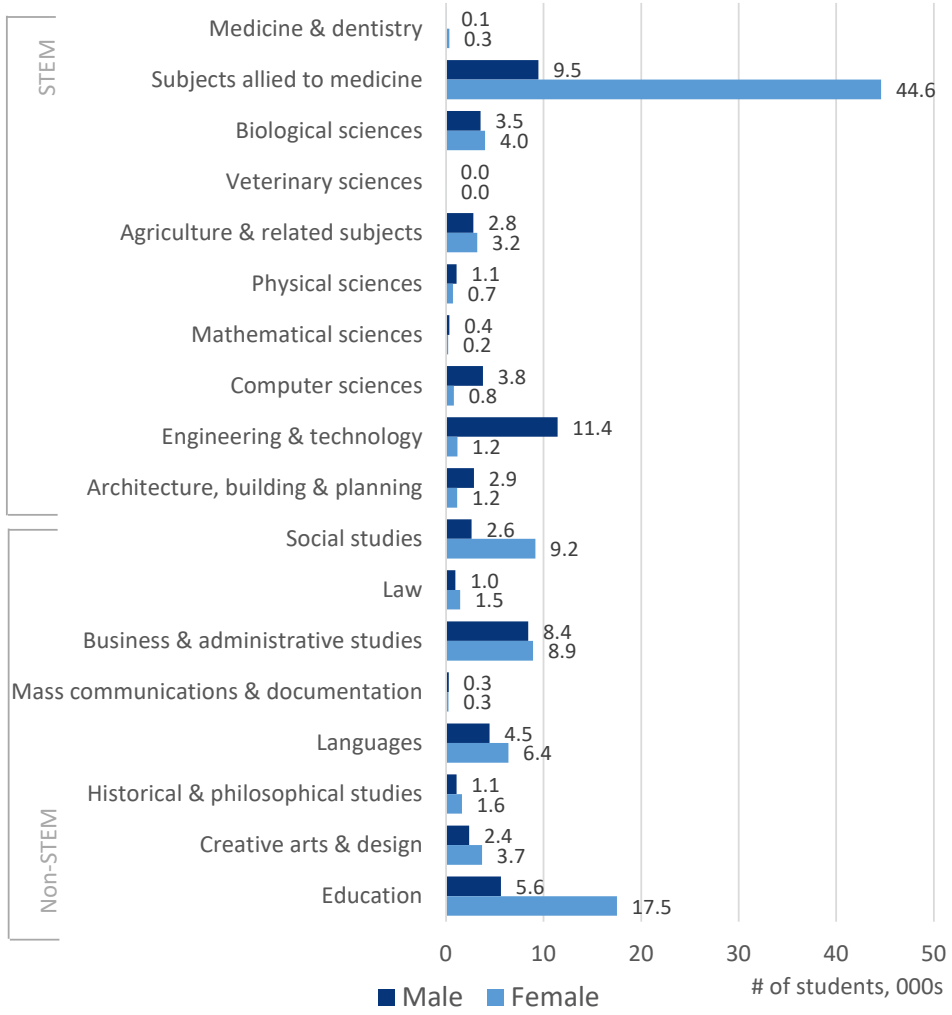
[11] Further information on the breakdown of students in STEM subjects into the underlying individual subject categories is provided in Section A3.1.

Figure 5 Number of first degree students enrolled at UK Higher Education Institutions in 2015/16, by gender and subject (in 000s)



Note: Includes both new and continuing UK and non-domiciled students enrolled at UK HEIs in 2015/16. Excludes a total of approximately 23,000 students studying combined subjects.
Source: London Economics' analysis of HESA (2017b).

Figure 6 Number of other undergraduate students enrolled at UK Higher Education Institutions in 2015/16, by gender and subject (in 000s)



Note: Includes both new and continuing UK and non-domiciled students enrolled at UK HEIs in 2015/16.Excludes a total of approximately 17,000 students studying combined subjects.
Source: London Economics' analysis of HESA (2017b).

Finally, a key aspect of the analysis is the definition of an appropriate **baseline/counterfactual** level of qualification to which the earnings and employment associated with higher education level qualifications are compared. For consistency, the labour market returns associated with Level 4, 5 and 6 HE qualifications are estimated **relative to possession of a (vocational or academic) qualification at Level 3**. Note that individuals in possession of these baseline qualifications have not been split by subject group. In other words, the analysis generates the returns to Level 4/5 (or 6) qualifications in STEM subjects or non-STEM[12] subjects relative to **Level 3 qualifications in *any* subject**.

2.2 Estimating the returns to HE qualifications

2.2.1 Estimating the gross graduate premium

To measure the economic benefits to undergraduate higher education, we estimate the *additional* labour market benefits associated with each qualification relative to individuals with the baseline level of qualification (rather than simply assessing the labour market outcomes achieved by individuals *in possession* of a higher education qualification). To achieve this, we undertake an **econometric analysis** where the 'treatment' group consists of those individuals in possession of the **Level 4/5 qualifications** of interest (as well as undergraduate degrees for comparison), and the 'counterfactual' group consists of those individuals with comparable personal and socioeconomic characteristics but in possession of a **Level 3 qualification** as their highest attainment.

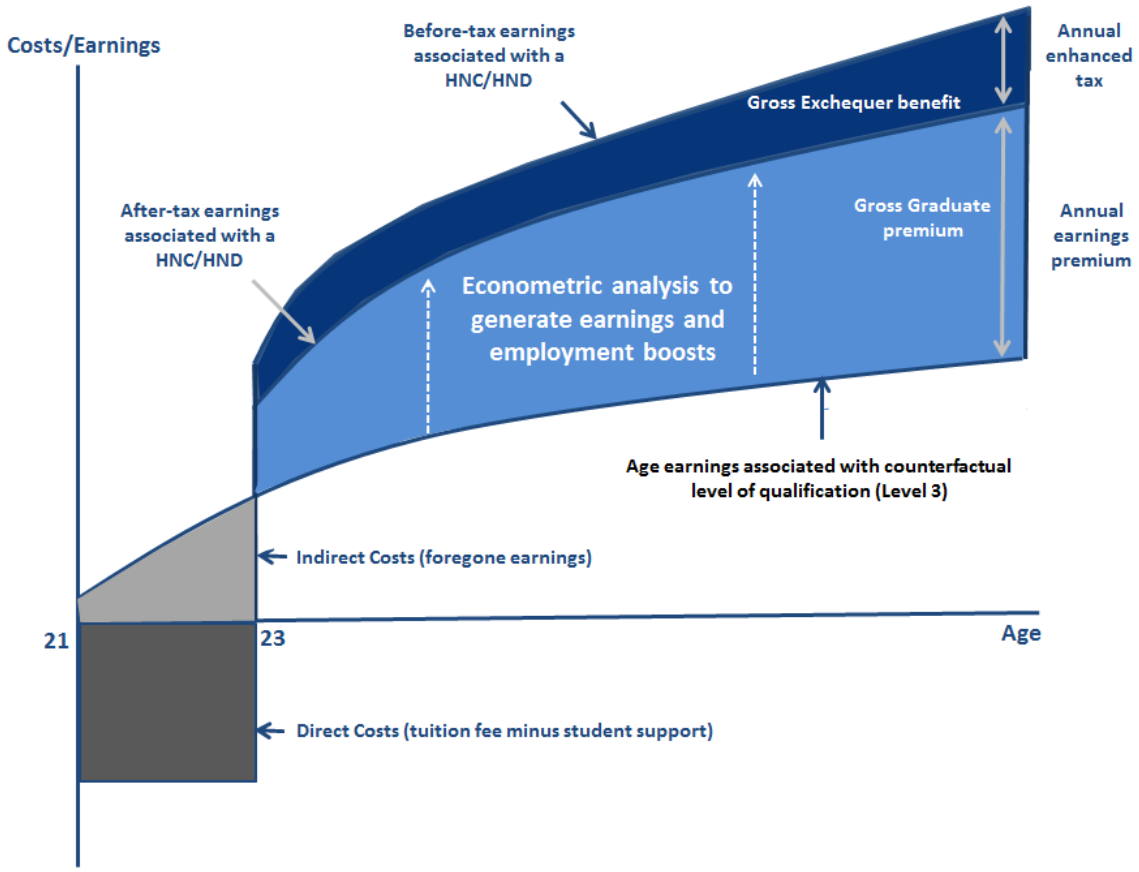
The rationale for this approach is that the comparison of the earnings and employment outcomes of the treatment group and the counterfactual groups 'strips away' those other personal and socioeconomic characteristics that might affect earnings and employment (such as gender, sector or region of employment), leaving just the labour market gains attributable to the qualification itself. An illustration of this (for full-time HNCs/HNDs) is presented in Figure 7, and full details of the econometric approach are presented in Section A2.1.

Throughout the analysis, the assessment of the returns to HE qualification attainment is undertaken *separately* by gender (reflecting the different labour market outcomes achieved by men and women) and subject group (i.e. STEM vs. non-STEM). In addition, the analysis is split by mode of study, where we apply differential assumptions regarding the **opportunity costs** in terms of foregone earnings over the period of study (see Section A2.2), and, given the fact that part-time students (and some groups of full-time students) typically undertake HE qualifications later in life, we apply a '**decay function**' to the returns associated with qualification attainment to reflect the shorter period of time in the labour market (see Section A2.3).

While the above discussion focused on the methodological approach used to estimate the marginal earnings and employment returns to HE qualifications (expressed in percentage terms (for earnings) and percentage points (for employment)), the associated conversion into monetary benefits to arrive at the gross graduate premium is described in Section A2.4.

[12] Again, note that the category of non-STEM subjects *includes* respondents to the Labour Force Survey whose subject was recoded as 'non answer' or 'does not apply'.

Figure 7 Estimating the gross graduate premium



Note: This illustration is based on an average age at enrolment of 21, and we have assumed that a full-time HNC/HND requires two years to complete.

Source: London Economics

2.2.2 Estimating the gross public purse benefit

The potential public purse benefits from the provision of higher education learning are derived from the enhanced taxation receipts that are associated with a higher likelihood of being employed and the enhanced earnings associated with more highly skilled and productive employees. Based on the analysis of the lifetime earnings and employment benefits associated with Level 4/5 (and Level 6) qualification attainment, and combined with administrative information on the relevant taxation rates and bands (from HM Revenue and Customs), we estimate the **present value of additional income tax, National Insurance and VAT** associated with each qualification of interest (again by gender, subject level and mode of study).

2.2.3 Estimating the net graduate premium

The difference between the gross and net graduate premium relates to the **direct costs** of acquisition[13] incurred by students. These direct costs refer to the **proportion of the tuition fee paid by the student** net of any **fee or maintenance support** provided by the Student Loans Company, and minus any **fee bursaries** provided by institutions[14]. In this respect, the net student benefit

[13] Note that the *indirect* costs associated with qualification attainment, in terms of the foregone earnings during the period of study, are already taken account of in the above-discussed gross graduate premium.
[14] See Section A2.6 for further information on the calculation of the net graduate premium.

associated with tuition fee loan or maintenance loan support equals the **Resource Accounting and Budgeting Charge** (RAB charge), capturing the proportion of the loan that is not repaid (described in further detail below).

2.2.4 Estimating the net public purse benefit

The direct costs[15] to the public purse include the **teaching funding** (administered through the Higher Education Funding Council of England (HEFCE)), and the **student support** in the form of the interest rate or write-off **subsidies** that are associated with maintenance and tuition fee loans (i.e. the RAB charge). The size of these loan subsidies has been modelled using the estimated future (employment-adjusted) earnings of individuals undertaking the different HE qualifications, combined with the repayment conditions attached to tuition fee and maintenance loans[16], to assess the proportion of loans that is not repaid[17].

The above-described direct costs to students and the public purse (by qualification level, study mode and subject level[18]) were calculated from the start to completion of a student's learning aim. Throughout the analysis, to ensure that the values of the economic benefits and costs are computed in **present value** terms (i.e. in 2016-17 money terms), all benefits and costs occurring at points in the future were discounted using the standard real HM Treasury Green Book discount rate of **3.5%**[19].

Deducting the resulting costs from the estimated gross graduate premium and gross public purse benefit, we arrive at the estimated **net graduate premium** and **net public purse benefit** per student.

2.2.5 Calculating Internal Rates of Return

The **internal rate of return** captures the discount rate (or interest rate) at which the present value of the benefits associated with HE qualification attainment equals the costs of acquisition. These rates of return were calculated based on the estimated *annual* flows of costs and benefits incurred by the individual student – again separately by qualification level, study mode, subject category and gender[20].

[15] Again, the indirect costs to the public purse in terms of income-tax, National Insurance and VAT receipts foregone during the period of qualification attainment are already incorporated in the gross public purse benefits described above.
[16] See Student Loans Company (2017).
[17] Please refer to Section A2.7 for further information on the calculation of the net public purse benefit, including a summary description of the modelling undertaken to estimate the RAB charge.
[18] Note that the breakdown by study level was only undertaken with respect to the level of teaching funding provided by HEFCE, based on different costs associated with different subject bands. See Section A2.7.1 for further information. All other direct costs were assumed to be the same for both STEM and non-STEM subjects.
[19] See HM Treasury (2011). Where values were estimated in current prices, we used the nominal discount rate (adjusted for inflation, and calculated as (1+3.5%)*(1+RPI)-1) to arrive at a net present value in constant prices.
[20] Note that, throughout these calculations, some of the annual 'cash flows' associated with HE qualification attainment had already been consolidated over multiple years; in particular, instead of including students' annual fee and maintenance loan repayments over their lifetime, the analysis applied the assumed percentage RAB charge (by study mode and qualification level) to the level of loan received during the period of study (to estimate the share of the loan which students do not repay).

3 The returns to undergraduate qualification attainment

In this section, we present the resulting estimates of the net graduate premium and net public purse benefit associated with Level 4, 5 and 6 HE qualifications, as well as the respective estimates of the expected internal rate of return accrued by students undertaking these qualifications. As outlined above, all of these estimates constitute averages among **students from England starting HE qualifications at English HEIs or FECs in the 2016/17 academic year**, and are presented separately **by study mode, subject group, qualification level and gender**.

3.1 Net graduate premium and net public purse benefit

3.1.1 Full-time students

Net graduate premium

Figure 8 presents our estimates of the net graduate premium associated with degree and sub-degree qualifications.

In terms of **non-STEM-related subjects** (upper panel), Figure 8 displays significant differences in the returns to qualifications by qualification level and gender. Focusing on Level 6 qualifications, the analysis indicates that the net graduate premium associated with a representative[21] male student from England starting a full-time non-STEM **undergraduate degree** in England in 2016/17 (with a Level 3 qualification as their highest level of prior attainment) stands at approximately **£126,000** in today's money terms. The comparable estimate for a female undergraduate student stands at approximately **£75,000**. The typically lower economic benefits of higher education qualification to female students are predominantly driven by the increased likelihood among women of spending time outside of the active labour force[22].

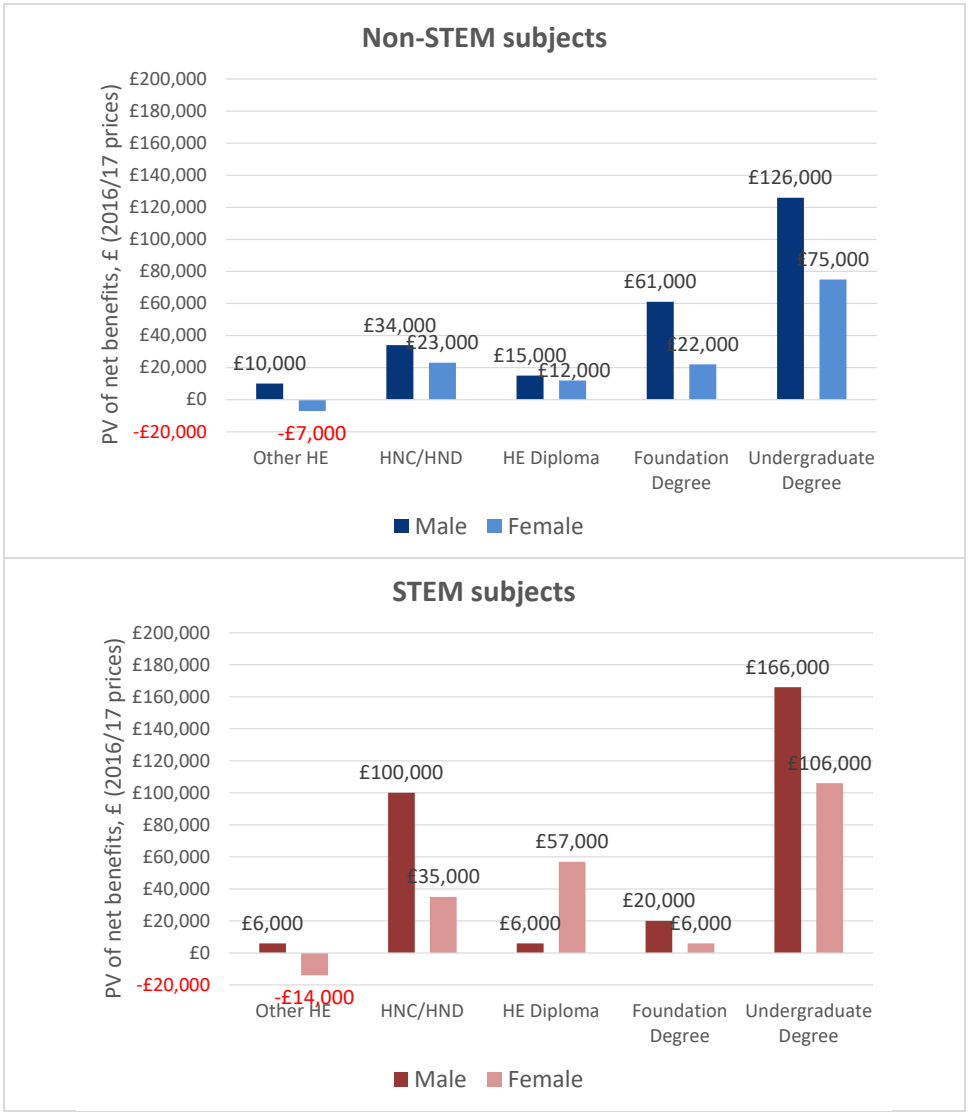
The net graduate premiums associated with full-time Level 4/5 HE qualifications are considerably lower than the comparable net benefits for undergraduate degrees. While the net graduate premium associated with **Foundation Degrees** are relatively high among Level 4/5 (**£61,000** for a representative male, and **£22,000** for a female), the net graduate premium associated with **HNCs/HNDs** (**£34,000** per male and **£23,000** per female) amounts to only approximately **30%** of the corresponding estimates for undergraduate degrees. The net benefits accrued by students undertaking **HE Diplomas** are also comparatively small, standing at only **£15,000** per male and **£12,000** per female.

As displayed in the lower panel of Figure 8, as with non-STEM subjects, the net graduate premiums associated with undergraduate degrees in **STEM subjects** are larger than the corresponding net benefits to Level 4/5 qualifications. However, the relative size and variation of the net benefits within this subject group is markedly different.

[21] The analysis is based on an average age at enrolment of 20 for full-time students undertaking undergraduate degrees, and an average study duration of 3 years. For more information, please refer to Section A2.3.

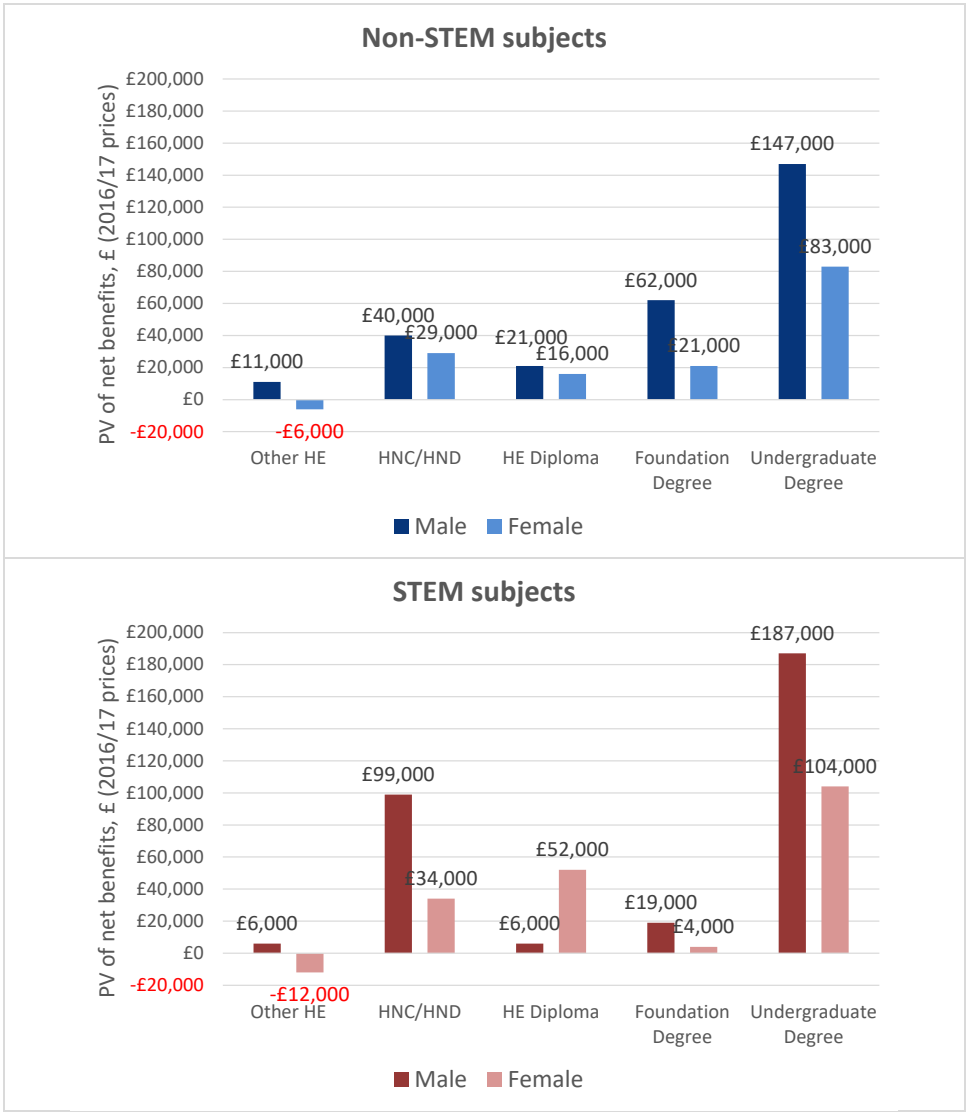
[22] However, as with the majority of the wider economic literature, it is often the case that the benefit associated with HE qualification attainment – expressed as either the *percentage* increase in hourly earnings or enhanced probability of employment – are greater for women than for men.

Figure 8 Net graduate premium per full-time student associated with Level 4, 5 and 6 qualifications



Note: All values are provided in constant 2016/17 prices, and rounded to the nearest £'000.
Source: London Economics' analysis

Figure 9 Net public purse benefit per full-time student associated with Level 4, 5 and 6 qualifications



Note: All values are provided in constant 2016/17 prices, and rounded to the nearest £'000.
Source: London Economics' analysis

The net graduate premiums associated with STEM **undergraduate degrees** (**£166,000** and **£106,000** per male and female student, respectively) are significantly higher than those for non-STEM subjects (**£126,000** per male student and **£75,000** per female student, as above). This reflects the larger marginal earnings returns attached to STEM degrees as compared to other (non-STEM) degrees[23]. These higher returns are likely driven by individual subjects within STEM associated with high earnings benefits; in particular, large proportions of male and female degree STEM students enrol in engineering and subjects allied to medicine, respectively[24].

Likewise, at sub-degree level, students undertaking **HNCs/HNDs** in STEM subjects achieve a significantly higher net graduate premium than students undertaking these qualifications in non-STEM subjects. This particularly applies to **male** students, where the net benefit per student undertaking a STEM HNC/HND (**£100,000**) amounts to almost three times the corresponding estimates for other (i.e. non-STEM) subjects (**£34,000**). Again, this difference likely arises from the fact that a significant proportion of male students completing STEM-based HNCs/HNDs are studying engineering subjects, resulting in very substantial marginal earnings returns accrued by these students. The corresponding estimated net graduate premium amongst female HNC/HND students in STEM subjects stands at **£35,000** in today's money terms (compared to **£23,000** for non-STEM subjects).

Further note the high net benefit accrued by **female** students undertaking STEM **HE Diplomas**, which was estimated to be **£57,000** per student. As with undergraduate degrees, the high proportion of these students studying subjects allied to medicine provides a potential explanation for this outcome.

Net public purse benefit

The net public purse benefits associated with degree and sub-degree qualifications display a similar variation by subject, gender and qualification level as the above net graduate premiums (see Figure 9). In terms of the size of these benefits, the analysis indicates that the net public purse benefits tend to be either approximately equal to or higher than the corresponding net graduate premiums per student[25]. Overall, this suggests that the total economic benefits associated with all undergraduate HE qualifications are **roughly equally split** between students undertaking this learning and the public purse (funding the provision of such learning).

3.1.2 Part-time students

Net graduate premium

Figure 10 presents the corresponding estimates of the net graduate premium associated with part-time students. Reflecting these students' higher age of attainment (implying lower lifetime wage and employment returns to their qualification due to assumed 'age decay', and fewer years in the

[23] See Section A2.1.1 for more information on these marginal earnings returns.

[24] For more information on the breakdown of STEM students into the individual subjects underlying this subject group, please refer to Sections 2.1 and A3.1.

[25] In those instances where the net public purse benefit exceeds the net graduate premium per student (e.g. for male students undertaking non-STEM HNCs/HNDs), the difference is partly driven by discrepancies in the (*indirect)* opportunity costs accrued by students as compared to the public purse. Given the progressivity of the UK tax system (i.e. individuals on higher incomes are charged higher tax rates), it is expected that the majority of the gross earnings (before tax) foregone during study would have accrued to students themselves, with only a relatively small proportion of tax and National Insurance contributions foregone by the public purse. Further, in terms of *direct* costs, students incur the relatively high costs of tuition fees (net of public student support), while the public purse incurs the relatively low cost of HEFCE teaching grant funding – again resulting in a gap between the net graduate premium and the public purse benefit.

labour market to accrue these returns[26]), the net benefits to part-time students are typically lower than the corresponding benefits to full-time students. Further, and as for full-time students, the net benefits associated with undergraduate degrees are typically larger than the corresponding benefits associated with Level 4/5 qualifications.

In particular, compared to the average net benefit per *full-time* student undertaking a STEM **undergraduate degree** of **£166,000** for men and **£106,000** for women, the respective estimates for *part-time* students stand at **£69,000** and **£26,000**. Similarly, whereas the net graduate premium to *full-time* **HNC/HND** students in STEM subjects is estimated at **£100,000** for men and **£35,000** for women, the net benefits to part-time students amount to **£66,000** and **£3,000**, respectively.

A notable exception to these observations applies to **male Foundation Degree** students. Here, the net graduate premiums for non-STEM students across the two modes of study are *roughly equal* (**£58,000** (part-time) compared to **£61,000** (full-time)). Further, for STEM subjects, the net benefit to part-time students (**£34,000**) is *larger* than the full-time equivalent **£20,000**). The high net graduate premiums accrued by male part-time Foundation Degree students likely result from the fact that:

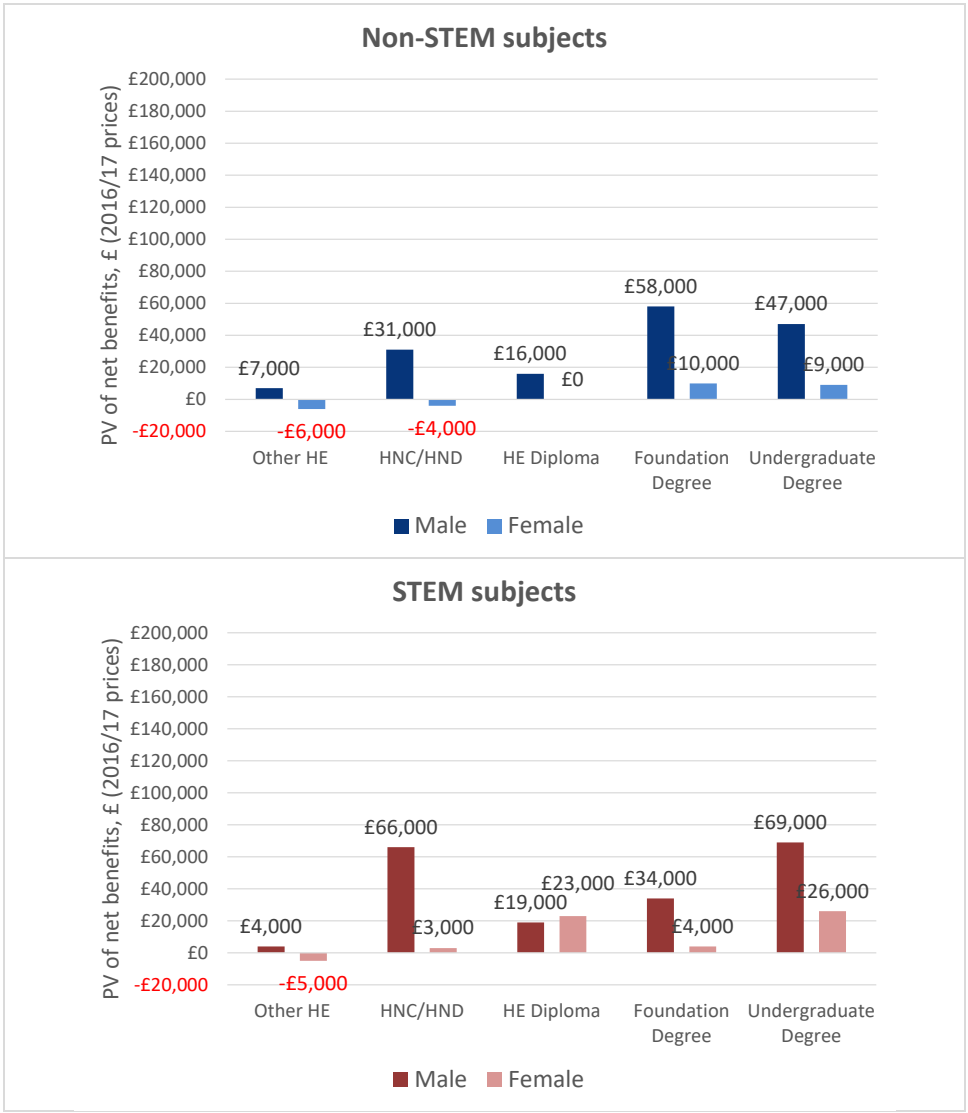
- These students are expected to accrue relatively low opportunity costs throughout their studies[27] [28]; and
- There are relatively low marginal earnings returns associated with STEM Foundation Degree attainment in particular[29], implying that the higher age of attainment among part-time students has less of a negative effect on the graduate premium than for other qualification levels.

Net public purse benefit

As outlined above, the analysis indicates that the total economic benefits associated with full-time students are roughly equally shared between students and the public purse (see Figure 11). In contrast, while again displaying the same variation as the net graduate premium, the estimated net public purse benefits for part-time students tend to be larger than the corresponding net graduate premiums per student[30].

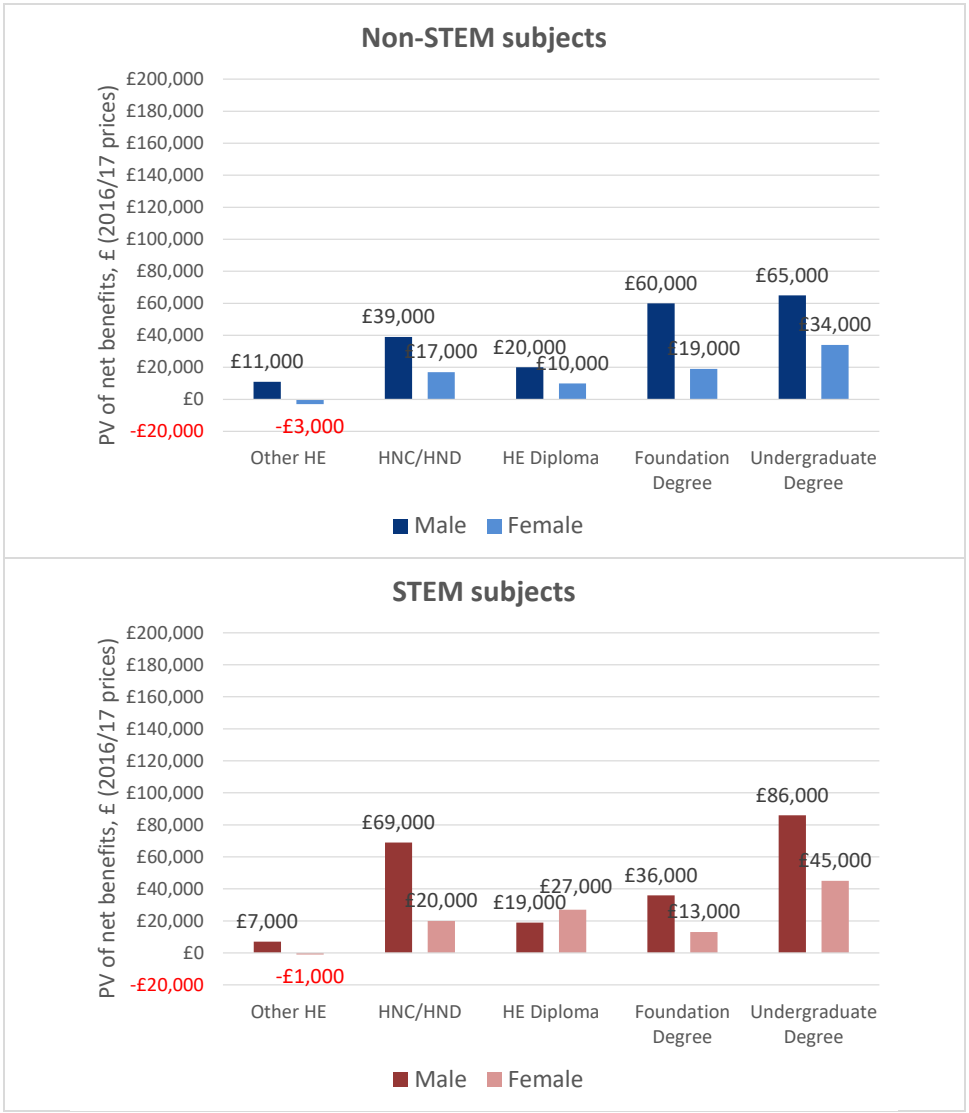
[26] Again, see Section A2.3 for more information on the age of attainment and the 'age decay' function.
[27] See Section A2.2 for more information.
[28] This point also results in male part-time HE Diploma students achieving a higher net benefit than comparable full-time students, particularly when considering students undertaking STEM subjects.
[29] See Section A2.1.1.
[30] In addition to the differences in direct and indirect costs already discussed with respect to full-time students (see footnote 25), this is further driven by the relatively low level of public student support funding provided to students studying on a part-time basis (particularly the lack of part-time maintenance loans). This results in a smaller transfer of student support between the public purse and students, and a larger gap between the net public purse benefit and the net graduate premium.

Figure 10 Net graduate premium per part-time student associated with Level 4, 5 and 6 qualifications



Note: All values are presented in constant 2016/17 prices, and rounded to the nearest £'000.
Source: London Economics' analysis

Figure 11 Net public purse benefit per part-time student associated with Level 4, 5 and 6 qualifications



Note: All values are presented in constant 2016/17 prices, and rounded to the nearest £'000.
Source: London Economics' analysis

3.2 Internal rate of return to students

The previous section provided an overview of the net **absolute benefits** (in today's money terms) associated with undertaking undergraduate HE qualifications, indicating that the net graduate premiums and net public purse benefits associated with (Level 6) undergraduate degrees are typically considerably higher than the net benefits associated with Level 4 and 5 qualifications.

However, in comparing these returns across different qualifications, it is crucial to consider HE qualification attainment from an **investment perspective** – where the individual student incurs an upfront investment (in terms of direct tuition net fee costs and indirect costs of foregone earnings during study) to achieve a future return (in terms of enhanced earnings and increased employability over their lifetime). As such, it is key to understand the **internal rate of return** to students, capturing the interest rate at which the present value of the costs (i.e. the investment) of qualification attainment is equal to the present value of the benefits (i.e. the return on the investment).

In contrast to the net graduate premium – capturing the absolute value/magnitude of the benefit from qualification attainment accrued by students - the IRR provides a measure of the **profitability** or **yield** of an investment, and implicitly takes into account the **relative size and timing of the returns/benefits as compared to the initial costs incurred**. In this respect, it facilitates a more accurate comparison across different qualifications; while individuals undertaking Level 4/5 HE qualifications typically incur lower (absolute) benefits upon completion of their studies than students undertaking undergraduate degrees, they also require significantly lower initial investments to attain their qualifications at the outset (given the shorter duration of their programmes, and the fact that they are more likely to combine work with their study)[31].

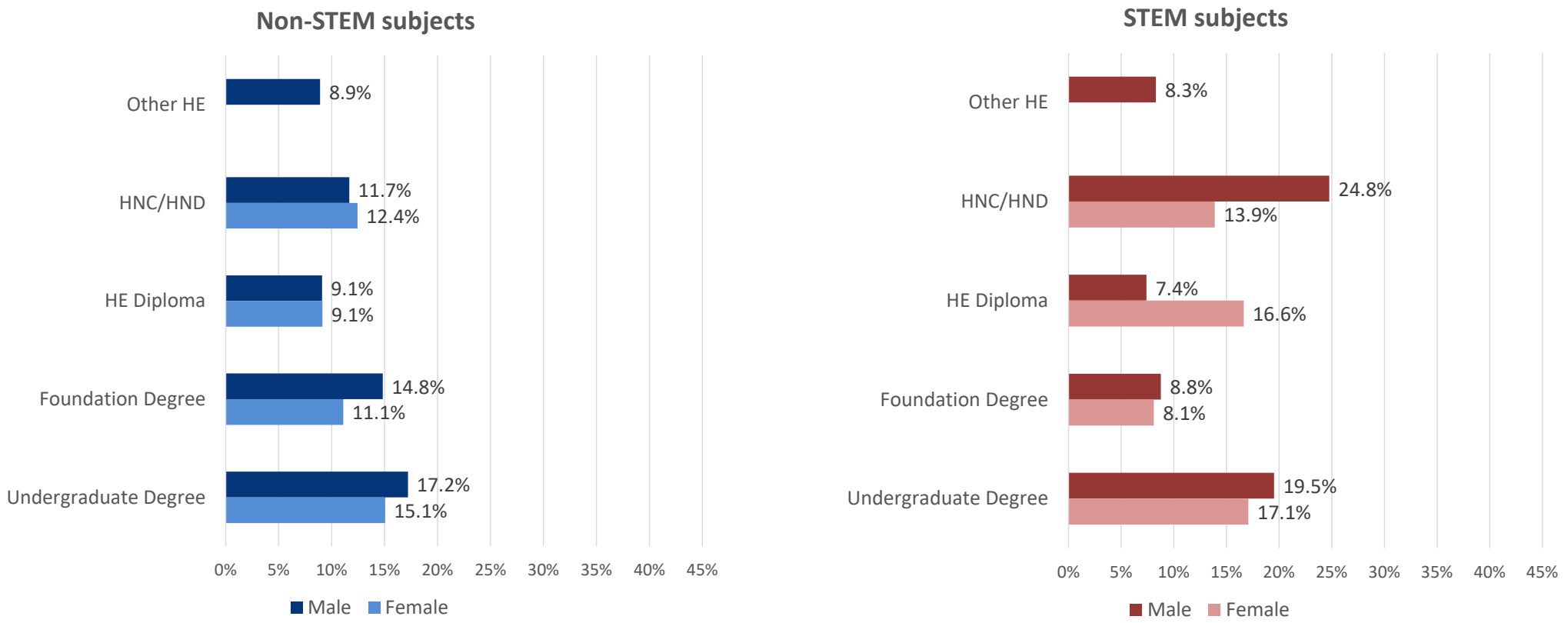
3.2.1 Full-time students

Figure 12 displays the estimated internal rates of return to students undertaking HE qualifications on a full-time basis, separately for non-STEM (left panel) and STEM subjects (right panel).

Within **non-STEM** subjects, the internal rates of return to students undertaking Level 4/5 qualifications are lower than the returns achieved by undergraduate degree students (across all qualification levels and for both men and women). The analysis indicates that the IRR associated with a male student from England starting a full-time non-STEM **undergraduate degree** in England in 2016/17 stands at **17.2%**, with the corresponding estimate for women standing at **15.1%**. In comparison, the IRRs achieved by students undertaking a non-STEM full-time **HNC/HND** range between **11.7%** for men and **12.4%** for women.

[31] Note however that the IRR needs to be considered within its limitations. Of particular relevance here, there are instances where the IRR is not mathematically defined or can produce multiple results (e.g. in the extreme case where all cash flows are either positive or negative, or if the cash flows alternate repeatedly between positive and negative signs). This caveat results in some gaps in the estimates of the IRR to full-time and part-time students presented in the following.

Figure 12 Internal rate of return to full-time students associated with Level 4, 5 and 6 qualifications



Note: Gaps may arise where the Internal Rate of Return is not defined, i.e. where there is no discount rate that would result in a net present value of zero (e.g. in the extreme, this would be the case if all cash flows associated with an investment were negative or positive). Further, the figure includes gaps for those (few) instances where the analysis estimates a negative net graduate premium.
The IRR was calculated based on the estimated annual costs and benefits incurred by the individual student. Note that some of these 'annual cash flows' had already been consolidated over multiple years; in particular, instead of including students' annual fee and maintenance loan repayments over their lifetime, the analysis applied the assumed percentage RAB charge (by study mode and qualification level) to the level of loan received during the period of study (to estimate the share of the loan which students do not repay). ***Source: London Economics' analysis***

In contrast, there are relatively more substantial rates of return associated with specific Level 4/5 qualifications in **STEM subjects** – both in comparison to non-STEM subjects, as well as in comparison to Level 6 qualifications in STEM subjects.

A key finding relates to the high rates of return achieved by students undertaking **HNCs/HNDs** in STEM subjects, standing at **24.8%** for male and **13.9%** for female students. Here, the returns for male students exceed the corresponding returns associated with undergraduate degrees (estimated at **19.5%**), although they are a few percentage points lower for women (**17.1%** for Level 6 female students). Again, one potential factor driving these differences – on the benefit side – relates to the fact that *male* HNC/HND students are relatively likely to study engineering subjects, resulting in high marginal earnings returns for these qualifications. Further, on the cost side, *both male and female students* undertaking HNCs/HNDs incur a considerably lower amount of initial investment associated with their studies compared to degree-level students, given the shorter duration of their programmes[32], as well as the greater tendency to combine work with study.

Further (and again reflecting the substantial net graduate premiums), there is a relatively high rate of return (**16.6%**) accrued by female students undertaking **HE Diplomas** in STEM subjects. Similar to the results for HNCs/HNDs, the cost of study to these students is significantly lower than for undergraduate degrees, due to a shorter average study duration. In addition, on the benefit side, female HE Diploma students in STEM subjects are primarily enrolled in subjects allied to medicine, with high expected marginal returns attached to these subjects.

3.2.2 Part-time students

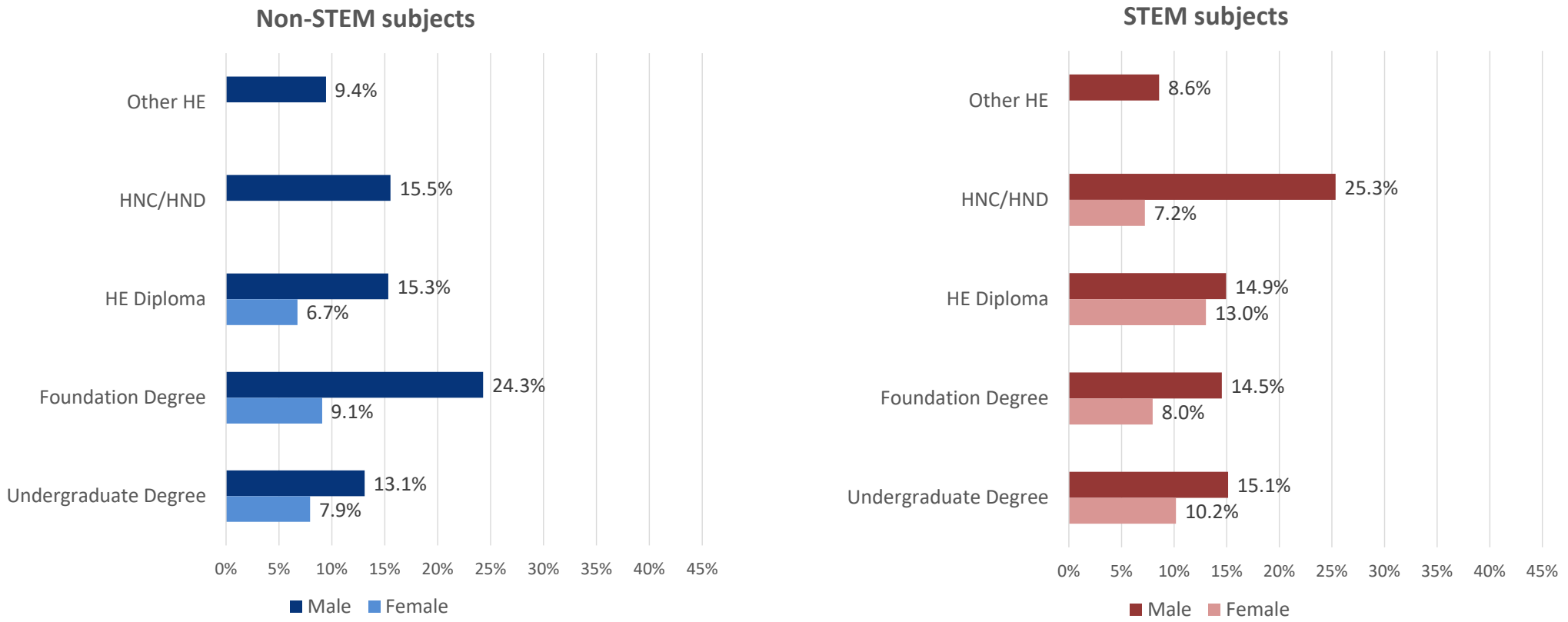
Crucially, the internal rates of return among part-time students undertaking Level 4/5 qualifications tend to be roughly equal to or larger than the corresponding returns to undergraduate degree students (see Figure 13).

For **non-STEM subjects**, the relatively high net graduate premium associated with Foundation Degrees (discussed above) translates into a high internal rate of return of **24.3%** for male students (and **9.1%** for female students). Further, the analysis indicates that there are relatively large returns associated with HNCs/HNDs and HE Diplomas in non-STEM subjects, with estimated IRRs of **15.5%** to male students completing HNCs/HNDs, and **15.3%** and **6.7%** to students completing HE Diplomas (males and females respectively). The corresponding IRRs to undergraduate degree students are either roughly equal to our lower than these, standing at **13.1%** and **7.9%** for male and female undergraduate degree students.

Finally, as with qualifications achieved on a full-time basis – and for similar reasons - the highest rates of return to part-time **Level 4/5 STEM** qualifications are achieved by **male students undertaking HNCs/HNDs** (IRR of **25.3%**), and **female students undertaking HE Diplomas** (**13.0%**). These estimates are considerably larger than the IRRs to undergraduate degrees in these subjects, standing at **15.1%** for men and **10.2%** for women, respectively.

[32] We assume an average study duration for full-time HNCs/HNDs of 2 years (compared to 3 years for full-time undergraduate degrees). See Section A2.3.

Figure 13 Internal rate of return to part-time students associated with Level 4, 5 and 6 qualifications



Note: Gaps may arise where the Internal Rate of Return is not defined, i.e. where there is no discount rate that would result in a net present value of zero (e.g. in the extreme, this would be the case if all cash flows associated with an investment were negative or positive). Further, the figure includes gaps for those (few) instances where the analysis estimates a negative net graduate premium.
The IRR was calculated based on the estimated annual costs and benefits incurred by the individual student. Note that some of these 'annual cash flows' had already been consolidated over multiple years; in particular, instead of including students' annual fee and maintenance loan repayments over their lifetime, the analysis applied the assumed percentage RAB charge (by study mode and qualification level) to the level of loan received during the period of study (to estimate the share of the loan which students do not repay). ***Source: London Economics' analysis***

4 Conclusions and recommendations

As a key priority in the Government's current skills and industrial strategies[33], and comprehensively reflected throughout the recent Sainsbury Review[34] of technical education in England, the UK economy is facing **significant skills shortages in sectors depending on STEM skills**. One particular concern is the overall lack of skilled technicians in possession of higher education qualifications, as well as the perception that existing higher technical programmes do not appropriately prepare students for skilled employment in these sectors.

Sub-degree qualifications constitute an important element of the UK higher education offering. With the majority of students undertaking these qualifications engaged in STEM subjects, higher education qualifications at Levels 4/5 already contribute to the UK's technical skills base. In addition, these programmes play a crucial role in widening access to higher education to students from non-traditional educational backgrounds, broadening the range of choices available to individuals wishing to engage in higher and technical learning. However, since the increase in higher education tuition fees in England in 2012/13, there has been a **significant decline** in both the number of students undertaking sub-degree qualifications, but also the composition of the student body.

To explore potential reasons for and measures to address this decline, London Economics were commissioned by the Gatsby Foundation to undertake an analysis of the returns associated with higher education qualifications at Level 4 and 5 in England, and to compare these to the corresponding returns to undergraduate degrees (Level 6). The analysis estimated both the net (absolute) monetary benefits to students from the acquisition of these qualifications, as well as the internal rate of returns to students – capturing the profitability or yield of HE qualification attainment from an investment perspective:

- In terms of the net **monetary benefits** to students from the acquisition of STEM-based sub-degree qualifications, in general, the analysis indicates that the **net graduate premiums** associated with STEM-based higher education qualifications at Level 4/5 are **lower** than the corresponding net graduate premiums achieved by students completing STEM-based undergraduate degrees. In addition, there is **significant variation** in these premiums by qualification, gender, study mode and subject group. The analysis further suggests that the **net benefits to the public purse** are roughly equal to (full-time students) or larger (part-time students) than the corresponding net graduate premiums. This suggests that there are substantial financial returns to the public purse associated with all forms of higher education qualification attainment.
- In terms of the **internal rates of returns** to students associated with HE qualification attainment, the analysis indicates that, although these are again unevenly distributed across the different qualifications: **in some instances, the IRR to students undertaking STEM Level 4/5 qualifications are significantly higher than, or equal to, the returns associated with undergraduate degrees**. This partly reflects the differences in the level of initial 'investment' required, where the direct and opportunity costs to students undertaking higher education at Levels 4/5 qualifications are typically lower than the costs to undergraduate degree students at Level 6.

Note that, while our analysis provides some plausible explanations for these observed differences in returns (e.g. in terms of the composition of the student cohorts engaged in higher level STEM

[33] See Department for Business, Innovation and Skills and Department for Education (2016), and Department for Business, Energy and Industrial Strategy (2017).
[34] See Independent Panel on Technical Education (2016).

education), further future research would be required to inform a more in-depth understanding of these differences based on the heterogeneity of the student body (e.g. by qualification, granular subject area, and programme).

Addressing the decline in students undertaking sub-degree qualifications

The analysis indicates that although there are strong positive returns to some higher technical education, there is some degree of variation across qualifications, genders, study mode and subjects. In particular, while the returns to some specific qualifications, particularly in STEM-based subjects, are substantial and often larger than the respective returns to undergraduate degrees, in other instances, Level 4/5 qualifications lag behind the returns accrued by degree-level students. This suggests **three potential approaches** to tackling the recent decline in enrolments at sub-degree level.

- In choosing their educational path, it might be the case that potential students are either unaware of *any* financial returns associated with different qualifications, or they consider only the *absolute* financial returns to these qualifications (i.e. the net graduate premium) – which are larger for undergraduate degrees than for sub-degree qualifications.

  However, from an investment perspective, it is crucial to also consider the *internal rate of return* to qualification attainment, taking into account the lower levels of investment required to enrol in Level 4/5 learning as compared to Level 6. This points to the importance of the **provision of information, advice and guidance** in ensuring that potential students can make informed choices throughout their educational journey – including an understanding of both the absolute monetary benefits *as well as* the profitability of their HE investments in terms of the internal rate of return. While financial return should certainly not be the only criterion in the decision to enrol in higher education, it is crucial that potential students are provided with reliable and comprehensive information on the options available to them.
- Mirroring recommendations made by the Sainsbury panel on technical education, a second key policy response – both to drive-up low returns, and to maintain the returns where they are currently high – would be to take additional measures to enhance the **quality** of Level 4/5 HE provision. This would ensure that students are endowed with the skills and knowledge **relevant to employers**, so that they benefit from higher earnings and employment returns in the labour market.
- However, the availability of improved information and guidance and/or an increase in the quality of Level 4/5 HE provision might not be sufficient to deliver a significant boost in the number of students undertaking Level 4/5 qualifications (particularly in the short run). In this respect, the uptake of such qualifications might be further incentivised by increasing the amount of **financial support** provided to students undertaking these Level 4/5 qualifications. This would result in an increase in the internal rate of return to students (due to lower net tuition fee costs paid by students), but would also address the potential credit constraints associated with enrolment in higher education.

Annex 3 further explores the last two of these recommendations, by analysing the impact of **alternative student support options** for students undertaking Level 4/5 qualifications on the estimated rates of return to these qualifications. We also present an analysis of how far the marginal earnings benefits to these qualifications would have to increase to achieve similar internal rates of return as those associated with undergraduate degrees. However, future research will be needed to assess the impact of any changes in the quality and funding available for sub-degree programmes on learner demand and the public costs of provision, and the resulting effects on the English higher education system as a whole.

Index of Tables, Figures and Boxes

Tables

Figures

Boxes

ANNEXES

Annex 1 References

Atkinson, B. (2005). 'Atkinson Review: Final Report. Measurement of Government output and productivity for national accounts'.
http://eprints.lse.ac.uk/33553/.

Callender, C., Wilkinson, D., Gibson, A., and Perkins, C. (2011). 'The impact of higher education for part-time students'.
http://webarchive.nationalarchives.gov.uk/20140108090250/http://www.ukces.org.uk/assets/ukces/docs/publications/evidence-report-36-impact-of-he-for-pt-students.pdf

Department for Business, Energy and Industrial Strategy (2017). 'Building our Industrial Strategy, Green Paper'.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/611705/building-our-industrial-strategy-green-paper.pdf

Department for Business, Innovation and Skills (2011). 'The returns to Higher Education Qualifications'. BIS Research Report 45.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32419/11-973-returns-to-higher-education-qualifications.pdf

Department for Business, Innovation and Skills (2016). 'Annual Report and Accounts 2015-16'.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/537425/bis-annual-report-accounts-2015-16-web.pdf

Department for Business, Innovation and Skills and Department for Education (2016). 'Post-16 Skills Plan'.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/536068/56259_Cm_9280_print.pdf

Department for Education (2017). 'Part-time maintenance loans. Government consultation response'.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/597367/Part-time_Maintenance_Loans_-_Government_consultation_response_.pdf

EngineeringUK (2016). 'Engineering UK 2016. Synopsis, recommendations and calls for action.
http://www.engineeringuk.com/media/1309/engineeringuk-report-2016-synopsis.pdf

Higher Education Funding Council for England (no date). 'Glossary'.
http://www.hefce.ac.uk/glossary/

Higher Education Funding Council for England (2009). 'Patterns in higher education: living at home'.
http://dera.ioe.ac.uk/148/1/09_20.pdf

Higher Education Funding Council for England (2016). 'Annual funding allocations for 2016-17'.
http://www.hefce.ac.uk/funding/annallocns/1617/institutions/

Higher Education Funding Council for England (2017). 'Higher education providers: Alternative providers'.
http://www.hefce.ac.uk/analysis/HEinEngland/providers/aps/

Higher Education Policy Institute (2015). 'It's the finance, stupid! The decline of part-time higher education and what to do about it'.
http://www.hepi.ac.uk/2015/10/29/finance-stupid-decline-part-time-higher-education/

Higher Education Statistics Agency (no date). 'JACS 3.0: Principal subject codes'.
https://www.hesa.ac.uk/support/documentation/jacs/jacs3-principal

Higher Education Statistics Agency (2015). 'Higher education student enrolments and qualifications obtained at higher education institutions in the United Kingdom for the academic year 2013/14'.

https://www.hesa.ac.uk/news/15-01-2015/sfr210-enrolments-and-qualifications

Higher Education Statistics Agency (2017a). 'Higher education student enrolments and qualifications obtained at higher education providers in the United Kingdom 2015/16'.
https://www.hesa.ac.uk/news/12-01-2017/sfr242-student-enrolments-and-qualifications

Higher Education Statistics Agency (2017b). 'Students in Higher Education 2015/16'.
https://www.hesa.ac.uk/data-and-analysis/publications/students-2015-16

HM Government (no date). 'What qualification levels mean'.
https://www.gov.uk/what-different-qualification-levels-mean/list-of-qualification-levels

HM Treasury (2011). 'The Green Book. Appraisal and Evaluation in Central Government'.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf.

Independent Panel on Technical Education (2016). 'Report of the Independent Panel on Technical Education'.
http://www.gatsby.org.uk/uploads/education/reports/pdf/report-of-the-independent-panel-on-technical-education.pdf

London Economics (2015). 'Mind the gap: Comparing public funding in higher and further education'.
https://www.ucu.org.uk/media/736/London-Economics---final-report-Mind-the-gap-Comparing-public-funding-in-higher-and-further-education-19-Nov-15/pdf/londoneconomics_mindthegap-publicfundinginheandfe_fullreport_nov151.pdf

OFFA (2015). 'Access agreements for 2016-17: key statistics and analysis'.
https://www.offa.org.uk/wp-content/uploads/2015/07/Access-agreements-for-2016-17-key-statistics-and-analysis.pdf

Office for Budget Responsibility (2017). 'Fiscal sustainability report, January 2017'.
http://budgetresponsibility.org.uk/fsr/fiscal-sustainability-report-january-2017/

Office for National Statistics (2017). 'Labour Force Survey – user guidance. Volume 3: Details of LFS variables'.
https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/labourforcesurveyuserguidance/pdf

Skills Funding Agency (2016). 'Skills Funding Agency: common and performance management funding rules'.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/604976/SFA_common_and_performance_management_funding_rules_2016_to_2017_V3.pdf

Student Finance England (2016). 'Student finance – how you're assessed and paid'.
http://media.slc.co.uk/sfe/1617/ft/sfe_how_you_are_assessed_guide_1617_d.pdf

Student Loans Company (2016). 'Student Support for Higher Education in England 2016: 2015/16 payments, 2016/17 awards'.
http://www.slc.co.uk/media/8444/slcsfr052016.pdf

Student Loans Company (2017). 'Student loans - a guide to terms and conditions'.
https://www.saas.gov.uk/_forms/slc_terms_conditions.pdf

Walker, I., and Zhu, Y., (2013). 'The impact of university degrees on the lifecycle of earnings: Some further analysis'. BIS Research Report 113.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/229498/bis-13-899-the-impact-of-university-degrees-on-the-lifecycle-of-earnings-further-analysis.pdf

Annex 2 Methodological Annex

A2.1 Estimating the wage and employment returns to higher education qualifications

A2.1.1 Marginal wage returns

To assess the impact of Level 4, 5 and 6 qualification attainment on earnings, using information from the Labour Force Survey, we estimated a standard **Ordinary Least Squares** linear regression model, where the dependent variable is the natural logarithm of hourly earnings and the independent variables include the full range of qualifications held alongside a range of personal, regional and job-related characteristics that might be expected to influence earnings. In this model specification, we included individuals who were employed on either a full-time or a part-time basis. This approach has been used widely in the academic literature. The basic specification of the model was as follows:

$$\ln(\omega_i) = \alpha + \beta' X_i + \varepsilon_i \qquad \text{for } i = 1 \text{ to n}$$

where $ln(\omega_i)$ represents the natural logarithm of hourly earnings, ε_i represents an error term, and X_i provides the independent variables included in the analysis as follows:

- Age and age-squared;
- Ethnic origin;
- Region of usual residence;
- Highest qualification held (by subject group, i.e. STEM and non-STEM);
- Marital Status;
- Number of dependent children under the age of 16;
- Full-time/part-time employment;
- Temporary or permanent contract;
- Public or private sector employment;
- Workplace size; and
- Yearly Dummies.

Using the above specification, we estimated earnings returns in aggregate and **for men and women separately**. Further, the regressions were estimated separately across **10 specific age bands** for the working age population[35] - in order to analyse the benefits associated with different education qualifications over the lifetime for individuals holding these qualifications- and separately for individuals in possession of **STEM** and **non-STEM subjects**[36]. In line with the overall focus of the analysis, the analysis of earnings premiums was restricted to individuals **usually resident in England** only.

To estimate the impact of higher education qualifications on labour market outcomes using this methodology, we used information from pooled **Quarterly UK Labour Force Surveys** between 2004 (1st quarter) and 2016 (3rd quarter)[37]. The selection of information over this period is the longest time for which information on education and earnings, along with the required information on

[35] These age bands are 16-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60 and 61-64.
[36] Note again that individuals in possession of baseline Level 3 qualifications have not been split by subject group.
[37] Where all values of hourly wages have been adjusted by inflation to reflect constant (December 2015) prices.

subject areas, is available on a relatively consistent basis. The resulting estimates of marginal wage returns to higher education qualifications are presented in Table 3.

Table 3 Marginal earnings returns to Level 4, 5 and 6 qualifications (relative to Level 3), in % (following exponentiation) by gender, age band and subject level

Qualification and gender	Age band										Sample size
	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-64	
Non-STEM											
Male											
Other HE						20.1%		21.9%	13.7%		**415**
HNC/HND				6.9%	7.3%	14.3%	18.8%	20.7%	16.6%		**1,463**
HE Diploma				7.4%	17.1%	14.5%	30.9%	14.7%			**783**
Foundation Degree	-13.7%		8.4%	20.0%	31.4%	16.3%	17.5%	26.6%	25.4%	47.0%	**516**
UG Degree		8.2%	18.8%	35.3%	34.7%	38.7%	38.8%	40.1%	38.8%	40.5%	**9,215**
Female											
Other HE		12.7%			7.7%			11.4%			**791**
HNC/HND		7.7%	12.6%	13.5%	18.6%	16.3%	17.1%	22.4%	15.3%		**1,536**
HE Diploma				13.3%	14.9%	20.6%	23.1%	29.8%	23.2%	23.9%	**1,654**
Foundation Degree			20.0%	16.9%	16.8%	21.8%	23.6%	10.3%	35.7%	46.8%	**829**
UG Degree		14.5%	25.6%	40.2%	49.3%	49.2%	47.1%	52.2%	43.5%	35.3%	**14,000**
STEM											
Male											
Other HE						27.4%			20.3%		**233**
HNC/HND		19.2%	22.5%	20.1%	15.8%	20.8%	19.2%	26.0%	23.5%	27.6%	**4,030**
HE Diploma						17.9%	26.2%	17.8%		24.0%	**510**
Foundation Degree	-29.0%	17.1%			14.9%		34.9%		48.6%	39.8%	**112**
UG Degree	56.8%	15.5%	27.0%	38.1%	42.0%	44.3%	48.3%	54.8%	56.2%	53.7%	**10,264**
Female											
Other HE			-8.0%	-18.2%			19.7%	30.6%			**160**
HNC/HND			16.6%	14.5%	18.6%	31.7%	11.6%	30.2%	19.4%	30.6%	**540**
HE Diploma		11.4%	16.1%	23.2%	30.2%	39.5%	30.7%	49.0%	33.9%	43.2%	**924**
Foundation Degree		21.8%			14.3%	70.6%		51.7%			**86**
UG Degree		17.6%	33.9%	48.4%	59.4%	58.7%	64.7%	62.9%	59.5%	63.2%	**7,539**

Note: Regression coefficients have been exponentiated to reflect percentage wage returns. In cases where the estimated coefficients are not statistically significantly different from zero (at the 10% level), the coefficient is assumed to be zero; these are displayed as gaps in the table. Sample sizes vary between the marginal earnings and marginal employment returns, due to the use of different dependent (and some independent variables) in the corresponding regressions.
All returns were restricted to individuals usually resident in England. The 'Other HE' category includes any other higher education below first degree (e.g. Certificates of Higher Education) not captured as part of the other qualifications.
Source: London Economics' analysis of Labour Force Survey data (2004-2016)

A2.1.2 Marginal employment returns

Using the same pooled Labour Force Survey data, we adopted a **probit model** to estimate the likelihood of different qualification holders being in employment or otherwise. The basic specification defines an individual's labour market outcome to be either in employment (working for payment or profit for more than 1 hour in the reference week (using the standard International Labour Organisation definition) or not in employment (being either unemployed or economically inactive)). The specification of the probit model was as follows:

$$probit(EMPNOT_i) = \alpha + \gamma' Z_i + \varepsilon_i$$

The dependent variable adopted represents the binary variable *EMPNOT*, which is coded 1 if the individual is in employment and 0 otherwise. We specified the model to contain a constant term as

well as a number of standard independent variables including the qualifications held by an individual (represented by Z_i in the above equation) as follows:

- Age;
- Age squared;
- Ethnic origin;
- Region of usual residence;
- Highest qualification held (by subject group);
- Marital Status;
- Number of dependent children under the age of 16; and
- Yearly Dummies.

Again, ε_i represents an error term. Similar to the methodology for estimating earnings returns, the described probit model was estimated in aggregate and **separately for men and women**, separately by **age-band**, and separately by **subject group**. Further, and again similar to the analysis of earnings returns, employment returns were estimated for **English residents only**. The resulting estimates of marginal employment returns to higher education qualifications are presented in Table 4.

Table 4 Marginal employment returns to Level 4, 5 and 6 qualifications (relative to Level 3), in percentage points by gender, age band and subject level

Qualification and gender	Age band										Sample size
	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-64	
Non-STEM											
Male											
Other HE											**792**
HNC/HND	25.7	8.0			3.4		2.6				**2,511**
HE Diploma											**1,514**
Foundation Degree	-20.1		3.6	4.4							**953**
UG Degree		8.4	1.9	2.8	3.3	1.5	1.9	2.4			**16,311**
Female											
Other HE							-5.1				**1,491**
HNC/HND	24.4	14.2		5.3							**2,560**
HE Diploma	9.1	6.3									**2,957**
Foundation Degree					5.6						**1,416**
UG Degree		9.9	3.6	3.8	2.8	1.6	2.1	2.1			**23,801**
STEM											
Male											
Other HE											**479**
HNC/HND	20.0	16.4		5.3	3.9	3.0	1.7	3.9	3.5		**6,913**
HE Diploma	17.4	11.0		3.4							**922**
Foundation Degree											**170**
UG Degree		7.8	2.6	4.3	4.5	2.6	3.6	3.6		-5.1	**17,138**
Female											
Other HE						-15.2				-20.9	**333**
HNC/HND	23.9	12.1	7.7			6.6		6.2	-9.9		**897**
HE Diploma		13.9	8.7	9.0	6.8	4.3	5.1		12.7		**1,349**
Foundation Degree								-22.7			**134**
UG Degree		6.8	5.0	6.4	5.9	5.7	3.5				**12,012**

Note: In cases where the estimated coefficients are not statistically significantly different from zero (at the 10% level), the coefficient is assumed to be zero; these are displayed as gaps in the table. Sample sizes vary between the marginal earnings and marginal employment returns, due to the use of different dependent (and some independent variables) in the corresponding regressions.
All returns were restricted to individuals usually resident in England. The 'Other HE' category includes any other higher education below first degree (e.g. Certificates of Higher Education) not captured as part of the other qualifications.
Source: London Economics' analysis of Labour Force Survey data (2004-2016)

A2.2 Opportunity costs during study

To assess the size of the opportunity costs in terms of foregone earnings over the period of study, we undertook an additional analysis of the same pooled Quarterly Labour Force Survey data as for the (above-described) analysis of marginal earnings and employment returns. For this, we calculated the average number of hours worked per week[38] for individuals who were currently in education[39], separately by study mode, gender and current qualification level. Using these average hours worked per week, and assuming a typical work week of **37.5 hours per week** per full-time employee, we then calculated the **average proportion of hours worked per week** (again by study mode, gender and qualification level). Finally, and inversely, we thus arrived at the proportion of *working hours foregone* per week per student, which were then used to inform our assumptions on the proportion of *earnings foregone* throughout each year of study, presented in Table 5.

Reflecting the expectation that part-time students are typically able to combine work with their academic studies, the analysis indicates that part-time students incur significantly lower opportunity costs than full-time students. This observation particularly applies to male students, where the proportion of annual earnings *foregone* by part-time students ranges from **1%** to **32%**, compared to between **69%** and **86%** for their full-time counterparts.

In addition to the differences by gender and study mode, the Table 5 displays noticeable variation across students studying at different qualification levels. For example, while students undertaking undergraduate degrees tend to forego relatively high proportions of earnings (ranging between **84%** and **86%** among full-time students), much lower opportunity costs are incurred by students undertaking HNCs/HNDs (ranging between **69%** and **74%** of earnings amongst full-time students).

Table 5 Assumed proportion of earnings foregone during study, by qualification level, gender and study mode

Qualification level	Full-time students		Part-time students	
	Male	Female	Male	Female
Other HE	79%	75%	32%	19%
HNC/HND	69%	74%	1%	46%
HE Diploma	80%	83%	9%	35%
Foundation Degree	82%	76%	8%	35%
UG Degree	86%	84%	21%	48%

Note: Based on proportion of average full-time working hours per week (37.5) foregone over the period of study.

Source: London Economics' analysis of Labour Force Survey data (2004-2016)

To convert these proportions into monetary estimates, we applied these proportions to the earnings associated with individuals in possession of Level 3 qualifications (i.e. the baseline) throughout the period of study (again separately by qualification level, gender, study mode)[40].

[38] Based on LFS variable SUMHRS, capturing total hours worked in main and second jobs in the given reference week. The variable was recoded so that hours for individuals who indicated more than 50 hours in the reference week were capped at 50 hours.
[39] Based on LFS variable CURED, capturing current education received. Individuals reported as at school (full-time), on a sandwich course, or full-time at university or college were captured as full-time students. All other current students (except those classified as 'not enrolled on course') were included in the part-time student category.
[40] For additional details on this conversion into monetary values, please refer to Section A2.4.

A2.3 Age-decay function

Many of the existing economic analyses considering the lifetime benefits associated with higher education qualifications[41] have focused on the returns associated with the 'traditional path' of higher education qualification attainment – namely progression directly from secondary level education and completion of a three or four year undergraduate degree from the age of 19 onwards (completing by the age of 21 or 22). Importantly, **these analyses make the implicit assumption that the individual accrues 100% of the estimated earnings and/or employment benefit achieved**.

However, the labour market outcomes associated with the attainment of higher education qualifications on a part-time basis are fundamentally different than those achieved by full-time undergraduate degree students. In particular, part-time students typically undertake higher education qualifications several years later than the 'standard' full-time undergraduate; generally undertake their studies over an extended period of time; and are more likely to combine their studies with employment (see Section A2.2). Similarly, both full-time *and* part-time students undertaking Level 4/5 qualifications also tend to start their higher education qualifications later than 'typical' full-time first degree students. This is outlined in Table 6, presenting the average age at enrolment and age of completion amongst English-domiciled first-year students studying at English HE providers in 2015/16.

Table 6 Average age at enrolment, study duration, and age at completion for students undertaking HE qualifications at Level 4, 5 and 6

Qualification level	Full-time students			Part-time students		
	Age at enrolment	Duration (years)	Age at completion	Age at enrolment	Duration (years)	Age at completion
Other HE	28	1	29	36	2	38
HNC/HND	21	2	23	27	4	31
HE Diploma	28	2	30	36	4	40
Foundation Degree	25	2	27	30	4	34
UG Degree	20	3	23	31	6	37

Note: Information on average age at enrolment was provided by the Higher Education Statistics Agency. Combined with assumptions on the average duration of study (based on 'typical' programme duration), we thus arrived at the assumed average age at qualification completion.

Source: London Economics' analysis and information provided by the Higher Education Statistics Agency

Given these characteristics, significant adjustments to the methodology need to be made when estimating the returns to Level 4/5 higher education qualifications and qualifications undertaken on a part-time basis. Specifically, the analysis was adjusted to introduce an **'age-decay' function**, assuming that possession of a particular undergraduate HE qualification is associated with a certain earnings or employment premium, and that this entire labour market benefit accrues to the individual *if* the qualification is attained before the age of 25.

However, as the age of attainment increases, it is expected that a declining proportion of the potential value of the estimated earnings and employment benefit accrues to the individual[42], i.e. those individuals completing qualifications at a relatively older age will see relatively lower earnings and employment benefits associated with HE qualification attainment (and perhaps reflect

[41] For example, see Walker and Zhu (2013).

[42] Callender et al. (2011) suggest that the evidence points to decreasing employment returns with age at qualification: older graduates are less likely to be employed than younger graduates three and a half years after graduation; however, there are no differences in the likelihood of graduates undertaking part- and full-time study being employed according to their age or motivations to study.

potentially different motivations amongst this group of learners). In contrast, those individuals attaining qualifications earlier in their working life will see a greater economic benefit (potentially reflecting the investment nature of qualification acquisition).

Table 7 presents the assumed age-decay adjustment factors which we apply to the marginal earnings and employment returns (in blue highlighter). For example, we assume that an undergraduate degree student undertaking their qualification on a full-time basis achieves the full earnings and employment premium (**100%**) indicated from the econometric analysis (for their entire working life). However, for a part-time degree student, we assume that because of the late attainment, these students recoup only **63%** of the corresponding full-time earnings and employment premiums from the age of attainment (again for their entire working life).

Note that the application of the 'age-decay' function implies that, for *all* qualification levels considered, the estimated employment and earnings returns for part-time students are lower than the returns for comparable full-time students. These differences reflect the (relatively limited) wider economic literature on the returns to part-time study[43].

Table 7 Assumed age decay adjustment factors for students undertaking HE qualifications at Level 4, 5 and 6

Qualification level	Age band									
	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-64
Other HE	100%	100%	88%	75%	63%	50%	38%	25%	13%	0%
HNC/HND	100%	100%	88%	75%	63%	50%	38%	25%	13%	0%
HE Diploma	100%	100%	88%	75%	63%	50%	38%	25%	13%	0%
Foundation Degree	100%	100%	88%	75%	63%	50%	38%	25%	13%	0%
UG Degree	100%	100%	88%	75%	63%	50%	38%	25%	13%	0%

Note: Shaded areas indicate relevant average graduation age per full-time / part-time student at each qualification level.
Full-time students Part-time students

Source: London Economics' analysis based on information provided by the Higher Education Statistics Agency

A2.4 Conversion into monetary benefits to estimate the gross graduate premium and public purse benefit

The gross graduate premium associated with qualification attainment is defined as the **present value** of the **enhanced post-tax earnings** (i.e. after income tax, National Insurance and VAT are removed, and following the deduction of foregone earnings) relative to an individual in possession of the counterfactual qualification. To estimate the gross graduate premium, we extended the econometric analysis by undertaking the following elements of analysis (separately by gender, qualification level, subject group and study mode):

[43] In general, these studies suggest that the economic returns to studying part-time are lower than the economic returns associated with studying full-time. This is in part because part-time students are often already employed when undertaking their studies, so the marginal (or additional) impact of the higher education qualification is lower. For instance, six months after graduation, graduates undertaking part-time study were three percentage points more likely to be employed than graduates undertaking full-time study, and less than half as likely (3% compared to 7%) to be unemployed. See Callender et al (2011).
According to the same study, the salaries of graduates from part-time study grow at a slower pace compared with their full-time peers. Part-time graduates are less likely to see their salaries increase and are more likely to see their salaries stagnate between 6 months and 42 months after graduation: specifically, during this period, 78% of part-time graduates and 88% of full-time graduates saw their salaries rise, while 16% of part-time and 8% of full-time graduates experienced no change in salaries, and 6% of part-time and only 2% of former full-time students saw a drop in their salaries.

1. We estimated the employment-adjusted **annual earnings** achieved by individuals in the counterfactual group (i.e. individuals in possession of a Level 3 qualification as their highest level of prior attainment).
2. We inflated these counterfactual earnings using the estimated earnings premiums and employment probabilities (see Section A2.1), adjusted to reflect late attainment (see Section A2.3), to produce (employment-adjusted) **annual age-earnings** profiles associated with the possession of each particular Level 4/5/6 qualification.
3. We adjusted these age-earnings profiles to account for the fact that earnings are expected to increase in real terms over time (at an assumed rate of **1.3%** per annum), and adjusted for inflation (with an assumed Retail Price Index of **3%** per year)[44].
4. Based on the age-earnings profiles of Level 4/5/6 qualification holders, and income tax, National Insurance rates and allowances and VAT rates for the relevant year[45], we computed the future stream of net earnings (i.e. post-tax)[46]. Using similar assumptions (as well as the assumptions on opportunity costs outlined in Section A2.2), we further calculated the stream of (employment-adjusted) foregone earnings (based on the earnings associated with Level 3 qualification holders) during the period of study, again net of tax[47].
5. We calculated the **discounted** stream of additional future earnings for undergraduate-level qualification holders relative to individuals in possession of Level 3 qualifications (using the standard HM Treasury Green Book real discount rate of **3.5%**)[48], and deducted the discounted stream of foregone earnings during qualification attainment, to generate a present value figure. We thus arrived at the **gross graduate premium** (or equivalent for Level 4/5 qualifications).
6. The **discounted** stream of enhanced taxation revenues minus the tax revenues foregone during students' qualification attainment derived in element 4 provides an estimate of the **gross public benefit** associated with HE qualification attainment.

A2.5 Estimates of the gross graduate premium and gross public purse benefit

The resulting estimates of the gross graduate premium per student (by gender, subject group, study mode and qualification level) are presented in Table 8, while the comparable estimates of the gross public purse benefit per student are presented in Table 9.

[44] The assumptions on average real earnings growth and RPI per year are based on the Office for Budget Responsibility's forecasts on long-term economic determinants (see Office for Budget Responsibility, 2017).
[45] I.e. 2016-17. Note that the analysis assumes fiscal neutrality, i.e. it is assumed that the earnings tax and National Insurance income bands grow at the same rate as annual earnings (i.e. at a rate of real annual earnings growth of **1.3%**, and with an inflation rate of **3%**). As before, these growth assumptions are based on forecasts by the Office for Budget Responsibility (2017).
[46] The tax adjustment for VAT revenues for HMG assumes that individuals spend **69%** of their annual income consuming goods and services within the economy (i.e. assuming a 69% propensity to consume), and a VAT rate of **20%**.
[47] And again assuming the same real earnings growth rate and RPI per annum as outlined above.
[48] See HM Treasury, 2011. Reflecting the fact that all annual age-earnings profiles were expressed in current prices (using an annual RPI of **3%**), to arrive at a net present value in constant 2016/17 prices, the discounting used the *nominal* discount rate of {(1+**3.5%**)*(1+RPI)-1}.

Table 8 Gross graduate premium associated with Level 4, 5 and 6 qualification attainment (relative to Level 3), by mode, qualification level and gender

Qualification level	Non-STEM subjects		STEM subjects	
	Male	Female	Male	Female
Full-time students				
Other HE	£13,000	(£4,000)	£9,000	(£12,000)
HNC/HND	£43,000	£32,000	£109,000	£44,000
HE Diploma	£21,000	£19,000	£12,000	£63,000
Foundation Degree	£67,000	£27,000	£25,000	£11,000
UG Degree	£140,000	£89,000	£180,000	£120,000
Part-time students				
Other HE	£10,000	(£2,000)	£7,000	(£2,000)
HNC/HND	£43,000	£7,000	£77,000	£15,000
HE Diploma	£24,000	£8,000	£26,000	£31,000
Foundation Degree	£66,000	£18,000	£43,000	£12,000
UG Degree	£61,000	£23,000	£83,000	£40,000

Note: All values are presented in constant 2016/17 prices, and rounded to the nearest £'000. Negative values are displayed in brackets.

Source: London Economics' analysis

Table 9 Gross public purse benefit associated with Level 4, 5 and 6 qualification attainment (relative to Level 3), by mode, qualification level and gender

Qualification level	Non-STEM subjects		STEM subjects	
	Male	Female	Male	Female
Full-time students				
Other HE	£17,000	£1,000	£15,000	(£3,000)
HNC/HND	£49,000	£37,000	£112,000	£47,000
HE Diploma	£31,000	£27,000	£22,000	£68,000
Foundation Degree	£74,000	£33,000	£36,000	£20,000
UG Degree	£158,000	£94,000	£204,000	£122,000
Part-time students				
Other HE	£14,000	£0	£11,000	£4,000
HNC/HND	£40,000	£18,000	£73,000	£24,000
HE Diploma	£25,000	£15,000	£27,000	£36,000
Foundation Degree	£64,000	£24,000	£43,000	£20,000
UG Degree	£69,000	£38,000	£94,000	£53,000

Note: All values are presented in constant 2016/17 prices, and rounded to the nearest £'000. Negative values are displayed in brackets.

Source: London Economics' analysis

A2.6 Calculating the net graduate premium

A2.6.1 Tuition fees

For assumptions relating to the fee charged per student, we made use of information on the average (provisional) tuition fee per **full-time** undergraduate student among Higher Education Institutions and Further Education Colleges[49] in 2016-17 (see OFFA, 2015). To arrive at a corresponding estimate per **part-time** student, we multiplied the average full-time fee by the average study intensity amongst part-time undergraduate students[50].

A2.6.2 Public student support funding

The average level of **fee loan** is based on the average fee charged per student (by study mode), net of fee bursaries[51] (described in Section A2.6.3).

The **maintenance loan** per student (applicable to full-time students only) depends on students' household income; therefore it was necessary to replicate the means-testing undertaken for maintenance loans. For this, we used information provided by the Student Loans Company[52] on the maximum level of loan support available – separately for students living at home, living away from home outside of London, or living away from home in London. This was combined with information on the relevant income thresholds and loan reductions/tapers per £ of household income[53], as well as data on household income distributions[54]. Finally, we calculated a weighted average maintenance loan across students living at home or away from home outside/inside London based on information on students' living circumstances[55].

Note that, in contrast to fee loans, we assume that publicly-funded maintenance loans and institution-funded maintenance bursaries (see Section A2.6.3) are complements, i.e. we assume that students receive the same level of maintenance loan irrespective of whether they are in receipt of a maintenance bursary.

The above information described the process to calculate the *gross* level of student support per student. A key aspect of estimating the *net* fee and maintenance loan support received by students relates to the proportion of these loans that students do not repay, i.e. the **RAB charge**. This is described in further detail in Section A2.7.2 below.

A2.6.3 Bursaries

Our assumptions on fee and maintenance bursaries supplied by HEIs and FECs is based on information provided by OFFA[56] on the estimated average fee waiver and other bursaries per full-

[49] Note that the average fee for Further Education Colleges includes institutions with and without access agreements (and assumes an average flat fee of £6,000 for institutions without access agreements).
[50] 41%, based on HESA information.
[51] i.e. we assume that there is a one-to-one reduction in the amount of fee loan available for every £1 of fee bursary received by a student.
[52] See Student Loans Company, 2016.
[53] See Student Finance England, 2016
[54] This was based on the proportion of student support applicants in receipt of full (43%), partial (14%) or zero (43%) maintenance loans in the 2015/16 academic year. See Student Loans Company, 2016.
[55] See HEFCE (2009).
[56] See OFFA, 2015. The information on bursaries includes bursaries, scholarships, fee waivers and in-kind support offered under access agreements to students from lower income backgrounds and other under-represented groups. We have assumed that such bursaries are only available to students with a household income of less than £25,000 per annum (reflecting the lower income threshold attached to the SLC's maintenance loans discussed above).

time undergraduate student in 2016-17. Again, for part-time students, we multiplied these measures by the average part-time study intensity.

A2.7 Calculating the net public purse benefit

A2.7.1 HEFCE teaching grant allocations

In terms of the recurrent teaching grants[57] allocated to HEIs and FECs by HEFCE, the analysis includes, for the 2016/17 academic year[58]:

- The mainstream allocation for high-cost subjects, and
- The targeted allocations for:
  - Very high-cost STEM subjects (including chemistry; physics; chemical engineering; and mineral, metallurgy and materials engineering);
  - Part-time students; and
  - Students attending courses in London.

The associated funding levels per student are split into different price groups. For the funding associated with **STEM** subjects, we included the (relatively higher) funding rates for **price group A and B**[59]. Funding rates for all other price groups (i.e. **C1, C2 and D**)[60] were instead allocated to **non-STEM** subjects.

Combining the funding rates per student across the different funding streams[61], we calculated a total funding rate per **full-time equivalent** student, by price group (i.e. A, B, C1, C2 and D) and subject group (STEM and non-STEM). We then calculated a weighted average total funding rate across the different price groups (based on the underlying distribution of students by price group)[62], separately for STEM and non-STEM subjects. To calculate HEFCE funding per **part-time student**, we again multiplied the full-time equivalent rate by the average part-time study intensity.

A2.7.2 Resource Accounting and Budgeting Charge

The RAB charge captures the proportion of fee and maintenance loans that students do not repay, and thus measures the long-term cost to the public purse of providing loan support to students, arising from the fact that:

- Any outstanding loan (including interest) is **written off** 30 years after an individual becomes liable to repay (or under other specific circumstances (e.g. death or disability)); and
- The loans are provided at **subsidised interest rates**, where the (average) interest rate charged to borrowers is lower than the Government's own cost of debt.

[57] Note that non-recurrent teaching grants (e.g. capital and other non-recurrent special funding) were not included in the analysis.
[58] See Higher Education Funding Council for England, 2016.
[59] Where price group A includes the clinical years of medicine, dentistry and veterinary science courses, and price group B includes laboratory-based science, engineering and technology.
[60] Price group C1 includes computing, archaeology, art and design, and media studies; C2 includes other intermediate-cost subjects with a laboratory, studio or fieldwork element; and D includes classroom-based subjects.
[61] For the funding rates associated with students studying in London, we calculated the midpoint between the rates for Inner and Outer London, and weighted these by the number of undergraduate UK- and EU-domiciled students attending HEIs in London as a proportion of the number of those students attending HEIs in England as a whole (based on HESA, 2017).
[62] Based on information provided by HEFCE, 2016 (October sector grant tables, Table C).

For the purpose of this analysis, we estimated the RAB charge by modelling the future (employment-adjusted) earnings[63] of individuals starting undergraduate HE qualifications in the 2016-17 academic year, combined with the repayment conditions attached to tuition fee and maintenance loans as set out by the Student Loans Company. These repayment conditions include:

- The rate of repayment;
- The income threshold for repayment;
- The interest rate charged (depending on income and whether the individual is still studying or not); and
- The number of years before any outstanding loan is written off in full.

The RAB charge was estimated separately by income decile, gender, qualification level, and mode of study[64].

Table 10 presents the estimated average RAB charge per student in the 2016-17 cohort, by qualification level and study mode. The estimates range between **25%** (undergraduate degrees) and **42%** (other HE below degree) among full-time students, and between **20%** (undergraduate degrees) and **45%** (other HE below degree) among part-time students. On average across qualifications levels, the RAB charge associated with full-time students was estimated at **25%**, compared to **34%** for part-time students. This is driven by differences in the distribution of students by qualification level, where part-time students are considerably more likely to undertake HE Diplomas and other HE qualifications below degree level (for which the RAB charge is relatively high) than full-time students (the majority of whom undertake undergraduate degrees, associated with a relatively low RAB charge).

Table 10 Average RAB charge associated with students starting qualifications in 2016-17, by study mode and qualification level

Qualification level	Full-time students	Part-time students
Other HE	42%	45%
HNC/HND	27%	9%
HE Diploma	36%	40%
Foundation Degree	39%	34%
UG Degree	25%	20%
Average by mode	**25%**	**34%**
Combined average	**27%**	

Note: Average values constitute a weighted average across all qualification levels, weighted by the distribution of first year undergraduate students in 2015-16 either from the UK and studying in any Home Nation[65], or from the EU and studying in England (see Higher Education Statistics Agency, 2017)[66]. ***Source: London Economics' analysis***

[63] This is based on the same Quarterly Labour Force Survey data used throughout the econometric analysis of marginal wage and employment returns. For more information, please refer to Section A2.1.

[64] Note that the analysis was *not* undertaken separately for individuals in possession of qualifications in STEM vs non-STEM subjects; instead, we used the same combined RAB charge estimates across both subject groups.

[65] Ideally, this would have focused on students from England studying in England only; however, the required breakdown by Home Nation domicile and country of study was not available in the HESA data.

[66] Note that, for lack of more detailed information, we assume that HESA's category of 'other undergraduate' students is equally split between students undertaking HE Diplomas and students undertaking other learning at sub-degree level (that is not already included in any of the above categories). Further note that this information relates to Higher Education Institutions only, while comparable information for Further Education Colleges was not available from the HESA data.

The (weighted) average RAB charge across all students was estimated at **27%**. To put this into context, our estimate is somewhat higher than the official RAB charge estimate of **23%**[67] (see Department for Business, Innovation and Skills (2016)). The difference arises from a change in the English student support regime for new full-time undergraduate students in 2016-17. Under the previous system, students could apply for both a (non-repayable) maintenance grant and a (lower) maintenance loan, where the smaller loan was associated with a relatively lower RAB charge. In contrast, from 2016/17 onwards, maintenance grants were abolished to be replaced by higher maintenance loans, implying an increase in the level of maintenance loan taken out by new students, and resulting in an increase in the estimated RAB charge for first-year students entering higher education in 2016/17.

[67] Note that the previous official estimate of the RAB charge amounted to 45%, where the new lower estimate of 23% resulted from a decline in the assumed real discount rate underlying the Department for Business, Innovation and Skills' modelling (from 2.2% to 0.7%). Throughout our modelling, we make use of the same lower real discount rate of **0.7%**.

Annex 3 Supplementary information

A3.1 Subjects within STEM

Section 2.1 (see Figure 5) presented information on the number of undergraduate students enrolled by individual subject category within STEM and non-STEM, respectively (in all UK HEIs, for 2015/16). To explore potential reasons for the observed variation in returns associated with undergraduate qualifications, this section provides further information on the subject choices of students undertaking STEM qualifications in particular.

Table 11 presents the distribution of undergraduate STEM students by individual subject category (in 2015/16 across all UK HEIs). Among students undertaking undergraduate degrees, a large proportion of male students (**26%**) was enrolled in **engineering and technology**, and a high proportion of female degree students (**37%**) were instead enrolled in **subjects allied to medicine**. These subject preferences are even more prevalent among students undertaking sub-degree qualifications, where **32%** of male students studied **engineering technology**, and as many as **79%** of female students undertook qualifications in **subjects allied to medicine**.

Table 11 Distribution of students undertaking STEM-related qualifications by subject of study (by qualification level and gender), 2015/16

Subject*	Undergraduate degrees		Other undergraduate qualifications	
	Male	Female	Male	Female
Medicine & dentistry	5%	7%	0%	1%
Subjects allied to medicine	9%	37%	27%	79%
Biological sciences	18%	30%	10%	7%
Veterinary sciences	0%	1%	0%	0%
Agriculture & related subjects	1%	2%	8%	6%
Physical sciences	12%	8%	3%	1%
Mathematical sciences	6%	4%	1%	0%
Computer sciences	17%	3%	11%	1%
Engineering & technology	26%	5%	32%	2%
Architecture, building & planning	5%	3%	8%	2%
Total	**100%**	**100%**	**100%**	**100%**
# of students	**366,630**	**356,475**	**35,390**	**56,240**

Note: Includes all students enrolled in UK higher education at undergraduate level, irrespective of country of study or domicile.
* Based on subject categories included in the Joint Academic Coding System (JACS) Level 1. See Higher Education Statistics Agency (no date).

Source: London Economics' analysis of HESA data (see Higher Education Statistics Agency, 2017b)

The above information focused on *all* other undergraduate qualifications combined (where a detailed qualification breakdown was not available from the HESA data). To inform an understanding of common subjects within STEM *separately* for each of the Level 4/5 qualifications of interest, we undertook an additional analysis of LFS data (again using pooled Quarterly LFS data 2004 to 2016). Table 12 presents the resulting distribution of individuals *in possession of* (rather

than undertaking) STEM-related qualifications by highest qualification level held and subject of study[68].

Mirroring the above observations on students *undertaking* **degrees**, Table 12 illustrates that individuals *in possession of* STEM-related undergraduate degrees as their highest level of learning are relatively dispersed across the different subjects, though **engineering** (**28%** of men) and **medical related subjects** (**35%** of women) again constitute the most common subjects.

Further, and again, individuals with STEM **Level 4/5 qualifications** as their highest attainment are relatively concentrated within these two subject categories, where:

- **63%** of men in possession of HNCs/HNDs undertook these qualifications in **engineering and manufacturing trades**;
- The vast majority (**81%**) of women holding HE Diplomas studied subjects relating to **health, medicine, nursing and dentistry**; and
- **49%** of men in possession of Foundation Degrees studied **engineering and manufacturing trades**, while **64%** of women studied subjects in **health, medicine, nursing and dentistry**.

[68] Note that the table includes only those LFS observations that were included in the regressions to assess the marginal wage returns to HE qualifications in STEM-related subjects (presented in Section A2.1.1). The breakdown for individuals in possession of undergraduate degrees excludes a total of 545 individuals (out of 17,803) who studied a combination of several STEM-related subjects.

Table 12 Distribution of individuals in possession of STEM-related qualifications by subject of study (by qualification level and gender)

Subject[1]	Other HE		HNC/HND		HE Diploma		Foundation Degree	
	Male	Female	Male	Female	Male	Female	Male	Female
Life sciences	3%	6%	1%	9%	3%	2%	5%	6%
Physical sciences	6%	4%	3%	7%	6%	1%	2%	1%
Mathematics and statistics	2%	4%	1%	1%	2%	1%	1%	0%
Computing	20%	13%	8%	17%	14%	5%	12%	5%
Engineering and manufacturing trades	35%	4%	63%	13%	23%	1%	49%	8%
Manufacturing and production	5%	3%	2%	6%	5%	1%	3%	5%
Architecture and building	11%	4%	18%	11%	16%	1%	15%	3%
Agriculture, forestry, and fishery	7%	5%	2%	7%	9%	3%	6%	3%
Veterinary	0%	5%	0%	3%	1%	2%	1%	3%
Health, medicine, nursing, dentistry etc.	8%	51%	1%	26%	18%	81%	6%	64%
Environment	2%	1%	1%	1%	3%	1%	0%	1%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
# of observations	**233**	**160**	**4,030**	**540**	**510**	**924**	**112**	**86**

Subject[2]	UG Degree	
	Male	Female
Biological Sciences	12%	24%
Physical/Environmental Sciences	16%	12%
Mathematical Sciences & Computing	23%	11%
Engineering	28%	3%
Technology	4%	2%
Architecture and related studies	7%	3%
Agricultural Sciences	2%	3%
Medicine and dentistry	3%	6%
Medical related subjects	6%	35%
Total	**100%**	**100%**
Total # of observations	**9,929**	**7,329**

Note: The table includes only those observations in the Labour Force Survey that were included in the regressions to assess the marginal wage returns to HE qualifications in STEM-related subjects (presented in Section A2.1.1). The breakdown for individuals in possession of undergraduate degrees excludes a total of 545 individuals (out of 17,803 observations) who studied a combination of multiple STEM-related subjects.

[1] Based on Labour Force Survey variable SUBCODE (coding of subject area of sub-degree qualifications).

[2] Based on Labour Force Survey variable SNGDEGB (single subject of degree (banded)). Note that the table also includes individuals who studied combined (rather than single) subjects, where an individual studying *one* of the above-listed STEM subjects as part of their combined subjects was categorised into the STEM group.

Source: London Economics' analysis of Labour Force Survey data (2004-2016)

A3.2 The impact of differential funding models and increases in marginal earnings returns

A3.2.1 Overview of scenarios considered

While the internal rates of return to students associated with Level 4/5 qualification attainment can be substantial, they vary significantly by qualification, gender, study mode and subject group. Furthermore, even when some rates of return are estimated to be relatively high, the numbers taking these Level 4 and 5 qualifications remain stubbornly low. One outcome of the reforms to technical education will be to strengthen qualifications available at Levels 4 and 5 and attract more students to them. However, to achieve this, it may not be possible to rely on the 'market' functioning perfectly (and even if it did, it might take a considerable length of time).

Therefore, we have assessed whether there are options within the current higher education student support arrangements that could be adjusted in such a way to boost the market by increasing the attractiveness of these qualifications but didn't overburden the Exchequer[69].

To explore potential options to increase the returns across all Level 4/5 qualifications (particularly in instances where these are relatively low), we estimated the internal rates of return under a range of hypothetical scenarios:

- In **Scenario 1**, we assessed the effect of introducing **maintenance loans for part-time undergraduate students** (to become available for new students in the 2018/19 academic year[70]);
- In **Scenario 2**, we estimated the revised IRRs after reducing the real interest rate charged on tuition fee and maintenance loans (currently ranging between 0% and 3%) to 0% for all students. This effectively takes away the current income contingency component of the real loan interest rate, and implies that all students would pay a only nominal interest rate of 3% (based on the Retail Price Index) – irrespective of their income.
- **Scenario 3** focuses on the introduction of a tuition fee grant covering 50% of the total fee charged (where students would be able to cover the remaining 50% though a tuition fee loan); and
- Finally, rather than focusing on the financial support provided to students *during* their qualification attainment, **Scenario 4** considers the marginal earnings returns achieved by students *after* completing their studies. Specifically, this scenario considers how much the marginal earnings returns to Level 4 and 5 qualifications would have to increase (e.g. through an increase in the quality of qualification provision) to achieve similar IRRs as those associated with undergraduate degrees.

More information on the assumptions underlying each of these scenarios is presented in Table 13 (where changes compared to the baseline are shaded in blue). The resulting estimates (by scenario) are presented in the following sections. Note that **all of these scenarios apply to Level 4/5 qualifications only**, i.e. we assume no change in the student support conditions and marginal wage returns for undergraduate degrees. Hence, throughout all of the results presented below, the internal rates of return associated with undergraduate degrees remain unchanged as compared to the baseline.

[69] In this respect, it should be noted again that the analysis at hand considers Level 4/5 higher education provision at Higher Education Institutions, Further Education Colleges and only one alternative provider (the University of Buckingham). According to HESA data, in 2015/16, approximately one-third of all first-year HE students enrolled at alternative providers were undertaking HNCs/HNDs (one-third of 26,145 students). While approximately half of all undergraduate provision in alternative providers in 2015/16 was in Business and Administrative studies (i.e. non-STEM based subjects), the incidence and type of provision in alternative providers should be considered when assessing the *aggregate* cost of any potential changes in the student support for Level 4/5 HE students.
[70] See Department for Education (2017).

Table 13 Overview of scenarios considered

Assumption	Baseline: 2016-17	Scenario 1: Part-time maintenance loan	Scenario 2: 0% real loan interest	Scenario 3: 50% tuition fee grant	Scenario 4: Uplift in wage returns
Full-time students					*How much would marginal wage returns have to increase to raise the IRR to Level 4/5 qualifications to the IRR to the IRR to Level 6 degrees?*
Maintenance loan	LAFHOL: £8,200 LAFHIL: £10,702 LAH: £6,904	LAFHOL: £8,200 LAFHIL: £10,702 LAH: £6,904	LAFHOL: £8,200 LAFHIL: £10,702 LAH: £6,904	LAFHOL: £8,200 LAFHIL: £10,702 LAH: £6,904	
Tuition fee grant	-	-	-	£4,500	
Tuition fee loan	£9,000[1]	£9,000	£9,000	£4,500	
Part-time students					
Maintenance loan	-	LAFHOL: £6,150[2] LAFHIL: £8,027 LAH: £5,178	-	-	
Tuition fee grant	-	-	-	£3,375	
Tuition fee loan	£6,750[3]	£6,750	£6,750	£3,375	
Loan interest					
Interest during studies	6% (RPI[4] + 3%)	6% (RPI[4] + 3%)	RPI (3%)	6% (RPI[4] + 3%)	
Interest after completion (by income)	<£21,000: 3%[4]) £21,000 - £41,000: 3-6%[5] >£41,000: 6%[6]	<£21,000: 3%[4]) £21,000 - £41,000: 3-6%[5] >£41,000: 6%[6]	RPI (3%)	<£21,000: 3%[4]) £21,000 - £41,000: 3-6%[5] >£41,000: 6%[6]	

Note: LAFHOL refers to students living away from home outside of London; LAFHIL refers to students living away from home in London; and LAH refers to students living at home.

1. This constitutes the maximum fee loan available. The assumed average actual loan taken out is based on average full-time tuition fees across HEIs and FECs in 2016/17 (£8,781).
2. The assumed maximum loan rates were calculated by multiplying the full-time maintenance loan rates by the average study intensity amongst part-time students (41%). As with the full-time maintenance loan, we assume that the (hypothetical) part-time maintenance loan depends on students' household income (i.e. is means-tested), using the same income thresholds as for full-time students, but multiplying the rate of loan decline per £ of income by the average study intensity among part-time students. We further assume that 0% of part-time students live at home during study, and instead split all students between living at home outside of or within London (based on the same distribution as for full-time students).
3. This constitutes the maximum fee loan available. The assumed average actual loan taken out is based on average full-time tuition fees across HEIs and FECs in 2016/17 (£8,781), multiplier by the average study intensity amongst part-time students (41%).
4. Based on RPI inflation of 3% per year (see Office for Budget Responsibility, 2017).
5. Based on RPI inflation of 3% per year + 0-3% real interest.
6. Based on RPI inflation of 3% per year + 3% real interest.

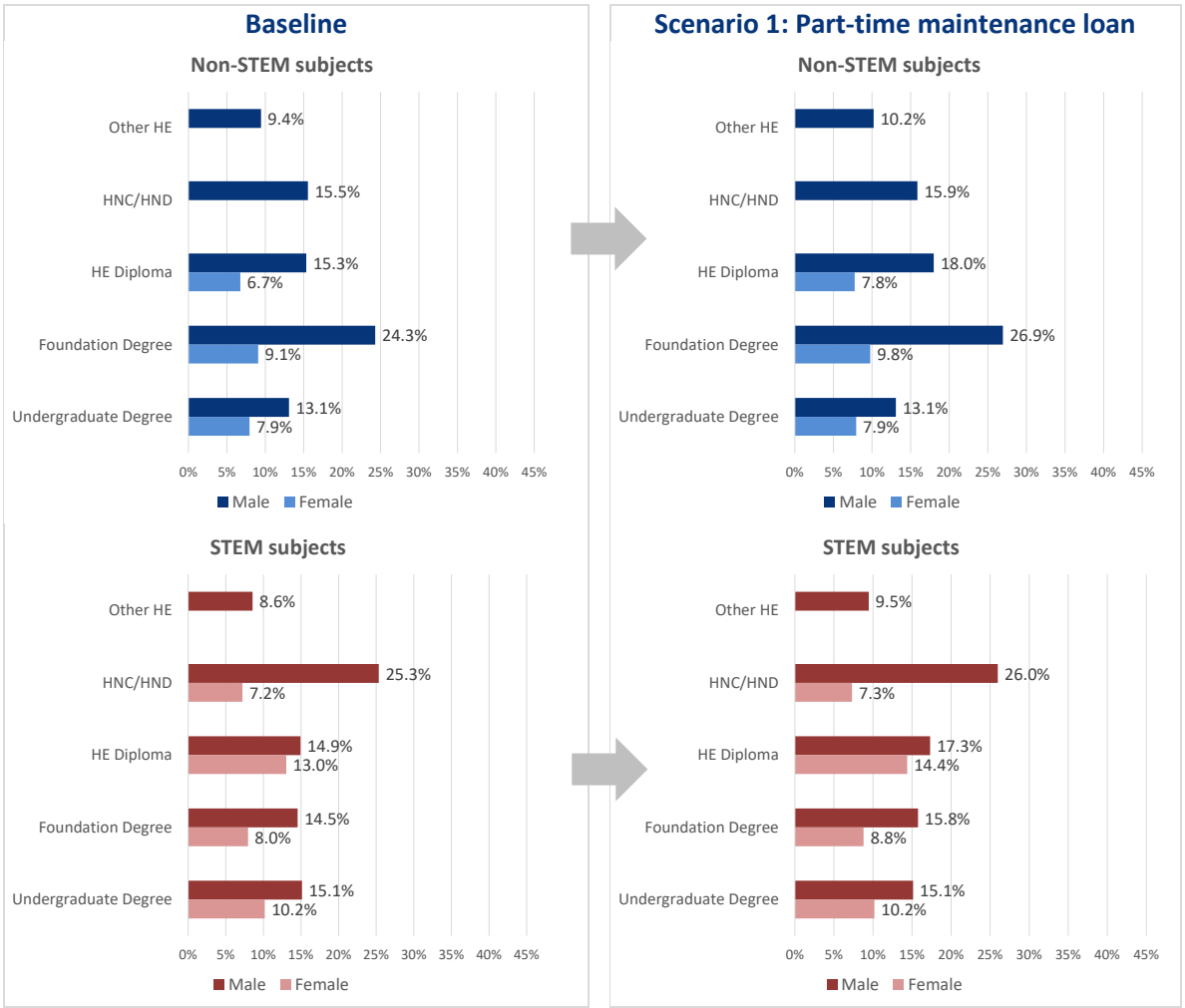
Source: London Economics' analysis

A3.2.2 Scenario 1: Introduction of part-time maintenance loans

Figure 14 presents the estimates of the internal rate of return to **part-time students**[71] following the introduction of Level 4/5 part-time maintenance loans (right panel) along with the baseline estimates (left panel, for comparison). This scenario would result in an increase in the net student support received by Level 4/5 part-time students. This results from the expectation that a proportion of the additional loans will not be repaid by these students (captured by the RAB charge), and that the increase in the total amount of loan taken out per student (in terms of the existing fee loans *and* the new maintenance loan) would result in an increase in the RAB charge.

As a result, the internal rate of return increases for all Level 4/5 part-time students (across all levels, for both men and women and for both STEM and non-STEM subjects). For example, the IRR to male students undertaking a (part-time) HNC/HND in STEM subjects would increase from **25.3%** in the baseline to **26.0%** under Scenario 1.

Figure 14 Internal rate of return to part-time students – Baseline vs. Scenario 1



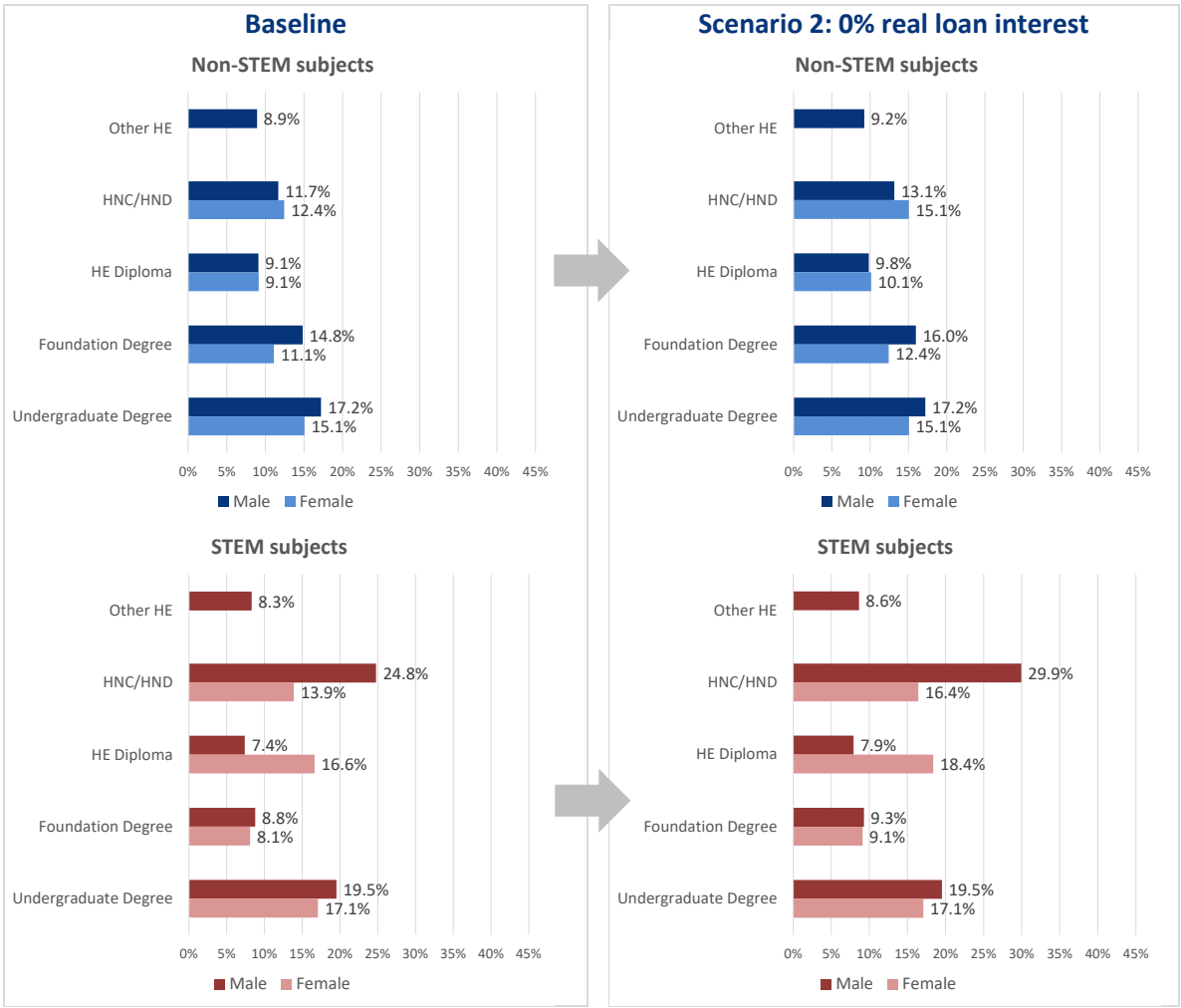
Note: Gaps may arise where the Internal Rate of Return is not defined, i.e. where there is no discount rate that would result in a net present value of zero (e.g. in the extreme, this would be the case if all cash flows associated with an investment were negative or positive). Further, the figure includes gaps for those (few) instances where the analysis estimates a negative net graduate premium.
Source: London Economics' analysis

[71] Note that the IRRs to full-time students would be unaffected by this scenario, so we do not present them here.

A3.2.3 Scenario 2: Zero real interest rate

Figure 15 displays the revised rates of return to **full-time students** under the removal of the real interest rate in Scenario 2, which results in **two opposing effects** on the RAB charge. On the one hand, the change implies that students would become more likely to repay their debt before the point of write-off, as the lower outstanding loan balance allows individuals to repay their debt earlier than they would have otherwise. This has a *negative* effect on the RAB charge. On the other hand, the 0% real interest rate would imply a further decline in loan interest rates below the Government's own cost of debt, resulting in an increase in the interest rate subsidy paid by the public purse. This has a *positive* effect on the RAB charge. Overall, the second effect outweighs the first, resulting in a net **increase** in the RAB charge, with a corresponding increase in the net support per student, and an increase in the IRR associated with Level 4/5 qualifications.

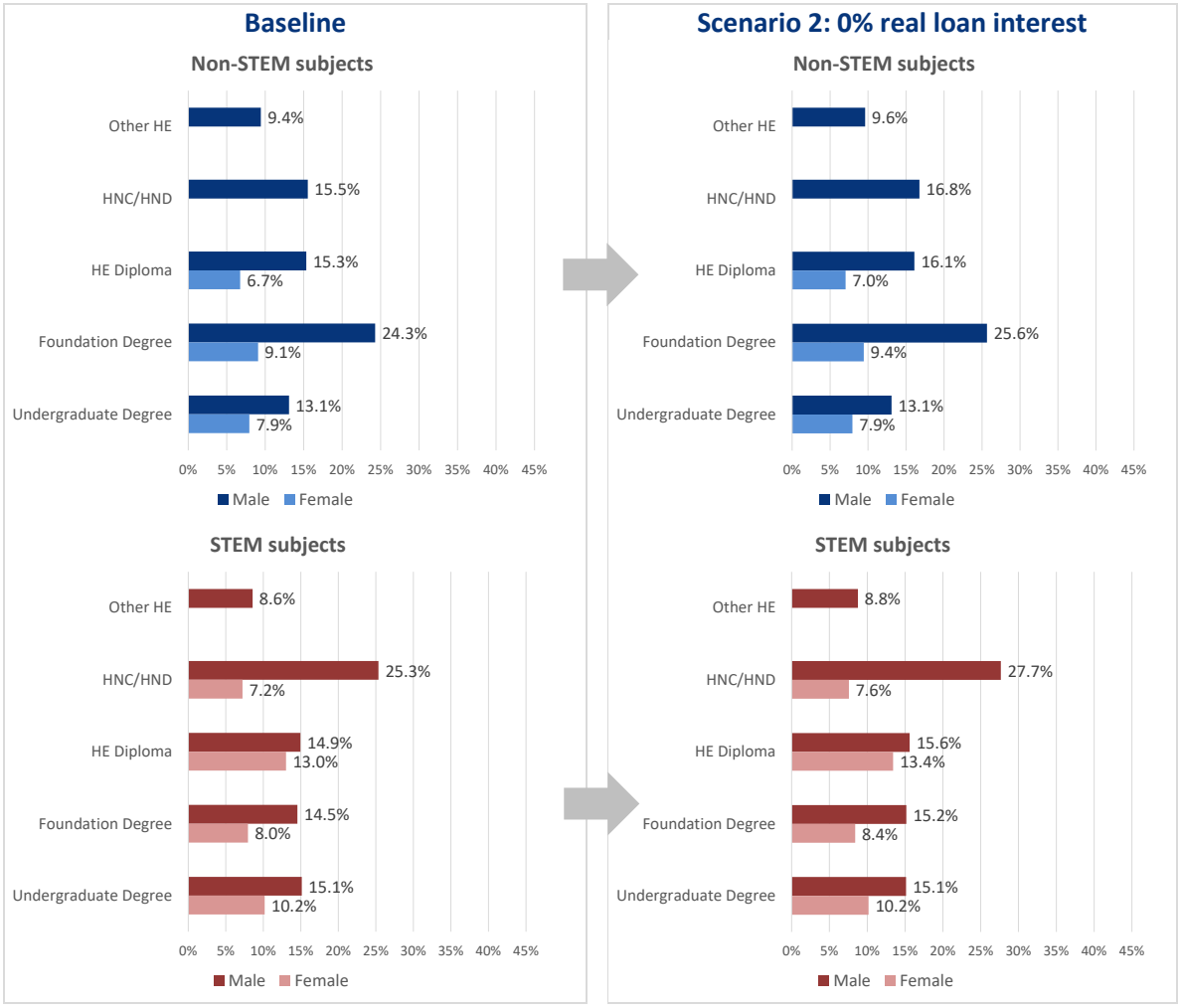
Figure 15 Internal rate of return to full-time students – Baseline vs. Scenario 2



Note: Gaps may arise where the Internal Rate of Return is not defined, i.e. where there is no discount rate that would result in a net present value of zero (e.g. in the extreme, this would be the case if all cash flows associated with an investment were negative or positive). Further, the figure includes gaps for those (few) instances where the analysis estimates a negative net graduate premium.
Source: London Economics' analysis

Figure 16 presents the corresponding internal rates of return (resulting from the same overall increase in the RAB charge as described above) to **part-time students**. Using the same example as above, under this second scenario, the IRR accrued by a male student undertaking a part-time HNC/HND in STEM subjects would increase from **25.3%** in the baseline to **27.7%** in Scenario 2.

Figure 16 Internal rate of return to part-time students – Baseline vs. Scenario 2



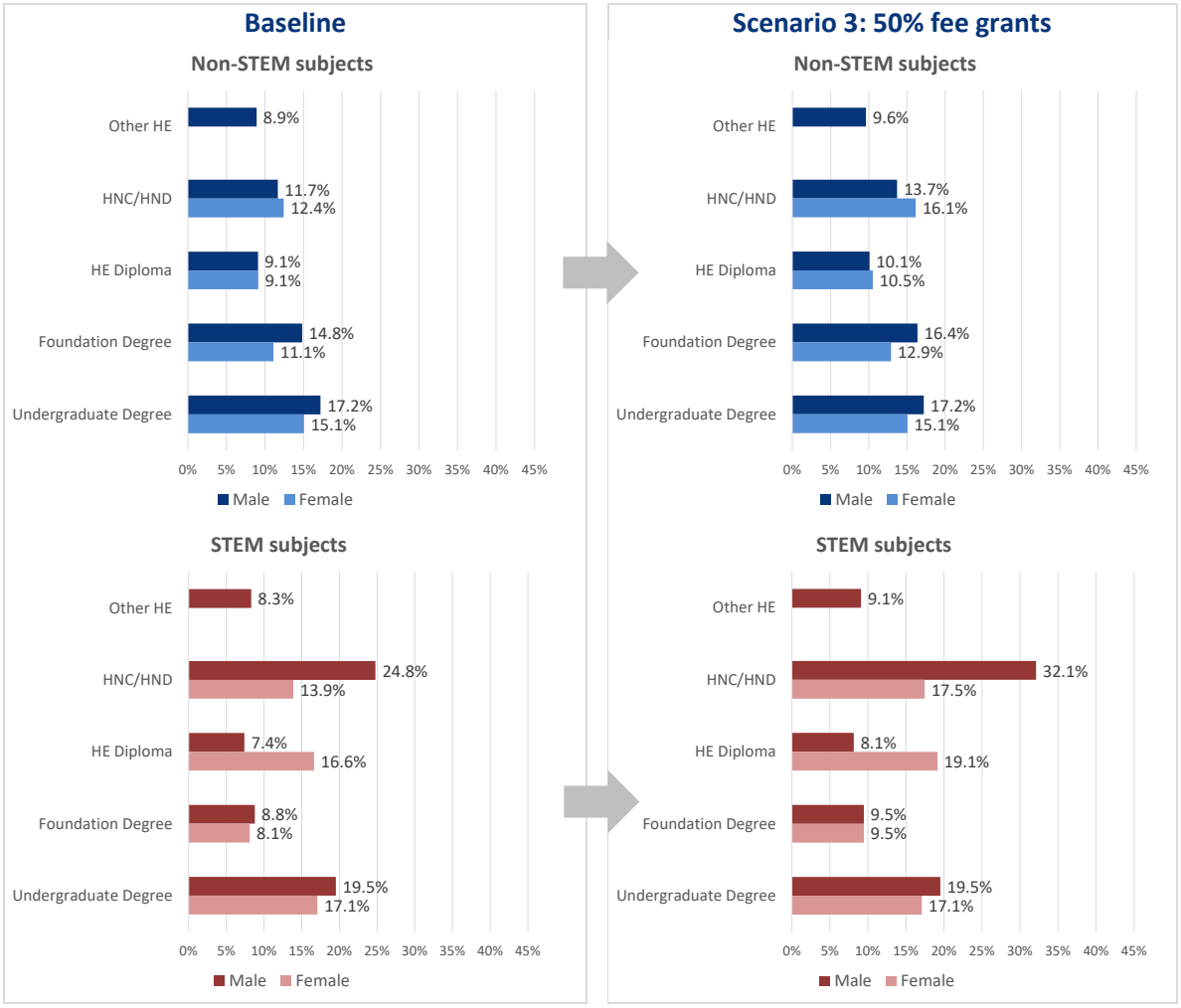
Note: Gaps may arise where the Internal Rate of Return is not defined, i.e. where there is no discount rate that would result in a net present value of zero (e.g. in the extreme, this would be the case if all cash flows associated with an investment were negative or positive). Further, the figure includes gaps for those (few) instances where the analysis estimates a negative net graduate premium.
Source: London Economics' analysis

A3.2.4 Scenario 3: Introduction of 50% fee grants

Compared to the first two scenarios, the introduction of a fee grant to cover half of the tuition fees charged per student would result in the **largest increase** in the estimated internal rates of return to Level 4/5 students. Again, there are two opposing effects at work here, where the *reduction* in the RAB charge (due to a smaller loan taken out) is outweighed by the *increase* in net student support funding from the additional (non-repayable) grant. The resulting internal rates of return to full-time and part-time students under Scenario 3 are presented in Figure 17 and Figure 18, respectively.

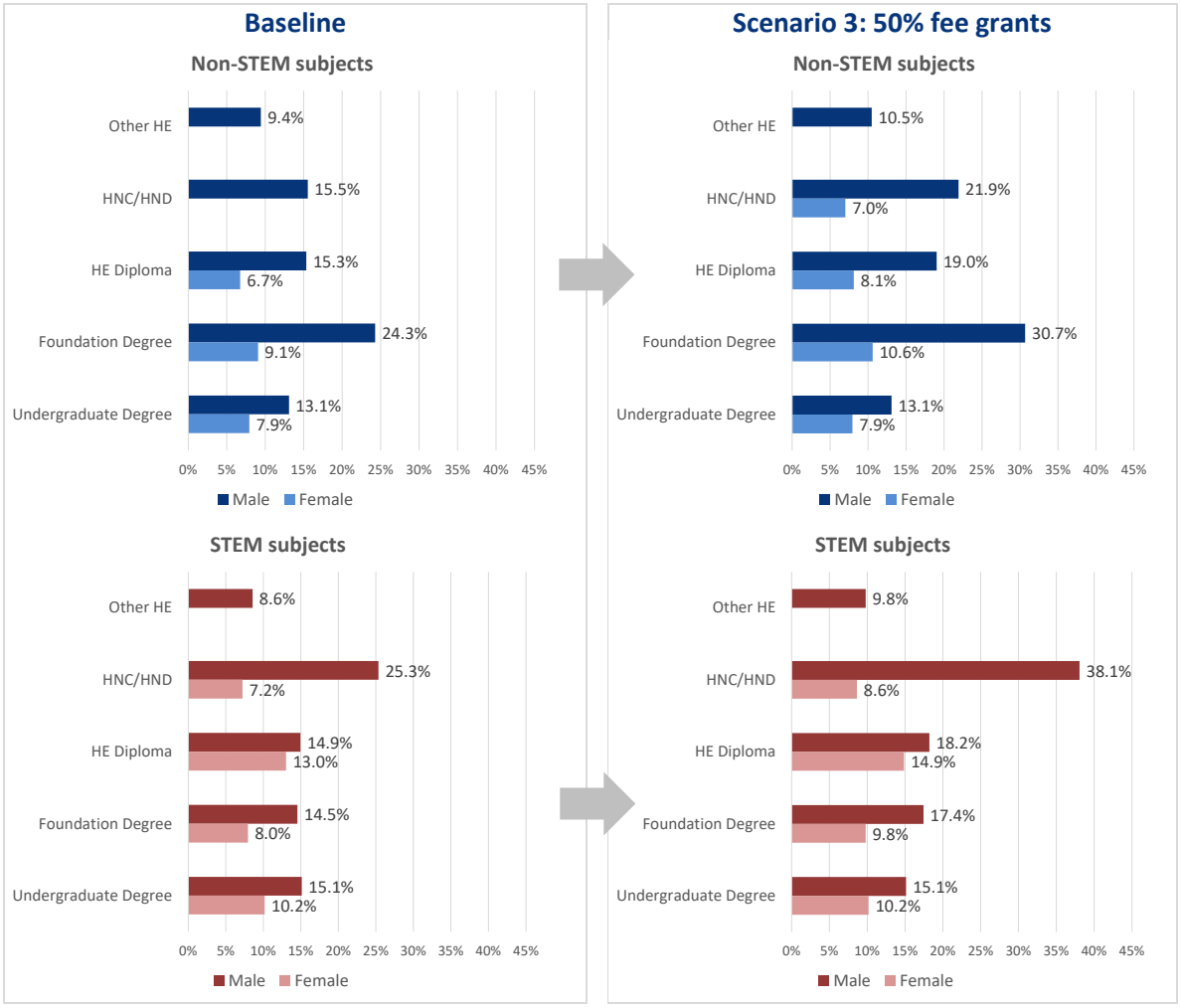
Again using the same example as above, the analysis indicates that Scenario 3 would result in an increase in the IRR associated with male part-time HNC/HND students in STEM subjects from **25.3%** (baseline) to **38.1%**.

Figure 17 Internal rate of return to full-time students – Baseline vs. Scenario 3



Note: Gaps may arise where the Internal Rate of Return is not defined, i.e. where there is no discount rate that would result in a net present value of zero (e.g. in the extreme, this would be the case if all cash flows associated with an investment were negative or positive). Further, the figure includes gaps for those (few) instances where the analysis estimates a negative net graduate premium.
Source: London Economics' analysis

Figure 18 Internal rate of return to part-time students – Baseline vs. Scenario 3



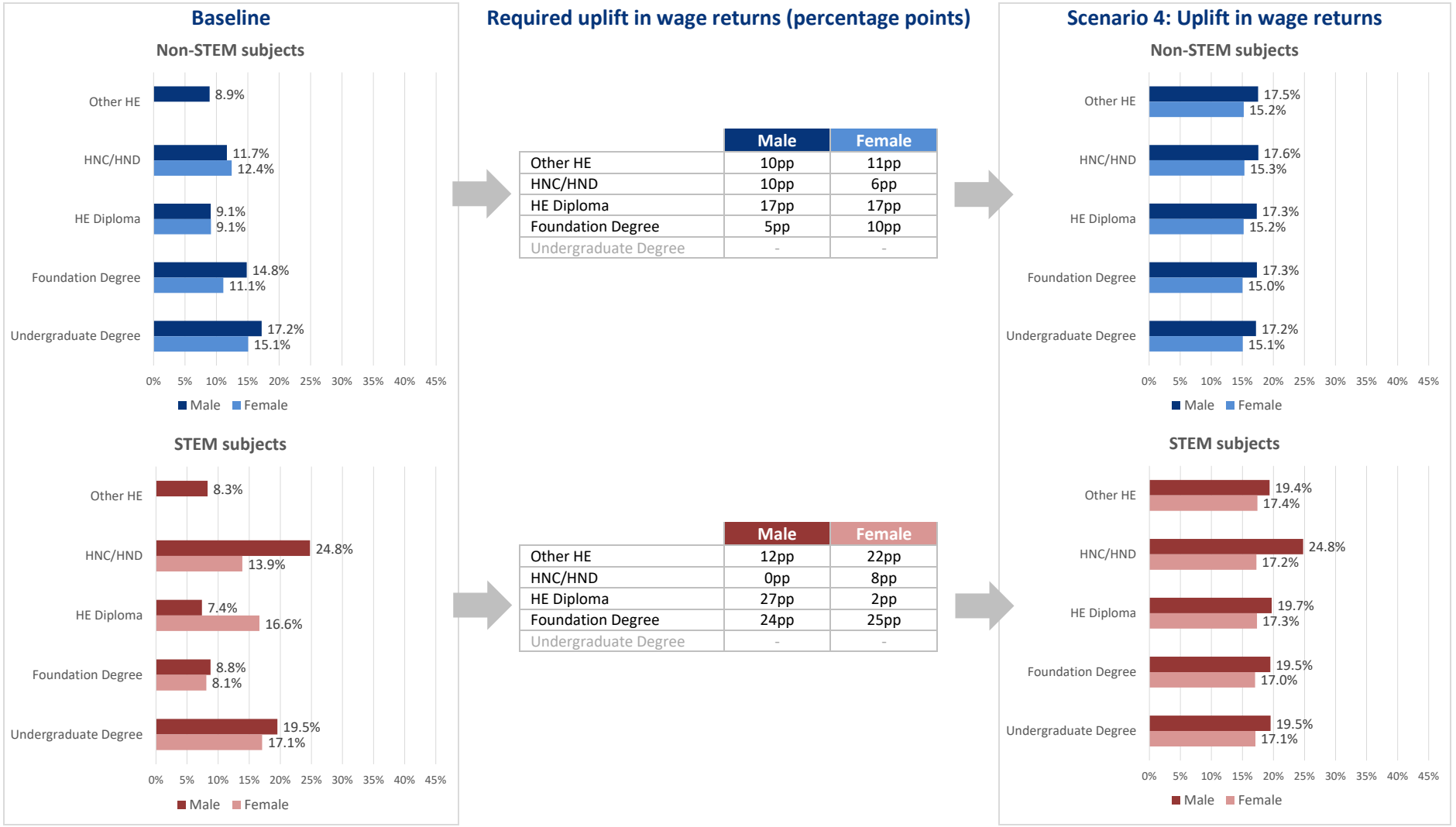
Note: Gaps may arise where the Internal Rate of Return is not defined, i.e. where there is no discount rate that would result in a net present value of zero (e.g. in the extreme, this would be the case if all cash flows associated with an investment were negative or positive). Further, the figure includes gaps for those (few) instances where the analysis estimates a negative net graduate premium.
Source: London Economics' analysis

A3.2.5 Scenario 4: Increase in wage returns

Finally, Scenario 4 analyses by how much (approximately, on average) the marginal earnings returns to Level 4 and 5 qualifications would need to increase for students undertaking these qualifications to equal IRRs as those associated with undergraduate degrees.

In this respect, Figure 19 and Figure 20 present the baseline IRR estimates (left panel), required uplifts in the marginal earnings returns in percentage points (middle panel) and resulting IRR estimates under Scenario 4 (right panel) – for full-time and part-time students, respectively. In terms of full-time students, the relatively large variation in required uplifts in marginal earnings returns (ranging between **zero** and **27 percentage points**) again illustrates the large variation in the returns to Level 4/5 qualifications. The required uplifts for part-time students are considerably lower (ranging between **zero** and **9 percentage points**), reflecting the fact that the baseline internal rates of return to part-time Level 4/5 qualifications already tend to be roughly equal to or larger than the corresponding returns to undergraduate degrees.

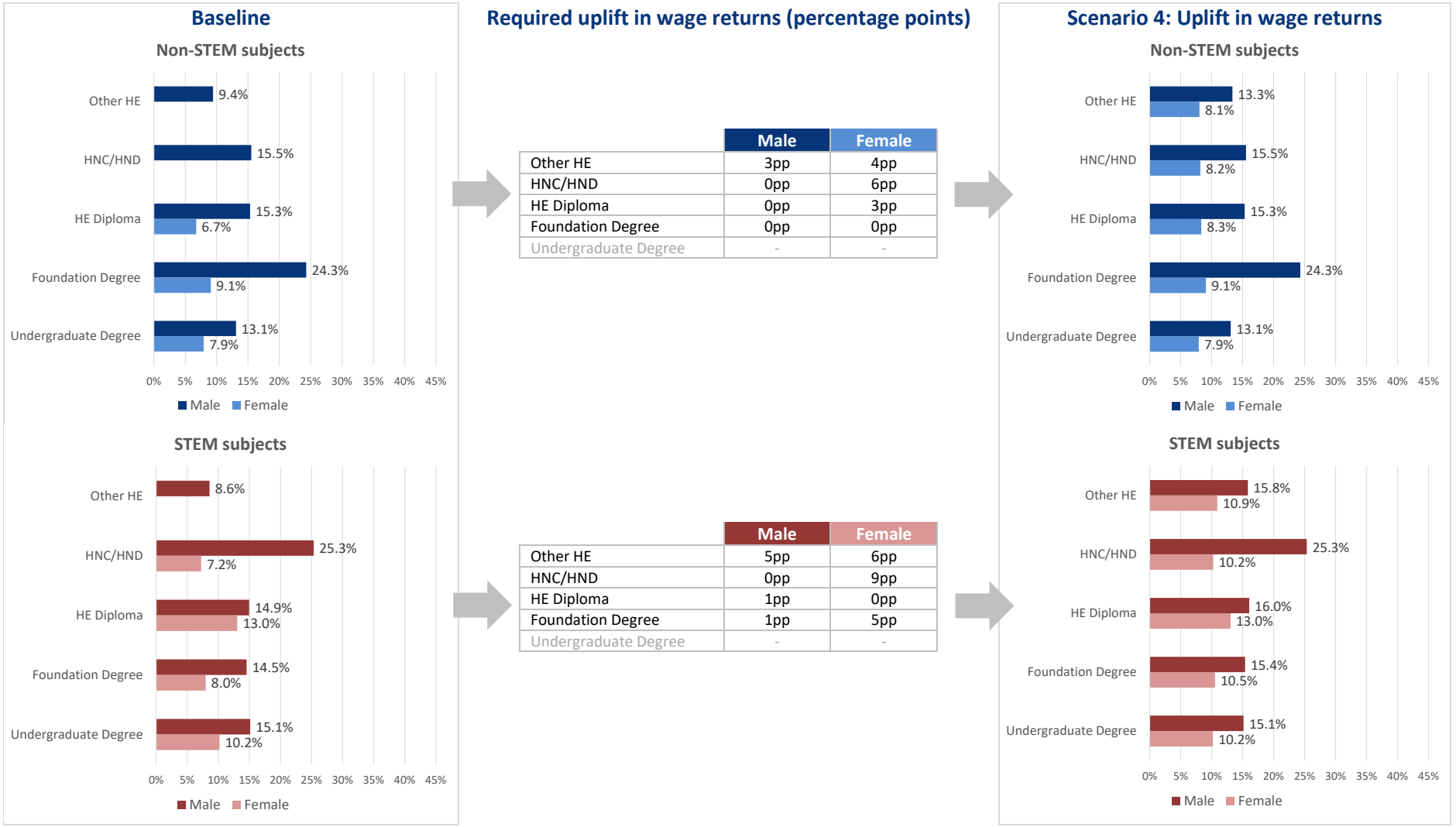
Figure 19 Internal rate of return to full-time students – Baseline vs. Scenario 4



Note: Gaps may arise where the Internal Rate of Return is not defined, i.e. where there is no discount rate that would result in a net present value of zero (e.g. in the extreme, this would be the case if all cash flows associated with an investment were negative or positive). Further, the figure includes gaps for those (few) instances where the analysis estimates a negative net graduate premium.

Source: London Economics' analysis

Figure 20 Internal rate of return to part-time students – Baseline vs. Scenario 4



Note: Gaps may arise where the Internal Rate of Return is not defined, i.e. where there is no discount rate that would result in a net present value of zero (e.g. in the extreme, this would be the case if all cash flows associated with an investment were negative or positive). Further, the figure includes gaps for those (few) instances where the analysis estimates a negative net graduate premium.

Source: London Economics' analysis

LE London Economics

Somerset House, New Wing, Strand
London, WC2R 1LA, United Kingdom
info@londoneconomics.co.uk
londoneconomics.co.uk
: @LE_Education @LondonEconomics
+44 (0)20 3701 7700