Is my bias your bias?:
The variability of demographic gaps in the good degree rate for UK physics degree programmes

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In the United Kingdom (UK), demographic gaps in the rate at which graduates from different backgrounds are awarded the top academic outcomes (i.e., degrees graded 1st or 2:1; a.k.a. **the good degree rate**) are important measures of equity for the higher education (HE) sector [1].

Data and Methods

We procured a Large, National Degree Outcome dataset (**LaNDO**) from HESA [2]. This dataset includes all first-degree students in higher education from 2012/13 through to 2019/20. We used the IOP's degree accreditation registers for the same time period [3] to identify accredited physics degrees programmes, highlighted in green in the results.

For each characteristic, we calculated the risk difference Δ in the good degree rate according to:

$$\Delta = P(G|\bar{M}) - P(G|M)$$

Where G is the event of obtaining a good degree and M is the event of belonging to the majority (modal) group. To avoid distortions due to COVID-19, we calculated results for 2019/20 separately, indicated by a *; all other results are for 2012/13 to 2018/19.

Within Physics. We calculated the weighted (by cohort size) mean of risk differences across years for each accredited physics programme. To ensure data protection, programmes with fewer than 23 students were excluded from the analysis [4].

Across Subjects. We calculated risk difference for all students on accredited physics degrees; then grouped by subject code (given in brackets) [5]; science, engineering, technology subject status; and at the sector level. We calculate 95% confidence intervals via the Newcombe score method [6].

Results and Discussion

This poster presents the results and key findings for **non-enhanced** (bachelor's) degrees. Results for **enhanced** (integrated master's) degrees are available online. Opposite this column we indicate two statistical phenomena, **overdispersion** and **Simpson's paradox** that may explain the observed heterogeneity within physics and discrepancy between subjects.

The Open University
School of Physical Sciences

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making physics matter

Is my bias your bias?

Scan me for a video summary!
bit.ly/perc22bias-video

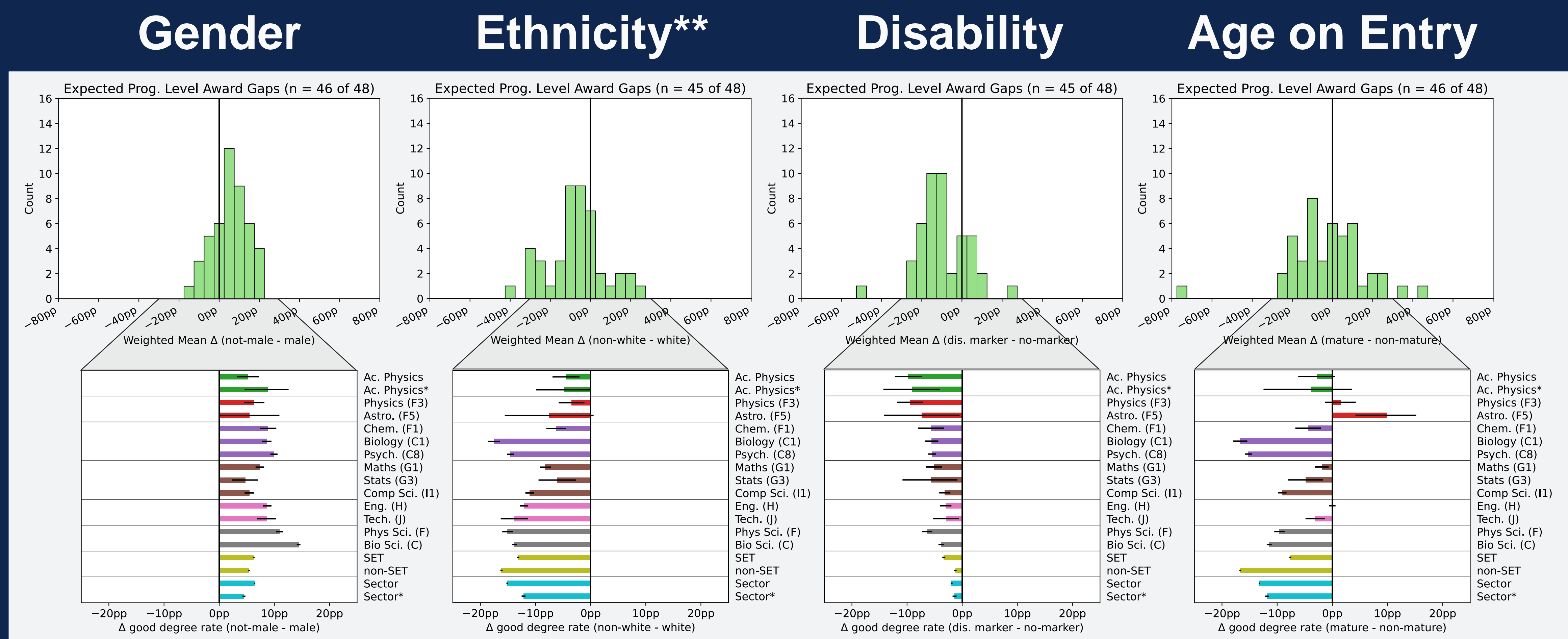We investigated bias in academic outcomes for UK Physics degrees (2012/13-2019/20)

Research Q1. How similar are outcome gaps across different physics courses?

Research Q2. How do the outcome gaps in physics compare to other subjects?

Surprisingly heterogenous inequalities

〈 Within Physics 〉

∧ Across Subjects ∨

| Gender | Ethnicity** | Disability | Age on Entry |

*Value for 2019/20 only

**Only collected for students registered as living permanently in the UK

NB: Mature students are defined as those aged 21 and over on entry [7]

Key Points:

In line with the rest of UK HE, **women are more likely to gain a good degree in physics**, but are disadvantaged on specific programmes.

The award gap for non-white students in physics is smaller than in the sector, but **several physics programmes have gaps larger than the sector average**.

In contrast to the sector, **physics students with a disability marker are generally much less likely to obtain a good degree**.

Award gaps across age categories are highly dispersed in physics, with some much larger programme gaps than the sector average in both directions.
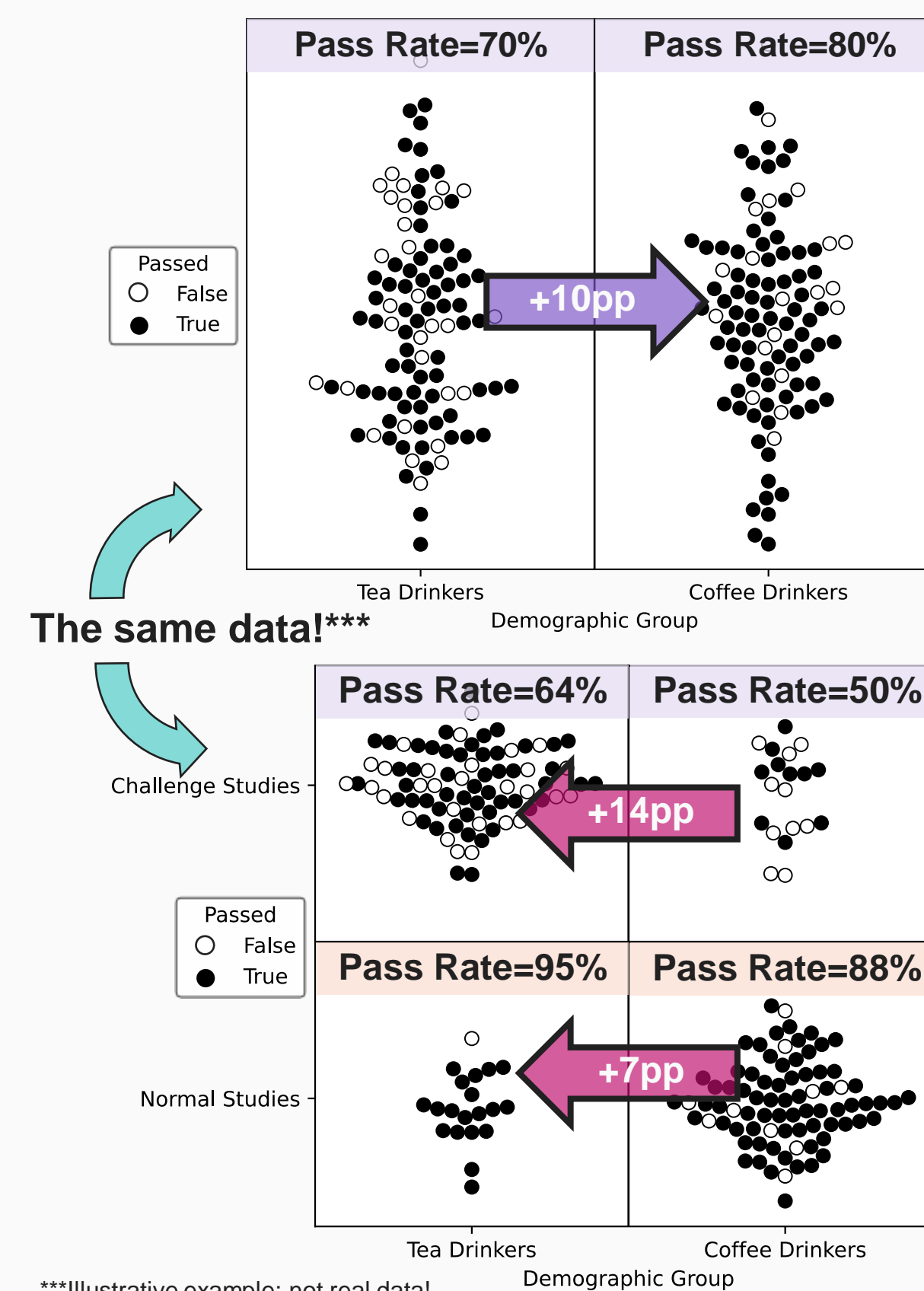

Overdispersion

Underling variability in the likelihood of obtaining a good degree between individual students makes the true distribution of success rates wider than expected under the binomial distribution. [8]
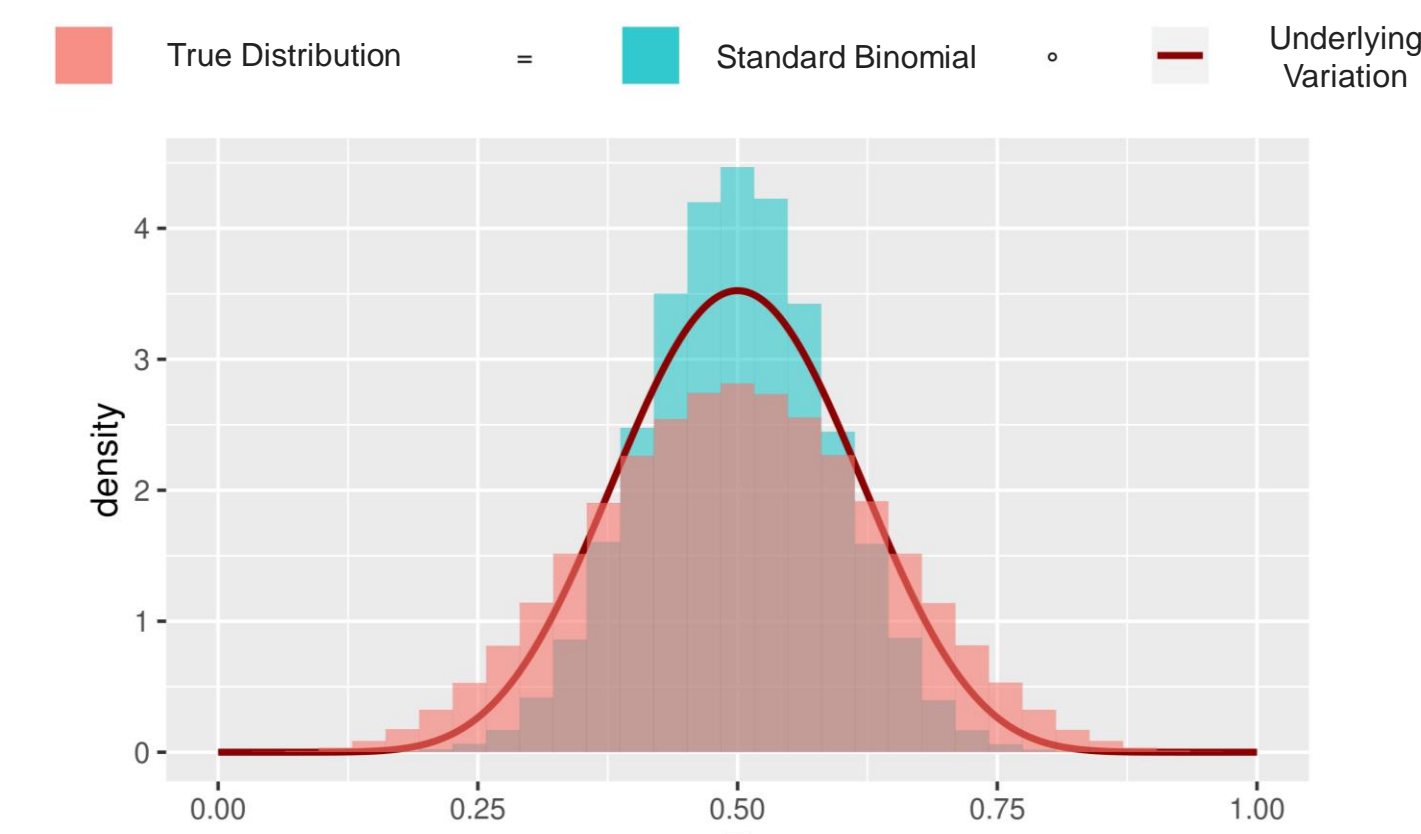
Simpsons Paradox

Effect size and direction depends on whether the data is in sub-groups or aggregated together. Whether to use the grouped or aggregate effect size(s) depends on the causal structure of the problem. [9]

***Illustrative example: not real data!

Future Work

Our next step will be to generalise this analysis to more characteristics and analyse the dispersion of physics degree outcomes. More broadly, we are working towards building an multinomial regression model that takes into account intersectionality, causal inference, and the possibility of over/under-dispersion.

Further results for enhanced degrees
bit.ly/perc22bias

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