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OECD R&D tax incentives database, 2021 edition

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Abstract

This report presents the latest OECD indicators and policy design information for expenditure-based R&D tax incentives in 38 OECD countries and 11 partner economies (central and subnational government level), drawing on data collected through the 2021 OECD-NESTI R&D tax incentives survey. It highlights the latest changes in the availability and design of R&D tax incentives and brings together two complementary sets of indicators on R&D tax incentives that facilitate a better and integrated view of government support for business R&D across countries and over time: OECD indicators of implied R&D tax subsidy rates and government tax relief for R&D expenditure (GTARD). Measures of tax subsidy rates such as those based on the B-index provide a convenient proxy for examining the implications of tax relief provisions and associated levels of tax subsidy that firms of different size (SME vs. large company) and profitability (profit vs. loss-making) face over the period 2000-2021, while GTARD reflects how much governments spent on R&D tax support during the 2000-19 period, comprising both foregone tax revenues and refunded amounts. These estimates of the cost of central and subnational government tax relief for R&D expenditure are combined with data on direct government funding of R&D (R&D grants and purchases), to provide a more complete picture of government efforts to promote business R&D over time. These combined figures highlight the extent to which governments support R&D through tax incentives over the 2000-19 period relative to other support mechanisms, and provide new information on the structure and composition of such support. This new edition of OECD R&D tax incentive indicators will feature in the OECD R&D tax incentive database, integrated in the OECD Corporate Tax Statistics database.

¹ This report has been prepared by Silvia Appelt, with input from Egle Skliaustyte, and has been reviewed by Fernando Galindo-Rueda, all from the OECD Directorate for Science, Technology and innovation. The report draws on quantitative and qualitative data provided by national country representatives in the 2021 OECD-NESTI R&D tax incentive survey. The contributions of OECD countries and partner economies to this OECD data collection effort are gratefully acknowledged. The opinions expressed and arguments employed herein do not necessarily reflect the official views of OECD member countries.

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OECD R&D tax incentives database, 2021 edition

1. Introduction

Investment in research and development (R&D) is a key factor driving innovation and economic growth. Governments worldwide adopt various financial support instruments to promote R&D by businesses and increasingly rely on tax incentives to incentivise business R&D investment. As of 2021, 34³ of the 38 OECD countries, 22⁴ of 27 EU countries and a number of partner economies (Argentina, Brazil, the People's Republic of China – China henceforth –, the Russian Federation, South Africa and Thailand⁵) offer tax relief for R&D expenditure at central or subnational government level.⁶ In the OECD area alone, this corresponds to an increase of more than 50% in the number of countries that provide R&D tax relief to businesses relative to the year 2000, where governments in 20 out of the 38 OECD countries offered this form of support. A similar pattern can be observed in the share of tax relief in total government support in the OECD area, which increased on average from 36% in 2006 to around 57% in 2019. The shift in the policy mix is even more pronounced in the European Union (EU-27), with R&D tax support doubling over ten years, from 27% of total government support in 2006 to 58% in 2019.

Since 2007, the OECD has continuously worked to extend the international evidence on R&D tax incentives and has developed experimental methodologies and data infrastructures that have been met with considerable interest and have become widely used in the policy, statistical and academic arenas. The latest evidence is available on the dedicated OECD website “Measuring Tax Support for R&D and Innovation” (<http://oe.cd/rdtax>). This progress in the measurement of expenditure-based R&D tax incentives is the result of 10 years of close collaboration with a network of official experts from OECD countries and partner economies, coordinated by the OECD Working Party of National Experts on Science and Technology Indicators (NESTI) as part of the Programme of Work and Budget of the OECD Committee for Scientific and Technological Policy. In recent years, such efforts have been intensified with support from the European Union's Horizon 2020 Programme, which has contributed to an increased frequency of data collection and extended coverage and analysis. This work has been supported by the OECD R&D tax incentives network, which comprises delegates from the OECD Working Party of National Experts on Science, Technology and Innovation (NESTI) and Working Party

³ In 2021, the exceptions are Costa Rica, Estonia, Latvia and Luxembourg.

⁴ In 2021, the exceptions are Bulgaria, Cyprus, Estonia, Latvia and Luxembourg.

Footnote by Turkey: The information in this document with reference to « Cyprus » relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognizes the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the “Cyprus issue”.

Footnote by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognized by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

⁵ At the time of reporting, the retroactive extension of the R&D tax allowance in Thailand for 2021 is pending government approval.

⁶ Governments may also provide tax relief for the income derived from R&D and innovation, alone (e.g. Cyprus, Luxembourg) or in combination with expenditure-based tax incentives. Income-based tax incentives for R&D and innovation are beyond the scope of this report due to the lack of comprehensive and internationally comparable data on the design and cost of such incentives. The OECD KNOWINTAX project aims to fill this evidence gap in collaboration with OECD countries and partner economies.

No. 2 on Tax Policy and Statistics (WP2) among other national experts on R&D tax incentives. This report focuses on expenditure-based tax incentives provided at central or subnational government level. It presents the latest evidence on the design of R&D tax incentives, the generosity of R&D tax incentives from the firm perspective and cost of R&D tax relief to governments, drawing on the data collected and validated by official contacts within countries as part of the 2021 OECD-NESTI R&D tax incentives survey completed in autumn 2021⁷. The report brings together two OECD time-series indicators of [implied marginal R&D tax subsidy rates](#) (by firm size and profitability scenario) for the period 2000-21 and time-series estimates of [government tax relief for R&D tax expenditure](#) (GTARD) for the 2000-19 period (central and subnational government level). As in previous OECD work, this report presents GTARD estimates (i.e. foregone tax revenues and refunded amounts) combined with data on direct government funding (i.e. R&D grants and purchases), as compiled by official national providers of R&D statistics based on reports from firms, in order to provide a more complete picture of government efforts to promote business R&D. These two R&D tax incentives indicators facilitate a better integrated view of government support for business R&D across countries and over time and will both feature in the OECD R&D tax incentive database (OECD, 2021; <https://oe.cd/ds/rntax>)⁸ and OECD Corporate Tax Statistics Database⁹ following the database update at the end of 2021.

In addition to statistics on the cost of R&D tax support, it is also relevant to assess how many firms within each country benefit from this type of tax relief and the magnitude of qualifying R&D expenditures based on which R&D tax benefits are determined. The annual OECD R&D tax incentive data collection has been collecting information on R&D tax relief beneficiaries since 2016 and further extended its scope in 2020 to additionally collect information on the amount of qualifying R&D expenditures. While the number of countries reporting beneficiary figures has steadily increased over the last years, reaching 36 in 2021, the group of countries reporting data for all available schemes is more limited, especially when reporting data by firm size or economic activity or on a time-series basis. For data on qualifying R&D expenditures, this effect is even more pronounced and only a subset of 24 countries were able to report these figures in this year's second data collection effort. As a result, both indicators have so far received a lower degree of scrutiny for international comparability and have therefore not been part of the R&D tax incentives indicator series publicly disseminated by OECD. This report presents these two new indicators, drawing attention to the relevance and feasibility of this type of information with a view of further improving the rate and comparability of data reporting. Refining the survey tool used by OECD and the concepts included therein is part of this ongoing process. Key changes in the scope and structure of the 2021 annual OECD R&D tax incentives survey further relate to the collection of additional information on the availability of special R&D tax relief provisions in priority areas such as green or energy related R&D and the collection of more granular information on the distribution of government tax relief by industry and economic ownership. The preliminary results available and presented for a subset of OECD countries in this report, seek to provide some additional insights into the directionality of R&D tax support.

This report is structured as follows:

- Section 2 provides a summary overview of the main design features of R&D tax incentives and discussion of recent changes in the availability and design of R&D tax incentives, including crisis response measures following the outbreak of the COVID-19 pandemic.
- Section 3 presents new evidence on the generosity of R&D tax support in OECD, EU and partner economies in 2021 and changes in implied R&D tax subsidy rates over the past decade. The indicators presented allow for an examination of the distribution of R&D tax subsidy rates

⁷ This data collection attempts to identify and address subtle differences in the tax treatment of R&D expenditures in firms. National experts on science and technology indicators have collaborated with public finance and tax authorities to provide the most up-to-date information using a common approach towards describing the various features that are relevant for describing the nature and generosity of tax support for R&D. From 2007 to 2015, the OECD-R&D tax incentive survey was carried out on a bi-annual basis and on an annual basis since 2015.

⁸ OECD (2019) presents the new R&D tax incentive time-series data available in the OECD R&D tax incentive database, highlighting its potential for descriptive and quantitative analyses at cross-country level.

⁹ See <http://www.oecd.org/tax/beps/corporate-tax-statistics-database.htm>

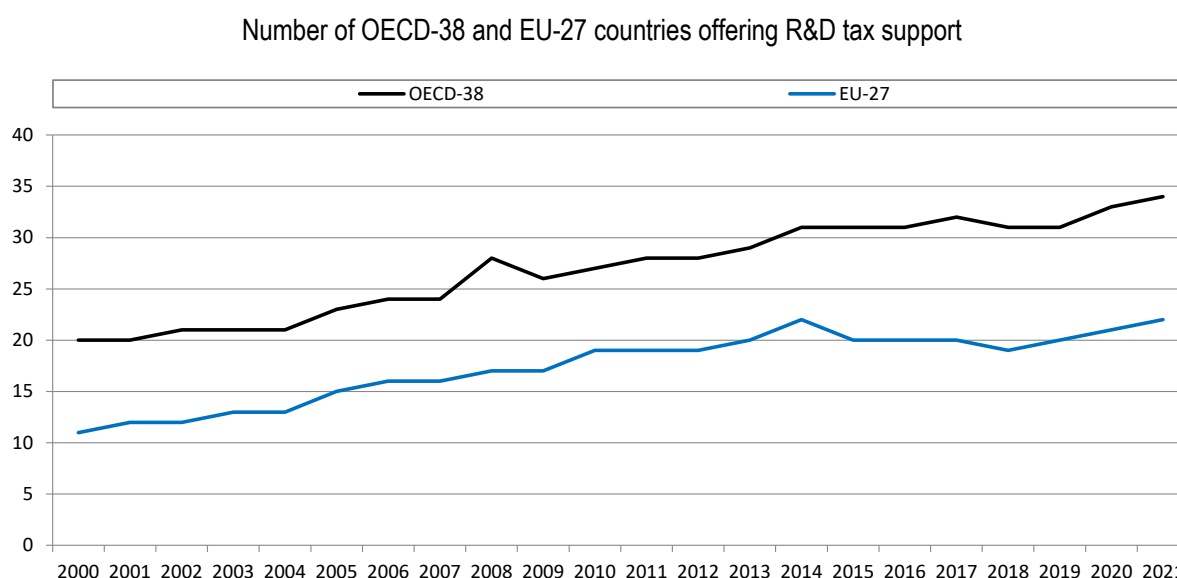
across countries by firm size and profit scenario and of aggregate trends in implied marginal R&D tax subsidy rates across OECD and EU countries over the 2000-21 period.

- Section 4 provides an overview of the levels of central (federal) and subnational R&D tax support in 2019, compared to direct funding of business R&D from national and international government sources. It examines the structure of central government tax support for business R&D by firm size, main economic activity and economic ownership and presents novel statistics on the number of R&D tax relief beneficiaries and amount of qualifying R&D expenditure. The session further documents trends in the relative and absolute importance of government tax relief for business R&D over the 2000-19 period, followed by an outline of the evolution of R&D tax relief beneficiaries and qualifying R&D expenditure across countries over time.
- Section 5 concludes with a summary of the main findings of the report and an outlook on future OECD work in this area.

2. R&D tax incentives in the OECD area and beyond

More countries currently rely on tax support to encourage business R&D than a decade ago. **Figure 1** shows how the number of OECD and EU countries offering R&D tax incentives has evolved over time. In 2021, 34 out of 38 OECD countries offer R&D tax incentives at central or subnational government level, and this number reaches 22 in the EU-27 area, with Germany and Switzerland (on an optional basis at cantonal level) introducing an R&D tax incentive for the first time in 2020 and Finland reintroducing R&D tax support in form of a tax deduction for R&D-related research cooperation expenditures in 2021. This implies an increase of around 70% in OECD and 100% increase in EU countries that provide R&D tax relief to businesses relative to the year 2000, where governments in 20 out of the 38 OECD countries and 11 out of 27 EU countries offered this form of support.

Figure 1. R&D tax incentives in the OECD and EU area, 2000-2021



Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

While the number of jurisdictions offering R&D tax incentives notably increased from the mid-2000s onward, **Figure 1** also displays cases where countries repealed their R&D tax relief provisions such as New Zealand and Mexico in 2009, Finland in 2015 and Latvia in 2018. However, New Zealand and Mexico reintroduced R&D tax incentives in the form of an R&D tax credit in 2015 and 2017 respectively, and Finland most recently in form of an R&D tax allowance in 2021.

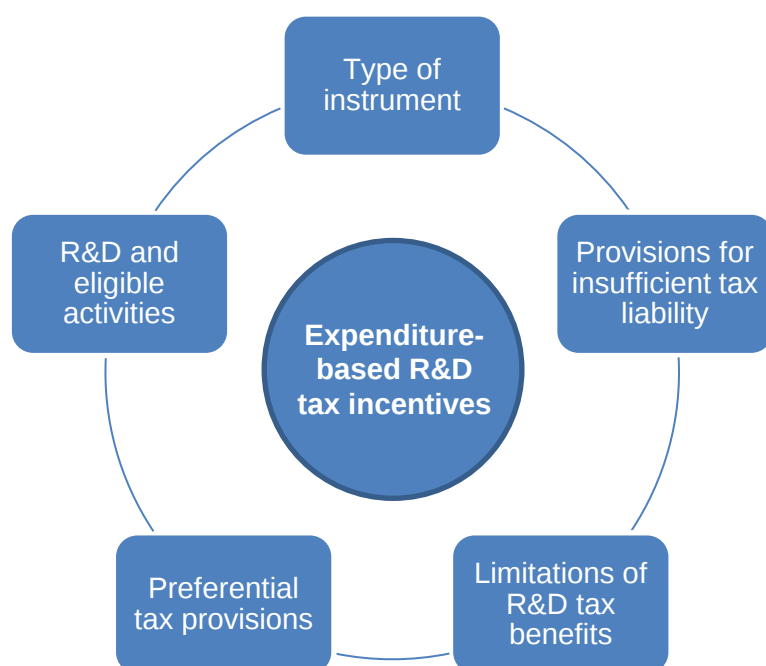
Changes in the availability of R&D tax relief provisions have been accompanied by various changes in the design and scope of R&D tax incentives in OECD countries and partner economies over time. The design of R&D tax incentives is inherently linked to the generosity, uptake and likely effectiveness of R&D tax incentives in encouraging business R&D. A recent cross-country analysis (OECD, 2020a, b) based on micro-aggregated data for 20 OECD countries provides new insights into the effect of R&D tax incentives and direct funding in spurring business R&D investment, and the heterogeneity of the effect of R&D tax incentives across different types of firms (e.g. by firm size, level of R&D, industry).¹⁰

This section presents the main design features of R&D tax incentives and highlights the most recent changes in the availability, design and administration of R&D tax incentives in OECD countries and other surveyed economies. This includes an overview of R&D tax relief related measures adopted by countries to support corporate R&D performers during the COVID-19 pandemic and outline of existing tax relief provisions for R&D in specific priority areas such as green or energy related R&D.

2.1. Main design features

Countries differ in the extent to which they rely on tax measures to support R&D, and those that do design tax relief measures in substantially different ways. Key R&D tax incentive design features (**Figure 2**) relate to the scope and definition of R&D for tax purposes, the choice of eligible R&D expenditure and tax instrument, provisions for firms with insufficient tax liability and for a limitation of R&D tax benefits as well as targeted tax relief provisions.

Figure 2. Key design features of expenditure-based R&D tax incentives



Source: OECD.

These design features influence the extent to which firms can make use of tax benefits in the loss-making vis-à-vis profit case and the degree to which specific types of firms such as SMEs, young firms, and start-ups benefit from a preferential tax treatment. **Table A.1** provides a summary overview of the main design features of R&D tax incentives available in OECD countries and other major economies.

¹⁰ For a literature survey, see OECD (2016).

2.1.1. R&D and eligible activities

Definitions of R&D or other types of expenditures eligible for tax relief differ across jurisdictions and with respect to the OECD Frascati Manual definition (OECD, 2015a) and explanatory guidance but in general most attempt to be consistent with it. Only a few countries extend tax relief beyond R&D to other innovation activities, and when they do so, it is typically under much stricter and less generous terms. R&D in the social sciences can sometimes be excluded, possibly because of the difficulty to distinguish from market research and related activities.

The target of tax relief is often more closely aligned to the financial cost of R&D to the firm (expense), regardless of who carries out the R&D, than the cost of the R&D activity incurred within the firm (i.e. intramural R&D, regardless of who funds the work). R&D carried out internally on own account and R&D expenditure subcontracted to off-site consultants, contractors and other third-parties, tend to be eligible under most R&D tax incentive provisions available in OECD, EU and other major economies. **Table A.2** outlines which countries allow the funder or performer of R&D to claim tax benefits in the case of subcontracting. The most common approach is to restrict the eligibility for tax relief to the contracting or purchasing party (funder). In only few countries (Colombia, France, Norway), firms are able to trade or exchange R&D tax benefits with third parties or use them as a security (**Table A.3**).

Some R&D tax incentive schemes explicitly target specific types of R&D costs. Overall, there is a general preference for considering within the scope of eligible R&D costs those relating to labour and other current expenditures. R&D personnel costs account for the largest share of intramural R&D costs, and in principle, the focus on R&D personnel does incentivise investment in human resources based in the domestic economy. Acquisition of capital assets to be used for R&D is less typically supported as assets may be subsequently disposed of or used for other purposes.

2.1.2. Types of tax instruments

Tax credits versus allowances

Any form of tax relief can be provided as an allowance, exemption, deduction or credit. Tax allowances, exemptions and deductions effectively subtract from the tax base before the tax liability is computed, reducing the taxable amount before assessing the tax. A tax credit is an amount subtracted directly from the tax liability due from the beneficiary unit after the liability has been computed. The choice between credits and allowances is largely a formal one, as they can be converted into each other to be made equivalent. However, the value of the tax benefit will react differently to changes in the tax rate, the value of R&D tax allowances being directly linked to the level of the corporate income tax rate. In the case of R&D, the normal default or benchmark position is to allow R&D expenses to be fully deducted, regardless of the fact that they represent (risky) investments in knowledge assets. Therefore, the term “enhanced allowance” is used to identify provisions that represent a deduction rate of more than 100% over eligible expenses.

Tax base

Tax relief measures can also be distinguished according to whether they are redeemable against corporate income vis-à-vis payroll (e.g. withholding) taxes or social security contributions. Most countries provide corporate income tax offsets, payroll withholding tax credits and social security exemptions being offered in only seven OECD countries as of 2020. Some countries target tax credits (e.g. United States) to R&D expenditures over and above of a pre-defined baseline amount. The latter type of incentive is commonly described as “incremental”. Some countries offer a hybrid system comprising both a volume and an incremental tax credit (Korea, Portugal and Spain) or allowance (Czech Republic and Slovak Republic).

Temporary vs permanent schemes

The use and impact of tax incentives can be influenced by the temporary or permanent nature of these programmes, as well as by how the business community expect R&D tax support to continue to be provided and under which terms (OECD, 2016). Most R&D tax support schemes initially came into being as temporary measures so there is some uncertainty attached to them. Finland introduced a scheme on a temporary basis over the 2013-14 biennium that was not extended beyond this period. Awareness of plans not to extend the scheme appears to have contributed to limited take up of the scheme (Kuusi et al., 2016). The United States introduced the federal research and experimentation (R&E) credit as a temporary measure in 1981, which after 17 extensions became permanent with effect from 2016.

Taxability of tax relief

Tax credits represent taxable income in Canada and the United Kingdom (R&D tax credit for large companies) or are effectively taxable (Australia, Chile and the United States) because in order to claim the headline credit rates the taxpayers has to renounce to the deductibility of the R&D expenses that are claimed. As payroll and social security related incentives reduce the expense base and increase the taxable income of businesses, such incentives are effectively taxable as well.

2.1.3. Provisions for firms with insufficient tax liability

Some countries address the limited incentive effect of standard types of tax relief instruments among firms with low or no profits by providing for the carry-over of tax benefits or even allowing for offsetting payments (refund) to be made by the tax authority to the firm for the relevant period.

Carry overs

While carry-over provisions are in place in most OECD and partner economies, the period of time over which unused tax incentive claims can be carried forward differs notably across countries. In 2020, firms can carry over unused claims for three years in the Czech Republic, for instance, six years in Poland, 8 years in Portugal, 18 years in Spain, and 20 years in the United States. Carry-overs over an indefinite time horizon are further available in several OECD countries (e.g. Australia, Chile, Denmark, Latvia, Lithuania, Turkey) and partner economies (e.g. Argentina, South Africa). Different provisions may also be in place for different schemes within a country. In Belgium, for instance, unused tax credits are carried forward for five years until any excess amounts are made payable to firms. Under the Belgian R&D tax allowance scheme, by contrast, an indefinite carry-forward is available to firms.

Refunds

A tax credit becomes “payable” or refundable, as mentioned above, when any credit excess on top of the tax liability can be paid in full or in part to the taxpayer. Refundability can be particularly beneficial for young, innovative firms, at the stage of investing in developing and launching their products. A potential downside of such provisions is that they can also be used by firms with the ability to shift profits to other jurisdictions. Increased awareness of the importance of refundability for firms without revenues such as start-ups and the experience of the global financial crisis appears to have resulted in an increased provision of refund and carry over possibilities.

Tax relief redeemable against payroll and related taxes

Tax offsets redeemable against payroll tax or social security contributions generally provide an alternative means to address the limited income tax liability problem. Such incentives, while limited to the payroll tax and social security liability of the corresponding tax period, unless alternative restrictions apply, are disconnected from the corporate tax liability of the firm and thus are in principle payable in both profit and loss-making scenarios. In their original design limited to labour costs for R&D, payroll tax and social security related incentives may be extended to cover other qualifying current or capital expenditure. The Netherlands, for instance, merged its payroll withholding tax credit (WBSO) and R&D tax allowance (RDA) scheme for non-labour related R&D expenditure, providing a broad based payroll tax offset with effect from 2016.

2.1.4. Limitation of R&D tax benefits

A firm's ability to benefit from R&D tax relief may not only be reduced in the context of insufficient taxable profits but may also arise as a result of additional provisions that authorities include to manage the overall financial burden on the public finances and assure a more equitable distribution of tax benefits. On this basis, several countries introduce different types of thresholds or upper ceilings for eligible R&D volumes or tax benefits (**Table A.1**). Ceilings may be defined in absolute monetary or relative terms (e.g. as a percentage of qualifying R&D expenditure or corporate tax liability). Offsets against payroll withholding taxes and social security contributions, by construction, are limited to the payroll withholding tax or social security contributions liability of the tax period unless additional restrictions (e.g. minimum required level of social security contributions) apply.

Overall, few countries adopt a floor (minimum threshold) as a means of determining tax relief eligibility and steering the minimum level of R&D expenditure. Only firms that incur a level of qualified R&D expenditure greater or equal to the floor amount qualify for tax support. Some countries offer incremental tax incentives with a specified base amount, i.e. the baseline level of R&D spending for which the firm cannot claim tax relief - only excess amounts qualify for support, hence their description as "incremental". Base amounts are typically defined as a function of past R&D expenditure (rolling average over previous *n* years) but alternative specifications have also been adopted. Countries use different base amount definitions and revise them over time.

Threshold-dependent rates imply a discrete reduction in the size of the R&D tax credit or allowance rate once qualified R&D spending surpasses a pre-defined threshold amount. France and the Netherlands offer such incentives aside Canada where enhanced tax credit rates are made available to eligible small companies, so called Canadian Controlled Corporations (CCPCs), up to a pre-defined threshold amount. In the case of France and the Netherlands, this threshold amount represents a fixed value. In Canada, by contrast, this threshold amount ("expenditure limit") of CAD 3 million is gradually reduced to zero, i.e. fully phased out, as prior-year taxable capital rises from CAD 10 to CAD 50 million.

While reducing the overall cost of support, the presence of thresholds or upper ceilings may reduce the incentive effect at the margin among firms with higher levels of R&D. Aggregation rules can play an important role, as some groups may be able to break down their R&D tax support claims across separate enterprises to optimise their tax bill. Aggregation rules for related companies can also matter if there are beneficial terms for SMEs since, in the absence of such rules, firms may have incentives to offload their R&D to smaller affiliates. In order to ensure that tax support accrues to the intended beneficiaries and to avoid unintended behaviours, tax authorities often impose aggregation and independence rules (e.g. Canada, United Kingdom).

Table A.3 shows that countries differ in the extent to which they rely on a joint or separate assessment of the tax benefits of affiliated companies. In Australia, Japan and the United States, for instance, members of consolidated groups act as a single taxpayer for tax purposes. Denmark and New Zealand, which offer tax credits for deficit R&D related expenditure, require the taxable income of the group to

be negative in order to qualify for relief.¹¹ Aggregation rules may also apply in the assessment of cash refunds (Spain, Canada), the application of thresholds (e.g. expenditure limit for CCPCs in Canada¹²) and classification of firms as SMEs (e.g. United Kingdom).

2.1.5. Targeted relief measures

Although tax incentives are generally seen as the more market-based, non-discretionary alternative to direct support for R&D, a number of countries target R&D tax incentives to particular types of firms, industries or activities. Targeted relief measures may be motivated by evidence or the belief that some groups of firms with observable characteristics, e.g. by firm size or age, can be more responsive to a given unit of financial support. Tax provisions may imply a more favourable treatment (**Table A.1**) for SMEs and young firms in the form of more generous rates of tax support or a refund provision that is exclusively available to these firms. Likewise, few countries reported as part of the 2021 OECD R&D tax incentives data collection to have in place any **special, temporary or emergency tax relief provision for R&D in specific priority areas** such as green or energy related R&D. This includes:

- **Italy:** Special provision of a higher tax credit rate for technological innovation aimed at 4.0 innovation or ecological transition.
- **Portugal:** Expenses related to the making of eco-design products are increased by 10 upon submission and approval of the project by the Portuguese Environment Agency.
- **Spain:** a higher tax credit rate currently applies to expenses in technological innovation activities aiming at new or relevant improvements in the production processes in the value chain of the automotive industry in Spain.

2.2. Recent policy developments

Across OECD countries and other surveyed economies, regular reforms of R&D tax incentives have led to a continuous change in the availability, scope and generosity of R&D tax relief measures over the past decade. Such reforms relate to the launch of new tax incentives, the R&D definition adopted for tax purposes, changes in tax credit and allowance rates, adjustments of thresholds or upper ceilings on qualifying R&D expenditure or tax relief amounts, or changes in the terms and availability of refunds. New Zealand, for example, reintroduced R&D tax relief in the form of a tax credit for research and development tax losses¹³ and Japan complemented its R&D tax credit regime with a new special tax credit for collaborative R&D. Furthermore, many countries have been progressively replacing relatively complex incremental/hybrid tax incentives with simpler and more generous volume-based tax incentives, such as France in 2008 and Ireland in 2015.

Table B.1 provides a summary overview of the latest reforms in 2021, including those taken in response to the COVID-19 outbreak. Country names are underlined whenever reported policy changes are COVID-19 related. The main policy changes in 2021¹⁴ include:

¹¹ In New Zealand individual companies that are part of a group may still be eligible if the group has an overall net loss position. Other requisites apply at the individual level. The firm needs to be resident in New Zealand, be in a tax loss position in the year, needs to have eligible tax expenditure and sufficient R&D wage intensity. In the case of a firm being part of a group, the R&D wage intensity calculation is based on the entire group's total R&D labour expenditure, divided by the total labour expenditure for the entire group.

¹² In Canada, the applicable ceiling and refundability of the tax credit is a function of prior-year taxable capital.

¹³ Under this credit, eligible firms in New Zealand obtain a refund for tax losses caused by qualifying R&D expenditure.

¹⁴ In 2021, Hungary did not undertake any changes in its R&D tax relief provisions. However, Hungary lowered the rate for Social Contribution Tax and related tax advances from 17.5% to 15.5% with effect of 1 July 2020 (17% including training levy), and the rate of the small business tax (KIVA) and related tax advances was reduced from 12% to 11% with effect of 1 January 2021. These tax rate reductions influence the value of social security and KIVA exemptions and credits available to R&D

- Changes in the availability of R&D tax incentives such as:
 - Introduction of a new R&D tax relief measure (Finland);
 - Extension of an existing R&D tax relief measure (China, Italy, Japan, Portugal, Turkey);
 - Expansion of the scope and improvement of terms of an existing measure (Korea);
 - Harmonisation in the scope of R&D tax relief (France).
- Changes to R&D tax credit/enhanced R&D tax allowance rates:
 - Increase of rate ([Australia](#), China, [Iceland](#), [Italy](#), [Netherlands](#), [Spain](#));
 - Adjustment of rate (Japan);
- Changes to threshold/ceiling on amount of eligible R&D expenditure or value of R&D tax relief:
 - Increase in existing ceiling ([Australia](#), [Iceland](#), Italy, Japan, New Zealand, Sweden);
 - Ceiling introduced (United Kingdom).
- Changes to the administration of R&D tax incentive schemes:
 - Advanced and/ or expedited cash payments – refunds ([France](#) and [Ireland](#));
 - Extension of time limit for filing applications ([Brazil](#) and [Norway](#));
 - Limitation of extensions of time limit for filing applications ([Australia](#));
 - Change in institution in charge of administrative ruling applications (France);
 - Introduction of the power to make binding determinations (Australia).

In 2021, changes in the availability and scope of R&D tax incentives and adjustments to headline R&D tax credit and allowance rates represent the most frequent type of policy reform. Overall, in 2021 there was one introduction (Finland) and five extensions (China, Italy, Japan, Portugal and Turkey) of tax relief provisions. In addition, one expansion in the scope of existing R&D tax relief measures was noted in one case (Korea) as well as one instance of harmonisation of the terms under which R&D tax relief can be claimed (France). Tax credit/allowance rates were increased in 2021 in the case of seven R&D tax relief provisions (Australia, China, Iceland, Italy – certain R&D labour, innovation and design expenses and firms in Southern regions, Netherlands, Spain) and adjusted in one case (Japan).

There were also a number of changes to ceilings on the amount of eligible R&D expenditure or value of R&D tax relief, the ceiling was increased in six cases (Australia, Iceland, Italy, Japan, New Zealand and Sweden), compared to one introduction (United Kingdom). In light of the COVID-19 pandemic, nine countries introduced modifications to the design or administration of R&D tax incentive schemes, including the advanced/expedited payment of cash refunds (France and Ireland), and the extension of the time limit for filing applications (Brazil and Norway). These changes suggest that countries have globally made efforts to enhance the generosity of their R&D tax relief measures over the last year, around one third of these changes having been implemented as a direct result of the COVID-19 crisis.

3. Generosity of R&D tax support

Measures of tax subsidy rates such as those based on the B-index provide a convenient proxy for examining the implications of tax relief provisions, “quantifying” a number of qualitative features of a national tax system in the form of estimates of implied R&D tax subsidy that apply to generic or “model” types of firms.¹⁵ The B-index specifies the pre-tax income needed for a “representative” company to break even on a marginal, monetary unit of R&D outlay (OECD, 2013; Warda, 2001), taking into account

performing firms in Hungary. An additional two (one) percentage point reduction in the Social Contribution (KIVA) tax is foreseen for 1 July 2022.

¹⁵ The B-Index indicator is conceptually linked to new R&D Tax Incentive indicators on corporate effective tax rates (ETR) for R&D, developed by the OECD Centre for Tax Policy and Administration and OECD Directorate for Science, Technology and Innovation (González Cabral et al. 2021). The first edition of ETR for R&D indicators, available for the years 2019 and 2020, were released as part of the OECD Corporate Tax Statistics database and OECD R&D Tax Incentives database in July 2021.

provisions in the tax system that allow for an enhanced treatment of R&D expenditures. This includes preferential tax relief provisions in the form of more favourable tax credit or allowance rates that apply to SMEs in some countries. A "representative firm" is typically defined for convenience as one with sufficiently large profits to be able to fully make use of earned tax credits in the reporting period. It is customary to present this indicator in the form of an implied subsidy rate, namely one minus the B index. More generous provisions imply a lower "breakeven" point and therefore a higher tax subsidy.

Implied marginal R&D tax subsidy = 1 minus B-Index

To provide a more accurate representation of different, relevant, scenarios, B-indices can be calculated for "representative" firms according to whether they can claim tax benefits against their tax liability in the reporting period. There are significant differences in the provisions made by countries for scenarios in which companies cannot immediately realise the entire value of tax incentives on R&D. By estimating the implied marginal R&D tax subsidy rate for four firm profiles (profitable large firms, profitable SMEs, loss-making large firms, loss-making SMEs), a more detailed assessment of the generosity of R&D tax incentives across OECD countries and partner economies becomes feasible. **Annex C** documents the B-Index methodology and estimation of R&D tax subsidy rates presented in the subsequent section.

3.1. Implied marginal R&D tax subsidy rates in 2021

Figure 3 presents the notional levels of tax support (before tax) per additional unit of R&D to which firms with defined characteristics are in principle entitled in 2021. This edition of implied marginal tax subsidy rates, focussing on R&D tax incentives offered at central government level¹⁶, is calculated based on headline tax credit and allowance rates and facilitates a comparison of R&D tax subsidy rates across 38 OECD and 11 partner economies¹⁷ by firm size and profitability scenario.¹⁸ In the case of SMEs, this level is highest for Colombia, the Slovak Republic and Iceland in both the profit-making (Panel A) and loss-making (Panel B) scenario (insufficient tax liability), followed by Portugal and the Netherlands. The high ranking of Colombia, the Slovak Republic and Iceland is attributable to recent policy changes (**Table B.1**). While the Slovak Republic significantly increased the rate of its R&D tax allowance in 2020 for both SMEs and large firms, Iceland increased those for SMEs more strongly, and Colombia introduced an SME specific R&D tax credit at very favourable rates.

The gap in the implied R&D tax subsidy rates for SMEs between Colombia, the Slovak Republic and Iceland is less pronounced in the loss-making scenario. Refunds and carry-forward provisions are sometimes used to promote R&D in firms that may not otherwise use their credits or allowances. Such provisions can be exclusively available to or more generous for SMEs and young firms as opposed to large enterprises. This is the case for France as well as Australia and Canada. In the Netherlands, tax offsets are redeemable against payroll taxes and disconnected from the corporate tax liability of the firm. As a result, the implied marginal R&D tax subsidy rates for profitable and loss-making firms are nearly identical, a very small gap arising from the availability and modelling of an indefinite carry forward provision (rather than refund) for baseline tax deductions in the loss case. In countries where R&D tax incentives entail neither a carry-over nor a refund option (Brazil and Japan), loss-making firms experience a full loss of R&D tax benefits (Panel C). Large firms receive the highest (lowest) R&D tax subsidy rate in the Slovak Republic, Portugal and France (Luxembourg, Argentina, and Malta) in the profit and loss-making scenario. Since 2018, Argentina has not carried out any R&D tax incentive calls

¹⁶ Switzerland has introduced R&D tax incentives on an optional basis at cantonal level in 2020. These incentives are not accounted for in the modelling which focuses on tax relief from central government.

¹⁷ Estimates for 2021 are currently not available for Thailand. The extension of its R&D tax allowance is pending approval.

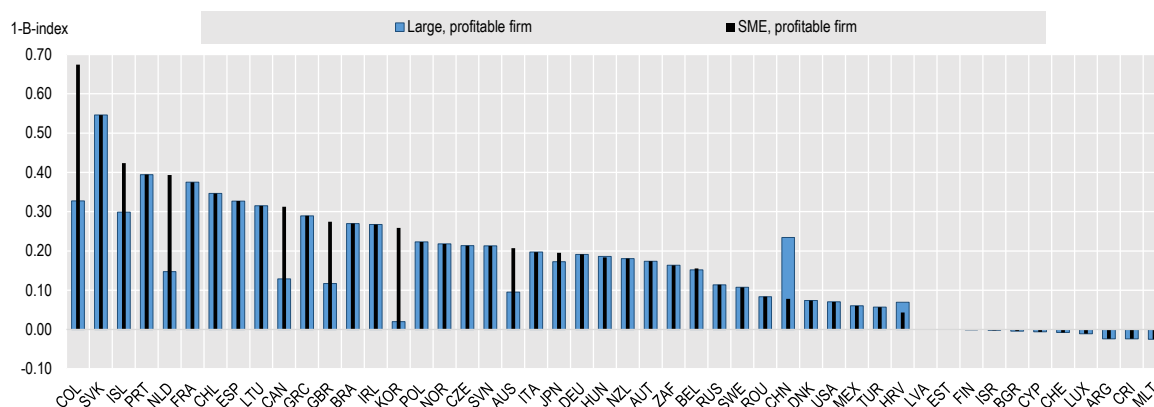
¹⁸ For general and country-specific notes on the B-index estimates, see <http://www.oecd.org/sti/rd-tax-stats-bindex-notes.pdf>

and Malta¹⁹ repealed its R&D tax allowance in 2020 with retroactive effect from 2019. Overall, there is large cross-country variation in R&D tax subsidy rates across the four scenarios considered.

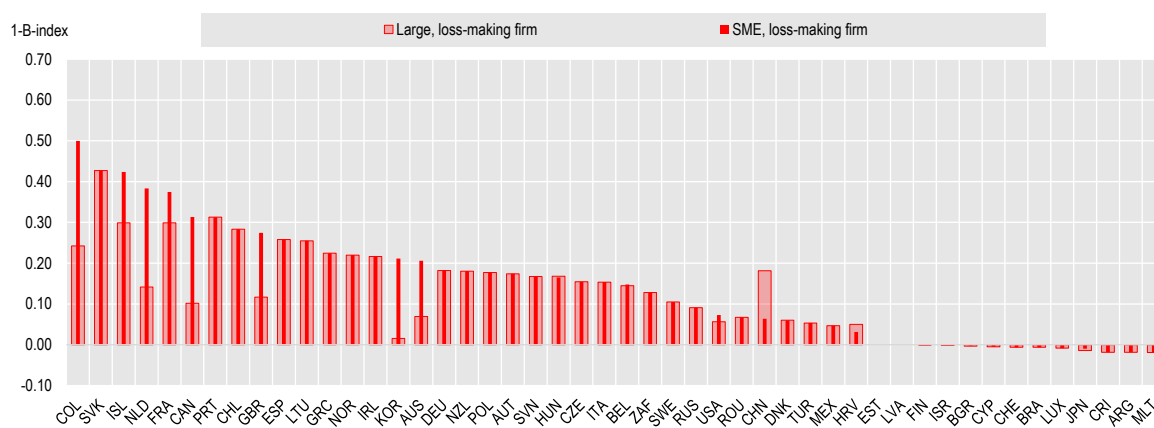
Figure 3. Implied marginal R&D tax subsidy rates, 2021

1 minus B-Index, by firm size and profit scenario

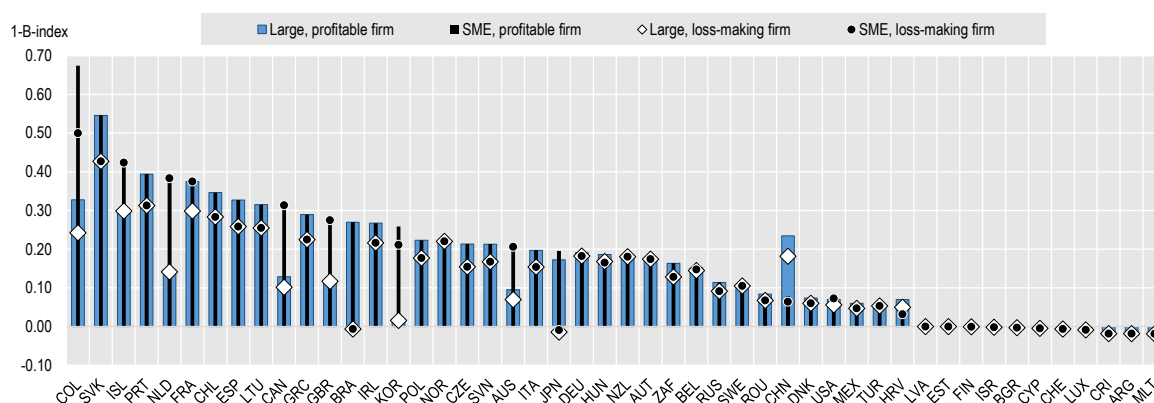
Panel A. Profit-making scenario



Panel B. Loss-making scenario



Panel C. Profit and Loss-making scenario combined



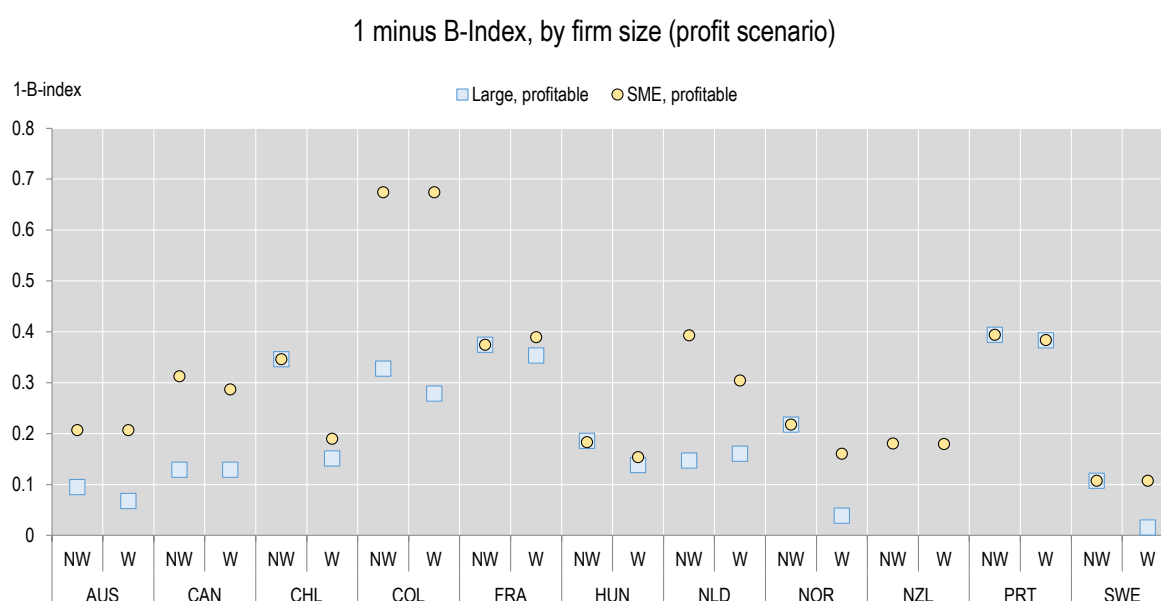
¹⁹ Malta repealed the enhanced R&D tax allowance, available at a rate of 50%, with retroactive effect from 2019. Malta offers additional R&D tax credits in 2021. Due to their very limited uptake, they are not accounted for in the modelling.

Note: Figures reflect the tax treatment of R&D expenditure for SMEs and large enterprises in OECD, EU and other major economies, some of which, but not all, offer tax incentive support for business R&D expenditure. Figures do not reflect preferential provisions for start-ups, young firms or a specific subset of SMEs (e.g. innovative SMEs).

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

The marginal tax subsidy rates presented for 2021 reflect the magnitude of marginal R&D tax credit rates applicable to an extra unit of R&D spend across a segment of the business population (e.g. SMEs or large enterprises). They are calculated based on headline tax credit and allowance rates that help to provide an upper bound and potentially useful benchmark for comparing the generosity of R&D tax relief measures but do not account for the effect of thresholds and ceilings. Whenever data or proxy measures for the distribution of eligible R&D spending are available, it is possible to account for the effect of such limitations in the modelling of R&D tax subsidy rates. A comparison of implied R&D tax subsidy rates (profit-scenario) based on weighted vs. non-weighted marginal tax credit and allowance rates is currently available for 11 OECD countries altogether (**Figure 4**) - Australia, Canada, Chile, Colombia, France, Hungary, the Netherlands, New Zealand, Norway, Portugal and Sweden – and highlights the importance of modelling ceilings and thresholds.

Figure 4. Weighted vs. non-weighted implied tax subsidy rates on R&D expenditures, 2021



Note: NW=non-weighted, W=weighted. Figures reflect the effect of applying weighted marginal tax credit (allowance) rates, where relevant weights are available, to account for ceilings and thresholds in the calculation of implied marginal tax subsidy rates. Figures do not reflect preferential provisions for start-ups, young firms or a specific subset of SMEs (e.g. innovative SMEs).

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Implied marginal tax subsidy rates based on weighted tax credit (allowance rate) often imply a lower level of subsidy compared to their unweighted counterparts, especially in the case of large enterprises where upper ceilings on qualifying R&D expenditure are more likely to be binding due to their large-scale R&D investments. This holds true for all countries considered with the exception of Canada, where the expenditure limit (threshold) is only applicable in the case of SMEs (CCPCs), and the Netherlands. In the Netherlands, the weighted tax subsidy rate for large firms slightly exceeds its unweighted counterpart, the latter being based upon the lower headline rate applicable for R&D above the WBSO threshold amount rather than a weighted average reflecting the distribution of firms' R&D expenditure relative to this cut-off point. For SMEs the change in non-weighted vs weighted implied marginal tax subsidy rates tends to be less pronounced, if not nil (e.g. Australia, France and New Zealand) when ceilings or thresholds are not binding. In the case of New Zealand, weights are only applied in the modelling of the tax subsidy rates for SMEs. Separate weights for SMEs and large firms, for the later of which ceilings and thresholds are more likely to be binding, are currently not available for the new R&D tax credit introduced by New Zealand in 2021. Future OECD work aims to apply this weighting approach more broadly in order to more fully capture the effect of thresholds and ceilings across OECD countries and partner economies over time.

3.2. Trends in implied R&D tax subsidy rates, 2000-2021

Time-series estimates of marginal R&D tax subsidy rates allow for an analysis of country specific and aggregate trends in the provision and generosity of R&D tax support by firm size and profit scenario. **Figure 5** compares the implied marginal R&D tax subsidy rates for large profitable firms (Panel A) and profitable SMEs (Panel C) in 2021 and 2010.²⁰ Profitable firms are those with a sufficient tax liability to fully make use of earned tax credits/allowances in the current period. The corresponding estimates for loss-making large firms and SMEs are presented in Panel B and D respectively. Estimates throughout all panels are sorted in descending order by the size of countries' marginal tax subsidy rate provided in 2021 for the type of firm under consideration. **Figure 5** provides a basis for identifying the onset of different tax relief provisions and the role of design features in influencing the generosity of R&D tax support for profitable large firms and profitable SMEs respectively.

Among the most generous R&D tax incentives for profitable large firms as of 2021 (Panel A), the Slovak Republic, Chile and Colombia stand out as their implied marginal tax subsidy rates increased notably over the last decade. The Slovak Republic introduced a hybrid R&D tax allowance in 2015 and increased applicable tax allowance rates significantly in 2018 (volume-based and incremental rate) and 2020 (volume-based rate only). Likewise, Colombia increased the rate of its volume-based R&D tax allowance from 25% to 50% and maintained this level of generosity when replacing the volume-based R&D tax allowance by a volume-based tax credit in 2017. Chile introduced an R&D tax credit for extramural R&D in 2008, extending its scope in 2012 to cover intramural R&D expenditure, leading to an increase in the estimated marginal R&D tax subsidy rates for large profitable firms.

In the case of profitable SMEs (Panel C), Colombia and the Slovak Republic once again stand out as countries with notable increases in marginal tax subsidy rates from 2010 to 2021. However, a larger-scale increase is also observable for Iceland where R&D tax subsidy rates increased more strongly for profitable SMEs (Panel C) vis-à-vis large firms (Panel A) from 2010 to 2021. This effect is attributable to the most recent reform of the R&D tax credit in Iceland in 2020, introducing enhanced rates for SMEs. The three countries (Slovak Republic, Portugal, France) with the largest marginal R&D tax subsidy rate for large firms in 2021 (Panel A) are also different from those (Colombia, Slovak Republic, Iceland) that provide the highest rates for SMEs in 2021 (Panel C). In general, a number of changes in position are noticeable throughout all ranks, when comparing the marginal R&D tax subsidy rates for large firms and SMEs in the profit-making scenario (Panel A and C). Those changes are in turn related to the more generous tax treatment that some countries (e.g. Australia, Canada, Colombia, Iceland, and United Kingdom) provide to SMEs in the form of enhanced tax credit or allowance rates, for example.

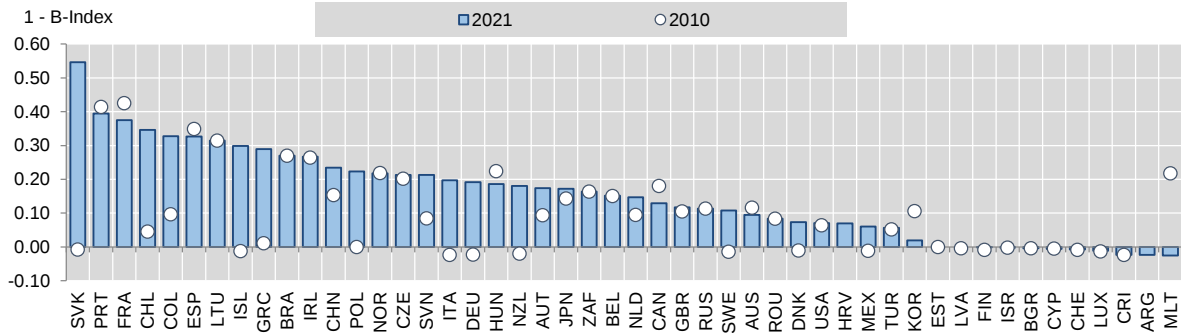
A number of first-time introductions and re-introductions of R&D tax incentives are also apparent since 2010 (Panel A and C). This includes the first-time introduction of R&D tax relief provisions in Iceland in 2011, Latvia and Sweden in 2014, the Slovak Republic in 2015, Poland in 2016, and Germany in 2020. Italy had experimented with various temporary tax credit schemes over the last decade and introduced a new incremental R&D tax credit in 2015, while Mexico re-introduced R&D tax incentives in the form of a volume-based R&D tax credit in 2015.

²⁰ For the full time-series of B-Index estimates, see <https://stats.oecd.org/Index.aspx?DataSetCode=RDSUB>

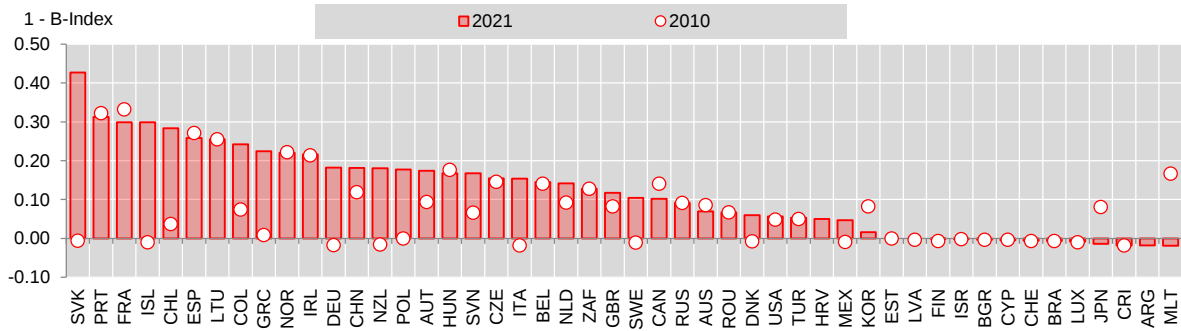
Figure 5. Implied marginal R&D tax subsidy rates, 2021 and 2010

1 minus B-Index

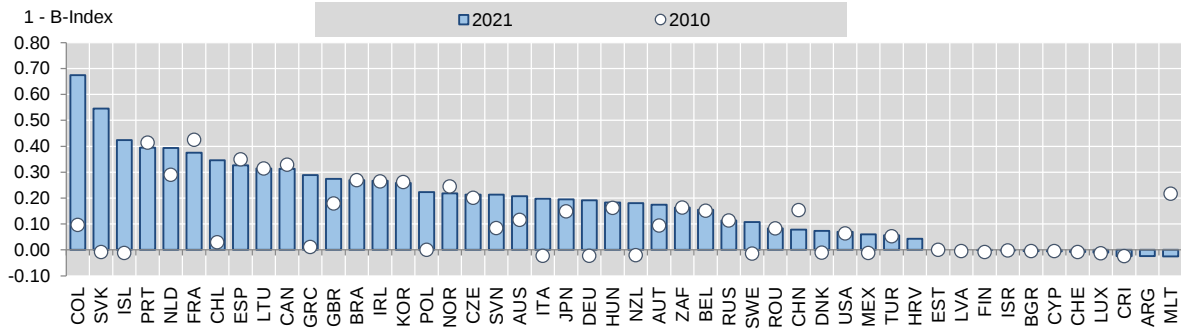
Panel A. Large firms, profitable



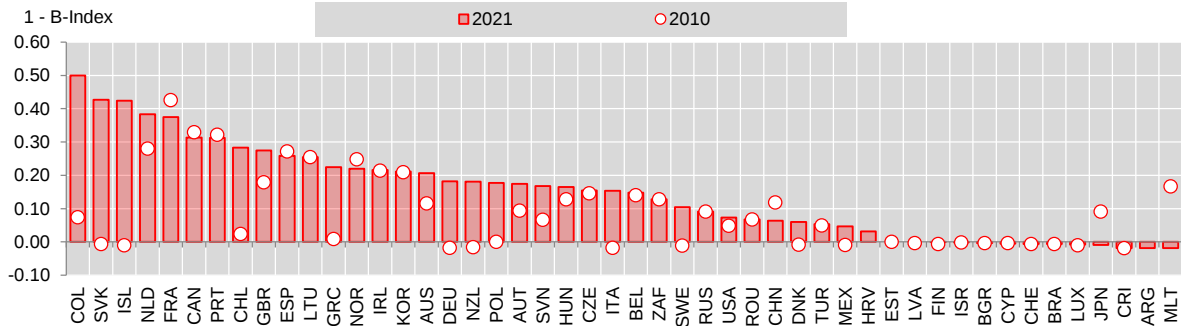
Panel B. Large firms, loss-making



Panel C. SMEs, profitable



Panel D. SMEs, loss-making



Note: Figures reflect the tax treatment of R&D expenditure for SMEs and large enterprises in OECD, EU and other major economies, most of which but not all, offer tax incentive support for business R&D expenditure. Figures do not reflect preferential provisions for start-ups, young firms or a specific subset of SMEs (e.g. innovative SMEs). For Argentina and Croatia, no estimates are currently available for 2010. Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Some countries also increased the generosity of existing schemes, complemented their tax relief regime with additional incentives or replaced existing schemes with new and more generous incentives. The latter applies to Australia, which replaced its previous R&D tax allowance scheme with a new R&D tax incentive from 1 July 2011, offering more generous rates for SMEs vis-à-vis large companies, and Greece which converted its incremental R&D tax allowance into a volume-based scheme in 2013. Slovenia increased the rates of its volume-based R&D tax allowance in 2012. The Netherlands complemented the existing payroll-withholding tax credit (WBSO) with an R&D tax allowance for non-labour related expenditures in 2012 (merged with the WBSO scheme in 2016).²¹ Denmark (2018) and New Zealand (2019) also recently introduced additional R&D tax incentives. It is also worth noting how changes in CIT rates directly influence the value of R&D tax allowances. For instance, the decrease in tax subsidy rates for SMEs in China (Panel C) can be linked to a reduction in SME CIT rates, while tax allowance rates increased for both SMEs and large firms from 2010 to 2020.

While the majority of countries increased the generosity of R&D tax support between 2010 and 2021 through the adaption of existing R&D tax relief provisions or introduction of new incentives, there are also cases, where the generosity of R&D tax support declined or simply remained unchanged over this period. In the case of Korea, for instance, the incremental tax credit rate for large firms was lowered in 2017 and adjustments to the definition of the base amount were undertaken, leading to a decrease in the R&D tax subsidy rate estimated for large firms (Panel A), while those for SMEs (Panel C) remained unaffected.²² The decline in the tax subsidy rates in Canada (Panel A and C) is similarly related to a reduction in the R&D tax credit rate in 2014, combined with an exclusion of machinery and equipment related spending from qualifying R&D expenditure. Malta in turn abolished its enhanced R&D tax allowance with retroactive effect from 2019, the main R&D tax incentive in place until then.

No discernible changes in R&D tax subsidy rates are observable in countries that did not provide any form of tax support at central government level during the 2000-2021 period (Bulgaria, Costa Rica, Estonia, Cyprus, Luxembourg and Switzerland), or offered R&D tax incentives only on a temporary basis such as Latvia (2014-17). Finally, no or only minimal changes in R&D tax subsidy rates are observable in countries that already offered generous R&D tax incentives back in 2010. This includes Spain where volume-based and incremental R&D tax credit rates have remained unchanged since 2008, and Portugal which significantly increased the volume-based rate of this hybrid tax credit scheme in 2009 after a temporary suspension of the SIFIDE tax credit in 2004-2005. Likewise, no discernible changes in implied R&D tax subsidy rates between 2010 and 2021 are observable for Finland which offered a temporary R&D tax allowance during the years 2013-2014 and reintroduced R&D tax support in form of an R&D tax allowance for R&D-related research cooperation expenditures in 2021. Owing to the small weight attached to such expenditure in the overall R&D cost structure of firms, the implied R&D tax subsidy generated by this incentive is effectively close to zero.

Similar breaks (e.g. R&D tax incentive introductions and repeals) and trends in the generosity of tax support are visible in the loss-making vis-à-vis profit making case (Panel B and D). In most cases, the loss-making estimates for SMEs and large firms are lower than those estimated for the profit-making firms (Panel A and C). Most countries offer firms with insufficient tax liability the option to carry-over unused tax credits/allowances. This implies a discount in the net present value of tax benefits. Exceptions are found in countries that offer refundable (payable) tax incentives, either exclusively to SMEs or the broader firm population. In 2021, SME-specific refunds are provided by Australia, Canada and France, for instance, whereas Austria, Belgium, Denmark, Germany, Iceland, Ireland (after 5

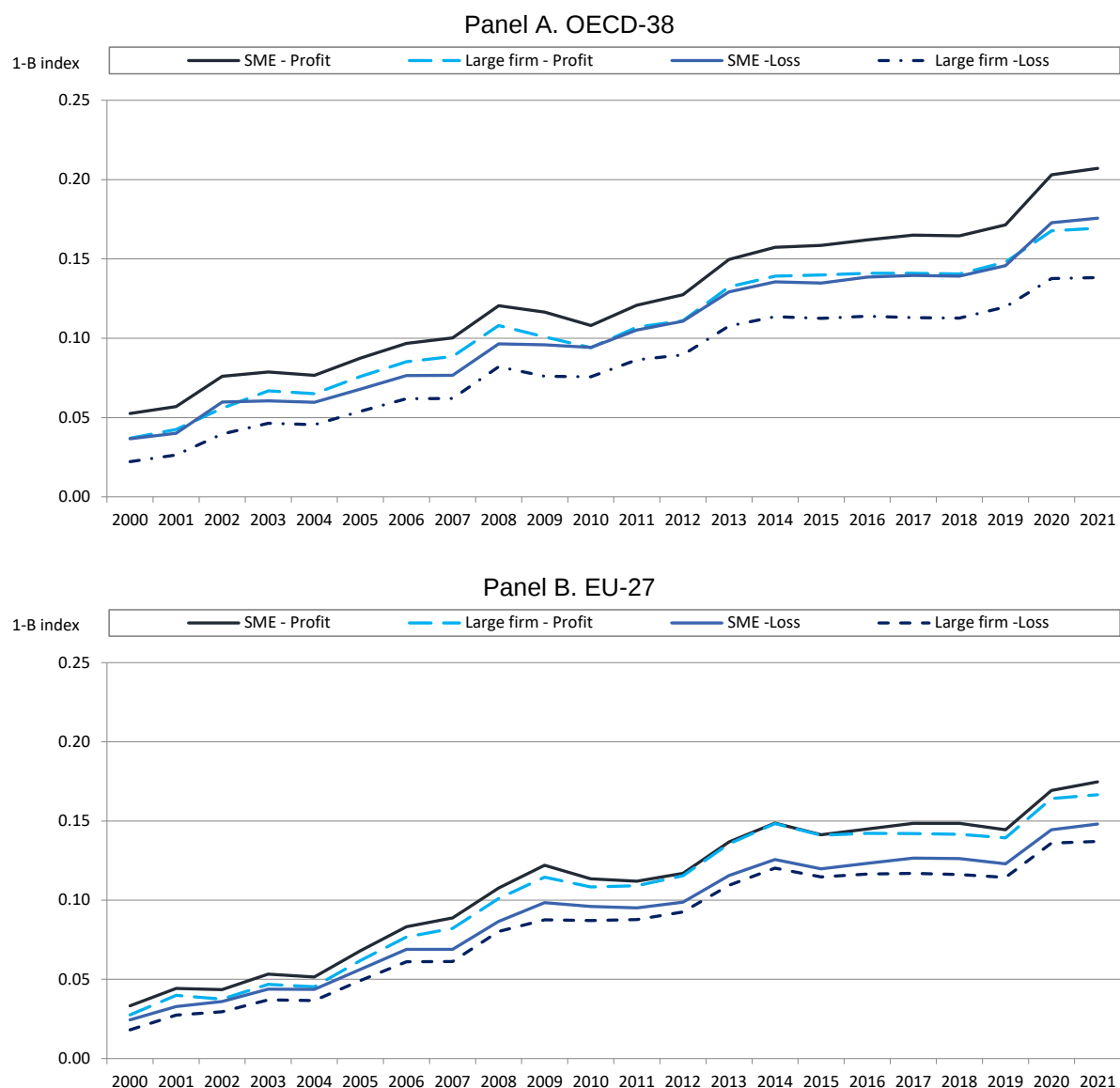
²¹ This extension in the scope of R&D tax relief in the Netherlands led to an increase in the R&D tax subsidy rate estimated for profitable large firms and maintenance of the corresponding levels for profitable SMEs. While the headline rates for R&D expenditure above the threshold amount (modelled in the case of large firms) declined slightly from 18% in 2010 to 16% in 2020, the headline rates below this cut-off point (modelled in the case of SMEs) decreased from 50% in 2010 to 32% in 2020.

²² These estimates focus on the hybrid R&D tax credit and the R&D investment credit in Korea. If the modelling accounts for the maximum volume-based tax credit rate available to SMEs (30-40%) and large firms (20-30%) under the Growth Industry and Basic Technology scheme – one component of the hybrid R&D tax credit, the implied R&D tax subsidy rate for SMEs is equal to 0.41 (0.33) in the profit (loss case) and the one for profitable (loss-making) large firms amounts to 0.37 (0.29).

years), New Zealand, Norway, Spain, and the United Kingdom offer payable incentives to both large firms and SMEs. It is important to keep in mind that tax offsets redeemable against payroll tax or social security contributions are disconnected from the corporate tax liability of the firm and are thus in principle also payable in both the profit and loss-making scenario.

Figure 6. Implied marginal R&D tax subsidy rates, 2000-21

1 minus B-Index, OECD and EU countries (unweighted average)



Note: Figures reflect the tax treatment of R&D expenditure for SMEs and large enterprises in OECD, EU and other major economies, most of which but not all, offer tax incentive support for business R&D expenditure. Estimates are available for selected years in the case of Greece (2004-2021), Croatia (2000-02, 2015-21) and Turkey (2008-21) when sufficient detail is available to carry out calculations for representative firms in the relevant categories. Figures do not reflect preferential provisions for start-ups, young firms or a specific subset of SMEs (e.g. innovative SMEs).

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

An analysis of aggregate trends can help shed light on the overall trends in the generosity of R&D tax support across countries over time. **Figure 6** displays the aggregate trends in implied marginal tax subsidy rates across OECD (Panel A) and EU (Panel B) countries for which available design information

enabled computing of the R&D tax subsidy rates for the four scenarios under consideration. The evolution of the average or mean (unweighted) marginal R&D tax subsidy rate for this group of 38 OECD and 27 EU countries is presented by firm size and profit scenario.

Looking at the mean OECD and EU R&D tax subsidy rates over the 2000-21 period, a marked increase in the notional level of tax subsidy is noticeable in OECD and EU countries with the increasing adoption of tax incentives from mid-2000 onwards, a slowdown at the onset of the global economic and financial crisis, and a reversion back to this growing trend afterwards. While a stabilisation in the level of notional tax support for R&D is visible in the years 2013-19, average OECD and EU tax subsidy rates spike in 2020 with the first-time introduction of an R&D tax incentive in Germany and enhancement of R&D tax relief provisions in a number of OECD countries and EU member states (**Section 2.2. ; Table B.1**).

Between 2000 and 2021, implied marginal tax subsidy rates increased significantly for SMEs and large firms in the OECD and EU area independent of their profit situation. In OECD countries (Panel A), implied marginal subsidy rates increased on average from approximately 0.05 to 0.21 in the case of profitable SMEs (0.04 to 0.18 for loss-making SMEs), and from approximately 0.04 to 0.17 in the case of large profitable firms (0.02 to 0.14 for large loss-making firms). Throughout this period of time, SMEs faced on average a higher marginal tax subsidy rate than large firms, comparing either profit-making or loss-making firms. It is worthwhile noting that from 2009 onwards, the mean R&D tax subsidy rate for loss-making SMEs essentially coincides with the one for large profitable firms.

In EU countries (Panel B), implied marginal subsidy rates increased on average from approximately 0.03 to 0.17 in the case of profitable SMEs (0.02 to 0.15 in the case of loss-making SMEs), and for large profitable firms from approximately 0.03 to 0.17 (0.02 to 0.14 for large loss-making firms). Like in the OECD area, profitable (loss-making) SMEs faced on average a higher marginal tax subsidy rate than profitable (loss-making) large firms in the EU area. However, from 2005 onwards, average R&D tax subsidy rates for loss-making SMEs fall below those of large profitable firms.

4. Government tax relief for business R&D

Measuring how much governments dedicate to R&D support schemes through R&D tax incentives involves a number of conceptual and practical challenges, especially when attempting to do so in an internationally comparable fashion. Measuring tax expenditures for R&D requires agreement on a common benchmark on what represents a baseline tax treatment of R&D expenditures. Tax expenditures are deviations from a benchmark tax system (OECD, 2010). Establishing a common scope is the first requirement for comparability. **Annex D** describes the methodology adopted by OECD in measuring and reporting government tax relief for business R&D (OECD, 2015b).

In addition to statistics on the cost of tax support for R&D, this section highlights complementary, yet more exploratory statistics on the number of R&D tax relief beneficiaries and the amount of qualifying R&D expenditures. OECD has collected information on R&D tax relief beneficiaries only since 2016 and information on the amount of qualifying R&D expenditure for the first time in 2020. Compared to statistics on the cost of government tax relief for R&D (GTARD), these indicators have received a lower degree of scrutiny for international comparability so far and have thus never been part of the R&D tax incentives data publicly disseminated by the OECD. This report presents these two new indicators, drawing attention to the relevance and feasibility of this type of information with a view to further improve the rate and comparability of data reporting.

4.1. Government tax support for business R&D in 2019

4.1.1. Statistics on government tax relief for R&D expenditure (GTARD)

This section lays out the most recently available evidence on the cost of central government support for business R&D through tax relief and direct funding, and the magnitude of subnational R&D tax

support when relevant data are available (Canada, Japan, Hungary). Data correspond to 2019²³ for 38 countries (including those providing no tax support), 2018 for 5 countries (Bulgaria, Chile, Spain, Sweden, the United States), 2017 for 5 countries (Brazil, China, South Africa, Switzerland, Thailand), 2016 for 1 country (Romania).²⁴ At the time of reporting, data on government-financed BERD are not available for Costa Rica. More recent values of GTARD for 2019 are available for Brazil, Chile, South Africa, Sweden, and Thailand, if presented alone and not combined with figures of government-financed business enterprise expenditure on R&D (BERD). Data on the cost of expenditure-based R&D tax relief are not available for one country (Israel), while no such support was provided in 2019 (or closest year) by seven OECD countries (Costa Rica, Estonia, Finland, Germany, Latvia, Luxembourg, and Switzerland) and two non-OECD EU countries (Cyprus, Bulgaria). Reliable data on R&D tax support is subject to timeliness problems because it needs to be based on tax returns for completed tax years. Budgetary data can be timelier but it is also subject to a greater degree of error.

Tax support for business R&D compared to direct government funding

Figure 7 presents the latest statistics on government support for business R&D, comparing the magnitude of tax support (central and subnational) and direct funding of BERD. Based on estimates traditionally available of direct funding (**Figure 7**, Panel A), the Russian Federation, Hungary, Korea, Iceland and the United States provided the most direct funding for business R&D as a percentage of GDP in 2019. The weighted average rate in the OECD (EU-27) area was close to 0.09% (0.07%). Direct support accounts for the equivalent of around 4.95% (5.2%) of BERD in the OECD (EU-27) area.

The compilation of data on tax support for business R&D indicates levels of support which are not accounted for in direct funding statistics but which are on a very similar order of magnitude if not larger for a majority of countries that use this form of support (**Figure 7**, Panel B). The average rate of tax support in the OECD (EU-27) area - including countries that do not provide this type of support - is close to 0.12% (0.10%). Tax support accounts for 6.7% (7.1%) of BERD in the OECD (EU-27) area.

As a percentage of GDP, tax relief for R&D expenditures in 2019 was largest for the United Kingdom, France and Belgium, followed by Portugal and Austria. New Zealand reintroduced R&D tax support in the form of an R&D tax credit for deficit-related R&D tax expenditure in 2015, complemented by a new and broader R&D tax credit (not limited to deficit related R&D expenditure) in 2019. This recent reform is not yet reflected in the tax expenditure estimates presented in this report. Countries where tax incentives are provided for business R&D at both national and subnational level include Canada, China, Hungary, Japan, Spain, and the United States. Canada, Hungary and Japan are able to report estimates of the cost of R&D tax support at subnational government level. While provinces account for around 30% of total tax support in Canada in 2019, subnational R&D tax incentives in Hungary and Japan account for a comparatively smaller share of total tax support of around 20% and 1% respectively.

Combining both types of support (direct and tax support), the Russian Federation, the United Kingdom, France and Belgium provided the most combined support for business R&D as a percentage of GDP in 2019. By taking into account R&D tax support, it is possible to get a better sense of the full extent of government support for R&D across the OECD and EU areas as well as other major economies. It is also possible to see how some countries, which appear to give little support on the sole basis of direct funding, were in fact providing significant assistance through the tax system. This is the case for Australia, Austria, Belgium, Canada, France, Ireland, Italy, Japan, Portugal and the United Kingdom.

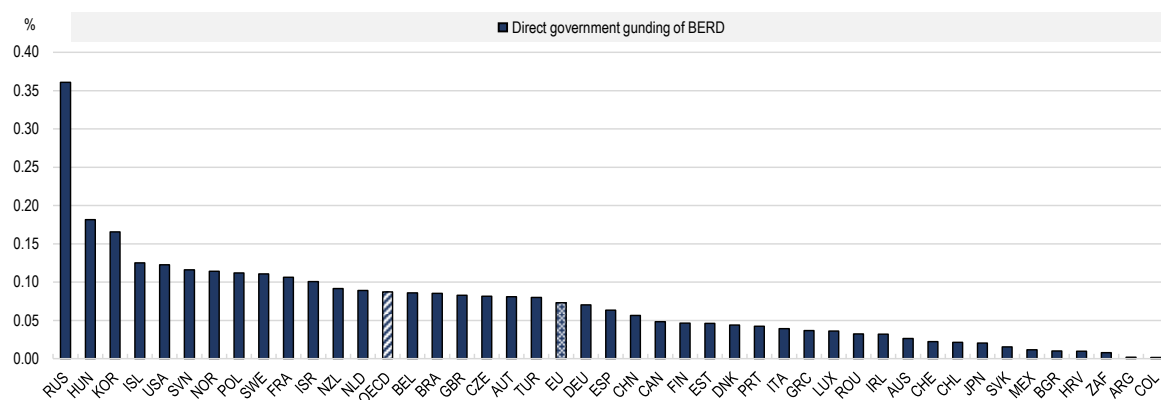
²³ In 2019 (or closest year), estimates of direct funding for Bulgaria, Croatia, Cyprus, Israel, Malta, Poland and Sweden are based on imputing the share of direct government-funded BERD in the previous year to the current ratio of BERD to GDP. In 2017, estimates of direct funding of BERD for Brazil are based on imputing the share of direct government-funded BERD in the third to last year to the current ratio of BERD to GDP.

²⁴ For general and country specific notes, see <http://www.oecd.org/sti/rd-tax-stats-gtard-notes.pdf>.

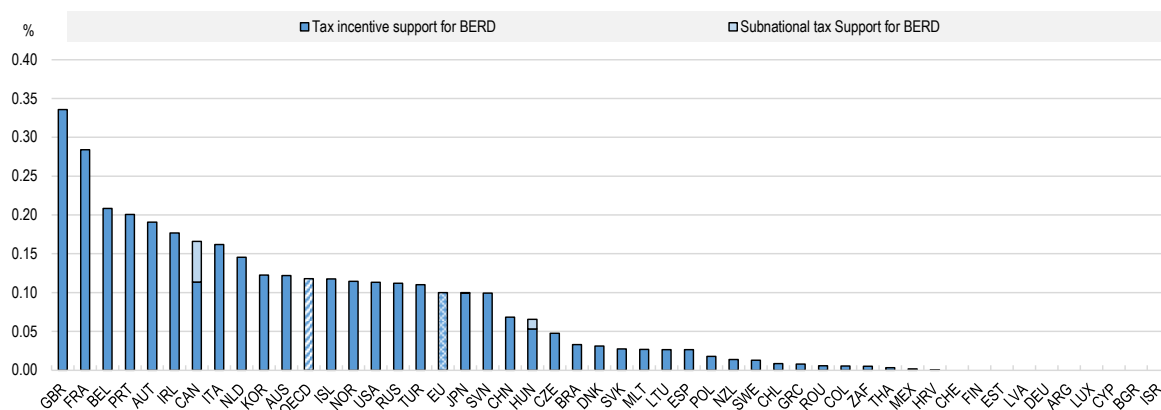
Figure 7. Direct government funding and government tax support for business R&D, 2019

As percentage of GDP

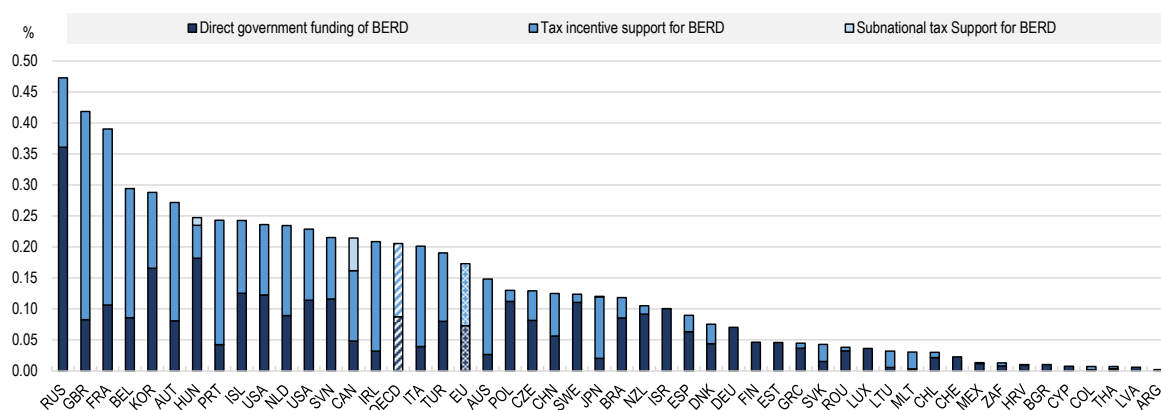
Panel A. Direct government funding of business R&D (GovFundBERD)



Panel B. Government tax relief for business R&D (GTARD)



Panel C. GovFundBERD and GTARD combined

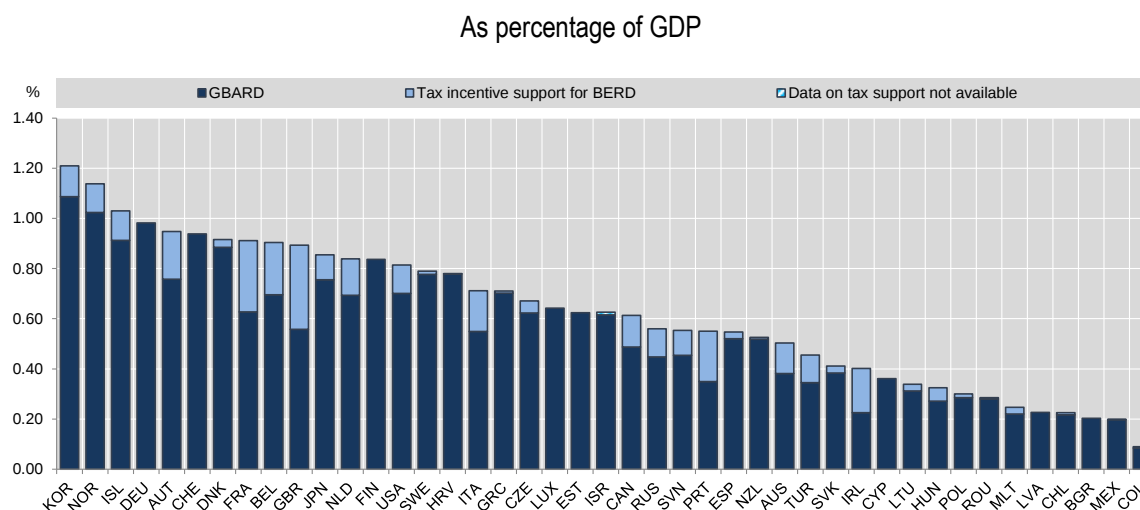


Note: Data on subnational tax support for business R&D are only available for a group of countries. Estimates of government tax relief for R&D (central government level) are not available for Israel.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Figure 8 puts the information on the value of tax support for business R&D in the broader context of overall budgetary support for R&D activities undertaken by governments. This presentation has the advantage of relying on more directly comparable types of administrative data sources, as opposed to comparing reports by R&D performers with tax support data, which may not fully align in time.

Figure 8. Government budgets for R&D and tax incentive support for business R&D, 2019



Note: Data on subnational tax support for business R&D are only available for a group of countries. Estimates of government tax relief for R&D (central government level) are not available for Israel. For Bulgaria, Canada, Chile, Poland, Spain, Sweden, and the United States, figures refer to 2018 instead of 2019. Figures for New Zealand and Switzerland refer to 2017, while those for Romania refer to 2016.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

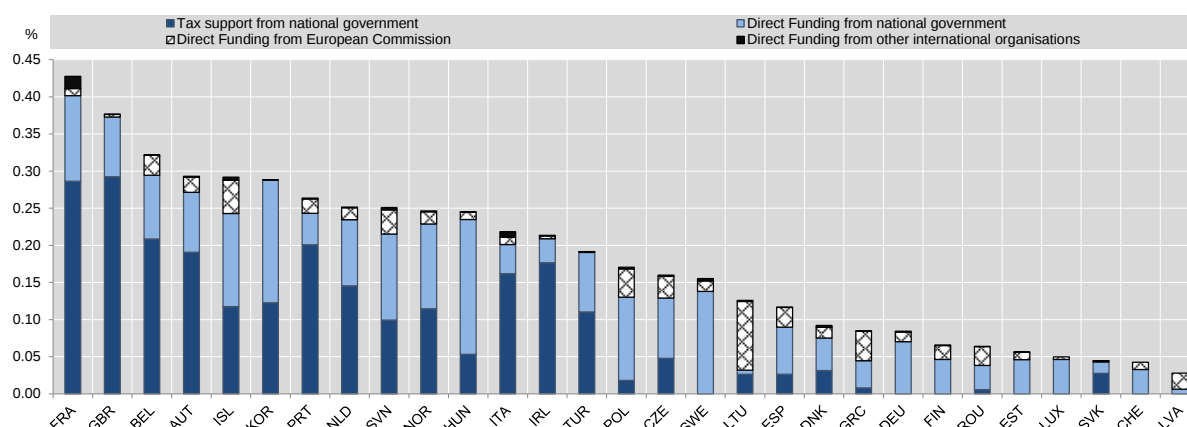
Government budget allocations for R&D (GBARD) include direct funding provided to all sectors, including contributions to R&D programmes abroad. On average, tax support represented in 2019 the equivalent of 11% of all support reported for R&D. In the case of countries with R&D tax incentives in place, this figure is equal to 14%. The relative importance of tax incentives in the total financial effort incurred by governments for R&D is largest in the case of Ireland (44%), the United Kingdom (38%), Portugal (37%) and France (31%), followed by Australia and Turkey (24%) and Belgium and Italy (23%). In these countries, R&D tax incentives are not only major policy instruments for supporting business R&D but also play a first order role in the overall R&D policy mix.

International organisations such as the European Commission provide public support for business R&D. In a number of transition economies, such international government-like sources of public support play an important role in financing business R&D. **Figure 9** shows the magnitude of direct and tax support for BERD by national governments as well as the amount of direct funding (e.g. R&D grants, procurement of R&D services) provided by the European Commission and other international organisations as a percentage of BERD. This breakdown is presented - as a percentage of GDP (Panel A) and as percentage of BERD (Panel B) - for a number of OECD-EU countries for which relevant data are available for 2019 (or closest year).

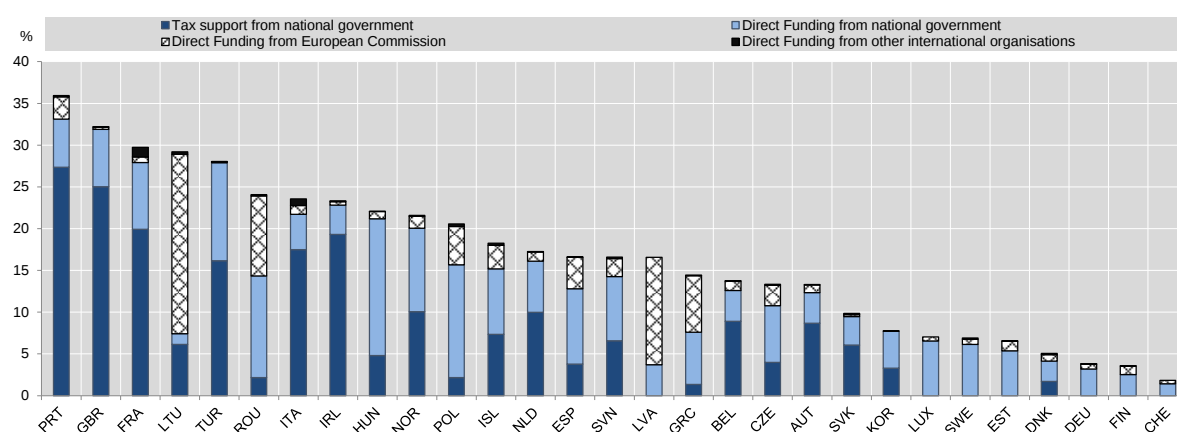
When national and international support for BERD is combined, a different picture arises of the degree of government support for business R&D. The share of foreign sources of funding in total public support for BERD (national and international) ranges from 1% in Turkey to 78% in Latvia and amounts on average to 18% among the countries considered. As a percentage of GDP (Panel A), national and international government support for BERD varies from 0.03% of GDP in Latvia to 0.43% of GDP in France. The overall share of BERD financed by national and international government institutions (Panel b) ranges from 2% in Switzerland to 36% in Portugal.

Figure 9. Domestic government and international organisation support for BERD, 2019

Panel A. As percentage of GDP



Panel B. As percentage of BERD



Note: Tax relief figures for Hungary exclusively refer to government tax relief for R&D at central government level.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

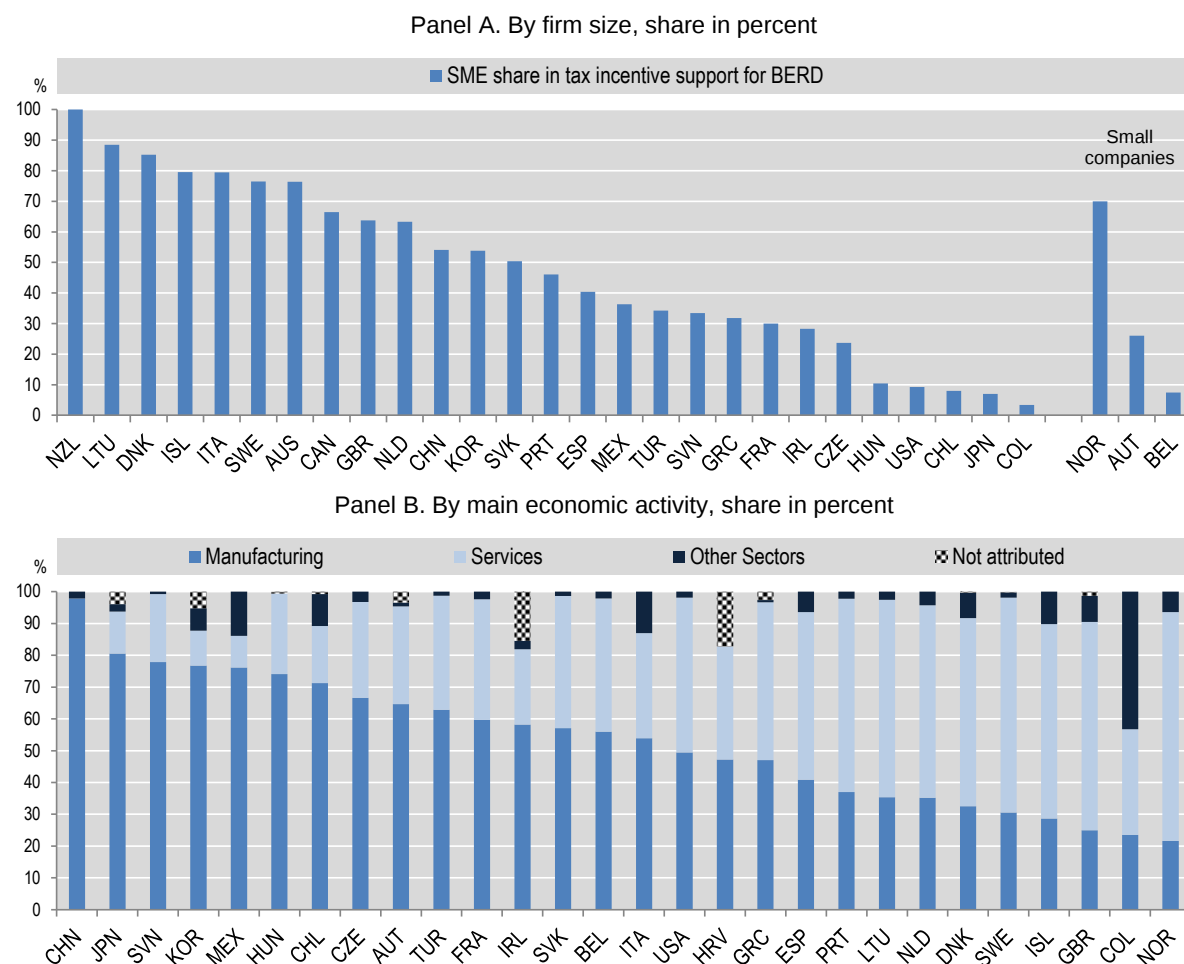
Distribution of R&D tax support by firm size, main economic activity and economic ownership

This section presents a range of indicators that aim to identify how the distribution of tax support for R&D within countries compares to the distribution of R&D performance and government direct funding and R&D performance in general. This is relevant for understanding what types of firms benefit more and less from tax support. Firm size and economic activity are often dimensions of particular interest. SME definitions for tax purposes typically vary across countries and may differ from those adopted for the purpose of R&D statistics. **Table E.1 (Annex E)** presents the criteria adopted by countries in defining SME status and based on which indicators on business R&D, direct and tax support by firm size are reported in this document. **Table E.2** specifies the broad (detailed) industry sector classification adopted in producing indicators on public support by main economic activity across countries for which relevant data are available. **Table E.4** in turn specifies the economic ownership definitions employed in presenting the new indicator on shares of R&D tax relief allocated to foreign controlled affiliates and domestic enterprises with multinational presence in this report.

Figure 10 (Panel A) sheds light on the distribution of R&D tax relief in 2019 (or closest year) by business size for a number of countries for which relevant data are available. As R&D is highly concentrated in large firms, the latter tend to be the main recipients of direct and tax support for business R&D (BERD). The share of R&D tax support accounted for by SMEs ranges between 3% in Colombia, 7% in Japan,

10% in Hungary, around 65% in Canada, 80% in Iceland and Italy and 100% in New Zealand. This figure for New Zealand refers to the tax credit for research and development tax losses but does not yet reflect the Research and Development Tax Incentive (RDTI) introduced by New Zealand in 2019.

Figure 10. Distribution of R&D tax incentive support, 2019



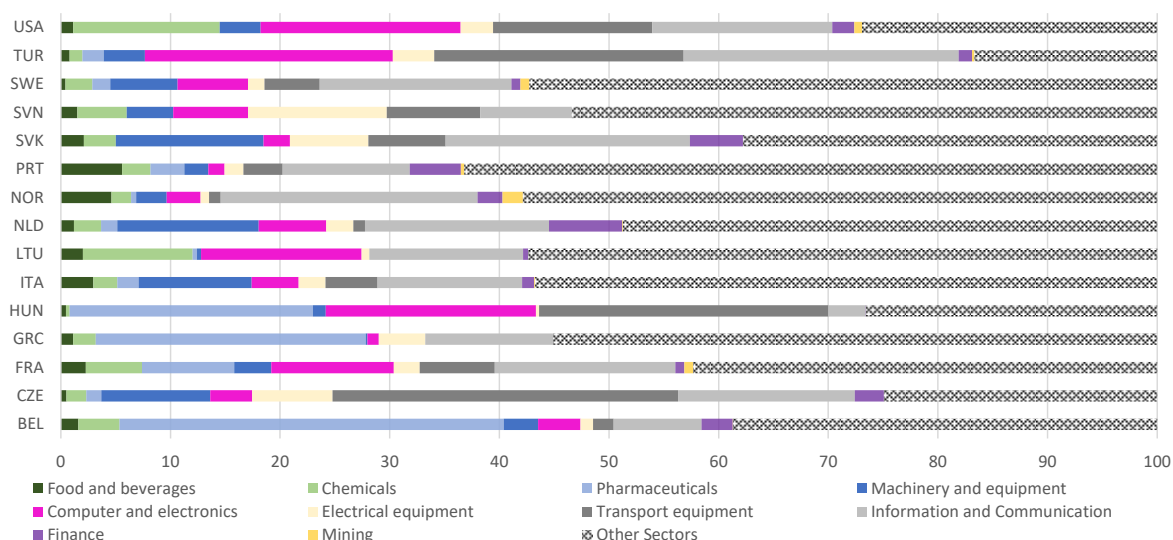
Note: Panel A: Figures for China refer to 2017 instead of 2019, for Spain they refer to 2014 and in the case of the United States, they refer to 2013 and only to corporate claimants. Panel B: Figures for the United States refer to 2018 instead of 2019, for China they refer to 2017 and for Spain figures refer to 2014. In the case of the United States, they refer only to corporate claimants. Some countries offer multiple R&D tax incentive schemes but are only able to report information for selected instruments. In the case of Belgium, figures refer to the payroll withholding tax exemption and R&D tax credit, for Italy, they refer to the incremental R&D tax credit introduced in 2015, and for Hungary, they refer to the R&D tax allowance and development incentive. For Spain, figures refer to the R&D&I tax credit and for the Slovak Republic, they refer to the R&D tax allowance. Furthermore, figures are generally not available for accelerated depreciation provisions (see Table A.1).

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

R&D-intensive industries typically account for the largest share of business enterprise expenditure on R&D in manufacturing. In line with this notion, firms in manufacturing tend to account for a substantial share of R&D tax support across OECD and partner economies (Figure 10, Panel B), for which relevant data are available for 2019 (or closest year). This percentage ranges from around 20% in Colombia, 25% in the United Kingdom, 60% in France, around 75% in Korea, 80% in Japan to close to 100% in China. Figure 11 provides additional insights into the distribution of government tax relief for R&D expenditure by industry, leveraging the more granular industry information collected for ten selected R&D intensive industry sectors for the first time in 2021. Such information is currently available for

fifteen OECD countries. Overall, there is a significant variation in the distribution of R&D tax support across these ten industry sectors among the fifteen countries under consideration.²⁵

Figure 11. Distribution of R&D tax incentive support by industry, 2019



Note: Figures for the United States refer to 2013 and only to corporate claimants. Some countries offer multiple R&D tax incentive schemes but are only able to report information for selected instruments. In the case of Belgium, figures refer to the payroll withholding tax exemption and R&D tax credit, for Italy, they refer to the incremental R&D tax credit introduced in 2015, and for Hungary, they refer to the R&D tax allowance and development incentive. For Spain, figures refer to the R&D&I tax credit and for the Slovak Republic, they refer to the R&D tax allowance. Furthermore, figures are generally not available for accelerated depreciation provisions (see **Table A.1**).

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Figure 12 provides a comparison of the SME shares in direct and tax support for BERD with the SME share in BERD. While direct support is by and large discretionary, the SME share in tax support tends to be more closely aligned with the SME share in BERD, confirming the notion that tax incentives are generally a demand-driven complement to direct government support for R&D. The SME share in tax support exceeds the share of direct funding in Canada, Denmark, France, Italy, Lithuania, the Netherlands, New Zealand, Norway, Sweden, Turkey and the United Kingdom. It is worth noting that with the exception of Denmark, Lithuania and New Zealand, all these countries offer refundable R&D tax incentives (or tax incentives redeemable against payroll withholding taxes and/or social security contributions) which particularly target smaller R&D performers. This allows them to make use of earned tax credits even in the case of insufficient tax liability where any excess credits are paid in full or in part to the taxpayer.²⁶ In Denmark and New Zealand, the R&D tax credit is limited to R&D tax losses, facilitating a reinstatement of baseline tax deductions for eligible R&D expenditure in the loss case. The entirety of support is provided to SMEs under the tax credit for R&D tax losses in New Zealand.²⁷

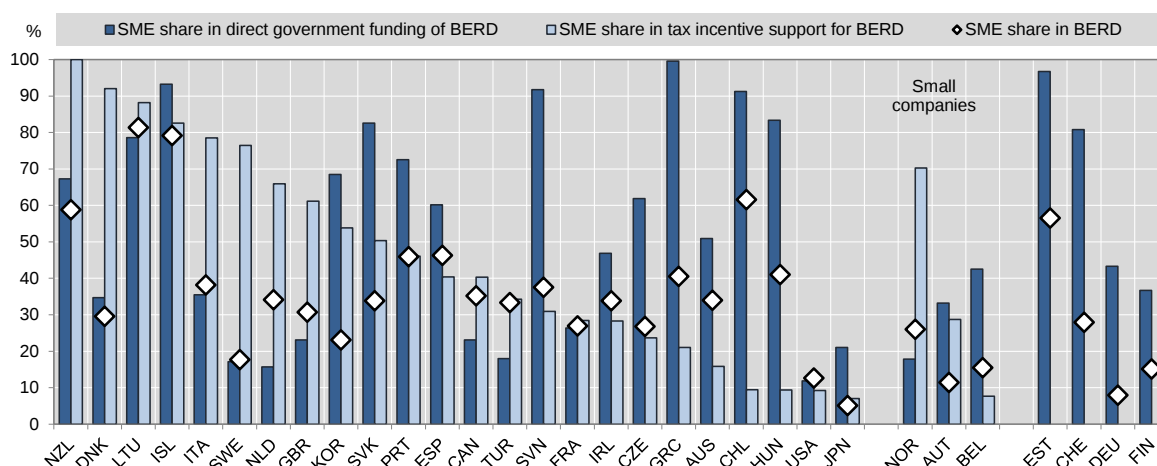
²⁵ With a large share of R&D tax benefits allocated to other sectors, the 2022 OECD R&D tax incentives data collection will aim to collect information for additional industry sectors, including Scientific research and development and Basic metals and fabricated metal products (except machinery and equipment) among other R&D intensive industry sectors.

²⁶ In the case of Italy, companies may offset earned credits against regional taxes (IRAP), VAT, PIT withholdings and social security contributions, besides their income tax liability, making the incremental R&D tax credit effectively refundable.

²⁷ The figures for New Zealand do not yet account for the Research and Development Tax Incentive introduced in 2019.

Figure 12. SME share in BERD, direct funding and tax incentive support, 2019

As a percentage of BERD and government support for BERD in each category

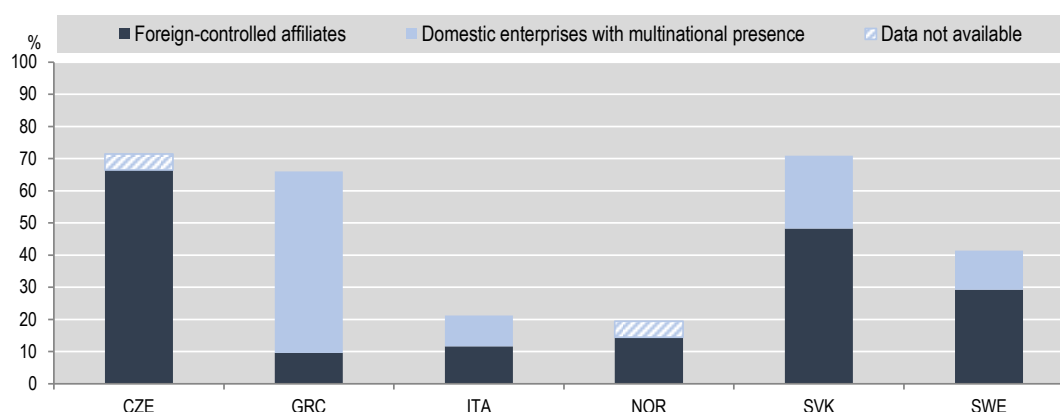


Note: Figures for Chile, Estonia, Germany, Hungary, Iceland, Italy, Lithuania, the Netherlands, New Zealand, Norway and the United Kingdom, refer to 2018 instead of 2019. For Austria, Belgium, Denmark, France, Greece and Switzerland, figures refer to 2017, for Slovenia, they refer to 2016 and for Spain to 2014. Figures for Canada and the United States (corporate claimants only) refer to 2013, while they refer to 2011 in the case of Australia. In the case of Sweden, estimates of government tax relief refer to 2019 while direct funding figures refer to 2013. Some countries offer multiple R&D tax incentive schemes but are only able to report information for selected instruments. In the case of Belgium, figures refer to the payroll withholding tax exemption and R&D tax credit, for Italy, they refer to the incremental R&D tax credit introduced in 2015, and for Hungary, they refer to the R&D tax allowance and development incentive. For Spain, figures refer to the R&D tax credit and for the Slovak Republic, they refer to the R&D tax allowance. Furthermore, figures are generally not available for accelerated depreciation provisions (see Table A.1).

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Figure 13. Distribution of R&D tax incentive support by economic ownership, 2019

Share of foreign-controlled affiliates and domestic enterprises with multinational presence



Note: Domestic enterprises with multinational presence are those with affiliates abroad. In the case of the Czech Republic and Norway, data on domestic enterprises with multinational presence are not available. Figures for Italy refer to 2020 instead of 2019.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Figure 13 provides information on the share of government tax relief for R&D accounted for by foreign-controlled affiliates and domestic enterprises with multinational presence (with affiliates abroad). This breakdown, for the first time collected in 2021, is currently available for six OECD countries. Among this subset of OECD countries, the share of R&D tax benefits attributable to foreign-controlled affiliates varies from 12% in Italy to 66% in the Czech Republic, while the corresponding figure for domestic enterprises with multinational presence (available for four OECD countries) ranges from 10% in Italy to

56% in Greece. As only a subset of OECD countries and partner economies have been in the position to report this information in the first attempt in 2021, this indicator should be seen as exploratory, relying on an improvement in the rate of data reporting and further scrutiny for international comparability.

4.1.2. Statistics on the number of firms applying for and receiving R&D tax support

This section presents available statistics on the number of R&D tax relief recipients. The experimental nature of these data calls for caution when interpreting the available figures, as some differences exist in the way such data are recorded and reported by countries. The OECD R&D tax incentives survey asks respondent to flag whether they report data on applicants or claimants instead of beneficiaries but not all conceptual differences may be fully captured in this survey and flagged in this report.

R&D tax relief beneficiaries, claimants and applicants

Different tax systems provide R&D tax support using different reporting systems and milestones for the administration process that impact on available indicators of taxpayer demand for and use of R&D tax support. **Table 1** proposes an indicative schema for understanding differences in reported figures. The schema accounts for the fact that some R&D tax incentive processes are based on individual projects that sometimes have to be put forward for pre-assessment and approval for eligibility. A single firm or enterprise group may put forward one or more of these in a given year.

Table 1. Schema for statistics on the number of R&D tax relief beneficiaries

Entity	Status	Submission of request for R&D tax support	Entitled to R&D tax support	Realisation of R&D tax support
Project/activity/schemes		Applications (Can be project or activity specific, or for separate types of incentives)	Claims (Can be part of tax returns, a company may submit more than one)	Realised claims
Firms (enterprises or groups)		Applicants (A company may submit more than one application within a year)	Claimants (Claims can be kept separate or combined within a firm)	Tax support recipients (beneficiaries)
Link to tax expenditure measurement		N/A	Accruals basis	Cash basis (Yet in some cases the value will only be realised in future periods)

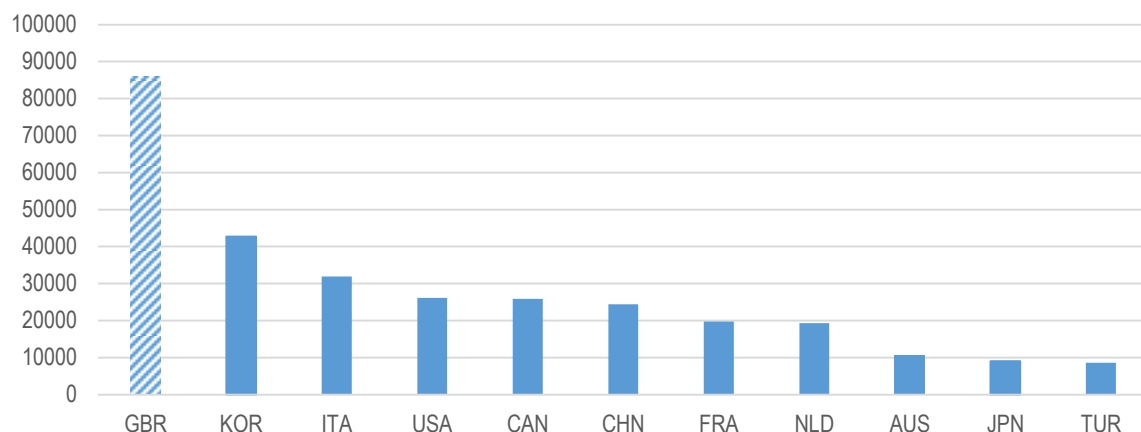
Source: OECD.

Different units of analysis (e.g. enterprise or enterprise group) may be adopted for reporting purposes. The term “claims” is used here to denote requests for support for eligible R&D, and is distinguished from the concept of claimants as referring to the unique firms behind one or more claims. Because there is a gap between claims and realised support, the concept of tax support beneficiaries is also important. This difference has a direct translation in the expenditure figures provided on an accrual or cash basis.

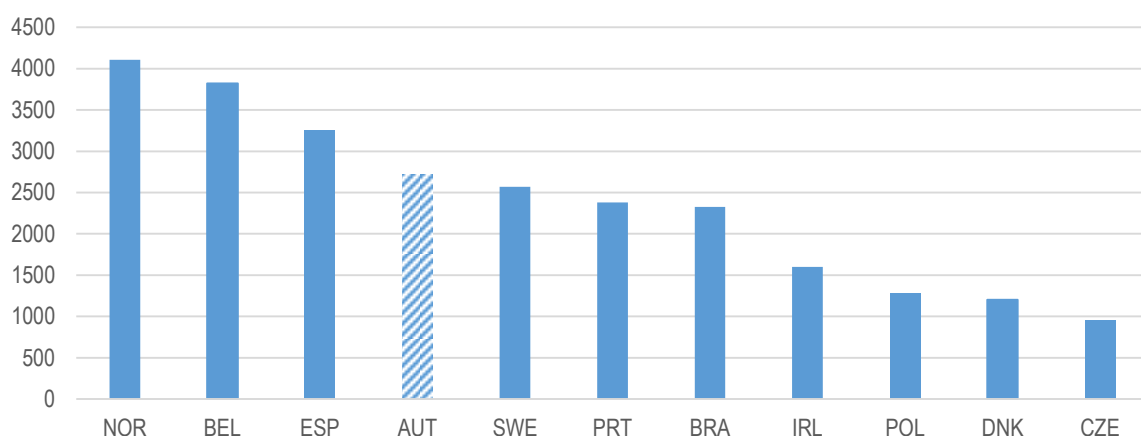
Overall, 36 countries have reported data on the number of R&D tax relief beneficiaries as part of the OECD R&D tax incentive data collection carried out since 2016. In the case of the United Kingdom, available figures correspond to claims rather than beneficiaries, while the figures for Austria reflect the total number of applicants. **Figure 14** reports the latest statistics available for 2019 or closest year. Among those countries who have contributed information on the number of R&D tax support beneficiaries (or claims or applicants), it is possible to note that at face value, the United Kingdom have the largest number of tax relief beneficiaries (claims), followed by Korea at around 43 thousand tax relief beneficiaries, well above other large and R&D intensive economies.

Figure 14. Number of R&D tax relief beneficiaries, 2019

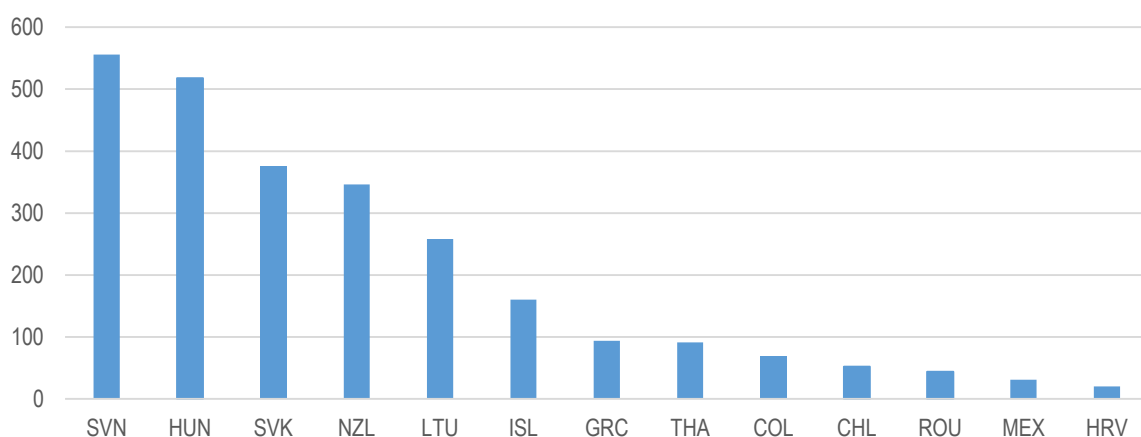
Panel A. Countries with more than 5000 beneficiaries



Panel B. Countries with less than 5000 and more than 900 beneficiaries



Panel C. Countries with less than 900 beneficiaries



Note: Figures for the United Kingdom correspond to claims, while those for Austria refer to applicants. Figures for the United States refer to 2018 instead of 2019 and only include corporate claimants. Figures for China and Denmark refer to 2017, and for Romania, they refer to 2015. Some countries offer multiple R&D tax incentive schemes but are only able to report information for selected instruments. In the case of Belgium, figures refer to the payroll withholding tax exemption and R&D tax credit, for Italy, figures refer to the incremental R&D tax credit introduced in 2015, and in the case of Hungary, they refer to the R&D tax allowance and development incentive. Furthermore, beneficiary figures are generally not available for accelerated depreciation provisions (see **Table A.1**), with the exception of Brazil.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Another comparison shows the United States and France as having significantly higher numbers of R&D tax relief beneficiaries than Japan, suggesting lower levels of uptake, which may in turn relate to higher levels of R&D concentration. In relation to the size of the economy and BERD estimates, the estimates for numbers of beneficiaries appear to be larger in countries providing refundable or equivalent forms of tax relief, especially those favouring smaller firms (e.g. Australia, Canada, France).

In more than a third of the countries surveyed (Panel C), less than 900 firms benefit from R&D tax support in 2019 (or closest year). In the case of Croatia and Mexico, the low uptake may be connected to the recent introduction of R&D tax incentives in 2019 and 2017 respectively, firms only starting to use the new R&D tax incentives available to them. Overall, there is a significant variation in the number of R&D tax relief beneficiaries among countries. This variation does not seem to be entirely attributable to differences in economic size as such. Factors such as business R&D intensity, industry structure, awareness and ease of use of R&D tax incentives (e.g. administration and compliance costs) likely shape the uptake of R&D tax incentives among corporate R&D performers in OECD countries and partner economies to some extent.

Unfortunately, statistics are not widely available on the number of R&D performers in the business sector within OECD countries, and when these are available, they may not align with definitions of enterprises used for tax purposes. As a result, it is not possible to assess whether a small or large percentage of R&D performers are using tax support. This is something that the OECD is investigating as part of the microdata workstream - the microBERD project. The OECD is also trying to mainstream the provision of demographic information on R&D performers as part of its international data collection.

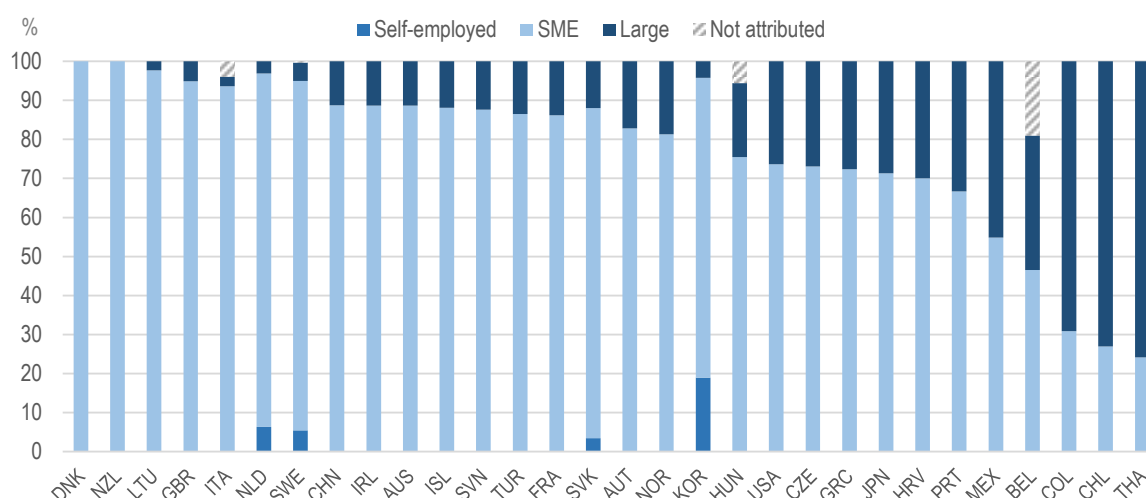
Distribution of R&D tax relief beneficiaries by firm size and main economic activity

Figure 15 shows how R&D tax relief beneficiaries are distributed by firm size and industry sector. Across the 30 countries (Panel A), where a breakdown of the number of beneficiaries by firm size is available, SMEs account for the majority of R&D tax relief recipients. SMEs represent at least 70% of tax relief recipients in 24 out of 30 countries, ranging from around 70% in Japan and 90% in the Netherlands to 100% in Denmark and New Zealand. In Belgium and Mexico, SMEs account for close to 45% and 55% of R&D tax relief recipients, while this number is around 30% in the case of Chile and Colombia. It is noteworthy that self-employed individuals feature among R&D tax relief recipients in Korea, the Slovak Republic, Sweden and the Netherlands. In the Slovak Republic (3%), the Netherlands (6%) and Sweden (5%) they account for less than 10% of tax relief recipients in contrast to Korea (~20%). Overall, SMEs frequently seem to benefit from tax relief throughout the surveyed countries, while the distribution of R&D tax support is skewed towards large firms which account for the bulk of R&D in most economies (**Figure 10**, Panel A).

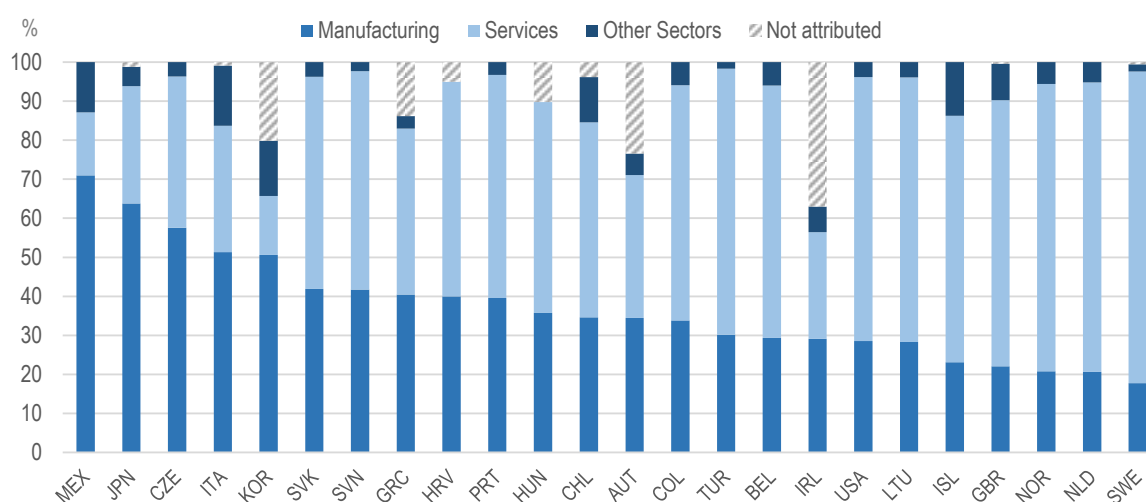
Economic activity is another dimension for which the distribution of R&D tax relief recipients can be of particular interest. Firms in manufacturing tend to account for a substantial share of R&D tax support across OECD and partner economies (**Figure 10**, Panel B) in line with R&D-intensive industries in manufacturing typically accounting for the largest share of business R&D expenditure. Across the 25 countries (Panel B), where a breakdown of the number of beneficiaries by industry is available, firms in manufacturing account for the largest group of R&D tax relief recipients 7 out of 25 economies, ranging from 29% in Ireland, around 50% in Italy and Korea to 99% in China. Firms in services in turn represent the largest group of R&D tax relief recipients in 18 out of 25 economies, whereby their share varies from 37% in Austria (applicants), around 70% in the United Kingdom and the United States, to 80% in Sweden. The share of firms in other sectors is overall small, equivalent to 7% or less in three out of four countries where relevant data are available. Overall, the distribution of R&D tax relief beneficiaries by broad industry sector is more mixed compared to the distribution of R&D tax benefits, which is skewed towards firms in manufacturing, often owing to differences in the scale of R&D activity.

Figure 15. Distribution of R&D tax relief beneficiaries, 2019

Panel A. By firm size, share in percent



Panel B. By main economic activity, share in percent



Note: Figures for the United Kingdom correspond to claims rather than beneficiaries, while those for Austria reflect the total number of applicants. Panel A: Figures for China and Denmark refer to 2017. In the case of the United States, figures refer to 2013. Panel B: Figures for the United States correspond to 2018 and only include corporate claimants. Figures for China refer to 2017. In the case of Austria, they refer to 2015. Some countries offer multiple R&D tax incentive schemes but are only able to report information for selected instruments. In the case of Belgium, estimates refer to the payroll withholding tax exemption and R&D tax credit, for Hungary, they refer to the R&D tax allowance and development incentive, and for Italy, figures refer to the incremental R&D tax credit introduced in 2015. Furthermore, beneficiary figures are generally not available for accelerated depreciation provisions (see **Table A.1**), with the exception of Brazil. Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

4.1.3. Comparing qualifying R&D and R&D reported in business R&D surveys

For the first time, the 2020 OECD R&D tax incentives survey collected information on the total amount of declared qualifying expenditure on R&D based on which R&D tax benefits are determined. Together with statistics on R&D tax relief beneficiaries, such data allow for a more comprehensive interpretation of the cost of government tax relief for R&D across countries and its evolution over time. This report presents the preliminary figures reported by countries for 2019 (or closest year) in the 2021 OECD R&D tax incentives data collection, comparing them with total business expenditure on R&D (BERD) as reported by firms in national business R&D surveys in line with the OECD Frascati Manual definition of R&D (OECD, 2015a). Total qualifying R&D expenditure denotes the amount of business R&D expenditure that is eligible for R&D tax support but does not represent all R&D performed by business in a country. Definitions of R&D or other types of expenditures²⁸ eligible for tax relief differ across jurisdictions and with respect to the OECD Frascati Manual (OECD, 2015a) although in a number of instances the manual's definitions are part of the national tax legislation. More specifically, measurement related differences can arise in the following contexts:

- BERD measures intramural R&D expenditure, i.e. R&D performed by businesses within a country but does not cover extramurally performed (outsourced) R&D expenditure either domestically or abroad. In a number of countries, R&D outsourced to third parties, such as business, universities and other research institutions, qualifies for tax relief. The most common approach (**Table A.2**) is to restrict the eligibility for R&D tax relief to the contracting or purchasing party. Likewise, qualifying R&D may not be limited to business R&D performed within country borders and may comprise R&D performed abroad. Within the European Union, for instance, several countries consider subcontracted R&D performed in other member states as eligible R&D expenditure.
- Some R&D tax incentive schemes explicitly target specific types of R&D costs. Overall, there is a general preference for considering within the scope of eligible R&D costs those relating to labour and other current expenditures. R&D personnel costs account for the largest share of intramural R&D costs, and in principle the focus on R&D personnel does incentivise investment in human resources based in the domestic economy. Acquisition of capital assets for R&D is less typically supported as assets may subsequently be disposed of or used for other purposes.
- R&D tax incentives may be available to non-corporate R&D performers such as higher education institutions. The OECD R&D tax incentive survey specifically focuses on tax relief for business R&D and asks countries to report cost, R&D and beneficiary data for non-business entities separately. In principle, this ensures an alignment between qualifying R&D and BERD figures. However, not all corporate R&D performers may claim R&D tax relief.
- BERD figures are reported on a calendar year basis while tax relief statistics are typically reported on a tax year basis, which may often not coincide with the calendar year. The OECD R&D tax incentive survey asks countries to report cost, R&D and beneficiary data on a calendar year basis and match tax years to the most closely related calendar year. This aids the comparison of qualifying R&D and BERD figures.

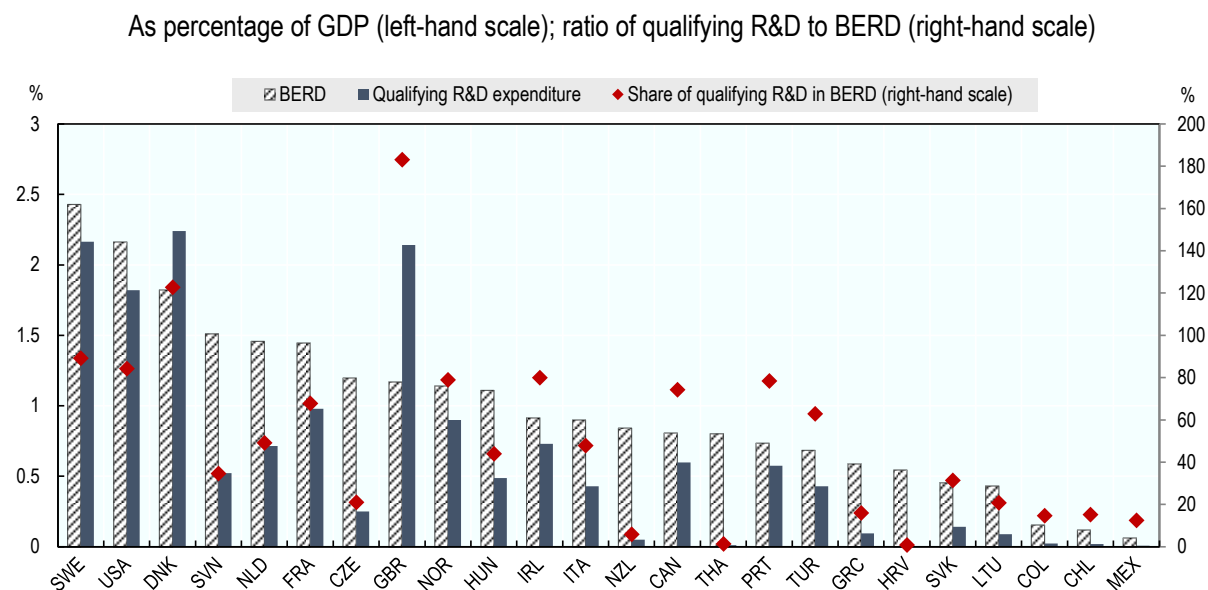
Figure 16 presents the preliminary figures on qualifying R&D expenditure expressed as a percentage of GDP for 2019 or closest year. At this stage, relevant data are available for 24 countries. In the majority (13 out of 24) of surveyed countries, qualifying R&D amounts to less than 0.5% of GDP. In some economies, this percentage is equal or smaller than 0.1%. This includes Chile (0.02%), Colombia (0.02%), Croatia (0.004%), Greece (0.09%), Lithuania (0.07%), Mexico (0.01%), New Zealand (0.05%) and Thailand (0.01%). In the case of New Zealand, tax relief is limited to deficit-related R&D expenditures in 2019 and in Croatia only introduced its R&D tax incentive in 2019, its uptake likely limited in the year of launch. Out of the 11 countries, where qualifying R&D amounts to 0.5% of GDP or more, four countries report qualifying R&D figures close to or larger than 1% of GDP: France (0.98%),

²⁸ See <http://www.oecd.org/sti/rd-tax-stats-expenditure.pdf>

Sweden (2.16%), the United States (1.82%), and the United Kingdom (2.14%). While some of this variation can be related to differences in BERD intensity, this correlation is far from perfect. As noted, various conceptual differences are prone to lead to a divergence in BERD and qualifying R&D figures.

The ratio of qualifying R&D to BERD, expressed as a percentage of the latter, is smaller than 50% (75%) in 14 (17) out of 24 OECD countries in 2019 or closest year. It amounts to 1% in Croatia and Thailand, 6% in New Zealand, 15% in Colombia and Chile, 30% in the Slovak Republic, 50% in Italy and the Netherlands, 70% in France, 80% in Ireland and Portugal, approximately 85% in the United States and reaches close to 120% in Denmark and 185% in the United Kingdom.

Figure 16. Qualifying R&D compared to BERD, 2019 or latest



Note: For Chile, Italy and the United States figures refer to 2018 instead of 2019, and those for Thailand refer to 2017. Some countries offer multiple R&D tax incentive schemes but are only able to report information for selected instruments. In the case of Hungary, figures refer to the R&D tax allowance, for Italy, figures refer to the incremental R&D tax credit introduced in 2015, and for Turkey, they refer to the R&D tax allowance. Furthermore, figures are generally not available for accelerated depreciation provisions (see **Table A.1**).

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Differences in the definition and scope of qualifying R&D and BERD, as explained above, particularly in connection with new software development and the companies that provide such services, may be the cause of the observed divergence between qualifying R&D and BERD figures. A comparison of available statistics by industry (HMRC, 2021; ONS, 2021), indicates that the UK Information and Communication industry accounts for a much greater share of R&D tax support compared to their contribution to BERD. Overall, this shows that a comprehensive and careful assessment of design changes and data related differences across countries is important in ensuring a correct interpretation of qualifying R&D figures and meaningful comparison with BERD. Furthermore, the production of BERD statistics needs to closely monitor the impact of tax support availability on survey response patterns. This and improving the rate of data reporting and comparability of qualifying R&D figures, including documentation of available metadata, are objectives of future OECD work.

4.2. Trends in government tax support for business R&D

4.2.1. Statistics on tax expenditures for business R&D

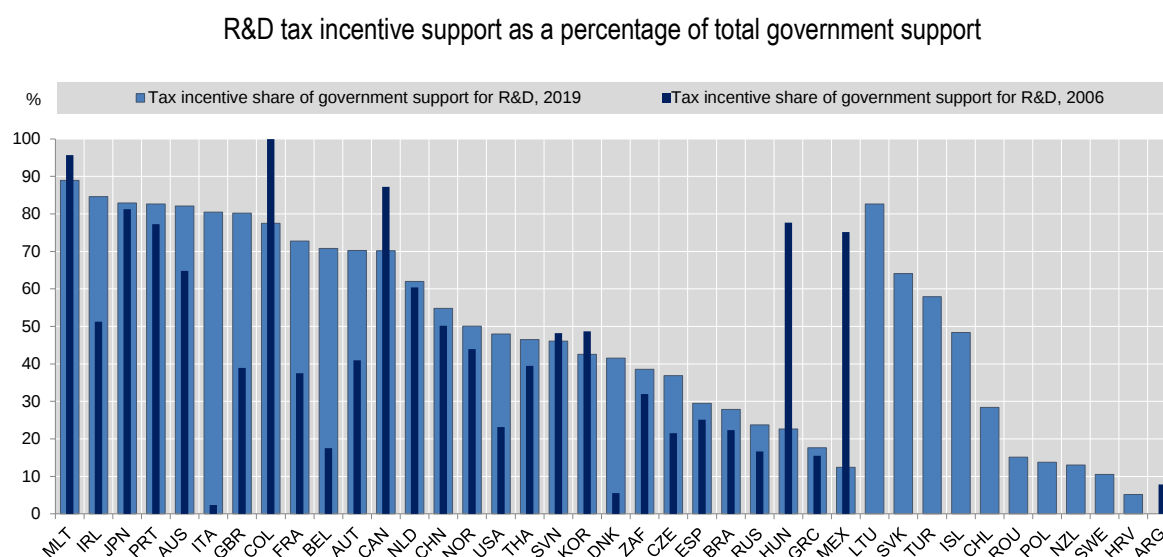
Over the last decade, a majority of OECD and partner economies have progressively moved towards tax support measures in order to incentivise business R&D. This section describes trends in the central (federal) government tax relief for business R&D over the 2000-19 period.

Tax support for business R&D compared to direct government funding

The shift in the policy mix towards R&D tax incentives is reflected in the available indicators of the composition of government support for business R&D. **Figure 17** provides a comparison of two snapshots of the structure of public support for business R&D in 2019 and 2006 (or closest years)²⁹. This shows an increase in the relative importance of R&D tax incentives among 31 out of 39 countries for which relevant data are available. Canada, Colombia, Malta, Mexico and Hungary, starting from a high share of tax relief, moved over this period towards rebalancing their support mix, increasing their reliance on direct funding. Argentina offered R&D tax support until 2017 but has not carried out any calls ever since and Malta discontinued its main R&D tax incentive with effect of 2018.

Overall R&D tax support increased across most countries. New Zealand had offered an R&D tax credit in 2008 on a temporary basis and re-introduced R&D tax support in form of an R&D tax credit for deficit-related R&D expenditure in 2015, introducing a broader (going beyond R&D tax losses) volume-based tax credit for R&D in 2019. Nine other OECD countries, Chile, Croatia, Iceland, Lithuania, Poland, Romania, the Slovak Republic, Sweden and Turkey also introduced tax incentives for R&D over the 2006-19 period. **Figure F.1** (Annex F) display the country-specific trends in the composition of government support for business R&D over the 2000-19 period in more detail.

Figure 17. Changes in the composition of government support for business R&D, 2006-19



Note: Figures for Canada, Hungary and Japan exclusively refer to government tax relief for R&D at central government level.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

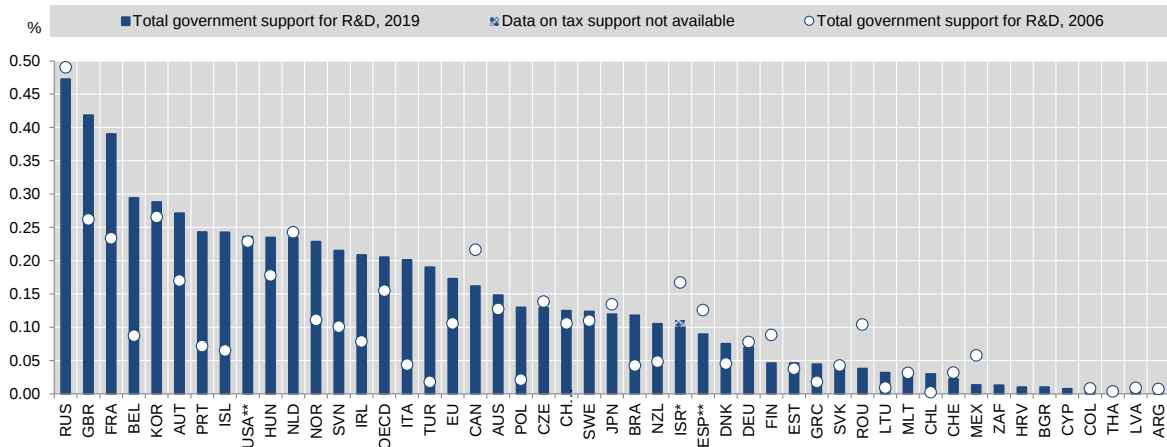
The increased use and generosity of R&D tax incentives (**Figure 1**, **Figure 6**) does not only result into a shift in the composition of the government R&D support mix towards R&D tax incentives (**Figure 17**) but also appears to go hand in hand with an increase in the magnitude of total (direct and tax) government support over the 2006-19 period (**Figure 18**). Total government support (direct and tax) as a percentage of GDP increased in 29 out of 48 countries (**Figure 18**, Panel A), as the magnitude of R&D tax relief increased in 28 out of 48 countries (**Figure 18**, Panel B) during these years.

²⁹ For Argentina, Chile, Denmark, and Korea, figures of direct and tax support for BERD refer to 2007 instead of 2006. For China and Malta, figures refer to 2009 instead of 2006. For Greece and the Russian Federation, available figures refer to 2010, for the Netherlands, they refer to 2013, and for South Africa, figures refer to 2012 instead of 2006. In 2006 (or closest year), estimates of direct funding for Brazil are based on imputing the share of direct government-funded BERD in the previous year to the current ratio of BERD to GDP. For New Zealand, and Sweden, the 2006 (or closest) figure of direct government support for BERD is an average of the previous and subsequent year values. In the case of Greece, the 2010 figure of direct government support for BERD is based on a linear interpolation using available figures for 2007 and 2011.

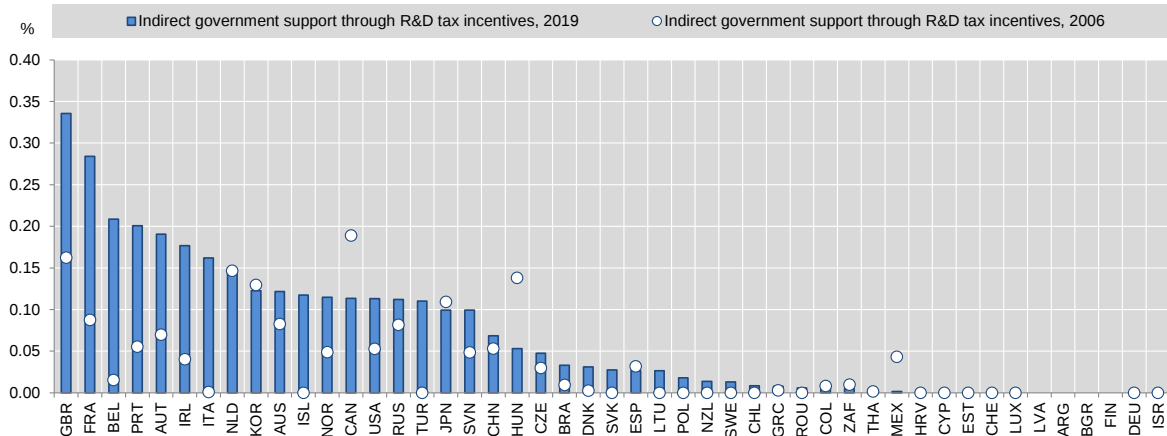
Figure 18. Changes in government support for business R&D, 2006-2019

As percentage of GDP

Panel A. Total government support (direct and tax) for BERD



Panel B. Tax support for BERD



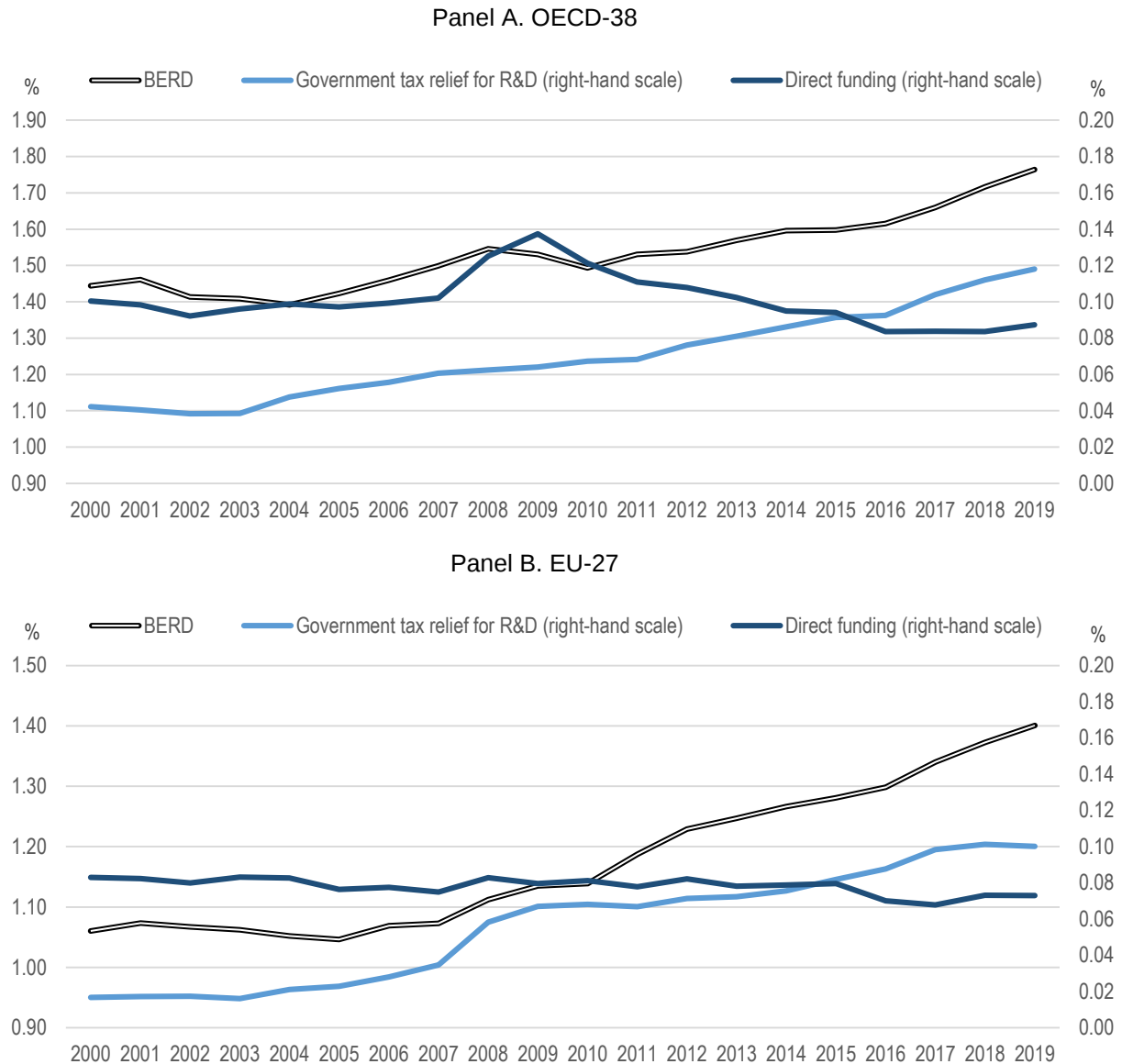
Note: Figures for Canada, Hungary and Japan exclusively refer to government tax relief for R&D at central government level.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

While the more detailed country-specific trends in the magnitude of government tax relief for R&D expenditure (as a percentage of GDP) are displayed in **Figure F.2**, **Figure 19** documents the aggregate trends in BERD and government tax and direct support for BERD in the OECD and EU-27 area, reporting the average (weighted) value of R&D tax support, direct funding and BERD over the 2000-19 period. In the OECD (EU-27) area, government tax relief for R&D accounted for 0.04% (0.02%) of GDP in 2000, reaching 0.06% (0.03%) in 2006 and 0.12% (0.10%) in 2019. R&D tax incentives surpassed direct funding in terms of value as percentage of GDP in 2016 (2015) in the OECD (EU-27) area.

Figure 19. Trends in BERD and government tax and direct support for BERD, 2000-19

As percentage of GDP, OECD and EU countries (weighted averages)



Note: OECD-GTARD figures exclude Israel where relevant data are not available. Direct support estimates include government R&D grants and public procurement of R&D services, but exclude loans and other financial instruments that are expected to be repaid in full.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

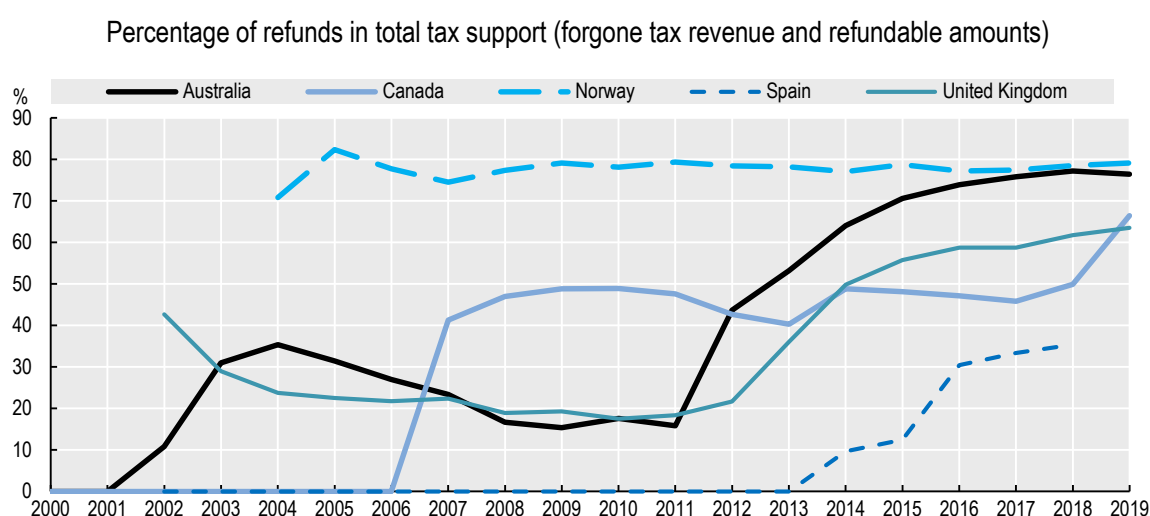
Foregone tax versus payable credits

Tax support for R&D comprises both taxes that are foregone by authorities, which the company is in a position to use to reduce its current tax liability, and the amounts that a firm can expect to reduce its future liability or receive a compensating direct payment if provisions allow for that. All these categories represent tax expenditures and the impact on the government's fiscal balances compared to the counterfactual of no tax support for R&D. One specific breakdown of interest is the component of support that results from payable credits. A tax credit becomes "payable" or refundable when any credit excess on top of the tax liability can be paid in full or in part to the taxpayer. Refundability can be particularly beneficial for young, innovative firms, at the stage of investing in developing and launching

their products. In 2019, 18³⁰ out of the 31 OECD countries that provide tax support for R&D offer refundable (payable) or equivalent incentives. A detailed breakdown of foregone tax versus payable credits is not available for most countries that report estimates of the cost of R&D tax support. **Figure 20** reports on the status of six countries that allow for payable credits under some conditions.

It is possible to note that Norway has the largest refundable component at close to 80%. This is explained by the existence of upper limits that constrain the extent to which larger, profitable firms with high levels of R&D can benefit from support, and the existence of provisions that make the level of support more predictable regardless of the profit situation of the firm. Recent trends point to an increasing use of refundable credits in recent years for Australia, Canada, Spain and the United Kingdom. In Australia, the share of the refundable component increased notably following the replacement of the R&D tax concession by the R&D tax incentive in 2012, both incentives being exclusively refundable for SMEs but the latter applying a less restrictive SME definition.³¹

Figure 20. Role of payable R&D tax benefits over time



Note: Figures for the United Kingdom refer to the payable credits available under the tax allowance provision for SMEs. Relevant data for the payable RDEC tax credit, introduced for large companies in the United Kingdom in 2013, are not available.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

4.2.2. Changes in the number of R&D tax relief beneficiaries

Figure 21 shows how the number of R&D tax relief beneficiaries has evolved in overall 36 countries over time. In line with the increasing importance of R&D tax incentives in the business innovation support policy mix of OECD countries and other major economies, the period 2010-19 has witnessed a significant increase in the number of firms receiving (claiming) R&D tax support.

In 28 out 33 countries, for which three or more years of data are available, the number of R&D tax relief beneficiaries increased over the said period. In 14 of these countries, the number of tax relief recipients increased twofold or more, comparing the first and last year of observation (when R&D tax incentives

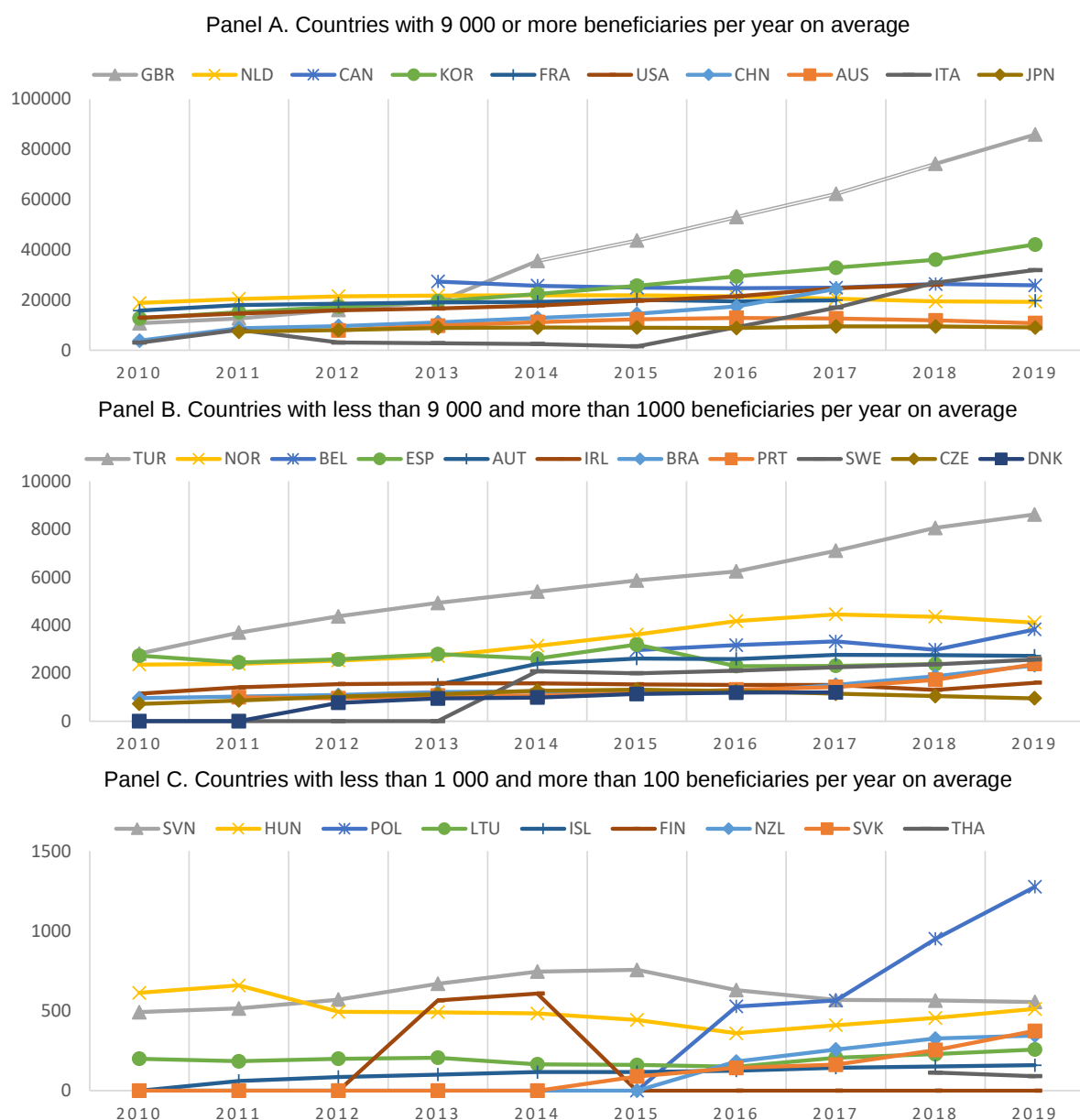
³⁰ This includes Australia (SMEs), Austria, Belgium (R&D tax credit after five years; payroll withholding tax exemption), Canada, (CCPCs only), Denmark (tax credit for deficit related R&D), France (R&D tax credit – immediate for SMEs, else after three years; SSC exemption – JEU/JEI), Hungary (SSC/VTC exemption), Iceland, Ireland, Italy, the Netherlands (Payroll withholding tax credit), New Zealand (tax credit for deficit related R&D), Norway, Spain (reduced, payable tax credit optional; SSC exemption), Sweden (SSC exemption), Turkey (SSC exemption), the United Kingdom, and the United States (certain start-ups).

³¹ Under the R&D tax Concessions, firms (SMES) are eligible to claim the corresponding refundable tax offset if both of the following apply: 1. the firm is not controlled by one or more exempt entities; and 2. the firm's aggregated turnover is less than AUD 5m. Under the R&D Tax Incentive, this turnover threshold was raised to AUD 20m.

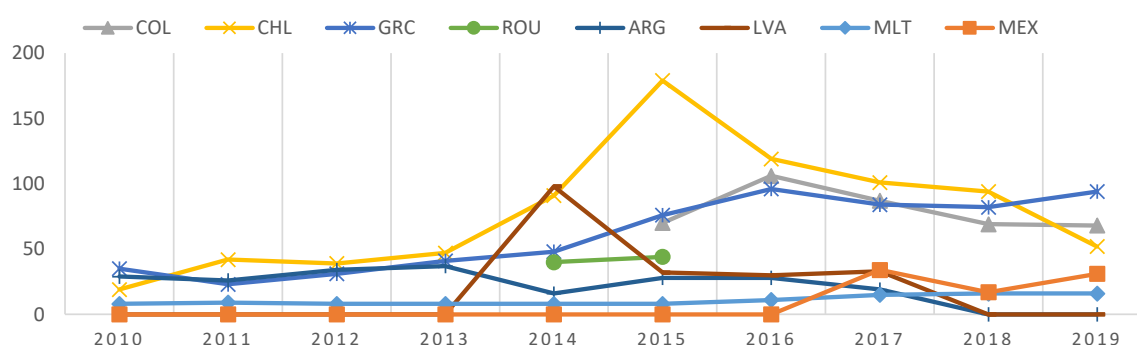
are in place). Growth is particularly pronounced in the case of Italy and the United Kingdom (claims) where respective figures increased by a factor of ten and eight respectively. In the case of the United Kingdom, several factors possibly explain this upward trend, including the increased generosity of tax support and a break in series (see **Section 4.1.3.**) In Italy, the number of tax relief recipients started to increase following the introduction of an incremental R&D tax credit in 2015, replaced by a volume-based R&D tax credit in 2020.

Significant growth is also observed in the case of Brazil, China, Chile, Greece, Iceland, Korea, Poland, Portugal, the Slovak Republic, Turkey and the United States, while few countries – Canada, Hungary, Latvia and Spain – witnessed a reduction in recipient numbers. In the case of Hungary Latvia, this is in line with the reshuffling of their innovation policy mix (**Figure 17**). However, there are also cases where the number of R&D tax relief recipients remained fairly constant or increased at a comparatively more moderate rate between the first and last year of observation (when R&D tax incentives are in place). This includes Australia, Belgium, Colombia, the Czech Republic, Denmark, France, Ireland, Japan, Lithuania, the Netherlands, Norway, Slovenia, and Sweden.

Figure 21. Number of R&D tax relief beneficiaries, 2010-19



Panel D. Countries with less than 100 beneficiaries per year on average



Note: Figures for United Kingdom correspond to claims rather than beneficiaries, while those for Austria reflect the total number of applicants and those for the United States include only corporate claimants. Some countries offer multiple R&D tax incentive schemes but are only able to report information for selected instruments. For Australia, figures refer to the R&D Tax Incentive, for Austria, they refer to the R&D premium, and for Belgium, figures refer to the payroll withholding tax exemption and the R&D tax credit. For Hungary, figures refer to the R&D tax allowance and development incentive, and in the case of the Slovak Republic, they refer to the R&D tax allowance. Furthermore, beneficiary figures are generally not available for accelerated depreciation provisions (see Table A.1), with the exception of Brazil. Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

4.2.3. Evolution of qualifying R&D and R&D reported in business R&D surveys

Differences in the definition and scope of qualifying R&D and BERD (Section 4.1.3.) may lead to a divergence between qualifying R&D and BERD figures. Furthermore, not all corporate R&D performers may claim and receive R&D tax relief. The latest figures collected for 2019 (Figure 16) show that the ratio of qualifying R&D to BERD tends to be smaller than one in the majority of OECD countries for which relevant data are available, this ratio amounting to less than 50% (75%) in 14 (17) out of 24 OECD countries in that year. Figure 22 presents the evolution of qualifying R&D expenditure and BERD over the 2000-19 period in 17 out of 24 OECD countries, for which relevant data are available for three or more years, providing additional insights into how this ratio has evolved over time.

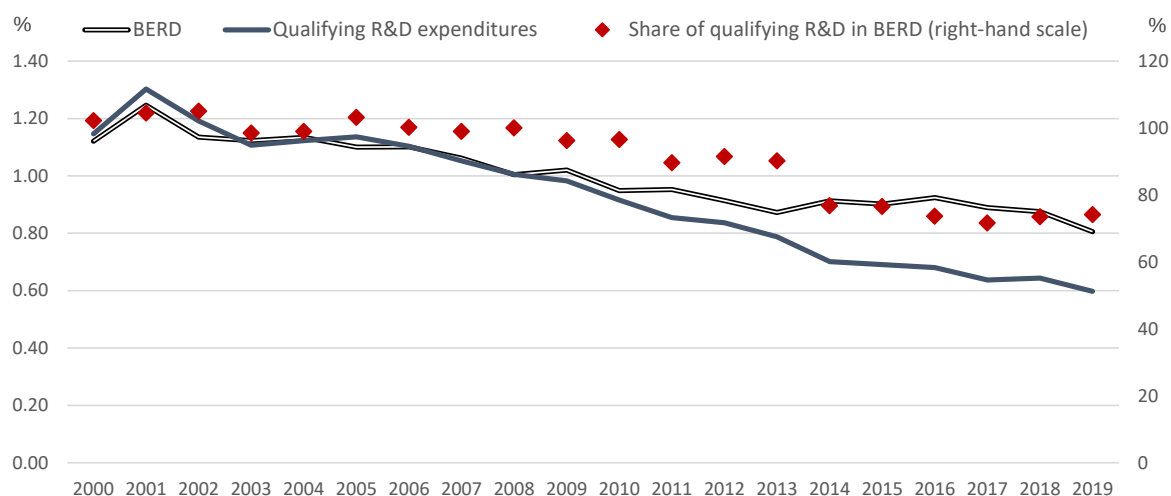
Interestingly, the ratio of qualifying R&D to BERD, expressed as percentage of the latter, remains relatively stable over time in most OECD countries under consideration. Some exceptions with more pronounced fluctuations include Canada, Chile, Denmark, Hungary, Ireland, Lithuania, Norway, the Netherlands, Portugal, the Slovak Republic, Slovenia, and the United Kingdom. These fluctuations can be connected to the introduction of new R&D tax incentives, changes in the definition and scope of qualifying R&D among other changes in the design of R&D tax incentives that may affect the uptake and amount of qualifying R&D used by firms to claim R&D tax support. Revisions in R&D statistics may also affect the comparison of qualifying R&D and BERD over time, as in the case of the Netherlands which revised its BERD figures in 2013 and 2019.³²

³² In 2013, the Netherlands revised their R&D statistics for BERD to capture from 2011 onwards R&D performed by enterprises with less than 10 persons as well as firms with small-scale level of R&D. In 2019, the Netherlands revised their R&D statistics for BERD to capture from 2013 onwards R&D activities undertaken by hired personnel as part of a company's own R&D and those of public entities that acquire a large share of income on the market. For additional details (in Dutch), see <https://www.cbs.nl/nl-nl/publicatie/2013/27/ict-kennis-en-economie-2013> and <https://www.cbs.nl/nl-nl/achtergrond/2020/02/research-en-development-revisie-2019>.

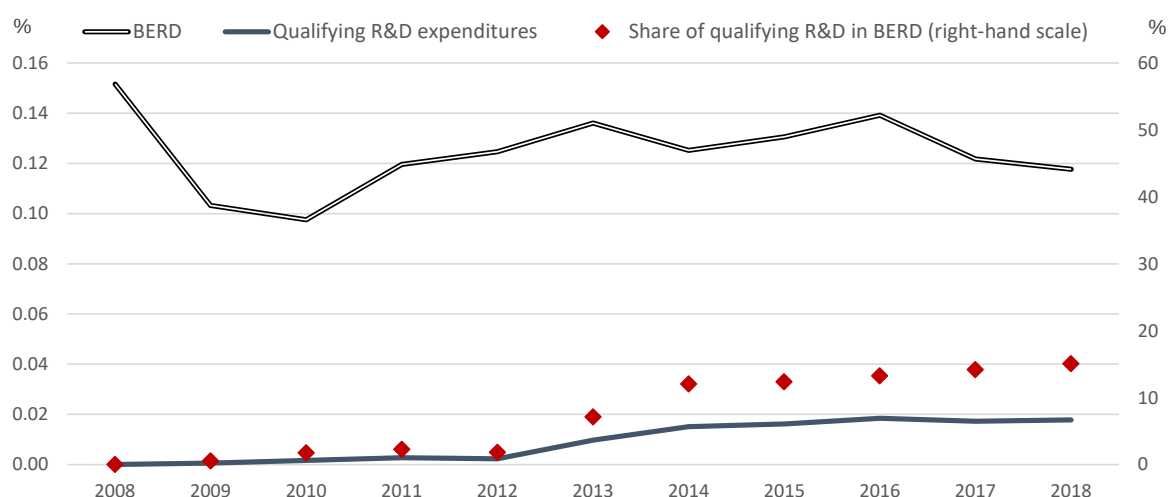
Figure 22. Qualifying R&D compared to BERD, selected OECD countries, 2000-19

As percentage of GDP (left-hand scale); ratio of qualifying R&D to BERD (right-hand scale)

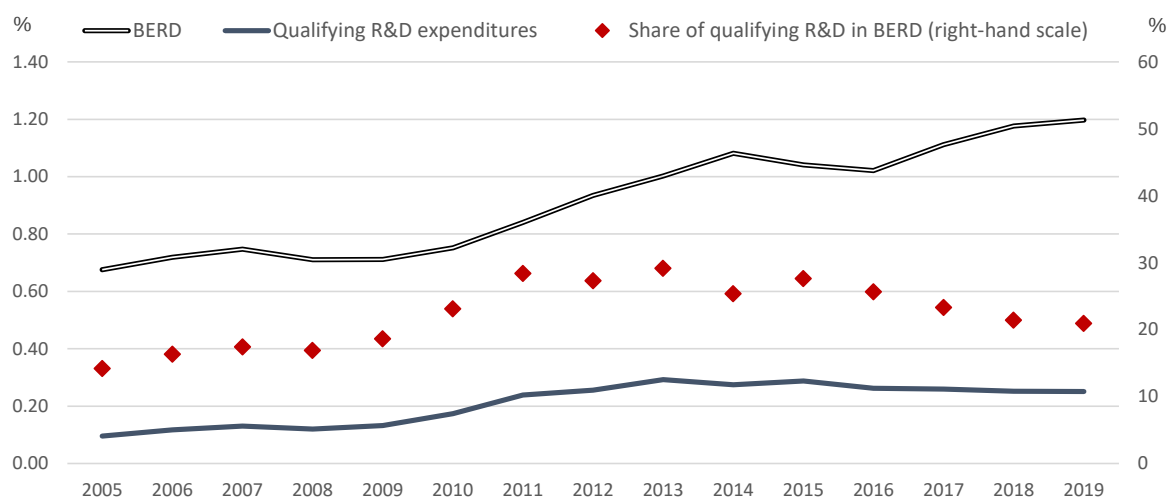
Panel A. Canada



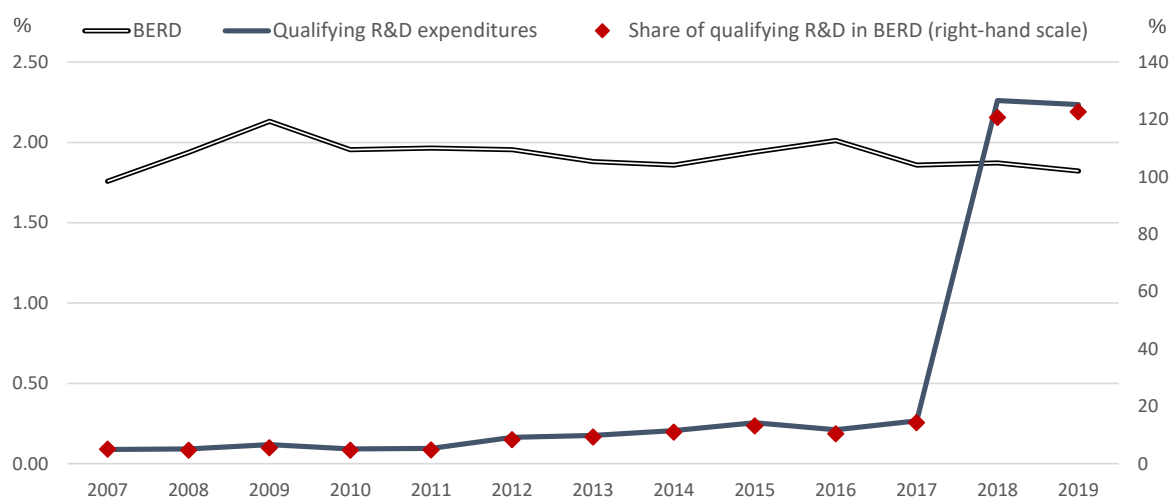
Panel B. Chile



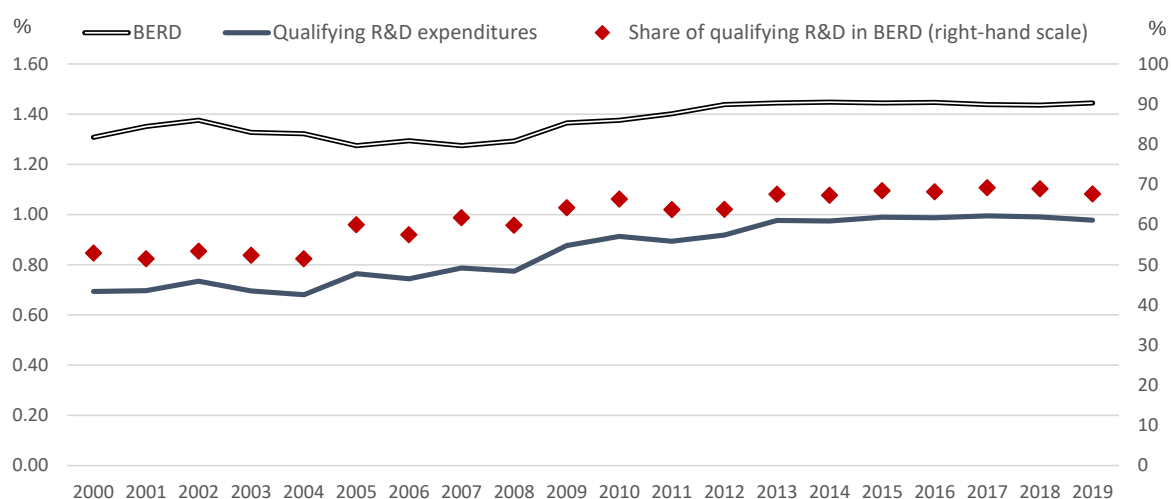
Panel C. Czech Republic



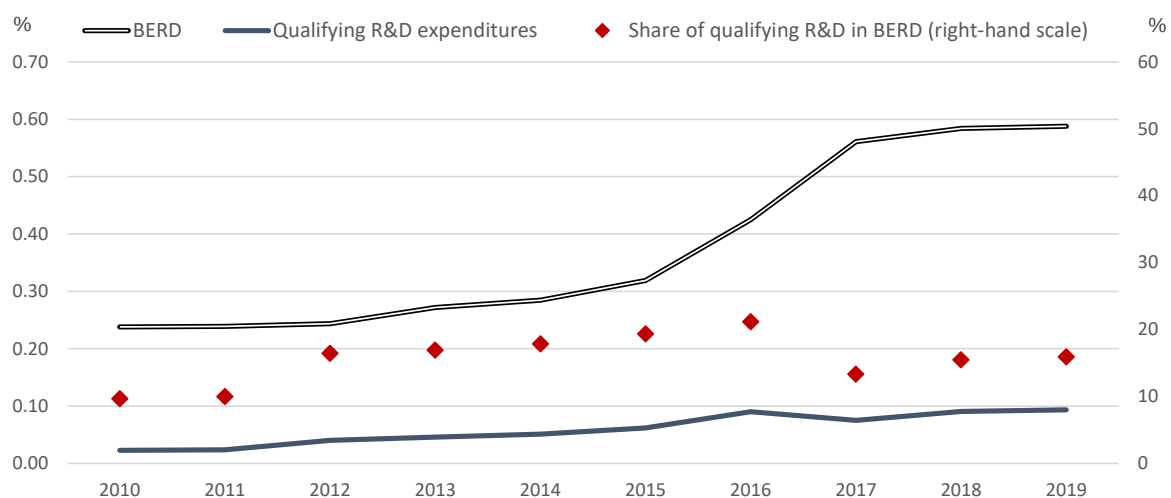
Panel D. Denmark



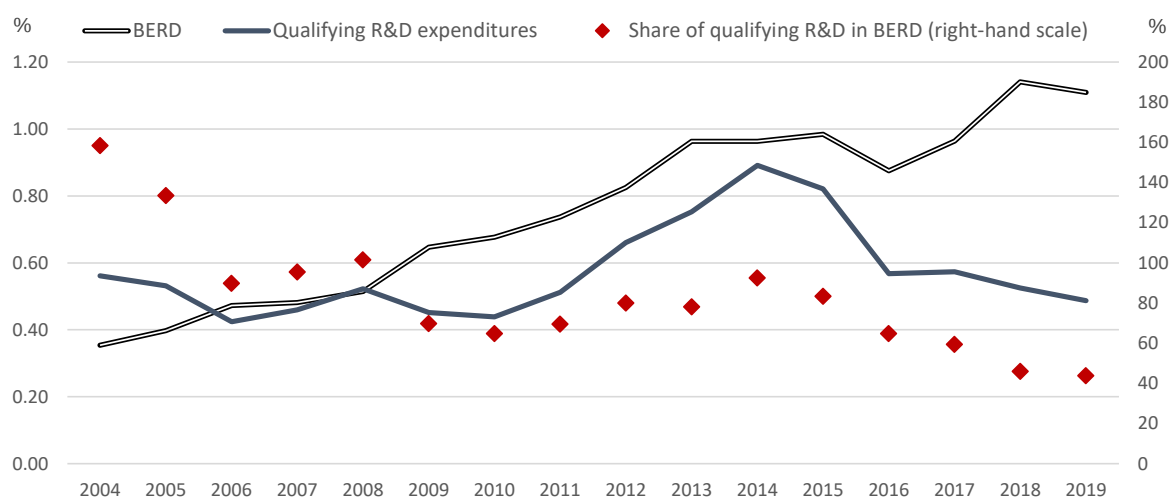
Panel E. France



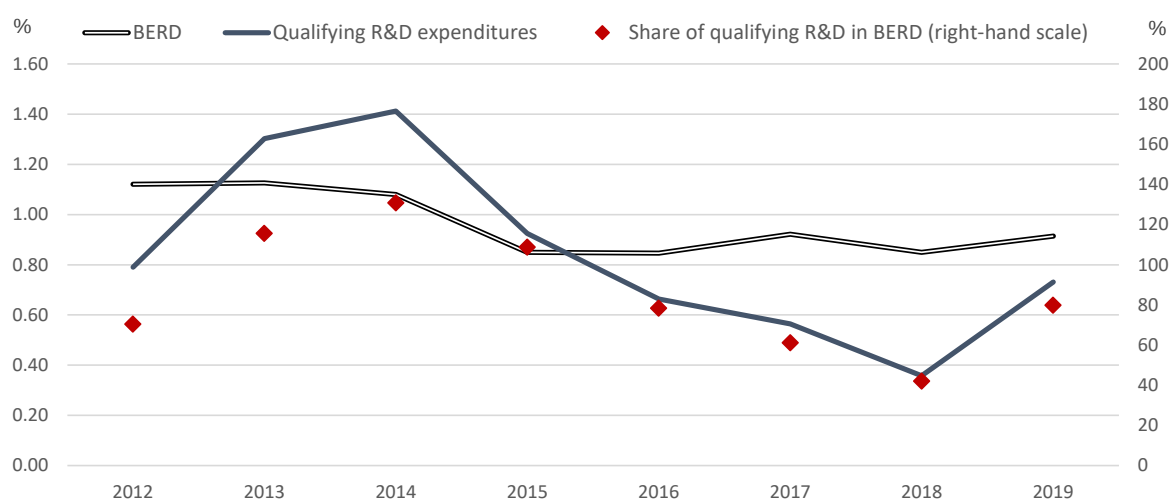
Panel F. Greece



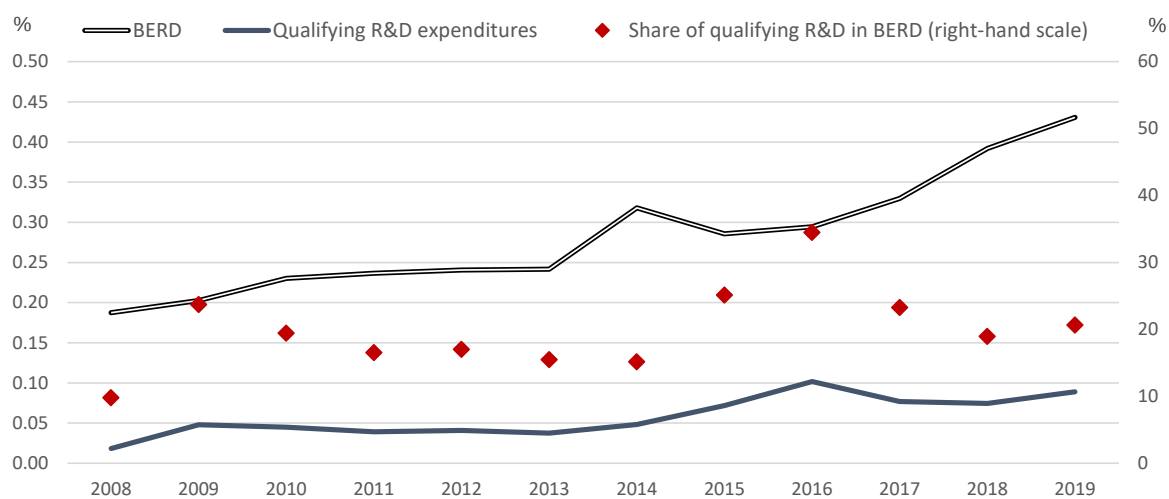
Panel G. Hungary



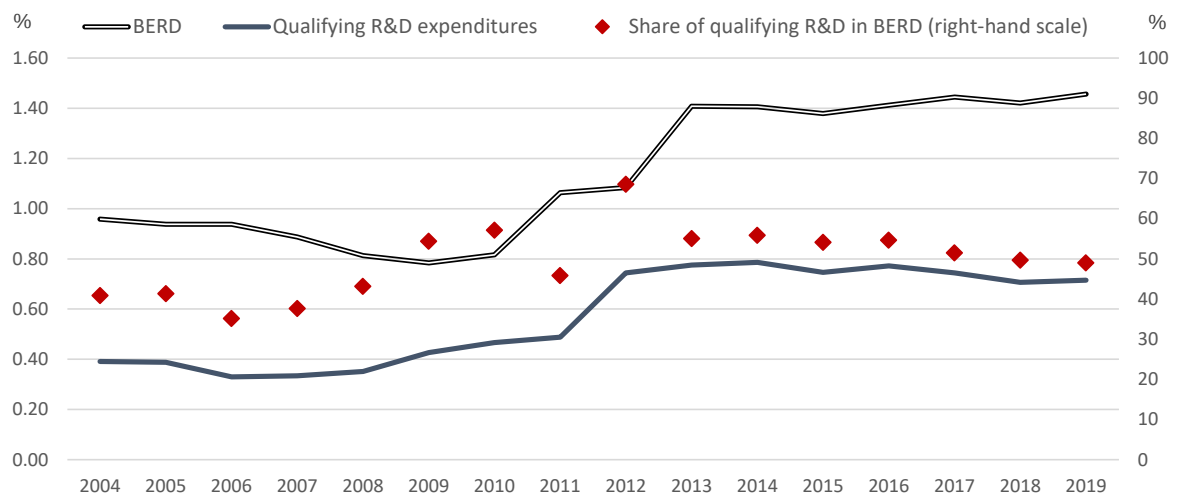
Panel H. Ireland



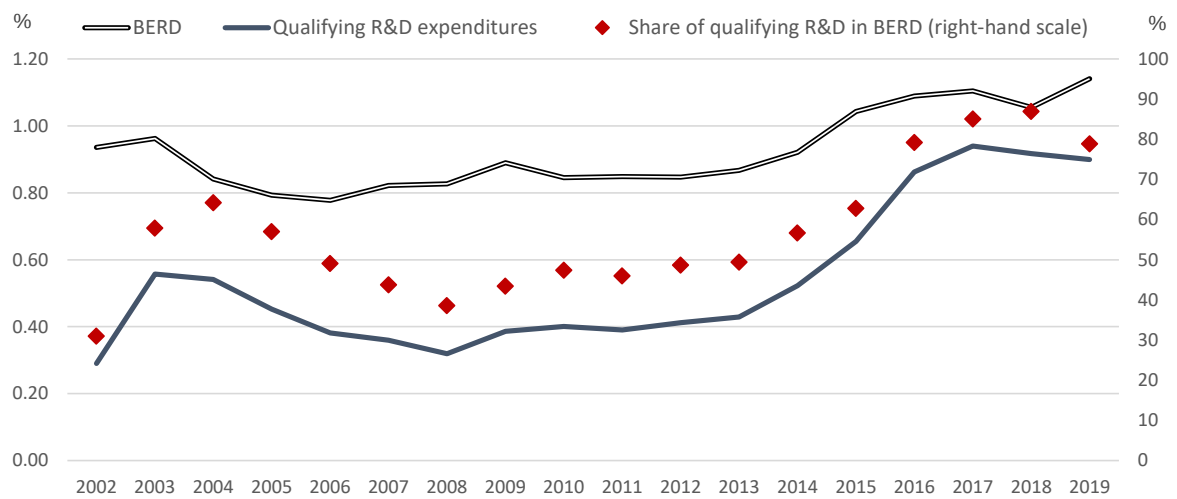
Panel I. Lithuania



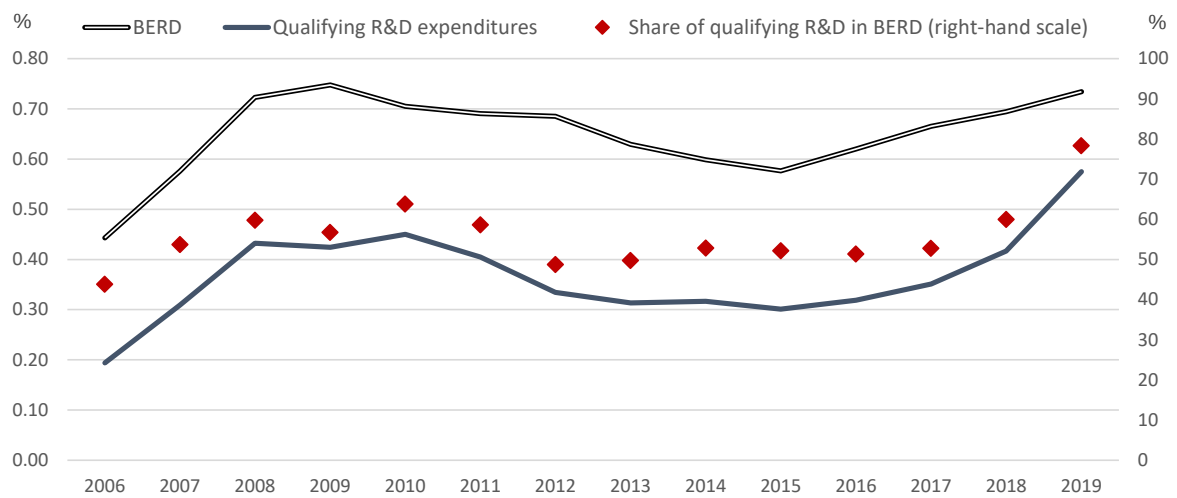
Panel J. Netherlands



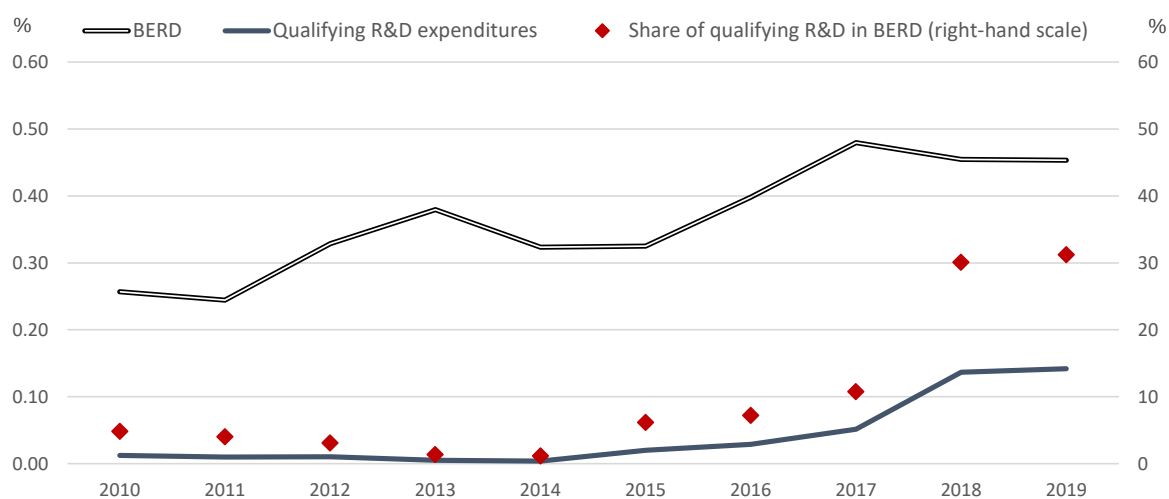
Panel K. Norway



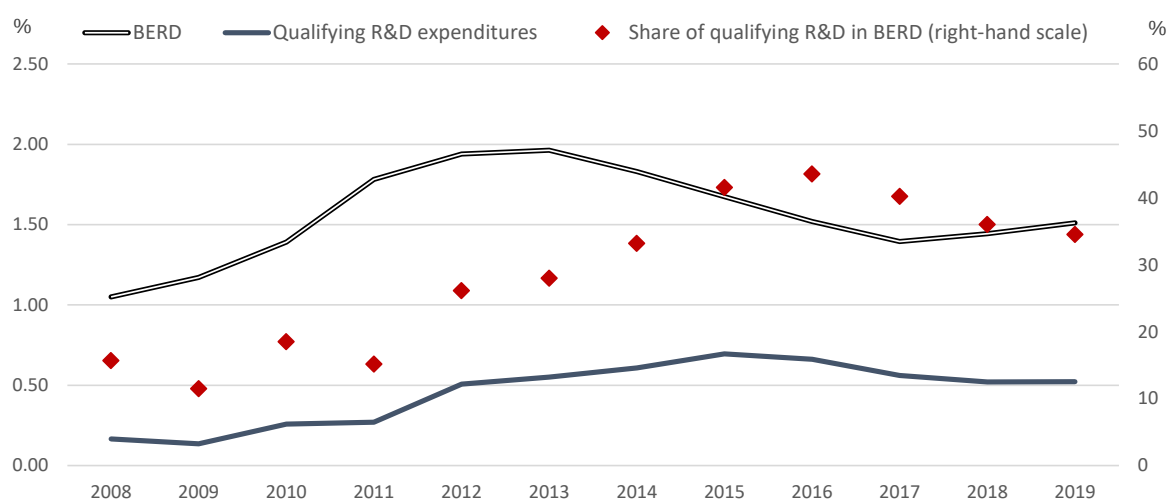
Panel L. Portugal



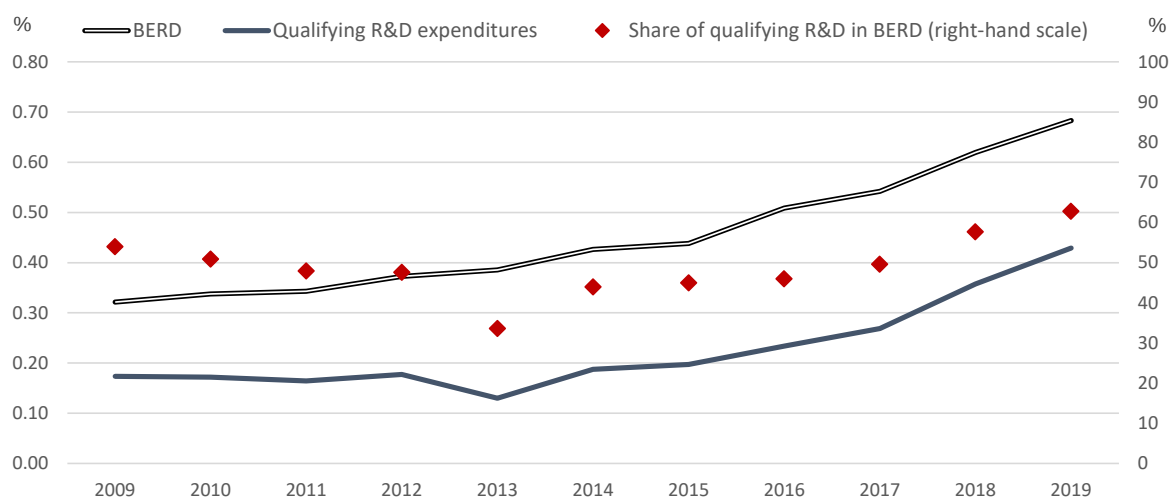
Panel M. Slovak Republic



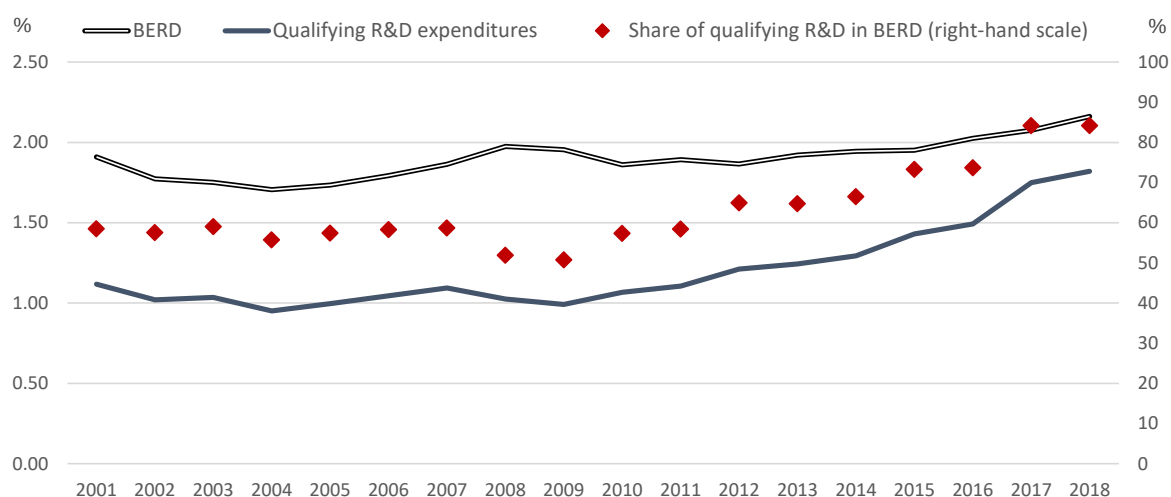
Panel N. Slovenia



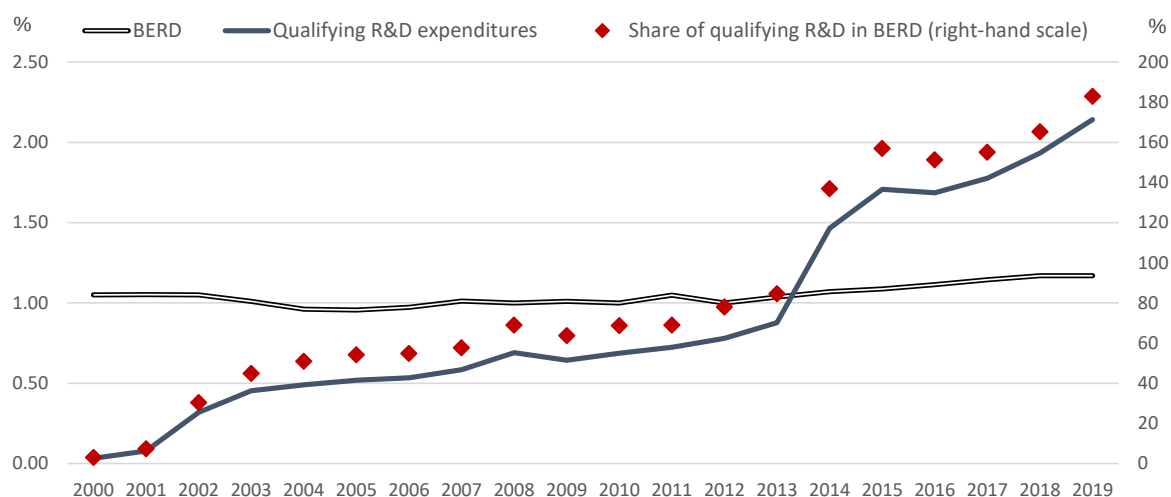
Panel O. Turkey



Panel P. United States



Panel Q. United Kingdom



Note: BERD measures expenditure on R&D carried out in the country, whereas qualifying R&D amounts reflect the R&D expenditure that is used to claim R&D tax relief in a country which may include overseas R&D and R&D subcontracted to third parties such as universities and other institutions. For additional details on qualifying R&D expenditure, see <http://www.oecd.org/sti/rd-tax-stats-expenditure.pdf>
Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Chile, for instance, introduced an R&D tax credit for extramural R&D in 2008, extending its scope in 2012 to cover intramural R&D expenditure, this being visible in an increase in qualifying R&D in 2013 (Panel B). Likewise, Canada's reform of its SR&ED tax credit in 2014, narrowing the base of eligible expenditures by removing capital expenditures and lease costs, can be associated with a drop in the ratio of qualifying R&D to BERD (Panel A), whereas the introduction of a new R&D tax allowance in Denmark in 2018 goes hand in hand with a significant increase in this ratio (Panel D). In the United Kingdom (Panel Q), the sharp increase in qualifying R&D in 2013 in the United Kingdom can be attributed to a number of factors (HMRC, 2021), which include an increase in SME allowance rates (2012-13, 2015-16) and the payable credit rate (2014-15), the introduction of a new payable tax credit for large companies in 2013 as well as the inclusion of additional claims from 2014-15 onwards. In other cases (e.g. Lithuania – Panel I, Slovenia – Panel N), changes in the ratio of qualifying R&D to BERD may at least in parts be attributable to differences in the way BERD and qualifying R&D are reported, as qualifying R&D evolves alongside a similar trajectory as BERD with a lag of 1 to 2 years. Such differences would, for instance, arise if qualifying R&D is reported in alignment with the year in which

tax benefits are paid out (cash basis) rather than the year in which the qualifying R&D activity was carried out (accrual basis).

As the snapshot overview of qualifying R&D vs BERD in 2019 (**Figure 16**), the trends in qualifying R&D vs BERD (**Figure 22**), presented for the first time in this report, show that a comprehensive and careful assessment of design changes and data related differences across countries is important in ensuring a correct interpretation of qualifying R&D figures and meaningful comparison with BERD. As highlighted in **Section 4.1.3.**, the production of BERD statistics also needs to closely monitor the impact of R&D tax support availability on survey response patterns. This and improving the rate of data reporting and comparability of qualifying R&D figures, including documentation of available metadata, are objectives of future OECD work.

5. Conclusions and next steps

This report contains the main findings arising from the 2021 OECD data collection on expenditure-based R&D tax incentives in OECD and EU countries and other major economies. It provides an overview of the main design features of R&D tax incentives and most recent changes in the availability, design and administration of R&D tax incentives in OECD countries and other surveyed economies, including crisis response measures adopted in the course of the COVID-19 pandemic. This is followed by a presentation of two complementary sets of indicators on R&D tax incentives that facilitate a more integrated view of public support for business R&D across countries and over time: OECD indicators of implied R&D tax subsidy rates and government tax relief for R&D expenditure (GTARD). Furthermore, on an experimental basis the report presents statistics on the number of R&D tax relief beneficiaries and qualifying business R&D expenditures. Such data, while still experimental, especially for purposes of international comparisons, allow in principle for a more comprehensive interpretation of the cost of government tax relief for R&D in OECD and partner economies and the evolution of GTARD over time.

Country responses provided through the OECD R&D tax incentive data collection survey revealed that the year 2021 has given rise to several policy developments in the area of R&D tax incentives. These changes generally reflect an increase in the accessibility and generosity of R&D tax incentive measures. Noteworthy enhancements include the introduction of three new R&D tax incentive schemes (Finland) along with five extensions (China, Italy, Japan, Portugal, Turkey); an increase in R&D tax credit/allowance rates for six countries (Australia, China, Iceland, Italy, Netherlands, Spain); and six cases of increased ceilings on the amount of eligible R&D expenditure or the value of R&D tax relief (Australia, Iceland, Italy, Japan, New Zealand, Sweden). Conversely, this year saw one ceiling introduced (United Kingdom) and no decrease in rates or repeal of R&D tax incentives. The COVID-19 pandemic was still a driving force behind the reforms undertaken in 2021 in this policy area. In light of the COVID-19 pandemic, nine countries introduced modifications to the design or administration of R&D tax incentive schemes, including the advanced/expedited payment of cash refunds (France and Ireland), and the extension of the time limit for filing applications (Brazil and Norway).

The analysis in this document highlights the extent to which governments support R&D through tax incentives relative to other mechanisms, providing new information on the structure and composition in 2019 (or closest year), including sub-national tax support for R&D. The report also contains for the first time, on an experimental basis, indicators on the share of R&D tax support accounted for by foreign-controlled affiliates and domestic enterprises with multinational presence (with affiliates abroad). Such statistics, while currently only available for a small group of six OECD countries (the Czech Republic, Greece, Italy, Norway, the Slovak Republic, Sweden), point to a notable variation in the share of R&D tax benefits attributable to foreign-controlled affiliates and domestic enterprises with multinational presence among the countries considered, with their shares in R&D tax benefits ranging from around 10% to 70%. As only a subset of OECD countries and partner economies have been in the position to report this information in the first attempt in 2021, this indicator should be seen as exploratory, relying on an improvement in the rate of data reporting and further scrutiny for international comparability.

Overall, this report confirmed the evidence in previous years of an increasing reliance on R&D tax incentives, visible also in the exploratory statistics on R&D tax relief recipients, which show an upward trend throughout many countries over the last decade. This appears to confirm that tax incentives exhibit less discretionary features than direct support for R&D and that the overall cost to the government is highly dependent on the level of business demand for R&D but also responsive to changes in the notional generosity of R&D tax support.

Country-specific and aggregate trends in R&D tax subsidy rates point to a surge in the availability and generosity of R&D tax incentives from mid-2000 onwards. R&D-investing firms experienced a gain in the generosity of tax support as a result of the increasing governmental adoption of preferential tax relief provisions for R&D, especially for SMEs. The level of notional tax support for R&D has stabilised in the last few years but increased notably again in 2020 when a number of OECD countries (Colombia, Germany, Italy) introduced new R&D tax incentives or increased the generosity of existing R&D tax relief provisions. The estimates for R&D tax subsidy rates presented in this report account for the most relevant design features and provide a synthetic representation of the generosity of a tax system from the perspective of a generic or model type of firm for the marginal unit of R&D expenditure. Those relate to the choice of eligible R&D expenditure and type of tax offset, provisions for firms with insufficient tax liability as well as targeted tax relief provisions. However, this new edition of the OECD time-series estimates of implied marginal R&D tax subsidy rates does not yet account for the effect of R&D tax relief limitations (e.g. ceilings, thresholds) and should thus be used with some caution. The report presents weighted R&D tax relief statistics for 2021 that account for the effect of thresholds and ceilings that may limit the amount of qualifying R&D expenditure or value of tax relief. Such weighted statistics are currently only available for selected OECD countries and years. A process in place to facilitate the collection of additional historical data and other suitable proxy measures on the distribution of eligible R&D spending over time that would allow to compute more accurately weighted R&D tax credit/allowance rates in upcoming editions of B-index time-series estimates.

The evidence presented in this report provides a resource for further analysis of the extent, uptake and causal effects of R&D tax incentives, in connection with other indicators and data sources. This is the object of other work conducted in the framework of this project, including future distributed microdata analysis (microBeRD project) and possible updates to this report. The follow-on work to this report will also aim to incorporate and extend the range of relevant indicators to not only capture the implied tax subsidy to the marginal business investment in R&D but also effective average tax rates - a measure of the average R&D tax subsidy – and this over time. This will help inform R&D investment decisions at the extensive margin, such as whether to invest in a given country, and how this may have changed over time. Continued efforts will also be undertaken to further improve the rate and comparability of data reporting in the case of the more novel indicators presented in this report –statistics on R&D tax relief beneficiaries and qualifying R&D expenditure, the latter information having been compiled for the first time in the 2020 OECD data collection on R&D tax incentives.

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Annex A. Policy design

Table A.1. Main features of R&D tax incentives in OECD, EU and partner economies, 2021

Expenditure-based R&D tax incentives				
Tax relief redeemable against CIT			Tax relief redeemable against payroll withholding tax or social security contributions	
R&D tax credit		R&D tax allowance		
Volume	Incremental/hybrid			
<i>Taxable:</i> Canada, Chile, United Kingdom (large firms) <i>Non-taxable:</i> Austria, Belgium (incompatible with allowance), Colombia (general and SME only tax credits), Denmark (deficit only), France, Germany, Hungary, Iceland, Ireland, Italy, Japan (volume and special R&D), Korea (investment), Malta, New Zealand (general and deficit only tax credit), Norway	<i>Taxable:</i> Australia, United States (credit on fixed, indexed base and incremental for simplified credit) <i>Non-taxable:</i> Japan (high R&D intensity), Korea, Mexico, Portugal, Spain	<i>Non-taxable:</i> Belgium, Brazil, China, Croatia, Czech Republic (hybrid), Denmark, Finland, Greece, Hungary, Latvia, Lithuania, Poland (R&D tax allowance, deduction for R&D Centres), Romania, Russian Federation, Slovak Republic (hybrid and volume-based), Slovenia, South Africa, Switzerland (cantonal level - optional), Thailand, Turkey (incremental), United Kingdom (SMEs)		
Treatment of unused claims				
Refund option				
Australia (SMEs), Austria, Belgium (after five years), Canada (CCPCs), Colombia (SMEs), Denmark, France, Germany, Iceland, Ireland, Italy, New Zealand (general and deficit only tax credit), Norway, United Kingdom (large companies)	Spain (reduced, payable credit optional), United States (payroll tax offset for certain start-ups)	Poland (R&D tax allowance - start-ups), United Kingdom (SMEs)	<i>Automatic refund through wage system (limited to PWHT and SSC liability)</i>	
Carry-forward option				
Australia, Belgium, Canada, Chile, Colombia, France, Hungary, Ireland, Malta, New Zealand (general tax credit), United Kingdom	Korea, Portugal, Spain (unreduced, non-payable credit), United States	Belgium, China, Croatia, Czech Republic, Denmark, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Russian Federation, Slovak Republic, Slovenia, South Africa, Turkey, United Kingdom	<i>Not applicable</i>	
Preferential tax incentive provisions or more favourable terms				
SMEs				
Australia, Canada (CCPCs), Colombia, France, Japan (volume), Malta, Norway	Korea, Portugal (start-ups), United States (qualified small business, certain start-ups)	Belgium, Croatia, Poland (R&D tax allowance - start-ups), United Kingdom (SMEs)	Belgium (young innovative firms), France (JEI/JEU), Netherlands (start-ups), Spain (innovative SMEs)	
Collaboration				
France	Iceland, Japan	Hungary	Belgium	
Limitation of R&D tax relief				
Threshold-dependent credit rates				
Canada (CCPCs), France			Netherlands	
Ceilings on amount of eligible R&D expenditure or value of R&D tax relief				
<i>R&D expenditure:</i> Australia, Austria (subcontracted R&D), Chile, Colombia, Denmark, France (subcontracted R&D), Germany, Iceland, Ireland (subcontracted R&D), Norway <i>R&D tax relief:</i> Colombia, Hungary, Italy, Japan (volume and special R&D), Malta, New Zealand (general and deficit only tax credit)	R&D expenditure: Portugal (incremental) R&D tax relief: Japan (incremental and high R&D intensity), Korea (large firms), Spain, United States	<i>R&D expenditure:</i> China (subcontracted R&D), Croatia, Turkey (subcontracted R&D), Switzerland (cantonal level - optional) <i>R&D tax relief:</i> Hungary (R&D collaboration), United Kingdom (SMEs) <i>R&D expenditure and tax relief:</i> Finland, Slovak Republic (volume-based tax allowance)	Belgium, France, Hungary (exemption and credit, incompatible in use), Spain, Sweden, Turkey	
Accelerated depreciation provisions for R&D capital				
Belgium, Brazil, Chile, China, Denmark, France, Ireland, Israel (non R&D specific), Lithuania, Poland, Romania, Russian Federation, Spain, Thailand, Turkey, United Kingdom				
No expenditure-based R&D tax incentives				
Bulgaria, Cyprus, Costa Rica, Estonia, Latvia, Luxembourg				

Notes: No call for R&D tax incentives in Argentina in 2021. The extension of the tax allowance in Thailand is pending approval. Hungary also offers a KIVA exemption and credit that are mutually exclusive in their use with the SSC exemption and credit. Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Table A.2. Tax relief eligibility in the case of R&D subcontracting, 2021

Party entitled to claim R&D tax benefits
R&D funder
Australia, Brazil, China (except for R&D contracted abroad), Colombia, Croatia, Czech Republic, Finland (tax deduction for R&D-related research cooperation expenditures), Germany, Greece, Iceland, Israel, Italy, Japan, Korea (R&D tax credits), Malta (R&D tax credit 2014-2020 and Aid for Research and Development Projects), Mexico (R&D tax credit), New Zealand (tax credit for R&D tax losses, R&D tax credit if the funder carries on a business through a fixed establishment in New Zealand), Norway, Slovak Republic (tax relief for incentive recipients), Slovenia, Spain, Thailand, United Kingdom (Corporate Tax Credit for Research & Development), United States
R&D performer
Australia (under very specific circumstances) ³³ , Belgium (R&D investment deduction and R&D tax credit), Denmark, France (R&D tax credit), Hungary (SSC credit, SSC exemption, KIVA credit and KIVA exemption), Netherlands, Romania, United Kingdom (RDEC)
R&D funder or performer
Austria, Chile (R&D tax credit for intramural and extramural expenses, accelerated depreciation for R&D capital), Hungary ³⁴ (R&D tax allowance CIT, local business tax base allowance and local business tax deduction and innovation contribution), Ireland (R&D tax credit), Lithuania, New Zealand (R&D tax credit, only if the funder doesn't carry on a business through a fixed establishment in New Zealand), Slovak Republic (Super deduction), South Africa
R&D funder and performer
Canada, China (in the case of cost-sharing agreements), Poland, Russia, Turkey (R&D tax allowance and SSC)
No details available
France (PWHTC, Accelerated depreciation for R&D capital assets), Ireland (Accelerated depreciation for R&D capital), Malta (innovation aid for SMEs, 50% enhanced tax deduction), Mexico (Accelerated depreciation of R&D capital), Turkey (Accelerated depreciation for R&D capital), United Kingdom (RDA)
Not applicable (subcontracted R&D does not qualify for R&D tax support)
Belgium (PWHTC, Accelerated depreciation for R&D capital), China (Accelerated Depreciation), Hungary (Development tax incentive), Korea (R&D investment credit), Malta (Tax Credits for R&D and Innovation), Portugal, Sweden

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

³³ Under subsection 355-210(1) of the ITAA 1997, an enterprise may qualify for the R&D tax incentive if: (i) the R&D activities are conducted for an associated foreign corporation that is a resident of a country with which Australia has a comprehensive double tax agreement – if certain conditions are met, (ii) the enterprise is a foreign corporation carrying on its business through a permanent establishment in Australia and the R&D activities are conducted for it and not for the permanent establishment – if certain conditions are met. In most cases, expenditure incurred on R&D activities conducted to a significant extent for another entity is unable to be claimed by the enterprise (as a subcontractor).

³⁴ Tax benefits may be shared by the R&D funder (customer) and R&D performer (service provider) by means of a written statement made jointly by the customer and the service provider, up to the amount that can be claimed by the service provider. This provision shall apply on condition that the customer and the service provider declare jointly by the deadline for filing the tax return in a written statement the quality of the research and experimental development services, the sum that can be claimed by the service provider, including the share of the customer and of the service provider from that sum.

Table A.3. Trade/exchange or use of R&D tax benefits as security, 2021

Alternative uses of R&D tax benefits
Trade/exchange or use of R&D tax benefits as security
Colombia (SMEs) ³⁵ France (CIR, CII) ³⁶ , Norway ³⁷
No trade/exchange or use of R&D tax benefits as security
Argentina, Belgium ³⁸ , Canada, Chile, Croatia, Czech Republic, Finland, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Korea, Lithuania, Mexico, Netherlands, New Zealand, Russian Federation, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Thailand ³⁹ , Turkey, United States
No details available
Australia, Austria, Brazil, Denmark, Japan, Malta, Poland, Portugal, Romania, United Kingdom

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021

Table A.4. Aggregation rules applicable in determining R&D tax benefits, 2021

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Treatment of R&D tax incentive claims of enterprises that are part of a group
Joint assessment of associated parties
Australia, Canada, Czech Republic (same legal entity), Denmark, Germany, Ireland (R&D tax credit), Japan, New Zealand, Poland, Russian Federation, Spain (R&D&I tax credit), Sweden, Thailand, United States
Separate assessment of associated parties
Austria, Belgium, Brazil, Chile, Colombia, Czech Republic (separate legal entities), Finland, France (R&D tax credit and PWHTC), Greece, Hungary, Italy, Korea, Lithuania, Mexico, Netherlands, Norway, Portugal, Romania, Slovak Republic, South Africa, Spain (PWHTC and SCC), Turkey
No details available
China, Croatia, France (Accelerated depreciation for R&D capital assets), Iceland, Ireland (Accelerated depreciation for R&D capital), Israel, Malta, Slovenia, United Kingdom

³⁵ SMEs benefiting from tax credit (50% investment in R&D projects) can request a tax refund through "tax refund titles" (Títulos de Devolución de Impuestos TIDIS, in Spanish) marketable to third parties.

³⁶ Faced with the growing need for cash in companies, financing organizations such as commercial banks offer pre-financing of Research Tax Credit (CIR) and / or Innovation (CII). This system makes it possible to support companies' efforts in Research and Development (R&D) investments by considerably shortening the time between the initiation of expenditure and the payment of aid. Indeed, the pre-financing of the CIR consists of a cash advance on the CIR expenses incurred in previous years but also on those of the current year. It is released following an audit and can concern all companies without restriction of size and sector or financial conditions. Pre-financing takes the form of a loan that is automatically closed upon payment of the tax credit. Through this, the company can obtain a considerable cash advance to undertake research work.

³⁷ Some banks and Innovation Norway use the tax advantage as part of the overall assessment of loan applications. It is unclear to what extent they will be able to use it as security.

³⁸ As of 2019, a tax consolidation was introduced in Belgium through the so-called "deduction of the group contribution". In practice, Belgian companies will be able to transfer taxable profits to other Belgian affiliated companies with the aim of offsetting these profits against current year tax losses. In the event of a merger, demerger or contribution as referred to in Art. 46, § 1, first paragraph, 2°, 211, § 1 or 231, § 2, first paragraph, BITC '92, a tax benefit may be transferred to the acquiring or acquiring company. Other than that no exchange of tax benefits is possible. For more details, see <https://financien.belgium.be/sites/default/files/downloads/704-brochure-RD-TaxIncentives-2018-en.pdf>

³⁹ In case of a change of ownership of approved R&D projects, tax benefits can be transferred to the new owner.

Annex B. Policy changes

Table B.1. Changes in main design features of R&D tax incentives in selected OECD countries, 2021

Change	Country	Tax Incentive	Description	COVID-19 related
Availability and scope of R&D tax incentive schemes				
Introduction	Finland	R&D TA	A volume-based tax deduction for R&D-related research cooperation expenditures was introduced with effect of 1 January 2021 for the tax years 2021-2025. The additional deduction of 50% applies to research cooperation expenditures, i.e. invoices from a research organization (R&D outsourcing). Eligible organizations for the R&D cooperation are certain research organizations as defined in the EU General Block Exemption Regulation (e.g. universities and other non-commercial research organizations). The minimum amount of qualifying R&D expenditure (minimum deduction) is EUR 10 000 (EUR 5 000) and the maximum amount of qualifying R&D expenditure (maximum deduction) is EUR 1 million (EUR 500 000) per fiscal year. A 10 year carry-forward provision is available for excess claims in the case of insufficient profits.	
Extension	China	R&D TA	The R&D tax allowance (super-deduction) in China has been extended for 3 years until December 31 2023.	
	Italy	R&D TC (volume)	The volume-based tax credit for R&D, innovation and design, introduced with effect of tax year 2020, is extended until tax year 2022.	
	Japan	R&D TC (incremental)	The high R&D intensity-based R&D tax credit has been extended by two years (until 31 March 2023).	
	Portugal	R&D TC (hybrid)	The SIFIDE-II tax credit is extended until 2025.	
	Turkey	SSC EXEMP	The R&D tax allowance (Law No. 5746) has been extended from 2023 to 2028.	
Expansion	Korea	R&D TC (volume)	The scope of the R&D tax credit was extended to additionally cover expenses paid for intellectual property research and analysis. The scope of the Growth Industry and Basic Technology scheme – one component of the R&D tax credit in Korea - was extended to additionally cover 25 technologies, most of which are related to "Korean New Deal" such as the Digital New Deal and Green New Deal. For both SMEs and large firms, enhanced tax credit rates apply to expenses incurred for innovative growth-related technology investments.	
Harmonisation	France	R&D TC (volume)	Finance Law for 2021 harmonized the tax treatment of outsourced expenditures to comply with EU rules. R&D operations conducted by state service providers and accredited private providers will be treated similarly. To date, the expenses incurred on R&D works subcontracted to state-funded service providers may be double counted when calculating the R&D tax credit. Moreover, the ceiling on subcontracted R&D expenditures can be raised from EUR 10 million to EUR 12 million in the case of R&D conducted by state-funded providers. These two mechanisms will be abolished with effect from 1 January 2022.	

Change	Country	Tax Incentive	Description	COVID-19 related
R&D tax credit/enhanced R&D tax allowances rates				
Increased	Australia	R&D TC (hybrid)	From 1 July 2021, the refundable R&D tax offset for small companies, those with aggregated annual turnover of less than \$20 million, has been set at 18.5 percentage points above the claimant's company tax rate. The rates of the non-refundable tax offset have been tied to a company's incremental R&D intensity, which is R&D expenditure as a proportion of total expenses for the year. The marginal R&D premium will be the claimant's company tax rate plus: • 16.5 percentage points for R&D expenditure above 2 per cent R&D intensity; and • 8.5 percentage points for R&D expenditure between 0 per cent and 2 per cent R&D intensity.	yes
	China	R&D TA	The rate of the enhanced tax deduction for manufacturing enterprises has been raised from 75% to 100%.	
	Iceland	R&D TC (volume)	The enhanced R&D tax credit rates introduced in 2020 continue to apply in 2021: 35% for SMEs (previously 20%) and 25% for large companies (previously 20%).	yes
	Italy	R&D TC (volume)	The R&D tax credit rate is increased from 12% to 20% and from 20% to 30% for certain R&D labour expenses. The tax credit rate for innovation (aimed at digital 4.0 innovation or ecological transition) and design is raised from 6% to 10% (10% to 15%).	
	Italy	R&D TC (volume)	The enhanced R&D tax credit rates introduced for companies in the Southern regions of Italy in 2020 continue to apply in 2021: a rate of 45% / 35% / 25% applies to small / medium-sized / large companies in the respective regions instead of the standard tax credit rate of 12%.	yes
	Netherlands	Payroll withholding TC	The headline rate in the first bracket (for eligible R&D costs up to EUR 350 000) has been raised from 32% to 40%, and from 40% to 50% in the case of start-ups. This is accompanied by an increase of the available WBSO budget in 2021 from EUR 1 281 million to EUR 1 438 million. The deduction of taxable income for self-employed persons has been raised from EUR 12 980 to EUR 13 188; and the supplementary deduction for start-up entrepreneurs from EUR 6 494 to EUR 6 598.	yes
	Spain	R&D&I TC (hybrid)	The rate of the tax credit for SMEs was increased from 12% to 50% (from 12% to 15% in the case of large firms) for expenses in technological innovation activities aiming at new or relevant improvements in the production processes in the value chain of the automotive industry in Spain. This change (Article 7 of Royal Decree Law 23/2020, of June 23, modified by Royal Decree Law 34/2020, of November 17) applies to the fiscal years 2020 and 2021.	yes
Adjusted	Japan	R&D TC (general)	Until 31 March 2023, the rate of the general R&D tax credit has been temporarily set at 2-14% for large firms (previously 6-14%, according to R&D intensity), while the rate for SMEs is maintained at 12-17%.	
Threshold/ceiling on amount of eligible R&D expenditure or value of R&D tax relief				
Ceiling increased	Australia	R&D TC (hybrid)	From 1 July 2021, the existing annual R&D expenditure ceiling has been increased from AUD 100 million to 150 million.	yes
	Iceland	R&D TC (volume)	The total ceiling on payments to individual parties has increased from ISK 900 to 1100 million in 2020 and 2021, including allowance for purchased external R&D-work up to ISK 200 million.	yes
	Italy	R&D TC (volume)	The ceiling on qualifying R&D expenditures has been raised from EUR 3 million to EUR 4 million and qualifying expenditures under the innovation and design tax credit have been capped at EUR 2 million, up from EUR 1.5 million in 2020.	

Change	Country	Tax Incentive	Description	COVID-19 related
	Japan	R&D TC (general)	The ceiling on R&D tax benefits will be raised by an additional 5% of the corporation's national corporate income tax liability (before the credit is applied) until 31 March 2023 if (i) gross sales in a fiscal year beginning between 1 April 2021 and 31 March 2023 decrease by 2% or more compared to the latest fiscal year that ended before 1 February 2020, and (ii) qualified R&D expenditures for the year are greater than the amount spent in that latest year.	
	New Zealand	R&D TC (deficit)	The maximum tax credit (refund) available under the tax credit for research and development tax losses is increased from NZD 476 000 to NZD 560 000 as from the 2020-21 year.	
	Sweden	SSC EXEMP	From July 1, 2021, the ceiling for the partial exemption of employer social security contributions has been increased from 450 000 SEK to 600 000 SEK per month. For enterprise groups the ceiling has been increased from 919 239 SEK to 1 225 652 SEK per month for all enterprises in the group.	
Ceiling introduced	United Kingdom	R&D TA (SMEs)	A cash credit cap for the SME tax allowance regime was initially introduced with effect from 1 April 2021. This introduction had been delayed by one year, i.e. from 1 April 2020 to 1 April 2021. From 1 April 2021, the amount of payable R&D tax credit which a SME can claim is limited to GBP 20 000 plus three times the company's total PAYE and NIC liability for the period.	
Administration of R&D tax incentive schemes				
Advanced and/ or expedited cash payments (refunds)	France	R&D TC (volume)	A program allowing expedited or accelerated refunds of corporate income tax credits in 2020 is continued into 2021. As from 1 January 2021, companies can apply for an administrative ruling regarding the R&D tax credit with the French tax administration (FTA).	yes
	Ireland	R&D TC (volume)	Inland Revenue will expedite the payment of any instalment of excess R&D tax credit that is due to be paid in 2021, bringing forward payment in advance of the date provided by Section 766 and Section 766A.	yes
Extension of time limit for filing applications	Brazil	R&D TA and ACC DP	The deadline for filing applications has been extended until 28th February 2021.	yes
	Norway	R&D TC (volume)	Projects that were started but delayed due to Covid-19 pandemic could be prolonged by one year.	yes
Limitation of extensions of time limit for filing applications	Australia	R&D TC (hybrid)	From 1 January 2021, the Industry Innovation and Science Australia Board's ability to grant an extension of time in filing applications for the R&D Tax Incentive for a further period is subject to a cap of 3 months on the total extension available. This is unless the extension is granted to allow an applicant to wait for the outcome of a separate pending decision.	yes
Change in institution in charge of administrative ruling applications	France	R&D TC (volume)	With the Finance Law for 2021, France repealed the possibility to file administrative ruling applications regarding the R&D tax credit to agencies in charge of supporting innovation. As of 1 January 2021, companies can apply for an administrative ruling regarding the R&D tax credit with the French tax administration (Direction Générale des Finances Publiques).	
Introduction of power to make binding determinations	Australia	R&D TC (hybrid)	Reforms made to give the Board of (Industry) Innovation and Science Australia the power to make determinations that set out how it will apply legislation, exercise powers, or administer the program. These determinations are then binding on the Board or its delegate.	

Notes: This summary table presents country-scheme level information based on country responses to the 2021 OECD data collection on tax support for R&D expenditure. The table is limited to expenditure-based R&D tax incentives for the business sector and does not cover income-based R&D tax incentives.

Source: OECD R&D Tax Incentive Database, <http://oe.cd/rdtax>, December 2021.

Annex C. B-index methodology

General formula

The B-index specifies the pre-tax income needed for a “representative” company to break even on a marginal, monetary unit of R&D outlay (OECD, 2013; Warda, 2001), taking into account provisions in the tax system that allow for an enhanced treatment of R&D expenditures. A “representative firm” is typically defined for convenience as one with sufficiently large profits to be able to fully make use of earned tax credits in the reporting period. It is customary to present this indicator in the form of an implied subsidy rate, namely one minus the *B index*. More generous provisions imply a lower “breakeven” point and therefore a higher subsidy. The *B index* is defined, in the case of a “representative” firm with sufficiently large profits and only current R&D expenditures⁴⁰, as:

$$B \text{ index} \equiv \frac{1-A}{1-\tau}.$$

In this expression, τ is the corporate tax rate and A is the combined net present value of allowances and credits applying to the marginal R&D outlay. For example, in the case of a θ allowance rate on R&D (deduction from taxable profits), it is defined as: $A = \tau \cdot \theta$. When $\theta = 1$, current expenditures are fully (100%) deductible but no enhanced incentive is provided, the benchmark scenario in most countries, $B \text{ index} = 1$ and the subsidy rate is zero.

Incremental R&D tax incentives have been modelled considering the impact that current decisions have on future baseline R&D levels. This is formally equivalent to implementing adjustments to the credit or allowance rates, a correction that also needs to be made when modelling the provisions in countries that treat credits as taxable income. The net present value of an incremental tax credit provided at rate c on qualifying R&D expenditure in excess of the base amount (average R&D expenditure in the previous n years), can be derived as follows:

$$\text{NPV Incremental Tax credit} = c \cdot \left(1 - \frac{1}{n \cdot r} (1 - (1 + r)^{-n})\right).$$

The formula for incremental tax allowances can be derived analogously. For companies with planned declining R&D profiles over time, the modelled $B \text{ index}$ may overstate the level of incentive as these firms are unlikely to qualify for the incremental component of the incentive, as the formula assumes that the marginal outlay qualifies for the incentive.

Insufficient tax liability scenarios

To provide a more accurate representation of different, relevant, scenarios, B -indices have been calculated for “representative” firms according to whether they can claim tax benefits against their tax liability in the reporting period. When credits or allowances are fully refundable, the B -index of a firm in such a position is identical to the profit scenario. Carry-forwards are modelled as discounted options to claim incentives in the future. The adverse economic climate experienced by some countries in the aftermath of the global economic and financial crisis has dented the profitability of many companies, particularly in the early phase of the global economic crisis where operating surplus has been negative in many countries’ corporate sector. This calls into question the relevance of the headline $B \text{ index}$ or related measures as a representative indicator for all R&D-performing companies, especially R&D start-ups. In recognition of the fact that there are significant differences in the provisions made by countries for scenarios in which companies cannot immediately realise the entire value of tax incentives on R&D, the B -index formula has been generalised as follows:

$$B \text{ index} \equiv \frac{1-\tau \cdot (x+(1-x) \cdot \psi) \cdot \theta}{1-\tau \cdot (x+(1-x) \cdot \psi)},$$

⁴⁰ This assumption is only made for illustrative purposes. This general framework has been adapted to account for R&D capital expenditures or specific types of eligible current expenditures. Across the OECD, current expenditures account on average for 90% of R&D expenditures and hence capital provisions account for a very minor component of the final estimate.

In this formula, x denotes whether the firm has a sufficiently large profit to claim the incentives ($x = 1$ if so, $x = 0$ otherwise). ψ is the net present value adjustment factor for the allowance (or equivalent incentive) in the scenario with an insufficiently large profit base ("loss making" for brevity). $\psi = 1$ if the incentive is fully and immediately refundable in the "loss" case and $0 < \psi < 1$ if the incentive can be carried forward.⁴¹ The value of ψ has been modelled, using some additional, simplifying assumptions, to reflect the terms of carry-forward provisions as well as instances when refunds are postponed for a given number of years if not previously used.

A firm with low or negative profits faces an implicit lower tax rate $\hat{\tau} = \tau \cdot \psi$ through which to realise the incentives theoretically available. For this reason, when $\theta > 1$, i.e. when the tax system subsidises R&D, $B \text{ index}(\text{loss}) > B \text{ index}(\text{profit})$ and the subsidy rate is lower for loss than for profit making firms. In the opposite case, when $\theta < 1$ (e.g. where no incentives are provided and R&D capital costs cannot be immediately amortised), a net tax is in place and the breakeven point is thus higher in the profit-making case $B \text{ index}(\text{loss}) < B \text{ index}(\text{profit})$. In the case where authorities apply different carry forward provisions to general losses and special allowances and credits, the following formulation has been derived:

$$B \text{ index} \equiv \frac{1 - \tau \cdot \left[x \cdot \theta + (1 - x) \cdot \psi_{\infty} \cdot \left(1 + \frac{(\theta - 1) \cdot \psi_T}{\psi_{\infty}} \right) \right]}{1 - \tau \cdot (x + (1 - x) \cdot \psi_{\infty})}$$

where ψ_{∞} is the expected net present value of a unit of loss which can be carried forward indefinitely, and ψ_T is the net present value that reflects a time limit T for carrying forward special credits and allowances.

Data requirements

For the derivation of B-index estimates, general tax system information and qualitative data on the design of R&D incentives are required. Information on the general tax system relates to corporate income tax rates for large firms and SMES, whenever targeted rates apply, as well as baseline/standard tax treatment provisions for current and capital expenditure. In addition to this information, a number of design parameters feed into the B-index calculation such as:

- **Type of Tax instrument**
 - Tax credit vs. allowance/exemption
 - Tax base
 - Volume-based, incremental, hybrid
 - Temporary nature of support
 - Taxability
- **Expense base**
 - Current (expensing, incompatibility with enhanced tax relief provisions)
 - Machinery and equipment (acquisition costs vs. depreciation expenditure)
 - Buildings and land (acquisition costs vs. depreciation expenditure)
- **Headline tax credit/allowance rates**
 - By type of R&D expenditure
 - By type of beneficiary

⁴¹ The NPV of an allowance carried forward depends is $\psi(T, \lambda, i) := [1 - (\frac{\lambda}{1+i})^T] (\frac{\lambda}{1+i}) / (1 - (\frac{\lambda}{1+i}))$ in the case of a constant probability λ of returning to profit (arbitrarily set to 50%), and interest rate i (10% in line with the literature). It can be noted that $\psi(T, \lambda, i) < \psi(\infty, \lambda, i)$. This formula has been further adapted to the case of specific countries which allow a full refund of outstanding credits at the end of the period.

- **Provisions for firms with insufficient tax liability**
 - Carry-over provisions (availability, number of years)
 - Refund provisions (availability, timing of payment)

Weights are applied to account for differences in the treatment of the various components of R&D expenditures and to model the net present value of incremental incentives and carry-forwards as discounted options to claim tax relief in the future.

Specific challenges arise in measuring the generosity of R&D tax relief measures over time. Such provisions may vary across several design features which need to be tracked over time, amplifying the dimensionality of the measurement task at hand. Furthermore, applying a consistent methodology in estimating time-series B-indices for a country is a prerogative for the interpretability of estimates within countries over time. This prevents the emergence of measurement related breaks-in-series that are unrelated to the generosity of the tax system. Like in the cross-section, caution must also be taken in defining the relevant firm populations (e.g. SMEs and large firms) and in assigning the correct design parameters to them. Sub-group-specific design parameters (e.g. for start-ups, young firms, new claimants) prevail in a number of countries.

Note: For general and country-specific notes on the calculation of B-index estimates, see <http://www.oecd.org/sti/rd-tax-stats-bindex-notes.pdf>.
Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Annex D. Measuring tax expenditures for R&D

Background and scope

The experiences accumulated over the past series of OECD R&D tax incentive data collections have fed into the guidance contained in the 2015 OECD Frascati Manual (OECD, 2015a), which for the first time provides guidelines on the measurement of government tax relief for R&D (GTARD) (OECD, 2015b). The estimation of the value of tax relief provided for R&D falls under the responsibility of national governments which report to the OECD following the provided guidelines as closely as possible. These guidelines seek to find a common, meaningful perspective that is consistent with different national R&D tax relief and data source systems.

Focus on R&D

Definitions of R&D or other types of expenditures eligible for tax relief differ across jurisdictions and with respect to the OECD Frascati Manual, although in a number of instances the manual's definitions are part of tax legislation. Definitions of R&D for tax purposes are under continuous evolution and reinterpretation by national tax authorities. For more information on R&D definitions used by countries, see the [OECD compendium of R&D tax incentive schemes](#).

Focus on business beneficiaries

This report is primarily concerned with tax relief provided by the government for R&D expenditures incurred by tax-paying units in the business sector. The business enterprise sector is usually the main intended direct recipient of tax relief for R&D. However, provisions may allow relief for R&D expenditures subcontracted to third parties, in other domestic sectors such as higher education or located abroad. These are within the scope of this report. Outside the scope of the report are incentives provided outside the business sector, including firms other than incorporated companies. This may include in some cases self-employed individuals.⁴²

Focus on central government

For practical reasons, this report focuses on estimates of tax relief at central (or federal) government level. Known instances where tax incentives are provided at the subnational level are Canada's provinces and states within the United States. Where additional information is available at subnational level (Canada, Hungary, Japan) – typically cost estimates are available for some but fewer years than those at central government level – this dimension is presented separately in this report.

Focus on relief for R&D inputs

Estimates reported in this report exclude income-based tax incentives⁴³ – preferential treatment of incomes from licensing or disposal of assets attributable to R&D (e.g. patents) or other innovation activities – and incentives to taxpayers other than companies. Figures refer to expenditure-based R&D tax incentives applied at a national level through corporate income taxes, employer social security contributions and withholding taxes for R&D personnel. Personal and consumption tax incentives are not included. While

⁴² Self-employed individuals are reported to be eligible to claim R&D tax relief in Belgium (R&D investment deduction), Canada (SR&ED tax credit), Denmark (R&D tax credit for deficit-related R&D expenditure), Japan (R&D tax credits), Netherlands (WBSO and RDA), Slovenia (R&D tax allowance), Turkey and the United States (R&D tax credits). In Hungary, private entrepreneurs are eligible to claim R&D tax relief in the form of an exemption of social security contributions paid for their employees but not for their own social security contributions.

⁴³ Similarly excluded, are income-based tax incentives (e.g. reduced CIT rates) for firms that meet specific R&D investment criteria (e.g. R&D intensity) where tax exemptions apply to the entirety of income and not income derived from R&D or other innovation related activity.

typically non-discretionary, some countries require pre-approval of R&D projects or accreditation of R&D performers by government agencies or third parties.

Estimation of tax relief for R&D

The estimation of the value of tax relief provided for R&D falls under the responsibility of national governments which report to the OECD following the provided guidelines as closely as possible. These guidelines seek to find a common, meaningful perspective that is consistent with different national R&D tax relief and data source systems.

Choice of benchmark

The OECD information request focuses on the cost to governments (benefit to firms) of provisions that imply a more favourable treatment of R&D activities relative to otherwise comparable activities that do not qualify as R&D. This approach is proposed in order to ensure comparability with countries that do not report dedicated R&D tax relief but allow for the deductibility of current R&D expenses. In the absence of enhanced incentives, companies generally have the ability to report the current expenditure components of R&D as the deductible costs of sales, without necessarily identifying the R&D nature of the activity. An exception may arise when companies capitalise their current R&D expenditures.⁴⁴

Estimation

Most countries adopt an initial revenue loss approach, which yields the amount by which tax revenue is reduced as a consequence of the introduction (or extension) of R&D tax relief measures, based on the assumption of unchanged behaviour and unchanged revenues from other taxes.

Net or gross basis reporting

The OECD R&D tax incentive survey collects information on the taxability of R&D tax benefits. In some countries, R&D tax incentives are taxable, i.e. tax benefits represent taxable income in the current or following income year, in others they are effectively taxable because in order to claim the headline tax credit rates the taxpayer has to renounce to the deductibility of the R&D expenses that are claimed. The new metadata collected in 2019 (**Table D.1**) provides additional details on whether estimates are reported on a gross or net basis whenever R&D tax benefits are taxable.

Table D.1. Gross vs net-of-tax reporting of GTARD

<i>GTARD – Gross of tax</i>	<i>GTARD – Net of tax</i>
• Belgium (Payroll withholding tax exemption) • Canada (SR&ED tax credit) • Hungary (SSC exemption) • Netherlands (payroll withholding tax credit) • Spain (SSC exemption) • Turkey (SSC exemption) • United States (R&E tax credit)	• Australia (R&D Tax Incentive) • Chile (R&D tax credit) • Thailand (R&D tax allowance) • United Kingdom (RDEC scheme for large firms)

Note: Responses to 2021 OECD R&D tax incentives data collection. *SSC exemption: exemption of social security contributions.
Source: OECD.

As **Table D.1** shows, most countries report gross of tax estimates of GTARD for taxable R&D tax relief provisions. However, several countries either additionally provided (e.g. CAN) or indicated (e.g. BEL, NLD,

⁴⁴ Accounting rules significantly restrict the instances in which R&D expenditures can be capitalised (IAS38) and implicitly confer significant discretion to firms as to whether to capitalise. To a first order of approximation and pending future analysis, this effect is considered to have a negligible impact on the relevant baseline.

USA⁴⁵) that they would also be able to report net of tax estimates of GTARD. Such estimates reflect the net of tax value of government tax relief to firms and account for the interaction of taxable schemes and other incentives, the former reducing the amount of qualifying expenditure (e.g. reduction of wage costs in the case of payroll or wage tax related incentives) based on which other R&D tax incentives are determined. Additional measurement efforts and metadata collection are required to further enhance the cross-country comparability and interpretability of GTARD vis-à-vis direct funding estimates. This should also come hand in hand with more detailed information on the gross vs. net-of-tax reporting of direct funding by firms in R&D surveys. Country responses to a question on the tax treatment of direct funding, included for the second time in the 2020 survey (**Table D.2**), suggest that direct funding of R&D represents taxable income in a number of OECD countries. 27 out of 42 countries that completed this question (6 countries provided no details) stated that direct funding (e.g. R&D grant funding) is treated as taxable income, often noting however that certain exceptions do apply.

Table D.2. Taxability of direct government R&D funding

<i>Taxable</i>
Argentina, Australia, Bulgaria, Canada, Croatia, Cyprus, Denmark, Finland, France (except repayable advances), Germany, Hungary (increases total revenue subject to CIT/KIVA, is not subject to local business taxes or SSC), Italy, Japan (however, if the firm acquires fixed assets with the subsidies suitable for its intended use, it may postpone taxation by entering a reduction), Latvia (however, if the taxpayer carried out R&D, they were able to decrease their taxable income by applying an augmented coefficient of 3 to their expenses), Lithuania (direct funding of R&D does not represent taxable income, however it is effectively taxable as it reduces the amount of expenditure deductible from taxable income), Mexico, Netherlands, New Zealand (associated expenditure is not deductible from income), Norway, Romania, Slovenia, Slovak Republic (financial grants are tax exempt only if they are awarded by an applicable international agreement), South Africa (however, there are 5 specific grants provided by the Department of Science and Technology that are exempt from tax), Spain, Sweden, Switzerland, Thailand, United Kingdom, United States (generally considered taxable, though there could be exceptions)
<i>Non-taxable</i>
Austria, Belgium (capital and interest subsidies granted by regional institutions), Brazil, Chile, Colombia, Czech Republic, Estonia, Greece, Iceland, Ireland, Israel (unless the grant was received by a person for the production of his income), Malta, Poland (subsidies from the State budget and the EU budget), Portugal, Russian Federation, Turkey
<i>No details available</i>
China, Korea, Luxembourg

Note: Responses to 2021 OECD R&D tax incentives data collection.

Source: OECD.

Recording

It is more difficult to ensure a common approach with respect to the recording of the provision of tax relief. In principle, this should occur when the R&D generating the basis for claiming tax relief has taken place; in practice, this may be possible only when the claim is recognised by the government regardless of the time when it is paid in cash by the government or used to decrease the tax liability of the firm. In many cases, tax authorities are only able to provide information based on payments, i.e. on a cash-based approach which more closely follows the actual flow of money between authorities and tax-paying units. Two practical challenges arise:

- Accounting for the timing of the actual settlement of tax liabilities, which in some cases may only take place up to a year after the reference period when the R&D generating the basis for claiming

⁴⁵ The totals in the SOI data include a mix of gross and net of tax credit amounts. This is a unique situation for USA tax credits. The net amount of the credit is generally 5 percent less than the SOI total.

tax relief took place. Most countries report adapting the reference cycle of tax expenditure statistics to refer to the tax year to which the settlement applies.

- Accounting for the possibility of carry-forwards or carry-backwards, when the firm has insufficient profits to fully use earned tax credits or allowances. There are significant differences across countries in terms of how this surplus is effectively dealt with. In some jurisdictions, under certain circumstances, eligible enterprises will be able to claim a direct payment from the authorities. Such provisions are known as payable or refundable tax incentives.⁴⁶

Because of the variety of support mechanisms and administrative accounting practices, the questionnaire submitted to national official contacts provides the basis for reporting either total relief earned by taxpayers within the current year (accruals basis) and/or total relief provided in the current year (cash basis).

A-Relief earned and claimed in the current year - including refunds.

B-Relief earned in previous year(s), claimed in the current year

C-Relief earned in the current year, carried back

D-Relief earned in the current year, carried forward

Therefore, a measure of tax relief on an accruals basis would be based on A+C+D while for tax support on a cash basis, this would be based on the sum A+B+C. Ideally, authorities should strive to maintain comprehensive record systems that allow for the production of estimates on both an accruals and cash expenditure basis. The amount of tax relief carried forward (item D) may not, or only partially, be claimed in the future due to insufficient tax liabilities, for example, and be reported by countries. Relief carried forward may be accumulated over time but there is uncertainty regarding when it will be used. The value of this component of relief may be expressed in nominal terms (thus overstating the true value to the firm) or as an estimate of its net present value based on past patterns.

Breakdowns

Firm size is one of the main business attributes that shape the provision of tax relief. Several international and national rules favour small and medium sized enterprises (SMEs) relative to large firms. The former may be entitled to more generous conditions for direct funding or tax support in order to compensate for other potential barriers to innovation and bureaucratic challenges in claiming support. It is important to take into account the scope for different definitions of SMEs for the purposes of general R&D statistics and tax purposes and the coverage. Economic activity is another dimension for which the distribution of R&D tax incentive support can be of particular interest. There is a widespread concern that overall government support for industry may mainly be flowing to sectors that carry out manufacturing-based R&D.

Compilation of time-series estimates

Some measurement challenges arise specifically in the compilation of time-series estimates of R&D tax expenditure:

- **Time-lag:** information on the cost of tax and direct support for R&D becomes available at different frequencies and the former typically with a time-lag of two to three years. Reliable data on R&D tax incentives are based on tax returns for completed tax years. Budgetary data can be timelier but it is also subject to a greater degree of error. To provide information on R&D tax support over time, tax return and budget-based estimates may be combined.

⁴⁶ Payroll withholding tax remissions and relief on employer taxes and social contributions are typically akin to refundable incentives because the relevant liability is rarely lower than the notional value of the relief.

- **Data revisions:** to the extent that countries allow firms to carry-forward unused tax benefits or claim those retrospectively, an update of cost estimates may be required over a certain period of time. Such an update can affect multiple data points in the time-series.
- **Missing and incomplete estimates:** information on the cost of R&D tax incentive for a specific year may be missing or only partial, not covering all R&D tax relief instruments offered by a country in a given year. Missing or incomplete estimates are generally flagged and not imputed by means of interpolation or other estimation methods.
- **Breaks-in series:** attention needs to be paid to the time-consistency of reported estimates of the cost of R&D tax relief. Breaks-in-series may arise as a result of changes in the estimation or projection method of R&D tax expenditure, and are generally flagged.

Note: For general and country specific notes, see <http://www.oecd.org/sti/rd-tax-stats-qtard-notes.pdf>.

Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Annex E. SME definition and other classifications

Table E.1. SME definitions

Country	Definition
Austria	Figures refer to small enterprises with 1-49 employees (direct and tax support). R&D tax relief estimates, on a cash basis, refer to the refundable research premium.
Australia	Figures refer to SMEs with less than AUD 20 million annual aggregated turnover. Estimates, on an accruals basis, refer to R&D Tax Incentive, as published in the Tax Benchmark and Variations Statement. The R&D Tax Incentive replaced the previous R&D Tax Concession from July 2011 onwards.
Belgium	Figures refer to small enterprises with 1-49 employees (direct support). Figures refer to SMEs as enterprises (R&D tax support) that do not exceed more than one of the following in the last two years: i) average annual number of employees below 50, ii) revenue under EUR 9 million, iii) balance sheet under EUR 4.5 million. Enterprises with an annual average of more than 100 employees are not eligible. Estimates, on an accrual basis, refer to the refundable tax credit for R&D and the payroll withholding tax credit for young innovative companies, private companies and partnership agreements with universities. They exclude the investment deduction for environmental projects, as the R&D component cannot be identified.
Canada	Figures refer to SMEs with 1-249 employees (direct support) and to CCPCs, Canadian Controlled Private Corporations (R&D tax support). For a definition of CCPCs, see http://www.cra-arc.gc.ca/tx/bsnss/tpcs/crprtns/typs-eng.html . R&D tax relief estimates, on a cash basis, refer to the scientific research and experimental development tax credit for current R&D expenditures. They do not reflect the cost of provincial governments' R&D tax incentives provided by many Canadian provinces. Estimates for the cost of accelerated depreciation provisions are not available.
Chile	Figures refer to SMEs with 1-249 employees (direct support) and to firms that sell 100.000 "Unidades de Fomento (UF)" per year (R&D tax support) as per Chilean regulation. R&D tax relief estimates, refer to the tax credit for intramural and extramural R&D (Law 20.570), which replaced the R&D tax credit for extramural R&D (Law 20.241) in September 2012.
China	No details available.
Croatia	SME are defined as undertakings fulfilling the criteria laid down in Annex I to the General Block Exemption Regulation
Colombia	Figures refer to SMEs meaning micro, small, and medium companies that have 1 to 200 employees. Estimates refer to the R&D tax allowance and R&D tax credit, the latter replacing the former in 2017. No further details are available.
Czech Republic	Figures refer to SMEs with 1-249 employees (direct and tax support). R&D tax relief estimates, on a cash basis, refer to the R&D tax allowance scheme introduced in 2005.
Denmark	Figures refer to SMEs with 1-249 employees (direct and tax support). Estimates, on a cash-basis, refer to the cost of the accelerated depreciation of R&D capital. From 2012 onward, estimates, on an accrual basis, further reflect the value of the R&D tax credit for deficit related R&D expenditures. From 2018 onwards, the figures also include the cash-based value of the enhanced tax allowance on R&D capital.
Estonia	Figures refer to SMEs with 1-249 employees. No R&D tax incentives in 2019 (closest).
Finland	Figures refer to SMEs with 1-249 employees. No R&D tax incentives in 2019 (closest).
France	Figures refer to SMEs with 1-249 employees (direct and tax support). R&D tax relief estimates, on an accrual basis, refer to the Crédit d'Impôt Recherche (CIR) and special provisions for social security contributions by young and innovative firms (JEIs) and young university enterprises (JEU), but exclude the cost of accelerated depreciation incentives for capital R&D.
Germany	Figures refer to SMEs with 1-249 employees. No R&D tax incentives in 2019 (closest).
Greece	Figures refer to SMEs with 1-249 employees (direct and tax support). Estimates refer to the volume-based R&D tax allowance, which replaced the previous, incremental R&D tax allowance scheme in 2013. Estimates include the tax benefits earned and claimed in the current year only.
Hungary	Figures refer to SMEs with 1-249 employees (direct support). Figures refer to enterprises (R&D tax support) that comply with the EU SME definition (The enterprise employs less than 250 employees and (i) its annual turnover does not exceed EUR 50 million or (ii) its annual balance sheet does not exceed EUR 43 million). Estimates, on an accrual basis, refer to the R&D tax allowance, the innovation contribution related R&D tax allowance (available since 2010; estimates include the tax benefits earned and claimed in the current year only) and the payroll withholding

	tax remission, but exclude the local business tax allowance. The estimates for 2004-2011 (2005-2014) also include the value of the innovation contribution related R&D tax credit (R&D tax credit on wages of researchers), and those for 2010-2017, the value of the innovation contribution related R&D tax allowance. From 2014 onwards, the figures also include the value of the development tax incentive. The breakdown of R&D tax support by firm size refers to the R&D tax allowance and development tax incentive.
Iceland	Figures refer to SMEs with 1-249 employees (direct support) and to SMEs (R&D tax support) according to criteria identified by the EU definition: the enterprise employs less than 250 employees and (i) its annual turnover does not exceed EUR 50 million or (ii) its annual balance sheet does not exceed EUR 43 million. Estimates, on a cash basis, refer to the R&D tax credit providing a deduction of eligible R&D expenses from the income tax at an enhanced rate of 20 percent.
Ireland	Figures refer to SMEs with 10-249 employees (direct support) and to SMEs (R&D tax support) with 1-249 employees. Estimates, on a cash basis, refer to the R&D tax credit on current, machinery and buildings expenditures, introduced in 2004. Estimates for the cost of accelerated depreciation provisions are not available.
Italy	Figures refer to SMEs with 1-249 employees (direct support) and to SMEs (R&D tax support) according to criteria identified by EU Commission in terms of employees, turnover and balance sheet total. From 2015 onwards, cash-based estimates refer to the following tax credits: R&D tax credit for SMEs (Law 449/1997), volume-based tax credit for R&D collaborations with universities and public research consortia (Law 449/1997), 10% volume-based R&D tax credit (Law 296/2006), incremental R&D tax credit for collaboration (L.70/2011), and an incremental R&D tax credit of 50% (Legge di Stabilità 2015, Article 1, par 35). The breakdown of R&D tax support by firm size refers to the incremental R&D tax credit of 25-50% (Legge di Stabilità 2015, Article 1, par 35).
Japan	For reporting purposes (Figures 10 and 12 in this report), figures refer to SMEs with 1-249 persons employed (direct support) and to firms with a stated capital no larger than JPY 100 million (R&D tax support). Estimates are on an accrual and final revenue loss basis. The volume-based R&D tax credit (permanent measure) is currently available in addition to the open innovation activity-based R&D tax credit (permanent measure) and high R&D intensity-based tax credit (temporary measure until March 31, 2021). The high R&D intensity tax credit was introduced in 2008 as alternative option to the incremental R&D tax credit, which was abolished with effect of 1 April 2017.
Korea	Figures refer to SMEs with 1-249 employees (direct support) and to SMEs (R&D tax support) that satisfy four conditions: (i) total asset amount is less than 500 trillion KRW, (ii) total sales are less than 40-150 trillion KRW (threshold varies by business sector). (iii) firms are not related to other large firms, (iv) firms do not run a lodging business or bar management. Estimates refer to the tax credit for research and human resources development and the R&D investment credit.
Lithuania	Figures refer to SMEs with 1-249 employees (direct support) and to SMEs (R&D tax support) with 1-249 employees, an annual turnover no larger than EUR 50 million or (ii) annual balance sheet no larger than EUR 43 million. Estimates, on an accruals basis, refer to the R&D tax allowance on current R&D expenditures, available since 2008. Estimates for the cost of accelerated depreciation provisions are not available.
Mexico	Figures refer to SMEs with 1-249 employees (R&D tax support). R&D tax relief estimates refer to the incremental R&D tax credit introduced in Mexico in 2017. Estimates for the cost of accelerated depreciation provisions (2002-2013, 2016-18 for taxpayers with an annual income of less than 100 million pesos) are not available.
Netherlands	Figures refer to SMEs with 0-249 employees (direct support) and to SMEs (R&D tax support) which comply with the EU SME definition: The enterprise employs less than 250 employees and (i) its annual turnover does not exceed EUR 50 million or (ii) its annual balance sheet does not exceed EUR 43 million). Budget-based estimates refer to the WBSO payroll tax credit for R&D labour and to the R&D tax allowance (RDA) for non-labour related R&D expenditures, which was introduced in January 2012 and merged with the WBSO scheme in 2016.
New Zealand	Figures refer to SMEs with 1-249 employees (direct support) and to SMEs with 0-199 employees (R&D tax support). R&D tax relief estimates refer to the tax credit for research and development tax losses, effective as of April 2015.
Norway	Figures refer to SMEs with 10-49 employees (direct support) and to SMEs with 1-49 employees (R&D tax support). R&D tax relief estimates for the fully refundable SKATTEFUNN R&D tax incentive cover current and machinery costs.
Portugal	Figures refer to SMEs with 1-249 employees (direct support). The SME definition for R&D tax incentives complies with the EU SME definition: the enterprise employs less than 250 employees and (i) its annual turnover does not exceed EUR 50 million or (ii) its annual balance sheet does not exceed EUR 43 million. Estimates, on an accrual basis, are for the SIFIDE-II tax credit which includes current and R&D-related capital expenditures

Slovak Republic	Figures refer to SMEs with 1-249 employees (direct support). Figures (R&D tax support) refer to SMES in compliance with the EU SME definition (The enterprise employs less than 250 employees and (i) its annual turnover does not exceed EUR 50 million or (ii) its annual balance sheet does not exceed EUR 43 million). R&D tax relief estimates, on an accrual basis, refer to the R&D tax allowance scheme introduced in 2015.
Slovenia	Figures refer to SMEs with 1-249 employees (direct support). Figures (R&D tax support) refer to SMEs which meet two of the following criteria on its balance sheet dates: balance sheet total is less than EUR 20 million; net turnover is less than EUR 40 million; average number of employees during the financial year is less than 250. R&D tax relief estimates, on a cash basis, refer to the R&D tax allowance scheme introduced in 2005.
Spain	Figures refer to SMEs with 1-249 employees (direct support). Figures (R&D tax support) refer to SMEs with 1-249 employees and (i) whose annual turnover does not exceed EUR 50 million or (ii) whose annual balance sheet does not exceed EUR 43 million. R&D tax relief estimates refer to the R&D and innovation tax credit, including support for technological innovation. Estimates do not include the cost of the accelerated depreciation provision for R&D capital. The estimates for 2014-2017 also refer to allowances for employers' social security contributions introduced through Royal Decree 475/2014 of 13 June. Estimates for the cost of subnational R&D tax incentive provisions (Basque Country, Navarre, and Canary Islands) are not available. The breakdown of R&D tax support by firm size refers to the R&D and innovation tax credit.
Sweden	Figures refer to SMEs with 10-249 employees (direct and tax support). Estimates, on a cash-basis, refer to the partial exemption of social security contributions for R&D employees introduced in Sweden in 2014.
Switzerland	Figures refer to SMEs with 1-249 employees. No R&D tax incentives in 2019 (closest).
Turkey	Figures refer to SMEs with 1-249 employees (direct and tax support). Estimates, on a cash-basis, refer to the R&D tax allowance. They may include the cost of standard deductions for current R&D expenditures and may therefore overstate tax support in relation to other countries.
United Kingdom	Figures refer to SMEs with 1-499 employees (direct support). An SME is defined (R&D tax support) as a company that meets the normal conditions specified in the EU SME definition, except that it can have up to 500 employees, turnover up to EUR 100m and have a balance sheet total of up to EUR 86m. Estimates, on an accrual basis, refer to the R&D Relief for Corporation Tax, and the R&D Expenditure Credit (RDEC) Scheme for large companies introduced for expenditure incurred on or after 1 April 2013. The RDEC scheme was initially optional, running alongside the Large Company enhanced-deduction scheme, which it replaced in April 2016. Estimates for the cost of accelerated depreciation provisions are not available.
United States	Figures refer to SMEs with 1-249 employees (direct support) and to enterprises with gross receipts of less than USD 50 million (R&D tax support). R&D tax relief estimates refer to the federal research and experimentation tax credit (only corporations). For international comparability, the cost of allowing for the expensing of research and experimentation expenditures is not included.

Source: OECD, R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021

Table E.2. Industry sector classifications (broad industry sectors)

Country	Description
Argentina	Economic activity was defined with ISIC Rev 3
Austria	Industry classification based on ÖNACE 2008 (NACE Rev. 2).
Belgium	Manufacturing: NACE, C (10-33) Services: NACE, G-U (45-99) Other sectors: NACE, A, B, D, E, F (01-03, 05-09, 35-39, 41-43)
Chile	Manufacturing: All metallic and non-metallic manufacturing Services: Activities of human health and social assistance, Telecommunications and Information; Transport and Storage, Commerce, Vehicle repair, Finance, Arts, Entertainment and Recreation, Biotech, Education, Scientific & Technical services; Mining services. Other sectors: All the sectors not considered in the two prior definitions.
China	No details available
Colombia	Manufacturing: companies described in section C according to CIIU rev.4 Services: CIIU Sections not mentioned above and below Other sectors: Primary sector (section A and B in CIIU rev.4)
Croatia	Manufacturing: activities within section C defined by ISIC, rev.4 Services: activities within sections G-Q defined by ISIC, rev.4 Other Sectors: activities within sections other than C and G-Q defined by ISIC, rev.4
Czech Republic	Manufacturing: NACE C; Services: NACE G-T; Other sectors: NACE A,B,D,E,F.
Denmark	No details available.
Finland	Standard Industrial Classification TOL 2008 (see http://tilastokeskus.fi/meta/luokitukset/toimiala/001-2008/index_en.html): Manufacturing: B-F Services: G-X Other Sectors: A (Agriculture, forestry and fishing)
France	An enterprise's economic activity is determined by the 'Sirene' index developed by the Insee (variable: "ActivitePrincipaleUniteLegale": code NAFrév2).
Greece	Manufacturing: Nace rev 2 10-33 Services: Nace rev 2 45-82 Other sectors: Any other activity despite of manufacturing and services
Hungary	Manufacturing: 4 digit level NACE Rev2.: 1011-3320 Services: 4 digit level NACE Rev2.: 3511-9609 Other sectors: All the rest
Iceland	Manufacturing: https://www.hagstofa.is/utgafur/nanar-um-utgafu?id=54698 Services: https://www.hagstofa.is/utgafur/nanar-um-utgafu?id=54699 Other sectors: https://www.hagstofa.is/utgafur/nanar-um-utgafu?id=54700
Ireland	Manufacturing: no details available Services: Wholesale and retail trade/Repair of motor vehicles and motorcycles, Information and Communication, Financial and Insurance Activities, Professional Scientific and Technical Activities and N Administrative and Support Service Activities Other sectors: no details available
Italy	Manufacturing: NACE Section C Services: NACE sections H-U Other sectors: all activities different from C and H-U
Japan	Economic activity is classified based on the Japan Standard Industrial Classification (JSIC) Rev.13 and a concordance between JSIC Rev.13 and ISIC Rev.4 for corporations with consolidated and non-consolidated tax declaration as follows: Manufacturing: JSIC Rev.13, E (i.e. 09-32), corresponding to ISIC Rev.4, 10-33 (i.e. C); Services: JSIC Rev.13, F-P, Q (partly), R (partly) (i.e. 33-80, 83-85, 87, 88-92), corresponding to ISIC Rev.4, 45-82, 86-96 (i.e. G-N, Q-S); Other Sectors: JSIC Rev.13, A-D (i.e. 01-08), corresponding to ISIC Rev.4, 01-03, 05-09, 35-39, 41-43 (i.e. A, B, D, E, F); Not attributed: JSIC Rev.13, O and T (i.e. 81-82, 99), corresponding to ISIC Rev.4, 85 and N.e.c. (i.e. P and N.e.c.).
Korea	Manufacturing: Steel, automobiles, food, etc. All kinds of products made in a factory Services: Legal, consulting, advertisement, education, etc. Other sectors: Agriculture, mining, fishing, construction, wholesale, retail, finance, healthcare, etc.
Latvia	Manufacturing: No details available

Country	Description
Lithuania	Services: No details available Other sectors: Real estate development Manufacturing: NACE rev. 2 section C taxpayers. Services: NACE rev. 2 H, I, J, N, M, S, K section taxpayers. Other sectors: taxpayers in other NACE rev. 2 sections, not covered in manufacturing or services categories.
Mexico	Manufacturing: according to the SCIAN classification Services: Administrative and support, waste management and remediation services, Finance and insurance, Professional, scientific and technical services (According to the SCIAN classification) Other sectors: Transportation and Warehousing, Wholesale trade, Agriculture, forestry, fishing and hunting (According to the SCIAN classification)
Netherlands	Manufacturing: BERD ISIC, Revision 4 Classification 10-33 Services: BERD ISIC, Revision 4 Classification 45-99 Other sectors: BERD ISIC, Revision 4 Classification 01-09 & 35-43
New Zealand	Manufacturing: no details available Services: no details available Other sectors: no details available
Norway	Manufacturing: SIC2007 [10-33] Services: SIC2007 [45-96] Other sectors: other
Portugal	Manufacturing: Consider section C of NACE code list. Services: Consider sections D to U of NACE code list. Other sectors: Consider sections A and B of NACE code list.
Slovak Republic	Manufacturing: NACE Rev.2 10-33 Services: NACE Rev.2 45-99 Other sectors: NACE Rev.2 01-03,05-09,35-39,41-43
Slovenia	Manufacturing: C (according to NACE Rev. 2.) Services: G - U (according to NACE Rev. 2.) Other sectors: A, B, D, E and F (according to NACE Rev. 2.)
Spain	Firms are classified by their main economic activity following the national classification based on NACE Rev.2.
Sweden	Manufacturing: 01-43 NACE rev.2 Services: 45-99 NACE rev.2
Turkey	Manufacturing: section C of NACE Rev.2 Services: section G to N of NACE Rev.2 Other sectors: other NACE sections
United Kingdom	Manufacturing: sector C. Services: industry sector G-S (SIC 2007). The "Other sectors" category includes industry codes A, B, D, E and F. "Non attributable" is calculated as the difference between the cost of support claimed for all R&D schemes on an accounting period basis (RD2) and the total amount of R&D tax benefits claimed by firms for which Industry sector information is available (RD6).
United States	OECD calculation based on IRS SOI 2013 corporate tax return data. Services includes wholesale and retail trade, transportation and warehousing, information, finance and insurance, real estate, rental and leasing, professional scientific and technical services, management of (holding) companies, administrative support and waste management services and various services. The "Other sectors" category includes agriculture, forestry, fishing and hunting, mining, utilities and construction.

Source: OECD, R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Table E.3. Industry sector classifications (detailed industry sectors)

Country	Description
Belgium	Food and beverages: NACE CA (10-12) Chemicals: NACE CE (20) Pharmaceuticals: NACE CF (21) Machinery and equipment: NACE CK (28) Computer and electronics: NACE CI (26) Electrical equipment: NACE CJ (27) Transport equipment: NACE CL (29-30) Information and Communication: NACE JC (62-63) Finance: NACE K (64-66) Mining: NACE B (05-09)
Czech Republic	Food and beverages: NACE 10+11 Chemicals: NACE 20 Pharmaceuticals: NACE 21 Machinery and equipment: NACE 28 Computer and electronics: NACE 26 Electrical equipment: NACE 27 Transport equipment: NACE 29-30 Information and Communication: NACE J Finance: NACE K Mining: NACE B (Data for this economic activity is not available due to the confidentiality reason)
France	Food and beverages: div 10 et 11 Chemicals: div 20 Pharmaceuticals: div 21 Machinery and equipment: div 28 Computer and electronics: div 26 Electrical equipment: div 27 Transport equipment: div 30 Information and Communication: Section J Finance: div 64 Mining: Section B
Greece	No details available
Hungary	No details available
Italy	Food and beverages: NACE Classification of economic activities Division 10 and 11 Chemicals: NACE Classification of economic activities Division 20 Pharmaceuticals: NACE Classification of economic activities Division 21 Machinery and equipment: NACE Classification of economic activities Division 28 Computer and electronics: NACE Classification of economic activities Division 26 Electrical equipment: NACE Classification of economic activities Division 27 Transport equipment: NACE Classification of economic activities Divisions 29 and 30 Information and Communication: NACE Classification of economic activities Section J Finance: NACE Classification of economic activities Section K Mining: NACE Classification of economic activities Section B
Lithuania	Food and beverages: 10-12 Chemicals: 20 Pharmaceuticals: 21 Machinery and equipment: 28 Computer and electronics: 26 Electrical equipment: 27 Transport equipment: 29-30 Information and Communication: 62-63 Finance: 64-66 Mining: 05-09
Netherlands	BERD ISIC, Revision 4 Classification: Food and beverages: 10-11 food products and beverages Chemicals: 20 chemicals Pharmaceuticals: 21 pharmaceuticals Machinery and equipment: 28 machinery and equipment N.E.C. Computer and electronics: 26 computer, electronic and optical products Electrical equipment: 27 electrical equipment

Country	Description
	Transport equipment: 30 other transport equipment Information and Communication: 58-63 information and communication Finance: 64-66 financial and insurance activities Mining: 05-09 mining and quarrying
Norway	No details available
Portugal	Food and beverages: NACE Code 10 and 11 Chemicals: NACE Code 20 Pharmaceuticals: NACE Code 21 Machinery and equipment: NACE Code 28 Computer and electronics: NACE Code 26 Electrical equipment: NACE Code 27 Transport equipment: NACE Code 29 and 30 Information and Communication: NACE Section J Finance: NACE Section K Mining: NACE section B
Slovak Republic	Food and beverages: NACE Rev.2 10-12 Chemicals: NACE Rev.2 20 Pharmaceuticals: NACE Rev.2 21 Machinery and equipment: NACE Rev.2 28 Computer and electronics: NACE Rev.2 26 Electrical equipment: NACE Rev.2 27 Transport equipment: NACE Rev.2 29-30 Information and Communication: NACE Rev.2 62-63 Finance: NACE Rev.2 64-66 Mining: NACE Rev.2 05-09
Slovenia	Food and beverages: CA Chemicals: CE Pharmaceuticals: CF, if less than 5 beneficiaries, N/A due to confidentiality standards Machinery and equipment: CK Computer and electronics: CI Electrical equipment: CJ Transport equipment: CL Information and Communication: JC Finance: CK Mining: B
Sweden	No details available
Turkey	No details available
United States	Food and beverages: no details available Chemicals: includes Pharmaceuticals Pharmaceuticals: Pharmaceuticals are included the Chemicals subsector. Machinery and equipment: no details available Computer and electronics: no details available Electrical equipment: no details available Transport equipment: no details available Information and Communication: no details available Finance: no details available Mining: no details available

Source: OECD, R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

Table E.4. Economic ownership definitions

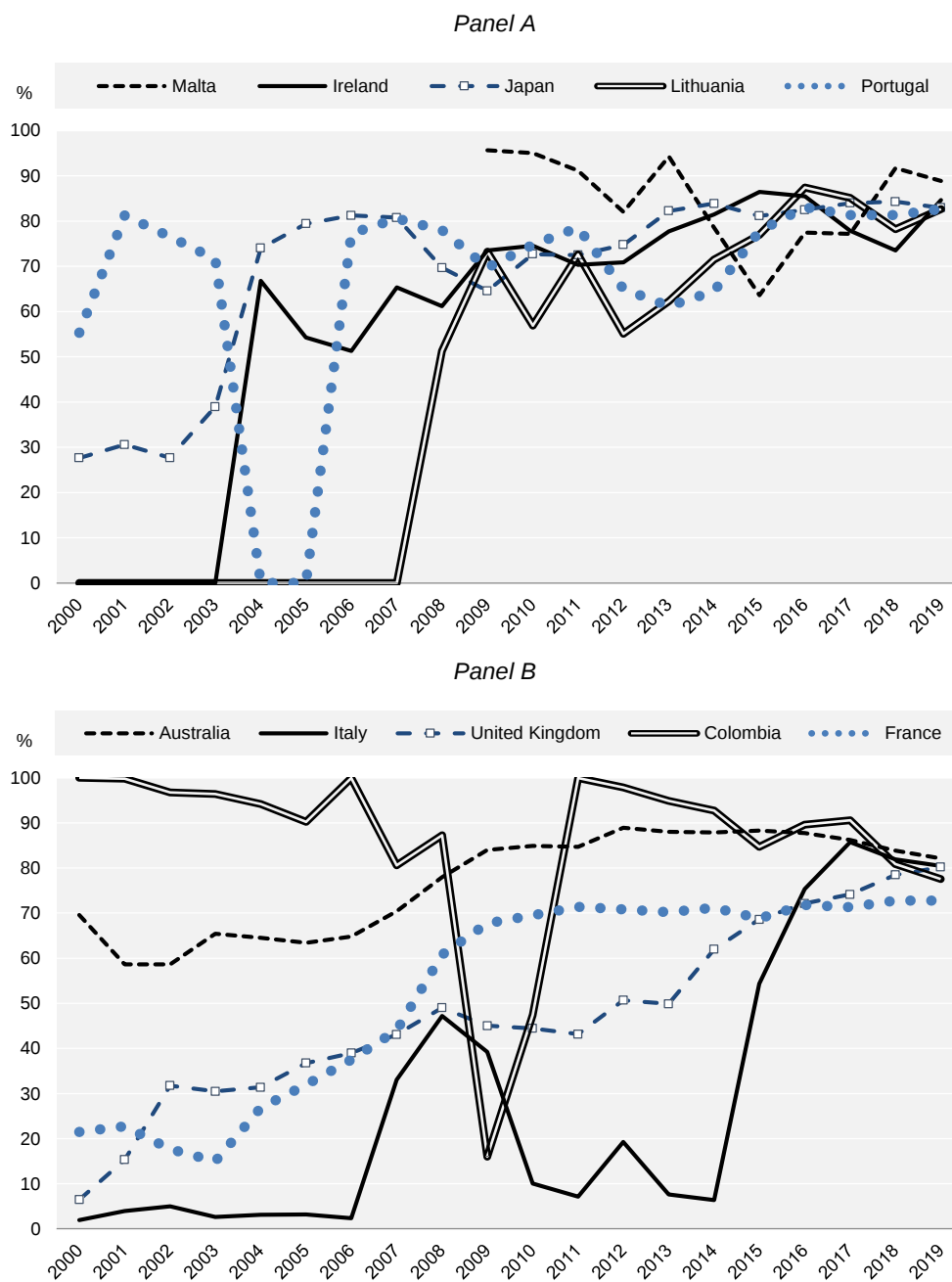
Country	Description
Czech Republic	- Foreign-controlled affiliates: the foreign affiliate means an enterprise resident in the compiling country over which an institutional unit not resident in the compiling country has control [Foreign Affiliates Statistics (FATS)]. - Domestic enterprises with multinational presence (with affiliates abroad): no details available.
Greece	- Foreign-controlled affiliates: no details available. - Domestic enterprises with multinational presence (with affiliates abroad): no details available.
Italy	- Foreign-controlled affiliates: figures only refer to tax credit used by corporations (società di capitali), therefore tax credit used by other types of businesses is not included. Foreign controlled affiliates are resident corporations reporting to be controlled (either directly or indirectly) by a non resident enterprise or to be related with a non resident company and both are controlled (either directly or indirectly) by a non resident enterprise. This information is reported in the CIT tax return form in the section dedicated to Transfer Pricing. - Domestic enterprises with multinational presence (with affiliates abroad): figures only refer to tax credit used by corporations (società di capitali), therefore tax credit used by other types of businesses is not included. Domestic enterprises with multinational presence are resident corporations reporting to control (either directly or indirectly) foreign enterprises. This information is reported in the CIT tax return form in the section dedicated to Transfer Pricing.
Norway	- Foreign-controlled affiliates: as in FATS. - Domestic enterprises with multinational presence (with affiliates abroad): no details available.
Slovak Republic	- Foreign-controlled affiliates: no details available. - Domestic enterprises with multinational presence (with affiliates abroad) : no details available.
Sweden	- Foreign-controlled affiliates: enterprises controlled by majority from outside Sweden. - Domestic enterprises with multinational presence (with affiliates abroad): no details available.

Source: OECD, R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

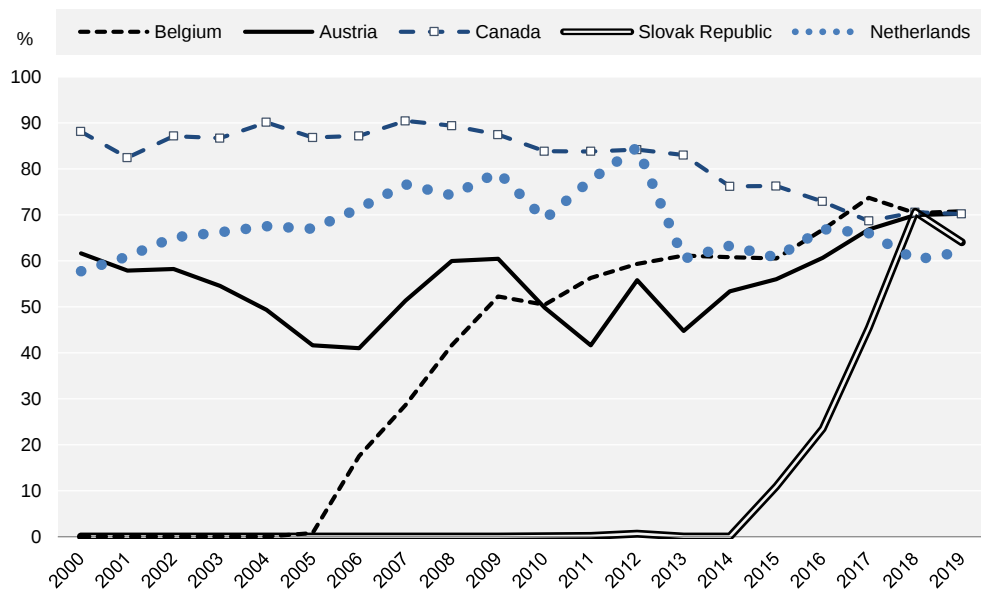
Annex F. Trends in public support for BERD

Figure F.1. Changes in the composition of government support, 2000-2019

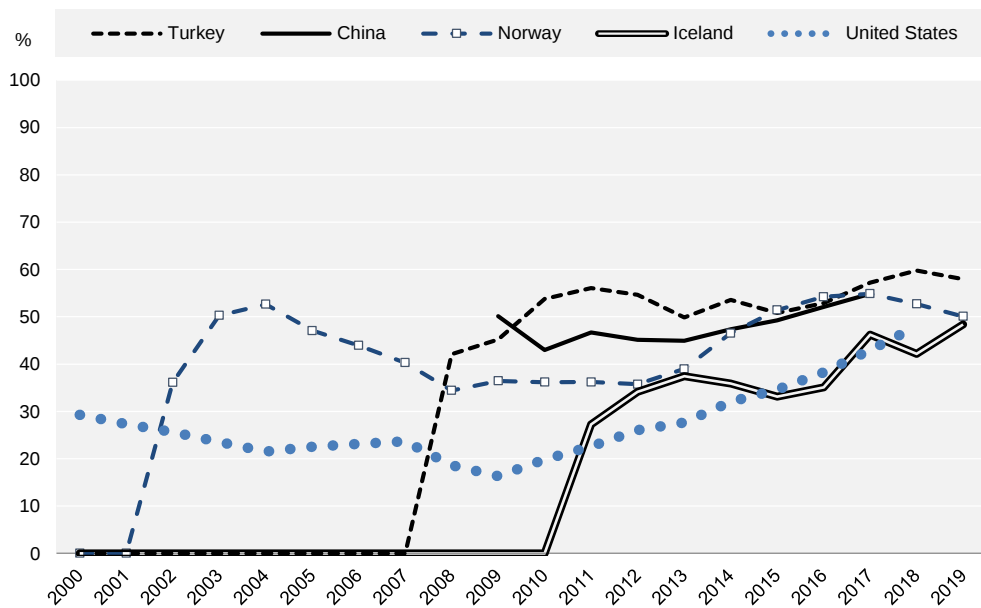
R&D tax incentive support as a percentage of total government support



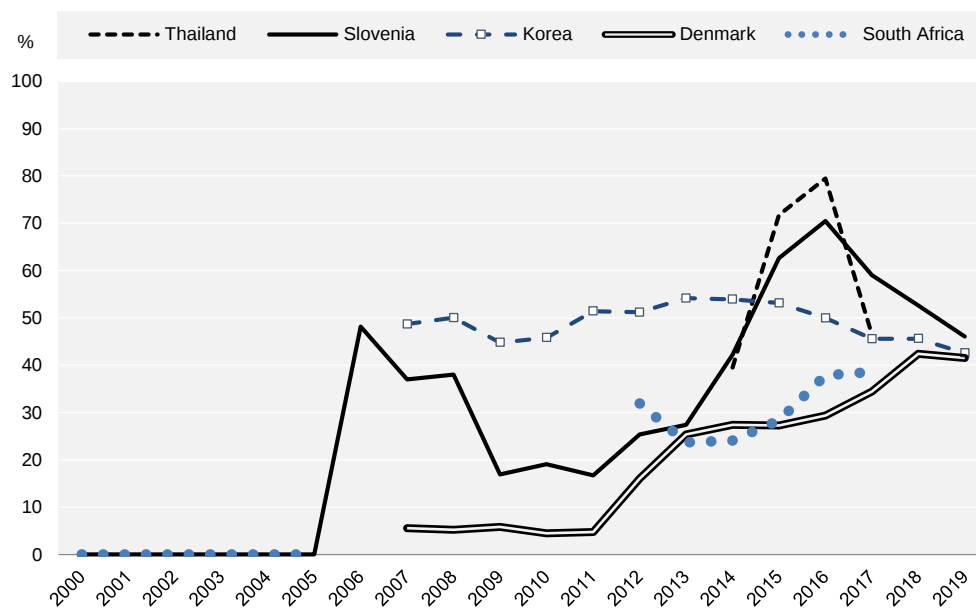
Panel C



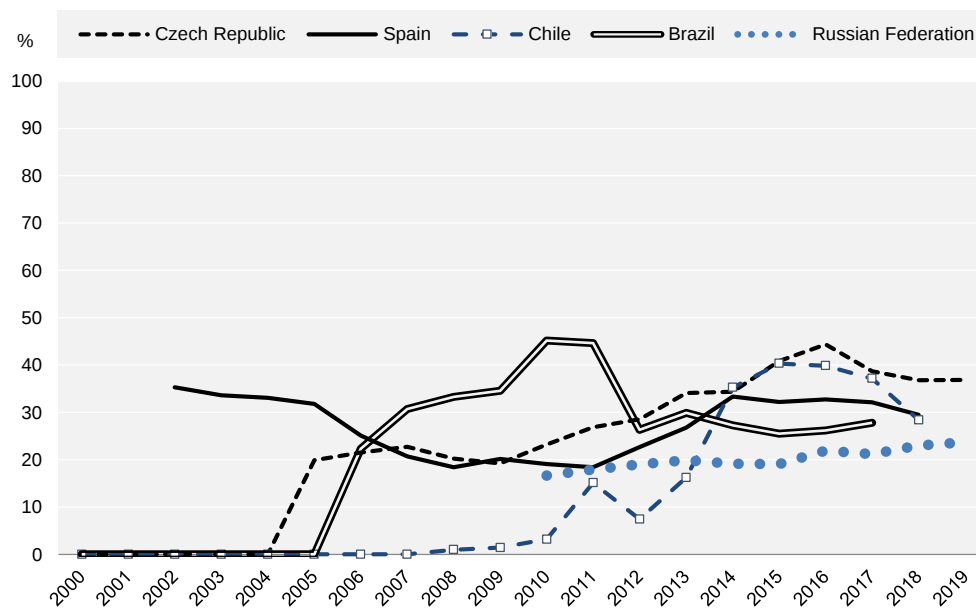
Panel D



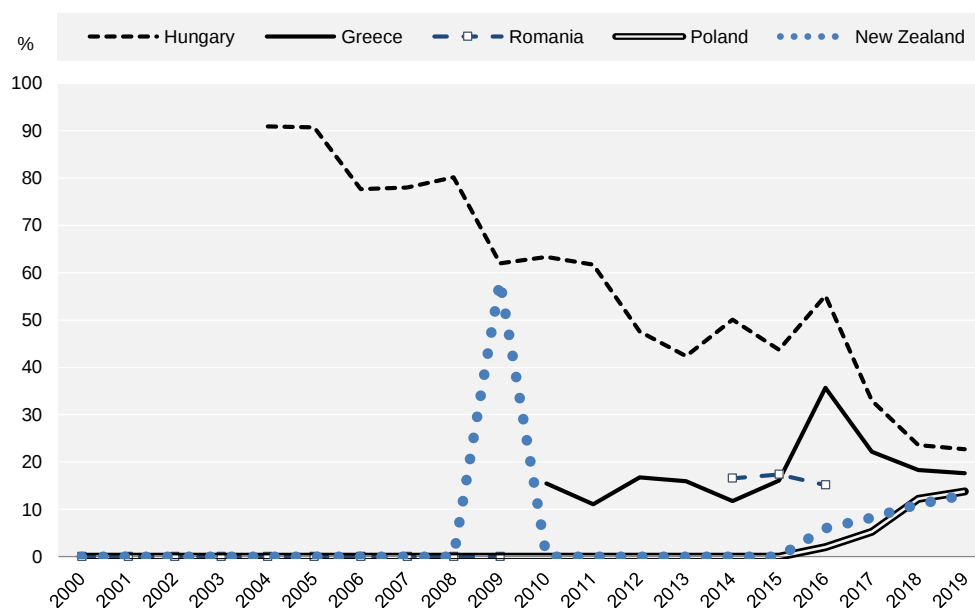
Panel E



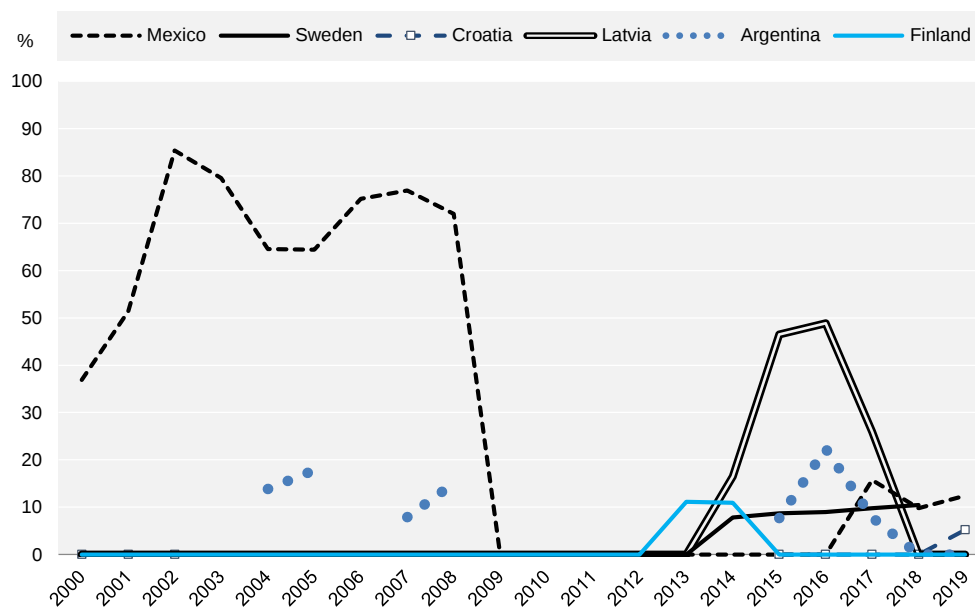
Panel F



Panel G



Panel H

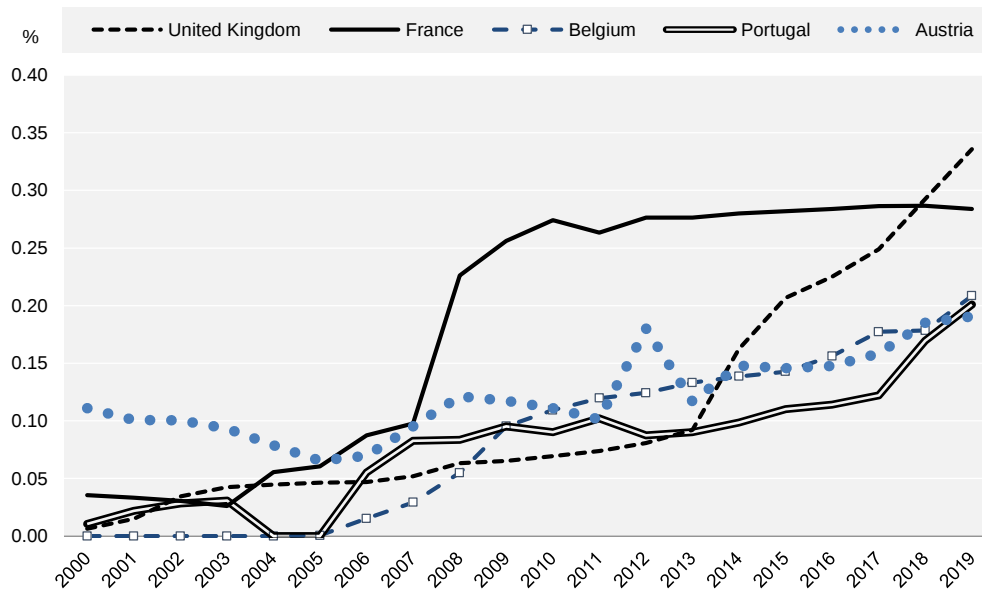


Note: Figures for Canada, Hungary and Japan exclusively refer to government tax relief for R&D at central government level. For the Netherlands, break in series in 2013 due to a revision of the BERD time series.
Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.

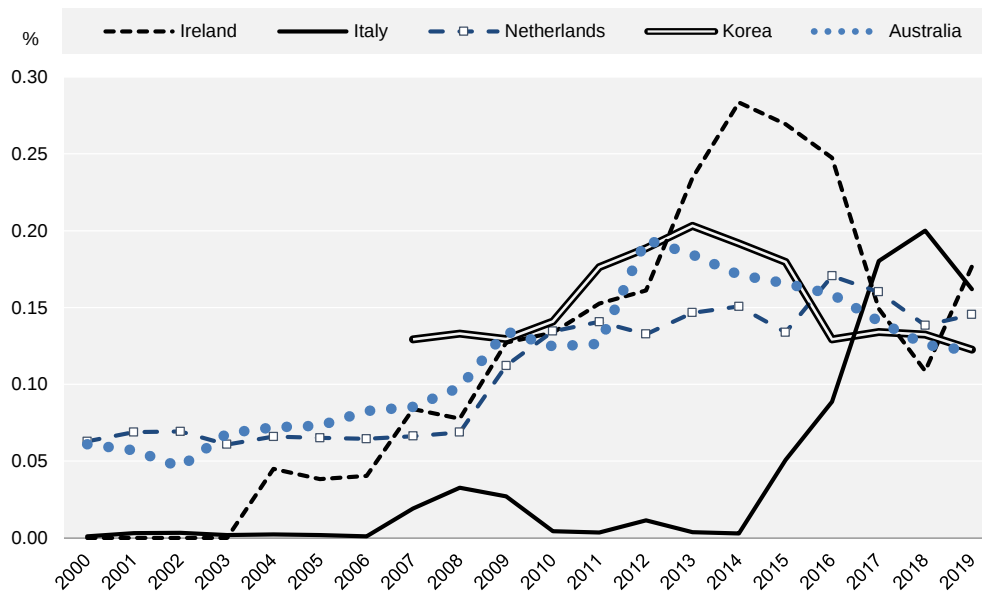
Figure F.2. Trends in government tax relief for business R&D, 2000-2019

As percentage of GDP

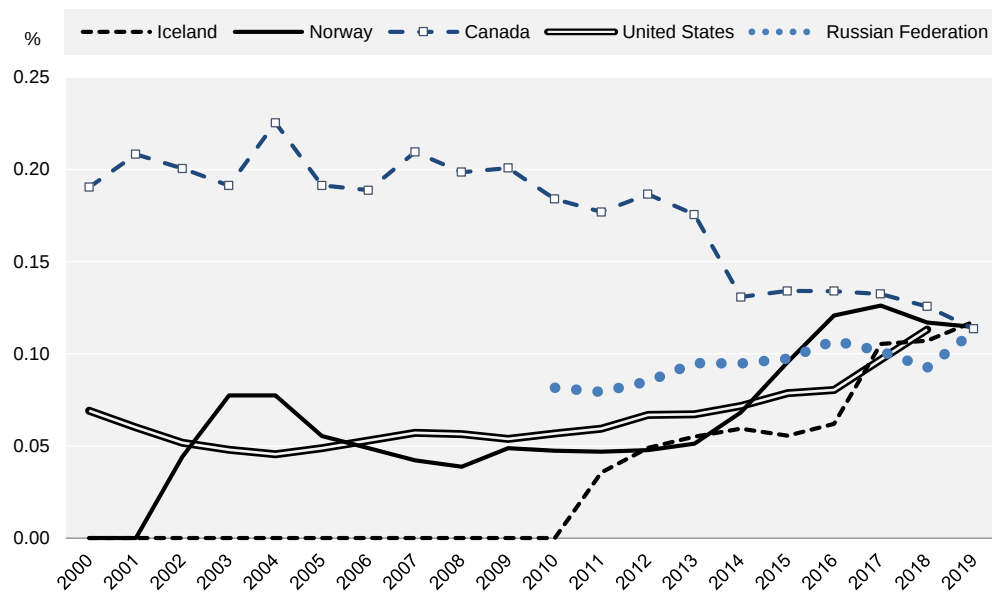
Panel A



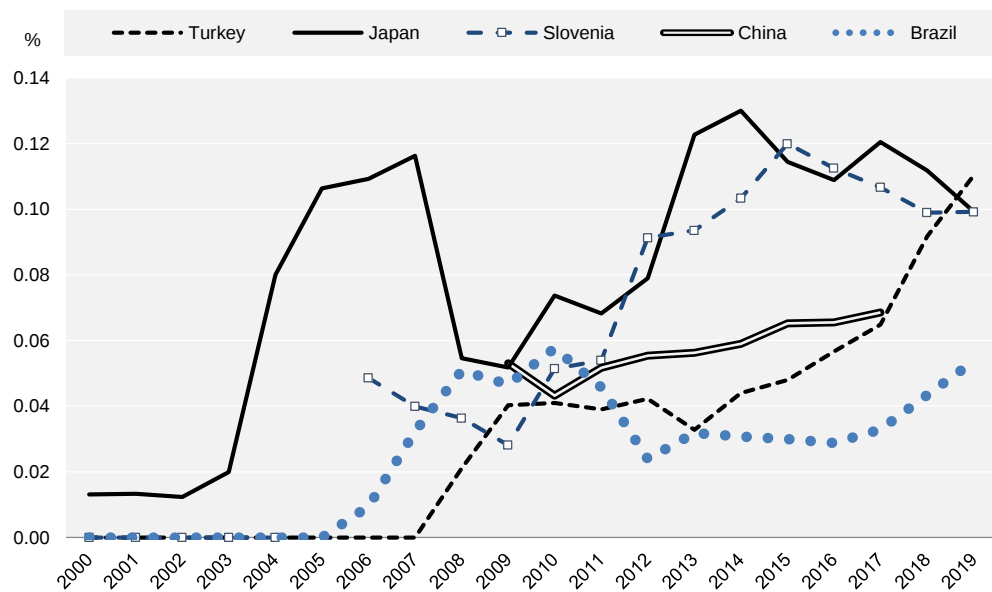
Panel B



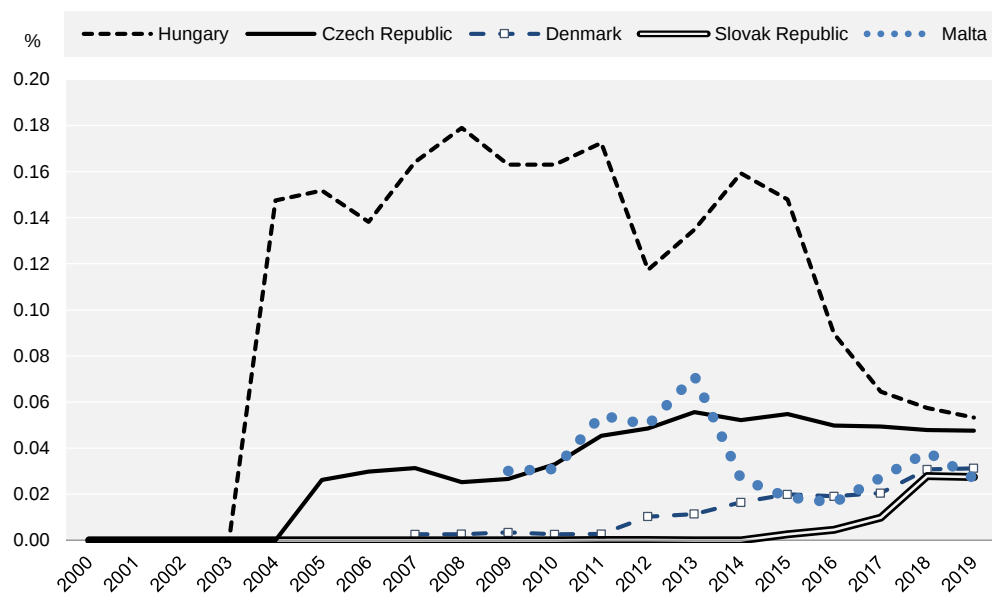
Panel C



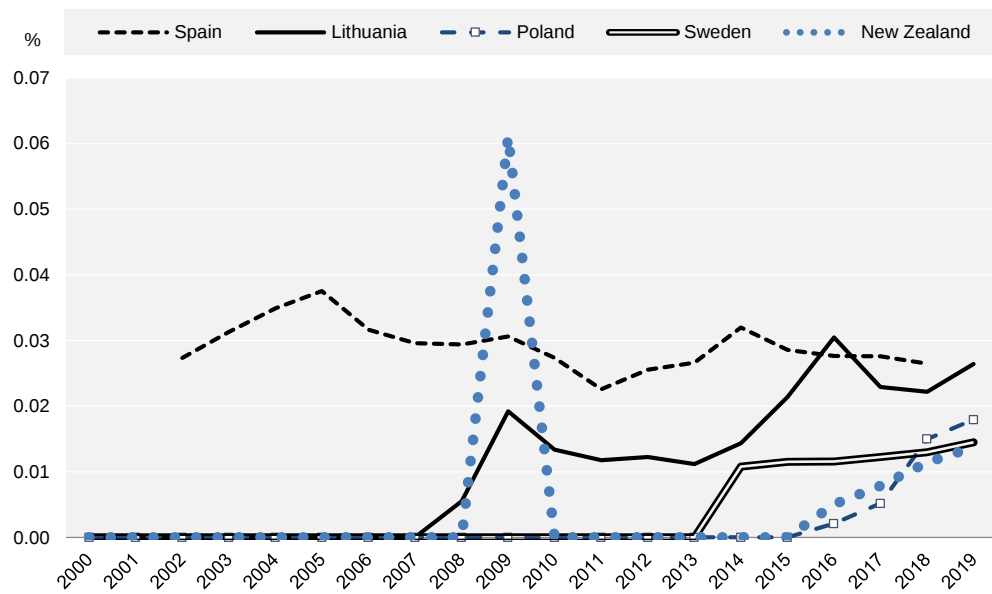
Panel D



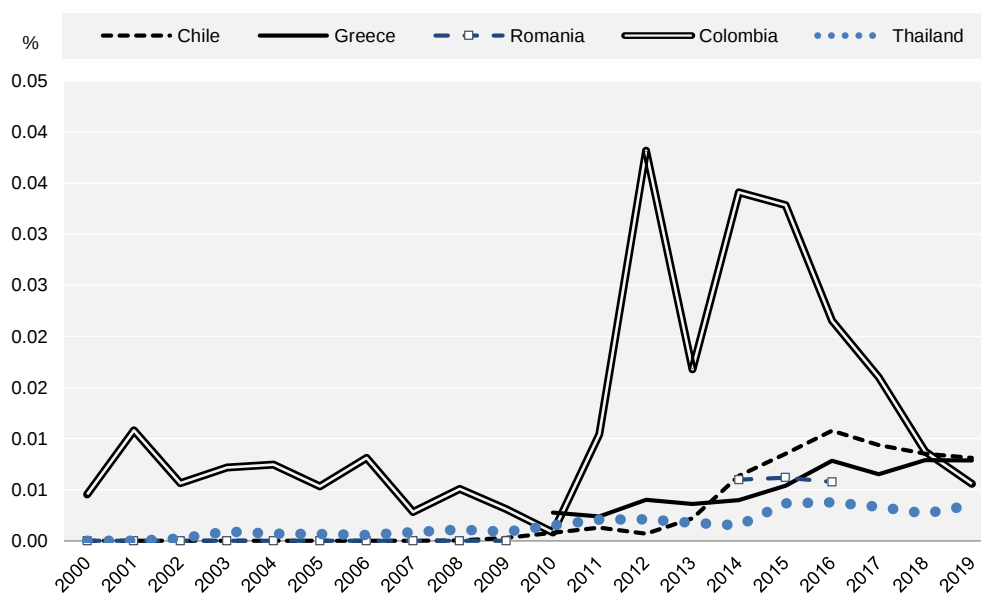
Panel E



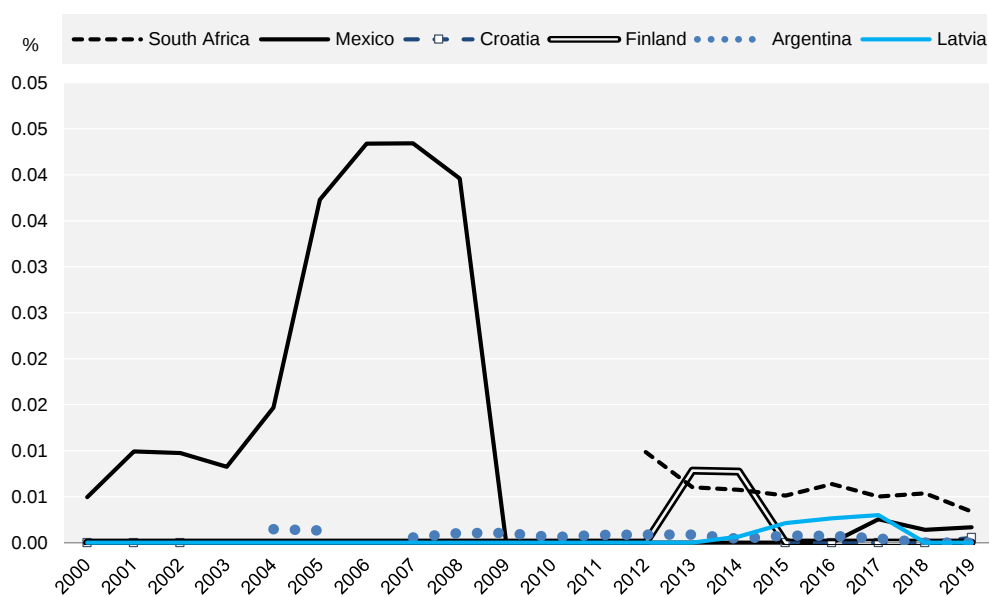
Panel F



Panel G



Panel H



Note: Figures for Canada, Hungary and Japan exclusively refer to government tax relief for R&D at central government level.
Source: OECD R&D Tax Incentives Database, <http://oe.cd/rdtax>, December 2021.