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Innovation Inputs,

How does the Republic of Ireland Compare?

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SUMMARY

The Republic of Ireland's industrial and enterprise strategies will have to evolve in the future to adjust to changing political, economic and technological realities.

One constructive step that the Irish government can take to future proof its economy is to renew its focus on innovation policy with a view to building a world class innovation system. Technological change and innovation have long been of fundamental interest to economists because of the belief that sustainable long-run economic growth depends on the ability of the economy to produce and diffuse new innovations.

It is unwise to conflate innovation with R&D or to treat innovation as a linear process. Yet it is notable that the Republic invests significantly less in innovation inputs than do other similar small open economies. While the Republic is making progress in building up its innovative capacity, its capacity remains weaker than in other small advanced economies.

KEY POINTS

- Economic growth is central to improved living standards, in turn; innovation and the spread of economically useful knowledge are essential inputs for sustainable growth.
- Characteristics of knowledge mean that a self-regulating market will invest less than is socially optimal in knowledge generating activities. This is a rationale for public investments in innovation activities.
- Technological change does not occur in a perfectly linear input-output sequence, but through feedback loops within the economic and social systems.
- Even so, the Republic invests notably less per person in public R&D than other Western European economies. It also invests less per pupil in education and has one of the weaker broadband networks.
- The Republic performs well across a range of innovation indicators. However, systemic underinvestment in innovation inputs has negative implications for the economy's future innovative competence and long-run growth.

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Research for new economic policies

Knowledge and economic growth

Economic production depends on the application of useful knowledge and there is a substantial body of empirical and theoretical work attributing much of the long-run fluctuations in economic output to technological change. It has even been argued that the application of new ideas in economically useful ways is the only sustainable source of long-term economic growth.

Knowledge differs from capital and labour as an input into the production process because it *does not exhibit diminishing returns*. Once obtained, knowledge is virtually costless, and through continuous learning and the application of new and useful knowledge we can produce the same value of goods and services for increasingly less effort.

While the cost of acquiring knowledge is independent of the scale on which the knowledge is eventually used, the benefit obtained from the knowledge very much depends on the scale at which it is used. This *inexhaustibility* or 'non-depletion' of knowledge generates increasing returns to scale, which in turn generates productivity gains and economic growth.

Knowledge is also *non-rivalrous*. This means that one person's use of knowledge does not reduce another person's use of the same knowledge. The non-rivalrous nature of knowledge opens up the potential for positive externalities in the economy in the form of spillovers.

However, knowledge is only *partially excludable*. The would-be producer of knowledge will often be unable to capture all of the benefits of its production and is therefore disincentivised to produce it in the first place. In addition, there is inherent *uncertainty in the cost of production* of new knowledge. The result is that a self-regulating market will produce a less than socially optimal amount of economically useful knowledge. The likelihood of market failures provides a rationale for internentionist technology policy.

Technology diffusion

The diffusion or spread of an innovation is essential if it is to have an impact on the economy. There has been a wide variation in the rates and speed of acceptance of even successful innovations. It may be that the diffusion process is influenced by the characteristics of the technology itself (e.g. observability), as well as by certain characteristics of potential technology adopters, for example their income levels and their levels of educational attainment. The wider socio-economic environment will influence the diffusion process as will the density and nature of social networks.

We can identify a number of factors that have influenced the historical diffusion or spead of new ideas. These include (A) improvements in *transport and communication technologies*; (B) increases in *effective population size* as well as greater *urbanisation* and individual proximity to a diversity of other people; (C) improvements in *education and human capital*, (D) changes to the *institutional environment* or socio-economic 'rules of the game' (e.g. strength of property rights and openness of society), and (E) improvements in the *absorptive capacity* or innovation competence of firms.

Innovation systems

The economic system's ability to generate original ideas and to communicate, diffuse and assimilate existing innovations can be thought of as its 'Innovative Capacity'. At a national level we can think of it as National Innovative Capacity (NIC).

NIC depends on the quality and dynamism of the National System of Innovation (NSI). Improving innovative competence is not simply a matter of increasing innovation inputs, although the quality and volume of innovation inputs is certainly important.

The NSI approach emphasises the systemic nature of innovation processes. The level and types of knowledge flows in the economy as well as the nature, density and strength of the relationships between people and organisations are crucial to innovation

Chart 1: Public R&D expenditures (% of GDP)

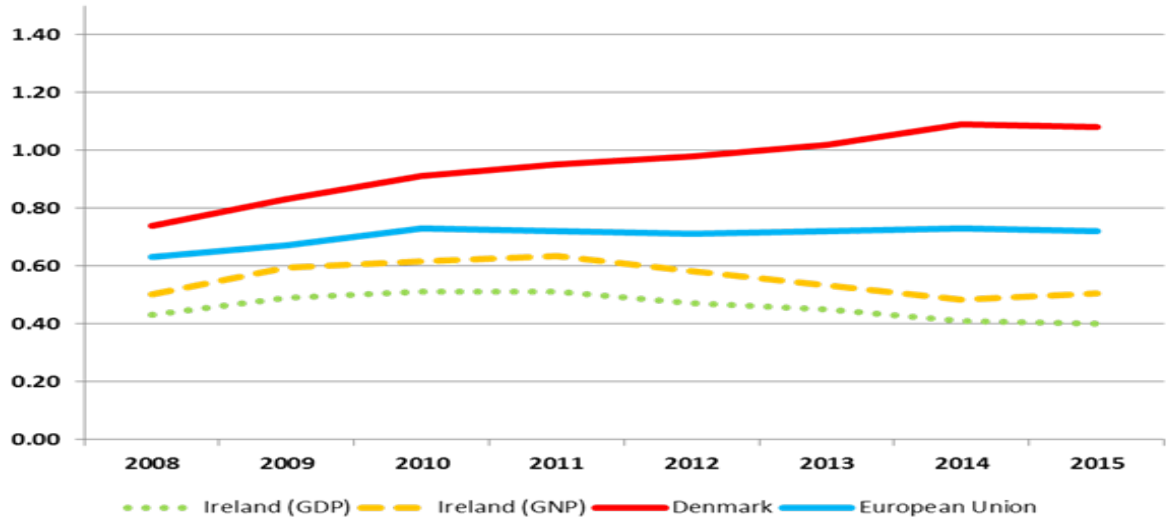


Chart 2: Per capita spend on public sector R&D in 2015 (€)

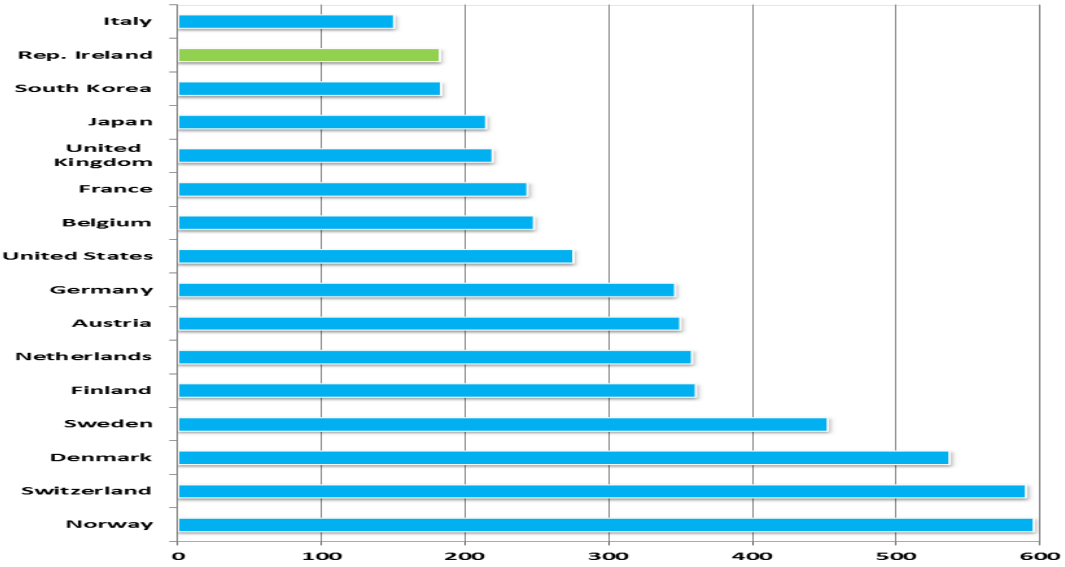
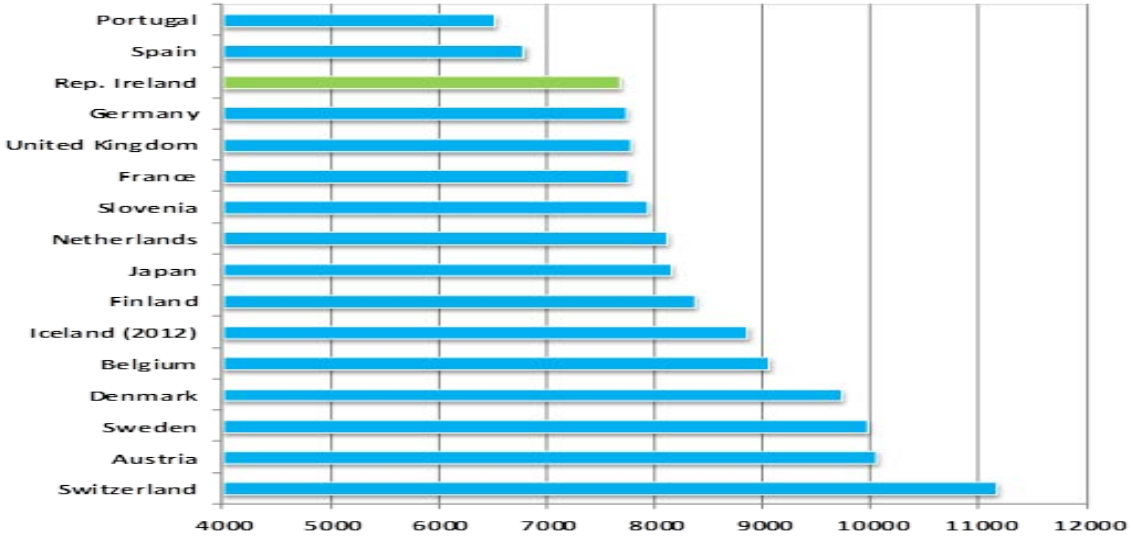


Chart 3: Public spending on education institutions per pupil (FTE) in 2013 (PPS)



Innovation performance

Innovation is now part of the policy mainstream and the Republic has a generally favourable and supportive environment for innovative activities. The Republic ranks 7th out of 128 countries in Cornell's 'Global Innovation Index and 6th out of 28 EU countries according to the European Innovation Scoreboard (EIS).

According to the EIS, the Republic ranks 3rd in '*human resources*', 1st in terms of '*innovators*' as well as 1st in terms of '*economic effects*'. The Republic's rankings for '*linkages and entrepreneurship*' (ranking 2nd for SMEs innovating in-house) and for '*innovators*' (ranking 2nd for SME marketing/organizational innovations and 2nd for employment in fast-growing firms of innovative sectors) suggests that the Republic's NSI is performing relatively well compared to most other countries.

While the Republic does not rank particularly badly in any one category it does underperform the EU average in three areas. The first of these is '*finance and support*' where underperformance is entirely attributable to the Republic's low level of public R&D expenditure. The Republc also underperforms in terms of '*firm investments*' (e.g. business R&D) and in terms of '*intellectual assets*' (e.g. patents).

Concerns

The Republic's fixed-line broadband penetration rate (a useful proxy for broadband diffusion) has remained in the bottom half of OECD countries since the broadband diffusion process began. The Republic also does poorly in terms of access to high-speed fibre broadband and access tp broadband in rural areas. Broadband is important for innovation because it reduces barriers and costs associated with accessing, using and diffusing knowledge.

Perhaps the most fundamental area of concern is the need to improve in relation to innovation investments. This includes public supports for R&D and education as well as innovation investments by enterprises. Berlitz et al. (2015) find that an increase of one percentage point of R&D spending in the economy leads to a short-term average increase in GDP growth of approximately 0.05 to 0.15 percentage points. According to the OECD (2016), the Republic's total R&D intensity was just 1.49% of GDP in 2014 compared to 2.38% in the OECD. Publically financed R&D was 0.40% of GDP compared to 0.61% in the OECD while business expenditure on R&D (BERD) was 1.09% of GDP and 1.77% in the OECD. The Republic also underperforms if we use GNP as the denominator.

The Republic spent €182 per capita on public sector R&D in 2014. This compares to expenditure of €219 in the UK; €462 in Sweden, €538 in Denmark and almost €600 in Switzerland and in Norway. While an economy's innovative capacity depends on far more than just the public spend on R&D it is evident that the Republic has significant scope to increase the R&D budget.

The Republic also significantly lags the leading countries on a 'per pupil' basis in terms of spending on primary and tertiary education. Increasing the per capita spend on education to Nordic country levels would increase the Republic's long-run growth potential by enhancing labour force and economy-wide innovative and productive capacity.

NIC depends on much more than the volume of innovation inputs. Knowledge flows and linkages, as well as compatible institutions and the quality of capital markets are also important. Even so, the volume of inputs is important for innovative competence and ultimately for productivity led growth. In this context, the Republic's systemic underinvestment is a concern.

References

This NERI *Research inBrief* accompanies NERI Working Paper No 40: Innovative Coompetence, How does the Republic of Ireland Fare and does it Matter?

Working Paper No 40 contains a full list of all of the references, data and findings used in this *inBrief*.