Gender Differences in Tertiary Education: What explains STEM Participation?

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Background

- Share of women achieving tertiary education has increased rapidly and now exceeds that of men in most OECD countries.
- But, women are severely under-represented in maths-intensive science fields - STEM (science, technology, engineering, and maths).
- These fields are seen to be especially important for productivity and economic growth; associated with occupations that have higher earnings.
- Presentation is based on a review of evidence on explanations for the STEM gap in tertiary education. EENEE reports: http://www.eenee.de/eeneeHome/EENEE/Analytical-Reports.html

https://cep.lse.ac.uk/_NEW/PUBLICATIONS/abstract.asp?index=7306

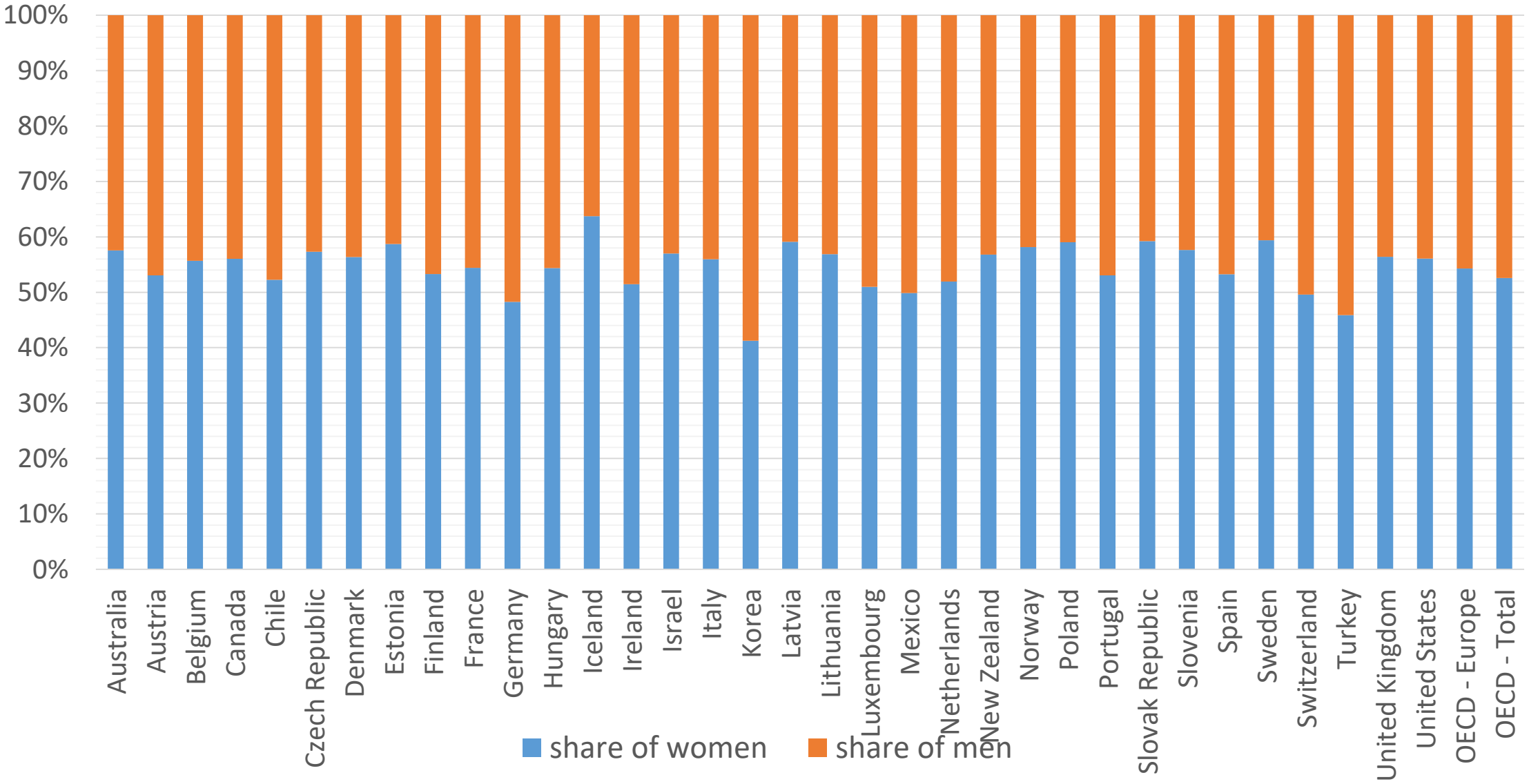
This presentation

- Stylised facts

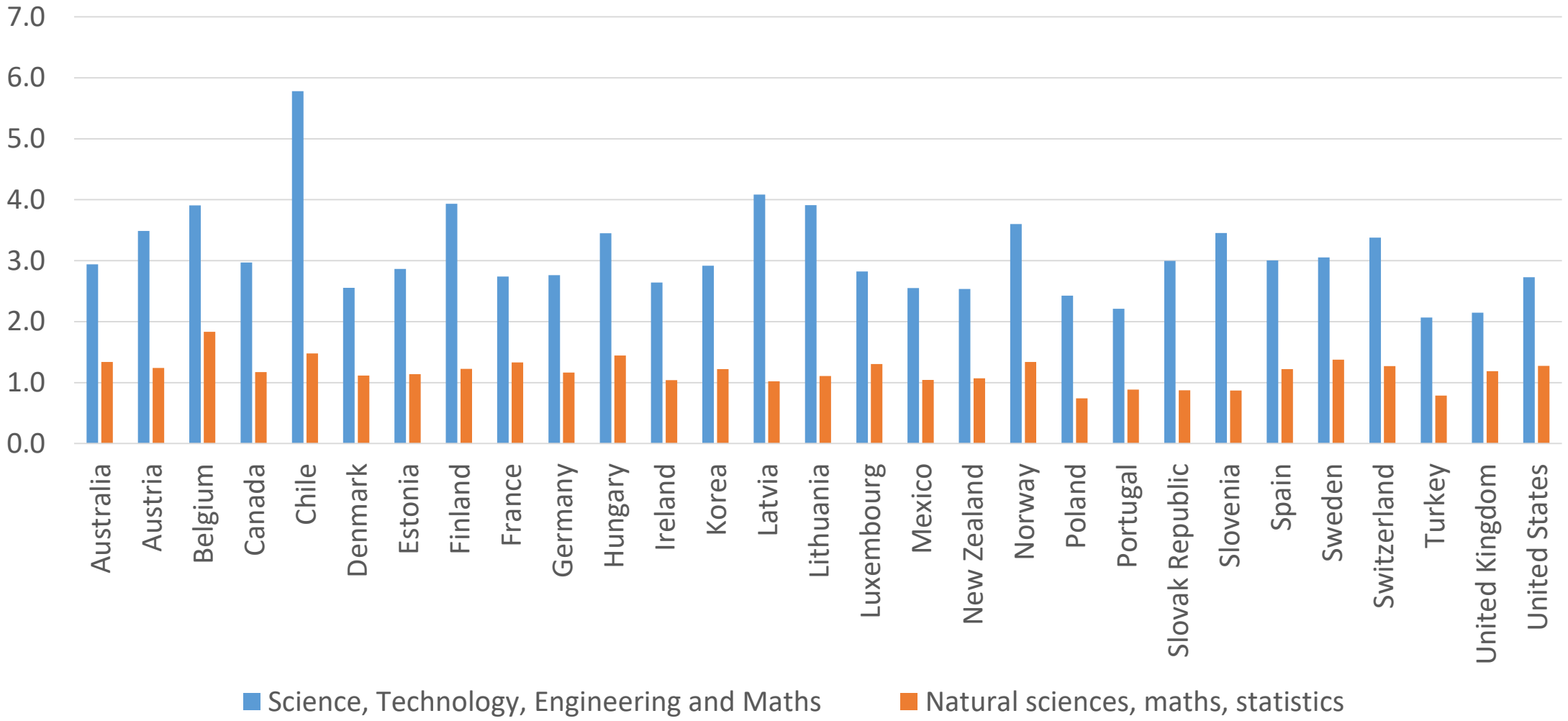
- Role of various (inter-related) sets of factors:
- Educational Preparedness
- Personal attributes
- Preferences and expectations
- Educational context

- Policy implications

Share of men and women in tertiary education (Eurostat)



Ratio of men to women in different fields of study (Eurostat)



Educational Preparedness:
Prior Achievement, Comparative Advantage and Course-taking

(a) General educational achievement across a range of subjects

(b) Achievement in mathematical subjects

(c) Comparative advantage in subjects requiring mathematical versus literacy proficiency.

Limited evidence on the role of these factors for explaining the STEM gender gap.

But course-taking in upper secondary school explains much variation in field of study in tertiary education (e.g. Card and Payne, 2017 for Canada; Delaney and Devereux, 2019, for Ireland).

Personal attributes: confidence, self-efficacy and competitiveness

- Laboratory experiments: men are more likely to enter competitive arenas because of higher confidence (Gneezy et al., 2003; Niederle and Vesterlund, 2007). This also (negatively) influences female performance in high-level maths tests (Niederle and Vesterlund, 2007).

- Insofar as students perceive STEM majors to require technical mastery, gender gaps in beliefs about one's own ability can lead men and women to sort into different academic tracks (Shi, 2018). This is backed up by many empirical studies

- Environment matters. A number of experimental studies have shown: for women willingness to enter competitive environments (and performance) is reduced when the competition group includes males (Gneezy et al., 2003; Balafoutas and Sutter, 2012; Niederdal et al., 2013).

Preferences and expectations

- Kahn and Ginther (2017) document that even at early ages boys and girls show different preferences and interests towards different subjects. The psychology literature on gender preferences finds that on average women are more “people-orientated” and men more “thing-orientated”.

- Review by Cheryan et al. (2017). The more women endorse goals to help and work with people, the lower their interest in computer science, engineering, maths and the physical sciences.

Educational context - peers

- Differences in preferences and educational preparedness do not develop in a vacuum
- Many papers consider show that the gender composition of peers affects educational performance and choices. ‘Female friendliness’ of environment is important
- Cheryan et al. (2017) note that ‘stereotype threat’ may be induced simply by women being under-represented in a situation: fear of confirming negative stereotypes about one’s group

Educational context – teacher grading bias

- Lavy and Sand (2018): primary school in Israel. Favouritism of boys among maths and science teachers has a large and positive effect on boys' maths test scores and on the probability of successful completion of advanced maths and science studies in high school, whereas the effect on girls is in the opposite direction.

- Lavy and Megalokonomou (2019): high school in Greece. Teacher bias (favouring boys) is found to have a large role in explaining both performance and students' choice of field of study in university. The bias strongly and significantly affects the probability that girls will enrol in different fields of study but has no significant effects for boys.

Educational context – role models

- Very important in both economics and psychology literature
- Professor gender at the post-secondary level. Carrell et al. (2010) - students are randomly placed into classrooms. Professor gender a powerful effect on female students' performance in maths and science classes, their likelihood of taking future maths and science courses and their likelihood of graduating with a STEM degree. Effects are much larger for students with high maths scores. Similar results found in different settings (Canaan and Mouganie, 2019; Bottia et al. 2015)
- Review by Cheryan et al. (2017) also emphasises the potential importance of role models; greater scarcity of potential female role models in computing, engineering and physics than in biology, chemistry and maths

Policy implications

- Girls have a lower perception of their own ability in maths-intensive subjects. Important that they are aware of their own performance (beyond their immediate environment). Also, inculcate a 'growth mindset'. In maths, this is the extent to which individuals believe that their maths abilities can be improved over time with effort. Shown to be particularly efficacious for girls (Boalar, 2013).

- Teacher grading bias shows why external testing is important.

- Girls respond well to female role models - especially girls of higher ability. Zafar (2013) finds important role for tastes and preferences: "A possible policy implication…is to encourage policies that increase the representation of females in academic science and engineering, since these female professors may change female students' beliefs and preferences toward STEM coursework and careers".

Policy implications (continued)

- Cheryan et al. (2015) emphasise importance of diversifying the image of computer science and engineering. Girls are currently exposed to an unrealistic image of these fields that depicts all computer science and engineering cultures as fitting a narrow profile.

- There are numerous interventions to encourage more girls and women to enter and stay in STEM fields. Much more needs to be done to evaluate programmes in a scientific manner and to collate and disseminate results.