

# CEPS POLICY BRIEF



## Why too few students do maths and science

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### KEY POINTS

*Policy-makers often fret about the low number of university graduates in the fields of science, technology, engineering and mathematics (STEM). Proposed solutions often focus on providing better information for students and parents about the employability or average wages of different fields to emphasise that STEM professions pay. This paper argues that, from a personal point of view, students are actually making rational decisions, if all benefits and costs are factored into the equation. It concludes, therefore, that public policy needs to change the incentives to induce students to enter these fields and not just provide information about them.*

Tackling the high and increasing unemployment rate ranks at the top of the EU policy agenda, especially with regard to young people. There is a general consensus that to achieve employment growth, especially for vulnerable groups, it is not enough to kick-start economic growth – skills among both the high- and low-skilled population also need to be improved. However, we need to move beyond simplified narratives and generic policies in order to better understand a much-debated and lamented phenomenon: the lack of graduates in subjects related to science, technology, engineering and mathematics (STEM).

Company surveys and statistics report a lack of graduates in STEM subjects, which persists despite the expansion of higher education. Policy interventions have been limited to the provision of better information to students via campaigns aimed at attracting them towards the natural or hard sciences. New research shows, however, that the problem might not be one of information, but rather one of incentives. When fully calculated, cost/benefit analyses do not point in favour of studying ‘difficult’ subjects. To encourage students to major in these subjects, therefore, policies should be geared towards both disseminating better information and providing of new incentives.

CEPS Policy Briefs present concise, policy-oriented analyses of topical issues in European affairs, with the aim of interjecting the views of CEPS researchers and associates into the policy-making process in a timely fashion.



This paper was initially prepared as Policy Brief No. 4.6 of the NEUJOBS research project, which is financed by the European Commission under the 7th Framework Programme. Its objective is to analyse likely future developments in the European labour market(s), in view of major transitions that will impact employment – particularly certain sectors of the labour force and the economy – and European societies in general (see [www.neujobs.eu](http://www.neujobs.eu) for more information).

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## 1. A puzzle

When higher education was largely the pursuit of elites, it did not matter so much what and where one studied as simply the fact that he (or, in a smaller number of cases, she) participated in tertiary education at all. Since the 1960s, Europe has gradually moved towards mass higher education, with the European Union recently setting itself the goal of 40% of young people having attained a higher education degree by 2020 (in the 30-34 year age cohort). It is reasonable to expect that as the group of university graduates grows, within-group heterogeneity will also increase, in that different labour market outcomes can be expected for graduates from different faculties. To what extent has this really happened and what are the policy implications?

European analysts and policy-makers appear to have a clear understanding of the issue. EUROPE 2020, the flagship EU policy strategy document, states: “At national level, Member States will need to ensure a sufficient supply of science, maths and engineering graduates” (European Commission, 2010).

This is based on research (European Commission 2012a) showing that “the current supply of STEM skills is considered to be insufficient and when combined with forecast growth in demand for STEM skills, these shortages present a potentially significant constraint on future economic growth in Europe”. At the same time, applied research (CEDEFOP 2010) highlights the fact that “those with specific degrees do better than those with more general degrees (arts and humanities)”.

There is a gender dimension to the choice of a field of study. While women now make up a majority of students enrolled in tertiary education, the share of female students in sciences, technology, engineering and mathematics remains only around one-third of the total, with little variation across countries. The European Commission (2012b) recently stated that it is “a key challenge for Member States and for higher education institutions to attract a broader cross-section of society into higher education”, noting that the need to make STEM education more attractive to women is “a well-known... challenge”.

This points to a conundrum – if studying ‘difficult’ subjects, such as STEM, leads to better employment and pay prospects, why are students ‘insufficiently’ motivated? It is interesting to observe that in the five countries considered in this study, the number of graduates in STEM subjects increased, proportionately with the more general educational expansion, but the share of STEM graduates in the total remained constant in Slovenia, increased in Poland and slightly decreased in France, Italy and Hungary. On average, they amount to one-quarter of new graduates each year. This situation is a reflection either of irrational decision-making on the part of students or a lack of relevant information. Or, in case of the women and STEM, it can be explained by an unfortunate historical legacy in which classes for engineering and physics majors have been 100% male-dominated.

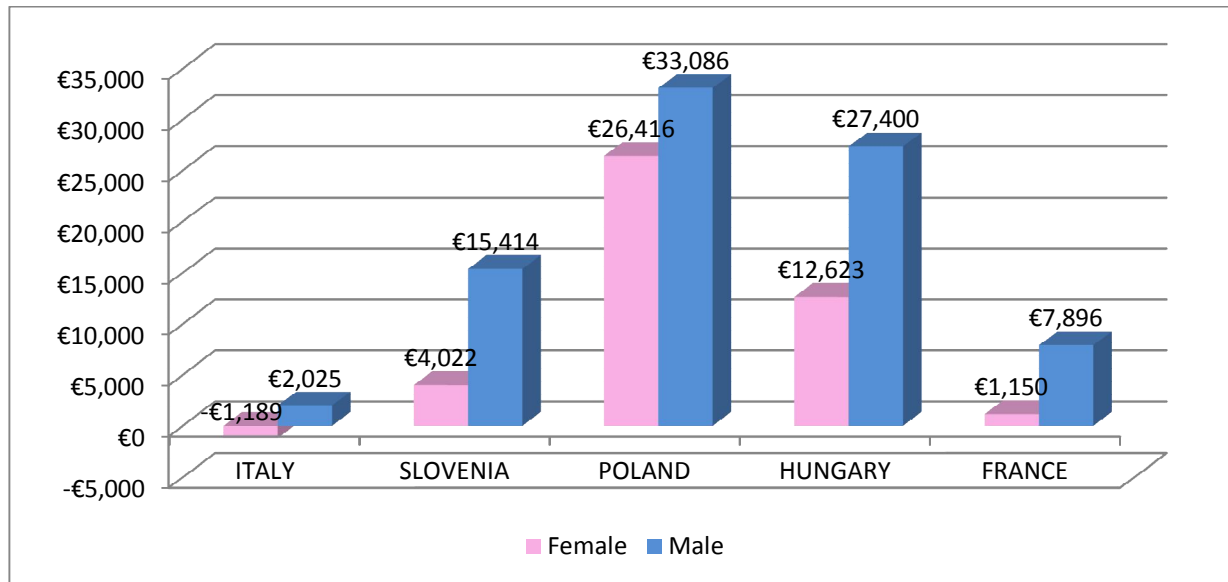
Recent research from the NEUJOBS project sheds some light on this dilemma by analysing the net present value (NPV) of university education by field of study in the five countries referred to above, namely France, Italy, Hungary, Poland and Slovenia. We contend that the current research examines only part of the equation because it tends to look at only some of the benefits (employment prospects and salaries of graduates). Private returns to education should include a broader set of variables. One of the main variables to take into account is the higher cost incurred by students in obtaining an education in terms of time, which significantly influences their opportunities to work while studying or to complete their education in a relatively short time.

## 2. (Opportunity) costs matter for the choice of the field

Once both the costs and benefits of tertiary education are considered, studying STEM subjects is often not the most attractive deal for students. Data indicate a good labour market outcome in terms of salaries and employment opportunities: in most cases graduates in STEM subjects score better than their peers in other fields, which is a signal that the market values and demands their skills. But the system fails on two major points: costs, especially opportunity costs, associated with pursuing the degree, and a strong gender bias.

As far as the latter is concerned, we should underline that better labour market outcome only pertains to male graduates. When a female student leaves university with a STEM degree, she has far a lower chance of success: in terms of salary and the likelihood of employment in the first five years after graduation, female students are much better off studying medicine or social sciences in all five countries. As a result, the net present value of education presents a wide gap for STEM when male and female graduates are compared, which explains why so few female students study in the *écoles polytechniques*.

Figure 1. NPV of tertiary education for STEM graduates, 5 years after graduation, males vs. females



Source: Authors' elaboration based on HEGESCO/REFLEX datasets.

This underperformance has been the subject of debate: according to some authors (Hall, 2007 and Hewlett et al., 2008), it is due to long working hours, a 'macho' culture and a lack of transparency in career paths. Hunt (2010) argues that it is because of dissatisfaction with pay and promotion opportunities. Our data indicate that there is a clear wage gap, which supports the latter hypothesis.

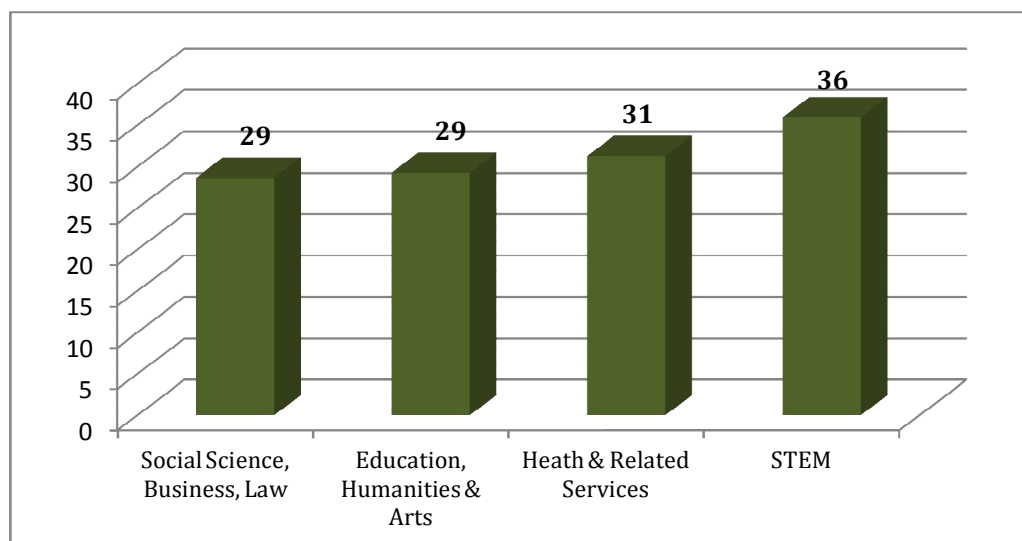
The second main failure concerns costs. Statistics show that before obtaining a degree, STEM students face higher costs than their peers from other faculties. These costs are not necessarily linked to fees<sup>1</sup> but rather to the time spent in universities: both in terms of hours spent on study (which translates into fewer hours available for part-time jobs) or in terms of the number of years needed to complete the courses. This makes the opportunity cost of graduating in STEM subjects higher than for social and human sciences graduates.

As a consequence, those who still decide to enrol in STEM (in particular female students) despite the high costs, are either very bright and expect to take less time than the average to complete the course, or have the means to afford more years or hours in education (or both). See Figure 2.

The important lesson to take from this analysis is that students decide rationally which field of study to pursue or, at least, that their decisions make economic sense. This finding creates a comfortable margin of manoeuvre for policy-makers. Policy action should therefore switch from launching useless campaigns to providing incentives for students, especially women, to compensate for the high opportunity costs associated with a STEM degree.

<sup>1</sup> Which are equalised across subjects in each country in the analysis.

Figure 2. Hours studied (classes plus personal work) by field in the five countries studied



Source: Authors' elaboration based on HEGESCO/REFLEX datasets.

### 3. Concluding remarks

The current economic crisis has put the issues of skills and the labour market very high on the policy agenda. In addressing them, it is important to move beyond simplified narratives and generic policies and better understand the actual phenomena. This Policy Brief focused on the perception of graduate unemployment and the oft-lamented lack of graduates in science, technology, engineering and mathematics. A new approach to the study of returns from education reveals that the insufficient supply of STEM graduates is, at least in part, attributable to the fact that the opportunity cost of such an education is significantly higher compared to other major degree subjects. As a consequence, the problem cannot be solved by campaigns but rather needs to be tackled via incentives, such as special scholarships or reduced fees. This is even truer for women, whose apparent limited interest in pure science is consistent with the fact that other studies constitute a much better investment in human capital. Yet, the issue is more complex in this latter case, because an enduring gender prejudice also needs to be counteracted.

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