

Increasing Productivity through Education and Innovation

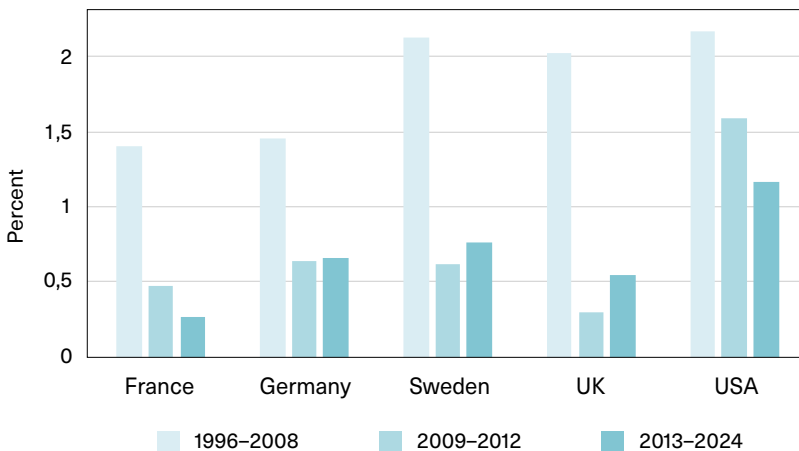
Harry Flam

Summary

The International Slowdown in Productivity Growth

A country's long-term material prosperity — measured as GDP per capita — is determined largely by productivity growth, that is, by how much more goods and services can be produced over time with a given amount of labor and capital. It is therefore worrying that productivity

Average annual percentage growth in GDP per hour worked. USD, constant prices, purchasing power adjusted.



Source: OECD Productivity Database and author's own calculations.

growth has slowed down since the financial crisis in 2008–2009 and has remained below the historical average of around 2 percent per year in the most advanced economies.

Explanations for the slowdown in productivity growth

LOWER INVESTMENT AFTER THE FINANCIAL CRISIS

One important explanation for slower productivity growth in many advanced economies is that investment as a share of GDP declined after the financial crisis. This explains roughly half of the slowdown. More capital relative to labor makes labor more productive, partly because investment often entails the use of more efficient technology. In Sweden's case, reduced investment in the information and communications sector after the early 2000s has contributed to slower productivity growth, although investment levels overall have remained high by international standards.

DECLINING TOTAL FACTOR PRODUCTIVITY

Another important explanation is that total factor productivity (TFP) — the part of productivity growth that cannot be explained by increased capital per worker — has also shown a declining trend. This explains the remainder of the slowdown in productivity growth, that is, roughly one half.

The probably most important drivers of higher TFP are:

- › research and development (R&D) and innovation
- › the spread of knowledge and innovation
- › human capital and its role in facilitating diffusion
- › increased international trade and investment, including the fragmentation of production into global value chains
- › creative destruction and structural change
- › competition.

In my assessment, the slower growth in TFP in Sweden is explained primarily by the stagnation of globalization between the financial crisis and the pandemic (participation in global value chains as a share of exports remained constant), weaker diffusion of new knowledge and technology — to which the shortage of labor with skills in science,

technology, engineering and mathematics (STEM) has contributed — weaker structural transformation, and weaker competition.

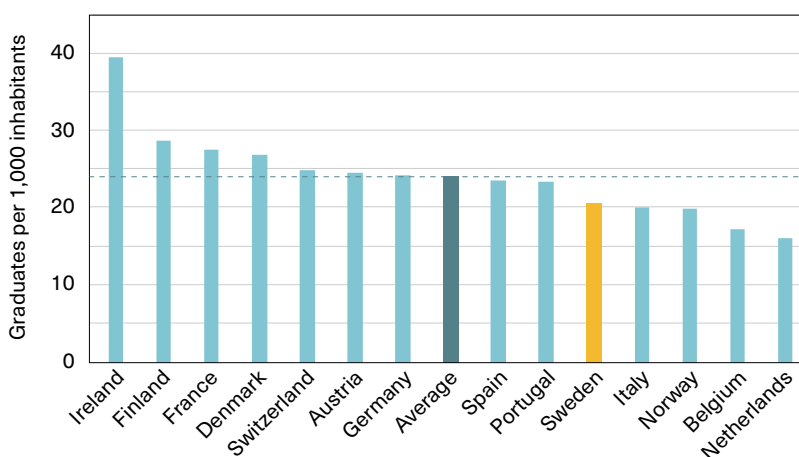
There are high expectations that the new AI tools will generate significant productivity gains for the economy as a whole. Case studies suggest that the gains are substantial in certain areas, but there is practically no evidence at the macroeconomic level.

Generally speaking, returns on investment in R&D are high. In Sweden’s case, new research shows that increased investment in R&D has generated particularly high returns in the information and communications sector, wholesale and retail trade, and high-tech manufacturing.

The share of R&D investment in GDP in OECD countries has increased since the financial crisis. Sweden ranks third, with a share of 3.6 percent (after Israel and South Korea). It is therefore unlikely that the share of R&D investment explains the slowdown in TFP growth in Sweden.

There is, however, virtually no relationship between R&D expenditure as a share of GDP and productivity growth within the OECD since the financial crisis. In other words, countries with relatively low levels of R&D expenditure can still grow relatively quickly, and vice versa.

STEM graduates per 1,000 inhabitants aged 20–29, 2023.



Source: Eurostat.

This suggests that the diffusion of knowledge and innovation from universities and firms to outside users plays an important role in productivity growth. Human capital probably plays a key role here, particularly STEM skills. Without such skills, it is difficult to absorb and make use of new knowledge and technology.

In terms of university graduates with STEM skills, Sweden ranks clearly below the average for comparable EU countries. Compared with young people in many other countries, Swedish school students show remarkably low interest in science and in pursuing a career in STEM fields. This is likely an important explanation for the relatively low share of university graduates in STEM subjects.

STRUCTURAL TRANSFORMATION AND OWNERSHIP CHANGES

Structural change has played a major role in productivity growth in Sweden through the closure of low-productivity firms and the contraction of sectors with relatively low productivity, while high-productivity firms have been established and sectors with relatively high productivity have expanded. In Sweden's case, structural transformation in the form of firm closures and new firm creation accounts for roughly 40 percent of the increase in TFP in recent years (with the remaining share arising within firms themselves). New research shows, however, that the frequency of firm closures and start-ups declined since the turn of the millennium, which may have contributed to weaker productivity growth.

Changes in ownership — including shifts from Swedish to foreign ownership — appear to contribute significantly to higher productivity. Firms that have changed ownership since the turn of the millennium account for as much two thirds of productivity growth. This illustrates the importance not only of free trade, but also of free cross-border investment.

Proposal: Increase the number of STEM Graduates

A STEM-skilled workforce is a prerequisite for conducting R&D. But it is also necessary in order to make use of innovations and the results of research and development carried out by others, both in Sweden and abroad. It seems to be a common perception that higher productivity depends primarily on domestic R&D. In fact, research shows that R&D conducted abroad has an effect on productivity that is two to three times greater than the effect of a country's own R&D, and that the effect of foreign R&D is greater in small countries than in large ones. A small country such as Sweden cannot therefore remain at the technological frontier in all areas, but must import new technologies and new methods.

There is a shortage of STEM skills throughout the EU, including in Sweden. Labor immigration can alleviate part of the shortage, but Sweden competes with other countries both within and outside the EU. One difficulty is that wage levels in Sweden, adjusted for living costs, are not particularly competitive. The shortage must therefore primarily be addressed by educating more people in Sweden.

The government adopted a STEM strategy in 2025 aimed at increasing the number of university students in STEM from 83,000 to 90,000 over a ten-year period, increasing the share of first-year upper-secondary students enrolled in science and technology programmes from 20 to 25 percent, and strengthening mathematics in education prior to high school.

The planned increase in the number of university students is not particularly ambitious. Given current dropout rates, an increase twice as large would be required for Sweden to reach the average of comparable countries in Europe.

The probability that the government's target will be achieved is also low. There are several reasons for this. The strategy relies on voluntary local initiatives, and state support for such initiatives is limited. It is therefore uncertain whether the necessary increases in the number of pupils and students can be achieved, and whether sufficient measures will be taken to generate greater interest in STEM. There is also a lack of central coordination of the strategy with sufficient authority and access to financial support.

Many school students choose high school programs other than science and technology for tactical and rational reasons. A report by the Union of Engineers in Sweden shows that, among students with similar academic performance in lower secondary school, those enrolled in science and technology programmes receive significantly lower grades than students in other programmes. An important measure would therefore be to compensate for the greater workload in admittance to tertiary education.

More can also be done to increase the share of students choosing STEM programmes. In several countries, including Israel and China, academically talented lower secondary students are actively identified and offered advanced programmes in science and technology at upper-secondary level. This helps raise the status of STEM subjects. More can also be done to reduce dropout rates in higher education. Research shows that the amount of teacher-led instruction is of decisive importance. In international comparison, Sweden has relatively few hours of teacher-led instruction in STEM programmes.

THE REPORT PROPOSES THE FOLLOWING MEASURES:

1. The target for the number of students enrolled in STEM programmes must be raised so that Sweden exceeds the average share of graduates among comparable countries. This requires central coordination and increased resources.
2. The state must cooperate systematically with local school authorities in order to increase young people's interest in STEM.
3. Sweden should consider identifying talented lower secondary students and encouraging them to pursue advanced science and technology programmes in high school.
4. Students enrolled in science and technology programmes in upper-secondary school must, in admissions to colleges and universities, be compensated for the greater workload required to achieve a given grade in these programmes compared with other programmes.
5. The number of hours of teacher-led instruction per week in university STEM programmes must be increased.

About the author

Harry Flam is Professur emeritus, Professor of International Economics, Institute for International Economic Studies, Stockholm University.