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Data Insight

# Where STEM graduates work and what it means for earnings

**Author:** Dr Golo Henseke
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**This Data Insight uses the Longitudinal Education Outcomes (LEO) dataset to examine where Science, Technology, Engineering and Maths (STEM) graduates work and how this relates to their earnings. University STEM programmes consistently channel young people into Science and Technology organisations, and these employers are geographically dispersed across England. Yet the earnings premium associated with different STEM fields at university varies substantially, and for some subjects, much of the observed premium reflects the high prior ability of students who enrol in these fields rather than the programme itself. Where value added to earnings by degree programme remains, it is closely linked to young people's employer destinations, a pattern far more pronounced for some subjects than others.**

## Summary

After someone turns 18, pursuing an undergraduate STEM programme can result in an earnings uplift compared to non-higher education routes - this is known as the 'STEM premium'. While recent work has documented substantial variation in returns across degree-institution combinations (Britton et al., 2022), less is known about how much of the STEM premium reflects transferrable skills gained from STEM programmes, versus the kinds of employers young people go on to work for following these programmes. This matters for students choosing degree programmes, for universities designing curricula, and for policymakers investing in the STEM workforce.

Using the Longitudinal Education Outcomes (LEO) dataset, an ADR UK flagship dataset linking education records with tax and employer data, this Data Insight provides new evidence on earnings and industry destinations associated with pursuing university STEM programmes. We follow approximately 1.17 million young people who completed A-levels from their GCSEs through to their early thirties, tracking not just their earnings but where they work.

### Background

STEM skills are central to the UK's economic and innovation ambitions (DSIT, 2023). Policy discussions frequently emphasise expanding the 'STEM pipeline' and addressing skills shortages.

However, the label 'STEM' conceals substantial variation. Engineering, Computer Science, and Mathematics are often grouped alongside Biology, Chemistry, and Physics, yet the labour market treats these fields very differently.

### Key findings

1. Most STEM programmes raise the chance that young people go on to work in Science & Technology organisations.
2. STEM employers appear geographically dispersed, with no clear concentration in the higher-paying regions of London or the South East.
3. All STEM fields show substantial raw earnings premiums, but much of this reflects the high prior attainment of students who choose these subjects. After accounting for students' prior attainment, applied STEM fields (Engineering, Computer Science, Mathematics) retain prominent earnings advantages, while natural science programmes show a more modest earnings uplift.
4. A decomposition of adjusted earnings premiums shows that the share associated with the organisation where people work varies markedly across fields. For Chemistry and Physics, virtually the entire adjusted premium is accounted for by former students working at higher-paying employers.

The results show that the 'pipeline' from STEM degree programmes to organisations that draw on these skills seems to be in good shape. But how the labour market rewards these skills differs sharply across fields, and for some subjects, where young people work is as closely associated with their earnings as what they studied.

# What we did

We study English GCSE cohorts 2002–2006, linking their school records (National Pupil Database), further and higher education records (Individualised Learner Record [ILR] and Higher Education Statistics Agency [HESA]), and tax records (HM Revenue & Customs [HMRC]) through the LEO dataset. We classify university programmes into seven STEM fields – Biology, Chemistry, Physics, Computer Science, Mathematics, Engineering, and Interdisciplinary Sciences – and compare outcomes against young people with equivalent school qualifications who did not enrol at university.

Our identification strategy relies on subject-combination fixed effects: we compare students from the same school and cohort who took identical GCSE and A-level combinations but pursued different degree subjects. For example, among students with A-levels in Maths, Further Maths, and Physics, many enrolled in Engineering, some in Physics, a few in non-STEM programmes, and some did not attend university. Rich controls on prior attainment and relative subject strengths help to isolate the average effect of the degree programme from pre-existing differences between students.

Crucially, the employer identifiers in HMRC tax records allow us to observe which organisations young people work for. We group employers by industry (Science and Technology, Finance and Business Professional Services, and others) and estimate enterprise-level pay premia using established methods. A Gelbach (2016) decomposition then partitions each subject's adjusted earnings premium into three components:

1. a within-enterprise component (the portion of the premium that is common across employers)
2. a between-enterprise component (the portion associated with young people working at higher-paying organisations)
3. a regional-sorting component (the portion associated with working in higher-paying regions).

This is an accounting decomposition: it describes how earnings differences are distributed across these channels, not whether organisational sorting causally generates the premium. It builds on evidence that between-enterprise pay differences account for a substantial share of the returns to higher education (Engbom & Moser, 2017).

# What we found

## STEM degrees channel graduates into Science & Technology

Almost all STEM degree programmes substantially raise the probability that students will work in Science & Technology organisations in early career. Biology, Chemistry, and Computer Science each increase this probability by around 11 percentage points, and Engineering by 14 percentage points, relative to comparable young people who did not attend university. Physics shows a more modest effect of 5 percentage points.

Mathematics is the notable exception. Rather than directing graduates towards Science & Technology, it shifts them strongly towards Finance & Business Professional Services (+15 percentage points), while actually reducing their probability of working in Science & Technology (−11 percentage points). This may reflect the distinctive portability and fungibility of mathematical skills in labour markets dominated by financial services.

The broader point is that STEM degrees – particularly in the sciences and engineering – seem effective at equipping students with the knowledge, skills and competences required by the UK's Science & Technology sector. Engineering students, and most other STEM students, do not line up to work in the City; they go where their technical skills are in demand.

### Table 1: Effect of STEM Degree Programmes on Firm Destinations (percentage points)

| Degree Subject | Science & Technology | Finance & Business Prof. Services |
|---|---|---|
| **Applied STEM** | | |
| Mathematics | −11 | +15 |
| Engineering | +14 | −5 |
| Computer Science | +11 | +2 |
| **Natural Sciences** | | |
| Physics | +5 | ~0 |
| Chemistry | +11 | −2 |
| Biology | +11 | −4 |

*Notes: Average marginal effects from linear probability models. Estimates account for socio-demographics, prior attainment, school and subject-combination fixed effects. Comparison group: Level 3 qualified individuals who did not enrol at university. Source: LEO, KS4 cohorts 2002–2006.*

## STEM employers are geographically dispersed

A common assumption in STEM policy discussions is that high-paying STEM careers concentrate in London and England's South East, implying geographic barriers for graduates from other regions. Our decomposition allows us to test this.

As shown below in Figure 1, regional sorting contributes minimally – and often negatively – to STEM earnings premiums. For Mathematics and Computer Science, the regional component is essentially zero. For Engineering, Biology, Chemistry, and Physics, it is slightly negative. This means that, if anything, STEM graduates are marginally less concentrated in enterprises in high-paying regions than the comparison group.

This suggests that the earnings advantage associated with STEM pathways is not primarily a 'London effect'. High-paying STEM employers appear to be geographically dispersed across England. This has implications for regional skills strategies: strengthening employer links and progression routes outside the South East may deliver more than simply encouraging geographic mobility.

## The STEM earnings premium: selection, skills, and firm destinations

Before accounting for students' prior attainment, all STEM fields show substantial raw earnings premiums over comparable young people who did not attend university, ranging from +11% for Biology to +58% for Mathematics. Physics (+34%) and Chemistry (+22%) sit alongside Engineering (+35%) and Computer Science (+24%). These raw differences, however, substantially reflect the high prior ability of students who choose STEM subjects. Once we account for school attainment, subject combinations at GCSEs and A-levels, and school fixed effects, the picture changes markedly. Applied STEM fields—Mathematics (+25%), Computer Science (+17%), and Engineering (+17%)—retain substantial early-career earnings premiums. Natural sciences show much smaller adjusted premiums: around +7% for Chemistry and Physics, and approximately zero for Biology. Table 2 summarises these figures.

The gap between raw and adjusted premiums is itself informative. For Physics, the raw premium falls from +34% to +7%; for Chemistry, from +22% to +7%. This tells us that a large share of the raw earnings advantage observed for natural science students reflects who these young people are, their prior attainment, ability, and accumulated science-related resources, rather than what the degree programme adds to their earnings potential in early career. These are high-achieving young people who would likely earn well regardless of what university studies they pursue.

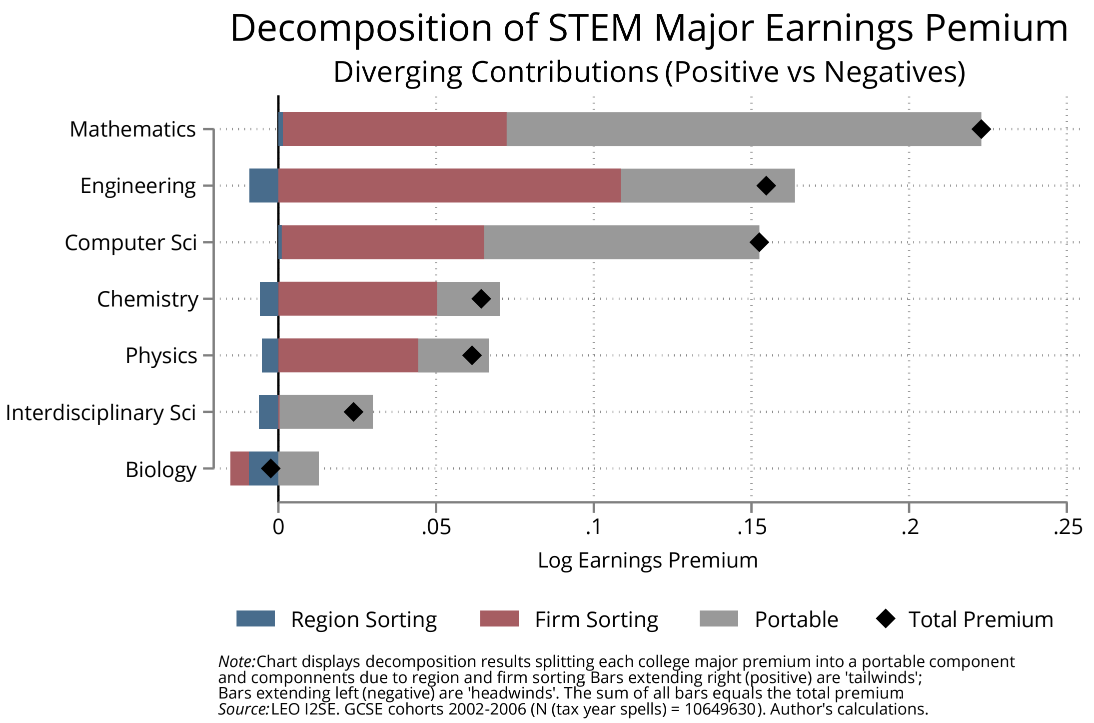
Having established that the adjusted premiums for natural sciences are modest, a further question is how these residual premiums relate to graduates' enterprise destinations. Using a Gelbach decomposition, we partition the adjusted premium into a within-enterprise component, the portion common across employers, and a between-enterprise component, the portion associated with working at higher-paying employers.

Table 2: Decomposition of STEM Earnings Premiums

| Subject | Raw Premium | Adjusted Premium | Within-Enterprises (Portable) | Between-Enterprises (Sorting) | % via Enterprises |
|---|---|---|---|---|---|
| **Mathematics** | +58% | +25% | +16% | +7% | ~30% |
| **Engineering** | +35% | +17% | +6% | +11% | ~60% |
| **Computer Science** | +24% | +17% | +9% | +6% | ~40% |
| **Physics** | +34% | +7% | +2% | +4% | ~80% |
| **Chemistry** | +22% | +7% | +2% | +5% | >80% |
| **Biology** | +11% | ~0% | +1% | −1% | n/a |

*Notes: Raw premium controls for demographics and work experience only. Adjusted premium additionally accounts for prior attainment (GCSE and A-level performance), school, and subject-combination fixed effects. Within-firm and between-firm components from Gelbach decomposition of the adjusted premium. Regional sorting component omitted (negligible for all fields). Approximate percentage differences derived from log-point estimates. Source: LEO, KS4 cohorts 2002–2006.*

Figure 1




The between-enterprises component is broadly similar in magnitude across most STEM fields, typically 4-7 percentage points. Engineering stands out as notably larger (+11%), while Biology is the exception, with no positive sorting contribution, as shown in Figure 1. What drives the large differences in the share attributed to enterprise sorting is variation in the within-enterprises component. For Mathematics, the within-enterprises premium is large (+16%), meaning former Maths students earn substantially more than comparable non-graduates regardless of which employer they work for. For Engineering and Computer Science, the within-enterprises component is more modest but still meaningful (+6% and +9% respectively).

The natural sciences present a different pattern. Their within-enterprises returns are near zero on average, meaning that within the same firm, former Chemistry and Physics students earn little more than comparable young people who did not attend university by age 20. Because the between-enterprises component is similar in absolute size to that of other STEM fields, it accounts arithmetically for almost the entire adjusted premium. But this reflects the small size of the adjusted premium itself, not a uniquely large firm-sorting effect for these subjects. In other words, the pay premium for natural science programmes is largely associated with these graduates going on to work for higher-paying firms, rather than leading to an earnings uplift within firms.

This pattern should be interpreted with care. The decomposition describes how earnings differences are distributed, not why. The near-zero within-enterprise average for natural sciences could mean that the skills acquired are genuinely match-specific: highly productive within organisations that deploy them but not broadly rewarded elsewhere. It could reflect career timing, since natural science pathways often involve longer qualification routes and the within-enterprise premium may grow with experience. Or it may simply reflect the fact that we compare graduates against non-graduates within the same firm, pooling across very different roles. What the decomposition does establish is that, for Chemistry and Physics, the modest adjusted premium that remains after accounting for selection is concentrated among former students who work at higher-paying employers.

# Why it matters

### The UK Science and Technology Framework places STEM skills at the centre of the country's innovation ambitions (DSIT, 2023). Our findings challenge three common assumptions in STEM policy:

- First, that all university STEM programmes offer similarly strong earnings returns. They do not: the variation within STEM is at least as large as the gap between STEM and non-STEM fields.
- Second, that STEM careers are geographically concentrated. They are not: regional sorting contributes negligibly to STEM premiums, implying that high-paying STEM employers are distributed across the United Kingdom.
- Third, that STEM graduates, and engineers in particular, are overwhelmingly drawn into City-facing industries such as finance and business services. With the sole exception of Mathematics, STEM degree programmes channel graduates towards Science and Technology organisations, not towards the City.

High-skill STEM training, by and large, delivers to the sector that likely benefits most from these skills.

The findings offer a more positive message than a narrow focus on adjusted earnings premiums would suggest. University STEM programmes, especially in the sciences and engineering, are effective at channelling graduates into Science and Technology organisations. The UK invests in STEM education partly to staff its innovation and technology sectors, and the evidence shows this pipeline is working. The fact that Biology, Chemistry, and Engineering graduates are substantially more likely to work in Science and Technology is a success on its own terms.

It is also worth noting that natural science graduates earn well in absolute terms. Before accounting for prior attainment, Physics and Chemistry graduates earn 34% and 22% more than non-university-bound young people, respectively, premiums comparable to those in Engineering. That much of this reflects the calibre of students who choose these subjects, rather than programme-specific value-added in earnings, is not a failure of these programmes. It tells us that natural sciences attract high-ability individuals who tend to do well in the labour market. The programmes may open specific doors, particularly to Science and Technology employers, but these students' broader prospects are strong regardless.

The modest adjusted within-enterprise premium for natural sciences raises questions but should not be read as evidence that these programmes fail to build valuable skills. Science and Technology organisations actively recruit students of these programmes, which is itself evidence of their economic value. Several explanations for the pattern are plausible and not mutually exclusive: the earnings returns to natural science skills may be match-specific, arising where the right training meets the right employer; early-career measures may understate returns that grow with experience and further qualifications; and our within-enterprise comparison pools graduates in very different roles at the same employer, potentially masking pay differences in specialist positions. Distinguishing between these interpretations is a priority for future research.

For students considering natural sciences, the findings suggest that employer destination is closely associated with earnings outcomes. University careers services and employer outreach programmes may be particularly important for these disciplines; not because employer access is the sole determinant of returns, but because the association between firm destination and earnings is especially pronounced.

# What next

**Several questions remain open. First, our earnings measure captures annual PAYE earnings, which does not distinguish between differences in hourly wages and differences in hours worked. Whether former STEM students in Science and Technology work fewer hours at comparable hourly rates is not testable with the LEO data.**

Second, the analysis examines early-career outcomes. As discussed, earnings may grow with career experience as young people complete further qualifications or move into senior technical roles.

Third, we do not observe occupation or job role. The within-firm comparison pools graduates in technical and non-technical positions at the same employer. If natural science students occupy specialist roles that are compensated differently from other positions, this heterogeneity is absorbed into the average.

Finally, while we document that firm destinations are closely associated with earnings differences, we cannot yet say what determines which graduates end up at higher-paying firms. Understanding the mechanisms behind differential firm access should be a priority for future research.

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# About ADR UK

ADR UK is a partnership transforming the way researchers access the UK's wealth of public sector data, to enable better informed policy decisions that improve people's lives. By linking together data held by different parts of government and facilitation safe and secure access for accredited researchers to these newly joined-up and de-identified data sets, ADR UK is creating a sustainable body of knowledge about how our society and economy function – tailored to give decision makers the answers they need to solve important policy questions.

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## Publication contact

Name: Dr Golo Henseke
Email: g.henseke@ucl.ac.uk