Chapter 6

Education and innovation policies

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6.1 Introduction

Two apparently different but extremely related policy arenas are discussed in this chapter: education and innovation. Over the years, their relations have become increasingly intertwined, forging a strong liaison in contemporary capitalism. Defined by Schumpeter as the ability of an entrepreneur to introduce economically relevant changes, innovation maintained for a long time certain independence from high educational attainment. In the past, the innovator may undoubtedly have had the characteristics of the great intellectual applying his knowledge to the technological improvement of certain products or machines, or even of the researcher working for the large companies that dominated the technological scene, yet his profile did not necessarily have to include a high level of education (Ramella, 2016). In other words, innovation was not based on formal education through which the innovators could learn a basic technology to apply to new products. The biographies of many entrepreneurs disclose an innovativeness that evolved more from know-how acquired "hands-on" in the workplace than in university classrooms.

However, as the international competitiveness of markets and the sophistication of demand have increased, the innovator has increasingly found the need to combine their abilities with codified skills. Nowadays, more specialist knowledge is required – whether it is technical or humanistic. State intervention has hence interlinked education and innovation increasingly. On the one hand, as emphasised by the Lisbon Strategy, raising education levels has become one of the main levers for bolstering economic development and strengthening the knowledge society.

On the other hand, a broad awareness that globalisation would hit the most ordinary productions in advanced countries, due to growing competition from emergent economies with low labour costs, has brought about more attention to innovation policies.

Since the second half of the 1990s, therefore, education and innovation policies have become progressively strategic pivots around which to

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generate economic policy in advanced countries. They have emerged as typical instruments of the supply-side approach, which considers public spending as public investment that buttresses private investment.

However fundamentally entwined, substantial differences nonetheless appear in these two policy areas, one of which concerns those who implement and those who receive the policies. The promotion of education is a typical area of public intervention, albeit with significant differences between countries, with a significant presence of the private sector in some cases (e.g. the United States). Encouraged by democratic values, advanced countries invested in education even before this evolved into a full-blown driving force of economic development, setting up complex and differentiated education systems that span from early childhood to university specialisation. This is therefore a predominantly public sphere of action which, however, since the end of the 1980s has been undergoing a progressive, albeit slow, process of greater privatisation. In contrast, innovation has traditionally been considered an activity to be managed by private entrepreneurs. The state was left with a residual role of solving market failures, as a guarantor of adequate funding for basic or pre-competitive research activities.

Here, however, compared to that observed in the field of education, an antipodal process has taken shape. Innovation policies have grown in size and scope since research results showed that public intervention is a necessary condition for private competitiveness (Block, 2008; Nelson, 1993; Mazzucato, 2013). They have expanded far beyond the mere incentivisation of business R&D towards public infrastructures supporting private innovativeness and, at the same time, the weaving of public–private networks.

A second difference concerns the effect of these two types of policies on inequalities. Education policies have a direct effect on curtailing inequalities, especially when construed as those interventions that aim to remove the socio-economic obstacles that prevent young people from achieving the desired higher levels of education. As the level of education increases, so does employability, together with income and the possibility of upward social mobility.

Nevertheless, the relationship between public investment in education and inequality curtailment rather than evolving in a linear fashion is mediated by multiple intervening factors, the key elements of which are the quality of the educational regime and the institutional characteristics of the national education system. The reference here is to the distinguishing traits within the different national education systems, arising from the possible early channeling of students into vocational paths, or relating to dualised university systems, between elite and popular paths. Dual and/or early-channeling education regimes are more likely to reproduce the ascribed socio-economic status of students and, consequently, even with generous public or private funding, the impact on reducing inequalities diminishes. Conversely, educational regimes that are more responsive to the needs of students with greater difficulties, combined with open and democratic education systems, can produce meritocratic effects. In the latter case, growth in public funding may have a stronger impact on upward social mobility.

The abatement of inequality is only indirectly affected by innovation policies, however. In this case, there are two mechanisms at work. First, the intensification of innovative activities corresponds to a significant increase in employment, both in those sectors where innovation is implemented and for the economy as a whole (Moretti, 2012). Second, innovation policies trigger trajectories of economic development that are more shielded from international competition, consequently enhancing the health of firms and, with it, their ability to bear higher taxation, generally directed at financing the welfare state. As such, these policies can offset the costs of reducing inequality (Trigilia, 2016).

While acknowledging their joint contribution in influencing development and inequality, these two policies will be handled separately in the following pages to better understand how the 18 advanced economies considered in our research differ under this aspect.

6.2 Education

The diversity among the four growth models emerges also in consideration of the level of public expenditure on education (Figure 6.1). The highest proportion of GDP spent on education (7.5%) is among the countries with inclusive

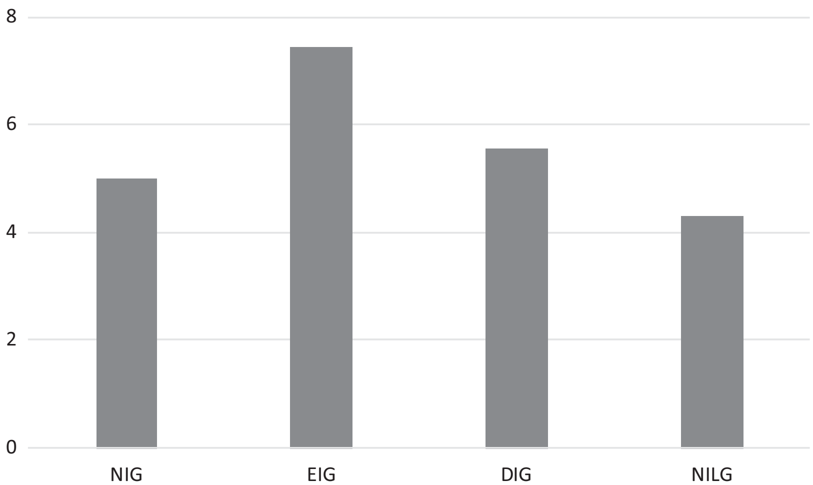

Figure 6.1 Public expenditure on education by growth model, as a percentage of GDP (2015).

Source: Elaboration on World Bank data, World Development Indicators.

and egalitarian growth. In this case, the EIG countries have quite homogeneous features, with expenditure ranging from 7.6% in Denmark to 7.1% in Finland.

In the other cases, spending on education is lower in the shift from growth to low growth models. Specifically, countries with dualistic inclusive growth are characterised by an average expenditure of 5.6 GDP points, two points below the EIG type. Within this grouping, the internal variance is pronounced: Belgium spends about 6.5% of GDP while Germany barely reaches 4.8%.

In the non-inclusive growth countries, the average value of expenditure (5.0%) is still significantly lower than with dualistic inclusive growth (DIG). Here, the average value is strongly influenced by the outlay in Ireland (3.8%), the lowest of the whole sample considered. In the other cases, the level of expenditure is entirely in line with that of the DIG countries (5.5%).

Overall, however, the group of countries that spend less on education belong to the non-inclusive low growth model. Only Portugal (4.9%) is above the average value of this group – at 4.3% – while the other three Mediterranean economies have extremely low levels of spending at around 4%.

Considering the expenditure devoted only to the tertiary level of education, the order of the growth patterns presented above does not change (Figure 6.2). Once again, the EIG countries are the ones to invest the most (39.5% of per capita GDP), followed by the DIG (33.7%) and non-inclusive growth (NIG)

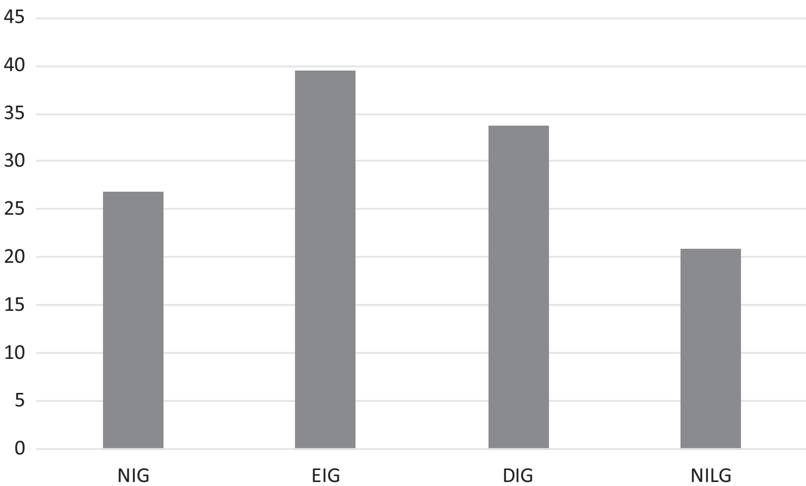

Figure 6.2 Public expenditure on tertiary education by growth model as a percentage of GDP per capita (2015).

Source: Elaboration on World Bank data, World Development Indicators.

(26.8%). The last group by total expenditure is the non-inclusive low growth (NILG) (21.0%).

The expenditure in higher education is more susceptible to strong country-level fluctuations in comparison with the overall spending. Excluding the DIG countries, higher education expenditure shows a high intra-group variation. This is especially true for those that belong to the NILG and NIG models, except for the UK and Canada. However, even in the EIG model, there are countries with an expenditure above the average value of the group: Denmark and Sweden have the highest value among the 18 countries considered (43.1%). On the other hand, within the NILG model, the average value of expenditure on tertiary education would be around 25% were it not for Greece, which considerably lowers the average of the group due to an outlay that is decidedly below the countries considered here (9.2%).

Going back to the differences between models, less variance comes to light in spending on primary education (Figure 6.3). In particular, the clear recovery of the NILG countries (20.3%) is worth noting, just below the EIG model (22.5%), outstripping even the DIG (19.5%) and NIG (18.6%) countries.

Here again, it is interesting to highlight certain national specificities. The most significant of these is the United Kingdom, whose expenditure (25.1%) is more similar to that of the inclusive growth countries than to the NIG model. Internal differences also characterise the DIG countries – here Germany, France, and the Netherlands spend around 17% of their GDP per capita, while Austria and Belgium spend relatively more (around 22.5%). The

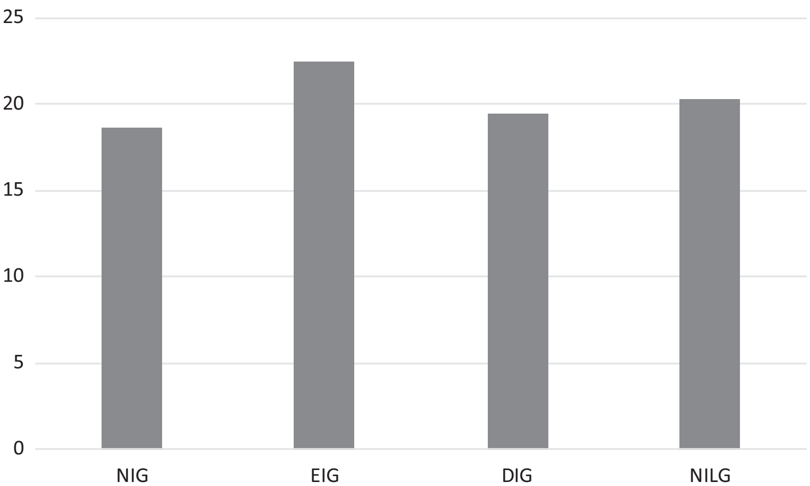

Figure 6.3 Public expenditure on primary education by growth model as a percentage of GDP per capita (2015).

Source: Elaboration on World Bank data, World Development Indicators.

NILG countries show more internal homogeneity, with only Spain (17.3%) presenting levels significantly below the group average.

Overall, the countries that invest the most in the education system, from primary schools to universities, are those with an inclusive egalitarian growth trend. Of particular interest to our research is the fact that much of the diversity between the models relates to spending on university education. This attests that primary education is one of the most typical and cross-cutting functions of governments in advanced economies while confirming that only a few countries, those that are most concerned with spending as an investment, focus on higher levels of education.

Moreover, in contrast with what emerges in most of the policies considered in our research, spending on tertiary education is also high in the NIG countries that invest almost as much as happens in the DIG model.

Concerning the share of the population aged 25-64 with a university degree, it is hardly surprising that the graduation rate is low in the NILG countries (27%), and equally unremarkable that in the inclusive growth models the rate is higher (see Figure 6.4). Worthier of note is the fact that NIG countries have the highest graduation rate (47%), followed by EIG countries (41%) and DIG countries (34%). In the light of these data, the level of public spending on education conditions the qualification of human capital, but at the same time, there are cases, such as those in the NIG countries, where the same conclusion is reached only if the sum of public funding and private contribution is considered.

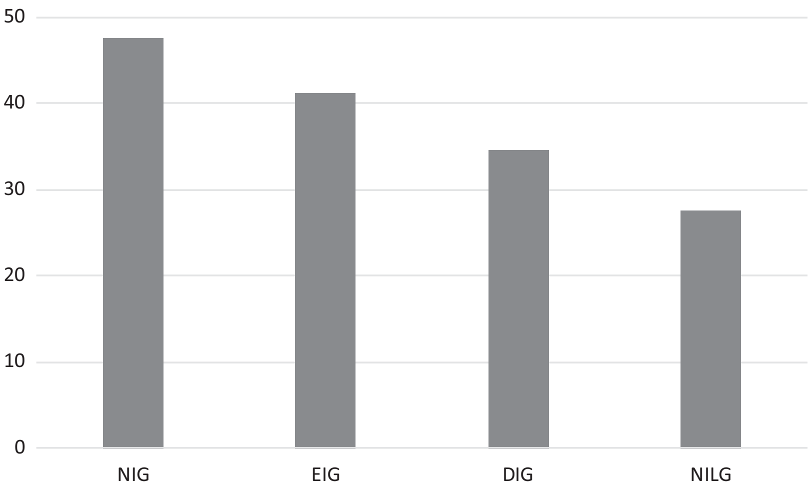

Figure 6.4 Population with university degrees as a percentage of the total number in 25–64 years age group (2018).

Source: Elaboration on OECD data (2019).

If the source of funding (public or private) has no bearing on the extent to which economic development is affected by the qualification of human capital, the same cannot be said for the relationship between education and the curtailing of inequality. It is precisely in this area that we find the main cleavage between the two models of inclusive and non-inclusive growth. On the one hand, we have the countries of the EIG model, and to a lesser extent of the DIG model. Here the state ensures everyone access to the highest levels of education, thanks to low, if any, university fees. On the other hand, in the countries of the NIG model, where enrolment in university courses is extremely expensive, scholarships are granted only to the most deserving, and access to university education for the majority depends on family heritage or borrowing capacity.

6.3 Innovation

Data on public spending on innovation policies in advanced economies confirm the trends highlighted for education policies. Higher levels are associated with the EIG countries (0.99%), while the NILG countries register the lowest spending (0.56%). The other two groupings are positioned on an intermediate level (Figure 6.5). In general, the variation of expenditure on innovation policies within the growth models is low, except for the NIG countries. The average value associated with this group hides different spending behaviours.

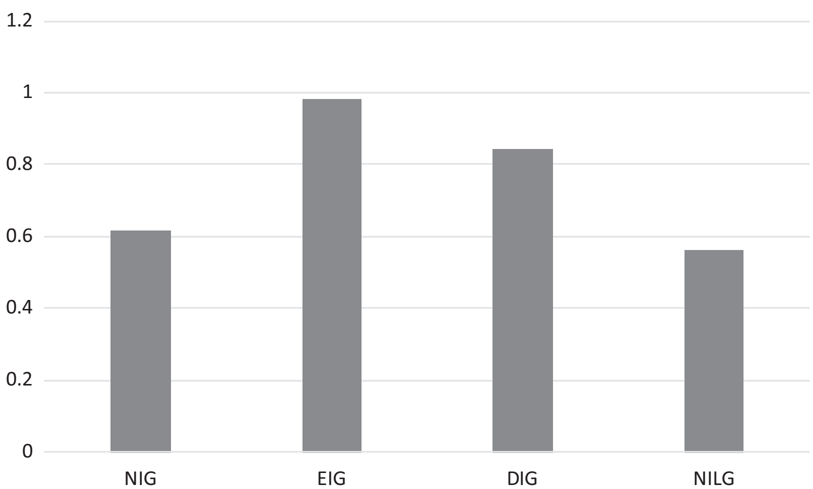

Figure 6.5 Public expenditure on R&D by growth model, as a percentage of GDP (2016).

Note: "R&D expenditure" refers to expenditure by governments (GOVERD) and universities (HERD).

Source: Elaboration on OECD data.

On the one hand, Australia and Canada show levels of investment similar to that of the DIG countries (0.80%); on the other, the United Kingdom and Ireland present quite low expenditure – 0.52% and 0.32% respectively. Between these two extremes is the United States, with an expenditure of just over 0.6% of GDP.

The taxonomy of public expenditure on research and development provided by the "Frascati Manual" – which guides the statistical definitions for the OECD countries – distinguishes between the spending exercised directly by the government (and its administrative units) and that exercised by the university system. In general, compared to those of the government the interventions of the university system are always financially more substantial: in advanced economies, the ratio between the two is almost three to one. Although government spending on R&D is highest in the DIG countries (0.27%) (Figure 6.6), specific national patterns are noticeable. First, the German case shows the highest figure among advanced economies (0.4%). It outlines a peculiar mode of intervention, which adds to the funding of the university system that of some research institutes, such as the Fraunhofer (dealing with applied research), the Max-Planck (which instead carry out basic research, often with an interdisciplinary approach) and the Leibniz institutes.

Also within the NIG model differences emerge. In the US, in the face of low levels of public spending on university R&D, the government invests a considerable part of its GDP (0.28%) in supporting a system of federal

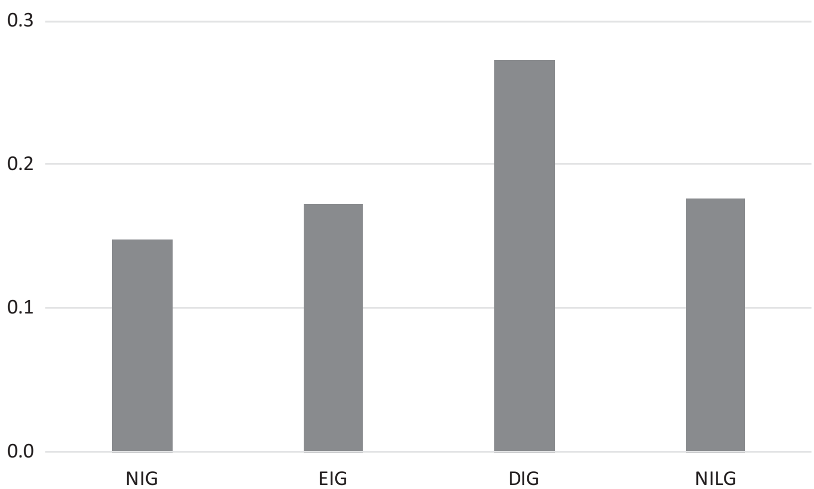

Figure 6.6 Governmental organisations' expenditure on R&D by growth pattern, as a percentage of GDP (2016).

Source: Elaboration on OECD data, Main Science and Technology Indicators.

agencies that carry out, among other things, mission-oriented research and development (e.g. DARPA, National Science Foundation, NASA, National Institutes of Health, Department of Energy, etc.). Finally, there are some countries that, regardless of the growth model, are characterised by a somewhat negligible intra-governmental research expenditure. This is the case with Ireland (0.05%), Denmark and Portugal (0.07%), Sweden and the United Kingdom (0.11%).

An appraisal of the amount spent on R&D by the (public) university system confirms that advanced economies fit the four types of growth thoroughly (Figure 6.7). The countries with inclusive, egalitarian growth, implementing an innovation system that is notoriously university-centric, disclose the highest expenditure. Within this group, spending levels are comparatively elevated; among these prevails Denmark, the country whose universities spend the most on R&D (1% of GDP). This is followed by the DIG countries (0.57%), the NIG countries (0.47%), and finally the NILG (0.39%). In this last growth pattern, the average value is propelled by Portuguese expenditure (0.57%), while Spain, Greece, and Italy are just above 0.3%.

In the NIG model, the two countries that invest the most (Australia and Canada are almost at the level of the DIG countries) offset those with much lower expenditure, ranging from 0.4% in the United Kingdom to around 0.3% in Ireland and the United States. However, in the latter cases, it is not a matter of weak university systems, as with the NILG model, but rather of strong, yet predominantly privately funded, university systems.

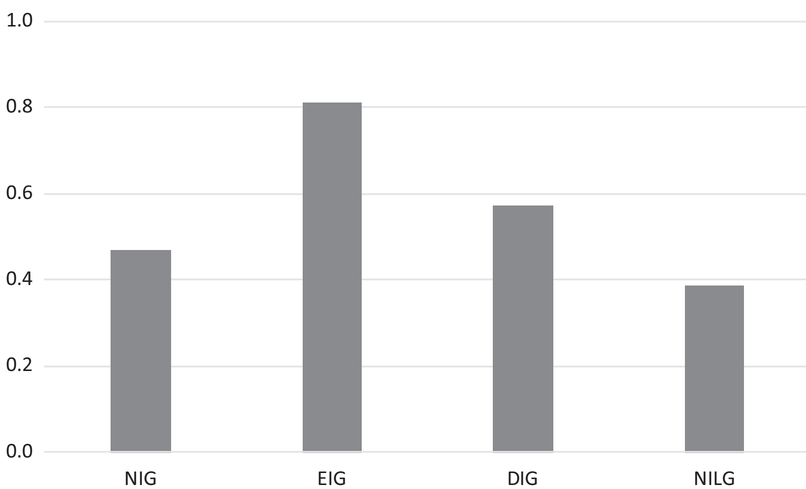

Figure 6.7 R&D expenditure of the university system by growth model, as a percentage of GDP (2016).

Source: Elaboration on OECD data, Main Science and Technology Indicators.

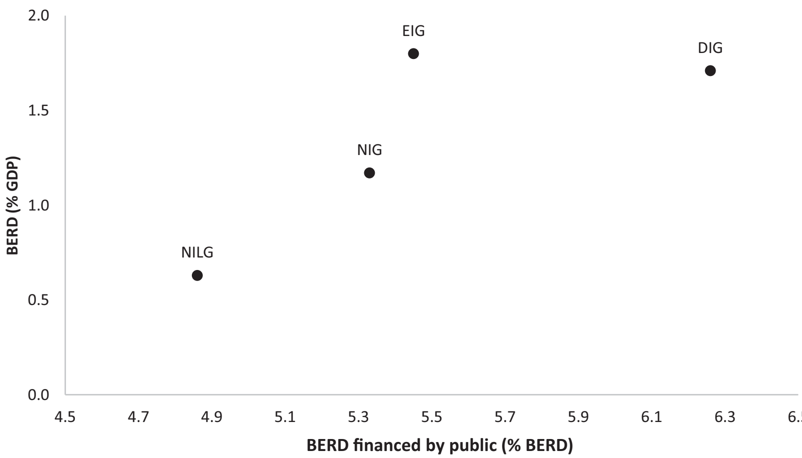

Figure 6.8 Publicly financed private R&D expenditure and private R&D expenditure by growth pattern as a percentage of GDP (2016).

Note: Private R&D expenditure financed by the public is calculated as a percentage of private expenditure (BERD).

Source: Elaboration on OECD data, Main Science and Technology Indicators.

The degree of innovativeness of the different growth models may nevertheless be still further appreciated upon an exploration of two other indicators. The first concerns research and development expenditure by private actors, the second the percentage of these activities financed by governments (Figure 6.8). Crossing these two indicators, four configurations can be clearly distinguished. The EIG model shows a prominent level of private expenditure where the public contribution is below the average of the 18 countries considered. The DIG model always shows high private R&D but is highly supported by public funding. The NIG and NILG models, on the other hand, share a low level of public funding for private R&D but reveal a different degree of business commitment, high in the NIG model and extremely low in the NILG model.

However, it is necessary to bear in mind that the variance within the four growth models can, in some cases, lead to misleading conclusions (Figure 6.9). Within the NIG countries, only Canada, Ireland, and Australia can be properly considered as being in the bottom left quadrant, while the US and the UK are notable exceptions. In the American case, private R&D expenditure is unusually high (2.0% of GDP), and, at the same time, there is a high incidence of public funding (6.4%). In the British case, on the other hand, investment in R&D by private individuals is modest (1.1%) while it is upheld more firmly by the state (7.8%).

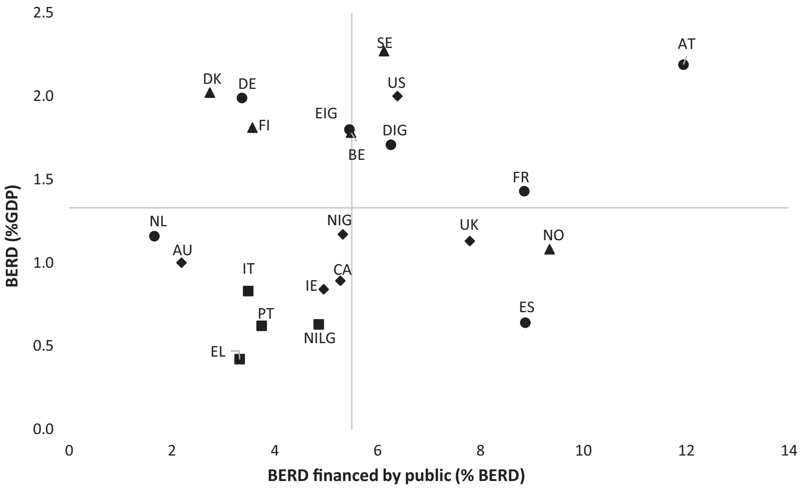

Figure 6.9 Publicly funded private R&D expenditure and private R&D expenditure by countries and growth patterns, as a percentage of GDP (2016).

Note: Private publicly funded R&D expenditure is calculated as a percentage of private expenditure (BERD).

Legend: see Figure 6.8.

Source: Elaboration on OECD data, Main Science and Technology Indicators.

In Finland and Denmark private activity in the field of R&D is high (1.8% and 2.0% respectively), mainly financed by companies themselves. In the case of Sweden, for the same level of private activity (2.3%), the incidence of public support increases considerably (6.1%). Finally, the Norwegian model includes state aid more than Sweden (9.3%) but with a business system that is less inclined to spending on R&D (1.1%).

In the DIG model, Austria and France show high private R&D activities and, at the same time, high public support for businesses. In particular, Austrian firms undertake activities worth 2.2% of GDP but, here more than in any other country, public funding is extremely high (11.9%). Compared to Austria, French companies conduct less private research and development (1.4%) and receive relatively less public funding (8.8%). Germany and Belgium are characterised by high private strength (2% in the former, 1.8% in the latter) with significant but below-average public support (3.4% in Germany and 5.5% in Belgium). Finally, in the Netherlands, private initiative in R&D is low (1.2%) and, at the same time, there is a negative record of public support (1.7%).

In contrast, the countries of the NILG model manifest more homogeneous values (low expenditure–low aid). Only Spain differs, placing the country in

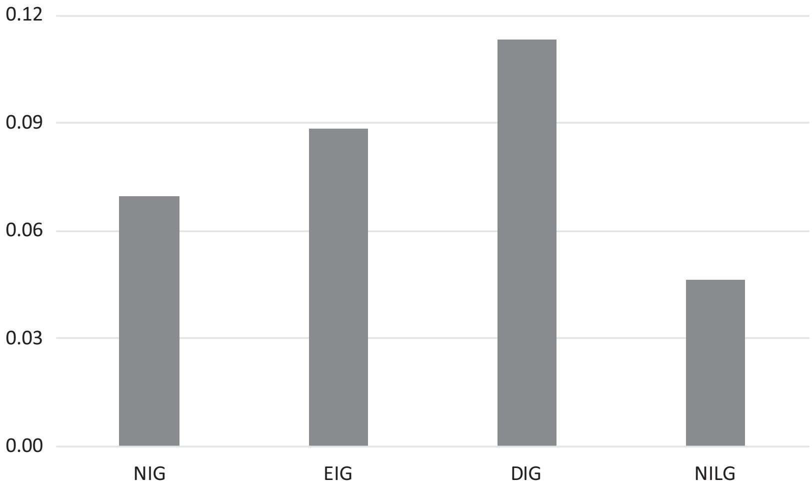

Figure 6.10 Direct funding of corporate R&D, as a percentage of GDP (2015).

Source: Elaboration on OECD data, Main Science and Technology Indicators.

the bottom right quadrant. Here public funding for private R&D is considerably higher than the average for the group (8.9%).

Upon closer inspection of how governments support private companies, another distinction emerges. In innovation policies discrimination between direct and indirect interventions is commonplace. Direct interventions allocate funds to firms that have passed a selection process, while indirect types of intervention denote automatic measures, i.e. measures granted whenever firms adopt certain behaviours identified as needing incentives, such as carrying out research and development.

Direct funding prevails in inclusive growth models, while indirect funding tends to be more widespread in both the DIG and NIG groups (Figures 6.10 and 6.11). More specifically, the countries making the most use of direct interventions are Austria (0.26%) and, to a lesser extent, Sweden (0.14%). In contrast, indirect interventions such as tax incentives for R&D activities are particularly common in two DIG countries – Belgium and France (0.28%) – as well as in Ireland (0.29%).

These initiatives are both implemented to a lesser extent in the NILG countries. The only exception is Portugal, where tax incentives for enterprises are above the group average (0.10%).

In conclusion, innovation policies would seem to respond more to national policy styles than to similar growth patterns. However, some relevant elements are worthy of comment. First, for all the indicators considered, the NILG countries always record lower levels of investment than the other countries.

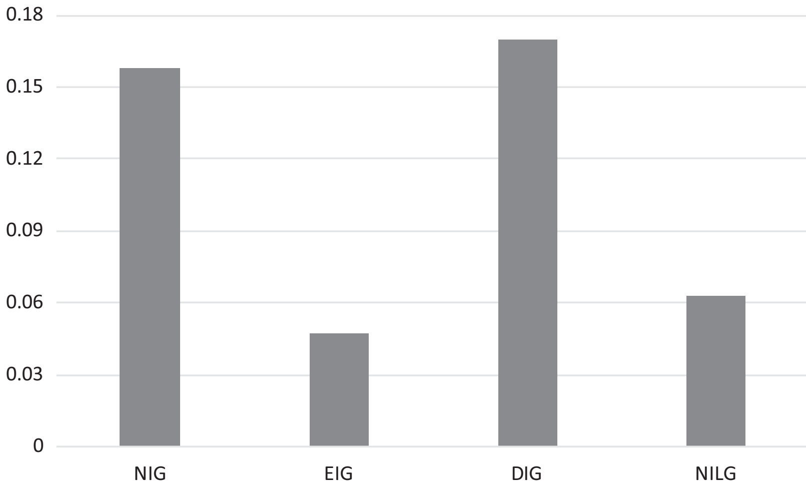

Figure 6.11 Indirect support to business R&D through tax incentives, as a percentage of GDP (2015).

Source: Elaboration on OECD data, Main Science and Technology Indicators.

Second, innovation is supported the most by the public sector, in particular universities, in the EIG model. Third, the DIG countries are characterised by a high degree of public intervention which, however, is more varied: there is leverage from the university system and government bodies, as well as public funding for private initiatives. Fourth, in the NIG model, innovation policies receive fewer resources than in the other models of inclusive growth, but more than in the NILG countries. In this case, more space is left to the market, although, as the US case shows, well below what one would expect.

6.4 Concluding remarks

This chapter commenced with a description of the pertinence of spending on education and innovation. For both policy areas our research illustrates how public funding is higher in inclusive growth countries, especially in the cases of the EIG, but also the DIG models. In these contexts, the university – understood as an organisation engaged in the training of human capital and generating research – constitutes a fundamental pivot on which development policy hinges, but also provides an indispensable contribution to the curtailing of inequality. Indeed, it has emerged how in these growth models the state intervenes to remove socio-economic obstacles and allow access to the highest levels of education. At the same time, particular emphasis has been given to the research infrastructures as representing a significant resource for businesses, which is a factor of systemic competitiveness that may well be worth a higher level of taxation.

In the NIG model, public investment in education and innovation is limited and the competitiveness of the economic system is ensured by private investment. In this case, therefore, the public sector could be said to play a more subsidiary role than the market. As a result, conditions to support the competitiveness of the economic system being equal, the effects on the abatement of inequalities are more limited.

In the case of the NILG model, low competitiveness can be attributed to low investment in education and innovation, also generating, however, a lower capacity to scale down inequalities. However, it is worth pointing out that in this case social mobility is thwarted more by low levels of university enrolment than by a segregating education system. Finally, in the NILG countries limited spending on innovation policies hinders growth and, ultimately, does not legitimise the high taxation endured by firms, forcing them inevitably to demand cutbacks, which thus, in turn, generate less likelihood to spend on welfare.

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