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Blending Academic and Vocational Education: The Impacts of T Levels

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Upper-secondary technical and vocational education and training (VET) is responsible for educating a large proportion of the world's population, significantly impacting productivity and economic growth. Over recent years, there has been a global trend towards combining academic and vocational tracks into one pathway within upper secondary education. In this paper, we analyse the short-run impacts of one of the most recent of these efforts – the T level reforms in England. T levels are large VET qualifications that are more academically oriented than existing VET qualifications and are designed in-part to support progression to further academic or vocational study. Using a combination of quasi-experimental methods (instrumental variables, regression adjustment and matching), we find mixed impacts of T levels on student achievement and progression. T level students are significantly less likely to achieve a full level 3 by the age of 18. However, T level students are more likely to progress to advanced apprenticeships and higher technical study. We show that these impacts are more negative for the marginal student and when considering other level 3 vocational pathways as an alternate form of study. We also find heterogeneity by T level pathway (subject), indicating that some pathways are performing significantly better than others.

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Disclaimer

Highlights

- Upper-secondary vocational education and training (VET) is responsible for educating a large proportion of the global population.
- Over recent years, reforms have been introduced to integrate more academic content into upper-secondary vocational education – "hybridising" upper-secondary education.
- One of the most recent of these efforts were the T level reforms in England. T levels are a new vocational pathway that combines elements of existing academic and vocational tracks.
- We study the causal impacts of T levels on short-run attainment and progression for the second cohort of T level learners using quasi-experimental methods.
- We find mixed impacts of T levels. On the one hand, T level students are less likely to achieve a full level 3 by the age of 18. However, they are more likely to progress to advanced technical study.
- We show that the effects vary considerably by pathway (subject) which has important implications for policy and the continued development of T levels.

Why does this matter?

Understanding the short-run impacts of the T level reforms is critical for the continued development and rollout of T levels in England and to provide evidence on the impacts of combining academic and vocational education into one track.

Blending Academic and Vocational Education: The Impacts of T Levels

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September 17, 2025

Abstract

Upper-secondary technical and vocational education and training (VET) is responsible for educating a large proportion of the world's population, significantly impacting productivity and economic growth. Over recent years, there has been a global trend towards combining academic and vocational tracks into one pathway within upper secondary education. In this paper, we analyse the short-run impacts of one of the most recent of these efforts – the T level reforms in England. T levels are large VET qualifications that are more academically oriented than existing VET qualifications and are designed in-part to support progression to further academic or vocational study. Using a combination of quasi-experimental methods (instrumental variables, regression adjustment and matching), we find mixed impacts of T levels on student achievement and progression. T level students are significantly less likely to achieve a full level 3 by the age of 18. However, T level students are more likely to progress to advanced apprenticeships and higher technical study. We show that these impacts are more negative for the marginal student and when considering other level 3 vocational pathways as an alternate form of study. We also find heterogeneity by T level pathway (subject), indicating that some pathways are performing significantly better than others.

Keywords: Education, Instrumental Variables, Qualifications, Technical, UK, Vocational

JEL Codes: C26, I26, I28

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1. Introduction

Technical and vocational education and training (VET, also referred to as TVET) is an important part of any country's economy and education system. VET is responsible for equipping individuals with the skills society needs for a range of highly skilled occupations and technical jobs (Cedefop, 2011). VET is also an important tool for promoting productivity, economic growth, addressing skills shortages and social mobility. On average, one in three 25-34 year-olds have a vocational qualification as their highest level of education across the OECD (OECD, 2023). Most of these qualifications are gained during upper secondary school and students tend to come from more disadvantaged backgrounds (OECD, 2023). This makes upper secondary vocational education an important area for improving the lives of many people and promoting social mobility (Bertrand et al., 2021; Hupkau et al., 2017).

Upper-secondary VET is often taken as an alternative route to the traditional "academic" pathway.[1] However, over recent years, there has been a global push towards more "dual style" or "hybrid" upper secondary education where academic and VET are combined into one pathway. The movement tends to be towards programmes that a) involve a substantial work experience component, b) have a significant classroom-based learning component and c) integrate academic or more general classroom study into the programme. This movement may come as no surprise given that these features are embodied in the German dual system which is heralded around the world (Deissinger, 2015). Furthermore, the importance of work experience and work placements in VET is widely recognised and advocated for (Oswald-Egg & Renold, 2021). Many researchers and policymakers have also argued that some general education is important for VET to ensure that VET graduates have broad transferrable skills alongside their specific occupational skills (Bertrand et al., 2021; Brunello & Rocco, 2017). This comes off the back of suggestions that the skills of purely VET-educated workers' are less flexible to changes in the economy (Hanushek et al., 2017; Krueger & Kumar, 2004).

Despite the importance of VET and the growing movement towards hybrid-style upper-secondary education, there is a relatively limited amount of evidence on the returns to vocational education (compared with traditional "academic" routes) and the returns to hybrid pathways that combine both academic and vocational education. In this paper, we address this

[1] In England, the traditional academic route would be studying 3 A levels.

gap by investigating the short-run impacts of a novel set of hybrid upper-secondary qualifications in England – T levels.

T levels are technical (or vocational)[2] courses which are broadly equivalent to 3 A levels but offer a mixture of classroom learning and 'on-the-job' experience. The T level reforms are part of a global push towards more "dual style" or "hybrid" upper secondary education where academic and VET are combined into one pathway. T levels were designed to be more academically rigorous than most other VET qualifications in the UK and to raise the quality of post-16 VET in order to address long-standing productivity issues and skills shortages in the UK economy (Department for Business, Innovation and Skills, 2016). They were also designed to simplify the complex qualifications landscape, raise the social esteem of VET and provide flexible pathways for VET students post-study (Maris, n.d.). T levels were introduced to sit alongside A levels as the two main level 3 upper-secondary qualification pathways in England.

We use a combination of methods to quantify the short-run impacts of T levels, exploiting the fact that the rollout was staggered by subject and area and that awareness of T levels was (and still is) patchy across the population of students, parents and teachers. For instance, more than 70% of level 3 learners not on a T level in 2022 had never heard of the qualifications (NatCen Social Research & NFER, 2023). We start by modelling the impacts of T levels using regression adjustment methods, arguing that the nature of the rollout means taking a T level is plausibly random after controlling for school-level variables, individual characteristics, prior attainment and area-based effects. We then combine these OLS models with weights from propensity score matching (PSM) to further adjust for observable confounders.

To account for any residual endogeneity and self-selection into T levels, we use an instrumental variables (IV) strategy to estimate the local average treatment effect (LATE) for students shifted into T levels by a common information shock at the school-level. The instrument we use is a peers' instrument, in line with previous papers estimating the causal impacts of VET (i.e., Birkelund & van de Werfhorst, 2022; Cavaglia et al., 2020; Oswald-Egg & Renold, 2021). We use this combination of methods to provide a broader understanding of the impacts T levels on short-run upper-secondary attainment and progression.

[2] The words vocational and technical are often used to describe T levels and other post-16 non-academic qualifications. When we use the term "vocational" we are referring to vocational and technical qualifications. There are subtle differences in definition, but they are not meaningful distinctions for this paper.

We find that T level students are significantly less likely to achieve a full level 3 qualification by the age of 18. These results suggest many students would have been better off taking alternative qualifications. However, we show that T level students are more likely to progress to advanced apprenticeships and higher technical study, showing there are positive progression opportunities for those who succeed on T levels. Our results indicate that the impacts of T levels are more negative for those on the Education and Early Years, and Health and Science pathways results are more positive for the Digital pathway.

As T levels are an entirely new set of qualifications, there is very little scholarly literature on T levels specifically. Hence, we are one of the first papers at the beginning of a new sub-literature on T level qualifications (see also Terry & Orr, 2024). Nonetheless, we make meaningful contributions to several wider areas of the literature. This includes the emerging and growing literatures on the returns to vocational education (Hanushek et al., 2017; Kreisman & Stange, 2020; LaForest, 2023; Matthewes & Ventura, 2022), the impacts of integrating academic and vocational education (Bertrand et al., 2021; Hall, 2016; Zilic, 2018) and the returns to different types of high school study (Altonji et al., 2012; Dahl et al., 2023). We briefly review these literatures below.

There is a vast literature that looks at the returns to schooling going back to early theoretical and empirical work in labour economics (i.e., Becker, 1964; Ben-Porath, 1967; Mincer, 1958). Since then, there has been an enormous amount of attention devoted to estimating and understanding the labour market returns to years of schooling, or education more broadly (for some relevant reviews, see Card, 2001; Griliches, 1977; Psacharopoulos & Patrinos, 2018). As Bertrand et al. (2021) points out, there has been far less work on the returns to different types of education and different curricula. This has been, in part, because classifying students into types of education can be difficult and more importantly because individuals endogenously select into different subjects and types of education (Dahl et al., 2023).

In particular, there has been considerably less research considering the impacts of vocational education on student outcomes. As Matthewes & Ventura (2022) assert, there is a "paucity" of compelling evidence on the economic returns to vocational education. Moreover, of the existing literature, most studies focus on relatively older cohorts of students who studied in a very different context than today (Machin et al., 2020). While the literature on the returns to vocational education is small, it has been growing over time and there have been notable earlier contributions (Dearden et al., 2002; Kang & Bishop, 1989; Mane, 1999; Meyer, 1981;

Shavit & Muller, 2000). As more and better data has become available, researchers have been able to exploit sources of quasi-random variation (or at least, condition on a greater set of characteristics) to estimate the causal effects of vocational education on educational attainment and labour market outcomes (i.e., Bertrand et al., 2021; Hemelt et al., 2019; Silliman & Virtanen, 2022).

Overall, the findings on the returns to vocational education are highly variable and depend on the subject, qualification, country and the comparison group. In the UK, for example, research has shown there are very poor returns to some types of vocational qualifications (NVQs) but much better returns to others like BTECs (Conlon & Patrignani, 2010; Dearden et al., 2004; McIntosh & Morris, 2016). For example, Dearden et al. (2004) found there were negative returns to level 2 NVQ qualifications relative to level 1 qualifications. On the other hand, apprenticeships tend to see relatively good returns in vocational space (Cavaglia et al., 2020; Hupkau et al., 2017; McIntosh & Morris, 2016).

Across the literature, male students tend to see higher returns in terms of wages, employment, college enrolments and fewer drop-outs (Bertrand et al., 2021; Brunner et al., 2021; Hemelt et al., 2019; Page, 2012; Zilic, 2018). A significant proportion of this disparity is driven by selection – male students tend to take vocational subjects that lead to higher paying jobs (like engineering or construction) while female students often select into lower paying subjects (like education or social care) (Brunner et al., 2021; Espinoza & Speckesser, 2022; Golsteyn & Stenberg, 2017). However, Brunner et al. (2021) shows that there is still a sizeable gender wage gap after controlling for industry selection.

The literature also suggests returns vary over the lifecycle. A common view grounded in human capital theory is that vocational education generates an early advantage but becomes obsolete quicker and is less adaptable. This results in the returns to academic education taking over vocational education later in the lifecycle (Espinoza & Speckesser, 2022; Golsteyn & Stenberg, 2017; Hampf & Woessmann, 2017; Hanushek et al., 2017; Krueger & Kumar, 2004). The principle is that vocational education confers an immediate labour market advantage by providing students with work experience and practical skills value by employers. However, unlike general (or more academic) education, the skills are less transferable to other settings. This has contributed to an increasing number of countries designing systems that incorporate elements of academic and vocational education into one track (to get the benefits of both types of education). However, recent evidence suggests this long-term trade-off to vocational education might not actually be as prevalent in the modern economy (Silliman & Virtanen, 2022). Other studies show that vocational education is significantly better for some students relative to their next best alternative even if that is academic education (Dahl et al., 2023; Kreisman & Stange, 2020; LaForest, 2023).

The potential complementarities between vocational and academic education have been increasingly noted by researchers and there has been a shift towards integrating more academic content into vocational courses (i.e., hybridising upper-secondary pathways - Kang & Bishop, 1989; Mane, 1999). As with the evidence on the broader returns to vocational education, the results on combining academic and vocational education are mixed and there are only a handful of papers studying this phenomenon. Bertrand et al. (2021) look at reforms in Norway that increased the amount of general education in the vocational track. They find positive effects overall, particularly amongst disadvantaged men. Malamud & Pop-Eleches (2010) look at a Romanian reform (during the move to a market economy) where students were forced to do an additional two years of academic study before they could specialise in a vocational track. They find fewer students go into manual labour jobs and craft jobs and no effects on wages or unemployment. Oosterbeek & Webbink (2007) use a difference in differences approach to model the effects of adding an additional year of general (academic) education into vocational programmes in the Netherlands. They find no long-run employment or wage effects.

Zilic (2018) looks at a reform between 1975 and 1978 in Croatia where high school was split into two phases which increased the vocational content of academic courses and the academic content of vocational courses. They find this increases high-school dropout rates and lowers the probability of competing a university degree for males. Finally, Hall (2012, 2016) look at reforms in Sweden (in 1991) where vocational education in secondary school was changed to become more academic and reduce the disparity between the academic and vocational track. Overall, they find no effects on wages and employment but some increase in the level of upper secondary education that is completed. However, there is a negative effect for the subset of individuals that have low grades in compulsory schooling, likely because of the increase in difficulty and a rise in subsequent drop-outs.

We make three main contributions to the literature. Firstly, we add to the limited but growing literature on the returns to VET. Most of the returns to education literature focus on academic education and we add to the growing number of papers that consider the returns to VET in different contexts (Hanushek et al., 2017; Kreisman & Stange, 2020; LaForest, 2023;

Matthewes & Ventura, 2022). Second, this paper adds to the literature on the effects of combining VET with more general academic education. Again, this literature is small but has growing over recent years (Bertrand et al., 2021; Hall, 2016; Zilic, 2018). Our context means we are one of the only papers to consider post-2000 reforms of this nature. Finally, we are the first paper to analyse the causal impacts of the new T levels qualifications which make an important contribution to the literature on VET in England. This is particularly pertinent given the strong ambitions for T levels to sit alongside A levels as the set of main upper-secondary qualifications in England.

In the next section, we discuss the background and motivation for the T level reforms. We also report on the current state of the T level rollout and issues that have emerged. In section 3, we review a broader set of literature on the returns to vocational education. Next, we summarise our data and sample selection process. We then report our methods and identifying assumptions, followed by results and discussion. We conclude with conclusions and recommendations for policy.

2. Background

In the UK, low productivity, skills shortages and social mobility concerns have been key drivers of reforms to VET. Additionally, upper secondary VET has become overly complex, confusing and has been delivering sub-optimal outcomes for students (Hupkau et al., 2017; Wolf, 2011). VET also has a social esteem issue in the UK – something many countries have in common (Billett et al., 2020; Chankseliani et al., 2016; Monk, 2018; Purdy et al., 2022). To address many of these challenges, in 2016 the UK government announced a new set of reforms to upper secondary VET following the Sainsbury Review (Department for Business, Innovation and Skills, 2016). The main component of these reforms was the establishment of T levels – a new set of large two-year post-16 technical qualifications that begun their rollout in 2020.

The notion was that T levels would form one-half of the level 3 VET post-16 offering, alongside apprenticeships. Part of the reforms, controversially, involved defunding all "overlapping" level 3 qualifications (like BTECs) to ensure that T levels were the dominant level 3 VET qualification.[3] At the time of the initial Sainsbury Review, the VET education landscape was bloated, confusing and not delivering the skills society needed. There were, and

[3] Controversially because many of these "overlapping" qualifications were not that comparable to T levels in terms of size, difficulty, content and the types of students they catered for.

still are, thousands of technical qualifications to choose from, making it difficult for students to ascertain quality and make informed decisions (Department for Business, Innovation and Skills, 2016; Wolf, 2011). The complexity of the VET qualifications landscape was a primary driver behind the T level reforms and other reforms in the UK (see the Tomlinson and Wolf reports - Tomlinson, 2004; Wolf, 2011).

To illustrate the extent of the problem, we show the range of choices students and parents face using Ofqual's new VET landscape tool in Figure 1. Figure 1 includes all level 3 qualifications (regardless of size and whether they are taken by post-16 students) and demonstrates the incredible level of complexity that parents, teachers and students have to navigate. Furthermore, the large number of different qualifications make it difficult for employers to understand the level of skills and education students have developed through their educations (Wolf, 2011). Wolf (2011) also reported that a significant proportion of existing vocational qualifications left students with very limited progression routes both to further education and employment.

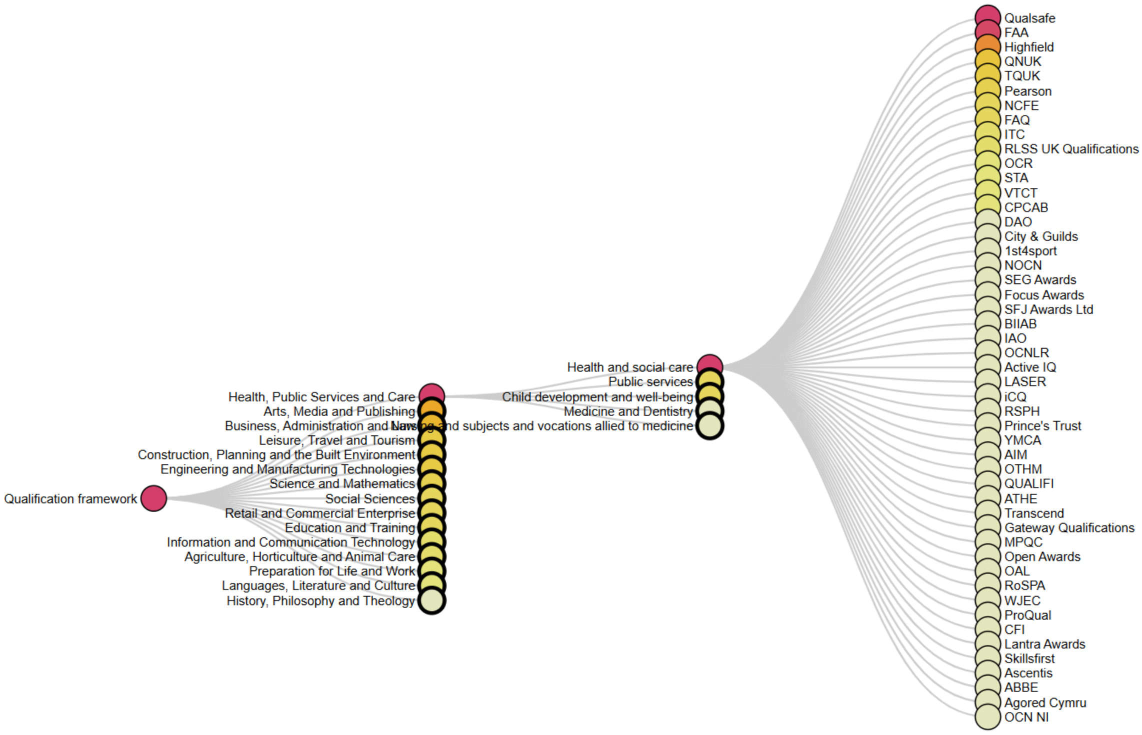

Figure 1. Extract from Ofqual's VET landscape tool (Ofqual, 2024).[4] Graph shows the number of different providers offering regulated level 3 qualifications in Health and Social Care in England.

2.1. T levels – An overview

In Figure 2, we present a broad overview of the UK qualifications landscape for post-16 learners. Currently, T levels sit alongside A levels, advanced apprenticeships and a range of other vocational qualifications. Students can progress from these qualifications to higher education, which includes university degrees, higher technical qualifications and higher-level apprenticeships. One of the rationales for the T level reforms was to strengthen the progression pathways between level 3 vocational qualifications and higher education and training, given that many existing vocational qualifications do not offer young people clear progression routes (Wolf, 2011).

[4] See https://analytics.ofqual.gov.uk/apps/VTQ/VTQLandscape/

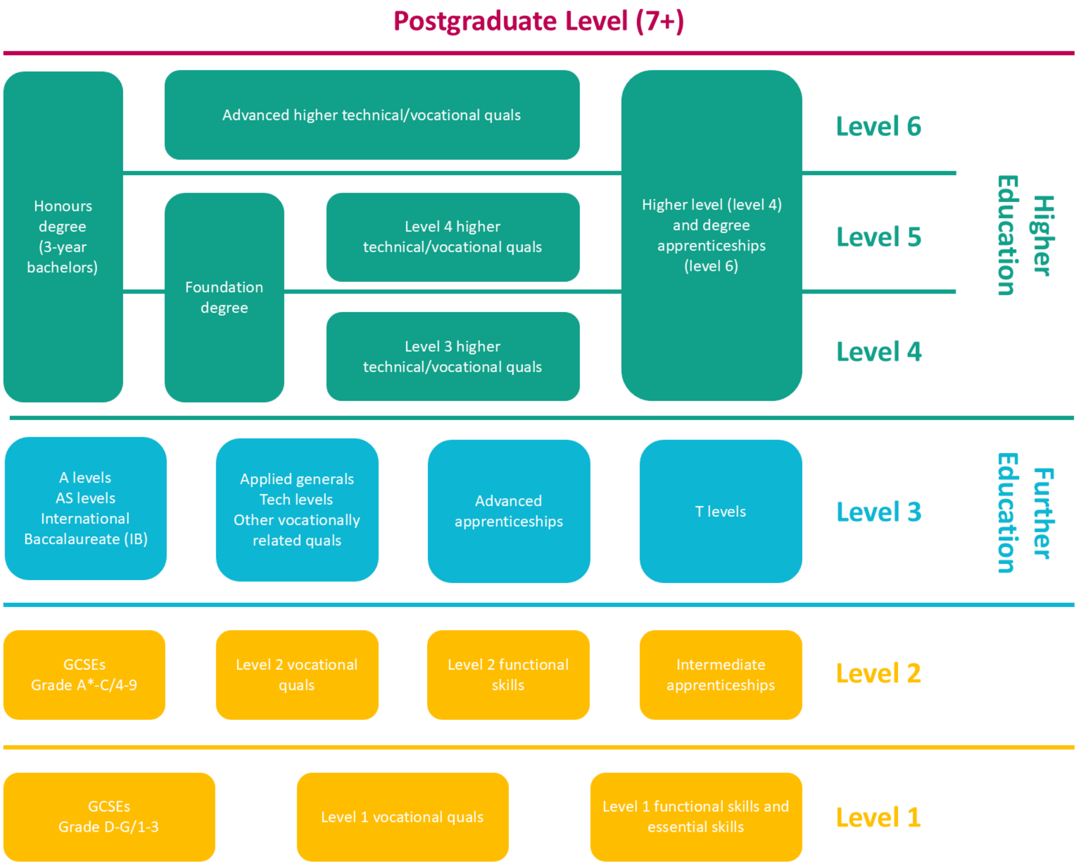

Figure 2. Qualification levels and landscape for post-16 education in England

Each T level consists of three main components – the core component, occupational specialism and industry placement. Students must complete all three components to be awarded a T level and their overall T level grade is determined by their grades in the core component and the occupational specialism (Pearson, 2024). Within each T level qualification, several occupational specialisms may exist. For example, in the Education and Early Years route, one can specialise in early years education or teaching assistance. In the Onsite Construction route, one could currently specialise in bricklaying, carpentry and joinery, painting and decorating, or in plastering. The content and structure for each T level and their occupational specialisms were co-designed with panels of relevant employers, professional bodies and providers to ensure the T level's content is relevant, high-quality and valued by industry (Department for Education, 2021). For further details on the components of the T level, see the Appendix.

2.2. State of the T level rollout

Launched in September of 2020, the T Level rollout is ongoing, with more T level routes and specialisms added each year. In 2020, there were three T levels available in Digital Production, Design and Development, Education and Early Years, and Construction and the

Built Environment (Department for Education, 2023a). As of September 2025, there were 18 T level qualifications on offer and over 50 occupational specialisms.

Around 1,300 students started a T level in September 2020 and around 25,500 started a T level in September of 2024. While this is a substantial increase in enrolments over time, T levels still represent fewer than 3% of enrolments for incoming 16-year-olds.

In terms of student characteristics, overall, there is a relatively even enrolment split across gender (Maris et al., 2024). However, there are marked differences in gender across the different pathways. For example, 95% of education and early years students were female and 92% of T level construction students were male. Most T level starters are white (81% in 2022/23), representing a lower level of diversity than both A levels and other level 3 technical qualifications (Maris et al., 2024). T levels have approximately average levels of disadvantage but currently under represent students with special education needs (SEN).

Emerging issues

There have been several issues raised before and during the T level rollout, including low levels of awareness and understanding around T levels, high drop-out rates and issues with T level content and structure, and low progression from the TLTP to T levels (Ofsted, 2023). One of the most contentious aspects of the T level reforms has been the plans to remove funding for vocational qualifications that "overlap" with T levels. A review of these issues can be found in the Appendix.

2.3. Awareness of T levels

One of the key challenges of the T level rollout has been raising awareness of T levels amongst students, parents, teachers and employers. In 2019, the year preceding the T level rollout, research showed that more than four in ten classroom teachers had never heard of T levels (Straw, 2020). Moreover, of those who had heard of T levels, the vast majority (83%) felt poorly informed or not informed at all (Straw, 2020). This fits an overall pattern of low awareness and understanding of technical and vocational education in the UK. In a large 2016 European opinion survey, the UK was the worst for awareness of vocational education and training (Cedefop, 2016).

More recently, in the Tech Ed learner survey, students *not* undertaking T levels were asked about their awareness of T levels. These are students that chose to take either A levels or other level three vocational courses. Of these students, less than 30% were aware that T levels existed (NatCen Social Research & NFER, 2023). Of the unaware students, 21% of A level students and 28% of other level three vocational learners were likely or very likely to have considered T levels over their current course of study. Moreover, most T level learners learnt about T levels through the college or provider themselves, rather than careers advisors and teachers within their secondary school (NatCen Social Research & NFER, 2023). In addition, only half of T level students' employers or institutions post T level were very or quite aware of T levels (NatCen Social Research & NFER, 2024). Given these institutions and employers selected into hiring T level students, this is likely an overestimate of the general awareness of T levels with employers and higher education institutions.

Raising awareness for new programmes and qualifications is always a challenge and this is likely exacerbated by the fact that T levels are being rolled out into a very complex and crowded technical education landscape (Department for Education & Department for Business, Innovation and Skills, 2016; Patel, 2023). Despite a relatively large advertising and marketing spend before and during the early stages of the rollout (£7 million between 2018 and 2021), initial take up of T levels was well below 1% of 16-year-olds (Patel, 2023). Recent work has also shown that uptake was significantly below the DfE's projections (National Audit Office, 2025).

3. Data

Overview

We use rich administrative data for England to estimate the causal impacts of T levels for the 2021/2022 cohort of post-16 starters. This administrative data allows us to see all aims and entries students' engage in and allows us to identify all T level students (which is important given how small the early cohorts have been).

We derive our initial population of students from the 2021 Spring School Census, filtering to students in their final year of lower secondary education (year 11). We link this data to the 2020/2021 key stage 4 (KS4) exam file to obtain information about students' performances in their high-stakes GCSE exams. Both datasets come from the National Pupil Database (NPD). We focus on the 2021/22 cohort of starters because this is the earliest cohort with complete data where we have outcomes at 18 years of age. There is one earlier cohort (the 2020/21 starters) but there were several data quality issues with the exam results for these students.[5] As such, we do not have a good record of post-16 attainment for these students and do not include them in our analyses.

We link our cohort of students to two datasets containing records of student entries for the 2021/2022 academic year. For students at school sixth forms, we use the Post-16 Learning Aims (PLAMs) dataset from the NPD. For students at further education (FE) colleges, sixth form colleges and other providers, we use the aims data from the individualised learner record (ILR). These data are used to categorise a students' initial post-16 choices. In England, students have a range of qualifications and programmes that they can enter in the post-16 phase. There are no *strictly* defined pathways for students to follow (vocational versus academic, for example) but there are some classifications provided by DfE that help sort students into unique pathways. For full details on how we classify students into pathways, please refer to Appendix A. The key point is that we only consider students' initial enrolments (provided they last longer than a week).

Outcomes

We are interested in understanding the impacts of enrolling on a T level on students' short run achievement and progression. We only look at students' initial post-16 choices (the decisions they make at the start of their post-16 education) so we can evaluate the impacts of choosing to enrol on a T level at the beginning of post-16 (rather than the impacts from enrolling at any time). This makes the analyses simpler and easier to interpret because all students are making their initial post-16 choices at the same time, and we can evaluate the impacts of T levels relative to other initial choices (regardless of the switching that may occur thereafter).

The outcomes we measure are derived from the key stage 5 (KS5) exam file and the 2022/2023 versions of the ILR and PLAMs. The outcomes we use are summarised in Table 1. Achieving a level 3 qualification (or a full level 3) is our primary outcome and is important because it is the highest level of qualification for upper secondary education, it supports progression to further study and it delivers significant economic returns on average (Dearden et al., 2002; Greenwood et al., 2007; McIntosh & Morris, 2016). Achieving a level 3 qualification was one of the key outcome measures and foci for Hupkau et al.'s (2017) paper on post-16 education choices. However, rather than focusing on the achievement of any level

[5] This was discovered when cleaning the data and was confirmed through personal communications with DfE officials.

3 qualification, we look at whether a student collectively (or through a single qualification) passes the level 3 threshold (2 A levels or equivalent).[6]

Table 1. Description of outcome variables

Outcome	Description	Age	Data source
Full level 3	Whether the student passed the equivalent of 2 or more A levels at level 3. This is typically considered a "full level 3" pass.	18	NPD (KS5 Exam File)
NET Yr 1	Is missing from education data in their first year of post-16 (after starting some course).	17	ILR (Aims) and NPD (PLAMS)
NET Yr 2	Is missing from education data in their second year of post-16 (after starting some course).	18	ILR (Aims) and NPD (PLAMS)
Apprenticeship progression Yr 3	Progresses to an advanced apprenticeship in the 2023/24 year.	19	ILR (Aims)
Higher Technical Study	Progresses to higher technical study (level 4+) in the 2023/24 year.	19	ILR (Aims)

Filtering

T levels make up a very small percentage of students in our cohort of interest (less than 1%). Therefore, it makes little sense to analyse the data for all students because there will be many with zero or near zero probability of taking a T level. Moreover, in the case of instrumental variables (IV) estimation, including these students would make our first-stage weaker and lower our precision. This arises because the standard 2-stage least squares (2SLS) IV estimate is a ratio where the first-stage coefficient is the denominator (Angrist & Pischke, 2014; Imbens & Angrist, 1994), so a small first-stage coefficient can lead to imprecision and unreasonably large LATE estimates.

Therefore, as is common in the causal inference and treatment effects literatures, we filter our sample to include control units that are most similar to T level students. In our case, for example, it would not make sense to include level 1 or level 2 learners in our T level sample because these students are studying well below the standard of a T level (which is equivalent to 3 A levels). Our sample filtering process is shown in Figure 3.[7] We exclude students from schools with less than 20 students in year 11 because we calculate school-cohort averages and

[6] We also run this analysis using 3 A levels as the threshold (which is the size of a T level) as a robustness check. Our results remain unchanged.
[7] We also show how we would filter to a sample of comparable students for the TLTP programme (which will be relevant for future research).

use these as control variables in our modelling.[8] For the T level comparator sample, we include students studying a full level 3 programme of study, excluding apprentices. We exclude apprentices because these students do not have qualifications and exams recorded in the same way as other level 3 learners.

Students in the T level comparator sample could be studying A levels, a collection of smaller vocational qualifications (BTEC certificates/diplomas), larger vocational qualifications (advanced diplomas) or a combination of the above. Moreover, because T levels are in very specific study areas, we also filter to students whose main learning aim is in one of the T level tier one subject areas.[9]

[8] 20 students is somewhat arbitrary so we test different cutoff points to ensure this step is not significantly changing our results.

[9] For the science T level, we use the tier two subject area ("Science") because the tier one subject area is too broad to be practically useful ("Science and Mathematics").

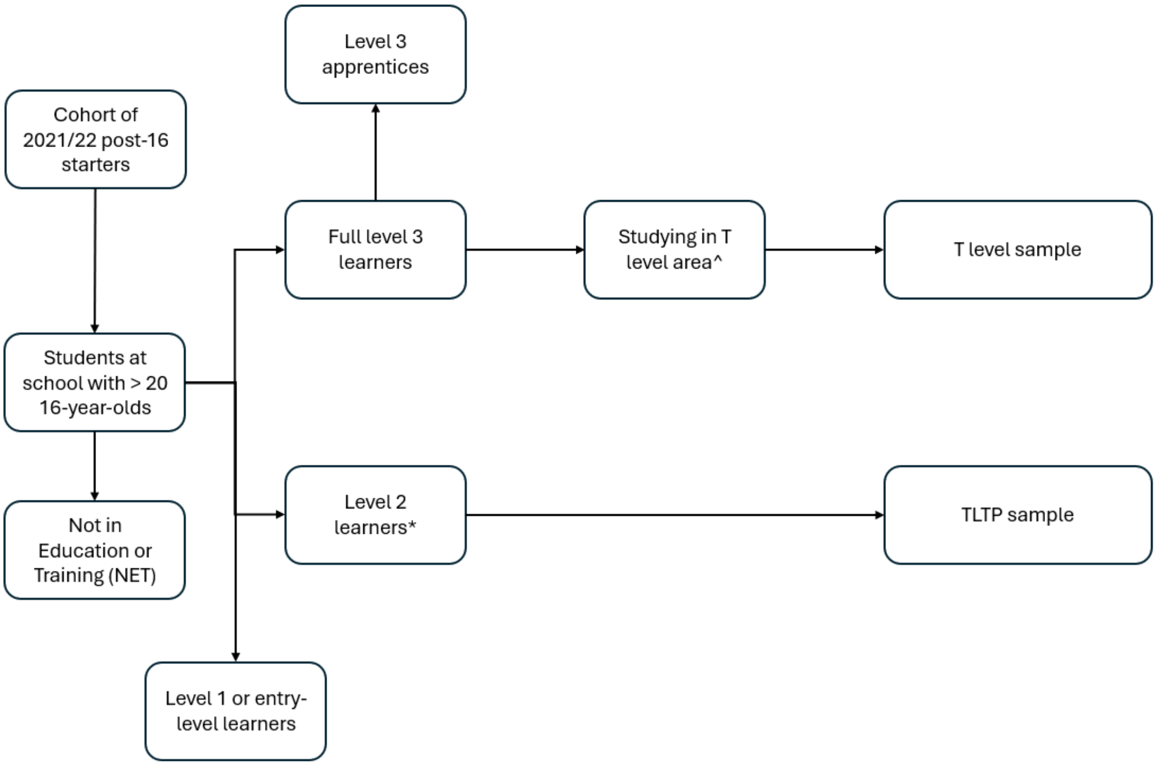

Figure 3. Sample selection diagram. * Level 2 learners can be studying for some smaller level 3 qualifications. ^ T level subject areas are based on tier one sector codes (except for the Science T level where we use the tier two code).

4. Methods

In this section, we outline our methods for estimating the causal effects of T levels on post-16 attainment and progression outcomes. We start by discussing the identification challenges we face and the variation in T level enrolment we exploit to identify the impacts of T levels. We then discuss our methods, starting with regression adjustment and propensity score matching (PSM) which rely on an exogeneity assumption conditional on observables. We then describe our instrumental variables method which relaxes this assumption and identifies the local average treatment effects assuming our instrument is relevant and valid.

4.1. Identification

To identify the causal impacts of T levels, we will use two types of approaches. The first uses regression adjustment and propensity score matching (PSM) and the second approach uses instrumental variables (IV) methods. These two sets of methods rely on different assumptions and identify different treatment effects when these assumptions are satisfied.

Regression adjustment and PSM are both covariate adjustment methods that rely on the assumption that treatment assignment (taking a T level) can be treated as independent of outcomes, conditional on our set of control variables. PSM methods also remove or down-weight observations that are not very similar to the treated units (are outside the region of common support) and they can be combined with outcome regression models to produce doubly robust estimates of parameters (Abadie & Imbens, 2006; Funk et al., 2011). These covariate adjustment methods enable researchers to identify average treatment effects (ATEs) or average treatment effects for the treated (ATTs) in the sample of interest.

IV, on the other hand, requires a conditionally exogenous instrument for the treatment (T level enrolment). It does not require that the treatment itself is conditionally independent of outcomes. Instead, it relies on the assumption that one can find a relevant instrument that has no direct or indirect effect on the outcome (conditional on covariates) except through its influence on the treatment (Angrist et al., 1996). Researchers can then use the instrument as an exogenous source of variation in treatment probability and estimate treatment effects for a sub-group of the population (the compliers). This type of treatment effect is called a local average treatment effect (LATE) and is a treatment effects for marginal students that are shifted into (or out of) treatment by the instrument. This means that, while the methods are often used in place of one another, they can often provide complementary information and be combined to give a better understanding of the effects of an intervention (Matthay et al., 2020).

We argue that the assumptions for both sets of methods can be reasonably satisfied in the context of the T level rollout. As we will show, the coefficients are similar across the methods, further supporting this assertion. We exploit our knowledge of the T level rollout and argue that certain features of the rollout provide plausibly exogenous variation in the likelihood of taking a T level. The primary source of this variation is awareness of the new T level qualifications. As we discussed in Section 2.3, the awareness of T levels was, and still is, patchy and low overall. These are new qualifications that are entering a saturated post-16 qualifications market and their uptake has been slower than expected (Patel, 2023). More broadly, the awareness of post-16 choices and access to comprehensive careers and qualifications advice varies considerably from school to school and student to student in the UK. This has led to recent reforms of careers guidance, including the establishment of the Gatsby benchmarks, careers hubs and the introduction of the Baker clause (Hochlaf & Dromey, 2019; Social Mobility Commission, 2021). Despite progress, careers education remains patchy and inadequate, partially stemming from funding issues (Whittaker, 2023). While some of this variation in careers advice and exposure can be explained by school characteristics (for example, the amount of funding a school receives or the average level of deprivation), there is still likely to be considerable levels of randomness in the advice and exposure to post-16 routes that students receive. This also generates a degree of random exposure to T levels. This type of random variation has also been exploited by previous researchers, including Cavaglia et al. (2020) who use this variation to provide support for their IV analysis of the impacts of apprenticeships in England.

This random variation in the awareness of T levels is important for both sets of modelling approaches. Firstly, it strengthens the plausibility of our assumption of conditional exogeneity for our regression adjustment and PSM matching approaches. This is because if we are confident that we can control for the systematic school-level and individual characteristics that determine awareness of and selection into T levels, the remaining variation in T level treatment propensity should be due to random differences in exposure to T level information through school (and is thus conditionally exogenous).

This quasi-random variation also provides support for our instrument (as we will discuss below). This is because sets of peers at certain schools will receive quasi-random information shocks and we can utilise this in a peers instrument (a measure of exposure to peers who take T levels and have knowledge of T levels).

In the following sections, we discuss out two sets of methods in more detail.

4.2. Regression adjustment

We start by estimating a series of OLS regression models, regressing our post-16 outcomes in Table 1 on a T level treatment indicator. We include a full set of demographic, attainment, school-level and area controls to account for a comprehensive range of factors that might influence post-16 outcomes.

Our demographic controls include disadvantage status (eligible for free school meals at any point in the past six years), ethnicity, sex, English as an additional language (EAL) status and special educational needs (SEN) status. Our attainment controls include the students' Attainment 8 score (for their GCSEs) and their performance on GCSE English and maths. Our school-level controls include school-level averages of disadvantage status, Income Deprivation Affecting Children Index (IDACI) scores, Attainment 8 scores, SEN status, EAL status, ethnicity and the proportion of students taking A levels in the following year.[10] We also include the size of the cohort and school and the sex type of the school (male, female or mixed). Finally, our area-based controls include local authority (LA) fixed effects and IDACI scores. In our outcome models, we also control for the type of post-16 institution students attended (sixth form college, school sixth form or further education college).

The basic model we estimate is:

$$Y_{ikg} = \alpha_g + \theta D_i + \boldsymbol{X_i \delta} + \boldsymbol{S_k \eta} + \varepsilon_i \qquad (1)$$

where Y_{ikg} is the outcome for individual i at school k in LA g, α_g are the LA fixed effects, D_i is a T level (or TLTP) treatment indicator, $\boldsymbol{X_i}$ is a vector of individual level demographic and attainment controls, $\boldsymbol{S_k}$ is a vector of school-level controls and ε_i is an idiosyncratic error term.

Assuming T level assignment is conditionally exogenous ($Y_i \perp D_i | \alpha_g, \boldsymbol{X_i}, \boldsymbol{S_k}$), θ represents the causal effect of enrolling on T levels on outcome Y. In our context, this is plausible given the range of characteristics we can account for and the patchiness of the T level rollout and T level awareness (as we discuss in the previous section). We also extend this model to include both Lower layer Super Output Area (LSOA) fixed effects and school fixed effects such that we are comparing students within the same school in the same home LSOA with similar characteristics and prior attainment.[11] Finally, we run a set of models that include the different T level pathways as separate treatment variables (Health and Science, Construction, Digital and Education and Early Years). For the coefficients on these variables to have a causal interpretation, the conditional exogeneity assumption must be satisfied for each T level pathway:

$$Y_i \perp D_{ij} | \alpha_g, \boldsymbol{X_i}, \boldsymbol{S_k} \; where \; D_{ij} = 1 \; when \; pathway = j \; and \; 0 \; otherwise$$

Our previous model hinges on the assumption that we can treat enrolling on T levels as exogenous conditional on observables. This means that if we have two students living in the same area with very similar prior attainment, demographics and school characteristics, the likelihood of these two students taking T levels is as good as random. Given the patchiness of careers advice, the low awareness of T levels and the fact that T levels are a brand new qualification, this is not an unreasonable assumption. In particular, because T levels are new

[10] This excludes the individual student themselves.

[11] The results are similar using different combinations of fixed effects. For brevity, these results are not presented in this paper but are available upon request.

and there is sizeable uncertainty around how “good” these qualifications are and how they will be perceived by employers, it is less likely there will be issues of self-selection on outcomes (Roy-style selection; Roy, 1951) or treatment effects (Ashenfelter & Card, 1985).

To add further credibility to our estimates, we use PSM methods which we discuss next.

4.3. Propensity score matching

As discussed earlier, using PSM to estimate causal effects relies on the assumption of exogeneity conditional on *observables*. If this assumption is satisfied, we can recover the average treatment effects (ATEs) of T levels.

We use generalised full matching to estimate our weights which is a generalised version of optimal full matching designed for large sample sizes (Greifer, 2023; Hansen, 2004; Sävje et al., 2021). Full matching is a form of PSM that is less sensitive to the form of the propensity score model and is more flexible than other common approaches (like nearest neighbour matching) (Austin & Stuart, 2015). The *generalized* component of generalized full matching trades off optimality with computational efficiency which is useful when dealing with large sample sizes. However, as Sävje et al. (2021) show, generalized full matching consistently produces near-optimal matches and achieves good balance between the treatment and control groups.

The variables we use for matching are the same as the covariates used in our outcome regression models. The one difference is that we exclude the post-16 institution type because that is endogenous to the choice of T levels (most T levels are offered at further education colleges). We also do not match on geography to allow T level students to match to similar students in areas where T levels may not be available.

We run our PSM models on two sub-samples of control units – those taking an academic (mostly A levels) route or those taking a vocational route. This allows us to compare T level students overall to a control group of similar-looking academic learners and similar-looking vocational learners. This is a useful and pertinent comparison because most T level students were re-directed from one of these two pathways *and* we might expect the treatment effects to differ based on the students’ counterfactual (what they would have studied in the absence of treatment).

After running our matching model, we assess for balance by examining the standardized mean differences in all our control variables between the control and treatment groups. If these differences are less than 0.1 SDs, we are satisfied we have achieved good balance (0.1 SDs is a commonly used threshold in the PSM literature - Austin, 2011). We then combine our original outcome regression model in Equation 1 with our matching weights w_i such that the new assumption we need to satisfy is $Y_i \perp D_i | \alpha_g, \boldsymbol{X_i}, \boldsymbol{S_k}, w_i$. This is a doubly robust approach in the sense that either the weighting model or the outcome model needs to be correctly specified. If one of these are correct, you recover consistent estimates of the ATEs (Abadie & Imbens, 2006; Ho et al., 2007).

4.4. Instrumental variables (IV)

Now we turn to our IV methods. Provided we have one or more valid instrument(s) (i.e., a variable that affects uptake of T levels without directly affecting our outcomes of interest), we can use instrumental variables (IV) estimation to recover the unbiased causal effects of taking T levels on the compliers (those who are affected by the instrument).

The causal effect can be recovered via two stage least squares regression as follows:

$$D_i = \alpha_1 + \beta_1 Z_i + \boldsymbol{X_i \delta_1} + \varepsilon_i \quad (2)$$

$$Y_i = \alpha_2 + \beta_2 \widehat{D_i} + \boldsymbol{X_i \delta_2} + \epsilon_i \quad (3)$$

In the first stage, taking a T level (the treatment, D_i) is regressed on the instrument Z_i and a vector of control variables $\boldsymbol{X_i}$. In the second stage, the outcome variable of interest Y_i is regressed on predicted treatment from the first stage $\widehat{D_i}$ and the vector of controls $\boldsymbol{X_i}$. In this setting, β_2 recovers the local average treatment effect (LATE) of T levels.

An instrument must meet two main criteria to be valid – relevance and exclusion (exclusion restriction).[12] Relevance states that the instrument must have some impact on the probability of treatment and this can be tested in the first stage by evaluating whether $\beta_1 \neq 0$ in Equation 2. The exclusion restriction states that the instrument must only affect outcome Y_i through the treatment variable, conditional on $\boldsymbol{X_i}$. That is, there are no omitted factors that the instrument affects that also impacts on the outcome. Moreover, there is no direct effect of the instrument on the outcome. The exclusion restriction cannot be explicitly tested and instead we must assess the plausibility of the assumption based on our understanding of theory and the local context.

The results are similar using different combinations of fixed effects. For brevity, these results are not presented in this paper but are available upon request.
ause both the instrument and outcome and that there are no defiers (Angrist & Pischke, 2014).

Proportion of peers taking T levels instrument

The instrument we use is the proportion of students in the same cohort c at the same school s who take a T level Z_{Pi}. This instrument is based on peer choice and follows the general logic and approach of several other recent papers in the literature (Battiston et al., 2020; Birkelund & van de Werfhorst, 2022; Cavaglia et al., 2020; Mora et al., 2024; Oswald-Egg & Renold, 2021).

Mora et al. (2024) use the proportion of students who take the dual VET route at schools within 5 km from the student as an instrument for taking the dual VET route in Spain. Oswald-Egg & Renold (2021) use regional enrolment rates in the dual VET pathway as an instrument for taking the dual VET pathway in Switzerland. Battiston et al. (2020) uses a peers-of-peers instrument for post-16 choice in the UK. Birkelund & van de Werfhorst (2022) use between-cohort variation in the proportion of peers at school choosing the academic and vocational track in Denmark. Perhaps most closely related to our paper (in instrument and context) is Cavaglia et al. (2020) who use between-cohort variation in the proportion of peers at school who enrol in apprenticeships.

Like Cavaglia et al. (2020), our instrument Z_{Pi} is calculated such that the student i in question is removed from the calculation:

$$Z_{Pi} = \frac{T\ level\ students_{cs} - 1}{Total\ students_{cs} - 1}$$

Z_{Pi} must affect student i's decision to enrol on a T level to be a relevant instrument and Z_{Pi} must be conditionally independent of outcomes to satisfy the exclusion restriction.

Relevance

The relevance of this instrument is straightforward to establish. Student's decisions are influenced by what their peers do (Hoxby, 2000; Sacerdote, 2011). There is a wide literature on the impact of peers on choice and two of the more prominent mechanisms driving these effects are the provision of information (social learning) and social norms (see Bursztyn et al., 2014). In our case, the information channel is likely to be the most important factor for driving T level choice. This is due to how new and relatively uncommon T levels are and the patchy awareness surrounding T levels. This is similar to the argument made by Cavaglia et al. (2020) who use a peers instrument to examine the effects of apprenticeships in the UK.

In our case, the relevance of the instrument is even stronger because T levels are a new qualification while apprenticeships were already established. If students are at a school with more of their peers apply for T levels, they are more likely to be aware of T levels and thus more likely to enrol themselves. This could be because the school as a whole has received more exposure to colleges offering T levels (through careers event, for example). On that basis, the instrument should satisfy the relevance assumption.

There is a critical point to make here about the influence of peers' choices on individual i's choice to take a T level. We are assuming that the correlation between peers' choices and individual i's choice is driven by common information shocks at the school (or local area) level rather than through direct information sharing. This is supported by the research showing that most students found out about T levels through their school or colleges directly and very few received information from friends and family (NatCen Social Research & NFER, 2023). Therefore, our argument is that peers' choices is not the instrument per se, but it is a proxy for the unobserved information shock at the school level (see the left panel of Figure 4).

This type of approach is described by Sundquist (2021) and overcomes one of the usual critiques of peer instruments – the simultaneity between student i's choice and their peers' choice. As a robustness check, we also compute an instrument based on students in the cohort before student i (see the right panel of Figure 4). This reduces concerns around simultaneity because student i's choice is made a year later than the previous cohort but is not our preferred approach because the previous cohort of T level students is very small and we lose precision.

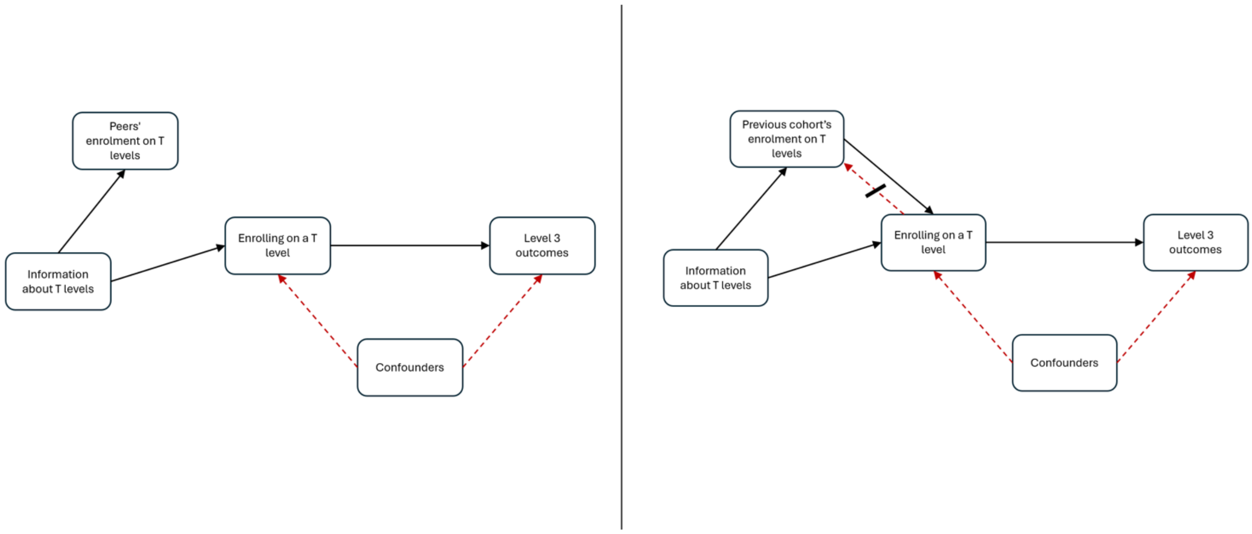

Figure 4. Directed acyclic graphs showing the basic relationships between our instrument, treatment and outcomes. The left panel assumes peers' decisions are related to the individual's choice *only* through a common information shock. The right panel relaxes this and allows peers' to affect the individual directly.

Exclusion restriction

Next, we need to assess the plausibility of the exclusion restriction. The exclusion restriction states that the only way the proportion of students taking T levels influences later attainment is through increasing the likelihood of taking T levels. It seems plausible that the enrolment of peers on T levels itself does not directly affect individual i's post-16 attainment and progression. However, there could be omitted factors that are associated with both the instrument and our outcome variables that would violate the exclusion restriction. For example, some schools that send more students onto T levels may have more vocationally oriented students in general and this influences student i's plans for further education. Likewise, schools sending more students down a vocational path may be weaker academically and this generates peer effects that reduce future attainment (Sacerdote, 2011) but has nothing to do with T levels. Alternatively, schools sending more students to T levels could be in more or less deprived areas which in turn affects future outcomes.

To deal with these concerns, we include a comprehensive set of controls that account for school-level characteristics, neighbourhood characteristics and student-level characteristics. The school-level characteristics include both a measure of average student performance and the average proportion of students that take the academic route, among other variables (like school size – see Section 5.1 for the full list of controls). Consequently, the residual variation we exploit is variation in the proportion of peers doing T levels between similar students who attend schools with similar peers and live in similar neighbourhoods. Our LATE will be for students with similar prior attainment, at similar schools in similar areas that are shifted into (or out of) taking T levels based on the visibility of the T level pathway at school.

5. Results and Discussion

5.1. Summary statistics

In Table 2 we report the summary statistics for our control variables and in Table 3 we summarise our outcome variables.

The results show that the academic sample of students have higher prior attainment, are less likely to be disadvantaged and are less likely to have SEN than all three other groups. These trends are very similar to those observed in other studies of level 3 learners in the UK (Hupkau et al., 2017). Academic learners are also at lower secondary schools with higher prior attainment, lower levels of disadvantage and lower rates of SEN. Academic learners are most likely to be at a school sixth form (73%) rather than a sixth form college (20%) or FE college (7%). For level 3 vocational learners, school sixth forms are still the most common destination, followed by sixth form colleges.[13] Almost all T level students study at FE colleges (this is where most of the T level provision happens).

T level students are broadly similar to students in the vocational groups, particularly the Level 3 mixed cohort (which are students studying a blend of academic and vocational courses). However, this cohort of T level students are less likely to be female, less likely to have EAL and less likely to be non-white. This suggests that amongst level 3 learners studying in T level areas, T levels are one of the least diverse pathways.

[13] The relatively high proportion of level 3 vocational learners at school sixth forms is in-part due to the T level subject area filters we apply. These filters include: Health, Public Services and Care (1), Science (2.1), Construction, Planning and the Built Environment (5), Information and Communication Technology (6) and Education and Training (13).

Table 2. Summary statistics for level 3 learners (demographics and prior attainment)

Group	Academic		Level 3 Mixed		Level 3 Vocational		T level	
Sample size	77,583 (74%)		10,031 (10%)		14,111 (14%)		3,729 (4%)	
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Demographics and attainment								
Att8 score	70	12	53	9.9	47	9.5	53	10
IDACI score	0.15	0.11	0.19	0.12	0.21	0.12	0.18	0.12
Disadvantaged	15%		25%		32%		24%	
Female	57%		65%		64%		57%	
English score	6.6	1.4	5.2	1.2	4.7	1.2	5.2	1.2
Maths score	6.9	1.5	5	1.2	4.4	1.2	5.1	1.2
EAL	23%		23%		26%		11%	
Non white	37%		35%		39%		16%	
SEN	5%		8%		12%		9%	
Rural	16%		12%		11%		18%	
School averages								
IDACI score	16%		19%		20%		18%	
Disadvantaged	22%		27%		30%		26%	
SEN	12%		14%		14%		14%	
EAL	19%		20%		24%		13%	
NET	7%		8%		8%		8%	
Boys school	6%		2%		3%		1%	
Girls school	11%		7%		8%		3%	
Mixed school	83%		91%		89%		96%	
Att8 score	55	9.5	50	6.3	50	6.6	50	6.3
Number of pupils	1209	383	1186	393	1153	410	1101	381
Cohort size	200	62	201	63	196	64	196	64
Proportion academic	51%		39%		37%		36%	
Someone attends T levs	42%		45%		45%		87%	
Prop attending T levs	1%		1%		1%		2%	
Destination								
FE college	7%		6%		25%		88%	
School sixth form	73%		69%		47%		3%	
Sixth form college	20%		25%		28%		10%	

The outcome summary statistics in Table 3 show that academic learners are less likely to go missing from education, more likely to pass a full level 3 and the least likely to progress to an advanced apprenticeship at the age of 19. T level students appear less likely to achieve a full level 3, more likely to go NET than academic and mixed learners and more likely to progress to an advanced apprenticeship or higher technical study at the age of 19. We can see that of 3,729 16-year-olds who started a T level at the beginning of 2021/2022, less than half had achieved a T level by the time they were 18.

Table 3. Outcome summary statistics

Group	Academic		Level 3 Mixed		Level 3 Vocational		T level	
Sample size	77,583 (74%)		10,031 (10%)		14,111 (13%)		3,729 (4%)	
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Full level 3	88%	-	78%	-	72%	-	44%	-
Pass 3 A levs eq.	81%	-	65%	-	64%	-	43%	-
Total size passed (A lev eq.)	2.9	0.75	2.6	0.94	2.5	1	2	1.1
NET yr 1	1%	-	2%	-	3%	-	3%	-
NET yr 2	4%	-	10%	-	12%	-	12%	-
Prog. to Advanced Appr.	3%	-	5%	-	5%	-	9%	-
Prog. to Higher Tech. study	2%		1%		1%		5%	
Passed full T level	-	-	-	-	-	-	40%	-
Passed T level core	-	-	-	-	-	-	47%	-
Passed T level occ.	-	-	-	-	-	-	62%	-

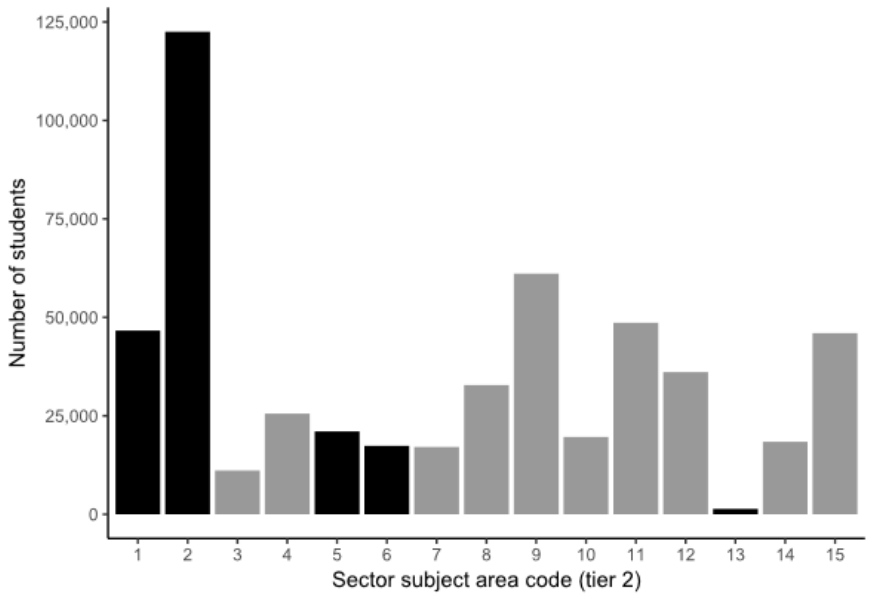

Figure 5. Tier 1 sector subject area enrolments (highlighted codes are T level subjects). The highlighted columns are T level areas. The highlighted columns correspond to: Health, Public Services and Care (1), Science and Mathematics (2), Construction, Planning and the Built Environment (5), Information and Communication Technology (6) and Education and Training (13).

5.2. PSM balance

For our PSM methods, we show balance statistics pre and post weighting in Figure 6. The results show that our weights from generalised full matching achieve good balance in all our covariates across the treatment and control groups. We can see that, for example, Attainment 8, KS4 English and KS4 maths scores (prior attainment) are all higher in the control group initially. However, after weighting, these differences fall very to close to zero. This is important because it shows we have achieved good balance in observables between our control and treatment groups and can make more valid comparisons between the two. We also find strong balance after our matching in the vocational only and academic only sub-samples. For brevity, the balance plots for these analyses are reported in Appendix C.

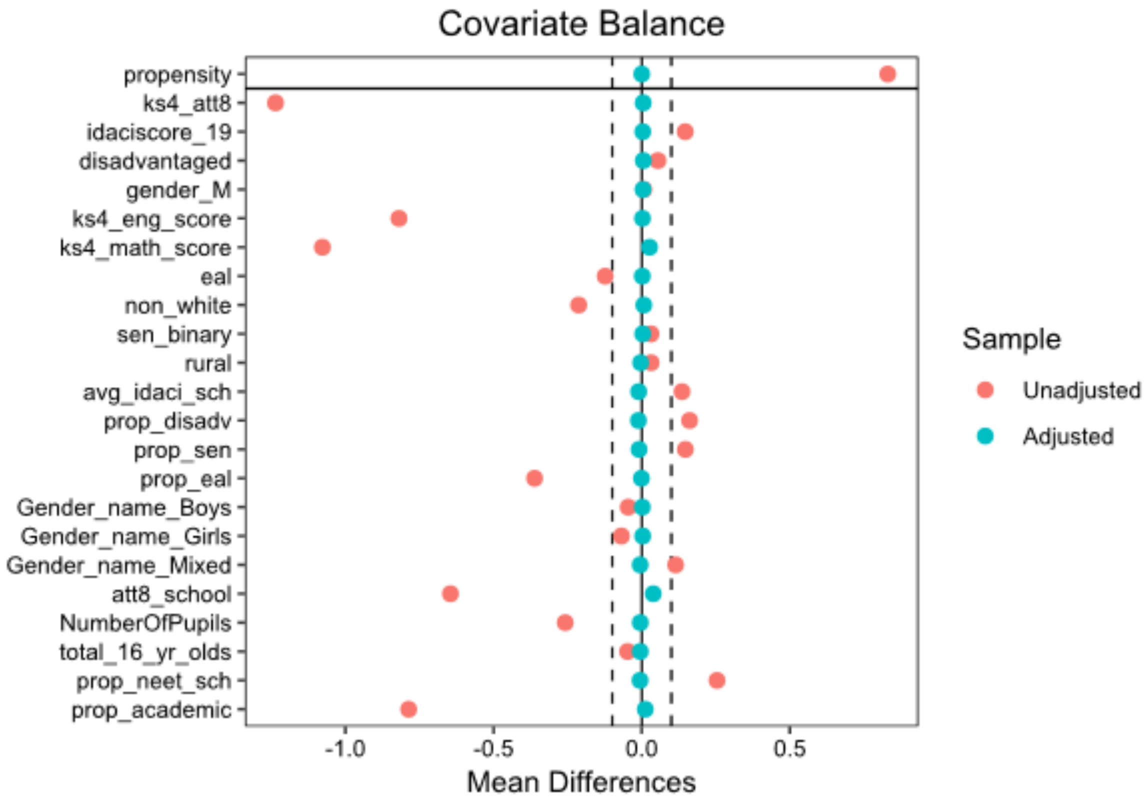

Figure 6. Balancing output for PSM. The differences are standardized mean differences with the 0.1 SD threshold delineated with dashed lines. The variables are described in the methods sections. Names starting with "prop" represent school-level averages, as do variables with "sch" or "school" in their names. gender_M is a binary variable for if the student was a male, ks4_att8 is Attainment 8 score and idaciscore_19 is the IDACI score for the student's neighbourhood.

5.3. Instrument relevance

We find strong support for the relevance of our peers' instrument. The first stage F statistic is very large (F stat >>> 10) and we show the correlation between our instrument and treatment probability using a logit function in Figure 7. As the proportion of peers enrolling on T levels rises, students are more likely to select into T levels themselves. The average treatment probability in our sample is 3.53% and the average proportion of peers taking T levels is 0.67%. The logistic function reaches a predicted probability of 1 for T level enrolment before the instrument reaches 15% of classmates taking T levels (showing that the distribution for our instrument is right skewed and clustered around zero). As discussed earlier, the mechanism through which our peers instrument affects T level enrolment is likely through a common information or awareness channel. Social norms are less likely to play a role here because T levels are new and an uncommon choice across 16-year-olds.

It is worth noting that our IV approach will estimate a LATE for those who comply with our instrument. The LATE will not capture the effects of T levels on students who would always take T levels (even when the number of peers taking T levels is zero) or the effects on students who would never take T levels (these are called always-takers and never-takers). Rather, our IV approach will capture the impact of T levels on students at the margin of taking or not taking a T level. This is different to our PSM methods which, assuming conditional exogeneity, will identify a weighted average treatment effect of T levels for the entire sample.

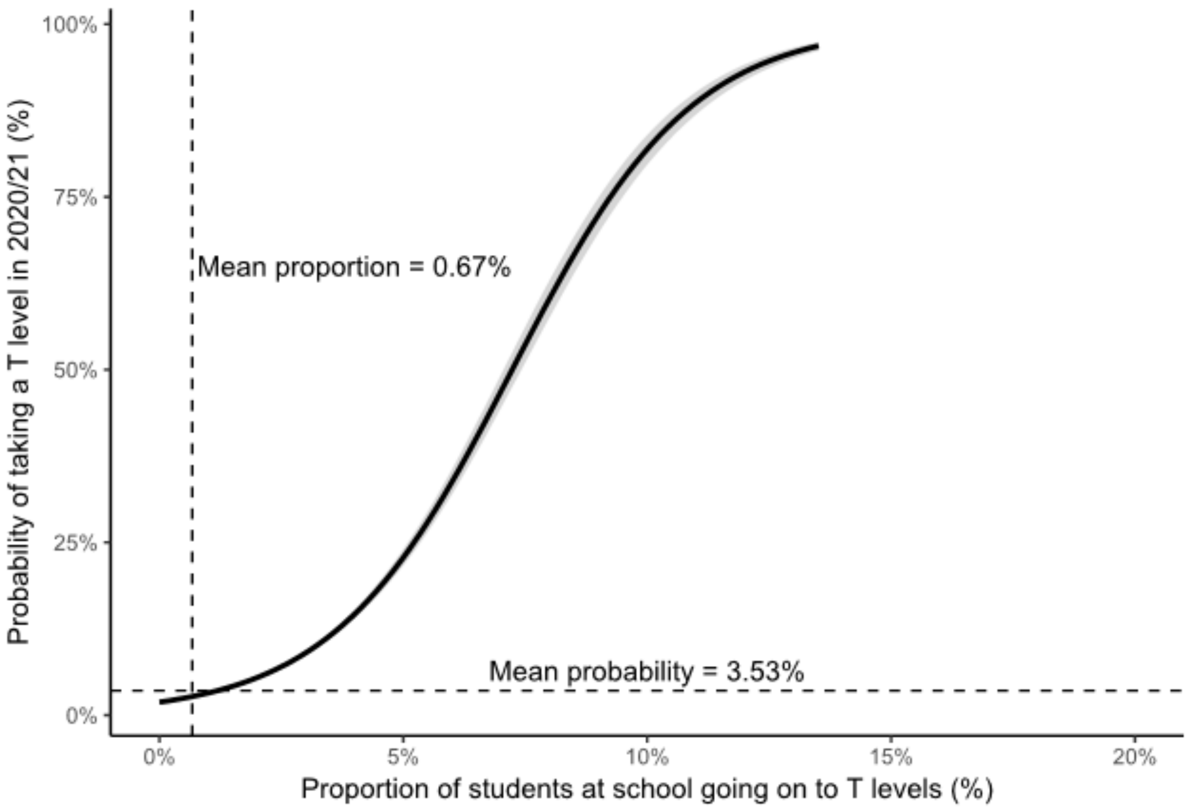

Figure 7. Smoothed predicted likelihood of taking T levels based on proportion of peers doing T levels (basic logistic function).

5.4. Main results

Our main results are summarised in Table 4. The first row contains the results from our OLS models with full controls, the following three rows contain the PSM results using OLS to further adjust for observables and the final row contains our IV modelling results. Also, in Table 6, we show the weighted differences in outcome variables between treated students and each of the weighted control groups from the PSM analysis. The overall group contains all level 3 students (vocational or academic) that are studying in similar areas to T levels while the academic and vocational groups only include their respective subset of students. This complements Table 4 by showing the average absolute values of the outcomes variables for each group rather than the ATE only.

We find that T level students are significantly less likely to achieve a full level 3 (2 A levels or equivalent) by the age of 18 than comparable students. Our standard OLS estimates show that T level students are 23 percentage points less likely to pass a full level level 3 than similar level 3 students studying in similar areas. This negative effect is more pronounced when comparing T level students to similar vocational learners. On the other hand, the effect is smaller when comparing T level students to similar academic students (T level students are 11 percentage points less likely to achieve a full level 3). Our IV estimates are larger than the OLS and PSM estimates with the marginal T level student 30 percentage points less likely to pass a full level 3. This suggests that the negative impacts on level 3 attainment are greater for students at the margin of enrolling on T levels. Moreover, A level students matched to T level learners perform worse than level 3 vocational learners that are matched to T level learners (see Figure 6).

Table 4. OLS, PSM and IV results

	Full level 3	NET yr 1	NET yr 2	Advanced Apprenticeship	Higher Tech. study
OLS	−0.231***	−0.003	0.008	0.043***	0.036***
	(0.009)	(0.003)	(0.006)	(0.005)	(0.004)
PSM All	−0.215***	−0.010**	−0.005	0.040***	0.036***
	(0.011)	(0.005)	(0.008)	(0.007)	(0.004)
PSM Acad.	−0.111***	−0.032***	−0.040**	0.038***	0.044***
	(0.017)	(0.010)	(0.016)	(0.010)	(0.004)
PSM Voc.	−0.249***	−0.002	0.001	0.032***	0.022***
	(0.013)	(0.005)	(0.009)	(0.008)	(0.006)
IV 2SLS	−0.299***	−0.033	0.039	0.004	0.040*
	(0.064)	(0.023)	(0.044)	(0.036)	(0.024)

*Note: Robust standard errors in parentheses. All models include a full set of demographic, attainment, school-level and area controls. * p < 0.1, ** p < 0.05, *** p < 0.01*

Table 5. PSM weighting results - basic differences

		Weighted control groups		
Variable	T level	Overall	Academic	Vocational
Unweighted N	3,635	100,308	76,584	23,725
Full level 3	44%	71%***	65%***	74%***
NET yr2	13%	12%	13%	12%
NET yr1	3%	3%	4%	3%
Advanced Appr.	9%	5%***	5%***	6%***
Higher Tech. study	5%	1%***	1%***	2%***

*Note: All means are weighted. Differences are tested using an F-test with respect to the T level group. * p < 0.1, ** p < 0.05, *** p < 0.01*

On a more positive note, T level students are slightly less likely to going missing from education and training (NET) in their first year and this difference is driven by comparisons with similar academic learners. T level students are around 4% more likely to move onto a higher apprenticeship by the age of 19 and 4% more likely to progress to higher technical study. However, most of these impacts are insignificant in our IV models (except for progressing to higher technical study) showing marginal T level students are no less likely to go NET or more likely to move on to an advanced apprenticeship.

5.5. Matched destinations

In Table 6, we show the destinations of the learners in our overall sample who are matched to our T level students. This table gives an insight into what programmes and places

T level students may have studied in the absence of the T level rollout. The majority of control students come from a school sixth form (58%) or sixth form college (25%). Very few are from an FE college (17%) despite this being the dominant institution type for T levels (87%). This is likely to be because many of the T level subjects (like health and science) are predominantly provided for by sixth form colleges and school sixth forms.

Table 6 also demonstrates that around half of the control students were taking A levels and half were taking vocational or mixed courses. This suggests that T levels have been able to attract students from different post-16 pathways. In particular, T levels appear to have diverted some students from the academic track into the vocational track. This is suggestive evidence that T levels may be increasing the attractiveness and esteem of the vocational track, one of the primary goals of T levels (Department for Business, Innovation and Skills, 2016).

Table 6. Post-16 destinations for matched learners

	Control (weighted)			Treated	
Variable	N	Mean	Mean (Wtd.)	N	Percent
Destination					
FE college	8,118	9%	17%	2,567	87%
School sixth form	64,362	70%	58%	92	3%
Sixth form college	19,366	21%	25%	279	9%
Study group					
Academic	71,800	78%	50%	-	-
Level 3 Mixed	8,734	10%	18%	-	-
Level 3 Vocational	11,312	12%	31%	-	-
Total	91,846		-	2,938	-

*Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$*

5.6. OLS results by pathway

Next, we explore our results further by presenting OLS regression output where the treatment variable is interacted with a set of pathway dummy variables (Table 7). Assuming conditional exogeneity (see section 5.1), the coefficients represent the impacts of each T level pathway on our set of post-16 outcomes. We find suggestive evidence that the negative impacts of T levels appear to be concentrated particularly in the Education and Ealy Years pathway and the Health and Science pathway. Moreover, the Digital pathway tends to show positive results overall for T level students.

The Education and Early Years T level students are 53 percentage points less likely to pass a full level 3 compared to similar students and Health and Science students are 20 percentage points less likely. There are still negative impacts overall for Construction (8 percentage points less likely to pass a full level 3) but there are no significant impacts for the Digital pathway. Likewise, the Education and Early Years pathway is the only pathway where T level students earn fewer post-16 points than other similar level 3 learners.

The reductions in students going NET in year 1 appear to be driven by the Digital and Health and Science pathways. However, in year 2, Health and Science students are the only group more likely to go NET than other similar students, completely erasing any earlier reductions in NET. The increase in advanced apprenticeship enrolments and progression to higher technical study is driven by the Construction and Digital pathways

Overall, these results show there is considerable heterogeneity by pathway, indicating that some pathways have done better than others in the early stages of the T level rollout.

Table 7. OLS results with pathway interactions

	Full level 3	NET yr 1	NET yr 2	Advanced Apprenticeship	Higher Tech. study
Health and	−0.195***	−0.016***	0.023**	0.003	−0.002
Science	(0.015)	(0.005)	(0.011)	(0.007)	(0.003)
Construction	−0.077***	0.007	−0.002	0.157***	0.104***
	(0.018)	(0.008)	(0.012)	(0.015)	(0.012)
Digital	−0.021	−0.014***	−0.013	0.056***	0.085***
	(0.017)	(0.005)	(0.011)	(0.012)	(0.011)
Education and	−0.530***	0.012	0.015	−0.004	−0.008***
Early Years	(0.012)	(0.007)	(0.011)	(0.007)	(0.002)

*Note: Robust standard errors in parentheses. All models include a full set of demographic, attainment, school-level and area controls. * p < 0.1, ** p < 0.05, *** p < 0.01*

5.7. Matching outcomes by drop-out status

Finally, we are interested in the extent to which our negative results for level 3 attainment are driven by T level students who drop out within their first year of study. In Table 8, we show our PSM results when we subset to students that drop their initial aim. Again, we achieve good balance on all covariates and Table 8 shows the weighted differences between our balanced treatment and control groups. The left-hand side of Table 8 shows the outcomes for students who did not drop their main study aim. Likewise, the right-hand side shows the outcomes for students that did drop their main aim.

We find that there are still negative associations between T level enrolment and post-16 outcomes, even after sub-setting to students that did and did not drop their first aim. For instance, we find that 54% of T level students who remain on their initial aim in year 1 achieve a full level 3 by 18. In contrast, 87% of other learners who remain on their initial aim achieve a full level 3 by 18. This could mean more T level students drop out of their programme during the second year (rather than their first) or T levels take longer than expected for a significant group of students (likely due to failing to pass one or more of the components of a T level).

Table 8. Matched outcomes for students that did and did not drop their main study aim in year 1.

	Did not drop aim			Dropped aim		
	T levels	Control	Diff	T levels	Control	Diff
N	83,967	27,779	-	856	16,341	-
Full level 3	54%	87%	-33%***	12%	25%	-13%***
NET yr2	5%	4%	1%***	36%	34%	2%
NET yr1	-	-	-	15%	13%	2%
Advanced Appr.	9%	4%	5%***	11%	8%	3%***
Higher Tech. study	6%	1%	5%***	1%	1%	0%

Note: All means are weighted. Differences are tested using an F-test with respect to the T level group. $* p < 0.1$, $** p < 0.05$, $*** p < 0.01$

6. Conclusions

In this paper, we look at the short-run impacts of T levels — a new set of vocational qualifications in the UK – on upper secondary attainment and progression. T levels are part of a broader global trend towards integrating more academic content into vocational programmes (for example, see Bertrand et al., 2021). We add to a growing literature studying these kinds of reforms and the literature on the impacts of and returns to vocational education.

Using a combination of approaches (regression adjustment, propensity score matching and instrumental variables), we find that enrolling on a T level significantly reduces the likelihood of attaining a full level 3 qualification by 18. These negative impacts appear to be concentrated in the Education and Early Years and Health and Science pathways and are more pronounced when considering students at the margin of T levels and alternative vocational qualifications. The negative impacts are smaller when considering matched students who take A levels. This could imply that T level learners are not as well suited to A levels compared to a vocational or mixed level 3 programme of study.

However, we also find that T level students are significantly more likely to progress to an advanced apprenticeship and to progress to higher technical study. This shows that T levels have increase progression to further study for the students that have successful experiences on the qualifications. Looking more closely at the pathways, we find that the Digital T level delivers broadly positive results, with students achieving better results than their non-T level counterparts. Furthermore, the construction and digital pathways do a better job than other pathways at helping T level students progress to higher forms of technical study.

Overall, though, T level students in the first cohort are 25-30% less likely to achieve a full level 3 by the time they are 19 than similar non-T level students. This is a serious concern and one that is not fully accounted for by *initial* T level drop-out. We suspect this is driven by the high level of difficulty of T levels, drop-out in the second year and difficulties finding placements, issues that have been raised by Ofsted (2023) and the Education Committee (2023a). It will be important to carefully consider the content of T levels and the problems that are unique to different pathways. As we show, the impacts of T levels vary considerably by pathways and this fits with results showing that T level drop-out is highly pathway-dependent (Tuckett et al., 2024).

Stepping back, T levels are still a relatively small proportion of the overall cohort of post-16 learners. In our sample, less than 1% of all 16-year-olds in 2021 enrolled on a T level. This number has grown significantly over the last few years but it is still a minority of the vocational cohort and cohort as a whole. The original goal was for T levels to become the main vocational option at level 3. This has not yet manifested. Moreover, the negative impacts of T levels on students in the early stages of the rollout suggest the qualifications may not be currently fit for all level 3 vocational learners. This is particularly salient as the government considers whether to continue with the defunding of level 3 qualifications that overlap in content to T levels.

If they do, our results suggest that T levels would need significant work to ensure that they are fit for purpose and do not negatively impact on students' post-16 education journeys. For instance, the government might want to consider a second tier of T levels that are smaller in size and would cater to a wider range of level 3 learners. This would align better with the existing system of qualifications while still ensuring that the qualifications landscape is simplified, students have a good range of options and the vocational track is of higher quality.

Future research should continue to interrogate the impacts of T levels as they are rolled out to more and more cohorts of students. At the time of writing, we did not have access to data on progression to university. This will be an important area for future work given T levels were designed in-part to increase the options available to vocational learners beyond upper secondary education.

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Appendix A. Details of the T level components

Table A1. Details of the T level qualification components.

Component	Description	Assessment and grading
Core	The classroom-based learning that covers the fundamental knowledge and skills for the T level. The theoretical content is common across all occupational specialisms within a T level.	Consists of (usually two) formal exams and an employer set project. A single Core grade is awarded on an A* to E grading scale. Exams are usually taken in the first year of the T level but can be taken several times.
Occupational specialism	The classroom-based learning that covers the *specific* knowledge and skills required for a specialism or career withing the broader T level pathway.	The assessment can vary by awarding organisation and T level. Generally, it is project-based and focuses on all of the key competencies and performance outcomes for the occupational specialism (Pearson, 2024). Graded on a Distinction, Merit, Pass scale. Is taken in the second (and final) year of the T level.
Industry placement	The work experience component of the T level. Consists of a minimum 45-day (315 hour) placement with a relevant and accredited employer.	Is not formally assessed by the awarding organisation. Providers themselves determine whether a student has completed their industry placement or not (in consultation with employers). The outcome is either completed or not completed. Students must complete to be awarded a T level qualification.
Overall	The overall T level qualification, awarded if students complete all three components.	Based on the highest grades achieved in the student's core and occupational specialism components. Graded on a Distinction*, Distinction, Merit, Pass scale. The look-up table is provided by DfE (Department for Education, 2024b).

Appendix B. Emerging issues with the T level rollout

Drawing on surveys, interviews and discussion groups, Ofsted (in a 2023 thematic review of T levels) found that many students reported being misled about T levels, teachers struggled with some of the theoretical components of the courses, concerns were raised about the volume and difficulty of the content and industry placement quality varied considerably (Ofsted, 2023). Some of the concerns about course content were noticeably stronger for the health and science T level route. Additionally, some students were surprised and disappointed to find that some universities did not accept their T level as a valid entrance qualification (despite T levels being designed to provide options to progress to higher education).

Similarly, the Education Committee (2023) released a report on the future of post-16 qualifications, with a particular focus on T levels. Like the Ofsted (2023) review, they find that the large size and high level of academic rigour of T levels is out of touch with the government's aspirations for T levels to be the main level three technical qualification. Several submissions to the committee argued that T levels are essentially restricted to students who are academically high achieving. Indeed, Lord Baker, who has had a significant influence on technical education reforms in the UK, asserted that T levels do not suit students with less than a grade six in their GCSEs. For context, less than a quarter of all GCSEs are graded above a six (FFT Education Datalab, 2023).

Both the Education Committee (2023) and Ofsted (2023) were highly critical of the T level transition programme (TLTP).[14] Specifically, there is wide variability in the quality of content and delivery across providers and an extremely low progression rate into T levels. Moreover, the Tech Ed learner survey showed that only 58% of students reported studying towards a vocational qualification in their chosen area and just over half reported doing any work experience (NatCen Social Research & NFER, 2023). By far the most concerning to policymakers and industry is the low rate of progression from the TLTP to T levels. In the first cohort, only 15% of TLTP students progressed onto a T level. This fell to 8% for the second cohort, meaning less than one in ten TLTP students' progressed onto a T level (Department for Education, 2024a). Given the TLTP's strong focus on progression to T levels, this is very stark. As the Education Committee (2023) put it, *"this is an entirely inadequate rate for a programme whose purpose is to provide a high-quality preparatory route into T Levels"*.

[14] The TLTP programme is being renamed to the T level foundation year from 2024/25 and beyond.

Nonetheless, the Ofsted (2023) and Education Committee (2023) reviews and more recent research suggests that many of the students that were retained on a T level had a positive experience. For example, Ofsted finds that around two thirds of retained students in 2022 felt well prepared for their next steps (Ofsted, 2023). Moreover, the Education Committee (2023) report receiving numerous submissions from individual colleges and stakeholders praising T levels and asserting that they were an improvement on existing qualifications. A recent survey of the 2020/21 cohort of T level learners found that most students (retained on a T level) reported being very or quite fulfilled with their T level, many students would recommend a T level to others and four fifths of completers stated their T level prepared them well for their future endeavours (NatCen Social Research & NFER, 2024). However, part of these positive sentiments arise because these are the students that selected to stay on their T level for the entire two years. In contrast, for the second cohort of learners (2021/22 starters), satisfaction after the first year was relatively low (NatCen Social Research & NFER, 2023). Only around half of T level learners reported being satisfied after their first year and satisfaction was notably low for health and science students (only 41% of students were satisfied).

These low levels of satisfaction and the range of issues discussed above are reflected in the fact that one third of 2021/22 starters dropped out of their T level (Chowen, 2023; Stein, 2023). This concerningly large drop-out rate has prompted an urgent review into the content of all T level programmes, taking heed of the critiques in both the Ofsted and Education Committee findings (Borrett & Foster, 2024; Chowen, 2024).

Defunding of overlapping qualifications

One of the most contentious aspects of the T level reforms has been the plans to remove funding for vocational qualifications that “overlap” with T levels. According to policymakers, this would radically simplify the technical and vocational education landscape in the UK by defunding thousands of “lower quality” qualifications that were crowding the sector (Department for Business, Innovation and Skills, 2016). Defunding was planned in stages, with most courses set for defunding in 2024 and 2025 (Department for Education, 2023b).

One of the major concerns around this defunding was that these “overlapping” qualifications were actually not overlapping at all. While they may be at the same level (level 3) and have a similar title, the qualifications to be defunded cater for a different group of students and have considerably different content and structure (Education Committee, 2023b). As mentioned earlier, T levels are very large and challenging qualifications that are currently geared towards more academically inclined students. Many of the students on these overlapping qualifications would not be well-suited to switch to a T level instead (Maris et al., 2024; Robinson, 2022). This would leave a large group of learners (that tend to be lower attaining and disadvantaged) with no or limited level three study options.

Responding to these concerns, the new Labour government announced a temporary pause and review of the defunding of overlapping qualifications. A decision on the defunding of overlapping qualifications is expected towards the end of 2024 (Doherty, 2024).

Appendix C. Post-16 choice classification

This file describes the approach taken to classify students' post-16 choices. The aim is to create a group of mutually exclusive categories that defines what students choose to undertake at the start of their post-16 study.

We start by merging the ILR with the KS5 student cut which allows us to identify important characteristics of learners in the ILR (like their KS4 cohort, ethnicity, prior attainment and more). We then filter the merged data to students who transitioned to KS5 in the year of consideration (i.e., 2021, if looking at 2021/2022 aims). We also merge qualifications data from Ofqual which provides us with qualification titles, grading schemes, levels and types. We also add a flag for qualification type from DfEs performance table data.

We use the Asize and Gsize variables in the key stage 5 exam file rather than the width variables in the ILR. This has several advantages – firstly, the Asize and Gsize variables have greater coverage and fewer zeroes for qualifications. Secondly, the Asize and Gsize variables are consistent with UCAS points and awarding body websites that state the equivalence between qualifications and A levels or GCSEs. For example, a BTEC Extended Certificate will be worth 1 A level while a BTEC Diploma is worth 2 A levels. In the ILR, most vocational qualifications either have a zero for width (empty) or a 100 (meaning the qualification is worth 2 A levels).

When we mapped this to the Asize and Gsize variables from DfE, there was poor consistency suggesting some major data quality issues in the ILR.

The new approach is as follows:

- We filter the aims so that we only include entries meeting the following criteria:
  - For most aims, they must start between 01/08/2021 and 19/09/2021 (the start of August to third Sunday of September). We do this because we want to capture initial choices rather than choices made during the post-16 phase.
  - For aims with an apprenticeship "progtype" in the ILR or a traineeship, we extend this end date to the 31/01/2022 (end of January) because apprenticeship starts are more staggered (this captures over 75% of starts in the academic year).
  - All aims must last at least 7 days. This ensures we exclude aims that students start and then immediately withdraw from.

- From these filtered aims, we create an indicator variable for whether a student has any of the following aims:
    - A T level aim
    - A T level transition programme aim
    - A level 2 apprenticeship aim (an apprenticeship aim with a level 2 width greater than zero)
    - A level 3 apprenticeship aim (an apprenticeship aim with a level 3 width greater than zero)
    - A traineeship aim
- With the large number of remaining aims, we use the ASIZE and GSIZE variables to identify how much each aim contributes to a full level 2 and level 3 award. For ASIZE, 1 = 1 A level so an ASIZE of 2 is considered a full level 3 (2 A levels). For GSIZE, 1 = 1 GCSE so a full level 2 is usually considered 4-5 GCSEs. In this part of the data cleaning, we only consider regulated aims that we have Ofqual data for.

The Asize and Gsize variables are still incomplete for some qualifications and these tend to be odd BTECs or other vocational qualifications. This is only around 1% of regulated and relevant (level wise) qualifications. To fill in these gaps, we did the following:

- We created a taxonomy of vocational courses based on common key words (see below) and calculated the median Asize (for level 3 qualifications) and median Gsize (for level 2 qualifications) for aims in those broader groups. We then used these values to impute the missing Asize and Gsize values (Table C1).

Table C1. Qualification keywords and assigned Asizes

Qualification keyword	**Broader group**	**Assigned Asize**
National Diploma	Larger Diplomas	100 (2 A levels eq.)
Extended Diploma	Larger Diplomas	100 (2 A levels eq.)
Subsidiary Diploma	Smaller Diplomas	50 (1 A level eq.)
Applied Diploma	Smaller Diplomas	50 (1 A level eq.)
Foundation Diploma	Smaller Diplomas	50 (1 A level eq.)
Diploma	Smaller Diplomas	50 (1 A level eq.)
Extended Certificate	Extended Certificates	50 (1 A level eq.)

Certificate	Certificates	25 (1 AS level eq.)
Award	Awards	25 (1 AS level eq.)
Other (small proportion)	Awards	25 (1 AS level eq.)

We then create the following distinct groups using a recursive assignment process and the following rules in Table C2.

Table C2. Post-16 routes and definitions

Group	**Rule**
Level 3 Apprenticeship	Has a level 3 apprenticeship programme type
T level	Has a T level programme type
A levels	Is undertaking A levels or AS levels that sum to at least ASIZE = 2 (2 full A levels)
Full Level 3 Academic	Is undertaking A levels, AS levels or other academic qualifications (i.e., extended projects) that sum to at least ASIZE = 2 (2 full A levels)
Full Level 3 Mixed	Has an ASIZE at least = 2 (full level 3) where at least 0.25 points (1 AS level eq.) come from academic qualifications
Full Level 3 Vocational	Has an ASIZE at least = 2 (full level 3) where less than 0.25 points (1 AS level eq.) come from academic qualifications.
Apprenticeship Level 2	Has a level 2 apprenticeship programme type
Traineeship	Has a traineeship programme type
T level Transition Programme	Has a T level transition programme type
Some Level 3	Has at least an ASIZE = 0.25 (1 AS level eq.) but less than a full level 3 (ASIZE = 2)
Full Level 2	Has a GSIZE of at least 4 (4 GCSEs) – this is consistent with a recent Nuffield report.
Some Level 2	Has a GSIZE >= 1 (1 GCSE).

Other (non-regulated or less than level 2)	Does not meet any of the following conditions: Either studying predominantly non-regulated aims or studying at level 1 or below.

Appendix D. Supplementary balance plots for PSM

The plots below show the balance achieved for our PSM using the academic only sub-sample (Figure D1) and the vocational only sub-sample (Figure D2).

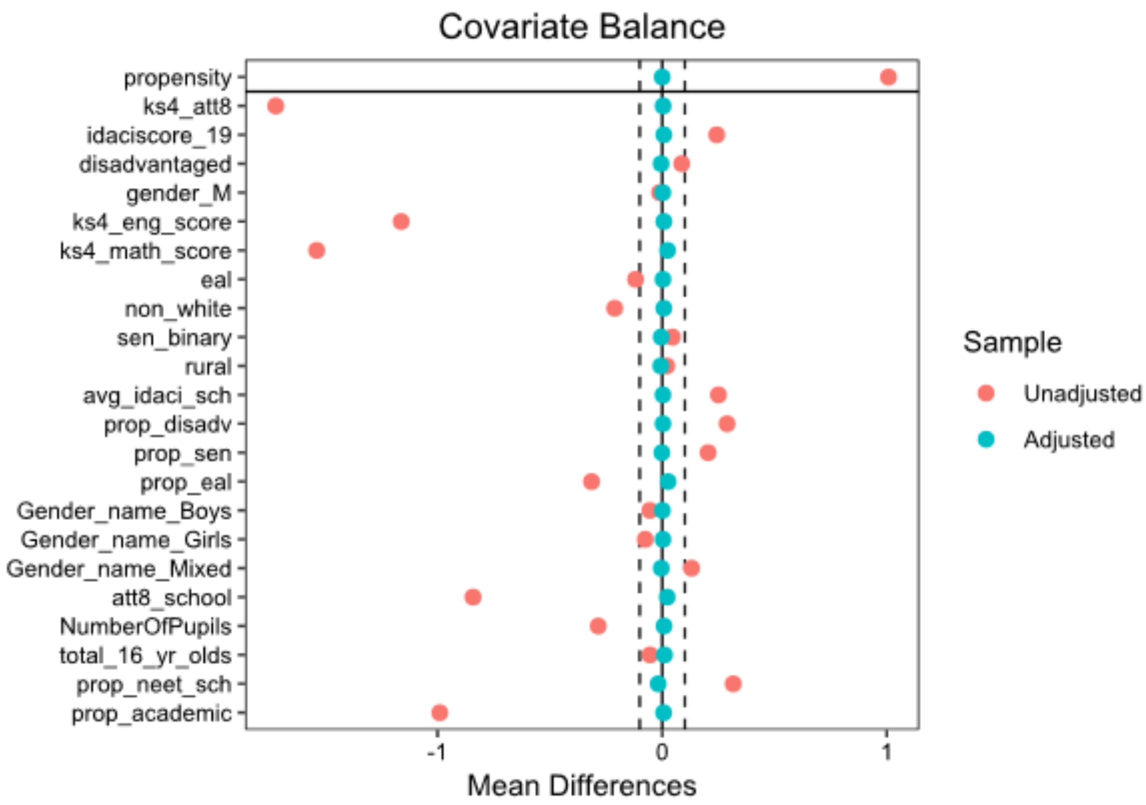

Figure D1. PSM balance statistics (standardized mean differences) for the academic only sample.

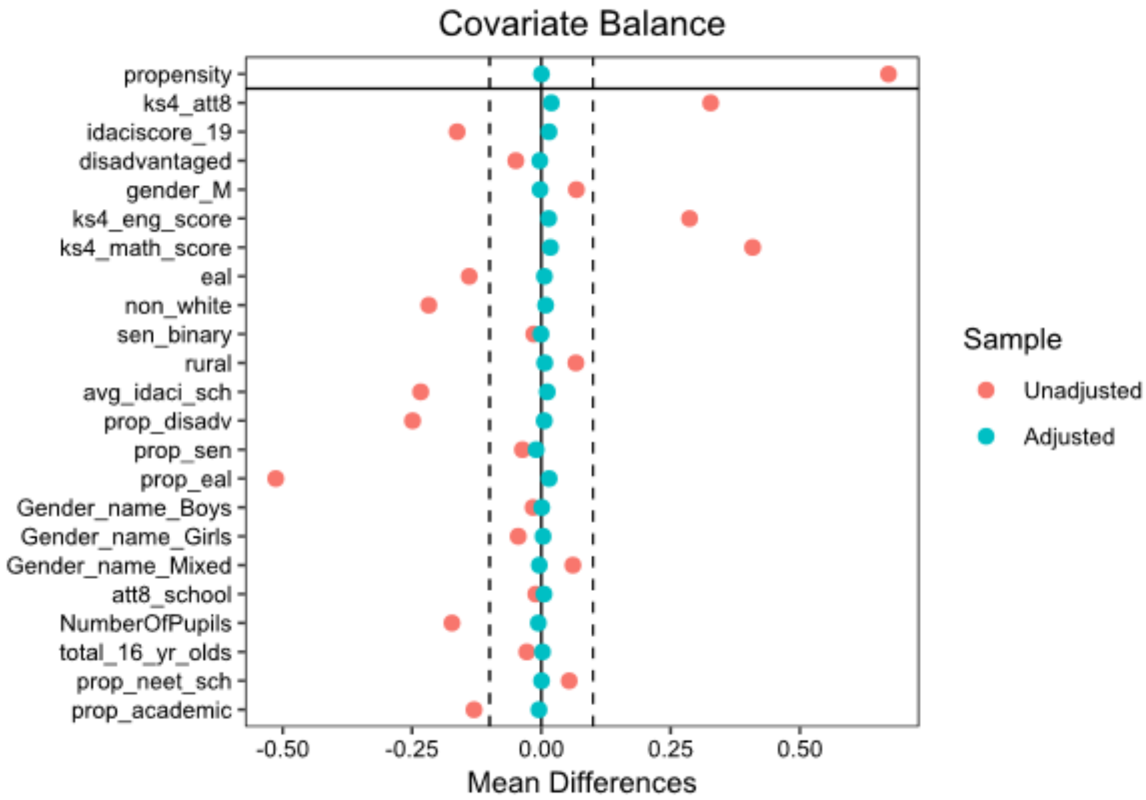

Figure D2. PSM balance statistics (standardized mean differences) for the vocational only sample.

ucl.ac.uk/ioe/cepeo