Navigating choices to a professional career: the role of subject choice in widening access to universities and the professions

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Declaration

I, Catherine Elizabeth Dilnot confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

This thesis examines the role of subject choice in widening access to elite universities and to an elite professional financial services firm. The analysis takes place at three transition points in the educational trajectory of young people: at 16+, 18+ and at graduation from university. It provides new evidence about these transitions in three ways.

First, using a taxonomy of A-levels developed for this thesis, it uses administrative population data for three cohorts of English students to examine the relationship between social background and A-level subject choices categorised according to their published efficacy for university entry. Less privileged young people are less likely to take A-levels universities say they prefer, but the considerable observed gap is largely accounted for by prior attainment and choices of subjects and qualification types at 14-16.

Prior attainment is also of primary importance at the second point of transition, at 18+, but analysis using linked national school and university data suggests that A-level subject choices do make a difference to ranking of university attended, over and above attainment.

Finally, the importance of prestige of university and the subject of study in the third transition, to graduate employment in an elite profession is considered, using newly available applications and admissions data from a large professional financial services firm. Again, the large raw gap in success rates by university type is almost entirely accounted for by prior attainment, although degree course subject plays a minor role. The direct effect of A-level subject choice is negligible at this transition.

The overall thrust of this thesis is that prior attainment and earlier qualifications choices have consequences at each transition, but, over and above attainment, A-level choices can affect high status university entry, and hence, to some extent, gaining a top graduate traineeship.

Impact statement

The findings of this thesis have been put to beneficial use in a variety of ways to date, and I hope will bring further benefits in future.

The taxonomy of A-levels developed in chapter 2 provides a rigorous basis on which to classify A-levels when considering their importance to university entry. The list was reviewed by Department of Education officials concerned with A-level reform, and A-levels categorised as 'less effective preparation' for university entry were almost all removed in recent reforms. It is also a useful basis for other researchers working in the area. The evidence about A-level choice and social background in chapter 3, published in 2016, is of benefit to others researching the persistent gaps between students from different socio-economic backgrounds in selective university attendance. It has been cited nine times to date. Its implications were considered by policy makers at the Department for Education responsible for the introduction of the EBacc suite of subjects at GCSE and for the reform of the A-level curriculum.

I have presented the findings of chapter 4 in meetings and as formal presentations to a wide variety of those concerned with subject choice and access to university. These stakeholders include university widening participation practitioners to inform them as they make public statements about the requirement or desirability of particular A-level subjects for entry to their institutions, internal conferences at the Department for Education, and Russell Group officials providing information to prospective students.

This evidence has been disseminated more widely to an academic audience through conferences and a published academic paper in 2018, and to the academic and policy community through specialist blogs. The findings were also published in 2017 A-level results week in the mainstream and specialist media (including the Observer, Telegraph, TES and Schoolsweek) and thus reached a variety of groups concerned with providing information, advice and guidance to young people: teachers; careers advisers; and parents.

Individual level data on application and admissions from large graduate recruiters has not previously been available to researchers, and I led on negotiating access. The findings of chapter 5 have been reported to the Professional Financial Services Firm which provided the data and discussed with key members of their staff. The findings have been of considerable interest to them, and were important in prompting planned changes to their recruitment system, as they aim to make the recruitment playing field more level for those from less privileged backgrounds. Future analysis across several such firms will inform more graduate recruiters, policy makers and researchers as they seek better to understand the barriers to admission to prestigious firms faced by young people from less privileged social backgrounds.

Methodologically, the use of intersection bounds in chapter 5 is the first use of the technique in the context of graduate recruitment of which I am aware, and thus demonstrates its applicability in settings other than those for which it has been used to date.

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Any views expressed in the thesis are mine, and not necessarily those of funders or data providers. Any errors are my own.

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1 Navigating choices to a professional career

1.1 Introduction: access to university and professional careers

For over twenty five years I have taught undergraduate accounting students at a post 1992 university. These students have come on average from relatively low socio-economic backgrounds for undergraduates, with the most recent cohort 60% more likely to have parents with a routine or semi-routine occupation than the mean for all undergraduates at the university. They typically aspire to a professional career within accounting and finance, and, except for a small proportion of mature students, have made the choice to apply for accounting at university whilst at school. Although 80% are working six months after graduating, of whom 75% are in professional or managerial occupations (Unistats, 2018) only very small numbers gain employment with the most prestigious (and highest paying) professional financial services firms. These statistics made me wonder whether they have made the best choices to achieve their goals, and I became aware that there is very little empirical evidence available to the young people themselves, and to the parents, teachers, careers advisers and university staff who advise them as they navigate the pathway from school, through university and into a professional career.

Some of these students have at age 16 chosen accounting as one of their limited number of A-level choices. Accounting A-level is not a pre-requisite for accounting degrees in the UK, and indeed an accounting degree is not a pre-requisite for gaining a professional accountancy training contract with a firm on graduating, although research suggests that students from less privileged backgrounds wanting to be accountants are unaware of this (Rowbottom, 2017). Aspirational 16-year-olds wanting a career in accounting might well consider that choosing accounting A-level might be helpful in getting a place to read accounting at university, which in turn would be useful in entering a professional financial services firm. But is this the case? Are students from less privileged backgrounds more likely to take vocationally related A-levels like accounting? To what extent is that a function of choices offered at their school or college or of their

prior attainment rather than an effect of their background per se? And would they be likely to end up at a more prestigious university if they chose the traditional A-level subjects that highly selective universities say they prefer? If a young person aspires to get a graduate traineeship in a top professional financial services firm, does it help to do a degree in accounting, even if it is not required? And is it more important to go to a prestigious university than to study accounting? Does success in entering a profession depend on attainment and performance during the interview process, rather than either degree subject or university attended? The same questions face a student thinking of training in the law or wanting to enter a business graduate trainee scheme. These questions remain largely unanswered in the literature to date, hampering decision-making by students at age 16 as they choose their A-levels and at 18 as they choose their university and subject. It is my intention in undertaking this thesis to address this lack of empirical evidence.

Although finding evidence about the relationships between subject choice at 16+, university type and subject of study and success in obtaining a professional job are intrinsically interesting, the primary motivation for this research is to understand better how A-level choices relate to social background and the consequences of choice differentials for subsequent transitions. I aim to provide evidence useful to young people from less privileged backgrounds as they navigate their way to professional careers, and to universities and employers as they make admission decisions.

1.2 Social stratification in universities and the professions

There are persistent differences in accessing professional careers by university type, school type and social background (Macmillan, Tyler, & Vignoles, 2015; Milburn, 2012a), whilst admission to the sorts of highly selective university conferring an advantage in access to a professional career is itself much less likely for applicants from less privileged social backgrounds (Anders, 2012; Chowdry, Crawford, Dearden, Goodman, & Vignoles, 2013; Sullivan, Parsons, Wiggins, Heath, & Green, 2014). Although much of this gap is explained by differential prior attainment in terms of grades and some by

application choices (Anders, 2012; Chowdry et al., 2013; Marcenaro-Gutierrez, Galindo-Rueda, & Vignoles, 2007) there remains evidence of a gap in selective university admissions by social background (Boliver, 2013; UCAS, 2016a). This gap by university type may then contribute to the differential in access to professional careers by social background. For example, of 100 top UK employers recently surveyed, 60% of graduate hires in professional financial services firms and 80% in law firms came from Russell Group universities (Social Mobility Foundation, 2018). To date there has been little research on the role of differential subject choice in explaining the gap in selective university admissions. Neither has there been examination of the consequences of university type and degree subject choice on access to professional careers, taking into account selection into university type and degree subject by prior attainment and school subject choices.

1.3 Why subject choice matters

Pupils in English schools do not all follow the same curriculum up to age 16. Despite not having a widespread 'tracked' system in the UK, in contrast to much of Europe (see, for example, tracking indices developed by Bol, Witschge, Van de Werfhorst, and Dronkers (2014)), pupils make choices of subjects at age 14, and increasingly even earlier, as schools switch to three years of preparation for the set of examinations taken at age 16 (General Certificate in Secondary Education, known as GCSEs, and their equivalents). Such choices have long term consequences (Iannelli, 2013) and there are significant differences in the subjects that young people choose at this stage according to their background (Henderson, Sullivan, Anders, & Moulton, 2018). These early choices may be problematic in several ways: pupils may not yet know what they want to do post school, they may know, but not know how their earlier choices might facilitate or impede their ambitions, and these choices may shaped by constraints imposed by schools, either on individual young people or through the options made available to all or some groups of students (Jin, Muriel, & Sibieta, 2011; McCrone, Morris, & Walker, 2005; Moulton, Sullivan, Henderson, & Anders, 2018). For the most academic third of pupils

staying on to take academic qualifications such as General Certificate of Education (GCE) A-levels at age 16+ the number of subjects studied is commonly reduced to between a third and a half of the number studied at GCSE, with most students choosing a maximum of four subjects, reducing to three after a year. This is a much narrower curriculum than seen in most of the world at this upper secondary stage and is unusual in containing no compulsory subjects (Hodgen, Pepper, Sturman, & Ruddock, 2010). This curriculum is a legacy of the relationship of A-levels and their predecessor qualifications as admission examinations to UK universities. Applicants who have studied a small number of subjects in depth are attractive to universities wanting well-prepared entrants who can complete undergraduate degrees in three years (Eckstein & Noah, 1993). A-level subject choice is a major decision for students, reducing significantly the number of subjects studied and without any required common core, in contrast with decisions made two years earlier. The educational choice theorist Gambetta (1987) describes such decisions as 'treacherous' in that they are made by people in their teens, with little experience to go on and possibly unstable preferences, and where decisions have important and often irreversible consequences.

Typically, around nine months before taking A-levels young people make decisions about post 18 education. For those who have decided to continue to higher education, deciding which university and what subject to study is the next challenge. Both university chosen and course subject can make significant differences to future earnings (Belfield et al., 2018). As with subject choice at GCSE and A-level, subject specialism at university for English students happens relatively early in their educational pathway. Unlike many countries, most English students choose their main course subject at university at original application, rather than specialising as their course progresses. Deciding on university subject of study is difficult even for those who have identified a preferred career by the age of 17 or 18: whilst some professions require academic study in their field for admission (for example medicine or pharmacy), in contrast with much of the world the UK has a system of access to some leading professions (for example law

and accountancy) which does not require a university qualification in the subject. This makes the pathways to access such professions far from obvious. Graduate outcomes vary considerably by university for the same course (Belfield et al., 2018) and universities may have different requirements of A-level entry subjects (either publicly or privately), meaning that even if students have identified a preferred degree course, their A-level choices may not allow them to enter a university which would maximise their chances of gaining access to prestigious professional careers.

In this thesis I develop a taxonomy of A-levels according to the expressed preferences of highly selective universities, allowing analysis of the differential A-level choices of English school students from different social backgrounds for the first time, using a rigorous classification system and administrative data. I go on to examine the relationship of these choices to measures of university quality, exploiting the very large sample sizes available in administrative data to drill down to reveal heterogeneous relationships for popular degree subjects (accounting, business and law) which might be considered useful preparation for a professional career, but which generally do not require particular A-levels for admission. Finally, I use newly available individual level admissions data from a major graduate employer to examine how university type and degree subject are related to chances of success at the two main stages of the application process.

1.4 Thesis framework

1.4.1 Theoretical background

This thesis addresses differences by social background in educational choices, particularly in choice of A-level subjects. It then moves on to provide empirical evidence of the implications of these differential choices for prestige of university attended, and then to how A-level, university and degree subject choices influence the likelihood of application and success in recruitment to a large professional firm.

There has been considerable debate in the educational choice theory literature about the extent to which genuine choices exist for young people. Are they able to evaluate

alternatives rationally in the light of future expectations and make decisions about them? Or are they 'pushed' (Gambetta, 1987) into courses of action either because external structural constraints are so great that no genuine choice is left, or because the internalizing of social and cultural norms leads them not to consider some alternatives. Ideas of rational evaluation of future expectations come from human capital theory (Becker, 1976), with external constraints on choices differing by SES (Becker & Tomes, 1986) and family circumstances having long run consequences (Carneiro & Heckman, 2002). Such external constraints in the context of subject choice might include the requirement for prior grades or subject choices earlier in a student's educational career, or the role of the school system, where availability of subjects and information, advice and guidance given to students vary across SES. The alternative view of social and cultural norms influencing choices suggests students may think that certain choices are not for them (see, for example, Reay, Davies, David, and Ball (2001) in the context of higher education decisions). As Gambetta suggests, each of these perspectives is likely to have a role to play in educational choices, for example because the same individual might employ different choice mechanisms at different times in their life, or several mechanisms might combine in one decision. Subject choices are an example of an educational decision where a heterogeneous approach to theoretical perspective is helpful to capture a fuller picture (Davies, Davies, & Qiu, 2017; Davies, Mangan, Hughes, & Slack, 2013; Van de Werfhorst, Sullivan, & Cheung, 2003).

Much of the theory of differential educational choices made by social background has been framed in the context of vertical stratification, examining levels of educational attainment reached (see, for example, Boudon (1974); Breen and Goldthorpe (1997)). These authors, in common with human capital theorists, suggest that young people will make rational choices, but rather than focusing on utility maximisation (for example future earnings) will strive to avoid downward social mobility. Their aim is to achieve a social position at least as high as that of their parents, a model known as relative risk aversion. As Codiroli Mcmaster (2017) notes, whilst the corollary of this aim might be

seen in a young person choosing to attend university to retain their social position (vertical stratification), the role of horizontal stratification is less clear, particularly in relation to subject choice. While for universities league tables exist, so providing individuals with a measure of 'quality' which they may associate with the chances of achieving their parents' social position, no such 'league table' of A-level subjects exists. The guidance on facilitating subjects (those keeping the most options of Russell Group applicants open) from the Russell Group of research intensive universities (Russell Group, 2016) is perhaps the nearest thing to A-level 'league tables', whilst the publication in school performance tables of the proportion of students gaining at least AAB in at least two facilitating A-levels provides a signal to those who know about it that a hierarchy of A-levels exists, at least in the view of the 24 member universities of the Russell Group. The relative risk aversion model would suggest that students from more privileged backgrounds would be more likely to take A-level subjects facilitating of entry to a high-ranking university. Such a choice may be linked with the differential availability of information, advice and guidance (IAG) to young people by social background. Rational decisions require optimal investments in information gathering (Elster, 2007), but the different costs to information gathering across classes (an example is the higher quality advice on the implications of subject choices for future educational trajectories in independent schools compared with state schools (Boliver, 2013; Dunne, King, & Ahrens, 2013)) may mean that less privileged young people are less able to make well-informed decisions about which A-levels to choose.

In chapter 3, differential choice of A-levels by social background is examined to untangle the extent to which students are 'pushed' into choices because of structural factors such as the sort of school they attend (and the IAG provided there), the choice set they are offered and the constraints of their prior attainment. Any remaining difference by social background might suggest the persistence of cultural and social norms in their choices, or of differential IAG outside the school environment.

Arguably, students of all social backgrounds have been unable to make fully rational decisions about what A-level subjects are helpful in access to high status university, particularly where courses have no subject pre-requisites, in the absence of evidence about the relationship between A-level subjects and prestige of university attended. Similarly, rational decision making about university and degree course is hampered because of a lack of evidence about which may be helpful in gaining a prestigious graduate traineeship. Chapters 4 and 5 therefore aim to provide empirical evidence to inform the decision making of all students, although noting the constraints on earlier subject choices examined in chapter 3 experienced by less privileged students.

1.4.2 Thesis structure

In chapter 2 I describe briefly the subject choices made at age 14, then go on to consider in more detail choices of A-level made at age 16. I derive for the first time a taxonomy of A-level subjects from public statements about their appropriateness and usefulness for university entry made by the Russell Group of 24 research intensive universities, commonly considered highly prestigious. Finally I consider the context within which English young people choose their degree course.

In chapter 3 I use administrative data for three recent cohorts of A-level students and the taxonomy of subjects developed in chapter 2 (and published as Dilnot (2015)) to provide empirical evidence of the reasons for the largely previously unexamined differential in A-level subject choices by social background for English state school students at the 16+ transition. This analysis provides an insight into the mechanisms driving differential A-level subject choices by social background, so leading to specific policy recommendations and guidance for school students making choices and those who guide them.

In the following two chapters I aim to provide evidence of the bearing these decisions have on subsequent educational outcomes. Chapter 4 investigates the transition from school to university and asks whether these different A-level subject choices, again based on the taxonomy developed in chapter 2, have consequences for the prestige of

university attended, taking into account the university subject of study. It then drills down into three popular degree courses which might be expected to lead to professional careers: accounting, business and law. For each of these courses (which generally have no pre-requisite A-level subjects), the relationship between choosing various A-levels, including the related A-level, and the prestige of university attended is examined. This analysis leads to policy recommendations for universities publishing course requirements and provides evidence relating to subjects held by students attending high status university for use by applicants and their advisors.

In chapter 5 the final transition examined is that from university to a prestigious and highly paid professional career. Here I use newly available data, for which I negotiated access, to unravel the relative importance of the prestige of university attended and the choice of subject of study at university on the likelihood of success in application to an elite professional financial services firm, as well as noting any residual effect of A-level choices, over and above choices of university type and degree course. This will for the first time provide such evidence to aspirational young people making choices which they hope will maximise their chances of successfully embarking on a professional career, as well as informing such firms about which elements of their processes and preferences might act against their recruiting staff from a broad range of social backgrounds.

1.4.3 Methodological overview

The analytical approach taken in this thesis is quantitative, aiming to uncover associations and generally being cautious about making causal claims. I use controls suggested by theoretical questions and evidence from previous empirical studies, complemented by consideration of model fit where appropriate.

In chapters 3 and 4 I use multi-level analysis to take into account the clustering of students within schools and colleges. I do this in two different ways, because of differences in the underlying structure of relationships between outcomes and school and college in the data, and the different emphases in my research questions. In chapter 3 I use clustered standard errors to examine relationships with school level

variables, and fixed effect models in order to deal with unobservable characteristics of schools and colleges likely to be important in subject choice. The choices of state school students only are examined in chapter 3, because of the lack of availability of data on social background for those in private schools, and overall the variation in subject choice between schools is small compared with that within schools.

In chapter 4, students are clustered in both state and private schools, and school type is of particular importance to the outcome. This is demonstrated in Table 1, showing rho, the proportion of total variation in outcome due to school or college level clustering for the empty model for the outcomes examined in chapters 3 and 4, using the chapter 4 sample. The proportion of variance accounted for by schools when private schools are included almost doubles for the chapter 4 outcome (score in the Times Good University Guide) compared with state school students only, whereas for the two outcomes for chapter 3, choices of A-level subject, including private schools only slightly increases the proportion of variance accounted for at school level. I therefore use a correlated random effects approach in chapter 4, allowing for the inclusion of school type in the analysis, which is discussed further in the chapter.

Table 1: Proportion of variance due to school level clustering for outcomes in chapters 3 and 4

Outcome variable	Rho – proportion of variance due to school level clustering	
	State schools only	State and private schools
Chapter 3 – choosing two facilitating A-levels	0.116	0.138
Chapter 3 – choosing two 'less suitable' A-levels	0.137	0.152
Chapter 4 – Times Good University Guide score	0.108	0.190
N	357,068	421,836
Number of clusters (schools/colleges)	2,175	2,719

In chapter 5 I use logistic regression to model the dichotomous outcome of success or failure at various stages of the graduate recruitment process. In this section I also attempt to address the question of unobservable characteristics potentially biasing results by using an intersection bounds test of a differential thresholds approach.

2 Subject choice in the English educational system

The English system is unusual in its early subject specialism, compared with other European and North American countries (Department for Education, 2011). In this chapter I describe the points at which English students make subject choices as they progress through secondary school. I focus on the pathways of those taking academic rather than vocational qualifications and aiming for university. The way these choices vary by social background is addressed in subsequent chapters.

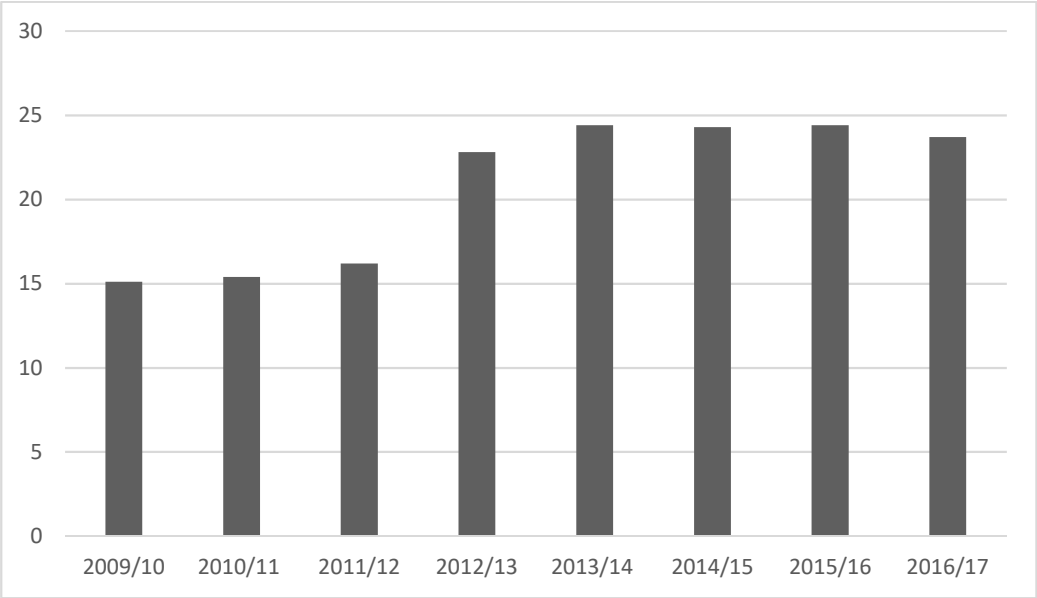
2.1 Choices at age 14

The focus of the substantive chapters of this thesis is on transitions at age 16 and afterwards, but to understand those choices it is important to consider the nature of, and constraints upon, the first substantial set of choices that is made by pupils at English schools. In this section I therefore describe choices of subjects followed between age 14 and 16.

Until the turn of this century, pupils at English schools had a relatively restricted range of choices of largely traditional academic subjects to study. Typically, a broad curriculum of these subjects was followed in the first three years of secondary school, and at age 14 a smaller number of these subjects, sometimes with opportunities to take up new subjects, was chosen, culminating in the sitting of nationally set examinations known as GCSEs (General Certificate of Secondary Education) generally at age 16 after five years of post-primary school study. The 2002 Education Act had the explicit intention of widening the curriculum, adding a suite of GCSEs in vocational subjects and other more vocational qualifications ('GCSE equivalents') to those available, and which counted towards the performance of schools in league tables. From the subsequent decade onwards, there has been concern that these vocational qualifications are of limited value to those studying for them (Wolf, 2011) and are replacing academic subjects more helpful to university entry, particularly for less privileged pupils (Gibb, 2011; Henderson et al., 2018; Sullivan, Zimdars, & Heath, 2010), not least because of incentives for schools to enter pupils for qualifications likely to maximise league table scores (Sullivan et al.,

2010). In response to these concerns the then coalition Conservative/Liberal Democrat government introduced the English Baccalaureate (EBacc) as a performance measure for schools and an individual 'qualification' for students. To count in a school's performance tables for the EBacc, a pupil must obtain a 'good pass' in GCSE English, maths, two sciences, history or geography and an ancient or modern language. Schools wishing to maximise their league table performance therefore have an incentive to enable and encourage their pupils to take these subjects.

Figure 1: Percentage of English state school students achieving the EBacc by year. Source: Department for Education. (2018). Statistical First Release: Main National Tables: SFR01/2018



Early evidence that schools have responded to this incentive is given in Figure 1. Although the EBacc was first included in performance tables in 2009/10, it was not announced as a performance measure until September 2010. School incentives to encourage take up of EBacc eligible subjects could therefore first act on those entering their two years of GCSE study in September 2011 and taking GCSEs in June 2013. A large jump in achievement of the EBacc is indeed seen between 2012/13 and the previous cohort. This perhaps illustrates that 'choices' of subject made by pupils at 14 are subject to institutional constraints, and is consistent with other work that finds the commonest reason for pupils not studying a subject that it is not available to them (Jin et al., 2011) and that school level differences explain a considerable proportion of the

variation in choice of ‘more selective’ subjects (Anders, Henderson, Moulton, & Sullivan, 2018).

Although the number of vocational qualifications counting in performance tables was reduced in 2016 following the recommendations of the Wolf Review (Wolf, 2011), many continue to count and a large number of students still take non-GCSE vocational qualifications such as City and Guilds and OCR National Certificates. In 2017 over 230,000 of the cohort of some 590,000 16 year olds passed at least one such qualification at level 2 (Department for Education, 2018b), in subjects including sports, business and ICT, with the last of these accounting for nearly three quarters of entrants. As shown in Figure 1 only a minority of students approaches decision making at age 16 with a common core of EBacc subjects and there remains a large spread of subjects and type of qualification taken, even within a system that is largely non-selective and untracked.

2.2 Choices at age 16

Since 2015 young people in England have been required to stay in full time education until age 18 unless undertaking education or training as part of employment or alongside part time employment or volunteering (Department for Education, n.d.). The overwhelming majority stays in education (90% of those reaching age 16 by September 2016 were still in education two terms later (Department for Education, 2017c)) but the form of that education varies considerably. The government has recently split students by three broad types of study at age 16-18 for analysis purposes: ‘Academic’, ‘Tech Level’ (technical qualifications recognised by employers) and ‘Applied General’ (applied learning of transferable knowledge and skills) (Department for Education, 2018a). Academic qualifications include A-levels, the International Baccalaureate, the Pre-U and some project/extension and freestanding maths awards, with those taking at least one A-level making up the overwhelming majority (98%) of the academic group. Overall the proportion of students choosing to follow an entirely A-level curriculum post 16 is a minority of the age cohort. For example, in 2017 52% of those who had taken GCSEs or

equivalents two years earlier took one or more A-levels, but only 36% took just A-levels, rather than a combination of A-levels and other qualifications (Department for Education, 2018a). Although these 'A-level only' students form a minority of the cohort, on average they are those with higher prior attainment, and therefore more likely to attend university. A-level qualifications are much the most commonly held entry qualifications for UK universities, particularly for highly selective universities. 80% of those accepted to the one third of universities with the highest average entry tariff hold A-levels, compared with 65% and 45% respectively of middle and lower tariff universities. By contrast only 2% of acceptances to higher tariff universities hold qualifications from the Business and Technology Education Council (BTEC) suite, the most popular applied general qualification overall for university entry (UCAS, 2017).

A-levels are therefore the most important qualifications in admission to the sorts of universities which are likely to matter, in ways that have yet to be uncovered clearly, in access to professional careers. This thesis therefore focuses on choices relating to A-levels, rather than other post 16 qualifications. In advance of making choices relating to A-level subjects, students will, of course, have made the choice to stay in education rather than work/training, and to follow an A-level curriculum rather than a technical or applied general one. Such choices have been examined extensively in the literature in both UK and international contexts, and been shown to relate strongly to students' social background (see, for example, Breen and Goldthorpe (1997)). Much less attention to date has been paid to the choice of subjects by social background among those deciding to follow the A-level pathway. The next section discusses the choice set available to such students and develops a taxonomy of A-level subjects according to the published preferences of highly selective universities, which is then used in analysis in subsequent chapters.

2.3 A-level subject choice

2.3.1 The A-level system

Once a young person has decided to stay on at school or transfer to a sixth-form or Further Education (FE) college to take A-levels, a large number of subject choices remain, without any compulsory core. In 2014/15 96 different A-levels were available for teaching in England and Wales, including single and double versions of some subjects. The actual choices faced by students are more restricted but still considerable; typically, schools and FE colleges offer 20 -30 different subjects, and sixth form colleges 30 - 50.

The number of different A-level subjects has grown to reflect the differing needs of the larger cohorts of students now taking A-levels (House of Commons Select Committee on Education and Skills, 2003), but as the number of options has grown, so has the perception that not all A-levels are equally acceptable to universities, and in particular to the most selective universities. There has been recent renewed involvement by Russell Group universities through membership of the A-level Content Advisory Board in advising Government on A-level content (Gibb, 2015). Recent reforms, set out in detail in Appendix 1, have somewhat reduced the number of options in response to concern that many subjects were not providing good preparation for university, were taken by too few candidates or duplicated content in other subjects, but there remain 61 possibilities[1] (Ofqual, 2018).

'Curriculum 2000' was a Government initiative reforming the structure and content of the post 16 academic examination system (House of Commons Select Committee on Education and Skills, 2003). It introduced AS (Advanced Supplementary) Levels, first examined in 2001. These then counted for half the points of an A-level. The aim of the reform was to broaden the subject range taken by year 12 students (age 16+ at the start of the year), who in general take four subjects at AS Level, then continue with three of them to A-level. AS examinations were taken at the end of year 12 within a modular

[1] Counting the three different Design and Technology specifications separately and including Welsh as a first and second language.

system until current curriculum reforms, then the additional modules required to make up the full A-level in those subjects with which the student wishes to continue are taken in year 13. From the June 2017 examination session onwards AS and A-levels started to be 'decoupled' so that AS results do not contribute to final A-level grades, with batches of subjects reformed over four years. Since decoupling, AS entries have dropped significantly, making choice of A-levels potentially more challenging to 16-year-olds, since many are now choosing only three A-level subjects at 16+, rather than choosing four and dropping one at the start of their final year, informed by their AS grades (Thomson, 2017).

17 of the 96 A-levels available for teaching in 2014/15 were single or double applied subjects. These were part of the A-level system and are in more vocational subjects than other A-levels, although in some cases they had similar content to non-applied A-levels (for example both A-level business and A-level applied business existed, pre reform). They were introduced for teaching from September 2005, replacing the suite of Advanced Vocational Certificates of Education (AVCE) which were withdrawn from teaching in 2004. The suite of applied A-levels is graded like non-applied A-levels but aimed at students with more vocational inclinations and includes several subjects in both single and dual award form. These qualifications were short-lived; none of them is retained under the reform of A-levels described in Appendix 1.

2.3.2 Selective university guidance on the choice of A-levels

A-levels have come to perform a dual role of providing both a summative assessment of the attainment of students leaving secondary education at 18+, and a predictive function as the most important element of selection into university for the majority of applicants (UCAS, 2013). Universities publish entry requirements couched not only in terms of grades but also, although by no means for all courses, for particular A-level subjects. Students choosing A-level subjects at age 16 may therefore find themselves unable to apply for preferred courses, either because they lack information about requirements or because they had not decided on their university course when they made their A-level

subject choices. In response to this problem in 2011 the Russell Group of universities first published 'Informed Choices', a guide to subject and qualification choice for year 11 students aspiring to enter Russell Group universities and those who advise them. Its aim was to help students make choices which kept options open for those who had not at that point decided on their degree subject, rather than to express a hierarchy of A-levels. However, in its earliest edition (Russell Group, 2011) it included examples of 'soft' subjects[2], considered less suitable for university preparation. This list has since been removed (Russell Group, 2016). In its recent editions it discusses 76 A-level subjects either individually, or as members of a group, remaining silent on 20. 33 subjects are classified as 'facilitating', including 20 classical and modern languages. It suggests that facilitating subjects are those most often required for courses at Russell Group universities, and that the more that are chosen, the more degree course options remain open. It recommends that at least two such subjects should be taken by students who have not yet made up their minds about what course to do at university, although notes that there are other subjects providing good preparation for university study but which are required for too few courses to be put on the facilitating list[3]. 23 subjects are described as either essential or useful for particular courses, but without conferring the broader options benefits of the facilitating group, such as music, economics and religious studies, and some subjects are specifically warned against as not providing good preparation for entry to a Russell Group university - general studies, critical thinking, citizenship and all 17 'applied' subjects. Even for students who refer to 'Informed Choices' in year 11 this leaves 23 subjects of uncertain status, and it would not necessarily be clear to students which A-levels are 'applied'; eight of the separately certified applied A-levels have the word 'applied' in their name, but nine do not.

In addition to the information published by the umbrella organisation, five individual Russell Group universities publish lists of acceptable or not acceptable A-levels (LSE,

[2] Media studies, art and design, photography (an endorsement of the art and design A-level) and business studies were listed.
[3] Economics, religious studies and Welsh (first and second language) are included as examples of such subjects.

2014; The University of Edinburgh, 2014; The University of Sheffield, 2014; UCL, 2014; University of Cambridge, 2013), and their lists suggest that many of these 'uncertain status' subjects are considered 'less effective preparation' for university study, and students should take no more than one of them. In some cases guidance conflicts; some subjects appear on 'not acceptable' lists but are considered useful for particular courses at other Russell Group universities. In other cases guidance might seem surprising for a student making choices at 16+; for example the LSE makes clear that even for admission to related degree courses such as accounting and finance, A-levels in accountancy, business studies and law are considered unhelpful.

2.3.3 Taxonomy of A-levels

I use this published information on the appropriateness of different A-levels for study at selective university to create a taxonomy of A-levels for use in analysis in the remainder of this thesis. This approach is to be preferred to subject content based categorisations such as creative arts or science, technology, engineering and mathematics (STEM) used in earlier work (for example Vidal Rodeiro (2007)), given that my aim is to examine subject choice in relation to selective university entry. These categories have been determined and A-levels classified based on the analysis of the following sources of information; 'Informed Choices'(Russell Group, 2016), Department for Education (DfE) guidance on facilitating subjects for the AAB Key Stage 5 Performance Table Indicator (Department for Education, 2017a), the general admissions webpages of the 24 Russell Group universities including the five publishing general lists noted above, and the webpages detailing specific course requirements for a range of Russell Group degree courses. Details of the methodology are set out in Appendix 2. From this analysis, the following categories have been determined:

1. **Facilitating** - as identified in 'Informed Choices' with lists of modern and classical languages supplemented by DfE guidance for the AAB performance indicator.
2. **Useful** - not appearing on any non-preferred lists or appearing on approved lists.

3. **More limited suitability** – appearing on at least one non-preferred list or absent from approved lists but also described as essential, useful, alternative required or preferred for related degree courses for at least one Russell Group university.
4. **Less effective preparation** – appearing on at least one non-preferred list or absent from approved lists and never described as essential, useful, alternative required or preferred for related degree courses at any Russell Group university.
5. **Non-counting** – general studies and critical thinking are described by many Russell Group universities as not counting towards an A-level offer, and others exclude them from counting within individual course requirements.

The taxonomy is set out in Table 2.

For analysis in Chapters 3 and 4, the ‘more limited suitability’ and ‘less effective preparation’ categories are combined as ‘less suitable’ subjects, because of the planned withdrawal of all but two of the ‘less effective preparation’ category in current reforms (accounting and dance - see Appendix 3 Table 17), and the small numbers of entries for the remaining ‘less effective preparation’ subjects (Table 3).

Table 2: Taxonomy of A-levels available for teaching in England in 2014/15

Facilitating	Facilitating cont'd (small entry languages)	Useful	More limited suitability	Less effective preparation[4]
Biology	Biblical Hebrew[5n]	Ancient history	Art and design[6]	Accounting
Chemistry	Arabic	Archaeology[7d]	Business	Anthropology[dn]
Chinese	Bengali	Classical civilisation	DT: product design (3-D design)[8]	Applied art and design (double)*[d]
Classical Greek	Dutch[d]	Classics[d]	DT: prod. design (textiles)[n]	Applied art and design*[d]
English literature	Greek (modern)	Computer science	DT: systems and control technology	Applied business (double)*[d]
French	Gujarati	Economics	Drama & theatre studies	Applied business*[d]
Further mathematics	Japanese	Economics and business[d]	Electronics	Applied ICT (double)*[d]
Geography	Modern Hebrew	English lang'ge & literature	Film studies	Applied ICT*[d]
German	Panjabi	English language	ICT[9d]	Applied science (double)*[d]
History	Persian	Environmental science	Law	Applied science*[d]
Human biology[dn]	Polish	Geology	Media studies	Citizenship studies[d]
Italian	Portuguese	Government and politics	Music technology	Communication and culture[d]
Latin	Turkish	History of art	Physical education	Creative writing[dn]
Mathematics	Urdu	Music	World development[d]	Dance
Physics		Philosophy		DT: food technology[d]
Pure mathematics[d]		Psychology		Engineering*[d]
		Religious studies		Health and social care (double)*[d]
Russian		Sociology		Health and social care*[d]
Spanish		Statistics		Humanities[dn]
Welsh second language[n]		Welsh first language[n]		Leisure studies (double)*[d]
				Leisure studies*[d]
				Media: communication and production*[d]
				Performances studies[d]
		Non-counting		Performing arts*[d]
		Critical thinking[d]		Science in society[dn]
		General studies[d]		Travel and tourism (double)*[d]
				Travel and tourism*[d]

[4] Applied A-levels marked *
[5] No entries in England/combined with other subject in National Pupil Database marked[n]
[6] Includes 6 additional endorsements/pathways
[7] To be withdrawn in 2015-18 reforms marked[d]
[8] DT: product design specifications/names changing in reforms
[9] Information and communication technology

The relative popularity of A-levels by taxonomy category is given in Table 3, for English students age 16 in 2009/10. Of the 657,000 students in this cohort, 50% (331,000) continued to take at least one A-level in 2012, and 189,000 (29%) of the original cohort took at least three A-levels. Further analysis of this sample by gender and school type is given in Appendix 3 (tables 21 to 25 and figure 7).

Table 3: A-level entries by category for 18 year olds in England taking at least one A-level in 2011/12. Data source NPD KS5 2011/12 taking at least one A-level.

Category	Number of subjects	Number of entries
Facilitating	33	318,612
Useful	20	172,496
More limited suitability	14	143,078
Less effective preparation	27	34,684
Non-counting	2	34,544
Total	96	703,414

Appendix 3 figure 8 shows A-level attempts by school type and category for the 21 subjects held by more than 5% of the 'three A-level' cohort of English students entering UK universities between 2010 and 2012, with data derived from linking NPD for three cohorts of students taking at least three A-levels in year 13 (but not taking an additional year) with UK university entry data from HESA (n=379,616)

2.4 Course choices at 18+

School students hoping to go to university in the academic year after they finish school generally make their application through the centralised Universities and Colleges Admissions Service (UCAS) system before the end of January in their final school year, although some apply post A-levels for a later year or apply for a deferred place, and a small but increasing number (around 3%) make direct late applications through the

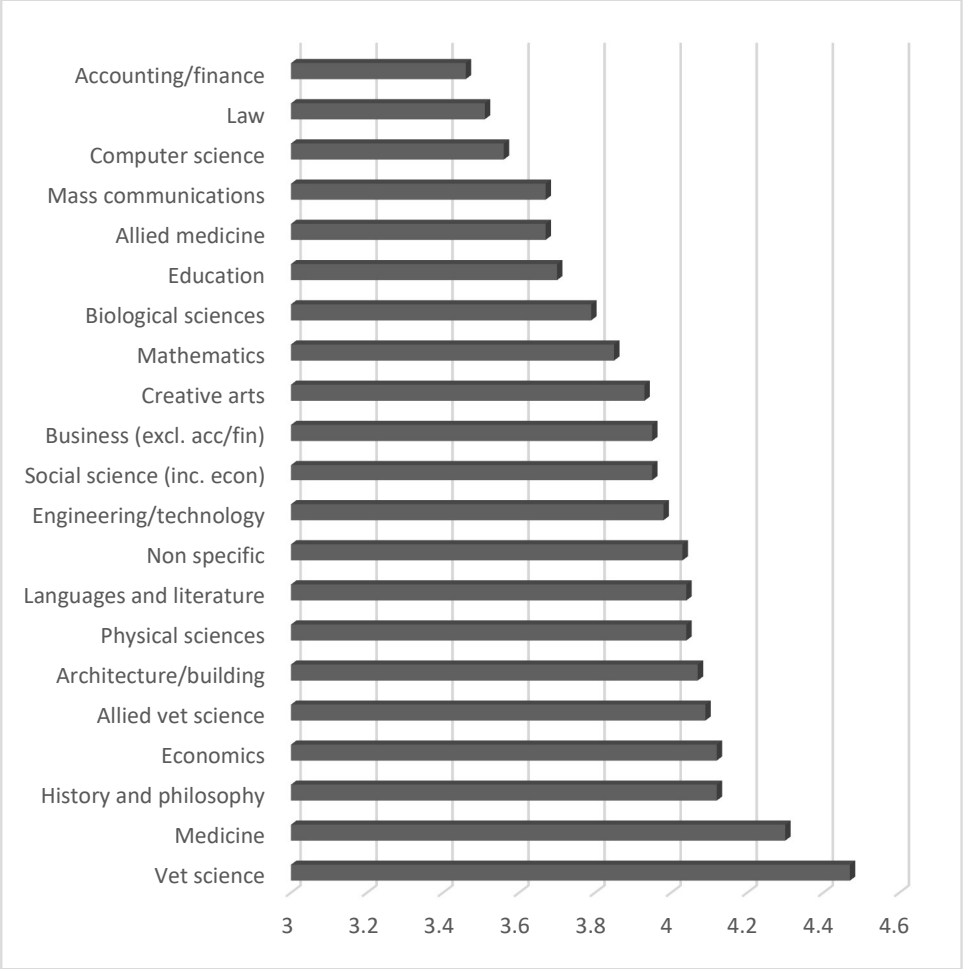
clearing system after A-level results are received (UCAS, 2017). These young people have two related choices to make, of degree subject and higher education institution. Applicants make up to five applications for different course/university combinations – typically for similar courses across different universities. Courses are overwhelmingly in particular subjects, or joint degrees over two or sometimes three subjects, but only a very small minority are the sorts of general or combined degrees that are widely seen in the US. For example, only 0.2% of first year UK domiciled students starting first degrees in the UK in 2015/16 were described as studying 'combined' subjects, rather than specific degree or joint degree subjects listed under the HESA course code system (HESA, 2018). Most students therefore need to choose their university subject at age 17. This early university subject specialism, coupled with the fact that many professions in the UK are graduate entry but do not require particular subjects, makes such choices challenging.

Although there is an increasing body of published work, reviewed briefly in chapter 5, on the returns to subject of study at university, particularly with the recent availability of Longitudinal Educational Outcomes (LEO) data which links administrative records from the Departments of Education, Work and Pensions and Her Majesty's Revenue and Customs (Department for Education, 2016), there has been relatively little recent quantitative work on the relationship between choice of subject of study at university and social background in a UK context. There are prima facie differences in university subject choice by social background, even amongst the already relatively privileged group of students taking at least three A-levels. Figure 2 shows the difference in social background as measured by quintile of SES computed from linked NPD HESA data[10] for their whole academic cohort at age 16 by university subject groups for students in the 116 Times Good University Guide listed institutions starting UK university between

[10] SES data quintile is constructed from a principal component analysis of a variety of measures in the administrative data, as described in chapter 3. Here and in chapter 4, private school students who have not been in state school up to age 16, and therefore for whom these measures are absent in the data, are included in the top quintile. The mean SES of the entire school cohort in compulsory education age 16 is set at 3.

2010/11 and 2012/13. Some HESA subject categories are further broken down to give detail for degree subjects that might be considered by students as particularly good preparation for a business-related career (accounting and finance, business excluding accounting and finance, and economics). The mean for all subject groups is significantly above the mean quintile of 3 for their age 16 cohort, but it is notable that the lowest means are for accounting and finance and law degrees, related A-levels for both of which are examined in detail in chapter 4. Business and management students other than accounting and finance, also examined in chapter 4, have a mean SES around half way up the distribution of means for all of the three A-level group of university entrants. Davies et al. (2013), controlling for a rich set of variables, find students from low income families slightly less likely to apply to read one of an aggregated group of 'high wage premium' subjects (business, computing, law, maths and medicine) than those from high income backgrounds. The raw data in Figure 2 suggest that among these subjects there may be differences in appeal to lower SES young people.

Figure 2: Mean SES quintile by degree subject for entrants with three A-levels at Times Good University Guide listed institutions



Work by Van de Werfhorst et al. (2003) suggests that these differences by SES in degree subject group chosen persist even after taking ability into account, at least for a cohort now aged 60, and it has been shown that such choice differences account for a significant proportion of the mean gap in chances of reaching a top profession for those with parents with high rather than low levels of education (Iannelli & Klein, 2014). How subject choices might make a difference to access to an elite profession where particular subjects are not required for entry has not previously been examined in the literature and the data available for this thesis allow this question to be examined for the first time for a top professional financial services firm.

In the following chapters the taxonomy of A-levels developed above is applied first to consider choices at age 16, then to university attended and degree course studied.

3 The link between the choice of A-level subjects and socio-economic status in English state schools

3.1 Introduction

Positive wage returns to an undergraduate degree persist, despite significant recent increases in the number of graduates (Blanden & Macmillan, 2014). In an intergenerationally mobile society, admission to university would depend principally on the efforts and abilities of the individual rather than the socio-economic status (SES) of their parents (Blanden, Gregg, & Macmillan, 2007; Crawford, Johnson, Machin, & Vignoles, 2011). We also know that returns to a degree vary considerably by type of university (Britton, Dearden, Shephard, & Vignoles, 2016; Chevalier & Conlon, 2003; Hussain, McNally, & Telhaj, 2009) and by degree subject choice (Britton et al., 2016; Walker & Zhu, 2011), so if social mobility is to increase, it is important that those from less privileged backgrounds are able to attend the types of institutions and take the subjects conferring higher returns. There is clear evidence that those from lower SES backgrounds and state schools rather than private schools remain under-represented at university generally and at highly selective universities in particular (Anders, 2012; Chowdry et al., 2013; Sullivan et al., 2014). The raw participation gap by SES does seem to be reducing for university generally over the last ten years, but more slowly for highly selective universities, and is increasing for the top quintile by achievement at Key Stage 5 (A-level) (Crawford, 2012).

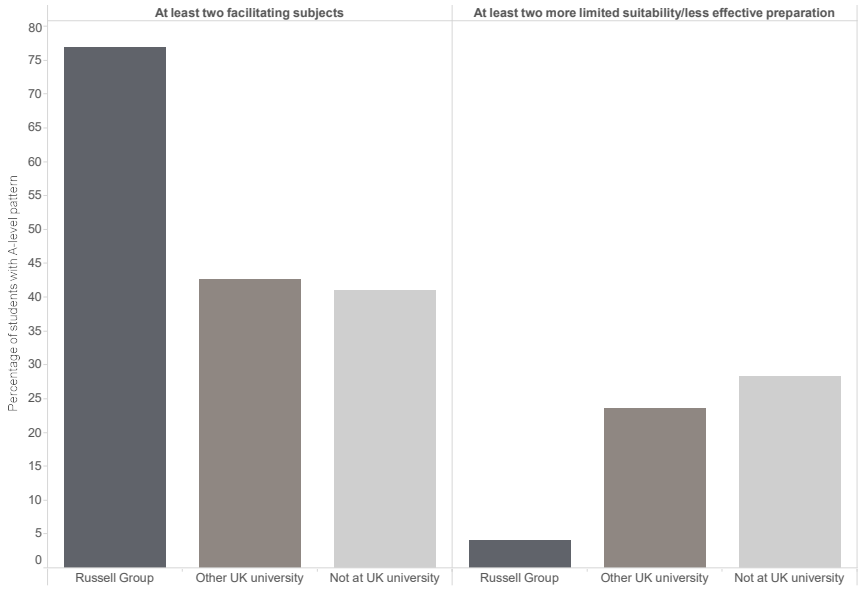
What is it about coming from a lower SES background that means students are less likely to go to a highly selective university? The main barrier seems to be lower school

attainment (Anders, 2012; Chowdry et al., 2013; Crawford, Macmillan, & Vignoles, 2017; Marcenaro-Gutierrez et al., 2007) but even after prior attainment is taken into account some effect of SES on highly selective university attendance remains (Anders, 2012; Crawford, 2012) suggesting that other factors may also be important. One such factor is A-level subject choice; applicants to highly selective universities may apply with good grades, but in the 'wrong' subjects (Russell Group, 2012). Helping able lower SES students make the 'right' choices might be a relatively easy way to increase their chances of attending a highly selective university.

Working out which are the 'wrong' A-level subjects is not straightforward. There were 96 separately certified A-levels available for English students to take in 2014/15. The Russell Group of 24 large, highly selective universities has since 2011 published annual guidance entitled 'Informed Choices' (Russell Group, 2011) on A-levels it considers helpful for admission to its member institutions. It suggests a list of 'facilitating' subjects (maths, sciences, modern and classical languages, English literature, history and geography). Its argument is that the more of these subjects chosen at age 16+, the more course options will be available at Russell Group universities when students make their applications in their final year (year 13) or afterwards. Counting all languages separately, facilitating subjects account for 33 of the 96 possible A-levels available for teaching in 2014/15. There is a lack of centralised information about the remaining subjects. I have therefore produced a taxonomy, based on the published preferences of Russell Group universities derived from 'Informed Choices', published lists of five Russell Group universities which make public statements about the general acceptability of a range of A-levels, and admissions pages for Russell Group courses in subjects related to A-levels, for which the A-level might plausibly provide useful preparation (Dilnot, 2015). This taxonomy further categorises non-facilitating subjects as 'useful', of 'more limited suitability' and 'less effective preparation' in the context of highly selective university admission. My analysis of all students with three A-levels at English mainstream schools and colleges (including private schools) entering UK universities between 2010 and 2012

using linked National Pupil Database (NPD) and Higher Education Statistics Agency (HESA) data does indeed suggest significant differences in proportions of subjects from these categories held by those attending Russell Group and non-Russell Group institutions, and not attending a British university as shown in Figure 3. Noting the difference in uptake of facilitating and non-facilitating subjects between private and state school pupils, the previous Government introduced the achievement of high grade A-levels in at least two facilitating subjects as a national social mobility indicator (Office of the Deputy Prime Minister, 2013) and a school level performance measure (Department for Education, 2014).

Figure 3: Proportions of three A-level cohort of students by A-level pattern held and university status



Evidence suggests that the participation gap by socio-economic status at British universities is reduced once A-level choices are taken into account (Boliver, 2013; Chowdry et al., 2013). This begs the question of why SES might affect subject choices. Human capital theory suggests that individuals make educational investment decisions to maximise their future productivity, subject to constraints which differ by SES (Becker & Tomes, 1986) over the long run . Although choosing one A-level subject rather than another results in no extra financial cost to students, long run factors to do with increased family resources helping to foster better cognitive and non-cognitive skills (Carneiro & Heckman, 2002) mean that students from different social backgrounds are

differentially constrained in their choices. The first differential constraint may arise from the effect of prior attainment, for example through schools requiring a threshold GCSE score before allowing an A-level to be chosen. Second, students from different backgrounds are sorted into different schools (Burgess & Briggs, 2010) and will have different choice sets of A-levels available to them, as well as differences in expectations made of them, and of guidance received. Third, there may be information differentials between students of different backgrounds which lead to choices that prevent more deprived students from fulfilling their academic ambitions (Jackson & Jonsson, 2013). Whitty, Hayton, and Tang (2015) suggest that the experiences and cultural capital of students from lower SES backgrounds are likely to affect their capacity to navigate educational pathways, which may be particularly problematic in the context of elite university entry. One of the ways in which such students may not 'know the ropes' (p44) is the necessity to choose appropriate A-level subjects that will keep options open, probably some considerable time before decisions about particular universities and courses are made.

I contribute to the literature by using my A-level taxonomy to investigate the largely unresearched relationship between SES and choice of A-levels, using linked administrative data from the National Pupil Database (NPD) for three cohorts of students taking A-levels in England from 2010 to 2012, and taking into account school differences, using first single level then fixed effects models. Illumination of the pathways through which SES status is linked with subject choice will help schools provide appropriate information, advice and guidance (IAG) to students making subject choices, and will provide evidence to university admissions teams considering A-level subject course requirements, so contributing to a reduction in inequality of elite university entry. I proceed in this paper by discussing the literature on the relationship between subject choice and social background, followed by setting out the methods and data. The last section includes a discussion of results, some conclusions and next steps.

3.1.1 The relationship between A-level subject choice and SES

The literature on subject choices at age 14+ has covered a wide range of GCSE subjects (for example Davies, Telhaj, Hutton, Adnett, and Coe (2008) and Iannelli (2013)) whilst that on A-level choice to date has largely concentrated on the uptake of STEM (Science, Technology, Engineering, Mathematics) subjects, partly because of the perceived economic need for a workforce trained for the predicted increase in STEM based occupations, and also because of concern over the lack of diversity in those choosing STEM subjects at A-level. Much of this work is concerned with the gender gap in subject choice, but there is also evidence of a relationship with SES. Gorard, See, and Smith (2008), in a systematic review of patterns of science participation from the literature and in an analysis of NPD data (Gorard & See, 2009) find students eligible for free school meals significantly less likely than their more privileged peers to take maths and science at A-level. Gill and Bell (2013) find a small reduction in the probability of taking A-level physics for pupils living in areas with low car ownership (although not for other measures of deprivation) once prior attainment is controlled for, and other studies find relationships between the uptake of A-level maths and SES (Cheng, Payne, & Witherspoon, 1995; Sharp, Hutchison, Davis, & Keys, 1996).

Vidal Rodeiro (2007) examines reasons for subject choice across all A-level subjects and finds that reasons for making particular subject choices, and the subjects chosen both relate to parents' occupational class. The children of higher managers and lower managers/professionals are significantly less likely to take at least two science subjects than the children of higher professionals, but the children of higher managers are more likely to take the business-related subjects of accounting, business and economics. Manual workers' children are significantly less likely to take a foreign language A-level, but no parental occupation effect is observed for taking two 'less effective preparation' subjects. No theoretically driven classification of subjects in terms of efficacy of subjects in highly selective university admission was used in this analysis; instead content based groupings of science, language, business, vocational, technologies, creative arts,

established humanities and newer humanities were used, together with the 'less effective preparation' list that was then in use by Cambridge University (but has since been withdrawn). The study was of a random stratified sample of 60 schools, with a response rate of 40% from the students within the schools, and did not aim to make estimates generalizable to the population. More recently, a longitudinal study of 3,000 students followed since age 3 finds bright but disadvantaged students much less likely to take at least one facilitating A-level subject than their bright but more advantaged peers (Sammons,Toth, & Sylva, 2015). Using NPD data for 2014, Gill (2015b) provides prima facie evidence of gaps in the take up of individual A-level subjects and in numbers of facilitating subjects by social background (measured using the Income Deprivation Affecting Children Index) and school type. I contribute to the literature in this area by using NPD data to analyse the choices by social background of all students taking A-levels in three recent cohorts, taking into account school and individual level characteristics.

Literature on the choices made by students in other countries is difficult to translate generally to the English context as it tends to concentrate on the effect of tracked systems rather than choices at age 16, but provides potentially generalizable insights. In a study in the Netherlands Van de Werfhorst (2002) finds children from working class backgrounds likely at age 12 to choose technical and commerce related subjects available within the vocational rather than general school track. Such subjects are classified as 'less suitable' for highly selective university entry in the UK context, despite their more obvious links to careers than subjects in other categories. As Davies, Qiu, and Davies (2014) suggest from work on university aspirations, cultural capital can help make sense of labour market information, and students from less privileged backgrounds might be less willing to take subjects not obviously linked to a career because they and their parents lack the knowledge that access to a career may not necessarily be via the most obvious route, and that choices maximising their entry chances to a highly selective

university might be better for their long term career goals than taking an A-level in a particular career-related subject.

Indications therefore exist in the literature that there are social class effects in uptake of facilitating subjects. The evidence on other subjects is mixed and requires further analysis; there does seem to be an effect for some such subjects (for example accounting and business studies) but not for all of the Cambridge less effective preparation list taken together, once academic attainment is controlled for (Vidal Rodeiro, 2007). The full extent of the pathways by which SES might have an effect on subject choice is as yet unclear. I therefore ask the following questions.

3.2 Research questions

1. Are there differences in the proportions of English state school students choosing facilitating or 'less suitable' A-levels by social background, before adjusting for any other characteristics?
2. How much of these differences is explained by prior attainment and choice of GCSE subjects?
3. Is any remaining difference in subject choice by social background accounted for by the observed characteristics of schools, into which students of similar social background tend to be selected?
4. If both observed and unobserved characteristics of schools (such as school ethos and quality of IAG) are taken into account, are there still differences in subject choice by social background?

3.3 Methods

I use the taxonomy to investigate the relationship between social background and choice of A-levels for students at English state schools and 6th form and further education colleges as SES data is largely unavailable for students at private schools. A-level outcomes are based on my classification of A-levels. Based on Russell Group advice that students wishing to keep their options open for admission to the largest number of courses at their member universities should do at least two facilitating subjects,

categorical outcome variables are observed for students with grades A* to U in at least two facilitating subjects (the facilitating outcome). The second outcome is whether students chose at least two subjects from the 'more limited suitability' and 'less effective preparation' categories combined (the 'less suitable' outcome). 'More limited suitability' subjects are those where at least one Russell Group member publishes reservations about the subject as appropriate preparation, but on the other hand it is described as useful, recommended or essential for at least one Russell Group course. 'Less effective preparation' subjects are those where reservations are expressed on at least one general list, and no Russell Group courses in related subjects describe the subject as useful, recommended or essential. Only a small number of candidates enter for 'less effective preparation' subjects and all but three of these subjects are in the process of being withdrawn in current A-level reforms (Ofqual, 2014b). I therefore combine them with 'more limited suitability' subjects. Figure 3 shows that only a very small proportion of Russell Group entrants hold at least two 'less suitable' subjects, which suggests that they may be unhelpful for entry to Russell Group courses, and so investigating their relationship with student background is valuable. The full list of A-levels in each category is given in Table 2, which also indicates those to be withdrawn.

The outcomes examined are dichotomous, and might generally be modelled using binary logistic regression. To answer the fourth research question, the unobservable effects of schools on subject choices are examined through the use of a fixed effect model. Binary logistic fixed effect models for the full sample do not converge as there are some 2,200 school fixed effects to estimate. I therefore adopt the approach used by Chowdry et al. (2013) who note that where the probability of an outcome is between 0.25 and 0.75, linear probability models give a close approximation to the logit model. In the case of the facilitating subject choice outcome the probability is 0.44. For the second outcome the probability is 0.23. This is slightly outside the suggested limits, but robustness checks of a fixed effect logit model on a smaller sample suggest the same substantive conclusions as the linear probability model. The use of robust standard errors deals with the problem

of heteroskedastic residuals. I therefore use linear probability models throughout, so that coefficients are interpreted as the increase in probability of a student taking at least two facilitating subjects, or at least two more limited suitability/less effective preparation ('less suitable') subjects, for a unit increase in the variable of interest, all else equal. In models 1 to 3 the data are analysed at the disaggregated level. The grouping of students within schools is taken into account by using clustered standard errors.

Model 1 shows the relationship between social background and subject choice without taking any account of the pathways through which the association might be mediated. I then control for individual observable characteristics that may contribute to the association. These are added in four blocks. Model 2a includes confounding demographic variables, likely to be associated both with SES and subject choice, but not forming part of the pathway from SES to choice (ethnicity, gender, region, English as additional language (EAL), special educational needs (SEN) status).

Prior attainment is then taken into account (models 2b-2d), as evidence suggests students with high prior attainment are more likely to choose maths and science subjects (all facilitating subjects) at A-level (Gill & Bell, 2013; Vidal Rodeiro, 2007), and conversely the lower their scores at GCSE the more likely students are to choose newer or vocational subjects (Vidal Rodeiro, 2007), all of which are included in the 'less suitable' outcome. This is consistent with work by Coe, Searle, Barmby, Jones, and Higgins (2008), whose work suggests that subjects in the facilitating category are on average more difficult than the mean, and those I classify as "less suitable" are largely easier. Gorard and See (2008) suggest that, in the context of science subjects, having high prior attainment is likely to mean students are prepared to take hard subjects, both because they think they will succeed at them and because schools may have threshold GCSE results for these subjects at A-level. Many 'less suitable and some 'useful' subjects are not commonly taught at GCSE making the imposition of threshold scores less likely, and so opening up the subject to students with lower attainment. Given that both attainment at GCSE and the choice of subjects (the English EBacc of core

academic subjects that are likely to be necessary preparation for the study of many facilitating A-level subjects) is related to SES (Allen, 2015; Sammons et al., 2014; Vidal Rodeiro, Sutch, & Zanini, 2013) it is likely that one of the ways social class is associated with subject choice, particularly of facilitating subjects, is through differential prior attainment and choice. Attainment controls are added sequentially in models 2b to 2d to gain understanding of the relative importance of attainment at age 11 and 16, and the role of having made particular GCSE choices at age 14.

I next take into account the observable characteristics of schools (model 3). Schools can influence students' A-level subject choices in a variety of ways, most obviously by either providing particular subjects or not. There are large differences between the proportion of schools offering particular subjects by school type: facilitating subjects are offered by higher proportions of selective state (grammar) schools than comprehensives and further education (FE) colleges; the converse is generally true of 'less suitable' subjects; and 6th form colleges tend to offer many subjects across all categories, because of their large A-level cohorts. Differences also exist in some subjects by school gender and size, and also mean school attainment, with larger proportions of higher attaining schools offering broadly more facilitating and fewer 'less suitable' subjects (Gill, 2015a). Vidal Rodeiro (2007) notes that independent and grammar schools offer fewer of the vocational and newer subjects introduced in the early 2000s with the aim of broadening the A-level curriculum. School type has been shown to have an effect on subject choice, with students from selective maintained schools, independent schools and colleges being more likely to take science A-levels, those in further education and tertiary colleges arts, social sciences and humanities, and from comprehensive schools a mixture (Vidal Rodeiro, 2007). The mechanism by which this happens is not clear and no account was taken of the choice set provided by type of school. I therefore control for a vector of school level variables relating to breadth of subject choice selectivity, school type, size of the A-level cohort and school gender. These school level characteristics may act as pathways mediating the relationship between SES and subject choice, but this has not

been examined to date. They are related to background as different types of students are found in different schools.

Model 3 includes only those school level variables that are observed in the data. A review of the literature by Bennett, Braund, and Sharpe (2013) in the context of STEM subject uptake suggests that a range of unobservable school level characteristics may play a part in subject choice. These include school ethos, leadership and management, curriculum effects, A-level entry policies, careers advice and guidance, the availability of enrichment activities and the impact of specialist teachers. These unobserved characteristics are also likely to act as mediating pathways, and are therefore taken into account in the final formulation of the model, model 4, which is defined as follows, using a linear probability model for outcome y_{ijt}:

Equation 1

$$\widehat{P}(y_{itj}=1 \mid S_{ij}, T_t, D_{ij}, A_{ij}, I_j)=\hat{y}_{ijt}$$

Where $y_{ijt} = \alpha + \beta S_{ij} + \gamma T_t + \delta D_{ij} + \rho A_{ij} + \tau_j I_j + u_j + \varepsilon_{ijt}$

The coefficient β is interpreted as the change in probability of choosing at least two facilitating subjects (or two 'less suitable' subjects) associated with a change in SES category S_{ij} compared with the baseline (least privileged quintile). T_t is a cohort dummy to account for trends in subject choice over the three pooled cohorts. D_{ij} are demographic variables, A_{ij} is prior attainment and I_j are observed school level characteristics. The u_js are school level residuals and ε_{ijt}s are individual level residuals.

The unobserved school level residuals are dealt with by using school fixed effects in model 4 to control for all differences in schools, both observed and not, so disentangling the relationship of subject choice with SES from that relating to schooling by effectively comparing students of different backgrounds within the same school.

An alternative multilevel method of estimating both individual and school level associations with subject choice is to use a random effects estimator. Clarke, Crawford, Steele, and Vignoles (2013) suggest that the fixed and random effects estimators should give similar results either where there are large numbers of observations per school, or

the variation between schools is small compared with that within schools. The random effects estimator is the weighted average of the between group and within group (fixed effect) estimates – in this case the groups are schools. Both conditions hold in this administrative data; there are large numbers of observations per school and the proportion rho of the total variation in the outcome measures due to school level clustering is small (0.11 for the facilitating subject outcome and 0.12 for the 'less suitable' outcome). The advantage of using the random effects approach is that it allows coefficients on observed school level variables to be estimated, but it requires a more problematic assumption than fixed effects, that u_j and ε_{ijt} are mutually independent and have zero means given the values of the remaining explanatory variables. In practice this means that unobserved school characteristics which make a difference to subject choice outcomes, such as the IAG given to students, must not be correlated with their social background. As they are likely to be correlated in this case the fixed effects method is used, and the random effect results are noted only.

3.4 Data

I use individual level administrative Key Stage 5 (KS5) data for three cohorts from the NPD. This contains detailed attainment data by subject for those students taking one substantial level 3 qualification (defined as at least the size of one A level - 180 guided learning hours per year) in 09/10, 10/11 and 11/12, and individual level characteristics from the spring School Census for students in state schools. These cohorts are linked to KS2 (age 11) attainment data relating to normal progression through school, and to KS4 (GCSE age 16) data with both attainment and School Census variables which are used when School Census data at KS5 is missing. The databases contain school identifiers allowing schools to be matched to Edubase[11], which provides school level variables (school gender and selectivity)

[11] Now known as 'Get Information About Schools', a Department for Education database of school level characteristics (*Get Information About Schools*, 2018).

Table 4: Socio-economic gradient of A-level cohort and KS4 cohorts

All state school students	% in SES quintile 1	% in SES quintile 2	% in SES quintile 3	% in SES quintile 4	% in SES quintile 5	% missing SES	Number of students
KS4 state school cohorts 2007/8 – 2009/10	19.2	19.2	19.2	19.2	19.1	4.1	1,803,337
KS5 at least one A-level 2009/10 – 2011/12	8.8	13.3	18.5	23.9	32.1	3.4	623,575
KS5 at least three A-levels 2009/10 – 2011/12	7.5	12.1	17.8	24.3	35.0	3.4	485,252
Common estimation sample used in analysis	7.6	12.4	18.5	25.4	36.1	0	444,467

The sample is restricted to those taking three or more A-levels excluding general studies and critical thinking, as they are those with a realistic chance of admission to a highly selective university. I recognise that by only including those doing A-levels a large proportion of lower SES students are excluded from analysis because of prior selection, but my aim is specifically to examine choices made by those who have already decided to stay in the post-compulsory academic cohort and who are most likely to attend university. Table 4 shows the socio-economic gradient of state school students taking A-levels compared with the year 11 state school cohort as a whole: those staying on to take at least one A-level are privileged compared with their year 11 peers with only 8.8% coming from the bottom year 11 quintile and 32.1% coming from the top, and the three A-level cohort is slightly more privileged still.

To be in a cohort, students must be completing their studies in that year, and be aged 18 or younger on 31 August. Those taking the International Baccalaureate or Cambridge Pre-U qualification without three A-levels are excluded from this analysis because of their small numbers (Vidal Rodeiro et al., 2013). Students taking BTEC are also excluded as they represent a very small proportion of English 18-year-old entrants to high tariff British universities; 2% of those accepted in 2014 hold the equivalent of ABB or better from BTEC compared with 77% from A-levels (UCAS, 2013).

If a student does four A-levels it is possible that they appear as positives for both outcomes. Only 1,637 students in the sample do at least two facilitating and at least two 'less suitable' subjects. The analysis of the at least two 'less suitable' subject' outcome was rerun, excluding these students. For all model specifications SES coefficients were within a very small margin (.001) of those for the full sample.

Table 5: A-level subject choices by student characteristics

Estimation sample	% taking at least two facilitating subjects	% taking at least two 'less suitable' subjects
OVERALL	44.4	23.1
BY GENDER		
Female	38.8	23.6
Male	51.5	22.5
BY FREE SCHOOL MEAL ELIGIBILITY:		
In either year 13 or year 11	37.3	25.6
In neither year	44.7	23.0
BY SES QUINTILE		
Quintile 1 (bottom)	37.1	26.3
Quintile 2	41.2	25.0
Quintile 3	44.1	23.6
Quintile 4	47.3	21.9
Quintile 5 (top)	52.0	18.9
BY ETHNICITY		
Any other ethnic group	55.5	18.4
Asian	52.7	18.2
Black	36.0	22.8
Chinese	64.0	17.4
Mixed	44.7	21.7
Undeclared	46.2	21.7
White	43.5	23.8

Table 5 shows differences in A-level outcome by student characteristics. Male students are much more likely to take facilitating subjects (51.5% compared with 38.8% of females), although only account for 43.7% of those taking three A-levels. Chinese students are the ethnic group much the most likely to take facilitating subjects (64.0%) followed by Asian students (52.7%) with white students (43.5%) and black students (36.0%) less likely. Much smaller differences in the choice of 'less suitable' subjects are observed by gender, but ethnicity remains important; Chinese students are the least likely to choose these subjects, and white students the most.

The individual data on SES available in the administrative datasets is limited, with the only individual level variable being free school meals eligibility (FSM). Hobbs and Vignoles (2010) suggest that FSM status is a poor proxy for income, and it only allows comparison of those who are at the bottom of the SES distribution (in the case of those doing three A-levels, 5.3%) with those above. The raw difference in choosing facilitating subjects by this measure is 7.4pp, and 2.6pp in 'less suitable' subjects.

In order to investigate the SES gradient across the whole distribution I follow Chowdry et al. (2013) in using a combination of individual FSM data with neighbourhood data to construct a measure of SES. I note that this has problems associated with it (for example being on FSM indicates a level of income deprivation which is already likely to be taken into account in some of the neighbourhood variables (Chowdry et al., 2013)). As a proxy it is a noisy measure with the error term in its measurement creating an endogeneity bias in the regression equation, skewing the estimated coefficients towards zero (attenuation bias). The models are therefore likely to show a smaller relationship in absolute terms between the outcomes of interest and SES than is actually the case. I use principal component analysis to construct an index of socio-economic background combining the following measures, linked using the student's home postcode at age 16 where available, and where missing at age 18. The variables used to construct the index are:

- Whether a student is eligible for FSM at either or both of age 16 and 18;
- An index of multiple deprivation (available for neighbourhoods containing around 700 households);
- The classification of residential neighbourhoods type, based on individual postcodes, and derived from information on housing details and socio-economic characteristics (each postcode contains around 15 households);

- Local area measures for around 150 households based on the 2011 census, of the proportion of:
    - individuals working in higher or lower professional or managerial occupations;
    - individuals aged 16 and over whose highest educational qualification is national qualification framework level 3 (ie A-level or equivalent) or above;
    - households that own their home.

Although it is problematic to use dichotomous variables in a principal component analysis (Kolenikov & Angeles, 2009), only one of the variables in this analysis is binary, and the remainder are continuous, so reducing the problem. Chowdry et al. (2013) construct an SES measure using this method and find their results substantively unchanged if they use FSM together with each of the measures separately. The Kaiser-Meyer-Olkin measure of sampling adequacy for the index I derive using this method is 0.8, suggesting that it is appropriate to consider the common variance as a measure of a latent underlying variable, in this case SES. The three A-level cohort of state school students is split into quintiles according to this measure, with a mean value of 3 across cohorts.

I observe a range of school level characteristics from Edubase. I classify schools as FE and 6th form colleges and selective or non-selective mainstream state schools. Schools are matched to individual students through their combined Local Authority and Establishment numbers, which remain constant when a school's status changes

.

Table 6: Descriptive statistics by school type

Estimation sample	Non selective state schools	Selective state schools	6th form colleges	FE colleges	Overall
Percentage taking at least two facilitating A levels	45.7	65.5	35.3	29.5	44.4
Percentage taking at least two 'less suitable' A-levels	23.1	9.3	28.2	29.4	23.1
Mean SES quintile (in sample)	3.06	3.27	2.85	2.62	3.00
Mean SES quintile (KS4 cohort)	3.77	3.96	3.53	3.34	3.70
Mean capped GCSE points, including equivalents	396	423	397	392	399
Mean 'facilitating' GCSE passes A*-C per student	4.3	5.8	4.1	3.9	4.4
Mean 'less suitable' GCSE passes A*-C per student	1.7	1.6	1.7	1.7	1.7
Mean total GCSE passes A*-C per student	8.2	9.4	8.1	7.8	8.3
Mean number of facilitating A-level subjects offered by school	7.7	11.0	11.2	6.3	8.0
Mean number of 'less suitable' A-level subjects offered by school	8.2	7.2	18.3	8.4	8.6
Mean total number of A-level subjects offered	20.6	25.5	40.7	20.4	21.8
Number of students	250,053	53,954	103,631	36,829	444,467
Number of schools/colleges	1,752	162	95	167	2,176

Table 6 shows the large differences in subject choice by school type, for those taking at least three A-levels. More than twice the proportion of students at selective schools take at least two facilitating subjects than those at FE colleges, but there are also substantial differences between non selective state schools and 6th form and FE colleges, despite the relatively similar average GCSE attainment and GCSE subject choice pattern at these types of schools. The converse is observed for 'less suitable' A-levels, with students at colleges around three times as likely to take them than those at selective state schools, and over 6pp more likely than those at non selective schools.

The number of subjects from different categories offered varies considerably by school type. 6th form colleges typically offer large numbers of A-levels, so facilitating subjects

form a relatively small proportion of average provision (28%), compared with 43% at selective schools. Conversely, the mean proportion of 'less suitable' subjects offered by selective schools is 28%, compared with 40% or more at non-selective schools and colleges. The SES quintile measures given in Table 6 show that students at colleges are on average less privileged than those at non-selective schools, who in turn are less privileged than those at selective schools.

Two measures are used for school choice set in each set of models; the total number of A-level subjects offered in the three-year period, and the number of subjects offered from the outcome of interest. A subject is counted within a school's offer if at least three students have taken it during the three years. A limitation of these measures is that all A-level subjects provided by a school are included, where in practice there may be timetabling or other constraints on choice. Evidence from the Longitudinal Study of Young People in England 2005-6 suggests that around a fifth of KS4 students are not able to take preferred subjects at GCSE; in the majority of cases because of timetable clashes or full classes (Jin et al., 2011). A similar effect at A-level has not yet been investigated, but it is possible that the 'offer' measures overstate the choices actually available to students.

Although A-level subject choices are often made at the end of year 11, I use the school characteristics of the 6th form attended because those changing school for A-levels are likely to make decisions based on available subjects at the school or college they plan to attend.

A rich set of data is available with which to control for prior attainment. KS2 deciles are constructed according to average point scores in English, maths and science. The relationship of subject choice with KS2 deciles is linear apart from for the top decile. I therefore include standardised average points scores for English, maths and science, and a dummy to indicate top decile in KS2. KS1 quintiles are not included in the models as they have negligible effect on model fit, yield largely non-significant coefficients and reduce the common estimation sample by some 20,000 relating to A-level students who

could not be found in the KS1 data 11 years earlier and had no other missing variables. Standardised capped GCSE and equivalents points scores are used as overall KS4 controls. An indicator of the number of facilitating A-level subjects a student could potentially have taken is constructed using the number of related 'facilitating' GCSE subjects held at grades A*-C (maths, English literature, separate sciences, languages, history and geography). The number of GCSE grades A*-C in subjects corresponding to 'less suitable' A-level subjects in the taxonomy is also counted to see whether having done these subjects from 14-16 is important in choice of A-levels.

Models are run on 444,467 complete cases from 485,252 students with at least three 'counting' A-levels over the three cohorts. This loss of data and therefore statistical power is not a significant problem given the size of the administrative dataset. Listwise deletion generally results in estimated standard errors that are good estimates of the true ones (Allison, 2001). The missing cases are slightly more likely to choose at least two facilitating subjects, and less likely to choose 'less suitable' ones, whilst being slightly less privileged. Their absence from the analysis would therefore, if anything, increase the SES gradients observed, so tending to overstate the relationship between subject choice and social background. The missing data is of three main kinds; first, missing data from the School Census (LSOA, ethnicity, FSM, SEN status for some 12,000 students, disproportionately at FE colleges so likely to be lower SES, on average), second, 3,500 students appearing in KS5 not matched to KS4, and finally around 24,000 students with missing attainment data at KS2.

3.5 Results

3.5.1 SES and choice of subjects

Model 1 in Tables 7 and 8 gives the marginal effects from the baseline models, showing the raw results of each of both outcomes, conditioning only on cohort. The socio-economic gap is clear; students from the top SES quintile are 14.9pp more likely than those in the bottom quintile to take at least two facilitating subjects and 7.5pp less likely to take at least two 'less suitable' subjects. These are large differences, given that the

overall probability of taking two facilitating subjects is 44.4% and ‘less suitable’ 23.1pp. A clear gradient in outcomes across SES quintiles can be seen.

Models 2a to 2d of each table show the effect of adding individual level controls, first demographic and then attainment. The addition of demographic controls (model 2a) slightly accentuates the gradient for facilitating subjects to 16.0pp between the top and bottom SES quintiles, dealing with the confounding caused by heterogeneity in demographic covariates by SES. The gradient in choice of ‘less suitable’ subjects is also increased, to -9.2pp. There are noteworthy differences in subject choice by gender and ethnicity for both outcomes, which will be the subject of future study

Table 7: Gradient in choice of at least two facilitating A-levels by SES

At least two facilitating A Levels	Model 1	Model 2a	Model 2b	Model 2c	Model 2d	Model 3	Model 4
SES quintile 2	0.041***	0.047***	0.025***	0.009***	0.000	-0.002	-0.003
	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
SES quintile 3	0.070***	0.079***	0.047***	0.017***	0.002	-0.001	0.000
	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
SES quintile 4	0.102***	0.114***	0.072***	0.029***	0.009**	0.004	0.005*
	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
SES quintile 5	0.149***	0.160***	0.103***	0.044***	0.015***	0.007*	0.011***
	(0.007)	(0.006)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Standardised maths score age 11			0.102***	0.040***	0.031***	0.032***	0.032***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Standardised English score age 11			0.000	-0.035***	-0.040***	-0.040***	-0.040***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Standardised science score age 11			0.079***	0.042***	0.031***	0.031***	0.030***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Top decile age 11			0.121***	0.049***	0.047***	0.046***	0.045***
			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Standardised GCSE capped points				0.215***	0.177***	0.177***	0.177***
				(0.002)	(0.002)	(0.002)	(0.002)
Total number GCSEs A*-C					-0.023***	-0.023***	-0.026***
					(0.001)	(0.001)	(0.001)
Number of 'facilitating' GCSEs A*-C					0.079***	0.079***	0.085***
					(0.001)	(0.001)	(0.001)
Number of facilitating A-levels						0.012***	
						(0.002)	
Total A-level subjects offered						-0.005***	
						(0.000)	
School gender – boys (base mixed)						-0.037***	
						(0.009)	
School gender – girls (base mixed)						0.018*	
						(0.008)	
School type – selective school						-0.065***	
(baseline non-selective school)						(0.008)	
School type – 6th form college						-0.048***	
(baseline non-selective school)						(0.008)	
School type – FE college						-0.079***	
(baseline non-selective school)						(0.008)	
School size (per 100 students)						0.001	
						(0.002)	
R^2	*.0112*	*.0423*	*.1681*	*.2745*	*.3177*	*.3263*	*.3140*
% with predicted values <0 or >1						*8*	*8*
Number of schools							2,176
Cohort controls	X	X	X	X	X	X	X
Demographic controls		X	X	X	X	X	X
School fixed effects							X
Observations	444,467	444,467	444,467	444,467	444,467	444,467	444,467

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10. Standard errors in parentheses.

Table 8: Gradient in choice of at least two 'less suitable' A-levels by SES

At least two 'less suitable' A Levels	Model 1	Model 2a	Model 2b	Model 2c	Model 2d	Model 3	Model 4
SES quintile 2	-0.013***	-0.021***	-0.005	0.004	0.008**	0.010***	0.009***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
SES quintile 3	-0.028***	-0.040***	-0.017***	-0.001	0.006*	0.011***	0.010***
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
SES quintile 4	-0.045***	-0.061***	-0.030***	-0.008**	0.003	0.009***	0.009***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
SES quintile 5	-0.075***	-0.092***	-0.053***	-0.021***	-0.005	0.005	0.006**
	(0.005)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)
Standardised maths score age 11			-0.044***	-0.012***	-0.004**	-0.004**	-0.003*
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Standardised English score age 11			-0.045***	-0.026***	-0.018***	-0.018***	-0.017***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Standardised science score age 11			-0.058***	-0.038***	-0.029***	-0.028***	-0.027***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Top decile age 11			-0.003	0.035***	0.032***	0.034***	0.031***
			(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Standardised GCSE capped points				-0.110***	-0.095***	-0.072***	-0.072***
				(0.002)	(0.002)	(0.002)	(0.001)
Total number GCSEs A*-C					-0.048**	-0.046***	-0.050***
					(0.001)	(0.001)	(0.001)
Number of 'less suitable' GCSEs					0.096***	0.093***	0.098***
					(0.001)	(0.001)	(0.001)
Number of 'less suitable' A-levels						0.018***	
						(0.001)	
Total A-level subjects offered						-0.008***	
						(0.001)	
School gender – boys (base mixed)						0.025***	
						(0.007)	
School gender – girls (base mixed)						0.009	
						(0.006)	
School type – selective school						0.050***	
(baseline non-selective school)						(0.007)	
School type – 6th form college						0.021*	
(baseline non-selective school)						(0.009)	
School type – FE college						0.022**	
(baseline non-selective school)						(0.008)	
School size (per 100 students)						0.003	
						(0.002)	
R^2	*.0049*	*.0122*	*.0936*	*.1347*	*.1903*	*.1996*	*.1877*
% with predicted values <0 or >1						*11*	*10*
Number of schools							2,176
Cohort controls	X	X	X	X	X	X	X
Demographic controls		X	X	X	X	X	X
School fixed effects							X
Observations	444,467	444,467	444,467	444,467	444,467	444,467	444,467

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10. Standard errors in parentheses.

3.5.2 SES, attainment and choice of subjects

Model 2b of each table shows the results of conditioning on attainment aged 11. A substantial proportion of the observed raw difference in facilitating subject choice (Table 7) is mediated by attainment; controlling just for KS2 attainment reduces the SES gap by

5.7pp. Adding GCSE (and equivalents) scores in model 2c reduces the gap by another 5.9pp, which is consistent with facilitating subjects being considered hard. KS2 scores become less important, but an increase of one standard deviation in GCSE scores (37 points with mean 399) is associated with a 21.5pp increase in probability of taking two facilitating A-levels. Model 2d demonstrates the importance of taking GCSE subjects that provide suitable preparation for facilitating A-levels. Controlling for total number of GCSEs, having just one more 'facilitating' GCSE rather than any other is associated with a 7.9pp increase in chance of taking two facilitating A-levels. The role of the overall GCSE score is still important, but less than before. For a student of given GCSE overall attainment and 'facilitating' GCSEs, having extra (useful or 'less suitable') GCSEs is negatively associated with choosing two facilitating A-levels. Controlling for attainment and subject choice at GCSE almost entirely accounts for the gap in A-level facilitating subject choice by SES. Only the top two quintiles differ from the bottom at conventional significance levels, and the gap between the top and bottom quintiles is very small. It is possible that there is some endogeneity bias here; students wishing to take facilitating A-levels for which some hurdle mark has been set may work harder to improve their GCSE score, or choose 'facilitating' GCSE subjects at 14+, and such foresight may be related to social background. If so, the role of GCSEs may be slightly overstated and that of SES understated, but the overall relationship of subject choice with GCSEs would remain much more important than with SES.

Prior attainment is also seen to have a role in choice of at least two 'less suitable' subjects in Table 8 consistent with their being easier subjects on average. Higher KS2 scores are associated with being less likely to make this choice. Controlling for KS2 results reduces the negative association of higher SES quintile with these subjects, because of the relationship of social background with attainment. Overall GCSE scores are negatively associated with the choice of two 'less suitable' subjects, and model 2c suggests they are more important than KS2 scores. As might be expected, model 2d shows that taking subjects at GCSE corresponding to A-level 'less suitable' subjects

makes it more likely that such subjects are taken at A-level too. For students of given overall GCSE score and number of 'less suitable' GCSEs, having more (facilitating or useful) GCSEs is associated with a lower probability of choosing two 'less suitable' A-levels. Including attainment controls completely accounts for the difference between uptake of two 'less suitable' A-levels by social background.

3.5.3 SES, schools and choice of subjects

Model 3 of Tables 7 and 8 includes the addition of school level observable variables. The inclusion of these variables removes the small remaining SES gradient choice of facilitating subjects, indicating some small further mediation by schools of the relationship between social background and subject choice, controlling for ability and demographics.

Whilst Model 3 cannot account for unobserved school effects, it has the benefit of showing how school level observable characteristics in the model relate to subject choice. The first significant school level predictor in each table is the number of subjects by category offered by the school. Tables 7 and 8 suggest the choice of two facilitating or two 'less suitable' subjects is sensitive to the number offered, with an increase in uptake of 1.2pp and 1.8pp respectively per additional subject from the category offered, keeping the total number of A-level subjects offered fixed. So, for example, offering five more 'less suitable' subjects rather than useful or facilitating ones , is associated with around 9pp more students taking at least two 'less suitable' ones, from an average of 23.1pp. Holding the number of facilitating subjects constant, increasing the total number of subjects offered is associated with a smaller but significant decrease in probability of taking at least two facilitating subjects (-0.5pp) and a similar but slightly larger relationship is seen with 'less suitable' subjects (-0.8pp).

Students at all boys' schools are 3.7pp less likely to take at least two facilitating subjects (Table 7) than those at mixed schools, and conversely 2.5pp more likely to take at least two 'less suitable' ones (Table 8), controlling for all else.

A significant predictor for both outcomes is school type; whether a student attends a selective or non-selective school, FE or 6th form college. Students at FE colleges, 6th form colleges and selective schools are less likely than those at a non-selective school to take at least two facilitating subjects (-7.9pp, -4.8pp and -6.5pp respectively), after controlling for attainment and breadth of choice. Students at selective schools, 6th form colleges and FE colleges are all more likely to take at least two 'less suitable' subjects. The raw differences observed in subject choice by school type in Table 6 are explained by the difference in attainment, GCSE subject choice, and breadth of A-level offer.

Controlling for unobserved school variables through the fixed effect model 4 shows substantially the same story as model 3 for both outcomes. The SES gap remains very small, with only a 1.1pp difference between the top and bottom quintile for facilitating subjects, and an insignificant gap (at 0.1% confidence) between top and bottom for 'less suitable' A-levels. Unobserved characteristics of schools do not seem to be important in accounting for the SES gap once attainment and GCSE subject choice are taken into account.

Results from the random effects version of model 4 give very similar results to the fixed effect model for the SES gradient for both outcomes. Full regression tables for models 3 and 4 are given in Appendix 4, Table 26.

3.6 Discussion and conclusion

This research contributes to the literature by using a new taxonomy to illustrate a clear difference in A-level subject choice patterns by social background. Students from less privileged backgrounds are less likely to choose those subjects described as particularly helpful for highly selective university entry and more likely to choose those that are not, so potentially limiting their future educational trajectory. But these raw differences in A-level choice by social background are effectively removed once attainment and the schools and colleges attended are taken into account, with GCSE subject choices and performance seen to be particularly important.

Although a detailed examination of the usefulness of A-levels for university entry from the categories developed in my taxonomy is the subject of a future paper[12], prima facie there is a relationship between holding A-levels from particular categories and entry to a highly selective university for students from these cohorts. The differentials in subject choice observed across SES quintile in this study may therefore form part of the reason for the under-representation of students from less privileged backgrounds at highly selective universities.

The models show that even when attainment at age 11 is taken into account, progress made between KS2 and KS4 is significant in the choice of A-level subjects, and it is well established that such progress is related to social background, with children from less privileged backgrounds making less progress on average than their more privileged peers (Allen, 2015; Sammons et al., 2014), even when they have been high attaining at age 11 (Crawford et al., 2017). Having good GCSE results is associated with higher chances of taking at least two facilitating subjects, which is consistent with these subjects being considered more difficult than others. Differential take-up is then likely both through schools setting hurdle marks and through students' own sense of whether they are likely to succeed. But it is not just general GCSE attainment as a measure of 'capacity to learn' that matters: particular GCSE subject choice is important too, and this work suggests decisions made at age 14 may have a lasting impact on individual's life chances, Here, too, we know there are differentials by social background, with students from poorer backgrounds less likely to choose the subjects that will provide good preparation for taking facilitating A-level subjects (Allen, 2015), suggesting an important role for information, advice and guidance at age 14. Providing A-level subject choice guidance at age 16, such as 'Informed Choices', may be too late. The GCSE subject choice problem is being addressed to an extent through the introduction of the EBacc,

[12] The paper forms chapter 4 of this thesis.

but it will take some time for this to work through: the first cohort for which the EBacc is compulsory[13] will take GCSEs in 2020.

The main way schools can mediate the relationship between social background and A-level subject choice is through reducing the GCSE attainment and age 14 subject choice gap. This work suggests that other characteristics of schools are relatively unimportant in closing the SES gap, although they can make a difference to A-level subject choices. Most obviously, in order to meet the needs and interests of their particular students and because of the size of their cohort, schools will make different decisions about the subjects they offer. Providing choice is desirable, but can also result in decisions which limit future options. It therefore seems particularly important that where students have a large choice of subjects, good IAG is available to help them decide which to take. The significant negative association of taking two facilitating A-levels with going to FE or 6th form college, even after taking account of the number of such subjects offered, suggests that particular efforts might be needed to make sure that students going to colleges are making well informed decisions. This may be challenging given that many are likely to be going to college specifically to take subjects not available at their existing school, and that the opportunities for the provision of IAG may be limited before students arrive to take up their studies. Grammar schools are an interesting case: the high proportions of students taking at least two facilitating A-levels (and conversely not taking 'less suitable' A-levels) is because of the high GCSE scores and 'facilitating' GCSE choices of their students and the weight in A-level provision towards facilitating subjects. Net of these relationships, students at grammar schools are less likely to take at least two facilitating subjects and more likely to take 'less suitable' subjects than non-selective school students.

The cohorts in this study chose their A-level subjects before the Government's AAB in at least two facilitating subjects performance indicator was introduced. Whether this

[13] Now expressed as a goal that 90% of students will follow an EBacc eligible curriculum by 2025 (Department for Education, 2017d).

indicator makes a difference first to the proportion of state school students taking facilitating A-levels, and second to the proportion of state school entrants to highly selective universities remains to be seen[14]. The measure is likely to cause shifts away from useful, more limited suitability and less effective preparation subjects and towards facilitating ones, at least for high attaining students, and indeed almost all 'less effective preparation' subjects are being removed from teaching under current reforms (Ofqual, 2014b). But the introduction of this measure is unlikely to solve the more fundamental problem with A-level subject choice suggested by this paper, that differential attainment and GCSE choice by social background by students equally well qualified at age 11 contributes significantly to the observed differences in A-level choice. The evidence suggests that students staying on to take three A-levels will choose facilitating subjects, from whatever background they come, if they have good GCSE scores in helpful subjects. Improving both the overall attainment of lower SES students and ensuring they have good advice on GCSE subject choice at age 14+, as well as good advice on A-level subject choice at 16 (particularly where there are a large number of options open to them) seem the most likely routes to address the subject choice gap.

Further work is needed to examine the extent to which A-level subject choice accounts for the gap in admission to highly selective university by SES, and the extent to which this varies by course applied for, as well as whether the introduction of the facilitating subject performance indicator achieves its intended aims. Examining further the unexplained school level differences, for example the availability of specialist A-level teachers through linking this data with the School Workforce Census, as well as individual level differences in subject choice such as ethnicity also seem fruitful areas for further study.

The thesis continues by considering the next transition for A-level students: entrance to university. In this chapter I have shown that less privileged students are less likely to

[14] Evidence forthcoming since this chapter was published suggests that the number of students at comprehensive schools taking at least two facilitating A-levels has indeed increased post 2011 (Thomson & Keshwani, 2017).

take facilitating A-level subjects and more likely to take ‘less suitable’ ones than their more privileged peers. In the next chapter I consider the extent to which such A-level choices make a difference to the prestige of university attended.

4 The relationship between A-level subject choice and league table score of university attended

4.1 Introduction

University participation for English school students has increased over recent decades, but among university entrants young people from less privileged backgrounds continue to be particularly under-represented at high status universities (Anders, 2012; Chowdry et al., 2013; Sullivan et al., 2014), as do students from state, rather than private, schools (Sullivan et al., 2014; Sutton Trust, 2011). This matters to social mobility because it is well-established that higher returns are associated with attending high status universities (Britton et al., 2016; Chevalier, 2014; Chevalier & Conlon, 2003; Hussain et al., 2009) and particular degrees (Britton et al., 2016; Walker & Zhu, 2011). For example, large professional service firms, recruiters of large numbers of relatively highly paid graduates, have been identified as socially exclusive (Ashley, Duberley, Sommerlad, & Scholarios, 2015; Cook, Faulconbridge, & Muzio, 2012; Milburn, 2009, 2012a) with some authors laying at least part of the blame for their social homogeneity on their recruiting from a narrow range of high status universities (Ashley et al., 2015; Cook et al., 2012; Sutton Trust, 2009). Research for the Social Mobility Commission found that at leading accountancy firms, 40-50% of applicants and 60-70% of those receiving job offers were educated at Russell Group universities (Ashley et al., 2015). Increasing participation of less privileged students who aspire to careers in areas such as law, accounting, finance and consultancy at the universities from which these employers recruit might therefore be an effective tool in increasing social mobility.

Why are there these differences in high status university attendance by social background and school type? The most significant reason seems to be prior attainment (Anders, 2012; Chowdry et al., 2013; Marcenaro-Gutierrez et al., 2007), but there is evidence that apparently equally well qualified applicants receive differential offer rates from universities according to their social background (UCAS, 2016b) and schooling (Boliver, 2013) conditional on having applied in the first place. The Russell Group has suggested that part of the reason for this is that students from less privileged backgrounds apply to university with the 'wrong' subjects and qualifications for the courses for which they apply (Russell Group, 2015). This begs the question of which are the 'right' subjects and qualifications.

A-levels are much the most widely held qualifications amongst English-domiciled university applicants; in 2015, 73% of English 18-year-olds applying to UK university did so with just A-levels and 9% had mixed A-level and BTEC qualifications. 15% applied with only BTECs (UCAS, 2016a). At age 16+, students following the academic A-level path typically choose four subjects to study at AS level during year 12, continuing with three of them to A2 level in year 13. Until 2015, some 96 A-levels (including double awards) were available for teaching in England, although 27[15] will no longer be delivered under present reforms. But that still gives a wide variety of subjects from which students may choose, and these choices may make a difference to their chances of acceptance at university in general, and high-status university in particular. As discussed elsewhere in this issue[16], schools may constrain choices at age 14 (Anders et al., 2018) which has a knock-on effect on A-level choices (Dilnot, 2016). Most students applying to university do so during year 13 with grades predicted by their schools in each of their A-levels, and offers of places from universities are made in terms of both the A-level subjects being followed and the required grade to be obtained.

[15] Final reforms post publication of this paper mean 35 will no longer be delivered – see Table 2.
[16] This paper was published in a special issue of the Oxford Review of Education on inequalities and the curriculum (Sullivan, Henderson, Anders, & Moulton, 2018).

Many university courses require particular A-levels to be offered by applicants, because of the importance of subject content to the degree course. The Russell Group has since 2011 published an annual guide to A-level subject choice for 16-year-olds known as 'Informed Choices'. This guidance classifies A-levels in science, mathematics, languages, history and geography as facilitating of highly selective university entry, in that the more of these subjects taken, the more degree courses at their member universities will be available. It suggests that students should take at least two such subjects to keep open options for degree courses requiring specific subject preparation. In addition to the benefit derived from their specific content, Russell Group guidance also suggests that some facilitating subjects are good general preparation for university because of the academic skills they foster. Whether these subjects are facilitating of entry to highly selective university because of their subject content or because of skills they demonstrate (or perhaps signal), is a question that has not yet been explored.

A related question is whether the remaining 63 subjects (pre-reform) are all equally unhelpful in contrast with facilitating subjects. A study of Informed Choices and the general admissions guidance of Russell Group universities suggests that some subjects are considered less suitable preparation by some universities. This has led to the production of a taxonomy of A-levels, dividing them into 'facilitating', 'useful', 'less suitable' and 'non-counting' in the context of highly selective university entry (Dilnot, 2015). There is little evidence to date on how the number of these subjects offered at A-level is related to the status of university attended. The taxonomy is reproduced in Table 2.

Many of the 'less suitable' A-level subjects have a vocational bent; they include law, accounting and business. A student making A-level choices at age 16 who aspires to a career in a professional services firm might think that taking an A-level in law, accounting or business would be helpful in achieving that goal through facilitating admission to a high-status university to read the corresponding subject. But none of these A-levels is described as essential for the corresponding degree in Informed Choices, and given that

some Russell Group universities at least consider them not good preparation for university study, it may be that choosing these subjects is actually unhelpful in high-status university admission.

A further question is whether all facilitating A-levels are equally facilitating. The very large difference between those entering Russell Group universities rather than non-Russell Group with maths A-level (over 50% compared with less than half that for those with three A-levels entering university in 2012/13) compared with any other subject (Dilnot, 2015) suggests that there may be a ranking premium associated with holding maths A-level, perhaps unrelated to its subject content. Attending a higher ranked university may be part of the reason for the large observed wage premium associated with having A-level maths, after taking into account initial ability, observed by Dolton and Vignoles (2002).

This paper uses linked administrative data for three recent cohorts of English school students entering UK universities to examine the relationship between status of university attended and subject choice at A-level using a newly devised taxonomy. Previous studies have not examined the detail of A-level choices and used facilitating subjects only as controls (Boliver, 2013; Crawford, 2014a). The relationship of 'less suitable' A-levels and university attended has not previously been examined. Using this linked data does not allow comparative offer rates to be computed in the absence of further linkage to UCAS applications data, which is unavailable at the time of this analysis (Machin, 2015), but does allow the role of GCSE performance to be taken into account, which has been shown to be very important in university entry (Crawford, 2014a).

I further shed light on the previously unexamined association with university status of vocational A-level subjects related to professional careers in law, accounting and business. Two of these related A-levels (law and accounting) are taken disproportionately by students from lower SES backgrounds and are rarely offered at

private schools. While no causal claims as to their efficacy (or not) in helping students to gain places on accounting, business and law degrees at highly ranked universities can be made in the absence of linked applications data, this work will provide information about associations to students making A-level choices at age 16 and those who guide them. I proceed by discussing the literature on A-level subject choice and university admission, then set out methods and data. In the last section I discuss results, conclusions, and directions for further research.

4.2 Previous literature on A-level subject choices and university admissions

4.2.1 Subject choice, social background and school type

A-level subject choice can only be part of the explanation for differential participation by SES and school type at high-status universities if choices differ by these variables, and there is a body of evidence that suggests that this is the case. Young people from more privileged homes are more likely to take facilitating A-levels (Dilnot, 2016; Sammons et al., 2015; Vidal Rodeiro, 2007), particularly maths and sciences (Gill & Bell, 2013; Gorard & See, 2009). This is in part because facilitating subjects tend to be taken by students with higher attainment, which is related to social background, but is also a result of subject choices they have made earlier in their school careers (Dilnot, 2016). Students at private and grammar schools tend to have higher proportions of facilitating subjects at higher grades than their peers at 6th form and FE colleges (Dilnot, 2016; Office of the Deputy Prime Minister, 2015; Sutton Trust, 2011). Conversely, students from lower SES backgrounds are more likely to take at least two 'less suitable' A-level subjects (Dilnot, 2016), and more of these subjects are offered by schools and colleges with lower mean attainment (Gill, 2015a).

4.2.2 Facilitating subjects – specific content versus general university preparation

Having A-level subjects from particular content-based groups is associated with taking university courses from related subject areas as one might expect, with particularly strong relationships for STEM subjects (Vidal Rodeiro et al., 2013). Clearly for many

students the content of their STEM A-level is necessary preparation for entry to a higher-status university.

'Informed choices' sets out 'essential' and 'useful' A-level subjects for some 60 popular Russell Group degree courses, where the 'essential' subjects are always content related. The majority of the courses listed do have 'essential' requirements, and those A-level subjects described as 'essential' for any of these degree courses effectively make up the 'facilitating' list (Russell Group, 2016). But some very popular courses (for example accounting, business/management and law) do not have 'essential' requirements. It is not clear whether having facilitating, rather than other, A-level subjects might be an advantage in admission to such courses because of their perceived value as good general preparation for university, rather than because of their content.

On average, facilitating subjects are relatively difficult compared with other A-level subjects (Coe et al., 2008), and offering more difficult A-level subjects is positively associated with gaining an offer of a place at a high-status university (Noden, Shiner, & Modood, 2014), even when the degree subject is controlled for. This would suggest that it is not only the content of facilitating A-levels that is important, but some additional value for preparation for university study. Having maths A-level is associated with high odds of attending a high-status university (Boliver, 2013; Chowdry et al., 2013). It is not clear in work done to date whether the ranking advantage associated with having maths A-level is just a result of its specific content (because of the balance of STEM degree courses at higher ranking compared with other universities), or also because of its perceived general preparation value.

4.2.3 'Less suitable' subjects

The 41 subjects categorised as 'less suitable' in the taxonomy are ones where at least one Russell Group university has expressed reservations about the subject as university preparation and the subject is never required for even related university courses. The 20 'useful' subjects are those which appear on at least one Russell Group university approved list of A-levels and are absent from all non-preferred lists. 'Less suitable'

subjects are more likely to be taken by students from lower SES backgrounds (Dilnot, 2016) and at non-selective state schools and colleges rather than private or grammar schools (Dilnot, 2016; Gill, 2015b).

Work by Vidal Rodeiro et al. (2013) suggests that doing at least two 'applied' or 'expressive' A-level subjects (most of which are in the 'less suitable' category of the taxonomy) is associated with reduced odds of being at a Russell Group university. Their analysis is based on HESA data for those at university in 2011/12, but not linked to attainment other than A-level results.

Accounting, business and law A-levels, all of which might be expected to be helpful preparation for university courses in their disciplines, are categorized as 'less suitable' in the taxonomy of A-levels because of published reservations by the relatively small number of Russell Group universities publishing general approved lists, and other highly selective universities either remaining silent or stating neutrality about their usefulness. Evidence as to their effectiveness as preparation is largely anecdotal, although Rowbottom (2013) finds that accounting students at a Russell Group university with an accounting A-level perform somewhat worse than those without, by the time they graduate. Fazackerley and Chant (2008) note that while many highly selective universities publicly say law A-level is welcome or do not rule it out, in practice only a handful of applicants at such universities out of cohorts of several hundred are admitted with it. They suggest it seems particularly harsh for most Russell Group universities not to be explicit about what seems to be treated by admissions tutors as a 'less suitable' A-level. The extent to which selective universities hold this view of law A-level is unclear, but a qualitative study quotes admissions tutors as saying law A-level results in students with 'the wrong type of understanding and complacency' (Higton et al., 2012, p. 38). There is little evidence in the literature about the efficacy of business A-level for admission to university, although the earliest version of Informed Choices (Russell Group, 2011) includes business in a list of 'soft subjects' (along with media studies, art and design and photography).

4.3 Data

Three cohorts of all English students taking GCSEs (KS4) from National Pupil Database (NPD) data in 2008 to 2010 were matched to those taking at least three 'counting' A-levels from 2010 to 2012 (KS5 data), and then linked to Higher Education Statistics Agency (HESA) data for starters in 2010 to 2012. Students were matched not just for 'normal' progression, but where possible when taking an extra year in the sixth form, and for taking one or two gap years before university. Students found only in the HESA and KS5 data (ie not at school in England at KS4 or otherwise unmatched) were retained in the dataset. Where students had more than one university instance in the dataset (because they left a university course and subsequently started again), their first instance only was included, as it was to this course that their A-levels would first have admitted them. 474,526 observations of students entering UK university with at least three 'counting' A-levels were matched to their school records at KS5, and of these, 451,491 were at universities included in the Times rankings. 6.5% had some missing demographic or GCSE data, leaving 421,836 complete cases for analysis.

Most previous work on high-status university entry has used dichotomous outcome variables (such as Russell Group attendance or not) to examine relationships between high-status participation and variables of interest. It is desirable, though, to use an interval level variable, both because of the improved tractability of statistical analysis methods and because it avoids the somewhat arbitrary cut off between universities of different types and because traditional groupings of universities may be over-simplified (Boliver, 2015). Such a variable is available in the UK, in the form of several published rankings based on computed quality scores for universities, and for departments within universities. Three rankings of UK universities are produced annually to guide students in making applications: The Times/Sunday Times Good University Guide, the Guardian University Guide and the Complete University Guide (CUG). Each organisation produces both subject level tables and an overall table. The Guardian rankings differ from the Times in that components are weighted differently and do not include a

measure of research quality. Guardian scores for individual subjects are available, but only ranks rather than scores are available at university level. The Complete University Guide uses a similar methodology to the Times guide, covers the same number of universities and ranks Russell Group universities almost the same as the Times Guide. The Times scores were chosen for use in analysis rather than the Guardian rankings because scores (rather than just ranks) are available for universities overall and including research is likely to be important to status. The Times guide is also the longest running provider (Chevalier, 2014), and arguably the most widely respected.

Scores were used rather than ranks in the analysis because they better capture the distance between universities. The analysis was repeated using ranks and the results footnoted[17]. Scores are those published in 2012 for students making applications for 2013, and are based on data from 2008 to 2011, coterminous with the cohorts examined. This approach is preferred to that adopted by Chevalier (2014) of deriving a quality measure from the individual indicators in the Times 'Good University Guide' for ease of interpretation of results. Robustness checks were performed using a derived quality measure and results footnoted. Overall scores for the institution rather than those relating to departments were used as future employers are likely to have knowledge of overall university prestige but not of individual departments (Chevalier, 2014). For the period relevant to these entrants, the Times guide covered 116 UK universities, and excluded very small and specialist institutions. The Times Guide scores and rankings, and the derived quality measure are given in Appendix 5.

The number of facilitating, useful and 'less suitable' A-levels attempted by each student, and whether they had attempted A-levels in maths, accounting, business or law, was

[17] The Times overall university rankings are a weighted linear function of eight standardised indictors: student satisfaction, research quality, services and facilities spend, completion rates, entry standards, student-staff ratio, good honours and graduate prospects. The first two have a weighting of 1.5 each, and the remainder 1 each. The last four indicators are adjusted for subject mix at the university. The top university is then given 1000 points and the others scaled accordingly (O'Leary, 2012).

calculated from KS5 data. Lists of facilitating, useful and 'less suitable' subjects were taken from the taxonomy (Dilnot, 2015).

Prima facie evidence of the relationships between A-levels from the different categories and score of university attended is set out in Figure 4. Students in the sample were split into quintiles according to the score of university attended, and the mean number of A-levels from different categories computed by quintile.

Figure 4: Mean number of A-levels from each category by quintile of score of university attended

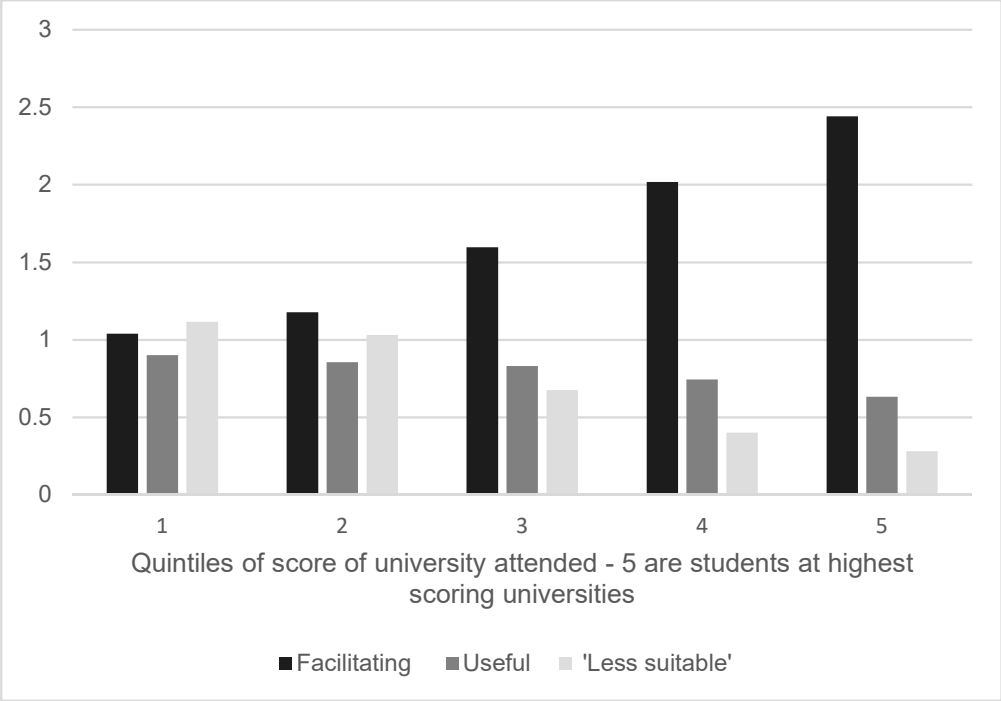


Figure 4 shows that for the quintile of students at lowest scoring universities, on average students had around one from each category of A-levels. As the scores of university attended increase, the mean number of facilitating subjects per student increases, whilst the number of 'less suitable' A-levels per student decreases, and the number of 'useful' A-levels stays relatively stable.

The total number of 'counting' A-levels (i.e. excluding general studies and critical thinking) was calculated for each student at KS5, enabling the association with subjects from particular groups to be disentangled from the association with the total number of subjects offered.

The results from the best three 'counting' A-levels, were computed for each student, with an A* worth 300 Quality and Curriculum Authority (QCA) points, an A 270 and so on in downward steps to an E at 150 points. Ungraded attempts were given zero points.

Capped GCSE and equivalent point scores were used to control for attainment at age 16. The cap is at the equivalent of 8 A*s at GCSE (464 points). One A* is 58 points, with each successive grade worth 6 points fewer than the previous one.

The HESA data contains variables for parental education, and parents' National Statistics Socio-Economic Classification (NSSEC) but both measures have significant amounts of missing data (19.4% and 18.2% respectively). I therefore follow Chowdry et al. (2013) and construct a measure of SES from KS4 data using principal component analysis from the attributes of local and very local areas and free school meal (FSM) eligibility. Quintiles were constructed for the whole cohort at KS4. FSM and local area data are not observable for students in private schools. These students, again following Chowdry et al. (2013), are assumed to be from families of higher SES than most maintained school and college students, and were therefore included in the top SES quintile. Dealing with the private school students in this way left only 4.1% missing data. Robustness checks on a common dataset for observations with non-missing data for all three measures show negligible differences in the coefficients of subject choice variables.

Table 9: Descriptive statistics for sample

	All	By school type					By degree subject		
		Non sel. state	Sel. state	6th form college	FE college	Private	Accounting	Business	Law
Number of students	421,836	198,110	48,402	80,281	30,275	64,768	8,761	32,287	20,588
Mean Times score (out of 1000)	603	581	659	574	544	690	554	531	591
Percentage female	54.9%	55.0%	53.0%	58.0%	60.0%	50.0%	38.7%	51.0%	65.5%
Mean SES quintile (of KS4 cohort)	3.9	3.8	4.0	3.5	3.3	4.9	3.5	4.0	3.5
Mean number facilitating subjects	1.6	1.6	2.1	1.3	1.1	2.1	1.4	0.8	1.2
Mean number 'useful' subjects	0.8	0.8	0.7	0.9	1.0	0.7	0.7	0.8	1.1
Mean number 'less suitable' subjects	0.7	0.8	0.4	0.9	1.0	0.4	1.0	1.4	0.8
Mean number of counting A-levels	3.1	3.1	3.2	3.1	3.1	3.2	3.1	3.1	3.1
Points from best three A-levels	711	693	749	699	676	767	676	667	717
Percentage with maths A-level	33.0%	31.5%	42.7%	28.7%	23.8%	40.0%	67.0%	17.5%	16.8%
Percentage with accounting A-level	1.0%	0.5%	0.1%	2.8%	3.4%	0.1%	21.7%	2.8%	0.8%
Percentage with business A-level	9.6%	8.8%	7.9%	11.2%	14.4%	9.2%	31.5%	46.4%	11.1%
Percentage with law A-level	5.3%	3.6%	1.4%	12.6%	13.9%	0.3%	5.8%	6.0%	42.4%

Descriptive statistics are given in Table 9, for all students in the sample split by school type, and for the three degree course subjects of accounting, business and law. The mean score of university attended of students from private schools is 690 (so Birmingham or Reading would be 'mean universities' for these students) and grammar schools 659 (Manchester or Kent). The mean score of university attended for students from non-selective state schools and colleges is much lower (581 for non-selective state schools, 574 for 6th form colleges and 544 for FE). These scores follow the pattern of average SES quintile by school type, as well as points held in the best three A-levels by school type, with the highest being those from private schools (767 points) and the lowest from FE colleges (676 points). Accounting and business students are, on average, at lower scoring universities than all students taken together, with mean scores of 554 and 531 respectively. Law students are on average at higher scored institutions, although still slightly below the mean for all degree courses.

Subject choice patterns vary considerably by school type, with grammar and private school students holding almost twice as many facilitating subjects, on average, as those at FE colleges (2.1 compared with 1.1) and 6th form college and non-selective state school students having 1.3 and 1.6 respectively. Maths accounts for some of this difference, held by 40% plus of grammar and private school students, but less than a third of students from other school types, and less than a quarter of FE college students. FE students conversely hold more than twice the proportion of 'less suitable' subjects than grammar and private school students. Very few private and grammar school students take law or accounting A-level, which contrasts strongly with the proportions for law at FE and 6th form colleges of 13.9% and 12.6% of students. The proportions of those doing business are much more similar across school type.

Subject choices also vary considerably by the three degree courses examined, despite none generally having A-level pre-requisites. Maths is held by 67% of accounting degree students, whilst for business and law students the proportions are 17.5% and 16.8% respectively. Business A-level is held by almost half of students studying for

business degrees, and almost a third of those reading accounting. Law A-level is also extremely popular among those doing law degrees (held by 42.4%). Accounting is held by 21.7% of accounting degree students, a rather less popular choice than either business or maths.

4.4 Methods

Previous work (Boliver, 2013; Chowdry et al., 2013; Noden et al., 2014; Shiner & Noden, 2015; Vidal Rodeiro et al., 2013) suggests that prior academic attainment, social background, gender, school type, prior application attempts and university course group are all important in university participation, and for the rank of university attended. These factors are therefore all controlled for in investigating the role of A-level subjects.

The measure of best three A-levels is the single best predictor of rank of university attended, as might be expected. A squared term is included for the observed non-linearity of the data[18]. Both capped GCSE score and capped GCSE score squared were significant predictors and included in prior attainment controls. Having a gap year is used as a proxy for having made a post qualification application.

Observations in the data set are clustered within schools, where unobservable factors such as the quality of information, advice and guidance on university applications are likely to differ. Whilst using school fixed effects would deal with such unobservable factors and the nested structure of the data, this approach is problematic in this case because school-level variables such as school type cannot be included in the analysis, and are of intrinsic interest. Random effect estimators, on the other hand, allow for the 'effects' of such school-invariant variables to be measured. An additional advantage of using the random effects estimator is that it is more efficient, and has less sampling variability than fixed effects estimators. A Hausman specification test suggests that between and within effects differ: for example, the relationship between university score

[18] Plotting lowess curves for a random sample of the data suggests that the relationship of A-level score with score of university attended is non-linear, with a flat line between university score and best three A-level scores until a little above 500 QCA points (the equivalent of DDE at A-level), and an increasing gradient thereafter.

and number of facilitating subjects found by comparing two students in the same school (the within effect) is different from that between two otherwise similar students who are at schools with different mean numbers of facilitating subjects taken (the between effect). Including the school mean of each level 1 (individual) variable in the model allows the within and between effects to differ, and effectively relaxes the assumption that there is no correlation between the level 2 error and the level 1 variables.

The models to be estimated are of the form:

Equation 2

$$Y_{ij} = \beta_0 + \beta_{1w} x_{1ij} + (\beta_{1b} - \beta_{1w})\,\bar{x}_{1j} + \beta_{2w} x_{2ij} + (\beta_{2b} - \beta_{2w})\,\bar{x}_{2j} + \ldots + \beta_{nw} x_{nij} + (\beta_{nb} - \beta_{nw})\,\bar{x}_{nj} + \gamma z_j + u_j + \varepsilon_{ij}$$

where Y_{ij} is the score of university attended by individual i from school j.

Using the random coefficients estimator means that the β_{nw} are the within (fixed effect) coefficients for the individual level variables. A positive coefficient on the 'within' subject choice variable is interpreted as an increase in mean score of university attended by students with a particular subject, or one from a particular group, rather than any other subject, or one from any other group, compared with other students at the same school. The coefficient term $(\beta_{nb} - \beta_{nw})$ of the school mean of each variable is the difference between the within and the between effects, and is known as the contextual effect.

The coefficient γ shows the relationship between university score and school type, the only term in the model which only varies at school-level. The elements u_j and ε_{ij} are the school-level and individual error terms respectively.

Effectively fully interacted models with university subject are run for students reading accounting, business and law at university, by running the models separately for each course.

4.5 Results

Table 10: Association of Times league table score with A-level subject choice across all university subjects

All students	Model 1	Model 2	Model 3
Number facilitating A-levels	13.861***	12.578***	
	(0.170)	(0.184)	
Contextual effect – facilitating	1.719	0.049	
	(1.129)	(1.321)	
Maths		7.110***	
		(0.385)	
Contextual effect - maths		8.638*	
		(3.534)	
Number 'less suitable' A-levels			-15.641***
			(0.197)
Contextual effect – 'less suitable'			-0.798
			(1.215)
Total counting A-levels	5.689***	5.590***	18.447***
	(0.428)	(0.427)	(0.407)
Contextual effect – counting A-levels	-12.469***	-11.960***	-8.788**
	(3.001)	(2.951)	(2.951)
Grammar school (Baseline comprehensive)	4.522***	4.874***	4.279***
	(1.173)	(1.153)	(1.173)
6th form college (Baseline comprehensive)	-5.155***	-5.591***	-7.714***
	(1.273)	(1.249)	(1.233)
FE college (Baseline comprehensive)	-6.528***	-7.093***	-10.808***
	(1.300)	(1.285)	(1.244)
Private school (Baseline comprehensive)	3.983***	4.533***	5.069***
	(1.095)	(1.082)	(1.086)
Observations	421,836	421,836	421,836
Number of schools	2,719	2,719	2,719
R-squared	0.6238	0.6242	0.6235

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10. Standard errors in parentheses.

Table 10 gives the results for all three cohorts across all university courses. Model 1 shows that each additional facilitating A-level held by someone at a comprehensive school is associated with being at a university 13.9 points higher in Times scores (the within effect) compared with an otherwise similar student at the same school. Although having extra A-levels for a given number of facilitating subjects and best three A-level points compared with a student's school mean is positively associated with score, there

is a significant negative relationship of university score with school mean number of A-levels, once the school mean number of facilitating A-levels, school mean marks from best three A-levels and all else in the model are controlled for. This 'between' effect suggests that each increase of one in school mean number of A-levels not adding to its mean A-level score from best three subjects is associated with being at a university scoring 7 points lower. Doing A-level maths (model 2) compared with someone in the same school with the same number of facilitating subjects but not doing maths is associated with a 7 point premium. The 'between' effect of schools is also important. Students at hypothetical schools where everyone does maths are on average at universities scoring 16 points higher than those at schools where no-one does maths, at 5% confidence. Being at a grammar school or private school rather than a comprehensive is associated with premium of around 4 or 5 points on average. A negative relationship of slightly larger magnitude is observed for those at FE and 6th form colleges.

Model 3 shows that the number of 'less suitable' subjects chosen is significantly negatively correlated with score of university attended, with a slightly larger magnitude than that for facilitating subjects (-15.6 compared with +13.9). A similar advantage is seen here as when controlling for facilitating subjects for those at grammar and private schools compared with comprehensives, but students at 6th form and FE colleges are even further down the university scores when the number of 'less suitable' subjects is controlled for, at -7.7 and -10.8 respectively.

Controlling for A-level points from the best three A-levels, and number of 'less suitable' A-levels, having an extra A-level is significantly positively associated with university score, suggesting that having more facilitating or useful subjects is a good thing. The

'between' effect of the mean number of A-levels per person by school is somewhat smaller, at around 10 points[19].

The relationship between facilitating subjects and university scores for students studying accounting, business and law is shown in models 1 and 2 of Table 11.

Despite none of these courses having pre-requisite A-level subjects, each facilitating subject is associated with attending universities with a score of between around 6 and 11 points higher, with maths conveying a further premium, particularly for business (14 points). Even for law students, having maths is associated with a premium over other facilitating subjects (6 points). For neither of these models is there a significant contextual (between minus within) effect of mean number of facilitating subjects for the school.

[19] Repeating the analysis for a quality ranking following Chevalier (2014) based on a principal components analysis of university scores excluding student satisfaction and proportion of good degrees yields substantially unchanged results.

Table 11: Association of Times league table score with A-level subject choice for students studying accounting, business and law at university

	Accounting students			Business students			Law students		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Number facilitating A-levels	5.973***	3.420**		10.737***	8.107***		10.864***	9.961***	
	(1.043)	(1.226)		(0.592)	(0.641)		(0.736)	(0.775)	
Maths		8.970***			14.201***			6.418***	
		(2.263)			(1.311)			(1.754)	
Number 'less suitable' A-levels			-7.043***			-10.970***			-12.629***
			(1.092)			(0.538)			(0.871)
Total counting A-levels	2.624	3.367	8.156**	-1.068	-1.721	8.399***	12.686***	12.291***	22.014***
	(2.986)	(2.990)	(2.895)	(1.956)	(1.953)	(1.922)	(1.791)	(1.794)	(1.717)
Grammar school (Baseline comprehensive)	4.827	4.740	4.242	9.487***	10.197***	9.008***	4.975+	4.837+	4.803+
	(4.202)	(4.202)	(4.198)	(2.251)	(2.259)	(2.261)	(2.869)	(2.881)	(2.914)
6th form college (Baseline comprehensive)	-5.542	-5.349	-4.658	-5.869**	-6.556**	-7.098***	-0.471	-0.341	-1.471
	(3.588)	(3.589)	(3.346)	(2.043)	(2.051)	(1.955)	(2.322)	(2.340)	(2.253)
FE college (Baseline comprehensive)	-10.535*	-10.410*	-9.303*	-2.542	-3.273	-4.920*	-3.971	-3.813	-5.843*
	(4.491)	(4.495)	(4.225)	(2.510)	(2.521)	(2.404)	(2.858)	(2.874)	(2.719)
Private school (Baseline comprehensive)	18.209***	18.598***	17.698***	12.015***	13.019***	13.317***	-3.369	-3.296	-2.771
	(4.638)	(4.640)	(4.607)	(2.146)	(2.156)	(2.141)	(3.138)	(3.158)	(3.157)
Observations	8761	8761	8761	32287	32287	32287	20588	20588	20588
Number of schools	1852	1852	1852	2375	2375	2375	2278	2278	2278
R-squared	0.581	0.582	0.582	0.495	0.497	0.497	0.674	0.675	0.674

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10. Standard errors in parentheses.

All models control for prior attainment, demographics, cohort and school means for all individual level variables.

Model 3 shows the negative association of university score with 'less suitable' subjects; it is slightly smaller for these three degree courses than for all students together, although still negative and significant, and largest for law students (-13 points). For all three

subjects FE college students are at lower scoring universities than comprehensive school students (at 5% confidence)[20].

All three models show large, positive differences in score of university attended between private and comprehensive school students (around 18 points for accounting and 13 for business), although not for law, and grammar school students studying business have a score advantage over comprehensive school students of around 10 points.

Table 12: Association of Times league table score with choosing the course-related A-level rather than an A-level from another category for students studying accounting, business and law at university

	Model 4	Model 5	Model 6	Model 7
Accounting students (n=8,761)				
Accounting A-level	-1.093	0.744	4.141	8.398**
	(2.814)	(2.765)	(2.819)	(2.961)
Business students (n=32,287)				
Business A-level	-5.569***	2.205*	6.063***	10.116***
	(1.056)	(0.988)	(1.005)	(1.045)
Law students (n=20,588)				
Law A-level	-19.289***	-15.485***	-9.687***	-4.896*
	(1.745)	(1.722)	(1.769)	(1.939)
A-level subject controls				
Other non-facilitating and total	Yes			
Total		Yes		
Facilitating and total			Yes	
'Less suitable' and total				Yes

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10. Standard errors in parentheses.

All models control for prior attainment, demographics, cohort and school means for all individual level variables.

Models 4 to 7 in Table 12 investigate the relationship between holding a related A-level and score of university attended for those taking accounting, business and law degrees. Model 4 holds fixed the total number of A-level subjects, the number of useful subjects and 'less suitable' subjects other than the related one. The coefficient on the related A-level thus shows the effect of swapping the related A-level (for example, accounting) with a facilitating A-level – the only remaining type of A-level not held fixed in the model. In

[20] As noted in Appendix 5, these models did not include the contextual effect at school level of degree courses chosen. Including this additional control slightly reduces the effect size for FE colleges (to -5.1) and it becomes significant only at p<0.10. All other changes are negligible.

model 5 only the total number of A-levels is held fixed, thus showing the effect of swapping the related A-level for any other. Model 6 controls for total number and for number of facilitating subjects, so the coefficient on the related A-level represents a comparison of the related A-level with any non-facilitating A-level, and finally model 7 controls for the total number of 'less suitable' A-levels, so showing the relationship with ranking if the related A-level is swapped with any other 'less suitable' subject.

The results show considerable differences for the three subjects examined. For accounting students, having accounting A-level is associated with no significant difference in score compared with a facilitating subject, any other subject, and any other non-facilitating subject. It is associated with an increase in score of 8 points compared with holding other 'less suitable' subjects. On the other hand, business A-level seems more helpful for admission to higher ranked university to read business than accounting is for accounting degrees. Although swapping business for a facilitating subject is associated with being at a university with 6 fewer points and swapping it for any other subject shows a very small relationship, swapping it for any non-facilitating subject and any other 'less suitable' subject shows significant positive relationships (6 and 10 points respectively).

Models 4 to 7 of Table 12 tell a different story for A-level law. Law students are at lower scoring universities, on average, if they take law A-level rather than any facilitating subject (-19 points), any other subject (-15 points) and any other non-facilitating subject (-10 points). It even appears to be worse than having any other 'less suitable' subject, at 1% confidence (-5 points). Full regression tables corresponding to tables 10 to 12 are in Appendix 6 (tables 28 to 30).

4.6 Discussion and conclusions

Across all university subjects together, each additional facilitating subject is associated with being at a university with a Times Good University Guide score 14 points higher, even when degree course group, A-level grades, other prior attainment and school type is controlled for. For two students with otherwise similar characteristics, one with three

facilitating subjects and one with none, this difference equates to being at Bristol rather than Leicester, or Oxford Brookes rather than Gloucestershire at 2013 rankings. This is consistent with previous literature and given that university subject group is controlled for seems not just to be an artefact of the way degree courses with facilitating pre-requisites are distributed through the rankings.

Using a random effects model allows for the investigation of the role of school-level variables in the models. School type was seen to be significant for all three models across all university subjects, with FE and 6th form college students being at lower scoring universities compared with comprehensive schools overall, and private and grammar school students at higher scoring ones, even after controlling for prior attainment and subject choice groups. This could, of course, be a result of selection (where those students have chosen to apply) but whether the reason is a lack of aspirational applications or acceptance rates varying systematically by school type, there is still a gap.

The answer to the question of whether there is something especially facilitating about maths A-level appears to be 'yes'. On average, having maths rather than any other facilitating subject is associated with a 7 point premium across all subjects. There is likely to be wide variation in this premium by degree course[21] but the overall relationship is significantly positive.

The number of 'less suitable' A-level subjects taken is shown to be significantly negatively related to the score of university, even after attainment and degree course are controlled for. This is consistent with the advice given by the small number of Russell Group universities that publish such information (Dilnot, 2015), and suggests that more transparency from universities which do not currently do so might be useful.

[21] Running the model for students taking only languages, literature, history and philosophy courses at university (n=62,933) for which maths is unlikely to be a pre-requisite, shows a significant premium for maths A-level of 5 points, a little lower than for all students together.

For all three of accounting, business and law degree courses, having more facilitating subjects is associated with a university score premium, suggesting that facilitating subjects may convey an admissions benefit independent of their subject content. Whether this is a signalling effect, a reflection of the relative difficulty of facilitating A-levels or a result of the human capital acquired in gaining particular transferable skills is beyond the scope of this paper, but is worth further study. The converse (and somewhat larger) effect is seen for 'less suitable' A-levels for all three of these course areas. This, too, could be a result of a combination of signalling and relative 'ease' of these subjects. The role of specific subject A-levels varies considerably between these three degree courses. Accounting A-level is done by relatively few students. It is not associated with a significantly lower ranking than facilitating subjects, on average, but neither is it helpful, except compared with other 'less suitable' subjects. Business, on the other hand, seems a relatively helpful choice compared with all but facilitating subjects. It is noteworthy that it is done by a much larger proportion of private school students than accounting or law.

The results for law students are consistent with the anecdotal evidence that higher ranking universities 'don't like' law A-level. Having law A-level is associated with a score discount of 19 points compared with swapping it for a facilitating A-level and 10 points compared with any non-facilitating one. Students taking it, of whom much the highest proportions are at 6th form and FE colleges, are apparently not putting themselves at the advantage that they might reasonably have expected.

Before dismissing law (or indeed any other A-level) as potentially unhelpful for university entry, it is important to consider both the aspirations of students taking it, and the context of their other subjects. Students may be unconcerned about the ranking of university they attend. But given that 42% of those reading law with at least three A-levels have law A-level, it is likely some students will have taken it to aid them get into a high-ranking university, and the results described here are likely to be counter-intuitive for these students. The context matters too: if a student is choosing between law and another 'less suitable' subject, then it might be entirely sensible to choose law to see whether it is

a subject they enjoy. On the other hand, if the choice is between law or a facilitating subject, a student making aspirational university applications might do better to choose the latter. It is possible, although relatively rare, to be admitted as a solicitor without gaining a degree, and it may be that for those using this route, having law A-level is helpful. Gaining one of the recently introduced legal apprenticeships may also be helped by having law A-level, but as yet the picture is unclear.

This work shows clear relationships between A-levels of different categories, and the league table scores of university attended. While no causal link can be claimed because of unobserved covariates determining A-level choices and both university applied for and likelihood of acceptance, it does suggest that doing facilitating subjects, particularly maths, may be a sensible choice of A-level for those aspiring to high ranking university, even if the content is not required for the intended course, and care should be taken in choosing 'less suitable' A-levels, even if they seem to relate to the degree course eventually followed. Using university application data to link to NPD and HESA data at the individual applicant level will help further understand these relationships.

This chapter has examined the importance of subject choice to the prestige of university attended. The next transition in the pathway of students aiming for a professional career is to gain a graduate job. The story therefore continues in chapter 5 by considering how important the prestige of university attended is in getting such a job, and the extent to which degree course matters, using as an example a large professional financial services firm.

5 The importance of university type and subject of study in obtaining a job offer: evidence from an elite professional financial services firm

Chapter 5 (pages 93-133) has been redacted for reasons of commercial sensitivity. If you are interested in these findings please contact me directly using my publicly available email address.

6 Summary and conclusions

6.1 Summary

In this thesis I have examined how A-level subject choice at 16 plus varies by social background, and how such choices might contribute to the observed SES gap by university type. I then considered how university type and degree subject relate to chances of gaining a 'top job'. I provided new evidence of reasons for the choice gap and its consequences. I used two novel datasets in my analysis. To examine the relationship between A-level choice and university attended I used (at the time of the start of this thesis) newly available linked administrative data for individuals at English schools and UK universities. For the analysis of job offers, I took the lead in negotiating access to individual level data from a large professional services firm on their admissions processes. I used quantitative methods taking into account the multi-level nature of the schools data, and attempted to deal with unobservable attributes of schools and the individual young people in two different ways. In chapter 3 I used fixed effects to account for the unobservable characteristics of schools in which students were nested, and in chapter 5 an intersection bounds approach to take into account characteristics observable by the firm but not the researcher.

In chapter 3 I used a taxonomy of A-levels, developed for this thesis and discussed in chapter 2, to examine the differential choice of A-level subjects by social background with subjects grouped according to a categorisation driven by the published preferences of the Russell Group of high status, research intensive universities. This allowed an analysis of A-level choices by a theoretically driven rationale in the context of university entry. One particular contribution of my taxonomy was that I did not just classify subjects as facilitating or non-facilitating (as had been done in the previous literature) but further split non-facilitating subjects into categories. Those in the top SES quintile were 40% more likely to take at least two facilitating subjects and 30% less likely to take two 'less suitable' subjects than those in the bottom quintile, but negligible differentials persisted once prior attainment and subject choices at GCSE, and the selection of students into

schools were taken into account. Of these factors, prior attainment and age 14 subject choices were more important in mediating the relationship of A-level choice and social background than characteristics of schools once attainment was accounted for. Although clearly the school offer of A-levels from different categories makes a significant difference to uptake by students, and the offer varies highly significantly by type of school, it is the sorting of students of different SES backgrounds into schools with different provision that appears to be problematic, rather than lower SES students making potentially adverse choices for high status university entry given the same choice set as their more privileged peers with the same prior attainment. This work has made explicit the important role of choice of subjects at age 14 as well as prior attainment in explaining the differential in A-level choices, and highlighted the importance for all students of providing good information advice and guidance on the appropriateness of their choices, particularly when faced with a large choice set. It has also made clear for the first time the particular challenges of making good choices for those transferring from school to FE or sixth form college at age 16, where there is likely to be an increased choice set and a higher proportion of 'less suitable' subjects but perhaps fewer opportunities for individual guidance of students as to how they might achieve their university objectives before they have made their A-level choices.

In chapter 4 I considered whether the choice of A-levels makes a difference to the prestige of university attended, where prestige is measured by Times Good University Guide Score, and thus whether A-level subject choice might be one of the reasons for the under-representation of lower SES students at highly selective university, even after their prior attainment is taken into account. Clearly some A-level subjects are required for related degree courses, but even taking into account the degree course group as well as prior attainment, having more facilitating A-levels was significantly associated with being at a more highly ranked university, and the converse was true for 'less suitable' subjects. Having maths as one of the facilitating subjects was associated with a further

premium, so adding to the body of evidence of the association of maths A-level with improved outcomes.

I further drilled down to examine these associations for students on accounting, business and law degrees, many of whom might hope to join graduate schemes in professional service firms or business more generally. In all three cases, despite no particular A-level subjects being publicly required by Russell Group universities, the same sorts of effects were observed, with facilitating subjects an apparent advantage in high status university entry, and 'less suitable' ones an apparent disadvantage. For each of these degree subjects an A-level categorised as 'less suitable' in the taxonomy exists. Whilst none of these A-levels seemed to confer an advantage compared with swapping for a facilitating subject, the results for swapping these A-levels for an alternative from a different category differed very considerably by degree subject. Law A-level seemed particularly disadvantageous for those reading law at university. The evidence of these heterogeneous results is a clear demonstration of the challenges faced by young people in making choices where no particular A-level is required by universities.

Chapter 5 continued the story by examining the importance of going to a prestigious university in successfully getting a job offer from a large graduate employer in the professional financial services sector. The data were also used to examine the relationship of degree subject and job offer chances for a graduate trainee scheme without a pre-requisite degree subject, but where some degrees might prima facie seem helpful.

Although very large raw differences in overall job offer chances were found by university type, these were explained by prior attainment, online test scores and other controls such as for the type of role applied for. The detailed data provided allowed the overall success rates to be broken down between a desk-based application screening stage and the 'face to face' stage. A small but significant advantage persisted for Oxbridge graduates compared with those at most new universities at the screening stage, but evidence of whether graduates of 'most old' universities were, on average, more likely to

pass screening than 'most new' ones with the same attainment levels was not robust to whether logit or LPM models were used. Attempting to account for omitted variable bias using the intersection bounds technique also gave ambiguous results, with the more stringent test suggesting no difference between the chances of passing screening for two similarly qualified applicants from the different types of university.

I then examined the 'face to face' stages, where it might be imagined taste-based discrimination in favour of applicants from more prestigious universities might occur. No evidence for such discrimination was found, in contrast with qualitative research in the sector from ten years earlier.

Finally, I considered the role of university degree subject choice. Whilst no difference in passing screening was observed by degree subject, all else equal, at the face to face stages having a business degree appeared to be an advantage and coming from engineering and technology a disadvantage. There was no evidence an accounting and finance degree was an advantage, despite the possibility of its content being closely aligned to professional qualifications.

6.2 Main conclusions and implications for action

The evidence from chapter 3 supports the idea that differences in young people's A-level choices arise as a result of differential constraints, rather than the existence of significantly different preferences by social class. In Gambetta's language they jump as far as they able but are constrained by earlier subject choices, their differential prior attainment and the different provision of subjects in schools with different social mixes. The relative risk aversion model suggests that those from more privileged backgrounds would choose subjects more likely to facilitate entry to high status universities likely to maintain their parents' social class. My work suggests that, controlling for a range of observable factors, higher SES students at state schools are no more likely than low SES to pick at least two facilitating subjects, or two less suitable ones. This may, of course, be a result of a lack of knowledge of which subjects might be helpful in getting a place at highly selective university, beyond those required for the course, even among

more privileged young people and their families. This lack of knowledge might stem in part from a lack of evidence about what difference subject choices actually make to selective university entry, which I have sought to address in chapter 4.

The findings of chapters 3 and 4 have implications for Government, schools and universities. The first implication is perhaps the most intractable: this work provides evidence of another way that the association of lower attainment at GCSE with low SES leads to poorer outcomes. Lower attainment is associated with reduced probability of choosing subjects which might improve the chances of entering higher ranked universities, and increased chances of picking subjects associated with attending lower ranked universities. Continuing efforts to reduce the association of attainment and SES are a major policy concern of the Department for Education. This work suggests that raising attainment might have positive effects on low SES students reaching higher ranking universities, both because of the attainment in itself, and because of its association with helpful subject choice.

The finding that subject choices at age 14 make a difference to A-level subject choice has implications that are perhaps easier to implement than the closing of the attainment gap by social background. At a school level, the recent introduction of the EBacc as a performance measure for schools, which seems to have changed behaviour at GCSE as shown in Figure 1 might thus be expected to work through into a shift towards facilitating subjects and away from less suitable ones in cohorts taking A-levels from June 2015 onwards[22]. It also highlights the importance of providing students with information about the whole system, and how one choice leads to another, rather than making choices in isolation and being hampered by previous decisions.

Whilst accounting for little of the raw gap in A-level choices by social background, the choice set presented by schools and colleges obviously makes a difference to students –

[22] The proportion of students taking at least two facilitating subject did indeed increase in June 2015, although this was following a trend which started a few years earlier with the introduction of the AAB performance indicator. It dropped slightly for 2016 A-levels (Thomson & Keshwani, 2017).

and whilst choice is to be encouraged, clearly it needs to be accompanied by good information, advice and guidance. The reduction in the number of approved A-levels under current reforms will reduce the choice set, but most of those withdrawn were selected by relatively few students. A more significant issue is therefore advice given where taking a popular subject, such as law, appears to be likely to be less helpful in high status university entry than one from the facilitating group, or perhaps working out the trade-off with a student between doing a subject such as maths, which conveys a premium, with the likelihood that they would obtain as high a grade. The trade-off might involve not only the students' liking for and aptitude for a subject, but the perceived (or actual) relative difficulty of obtaining high grades (He, Stockford, & Meadows, 2018). Inter-subject grade comparability has recently become a hotly contested topic between exam regulators, and, in particular, those interested in increasing the take-up of the three sciences and traditional modern foreign languages (all facilitating subjects) at A-level. These are considered 'more difficult' subjects using a range of statistical tests and assumptions (Coe et al., 2008; He et al., 2018), but the regulator does not have inter-subject comparability as an aim of the reformed A-levels (Opposs, 2016). A corollary of lack of inter-subject comparability is that universities might have an incentive to favour applicants with A-levels in more difficult subjects for given A-level grades, but do not make such preferences public. This seems particularly problematic for degree subjects not requiring particular A-levels, where students are theoretically free to choose whatever they like, but practically may be less likely to obtain an offer at a higher ranked university through their choice. Ofqual has recently committed to investigating grade standards in the three sciences, French, German and Spanish with a view to possible grade boundary adjustments (Opposs, 2016): it will be important to see whether this changes take up of facilitating subjects in future.

This thesis adds to the body of evidence suggesting that studying maths to 18 is associated with particularly good earnings outcomes (Dolton & Vignoles, 2002; Iannelli & Duta, 2018). It suggests a mechanism: even taking into account the university subject of

study across all subjects, taking maths is related to being at a higher ranking university. The Government's recent initiative to provide financial rewards to schools and colleges increasing numbers of students taking maths and further maths A-level (Education and Skills Funding Agency, 2018) seems in this context to be sensible. Whether this incentive for schools and colleges results in higher uptake remains to be seen; it may perhaps profitably be used alongside the provision of information on future outcomes to students as they make A-level choices, shown to be able to increase maths take-up (Davies et al., 2017).

Evidence from Chapters 4 and 5 of this thesis has implications both for those involved in setting admission criteria at universities, and those involved in course content planning. For some degree courses, particular A-levels are clearly required preparation and described as such by universities – STEM subjects and languages are the obvious examples. But where no subjects are required for courses, and even more in the cases when the corresponding A-level is not seen as helpful preparation for university study, it appears that more clarity from high ranking universities about how they perceive different A-levels might be particularly helpful in narrowing the SES gap, given that it is lower SES applicants who are more likely to apply with these 'less suitable' A-levels, and for whom perhaps less detailed information, advice and guidance from school or college on the heterogeneous relationships of choices with league table position of university attended is available .

Chapter 5 provides some evidence for a large professional financial services firm that degree subject makes a difference at the face to face stages of an application, which include interviews and assessment centre activities. Business graduates were seen to be at an advantage, even compared with otherwise similarly attaining economists. It could be that unmeasured motivation towards the career is being proxied by the business degree, but even if that is the case, doing such a vocational degree is not found to be a disadvantage. It would be profitable to discover more about which recruitment criteria graduates of business perform particularly well against, and hence whether

course content or assessment methods typical of these degrees are helpful in gaining graduate employment. Such knowledge could be particular useful in the re-design of university courses, particularly those taken by on average less privileged applicants, in aiming to increase the social diversity of graduate recruits to prestigious firms.

I did not find conclusive evidence that the elite graduate recruiter studied uses university type as an 'efficient shorthand for merit' (Rivera, 2012). Measured 'merit', as operationalised as the prior attainment of applicants including performance in online tests, seemed to account for the very large raw success rate differences observed in the data. This recruiter has a high ranking in the annual Social Mobility Index (Social Mobility Foundation, 2018), which ranks firms on the basis of efforts made towards diversifying their workforce. The index is dominated by very large PFSFs, law firms, public sector institutions and large companies. It is, of course, not possible to generalize from one large employer to graduate recruiters of all sizes and types. It has been suggested that smaller recruiters might find engaging with the social diversity agenda too large a drain on their more limited resources (All Party Parliamentary Group on Social Mobility and Sutton Trust, 2017), and this is an important area for future research. For this firm, the findings of chapter 5 suggest university blind admissions might make some, but not much, difference to recruitment decisions and might send a helpful message to applicants from lower ranked universities, so increasing the social mix of those applying.

A significant missing piece of information for graduate recruiters such as the one studied in chapter 5 is how the prior attainment used to screen applicants relates to future performance in the firm. Although most of the difference in success chances by university type can be accounted for by prior attainment, the fact remains that very large differences by university type exist. Given the selectivity of UK universities, admitting more applicants from lower ranked universities, and thus broadening the social background of the firm's graduate intake, would mean allowing applicants with lower prior attainment to pass screening, effectively using some sort of contextual admissions system. It is therefore highly important for firms such as this to relate the subsequent

performance of successful applicants with their prior attainment, in order to make well-informed decisions about entry requirements.

The literature in the field of access to top jobs is critical of firms' recruiting from a narrow range of universities, such as the Russell Group (Ashley & Empson, 2017; Duff, 2017; Macmillan et al., 2015; Milburn, 2012a). Where type of university attended is indeed being used as 'efficient shorthand for merit' (Rivera, 2012) rather than a reflection of the sum of cognitive and other skills required on entry and acquired during study, this is clearly problematic. But if very strong skills are required then it seems unfair to criticize firms for recruiting from those universities where such students are concentrated. The problem in increasing social diversity is then that lower SES applicants are under-represented at highly selective universities. Choosing A-level subjects which increase their chances of reaching a highly ranked university is one way in which students from less privileged backgrounds can maximise their chances of successful navigation to a professional career.

6.3 Future research

Research for this this thesis, undertaken part-time between 2013 and 2018, took place during a period of considerable change to the 14+ and 16+ qualification regime in England. This rapidly evolving policy environment means that ongoing work will be needed to see how choices of subject at A-level respond to the increase of EBacc subjects being chosen at 14+, the withdrawal of applied A-levels and some other subjects, the reform of A-level content in continuing subjects and the introduction of linear assessment, with its already visible effect in the reduction of AS levels taken and hence reduction in number of choices at 16+, the working through of the AAB performance indicator for two facilitating subjects, and the introduction of cash incentives for schools to increase maths A-level take-up. These changes might be expected to affect subject choice by social background differently, through the actions of schools and colleges into which students from different backgrounds are selected. Linking subject choice and School Workforce Census data would also be a very fruitful area for future

study, acknowledging that to provide A-levels, schools need well-qualified subject teachers. The shortfall in recruitment of teachers compared with targets at a time of growing secondary school populations, particularly in specialist areas such as maths, physics and modern foreign languages, is well documented (see, for example Foster (2018)), but the extent to which this contributes to the SES subject choice gap is unknown.

The recent publication of data linking university subjects and courses with income five years after graduating now provides evidence to school students making university and degree subject decisions which was unavailable to the students examined in this thesis and those who advise them. Evidence suggests that the provision of such evidence does indeed affect their decision-making, as human capital theory would suggest (Davies et al., 2017). It would be useful to examine the extent to which this happens differentially by social background in order best to target such information provision.

The approaches adopted to examine choice by social background in chapter 3 of this thesis come from an economic and sociological perspective. A considerable literature on post 16 subject choice exists within education from more psychological perspectives, such as self-efficacy (for a review for mathematics see Sheldrake, Mujtaba, and Reiss (2014)) and the theory of planned behaviour (Taylor, 2015). Exploring interactions between social background and the attributes found to be important in subject choice in studies such as these would be valuable in getting a more complete picture of how post 16 subject choices are made, but was outside the scope of this thesis, relying as it did on administrative data for analysis of choices and their relationship with university attended.

In chapter 4, I was unable to take into account where students applied, rather than where they ended up at University, conditional on having applied, because of the lack of availability of linked UCAS/NPD/HESA data. At the time of writing, the way such data will be made available to researchers is unclear, with the closure of the Administrative Data Research Network in July 2018. The availability of such linked administrative data

in future would allow stronger causal analysis of the way choice of subjects affects the rank of university attended to be made.

Another area that has so far received insufficient research attention is the relationship between A-level subject choice and university outcomes of drop-out, repetition of the first year, and gaining a good degree (2:1 or above) and how differential subject choice might contribute to the observed poorer outcomes for low SES students documented by Crawford (2014b). This is particularly important for highly popular degree courses such as business, accounting and law where the related A-level might be considered good preparation by potential students but is not generally a pre-requisite for the degree. The results in chapter 4 suggest that swapping the related A-level for a facilitating subject, particularly maths, is likely to help in admissions, but is this because such subjects are more helpful for performance at university, or is the apparent benefit merely a signal?

Finally, the rich data provided by the firm in chapter 5 is, I hope, the first in a large collection of data from firms in different sectors and of different sizes and over time, that will help us understand how firms recruit graduates, and how graduates from less privileged backgrounds can put themselves in the best position to gain a 'top job'. Such future analysis will not only be of use to graduates, but also to inform the practices of graduate recruiters so that they develop a more socially diverse workforce. Firms will need to understand the relationships between the recruitment criteria they set and progress within their organisations to meet both business and broader societal objectives, although there is a growing appreciation that the two are linked, and a business case can be made for a more socially diverse workforce, as well as one argued on grounds of equity.

Appendices

Appendix 1 – The A-level system: history, regulation and recent reform

History

The precursors of A-levels were the 'Local' examinations set by London, Oxford and Cambridge universities from the mid-19th Century (Eckstein & Noah, 1993). These examinations were taken by students at their schools (hence 'local') as part of the selection process to university. A-levels to be taken by students leaving school aged 18+ were introduced in 1951, following the Norwood Report of 1943 on the whole school examination system. They replaced Higher School Certificate whose main subject syllabuses became the first A-level subjects, with the important distinction that A-levels were awarded in individual subjects, rather than in groups. The School Certificate and Higher School Certificate system had been finally rolled out by 1917, following the 1902 Education Act.

A-levels are graded from A* to E, with the A* being awarded for the first time in 2010 in response to the criticism that the existing grade structure did not discriminate enough at the top end.

Regulation

A-levels are regulated by the Office of Qualifications and Examinations Regulation (Ofqual) and provided by four examination boards[23] (Table 13). Most subjects are provided by more than one examination board, and there is more than one specification available within examination boards for several subjects. Schools and colleges can choose to teach specifications from different exam boards.

[23] The fifth A-level examination board regulated by Ofqual, CCEA (Council for the Curriculum Examinations and Assessment) offers A-levels taken only in Northern Ireland.

Table 13: Numbers of subjects available for teaching in England by examination board

Examination board	Number of A-level specifications available 2014/15	Number of different A-level subjects available 2014/15[24]
AQA	69	58
OCR	67	52[25]
Edexcel	54	42
WJEC	39	37

Recent reforms to AS and A-levels

Following the Coalition Government's 2010 White Paper 'The Importance of Teaching' (Department for Education, 2010), in 2012 the Secretary of State for Education set out a plan for the reform of A-levels in England, covering their design, regulation, assessment and content, and in particular requiring that universities be more involved in the design of A-levels to ensure that they provide effective preparation for university study. This was followed by consultations by Ofqual on design, regulation and assessment (Ofqual, 2013), and by the DfE on content (Department for Education, 2013). Ofqual and DfE took advice from the A-level Content Advisory Board (ALCAB), a body reporting to the Russell Group of Universities and funded by the DfE, with the remit to advise on the content of A-levels considered particularly important in preparation for undergraduate study at leading universities, namely the 'facilitating subjects' group. Reformed A-levels were introduced for first teaching in 2015 (therefore first examined in 2017), starting with five facilitating subjects and others taken by large numbers of candidates[26]. The second

[24] Ofqual includes separate listings for the four design and technology pathways available at this date for AQA, whereas for OCR (2 pathways), Edexcel (2 pathways) and WJEC (3 pathways) there is just one 'design and technology' A-level on the regulated list. The pathways are included separately on Department for Education statistics and are certified separately.
[25] There is one entry for 'classics' on the Ofqual list, although four additional pathways exist within the OCR regulated classics specification which are certified separately and are included separately in Department for Education statistics. Only OCR provides classics and its pathways.
[26] English language, English literature, English language and literature, biology, chemistry, physics, history, psychology, art and design, sociology, business, economics, computer science.

phase of reformed subjects was introduced for first teaching in September 2016[27]. The introduction of reformed A-levels in maths and further maths was postponed until 2017, along with 16 other subjects[28]. Finally, from September 2018, reformed A-levels in 12 modern languages commonly described as 'community languages'[29] and Biblical Hebrew will be available for teaching. A-levels in Welsh as a first and second language are not included in current reforms but remain theoretically available to students in England as well as Wales.

Part of Ofqual's rationale for reform was to discontinue A-levels done by very few students, those with similar or overlapping content with other A-levels, and those with content not meeting Ofqual's principles for reform (Ofqual, 2014a). All 17 applied A-levels were discontinued from 2017 or before, as well as 18 other A-levels[30] previously available to students in England (Department for Education, 2015a, 2015b; Ofqual, 2015, 2018).

Most of the A-levels to be discontinued come from the 'less effective preparation' category of the taxonomy, which is unsurprising given the renewed emphasis on A-levels as preparation for university study. Although these reforms took place after the cohorts studied in this thesis had taken A-levels, relatively few students took the subjects that were subsequently discontinued (see Appendix 3 Table 17). The implications of the reforms for the findings of this thesis are discussed in Section 6.2.

[27] Ancient languages (classical Greek and Latin), modern foreign languages (French, German, Spanish), dance, drama and theatre, geography, music, physical education, religious studies.
[28] Accounting, ancient history, classical civilisation, design and technology (three specifications), electronics, environmental science, film studies, history of art, law, media studies, modern foreign languages (Chinese, Italian, Russian) music technology, philosophy, statistics.
[29] Arabic, Bengali, Gujarati, modern Greek, Japanese, modern Hebrew, Panjabi, Persian, Polish, Portuguese, Turkish, Urdu.
[30] Anthropology, archeology, citizenship studies, classics (as distinct from separate A-levels in ancient history, classical civilization classical Greek and Latin) communication and culture, creative writing, critical thinking, Dutch, economics and business, food technology, general studies, human biology, humanities, ICT, performance studies, pure mathematics, science in society and world development.

Appendix 2 – A-level classification methodology

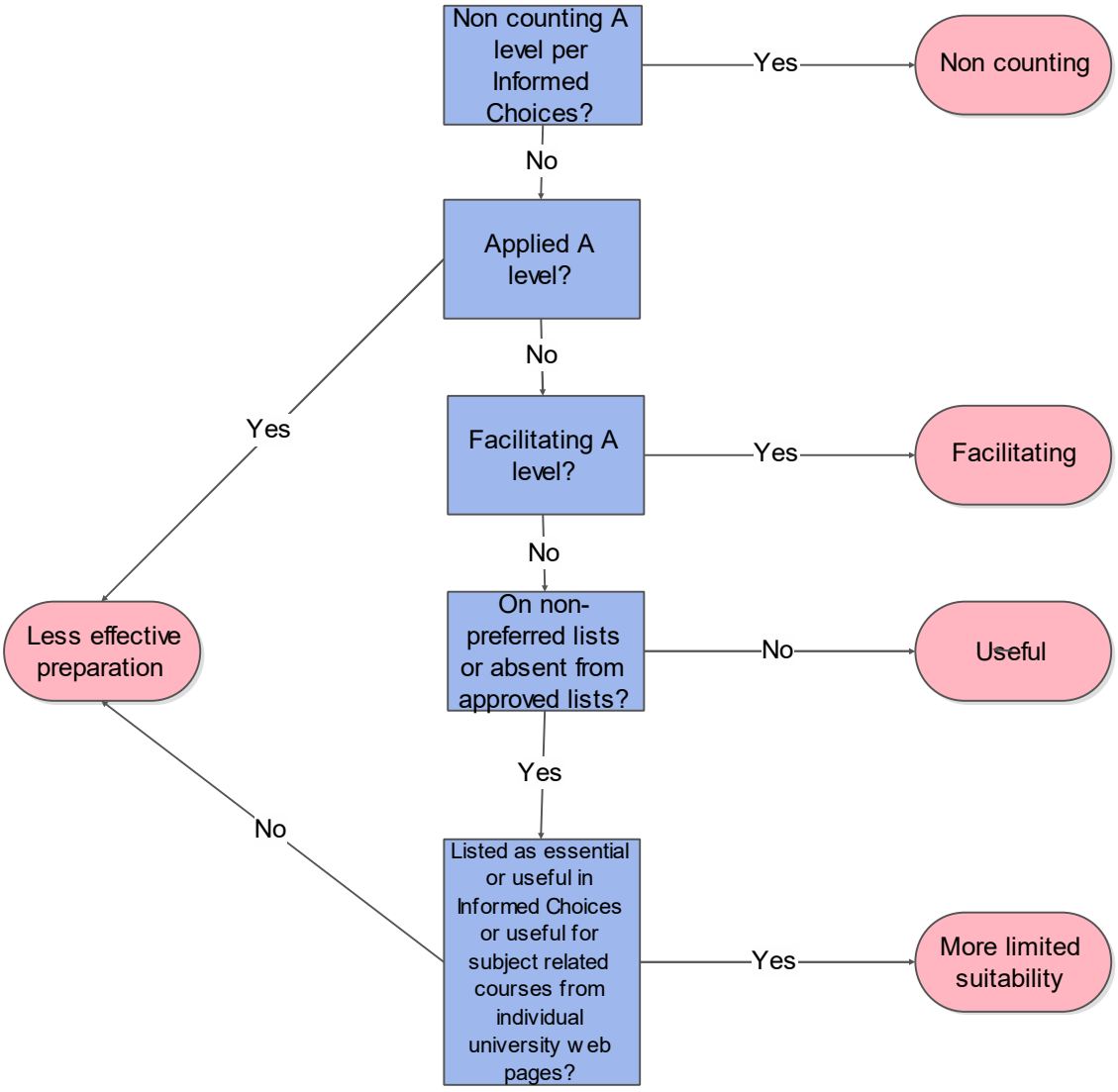
The five universities publishing general guidance on the acceptability or otherwise of A-levels at university level, as well as for individual courses, do so in different ways. Edinburgh and Sheffield publish complete lists of A-levels split between approved/not approved (The University of Edinburgh, 2014) and acceptable/acceptable only in combination (The University of Sheffield, 2014); the LSE publishes a list of non-preferred subjects(LSE, 2014)[31]; UCL has a list of acceptable A-levels (UCL, 2014) and Cambridge has a document discussing required and helpful A-levels which says that those it does not mention are either too specialised and not a good choice for keeping options open, or are not good preparation for Cambridge courses (University of Cambridge, 2013). 41 subjects appear non-preferred by reference to one or more of these lists, in addition to critical thinking and general studies, discussed below. Most of these universities suggest that no more than two A-levels are taken from these lists.

Reviewing these sources, alongside Informed Choices (Russell Group, 2016), suggests that some A-levels are perceived as particularly helpful for Russell Group university entry. A second set of subjects is considered generally useful, and no general reservations about them are expressed in the sources. A third set is considered useful for particular degree courses, but at least some Russell Group universities have reservations about the general usefulness of these subjects. There is then a group of subjects where at least some Russell Group universities have reservations, and no related degree courses describe the subjects as useful preparation. Finally, there are two subjects which are frequently mentioned as not counting towards the three A-levels generally required for Russell Group courses.

[31] In 2015 LSE started also publishing a list of preferred subjects. These changes do not alter the A-level classifications in the Taxonomy.

Classification process

Each of the 96 A-levels was classified into one of the five categories as follows:



Search terms

Non-applied A-levels appearing on non-preferred lists (whether discussed in 'Informed Choices' or not) were checked to individual Russell Group entry requirements pages for courses to which they related[32] and to Informed Choices. The list of search terms for courses examined is given below.

A-level (and applied version where appropriate)	Search terms on UCAS course search tool (for students normally living in England)	Number of RG universities with relevant courses (including joint honours)	Omitted from preferred/on 'non-preferred lists' at which universities?	Is A-level ever described as essential/alternative required/preferred/useful for relevant courses?	Is A-level so described for courses listed in Informed Choices?
Accounting	Accounting, accounting and finance	19	Cambridge, LSE, UCL	No	No
Anthropology	Anthropology, archaeology and anthropology	13	Cambridge, UCL	No	No
Art and design	Art, fine art, design	6	LSE, Sheffield	Yes	Yes
Business Studies	Business, management	22	Cambridge, LSE	No	Yes
Citizenship studies	Citizenship	0	Cambridge, Edinburgh, LSE, Sheffield, UCL	N/A	No
Communication and culture	Communication and culture	1	Cambridge, Edinburgh, LSE, Sheffield, UCL	No	No
Creative writing	Creative writing	6	Cambridge, Edinburgh, UCL	No	No
Dance	Dance	0	Cambridge, LSE, Sheffield, UCL	N/A	No
Design and technology: product design (3D), product design (textiles), systems and control	Design, technology, design and technology	12	LSE, Sheffield, UCL	Yes	Yes

[32] Excluding general studies and critical thinking, as non-counting A-levels.

Drama and theatre studies	Drama, theatre studies, drama and theatre studies	12	Cambridge, LSE	Yes	Yes
Electronics	Electronics	20	Sheffield, UCL	Yes	No
Film studies	Film studies	11	Cambridge, Sheffield	Yes	No
Design and technology: food technology	Home economics, food	4	LSE, Sheffield, UCL	No	Not specific pathway
Humanities	Humanities	1	Cambridge, LSE, Sheffield	No	No
ICT	Information and communication technology, ICT, computing	23	Cambridge, LSE, Sheffield	No	Yes
Law	Law	23	LSE	No	Yes
Media studies	Media, film, media communication, media production	5	Cambridge, LSE, Sheffield, UCL	No	Yes
Music technology	Music technology, music	20	Cambridge, LSE, Sheffield, UCL	Yes	No
Performance studies	Performance, performing	4	Cambridge, LSE, Sheffield	No	No
Physical education	Sport, physical education, physiotherapy	11	Cambridge, LSE, Sheffield, UCL	Yes	Yes
Science in society	Science in society	3	Cambridge, UCL	No	No
World development	World development, geography	22	Cambridge[33] UCL	Yes	No

[33] Not on the Cambridge list of suitable preparation subjects, although described as useful for the relevant course (geography) at Cambridge.

Facilitating

These are the A-level subjects identified in 'Informed Choices'. 20 are modern languages (full list given in Department for Education guidance of subjects to be included in the AAB facilitating subject performance measure (Department for Education, 2017a))and three are classical languages (Latin, classical Greek, biblical Hebrew). Four are science subjects (biology, human biology, chemistry, physics), three are mathematics (further mathematics, mathematics, pure mathematics) and the remainder are English literature, geography and history.

Useful

It is assumed that where subjects do not appear on any of the non-preferred lists or do appear on all the approved lists as appropriate that they may be classified as useful for Russell Group university entry. 20 non-facilitating subjects are therefore described as useful.

More limited suitability

Although at least one of the five universities above has reservations about 41 subjects, in many cases it appears these subjects are useful for particular degree courses at some Russell Group universities. In addition to the facilitating list, 'Informed Choices' lists 'essential' and 'useful' subjects for the 61 most popular university degree course groups. Of the 41 subjects where there are reservations, the 24 non-applied subjects were all checked to these popular degree course lists to see whether they are described as useful for particular course choices (for example, art and design is useful for architecture, but 'non-preferred' by LSE and Sheffield). Because the list of 61 university course groups in Informed Choices is not exhaustive, these 24 subjects were also checked against entry requirements on Russell Group degree course websites to see if the subjects are ever described as essential, useful, preferred or acceptable. The UCAS course search tool[34] was used to find courses at Russell Group universities in subject

[34] Search.ucas.com, accessed 13.8.14 to 26.8.14.

areas for which the A-level might be useful or essential[35]. The search terms by A-level are given above.

14 of these subjects (counting design and technology certifications separately) were described as essential, alternative required, preferred or useful for particular courses either in the 'Informed Choices' degree course lists or on Russell Group websites for related degree courses, and were therefore classified as 'more limited suitability'[36]; they are useful for specific degree subject courses but there are reservations at one or more Russell Group universities as to their general usefulness for university admission. This is a cautious approach to their classification; designed to flag up the possibility that even one of the five Russell Group universities publishing overall lists might not consider a subject good preparation for its courses.

Less effective preparation

Those A-levels included on non-preferred lists or omitted from approved lists that are not described as essential, alternative required, preferred or useful for any of the Informed Choices list of subjects or on the websites of related individual Russell Group courses are categorised as 'less effective preparation'. There are 10 non-applied such subjects, and 17 applied A-levels, discussed below. As with the 'more limited suitability' group, it is a cautious classification, where expressed reservations by only one Russell Group university result in its inclusion, if it is not useful for related courses. Eight of the 10 non-applied subjects are being discontinued under current reforms.

The phrase 'less effective preparation' was used by Cambridge University of a list of 20 subjects published in 2006 (Vidal Rodeiro, 2007). Cambridge has now withdrawn this 'negative' list and replaced it with the positive list reviewed for this study, but the phrase

[35] The search was performed for 2015 entry for a student normally living in England, and entry requirements were then looked up on the university's website, rather than the UCAS summary (in case of errors on the UCAS site). Where both a Bachelor's and Master's degree in a subject are available, requirements for Bachelor's are chosen, and single honours where both single and joint courses are offered.

[36] A phrase used by Trinity College Cambridge, who also publish a list of A-levels by category, which is more prescriptive than that provided by Cambridge University overall (Trinity College Cambridge, 2015).

remains in the literature and is a useful encapsulation of the idea that whilst these A-levels are worthwhile in their own right, they may be less effective in facilitating entry to a Russell Group university.

Applied A-levels

The third edition of 'Informed Choices' suggests that applicants with a double applied A-level award will need "very high grades indeed plus a high grade in an extra A-level to be considered by most Russell Group universities" (Boliver, 2013, p. 16) and that "for several university courses these vocational qualifications are not considered to be suitable". They have therefore been included in the 'less effective preparation' category. All of these will be discontinued under current reforms, and are not discussed in the most recent edition (Russell Group, 2016).

Non-counting

Many of the Russell Group universities describe general studies and critical thinking as not counting towards an A-level offer on their general admissions pages (11 for general studies, six for critical thinking), and more exclude them from counting within individual course requirements. 'Informed Choices' suggests that they should be taken as an 'extra', rather than as one of the A-level choices on which university applications will be based. They are therefore categorised as not counting at all, rather than being less effective preparation. 'Informed Choices' also includes citizenship in this category, but a review of the general entry requirements does not suggest that universities treat it as non-counting. It has therefore been categorised as 'less effective preparation'. Both non-counting A-levels (and indeed citizenship) will be discontinued under current reforms.

Appendix 3 – A-level subjects by taxonomy category, gender and school type

Table 14: Facilitating subjects taken by all school and college students taking at least one A-level in 2012 (n=331,169)

Facilitating subjects	All attempts	% of all students	% of all female students	% of all male students	% all state school students	% of all college students	% all private school students
Maths	63,427	19.2%	14.3%	24.9%	23.2%	10.4%	35.9%
Biology	48,231	14.6%	15.4%	13.6%	18.2%	8.2%	23.8%
History	41,606	12.6%	12.1%	13.1%	16.0%	6.7%	20.4%
English literature	40,310	12.2%	16.6%	6.9%	16.2%	6.0%	18.5%
Chemistry	37,992	11.5%	10.0%	13.2%	13.9%	6.3%	21.3%
Physics	26,684	8.1%	3.1%	13.9%	10.1%	3.9%	15.1%
Geography	25,950	7.8%	7.0%	8.9%	10.0%	3.5%	15.5%
Further maths	10,371	3.1%	1.7%	4.9%	3.6%	1.5%	7.6%
French	9,739	2.9%	3.8%	2.0%	3.2%	1.3%	8.6%
Spanish	5,397	1.6%	2.0%	1.2%	1.6%	0.8%	5.3%
German	3,525	1.1%	1.2%	0.9%	1.3%	0.5%	2.4%
Latin	1,275	0.4%	0.4%	0.4%	0.2%	0.0%	3.0%
Chinese	1,157	0.3%	0.4%	0.3%	0.1%	0.1%	2.6%
Italian	532	0.2%	0.2%	0.1%	0.2%	0.1%	0.5%
Russian	530	0.2%	0.1%	0.2%	0.1%	0.0%	1.1%
Polish	303	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%
Classical Greek	267	0.1%	0.1%	0.1%	0.0%	0.0%	0.7%
Arabic	218	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%
Turkish	210	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%
Urdu	210	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%
Japanese	157	0.0%	0.1%	0.0%	0.1%	0.0%	0.2%
Portuguese	141	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%
Other facilitating[37]	380	0.1%					
Total	318,612						

[37] Subjects aggregated because of sparsely populated cells (<5): Persian, Dutch, pure maths, Panjabi, modern Greek, modern Hebrew, Bengali, Gujarati, (human biology not listed separately in NPD data for these years). Human biology, pure maths and Dutch discontinued in 2015-2018 reforms.

Table 15: 'Useful' subjects taken by all school and college students taking at least one A-level in 2012 (n=331,169)

Useful subjects *(subjects to be withdrawn 2015-18 in italics)*	All attempts	% of all students	% of all female students	% of all male students	% of all state school students	% of all college students	% of all private school students
Psychology	47,008	14.2%	19.5%	7.9%	17.9%	11.1%	9.1%
Sociology	23,627	7.1%	10.2%	3.6%	8.8%	6.7%	0.8%
English language	21,343	6.4%	8.2%	4.4%	7.4%	6.3%	2.4%
Economics	18,031	5.4%	3.2%	8.1%	5.4%	2.9%	16.2%
Religious studies	16,605	5.0%	6.4%	3.4%	6.9%	1.8%	9.3%
English Lit and Lang	13,356	4.0%	5.3%	2.5%	4.4%	4.3%	0.8%
Government and politics	11,884	3.6%	2.9%	4.4%	3.8%	2.3%	8.1%
Music	4,784	1.4%	1.4%	1.6%	1.7%	0.7%	3.1%
Classical civilization	3,279	1.0%	1.2%	0.8%	0.8%	0.8%	2.8%
Computer studies	3,061	0.9%	0.1%	1.9%	0.8%	1.1%	0.5%
Philosophy	2,688	0.8%	0.8%	0.8%	0.5%	1.1%	1.1%
Business and economics	1,726	0.5%	0.4%	0.6%	0.9%	0.0%	1.0%
Geology	1,599	0.5%	0.3%	0.7%	0.4%	0.6%	0.5%
Environmental science	1,051	0.3%	0.3%	0.4%	0.2%	0.5%	0.0%
History of art	912	0.3%	0.4%	0.1%	0.1%	0.1%	1.9%
Ancient history	588	0.2%	0.1%	0.2%	0.1%	0.2%	0.3%
Statistics	542	0.2%	0.1%	0.2%	0.1%	0.3%	0.1%
Archaeology	398	0.1%	0.1%	0.1%	0.0%	0.2%	0.1%
Classics (other)[38]	14	0.0%					
Total	172,496						

[38] No analysis by gender or school type because of sparsely populated cells (<5).

Table 16: 'More limited suitability' subjects taken by all school and college students taking at least one A-level in 2012 (n=331,169)

More limited suitability *(subjects to be withdrawn 2015-18 in italics)*	All attempts	% of all students	% of all female students	% of all male students	% of all state school students	% of all college students	% of all private school students
Art and design – all pathways	38,143	11.5%	15.9%	6.4%	12.8%	9.6%	13.3%
Business	21,777	6.6%	5.1%	8.3%	7.1%	5.4%	9.1%
Media studies	20,162	6.1%	6.6%	5.5%	7.8%	5.3%	1.2%
Physical education	13,776	4.2%	2.7%	5.8%	5.2%	2.6%	5.4%
Drama	12,701	3.8%	4.9%	2.6%	5.0%	2.1%	5.6%
Law	10,464	3.2%	3.6%	2.6%	2.4%	4.7%	0.3%
DT: product design	9,465	2.9%	1.6%	4.4%	4.4%	0.8%	4.3%
ICT	7,022	2.1%	1.5%	2.8%	2.6%	1.8%	1.4%
Film studies	5,471	1.7%	1.4%	1.9%	1.6%	2.1%	0.3%
Music technology	2,521	0.8%	0.2%	1.4%	0.8%	0.7%	0.6%
Electronics	901	0.3%	0.0%	0.6%	0.2%	0.4%	0.2%
World development	419	0.1%	0.1%	0.1%	0.1%	0.2%	0.0%
DT: systems and control[39]	256	0.1%	0	0.2%			
Total	143,078						

[39] No analysis by school type because of sparsely populated cells (<5).

Table 17: 'Less effective preparation' subjects taken by all school and college students taking at least one A-level in 2012 (n=331,169)

Less effective preparation *(subjects to be withdrawn 2015-18 in italics)*	All attempts	% of all students	% of all female students	% of all male students	% of all state school students	% of all college students	% of all private school students
Applied ICT	6,583	2.0%	1.5%	2.5%	3.2%	1.0%	0.2%
Applied business	4,671	1.4%	1.3%	1.5%	2.5%	0.4%	0.2%
Health and social care	4,364	1.3%	2.4%	0.1%	1.7%	1.2%	0.0%
Accounting	2,454	0.7%	0.5%	1.0%	0.3%	1.3%	0.6%
Applied science	2,043	0.6%	0.7%	0.6%	1.0%	0.3%	0.0%
Dance	1,863	0.6%	1.0%	0.1%	0.6%	0.6%	0.2%
Comm'n and culture	1,631	0.5%	0.7%	0.3%	0.3%	0.8%	0.1%
Travel and tourism	1,407	0.4%	0.6%	0.3%	0.6%	0.4%	0.0%
Performing arts	1,101	0.3%	0.5%	0.2%	0.5%	0.2%	0.1%
DT: food technology	1,098	0.3%	0.5%	0.1%	0.6%	0.0%	0.2%
Performance studies	991	0.3%	0.4%	0.1%	0.3%	0.4%	0.1%
Applied business (double award)	915	0.3%	0.2%	0.3%	0.5%	0.1%	0.0%
Citizenship studies	753	0.2%	0.3%	0.2%	0.3%	0.2%	0.0%
Leisure studies	567	0.2%	0.1%	0.2%	0.3%	0.1%	0.0%
Applied art and design (double)	459	0.1%	0.2%	0.1%	0.2%	0.1%	0.0%
Applied art and design	400	0.1%	0.2%	0.1%	0.2%	0.0%	0.0%
Applied ICT (double award)	386	0.1%	0.0%	0.2%	0.1%	0.1%	0.0%
Applied science (double award)	312	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%
Engineering	178	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%
Travel and tourism (double award)	117	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%
Leisure studies (double award)	57	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other less effective preparation[40]	2,334						
Total	34,684						

[40] Subjects aggregated because of sparsely populated cells (<5): health and social care (double award), media: communication and production, both withdrawn in 2015-18 reforms.

Table 18: Non counting subjects taken by all school and college students taking at least one A-level in 2012 (n=331,169)

Non counting (both to be withdrawn in current reforms)	All attempts	% of all students	% of all female students	% of all male students	% of all state school students	% of all college students	% of all private school students
General studies	33,667	10.2%	10.3%	10.0%	12.9%	8.3%	4.6%
Critical thinking[41]	877	0.3%	0.3%	0.3%	0.2%	0.3%	0.1%
Total	34,544						

[41] Commonly done as AS level, rather than continued to full A-level

Figure 5: Proportion of university entrants holding A-levels by University type (Russell Group or not) and taxonomy category (21 most popular subjects

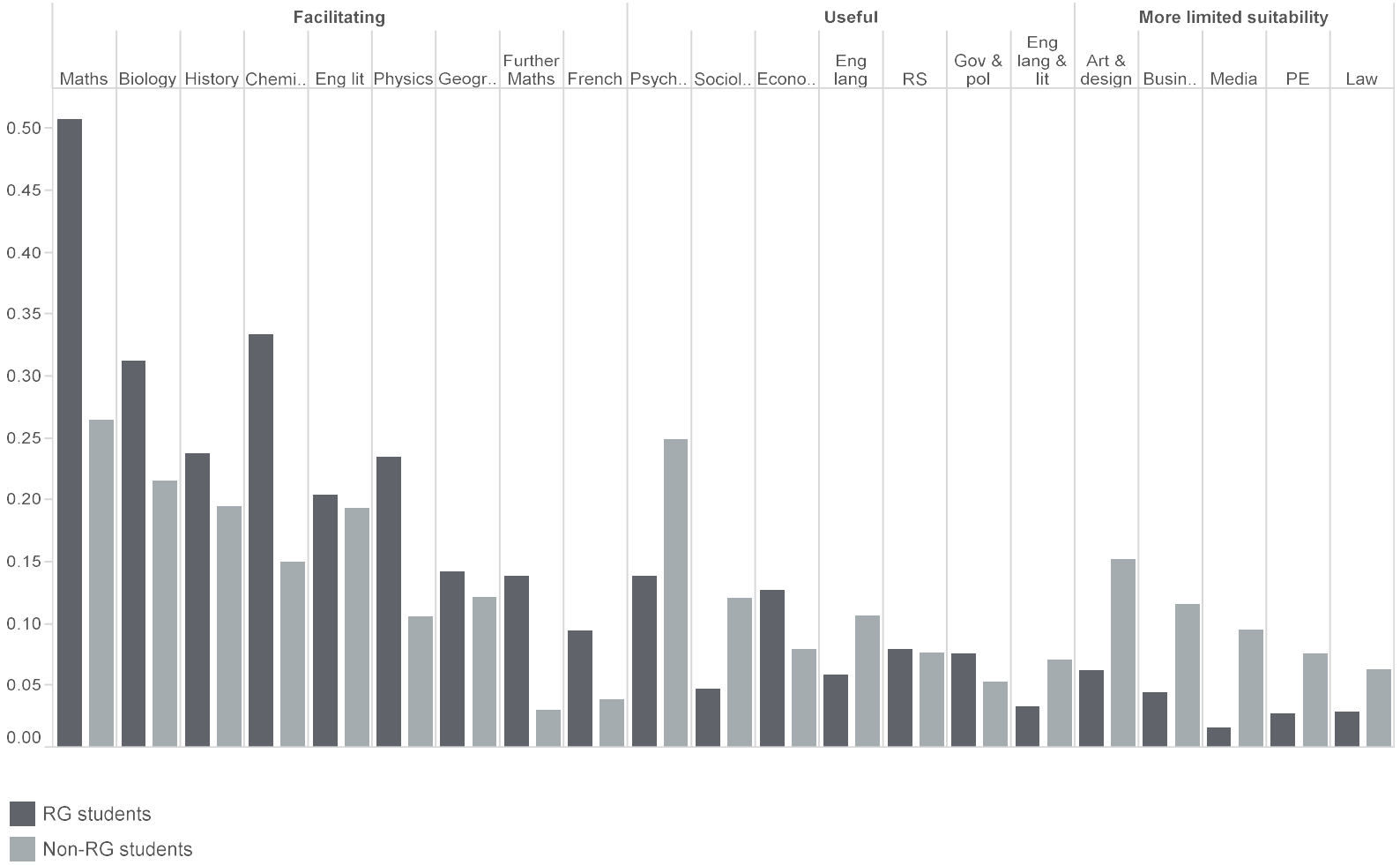
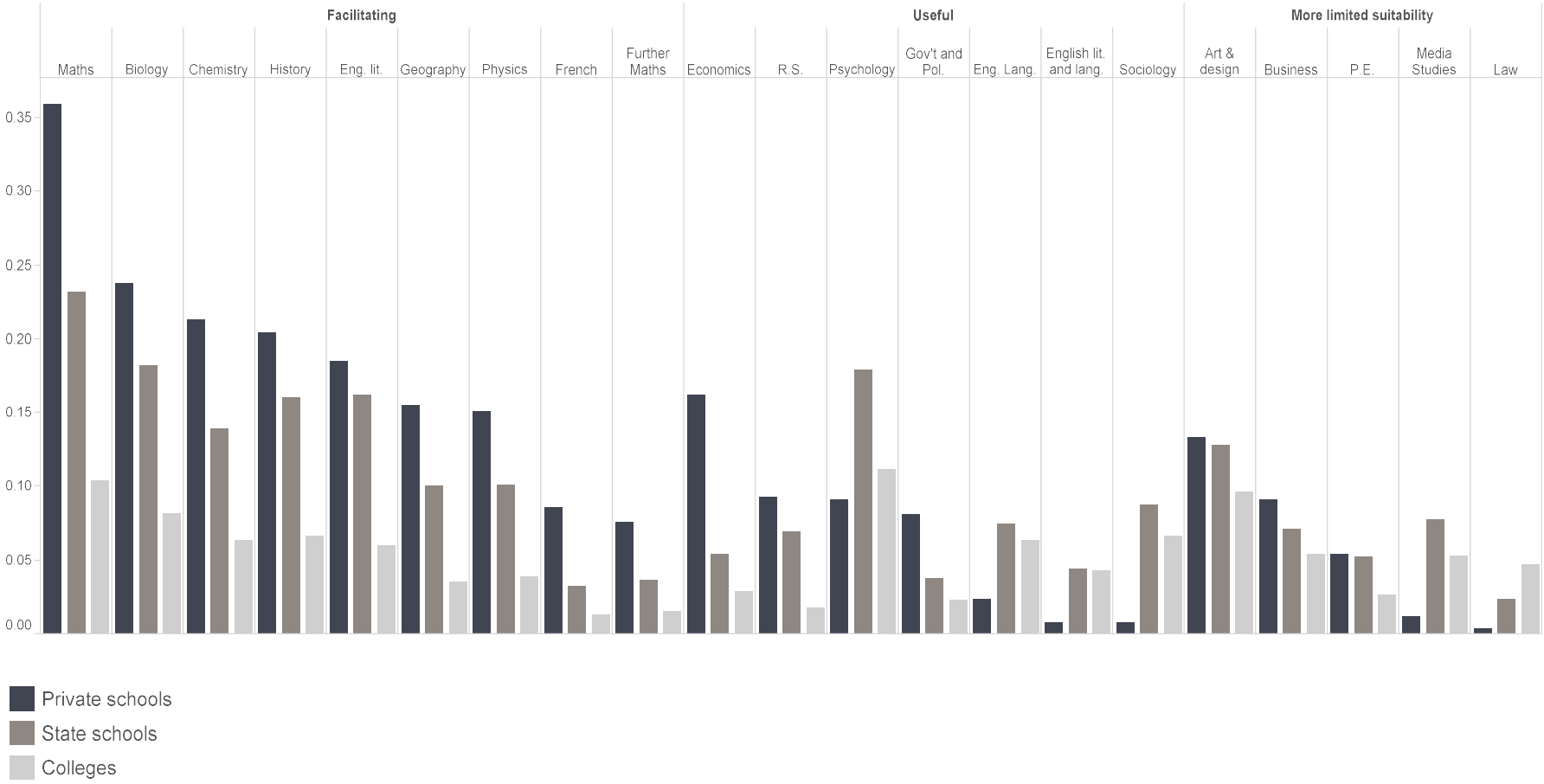


Figure 6: Proportion of students taking A-levels by school type (21 most popular subjects)



Appendix 4 – Full regression tables for chapter 3

Table 19: Gradient in choice of at least two facilitating A-levels and at least two 'less suitable' A-levels - full tables

Outcome measure	Model 3	Model 4	Model 3	Model 4
	At least two facilitating A-levels		At least two 'less suitable' A-levels	
	Clustered standard errors	Fixed effects	Clustered standard errors	Fixed effects
SES quintile 2	-0.002	-0.003	0.010***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)
SES quintile 3	-0.001	0.000	0.011***	0.010***
	(0.003)	(0.002)	(0.003)	(0.002)
SES quintile 4	0.004	0.005*	0.009***	0.009***
	(0.003)	(0.002)	(0.003)	(0.002)
SES quintile 5	0.007*	0.011***	0.005+	0.006**
	(0.003)	(0.003)	(0.003)	(0.002)
Standardised maths score age 11	0.032***	0.032***	-0.004**	-0.003*
	(0.001)	(0.001)	(0.001)	(0.001)
Standardised English score age 11	-0.040***	-0.040***	-0.018***	-0.017***
	(0.001)	(0.001)	(0.001)	(0.001)
Standardised science score age 11	0.031***	0.030***	-0.028***	-0.027***
	(0.001)	(0.001)	(0.001)	(0.001)
Top decile age 11	0.046***	0.045***	0.034***	0.031***
	(0.003)	(0.003)	(0.002)	(0.002)
Standardised GCSE capped points score	0.177***	0.177***	-0.072***	-0.072***
	(0.002)	(0.002)	(0.002)	(0.001)
Total number GCSEs A*-C	-0.023***	-0.026***	-0.046***	-0.050***
	(0.001)	(0.001)	(0.001)	(0.001)
Number of facilitating GCSEs A*-C	0.079***	0.085***		
	(0.001)	(0.001)		
Number of 'less suitable' GCSEs A*-C			0.093***	0.098***
			(0.001)	(0.001)
Number of facilitating A-levels offered by school	0.012***			
	(0.002)			
Number of 'less suitable' A-levels offered by school			0.018***	
			(0.001)	
Total number A-level subjects offered by school	-0.005***		-0.008***	
	(0.000)		(0.001)	
School gender – boys (baseline mixed)	-0.037***		0.025***	
	(0.009)		(0.007)	
School gender – girls (baseline mixed)	0.018*		0.009	
	(0.008)		(0.006)	
School type – selective school (baseline non-selective school)	-0.065***		0.050***	
	(0.008)		(0.007)	
School type – 6th form college (baseline non-selective school)	-0.048***		0.021*	
	(0.008)		(0.009)	
School type – FE college (baseline non-selective school)	-0.079***		0.022**	
	(0.008)		(0.008)	
School size (per 100 students	0.001		0.003	
	(0.002)		(0.002)	
Cohort 2 (baseline cohort 1)	-0.016***	-0.017***	0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Cohort 3 (baseline cohort 1)	-0.050***	-0.053***	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Gender female (baseline male)	-0.090***	-0.088***	-0.010***	-0.010***
	(0.002)	(0.002)	(0.002)	(0.002)

Outcome measure cont'd	At least two facilitating A-levels		At least two 'less suitable' A-levels	
	Clustered standard errors	Fixed effects	Clustered standard errors	Fixed effects
Asian ethnicity (baseline White)	0.093***	0.092***	-0.071***	-0.061***
	(0.006)	(0.004)	(0.005)	(0.004)
Black ethnicity (baseline White)	0.050***	0.053***	-0.071***	-0.067***
	(0.007)	(0.005)	(0.007)	(0.005)
Chinese ethnicity (baseline White)	0.038***	0.041***	0.014*	0.010
	(0.008)	(0.008)	(0.007)	(0.006)
Mixed ethnicity (baseline White)	0.016***	0.015***	-0.019***	-0.017***
	(0.004)	(0.004)	(0.004)	(0.003)
Other ethnicity (baseline White)	0.080***	0.077***	-0.041***	-0.036***
	(0.007)	(0.007)	(0.008)	(0.007)
Ethnicity undeclared (baseline White)	0.021*	0.028***	-0.021***	-0.018***
	(0.010)	(0.006)	(0.005)	(0.005)
North West region (baseline North East)	-0.008	0.026	0.009	-0.006
	(0.011)	(0.026)	(0.008)	(0.018)
Yorkshire/Humber region (baseline North East)	0.005	0.061**	-0.002	-0.032**
	(0.012)	(0.019)	(0.008)	(0.012)
East Midlands region (baseline North East)	0.014	0.075***	-0.027**	-0.049**
	(0.012)	(0.022)	(0.009)	(0.016)
East of England region (baseline North East)	-0.002	0.050+	0.012	-0.018
	(0.011)	(0.027)	(0.010)	(0.019)
London region (baseline North East)	-0.001	0.085***	0.005	-0.048**
	(0.011)	(0.025)	(0.009)	(0.018)
South East region (baseline North East)	0.017	0.102***	0.002	-0.043*
	(0.011)	(0.025)	(0.008)	(0.018)
Midlands region (baseline North East)	0.026*	0.094***	0.001	-0.046*
	(0.011)	(0.025)	(0.008)	(0.018)
South West region (baseline North East)	0.038**	0.080**	-0.011	-0.025
	(0.012)	(0.026)	(0.009)	(0.020)
Non-statemented SEN (baseline no SEN)	0.026***	0.027***	-0.019***	-0.021***
	(0.003)	(0.003)	(0.003)	(0.003)
Statemented SEN (baseline no SEN)	0.070***	0.072***	-0.068***	-0.068***
	(0.010)	(0.010)	(0.010)	(0.010)
English as an additional language (baseline English)	0.036***	0.035***	-0.023***	-0.016***
	(0.004)	(0.004)	(0.004)	(0.003)
Language status undeclared (baseline English)	0.009*	0.008*	-0.010*	-0.009*
	(0.004)	(0.004)	(0.004)	(0.004)
Observations	444467	444467	444467	444467
Number of schools		2176		2176

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10. Robust standard errors in parentheses

Appendix 5 – University quality measures

Table 20: Times Good University scores and rankings and derived quality measure rankings (PCA rank) 2013

University	Times Score	Times Rank	PCA rank
Oxford	1000	1	1
Cambridge	990	2	2
London School of Economics	911	3	4
Imperial College	835	4	3
Durham	834	5	7
St Andrews	814	6	6
UCL	811	7	5
Warwick	789	8	8
Bath	767	9	19
Exeter	764	10	20
Bristol	762	11	9
Lancaster	759	12	17
York	749	13	13
Edinburgh	735	14	10
Glasgow	734	15	12
Loughborough	727	16	29
Leicester	724	17	25
Southampton	717	18	14
Sussex	717	18	31
Nottingham	715	20	16
Sheffield	714	21	24
King's College London	710	22	11
Newcastle	702	23	22
Birmingham	690	24	15
Reading	690	24	35
Surrey	688	26	30
Royal Holloway	680	27	32
UEA	675	28	33
Liverpool	673	29	18
Leeds	672	30	34
SOAS	662	31	21
Cardiff	661	32	27
Manchester	660	33	23
Kent	657	34	41
Queen's, Belfast	653	35	28
Strathclyde	646	36	36
Aston	646	36	39
Queen Mary	638	38	26
Aberdeen	630	39	37

University cont'd	Times Score	Times Rank	PCA rank
Essex	620	40	47
Buckingham	618	41	42
Heriot-Watt	613	42	43
Brunel	612	43	46
Dundee	609	44	40
Keele	607	45	44
City	597	46	38
Aberystwyth	576	47	62
Goldsmiths	561	48	53
Hull	558	49	51
Stirling	556	50	60
Robert Gordon	555	51	48
Swansea	549	52	45
Oxford Brookes	549	52	50
Lincoln	549	52	59
Coventry	548	55	56
Bangor	544	56	61
Huddersfield	540	57	54
Northumbria	538	58	58
Chester	527	59	57
University of the Arts London	524	60	52
Chichester	522	61	90
UWE Bristol	510	62	68
Portsmouth	509	63	72
Plymouth	508	64	55
Ulster	506	65	63
Gloucestershire	506	65	99
Bradford	504	67	49
Hertfordshire	500	68	66
Brighton	499	69	86
Bath Spa	497	70	108
Central Lancashire	492	71	65
De Montfort	488	72	79
Sheffield Hallam	487	73	85
Edge Hill	487	73	88
Birmingham City	486	75	73
Winchester	486	75	94
Sunderland	482	77	82
Nottingham Trent	478	78	67
Cardiff Metropolitan	478	78	96
York St John	475	80	107
Bournemouth	474	81	64
Glasgow Caledonian	474	81	77

University cont'd	Times Score	Times Rank	PCA rank
Queen Margaret	470	83	84
Edinburgh Napier	468	84	95
Canterbury Christ Church	467	85	76
Roehampton	463	86	81
Teesside	461	87	80
Bedfordshire	458	88	75
Derby	456	89	89
Middlesex	453	90	71
Salford	452	91	69
Greenwich	452	91	98
Liverpool John Moores	451	93	101
Worcester	451	93	106
Westminster	447	95	70
Glamorgan	447	95	87
Cumbria	446	97	74
Glyndwr	446	97	78
Northampton	438	99	103
Staffordshire	437	100	104
Kingston	435	101	93
Manchester Metropolitan	434	102	83
University for the Creative Arts	430	103	91
Leeds Metropolitan/Beckett	429	104	105
Trinity Saint David	428	105	92
Buckinghamshire New	413	106	109
Anglia Ruskin	410	107	102
Newport	392	108	114
West of Scotland	387	109	97
West London	380	110	100
London South Bank	378	111	110
Abertay Dundee	366	112	112
Southampton Solent	363	113	111
Bolton	328	115	115
London Metropolitan	327	116	113
East London	327	116	116

The derived quality rankings are computed from a principal component analysis of the following university performance measures: research quality, entry standards, student-staff ratio, spend per student, graduate prospects, as suggested by Chevalier (2014).

Appendix 6 – Full regression tables for chapter 4[42]

Table 21: Full models of Times league table score with A-level subject choice across all university subjects (re Table 10)

	Model 1	Model 2	Model 3
Number facilitating A-levels	13.867***	12.584***	
	(0.212)	(0.220)	
Contextual effect – facilitating	-0.455	-2.320	
	(1.426)	(1.616)	
Maths		7.094***	
		(0.434)	
Contextual effect - maths		12.989**	
		(4.649)	
Number 'less suitable' A-levels			-15.651***
			(0.251)
Contextual effect – 'less suitable'			1.853
			(1.735)
Total counting A-levels	5.677***	5.576***	18.447***
	(0.567)	(0.568)	(0.576)
Contextual effect – counting A-levels	-10.606***	-10.707***	-9.675**
	(3.213)	(3.167)	(3.167)
School type (baseline comprehensive)			
Grammar school	5.166***	5.523***	5.163***
	(1.102)	(1.093)	(1.130)
6th form college	-4.797***	-5.195***	-6.951***
	(1.211)	(1.223)	(1.191)
FE college	-6.201***	-6.731***	-9.520***
	(1.388)	(1.384)	(1.358)
Private school	3.859***	4.135***	5.036***
	(1.159)	(1.149)	(1.139)
Degree subject group (baseline biological sciences)			
Medicine	-38.845***	-39.290***	-31.382***
	(1.315)	(1.313)	(1.335)
Allied to medicine	0.995	0.886	4.910***
	(0.989)	(0.990)	(0.980)
Veterinary science	10.672***	10.403***	18.815***
	(3.111)	(3.112)	(3.116)
Allied vet science/agriculture	9.416***	9.675***	13.700***
	(2.088)	(2.089)	(2.091)
Physical sciences	26.179***	25.335***	31.566***
	(0.714)	(0.711)	(0.712)
Maths	12.762***	9.433***	17.956***
	(0.862)	(0.873)	(0.863)
Computer Science	17.906***	16.028***	21.357***
	(1.041)	(1.047)	(1.039)
Engineering/technology	11.894***	9.217***	19.298***
	(0.841)	(0.848)	(0.825)

[42] The published results reproduced in Tables 10 to 12 of chapter 4 did not include a control for the school contextual effect of individual university subject choices. Adding these contextual controls makes negligible difference to the results, but the revised versions (Tables 28, 29 and 30) are included here for completeness.

Degree subject group cont'd	Model 1	Model 2	Model 3
Architecture/building	-27.968***	-29.501***	-21.557***
	(1.392)	(1.392)	(1.367)
Social studies	29.320***	28.886***	24.145***
	(0.608)	(0.610)	(0.611)
Law	0.743	0.973	-0.906
	(0.818)	(0.816)	(0.820)
Business and administrative studies	-11.978***	-13.076***	-9.373***
	(0.622)	(0.624)	(0.639)
Mass communications	-24.249***	-24.104***	-22.062***
	(1.013)	(1.013)	(1.020)
Languages and literature	22.411***	23.736***	21.966***
	(0.652)	(0.657)	(0.660)
History and philosophy	29.492***	30.572***	26.885***
	(0.722)	(0.725)	(0.724)
Creative arts	-34.317***	-34.564***	-29.072***
	(1.030)	(1.028)	(0.999)
Education	-29.284***	-29.477***	-30.779***
	(1.092)	(1.092)	(1.097)
Unspecific subject	20.524***	20.429***	20.088***
	(2.485)	(2.487)	(2.488)
Contextual effect of degree subject (baseline biological sciences)			
Medicine	5.159	2.275	6.906
	(16.553)	(16.289)	(16.745)
Allied to medicine	4.113	1.360	6.018
	(9.765)	(9.689)	(9.808)
Veterinary science	-64.603	-43.207	-45.499
	(63.972)	(63.982)	(62.960)
Allied vet science/agriculture	-31.496	-28.015	-17.227
	(28.361)	(28.010)	(28.498)
Physical sciences	18.463+	19.089*	30.785***
	(9.479)	(9.423)	(9.294)
Maths	21.286+	1.497	32.275**
	(11.568)	(12.631)	(11.423)
Computer Science	-2.918	-9.398	8.208
	(11.789)	(12.043)	(12.116)
Engineering/technology	27.268**	15.980	34.154***
	(9.729)	(10.169)	(10.099)
Architecture/building	15.635	15.466	25.927
	(19.414)	(19.323)	(19.450)
Social studies	32.349***	30.583***	28.058***
	(7.916)	(7.898)	(8.035)
Law	-6.766	-8.136	-6.516
	(10.506)	(10.412)	(10.722)
Business and administrative studies	4.010	1.518	11.803
	(7.997)	(7.984)	(8.341)
Mass communications	-6.624	-6.986	1.264
	(11.230)	(11.255)	(11.657)
Languages and literature	16.382+	20.718*	21.678*
	(8.534)	(8.560)	(8.519)
History and philosophy	24.543*	29.749**	32.474**
	(10.469)	(10.460)	(10.428)
Creative arts	-3.166	-2.745	4.970
	(10.041)	(10.012)	(10.415)
Education	-8.818	-8.109	-4.871
	(13.946)	(13.737)	(13.993)
Unspecific subject	34.936	33.840	29.300
	(31.996)	(31.611)	(32.224)

	Model 1	Model 2	Model 3
A-level QCA points – best 3	-1.185***	-1.184***	-1.207***
	(0.019)	(0.019)	(0.020)
Contextual effect of best 3 A-levels	-1.116***	-1.033***	-1.199***
	(0.144)	(0.143)	(0.145)
A-level points squared	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)
Contextual effect of A-level points squared	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)
GCSE points	-0.798***	-0.775***	-0.909***
	(0.033)	(0.033)	(0.035)
Contextual effect of GCSE points	0.267	0.283	0.364
	(0.227)	(0.224)	(0.239)
GCSE points squared	0.001***	0.001***	0.002***
	(0.000)	(0.000)	(0.000)
Contextual effect of GCSE points squared	-0.001*	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)
SES quintile (baseline bottom quintile)			
SES quintile 2	0.846	0.880	1.025
	(0.639)	(0.640)	(0.634)
SES quintile 3	1.775**	1.851**	2.125**
	(0.679)	(0.681)	(0.671)
SES quintile 4	3.807***	3.938***	4.353***
	(0.680)	(0.682)	(0.673)
Top SES quintile	8.159***	8.337***	8.928***
	(0.724)	(0.725)	(0.714)
Contextual effect of SES, per quintile	-0.133	-0.030	-0.386
	(0.601)	(0.598)	(0.601)
Cohort (baseline earliest cohort A-levels in 09/10)			
Cohort 2	-10.177***	-10.228***	-10.383***
	(0.375)	(0.375)	(0.376)
Cohort 3	1.669***	1.626***	1.031*
	(0.420)	(0.420)	(0.423)
Gender (baseline male)			
Female	-9.942***	-9.509***	-12.447***
	(0.350)	(0.350)	(0.349)
Contextual effect of gender	1.533	1.387	3.317+
	(1.759)	(1.741)	(1.775)
Post qualification application	9.107***	9.208***	9.016***
	(0.495)	(0.495)	(0.498)
Contextual effect of post-qualification application	16.780***	17.173***	17.560***
	(4.480)	(4.419)	(4.549)
Observations	421,836	421,836	421,836
Number of schools	2,719	2,719	2,719

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10. Robust standard errors in parentheses

Table 22: Full models of Times league table score with A-level subject choice for accounting, business and law students (re Table 11)

	Accounting students			Business students			Law students		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Number facilitating A-levels	5.965***	3.425**		10.737***	8.094***		10.780***	9.898***	
	(1.108)	(1.270)		(0.630)	(0.681)		(0.734)	(0.773)	
Contextual effect – facilitating	-7.419	-4.044		0.720	-2.445		2.419	2.544	
	(5.468)	(6.309)		(3.099)	(3.452)		(3.953)	(4.541)	
Maths		8.996***			14.063***			6.470***	
		(2.221)			(1.420)			(1.884)	
Contextual effect - maths		-16.740			24.731*			1.854	
		(17.873)			(10.285)			(13.591)	
Number 'less suitable' A-levels			-7.121***			-10.999***			-12.612***
			(1.091)			(0.557)			(0.867)
Contextual effect – 'less suitable'			9.577+			2.550			6.978
			(5.740)			(3.670)			(4.801)
Total counting A-levels	2.580	3.330	8.107*	-1.047	-1.676	8.377***	12.715***	12.314***	21.987***
	(3.328)	(3.347)	(3.241)	(2.311)	(2.301)	(2.256)	(1.980)	(1.990)	(1.974)
Contextual effect – counting A-levels	26.689*	26.552*	19.733+	13.703+	13.745*	15.546*	-3.904	-3.720	-5.059
	(11.843)	(11.838)	(11.723)	(7.032)	(6.901)	(6.517)	(7.951)	(7.933)	(7.560)
School type (baseline comprehensive)									
Grammar school	5.466	5.227	5.197	9.725***	10.334***	9.476***	3.867	3.967	4.265
	(4.396)	(4.395)	(4.396)	(2.394)	(2.390)	(2.395)	(2.993)	(2.984)	(3.012)
6th form college	-4.494	-4.214	-3.091	-6.370***	-7.056***	-7.400***	-0.037	-0.155	-1.263
	(3.357)	(3.384)	(3.194)	(1.836)	(1.847)	(1.722)	(2.320)	(2.335)	(2.176)
FE college	-9.519*	-9.243*	-7.348+	-2.959	-3.803	-4.522+	-3.356	-3.452	-5.078+
	(4.385)	(4.442)	(4.285)	(2.436)	(2.422)	(2.364)	(2.799)	(2.821)	(2.694)
Private school	16.750***	17.070***	16.395**	11.669***	12.093***	12.864***	-7.519*	-7.248*	-6.748*
	(5.040)	(5.029)	(5.041)	(2.297)	(2.284)	(2.262)	(3.334)	(3.334)	(3.358)
Contextual effect of degree subject (baseline biological sciences)									
Medicine	7.150	10.454	-0.189	31.985	31.463	21.838	60.360	60.482	72.434
	(69.666)	(69.561)	(69.191)	(35.497)	(35.648)	(35.709)	(46.373)	(46.165)	(46.598)
Allied to medicine	4.926	7.281	0.560	57.952*	49.518*	59.493*	23.949	23.141	26.104
	(41.688)	(41.769)	(41.590)	(23.603)	(23.359)	(23.437)	(28.165)	(28.223)	(27.918)
Veterinary science	-258.622	-262.331	-221.424	-98.905	-75.518	-71.202	131.344	141.487	145.723
	(363.091)	(364.514)	(358.181)	(179.698)	(177.305)	(176.429)	(217.661)	(218.134)	(219.129)
Allied vet science/agriculture	-78.305	-76.258	-78.258	-50.416	-31.804	-38.655	73.603	71.724	73.920
	(142.741)	(141.720)	(143.648)	(66.047)	(65.339)	(65.173)	(107.798)	(107.879)	(107.926)
Physical sciences	-8.232	-6.919	-14.676	18.271	20.296	32.512	-9.900	-10.937	13.229
	(42.806)	(42.834)	(42.159)	(22.161)	(22.032)	(21.676)	(30.245)	(30.197)	(29.697)
Maths	36.570	49.096	34.184	39.367	-9.122	49.234+	-18.379	-27.384	5.985
	(52.173)	(57.596)	(50.461)	(28.652)	(31.182)	(28.020)	(34.614)	(39.245)	(34.923)
Computer Science	-49.379	-45.699	-57.116	24.533	10.941	31.513	-43.593	-44.704	-46.028
	(47.532)	(47.820)	(48.945)	(30.432)	(31.105)	(30.956)	(40.441)	(41.043)	(40.572)
Engineering/tech'logy	18.380	24.766	10.378	22.026	-2.517	31.467	5.503	1.454	10.103
	(44.747)	(46.502)	(44.368)	(20.922)	(22.230)	(20.687)	(33.932)	(35.070)	(33.734)
Architecture/building	83.163	87.441	63.031	-24.902	-20.185	-10.475	106.353+	108.446+	102.364
	(74.267)	(73.723)	(75.310)	(42.619)	(42.362)	(42.726)	(64.479)	(64.643)	(64.558)
Social studies	-2.774	-1.140	-11.084	54.869**	49.464**	43.265*	32.001	31.858	23.130
	(34.884)	(34.997)	(34.830)	(17.355)	(17.300)	(17.355)	(22.444)	(22.439)	(22.493)
Law	-47.184	-46.137	-53.924	41.145+	36.407	40.618+	-12.139	-13.442	1.296
	(46.648)	(46.700)	(47.004)	(24.043)	(23.832)	(23.902)	(24.303)	(24.208)	(24.905)
Business and administrative studies	8.119	11.652	-0.474	18.525	14.757	29.878+	34.385	33.663	33.780
	(31.807)	(32.110)	(33.969)	(17.184)	(17.218)	(17.467)	(24.768)	(24.947)	(25.398)
Mass communications	3.816	3.998	-0.520	5.992	7.431	10.857	11.467	10.753	10.666
	(51.522)	(51.490)	(52.237)	(25.654)	(25.589)	(25.958)	(38.071)	(38.183)	(38.977)
Languages and literature	13.605	8.098	12.124	42.479*	51.335**	45.759*	38.244	38.646	50.615+
	(39.636)	(40.073)	(39.703)	(18.691)	(18.838)	(18.658)	(25.905)	(26.357)	(26.102)

Contextual effect of degree subject cont'd	Accounting students			Business students			Law students		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
History and philosophy	79.367+	75.605+	79.783+	61.235**	72.058**	71.537**	66.613*	67.749*	81.423**
	(43.661)	(43.886)	(43.482)	(23.526)	(23.764)	(23.385)	(29.929)	(30.087)	(29.743)
Creative arts	-65.040	-66.350+	-75.802+	7.338	8.297	10.952	3.024	4.380	-8.849
	(40.025)	(40.117)	(42.533)	(19.410)	(19.323)	(20.478)	(25.881)	(25.851)	(27.312)
Education	4.261	1.372	4.796	-20.340	-16.743	-17.599	-54.880	-57.475	-58.412
	(64.124)	(63.838)	(65.519)	(31.411)	(31.043)	(31.562)	(39.853)	(39.820)	(40.100)
Unspecific subject	174.242	168.731	173.292	-104.601	-118.454	-109.630	-5.212	-7.603	-31.263
	(184.079)	(183.773)	(185.042)	(85.686)	(83.934)	(85.781)	(103.975)	(104.038)	(107.862)
A-level QCA points – best 3	-1.315***	-1.308***	-1.310***	-1.611***	-1.603***	-1.608***	-2.218***	-2.214***	-2.231***
	(0.092)	(0.092)	(0.092)	(0.049)	(0.049)	(0.049)	(0.076)	(0.076)	(0.076)
Contextual effect of best 3 A-levels	-0.230	-0.275	-0.180	-0.770*	-0.578+	-0.777*	-1.013*	-0.970*	-1.144**
	(0.479)	(0.488)	(0.472)	(0.314)	(0.318)	(0.311)	(0.395)	(0.396)	(0.395)
A-level points squared	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Contextual effect of A-level points squared	0.000	0.000	0.000	0.001**	0.001*	0.001**	0.001**	0.001**	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GCSE points	-0.596***	-0.586***	-0.597***	-0.736***	-0.653***	-0.788***	-1.019***	-0.997***	-1.125***
	(0.137)	(0.139)	(0.137)	(0.084)	(0.082)	(0.085)	(0.137)	(0.136)	(0.141)
Contextual effect of GCSE points	-0.708	-0.783	-0.755	-0.343	-0.346	-0.318	-1.189	-1.160	-1.275
	(0.772)	(0.776)	(0.784)	(0.285)	(0.284)	(0.293)	(0.879)	(0.869)	(0.867)
GCSE points squared	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Contextual effect of GCSE points squared	0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
SES quintile (baseline bottom quintile)									
SES quintile 2	1.148	0.885	1.182	-0.635	-0.744	-0.379	-1.990	-1.939	-1.613
	(2.868)	(2.865)	(2.887)	(2.005)	(1.999)	(1.987)	(2.189)	(2.182)	(2.183)
SES quintile 3	-1.067	-1.323	-0.778	-2.505	-2.608	-2.170	0.342	0.304	0.992
	(3.235)	(3.233)	(3.275)	(2.080)	(2.070)	(2.067)	(2.041)	(2.038)	(2.046)
SES quintile 4	2.871	2.404	3.061	-2.250	-2.234	-1.649	3.937+	3.947+	4.746*
	(3.354)	(3.352)	(3.359)	(1.907)	(1.900)	(1.909)	(2.320)	(2.317)	(2.302)
Top SES quintile	6.488+	6.355+	6.641*	2.142	2.214	2.611	7.179**	7.202**	8.499***
	(3.334)	(3.321)	(3.341)	(1.886)	(1.881)	(1.889)	(2.239)	(2.235)	(2.234)
Contextual effect of SES, per quintile	4.331*	4.030+	4.173+	-2.385+	-2.238+	-2.844*	1.186	1.165	1.598
	(2.130)	(2.128)	(2.133)	(1.279)	(1.274)	(1.280)	(1.550)	(1.550)	(1.554)
Cohort (baseline earliest cohort A-levels in 09/10)									
Cohort 2	-18.46***	-18.42***	-18.89***	-10.23***	-10.35***	-10.69***	-4.755***	-4.808***	-4.954***
	(2.196)	(2.194)	(2.187)	(1.064)	(1.061)	(1.068)	(1.410)	(1.409)	(1.411)
Cohort 3	-2.513	-2.346	-3.244	-2.082+	-2.037+	-2.798*	7.224***	7.283***	6.540***
	(2.358)	(2.356)	(2.353)	(1.189)	(1.184)	(1.189)	(1.535)	(1.535)	(1.521)
Gender (baseline male)									
Female	-7.469***	-7.431***	-8.522***	-15.561***	-14.815***	-17.188***	-9.687***	-9.362***	-11.550***
	(1.879)	(1.881)	(1.867)	(0.978)	(0.974)	(0.981)	(1.391)	(1.385)	(1.385)
Contextual effect of gender	-1.205	-1.811	-0.735	0.268	-0.759	1.498	0.884	0.571	1.089
	(7.586)	(7.581)	(7.594)	(4.058)	(4.008)	(4.055)	(5.134)	(5.115)	(5.153)
Post qualification application	22.226***	22.834***	21.808***	5.162***	5.378***	4.705***	15.621***	15.745***	15.207***
	(2.967)	(2.974)	(2.963)	(1.400)	(1.396)	(1.407)	(2.165)	(2.161)	(2.164)
Contextual effect of post-qualification application	-1.653	-2.594	-2.740	7.451	8.389	8.457	25.251*	24.444*	26.630*
	(15.350)	(15.400)	(15.388)	(9.594)	(9.443)	(9.766)	(11.265)	(11.279)	(11.363)
Observations	8,761	8,761	8,761	32,287	32,287	32,287	20,588	20,588	20,588
Number of schools	1,852	1,852	1,852	2,375	2,375	2,375	2,278	2,278	2,278

Table 23: Association of Times league table score with choosing the course-related A-level rather than an A-level from another category for students studying accounting, business and law at university, including contextual effects of university subject choice in controls (re Table 12)

	Model 4	Model 5	Model 6	Model 7
Accounting students (n=8,761)				
Accounting A-level	-1.021	0.753	4.180	8.497**
	(2.761)	(2.695)	(2.746)	(2.837)
Business students (n=32,287)				
Business A-level	-5.460***	2.140*	6.098***	10.245***
	(1.111)	(1.046)	(1.054)	(1.102)
Law students (n=20,588)				
Law A-level	-19.301***	-15.599***	-9.738***	-5.048**
	(1.865)	(1.843)	(1.831)	(1.948)
A-level subject controls				
Other non-facilitating and total	Yes			
Total		Yes		
Facilitating and total			Yes	
'Less suitable' and total				Yes

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10. Robust standard errors in parentheses.

Appendix 7 – University type categories

Table 24: Universities categorised by Boliver cluster

Cluster 1 (Oxbridge)	Cluster 3 (New universities and old lower ranked)	Cluster 3 cont'd	Cluster 4 (Bottom ranked)
Cambridge[a]	Abertay Dundee	Newman	Anglia Ruskin
Oxford[a]	Aberystwyth	Northampton	Bishop Grosseteste
	Arts University, Bournemouth	Nottingham Trent	University College, Birmingham
Cluster 2 (Russell Group and other higher ranked)	University of the Arts, London	Northumbria	Bolton
Aberdeen	Aston	Oxford Brookes	Buckinghamshire New
Bath	Bangor	Plymouth	Cumbria
Birmingham[a]	Bath Spa	Portsmouth	East London
Bristol[a]	Bedfordshire	Queen Margaret	Edge Hill
Cardiff[a]	Birmingham City	Robert Gordon	Glyndwr
Dundee	Bournemouth	Roehampton	Leeds Trinity
Durham[a]	Bradford	Salford	Liverpool Hope
UEA	Brighton	Sheffield Hallam	London Metropolitan
Edinburgh[a]	Brunel	Staffordshire	Newport
Exeter[a]	Christ Church, Canterbury	Stirling	St Mark and St John
Glasgow[a]	Cardiff Metropolitan	Sunderland	Southampton Solent
Goldsmiths	Central Lancashire	Swansea	Suffolk
Heriot-Watt	Chester	Teesside	Trinity St David
Imperial College[a]	Chichester	Ulster	Wolverhampton
Kent	City	UWE Bristol	York St John
King's College London[a]	Coventry	West London	
Lancaster	University for the Creative Arts	West of Scotland	
Leeds[a]	De Montfort	Westminster	
Leicester	Derby	Winchester	
Liverpool[a]	Edinburgh Napier	Worcester	
UCL[a]	Essex		
London School of Economics[a]	Falmouth		
Loughborough	Glamorgan		
Manchester[a]	Glasgow Caledonian		
Newcastle[a]	Gloucestershire		
Nottingham[a]	Greenwich		
Queen Mary[a]	Harper Adams		
Queen's Belfast[a]	Hertfordshire		
Reading	Highlands and Islands		
Royal Holloway	Huddersfield		
St Andrews	Hull		
SOAS	Keele		
Sheffield[a]	Kingston		
Southampton[a]	Leeds Becket		
Strathclyde	Lincoln		
Surrey	Liverpool John Moores		
Sussex	London South Bank		
Warwick[a]	Manchester Met		
York[a]	Middlesex		

[a]Russell Group universities

Appendix 8 – Full regression tables for chapter 5

The appendix for chapter 5 (pages 174 and 175) has been redacted for reasons of commercial sensitivity.

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