4 Tax incentives for research and development

Key insights

- Tax incentives for research and development (R&D) are increasingly used to promote business R&D with 33 out of the 38 OECD jurisdictions offering tax relief on R&D expenditures in 2021, compared to 19 in 2000.
- Most jurisdictions use a combination of direct support and tax relief to support business R&D, but the policy mix varies. Over time, there has been a shift towards a more intensive use of R&D tax incentives to deliver financial support for business R&D.
- The effective average tax rate (EATR) for R&D in 2022 was lowest in Ireland, Poland and Lithuania, providing greater tax incentives for firms to locate R&D investment in these jurisdictions.
- The cost of capital for R&D in 2022 was lowest in Portugal, Poland and France where these jurisdictions provide greater tax incentives for firms to increase their R&D investment.
- Isolating the impact of R&D tax incentives, the largest preferential tax treatment for profitable and marginal R&D investments was offered in Portugal, France and Poland in 2022.
- For profitable small and medium-sized enterprises (SMEs), implied marginal R&D tax subsidy rates were highest in Colombia, Iceland and Portugal in 2022.
- In 2022, 21 out of the 33 OECD countries that offer tax incentives offer refundable (payable) tax credits or equivalent incentives. Such provisions explicitly target SMEs and young firms compared to large enterprises in Australia, Canada and France.
- R&D tax incentives have become more generous, on average, over time. This is due to the higher uptake and increased generosity of R&D tax relief provisions. While this trend stabilised between 2013 and 2019, an increase is again observed from 2020 and maintained through to 2022.

Incentivising investment in R&D by businesses ranks high on the innovation policy agenda of many jurisdictions. R&D tax incentives have become a widely used policy tool to promote business R&D over recent decades. Several jurisdictions offer them in addition to direct forms of support such as R&D grants or government purchases of R&D services. R&D tax incentives can provide relief to R&D expenditures, such as the wages of R&D staff and/or to the income derived from R&D activities, such as patent income. The indicators referred to in this section relate to expenditure-based R&D tax incentives. An overview of income-based tax incentives is available in the section on Intellectual Property regimes. The significant variation in the design of expenditure-based R&D tax relief provisions across jurisdictions and over time affects the implied generosity of R&D tax incentives.

Indicators of R&D tax incentives

The Corporate Tax Statistics database incorporates two sets of R&D tax incentives indicators that offer a complementary view of the extent of R&D tax support provided through expenditure-based R&D tax incentives.

The first set of indicators reflects the cost of expenditure-based tax incentives to the government:

- Government tax relief for business R&D (GTARD) includes estimates of foregone revenue (and refundable amounts) from national and subnational incentives, where applicable and relevant data are available. This indicator is complemented with figures on direct funding of business R&D to provide a more complete picture of total government support to business R&D investment.
- Both indicators, compiled by the OECD Directorate for Science, Technology and Innovation, are available for 49 jurisdictions – OECD jurisdictions and 11 partner economies – for the period 2000-20.

The second set of indicators are synthetic tax policy indicators that capture the effect of expenditure-based R&D tax incentives on firms' investment costs (see Box 4.1):

- The EATR for R&D measures the impact of taxation on R&D investments that earn an economic profit.
- The user cost of capital for R&D measures the return that a firm needs to realise on an R&D investment before tax to offset all costs and taxes that arise from the investment, making zero economic profit.
- Implied marginal tax subsidy rates for R&D, calculated as 1 minus the B-Index, reflect the design and implied generosity of R&D tax incentives to firms for an extra unit of R&D outlay. The B-Index captures the extent to which different tax systems reduce the effective cost of R&D.

The second set of indicators are available for 48 countries, including OECD jurisdictions and ten partner economies. Indicators of the user cost of capital and the EATR are available for 2019-2022 and refer to large businesses who are able to fully utilise their tax benefits. Large companies account for the bulk of the R&D in most OECD countries (OECD, 2023[1]; Dernis et al., 2019[2]). The EATR and user cost for R&D are produced by the OECD Centre for Tax Policy and Administration and the OECD Directorate for Science, Technology and Innovation. The B-Index, compiled by the OECD Directorate for Science, Technology and Innovation, covers a wider group of firm scenarios (SMEs; large firms; profit and loss-making) over the 2000-2022 time period.

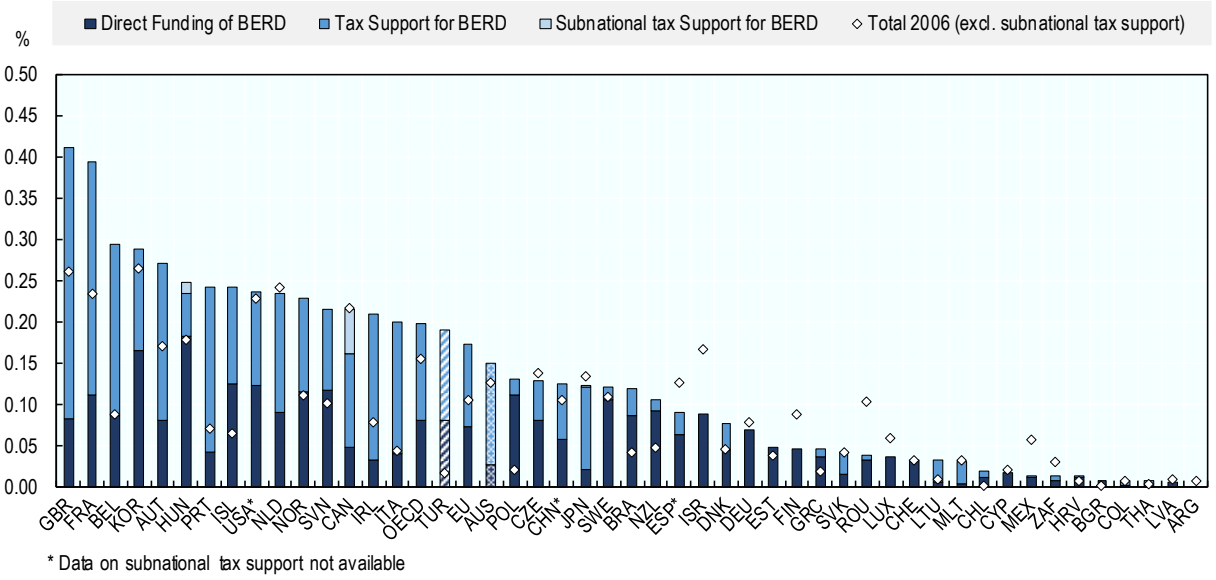
The indicators of ETRs and cost of capital for R&D in this section extend the corporate ETRs shown in the previous section to include internally generated R&D assets, i.e., those that are the result of a firms' own R&D.[1]

Government support for business R&D

Indicators of government tax relief for business R&D combined with data on direct R&D funding provide a more complete picture of governments' efforts to support business expenditure on R&D (BERD). Together, these indicators facilitate the cross-jurisdiction comparison of the policy mix provided by governments to support R&D and the monitoring of any changes over time.

Figure 4.1. Direct government funding and tax support for business R&D (BERD), 2020

As a percentage of gross domestic product (GDP)



Data and notes: https://oe.cd/rdtax. Time series data available for 2000-20.
Source: OECD (2023), R&D Tax Incentive Database, http://oe.cd/rdtax, April 2023, (accessed in September 2023).

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Between 2006 and 2020, total government support (direct and national tax support) for business R&D expenditure as a percentage of GDP increased in 31 out of 46 jurisdictions for which relevant data are available. The United Kingdom, France and Austria provided the largest levels of support in 2020. Subnational R&D tax incentives accounted for 25% of total tax support in Canada in 2020, playing a comparatively smaller role in Hungary and Japan (nearly 5% and 1% of total tax support, respectively).

Most jurisdictions integrate both direct and indirect forms of R&D support in their policy mix, but to different degrees. In 2020, 16 OECD jurisdictions offered more than 50% of government support for business R&D through the tax system, and this percentage reached 75% or more in seven OECD jurisdictions: Australia, Colombia, Ireland, Italy, Japan, Lithuania and Portugal. Seven OECD jurisdictions relied solely on direct support in 2020. These are Estonia, Finland, Germany, Israel, Latvia, Luxembourg and Switzerland.

Combining time-series estimates of GTARD and direct funding helps illustrate variations in governments' policy mix over time. In recent years, many jurisdictions have granted a more prominent role to R&D tax incentives. Compared to 2006, the share of tax support in total government support in 2020 increased in 27 out of 36 OECD jurisdictions for which data are available. This implies a general shift towards less discretionary forms of support for business R&D, with some exceptions, e.g., Canada and Hungary increased their reliance on direct support.

Measuring the preferential tax treatment for R&D

R&D tax incentives exhibit very heterogeneous design features across jurisdictions, which come on top of existing differences in standard corporate income tax systems. Indicators based on forward-looking effective tax rates are therefore useful to capture in a synthetic manner the effect of taxation on firms' R&D

investment incentives. By fixing the composition of the R&D investment, they enable comparisons of the preferential tax treatment provided for R&D investments across jurisdictions.

This database provides a toolbox for policymakers to analyse the incentives that firms face through the tax system to increase their R&D investment in a given country or to (re)locate their R&D functions, taking into account both the impact of underlying corporate taxation as well as specific R&D tax incentives. Indicators calculating the EATR and the cost of capital for R&D are useful to analyse decisions at the extensive margin (e.g., whether or where to invest in R&D) and at the intensive margin (e.g., how much to invest in R&D), respectively. These indicators focus on the incentives faced by large firms among which R&D is heavily concentrated (OECD, 2023[1]; Dernis et al., 2019[2]) and assume that firms are able to use their tax benefits in full.

Governments often introduce specific provisions to target particular firm types and to promote R&D among firms that may not be able to fully use their tax benefits. The B-Index, tightly related to the cost of capital, is another useful indicator to analyse R&D investment decisions at the intensive margin and to compare differences in the implied R&D tax subsidy rates among different firm types (SMEs and large firms) and profit scenarios (profit and loss). Box 4.1 provides an overview of the three indicators.

Box 4.1. Three complementary indicators of the generosity of R&D tax support

The cost of capital, the B-Index and the EATR are conceptually linked and rely on the same modelling of R&D tax incentives. As indicators of the cost of R&D for a marginal unit of R&D outlay, the B-Index and cost of capital are used in the economic literature to assess firms' R&D investment decisions at the intensive margin, e.g., how much to invest in R&D.

The **B-Index** offers a way of comparing the generosity of R&D tax incentives in reducing the upfront investment cost of an R&D investment while abstracting from the financing of the investment. By focussing on the tax component of the cost of capital, the B-index does not require assumptions on the depreciation rate of R&D, which is typically difficult to measure, and directly displays the variation in the tax treatment induced by R&D tax incentives.

The **cost of capital** complements and extends the B-Index indicator by accounting for additional costs and taxes relevant to the R&D investment. Since the cost of capital can in principle account for a variation in economic depreciation across assets and financing options, it also facilitates the analysis of different types of R&D projects. Finally, the cost of capital is also a stepping-stone in the calculation of the EATR.

The **EATR** complements previous indicators by capturing the effect of taxation on profitable investments. This makes the EATR the relevant indicator to assess of investment decisions at the extensive margin (where or whether to invest in R&D). Together, the three indicators offer a complementary set of indicators to assess the impact of taxation on firms' R&D investment decisions.

Source: González Cabral, Appelt and Hanappi (2021[3]).

Incentives at the extensive margin

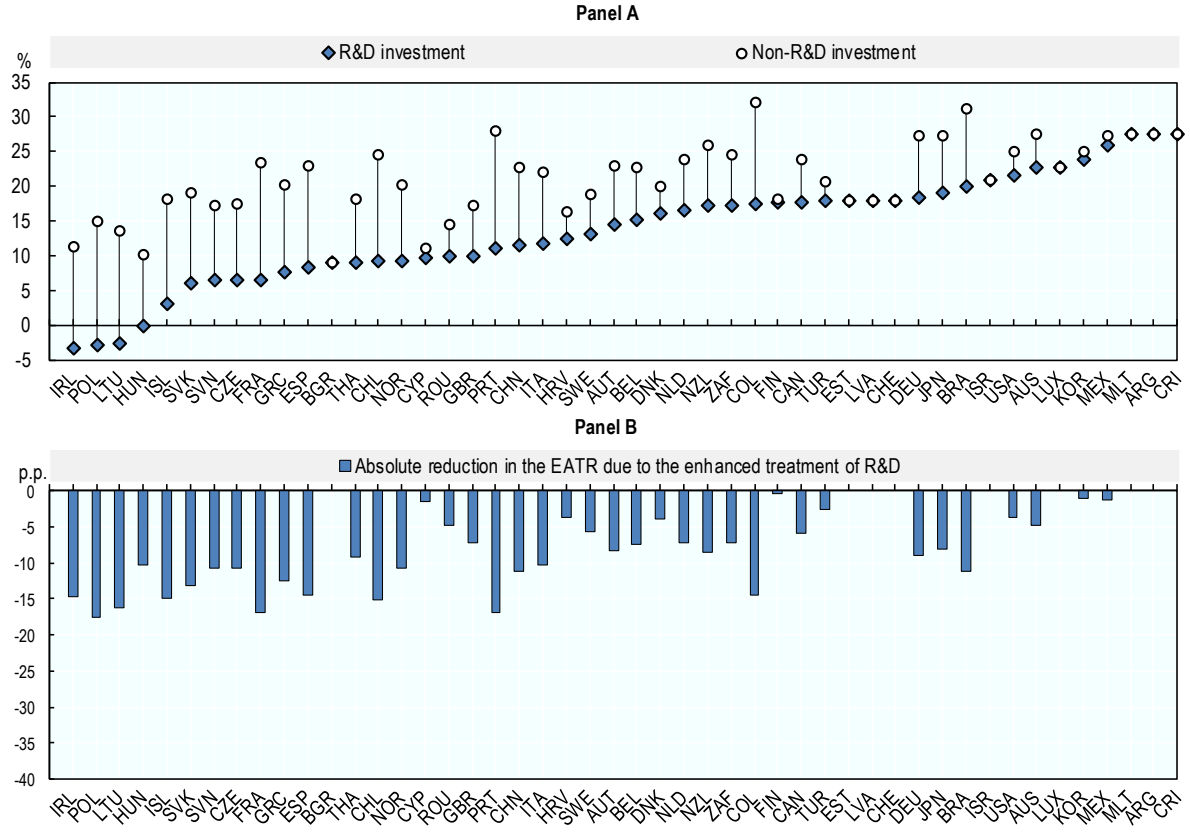
Comparing the EATRs for R&D investments across jurisdictions gives insights into the incentives provided by the tax system for the location of profitable R&D investments (Panel A). The lowest EATRs for R&D investments carried out by large firms are observed in Ireland, Poland and Lithuania, while the highest EATRs for R&D are observed in Malta, Argentina and Costa Rica. Estimates of the EATR are typically

lower for jurisdictions with lower STRs or more generous provisions affecting the tax base, including both standard tax provisions and those specific to R&D investments.

To assess the preferential tax treatment for R&D investments in relation to other investments, it is useful to calculate the EATR for a comparable investment to which R&D tax incentives do not apply. Where available, R&D tax incentives decrease the effective cost of R&D and reduce firms' EATRs, as shown in Panel A by the fact that the diamonds lie lower than the circles. The extent of the reduction, shown in Panel B, is explained by the generosity of the R&D tax incentives in each jurisdiction, which is closely linked to the design of these provisions. This figure includes only the impact of tax provisions in supporting R&D: modest reductions, as in Sweden or the United States, may reflect a higher reliance on direct forms of government support for R&D.

By taking the difference between the two EATRs, it is possible to gauge the preferential tax treatment offered to R&D in a given jurisdiction, in isolation from baseline tax provisions available to all types of investments. From a within country perspective, the preferential tax treatment for R&D investments is greatest in France followed, by Poland and Portugal. The absence of bars, as in Costa Rica or Luxembourg, indicates that no preferential tax treatment for R&D is available in the jurisdiction relative to other investment types.

Figure 4.2. The effective average tax rate for R&D, 2022



Note: Results refer to a macroeconomic scenario 3% real interest rate and 1% inflation and refer to an investment financed by retained earnings including the effect of allowances for corporate equity where available. In the non-R&D case, the EATRs lie close to the statutory tax rate (STR) due to the large current component in the R&D investment (see Box 4.1), except when an allowance for corporate equity is available.

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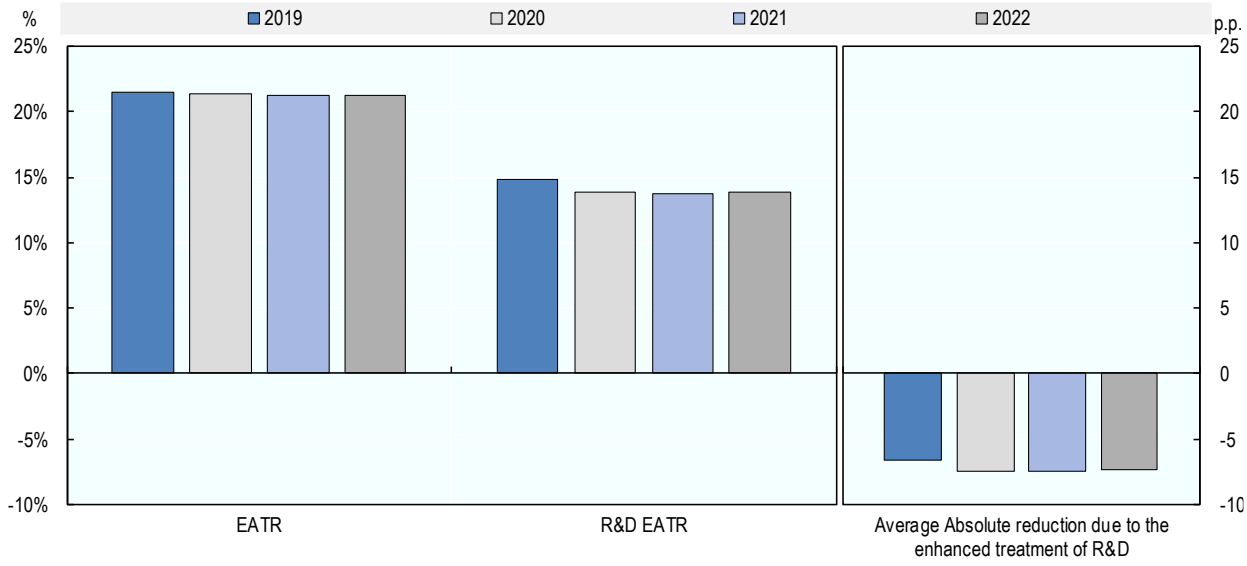
Figure 4.3. Changing distribution of the average EATR for R&D, 2019-2022



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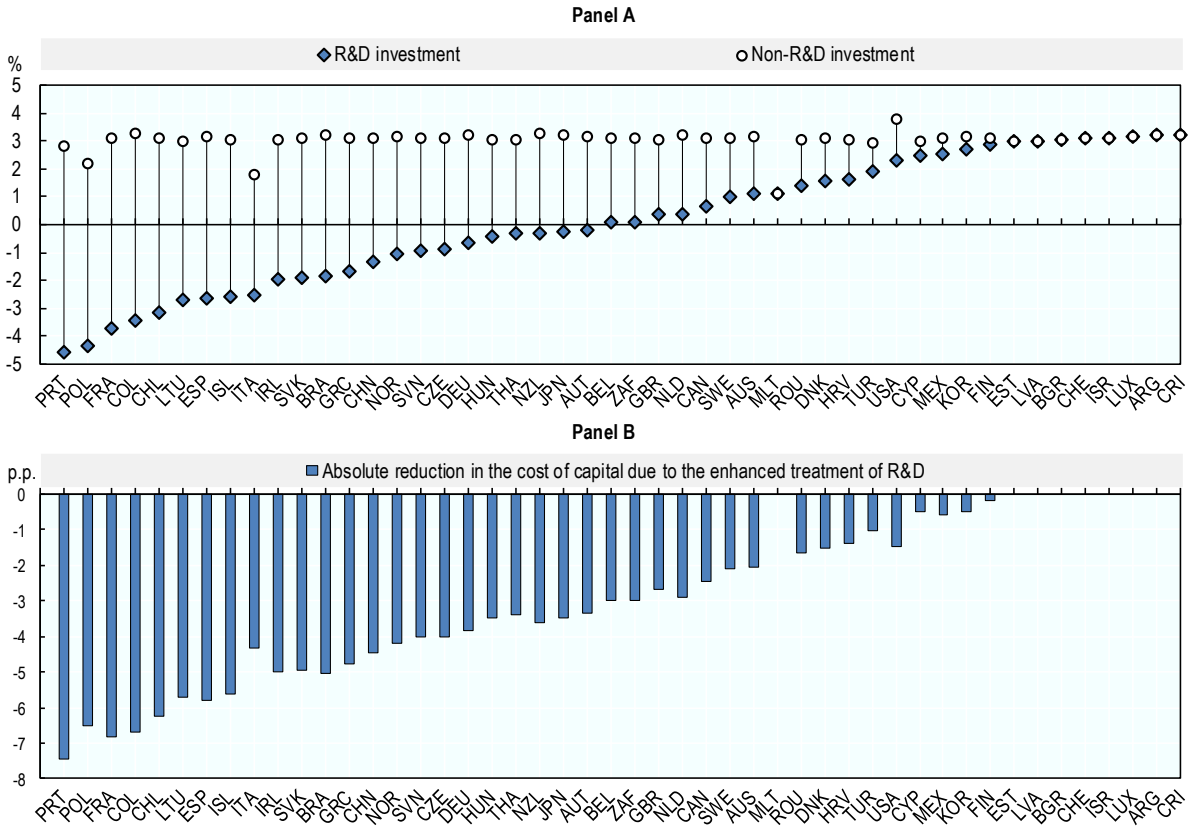
The EATR for R&D has modestly declined over time and while preferential tax treatment has increased compared to 2019, recent years show signs of stabilisation. Figure 4.3 displays average changes to the EATR over time. Consistent with the trends outlined in the baseline effective tax rate (ETR) (Section 3), the EATR in the absence of R&D tax incentives have tended to modestly decline over the period covered. A similar but more substantial trend is observable for the EATR once R&D tax incentives are included. The EATR for R&D declined from an average of 14.9% in 2019 to 13.9% in 2020 and to 13.9% in 2022. Changes over time in the EATR for R&D are due to first time introductions (Germany and Denmark in 2020, Finland 2021 or Cyprus in 2022) or changes to the generosity of R&D tax incentives (the Slovak Republic in 2020 and 2022, Italy in 2021 or Poland in 2022). In 2022, R&D tax incentives reduce the average EATR by 34.7%, from 21.5% to 13.9%. Over time, preferential tax treatment has increased between 2019 and 2020 and remained relatively stable between 2020 and 2022. The increase in 2020 is linked to COVID recovery measures, some of which have been maintained over time.

Incentives at the intensive margin

Once established in a given location, firms decide upon the level of investment with reference to tax provisions that affect the intensive margin. The cost of capital for R&D is one relevant indicator of tax incentives at the intensive margin. Across the jurisdictions considered Portugal, Poland and France are the jurisdictions providing greater incentives through the tax system to increase the volume of R&D. Among jurisdictions offering R&D tax support, estimates of the cost of capital for R&D are highest in Argentina, Costa Rica and Luxembourg. Estimates of the cost of capital for R&D capture both the variability in standard tax provisions and those specific to R&D investments. R&D tax incentives reduce the cost of capital, with the extent of the reduction being affected by the generosity of R&D tax incentives. The absolute difference between the cost of capital for an R&D investment and a comparable non-R&D investment provides a within-country indication of the magnitude of R&D tax relief to marginal R&D investments, net of the standard tax treatment available to all investments. This allows the preferential tax treatment for R&D to be isolated. The largest reductions in the cost of capital for R&D investments are observed in Portugal, France and Colombia, which are among the jurisdictions with the lowest cost of capital estimates.

Figure 4.4. The cost of capital for R&D, 2022



Note: Results refer to a macroeconomic scenario incorporating a 3% real interest rate and a 1% inflation rate and refer to an investment financed by retained earnings including the effect of allowances for corporate equity where available. In the non-R&D case, the cost of capital lies close to the real interest rate due to the large current component in the R&D investment (see Box 4.1), except when an allowance for corporate equity is available.

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Tax incentives significantly reduce the cost of capital for R&D and while preferential tax treatment has increased since 2019, recent years show a more stable trend. Figure 4.5 compares the evolution of the cost of R&D capital during the period 2019-2022. Similar to the EATR, the cost of capital is affected by changes in the availability of R&D tax incentives and their design. The cost of R&D capital showed a significant decline from an average of 0.4% in 2019 to 0.1% in 2020 and displayed a small increase to 0.14% in 2022. Since 2020, the implied tax subsidies have remained relatively stable, only dropping slightly in 2022. Tax incentives reduced the cost of R&D capital by 97% in 2021 and by 95% in 2022.

The heterogeneity of implied R&D tax subsidy rates

R&D tax benefits may vary with business characteristics such as firm size and profitability. Implied marginal tax subsidy rates for R&D, based on the B-Index indicator (1-B-Index), provide a synthetic indicator of the expected generosity of the tax system towards an extra unit of a firm's R&D investment (Figure 4.6). The more generous the R&D tax incentive is, the greater the value of the implied tax subsidy. This indicator shows differences in tax benefits between large and SMEs and firms in profit and loss-making positions. In jurisdictions, such as Australia or Canada, that offer enhanced tax relief provisions for SMEs that are not available to large firms, the indicator shows the difference in the implied subsidies offered to each firm type.

Figure 4.5. Changing distribution of the average cost of R&D capital, 2019-2022

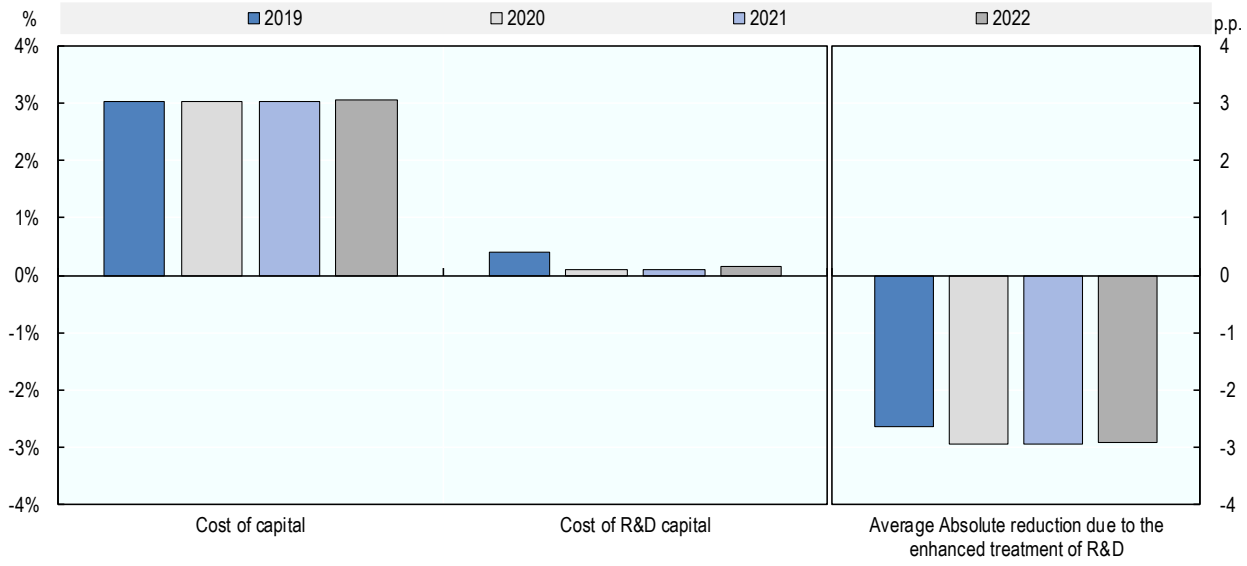

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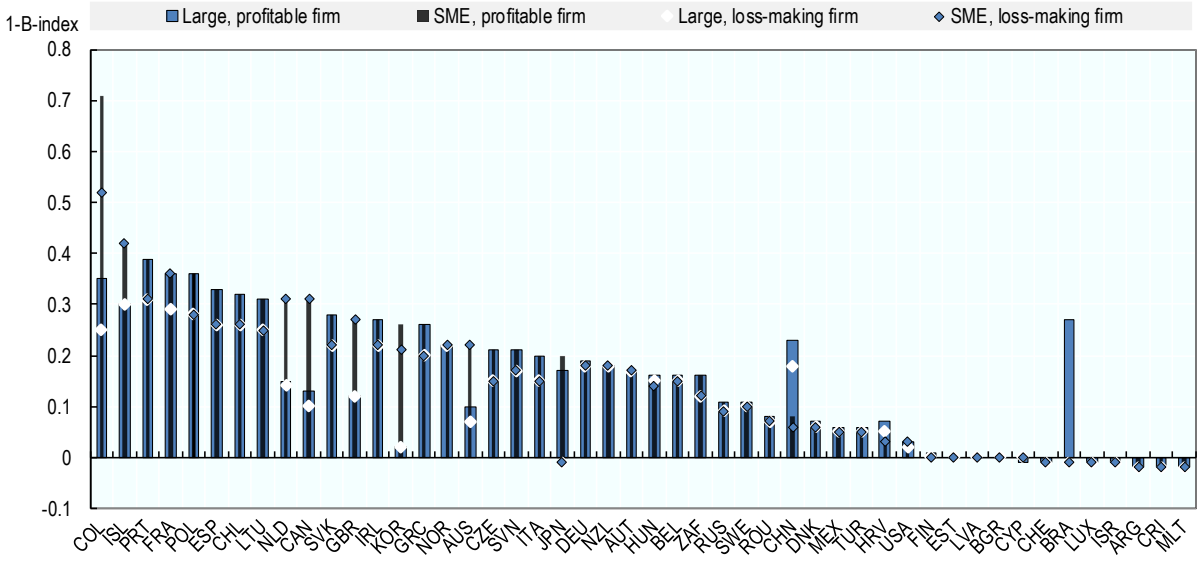
Figure 4.6. Implied marginal tax subsidy rates on business R&D expenditures, 2022



Note: Data and notes: https://oe.cd/ds/rdtax. Modelling assumes a nominal interest rate of 10%.
Source: OECD (2023), R&D Tax Incentive Database, http://oe.cd/rdtax, April 2023, (accessed in September 2023).

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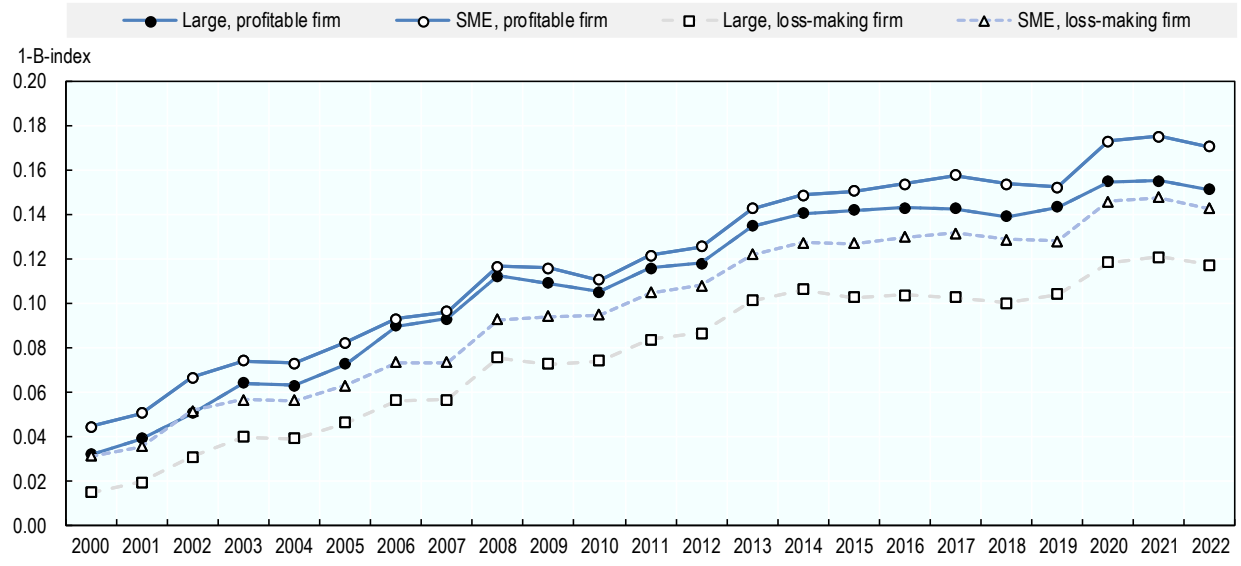
Refunds and carry-over provisions are common means of promoting R&D in firms that would not otherwise be able to utilise the support provided by the tax system. This may arise when firms do not have sufficient tax liability to offset earned deductions or do not draw a profit. Implied marginal subsidy rates are calculated under two scenarios: profitable firms (which are able to fully utilise the tax support available to them) and loss-making firms (which may not be able to fully utilise the tax support available to them) to reflect the

varying impact of these provisions. Refundability provisions such as those available in Austria and Norway align the subsidy for profitable and loss-making firms. Compared to refunds, carry-over provisions, such as those available in Spain or Portugal, imply a lower subsidy for loss-making firms compared to profitable firms as the benefits may only be used in the future. In jurisdictions where no such provisions exist, such as Brazil or Japan, loss-making firms experience a full loss of tax benefits.

Figure 4.7. Evolution of the implied marginal tax subsidy rates R&D, 2000-2022



Note: Data and notes: https://oe.cd/ds/rdtax. Modelling assumes a nominal interest rate of 10%.
Source: OECD (2023), R&D Tax Incentive Database, http://oe.cd/rdtax, April 2023, (accessed in September 2023).

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R&D tax incentives are on average higher for SMEs and profit-making firms. Figure 4.7 offers an overview of the evolution of implied marginal tax subsidy rates across four categories of firms in the period 2000-2022: SMEs and large firms in profit or loss. The generosity of R&D tax incentives rises over time for all firm types. Although between 2013 and 2019 subsidy rates had stabilised, a step increase is observed in 2020, with implied subsidies stabilising at a new level since them. This is consistent with the patterns observed in the cost of capital and EATRs above. Persistently higher subsidy rates are offered over time to SMEs compared to large firms in both the profit scenarios considered; and to profitable than loss making firms for both firm types. This suggests that jurisdictions tend to provide greater tax benefits to SMEs than large firms.

The evolution of the data depicted in Figure 4.7 also reflects heterogeneity in the magnitude of year-on-year changes. The largest increase in implied marginal tax subsidy rates occurred between 2007-2008, at the time of the financial crisis, (an increase of about 2.0 p.p. throughout all four categories) and 2019-2020 (around 1.6 p.p.), at the time of the COVID pandemic.

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OECD (2023), *R&D Tax Incentive Database*, http://oe.cd/rdtax (accessed on 1 September 2023). [4]

Note

[1] The OECD methodology to compute effective average tax rates for R&D is described in detail in González Cabral, Appelt and Hanappi (2021[3]) and to compute the B-Index is described in OECD (2023[4]). These indicators also feature in the OECD R&D Tax Incentive database compiled by the OECD Directorate for Science, Technology and Innovation.