

Effective tax rates for R&D: Modelling notes

Explanatory Annex to Corporate Tax Statistics

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

Indicators of the effective average tax rate (EATR) and the cost of capital for R&D are useful to analyse decisions at the extensive margin (e.g. whether or where to invest in R&D) and at the intensive margin (e.g. how much to invest in R&D), respectively. This note contains a summary of the key parameters and modelling assumptions that enter the indicators of the cost of capital and EATR for an R&D investment in Corporate Tax Statistics. **The methodology that underpins these indicators is available in an accompanying [OECD Taxation Working Paper](#)** (González Cabral, Appelt and Hanappi, 2021^[1]). These indicators stem from the ongoing collaboration of the Centre for Tax Policy and Administration (CTPA) and the Directorate of Science, Technology and Innovation (STI).

Estimates in the database include indicators of the EATR and cost of capital for R&D investments, including expenditure-based R&D tax incentives. To assess the preferential tax treatment for R&D investments in relation to other investments, it is instrumental to calculate the EATR or the cost of capital for a comparable investment to which R&D tax incentives do not apply. By taking the difference between the estimate in the R&D and non-R&D case, it is possible to gauge the preferential tax treatment offered to R&D in a given jurisdiction, in isolation from baseline tax provisions available to *all* types of investments. Income-based tax incentives that provide preferential tax treatment to the income from R&D or R&D-related activities are not captured in these estimates. OECD work is ongoing to expand the measurement work to capture income-based tax incentives.

Closely linked to these indicators is the B-Index, the tax component of the cost of capital abstracting from financing decisions, which is a well-established indicator in the R&D literature (Warda, 2001^[2]; OECD, 2021^[3]). The three indicators: the EATR for R&D, the cost of capital for R&D and the B-Index, which are all contained in OECD Corporate Tax Statistics and the OECD R&D tax incentives database, provide a toolbox for policymakers to evaluate the impact of taxation on firms' R&D investment decisions at the extensive and intensive margin. The modelling of R&D tax incentives is consistent across the three indicators; certain differences in the estimation remain and are discussed in this note (OECD, 2021^[3]; OECD, 2021^[4]).

Modelling assumptions

Estimates of the EATR for R&D and the cost of capital for R&D focus on the incentives faced by large firms among which R&D is heavily concentrated (Dernis et al., 2019^[4]; OECD, 2021^[5]) and assume that firms are able to use in full their tax benefits. Provisions introduced by governments to target particular firm types and to promote R&D among firms that may not be able to fully use their tax benefits are not captured in these indicators, but can be analysed using the B-Index indicator available since the year 2000 (OECD, 2021^[2]).

Certain design features that limit tax benefits for R&D such as the presence of ceilings and thresholds are assumed not to be binding due to a lack of data reflecting the share of R&D expenditure or performers bound by these limitations. These estimates should be interpreted as an upper bound of the generosity of R&D tax incentives, i.e. the maximum amount of relief firms can obtain from an R&D investment, see González Cabral et al. (2021^[1]) for a discussion of the three indicators.

An R&D investment

In generating R&D assets, firms typically incur a mix of current costs and capital investments. The enhanced tax treatment for each component differs across jurisdictions (Appelt, Galindo-Rueda and González Cabral, 2019^[7]; González Cabral, Appelt and Hanappi, 2021^[1]). The modelling considers a fixed mix of 90% current expenditure (60% labour; 30% other current expenditure) and 10% capital (5% tangible assets; 5% non-residential structures) to produce the R&D asset, reflecting average R&D input shares in OECD countries (OECD, 2021^[5]).

The indicator captures variation in baseline depreciation rules and on the preferential tax treatment of current and capital inputs used for R&D purposes across countries. The composition of the R&D investment underpins the calculation of the B-Index, cost of capital and EATR for R&D indicators. A fixed project composition ensures that variations across jurisdictions can be attributed to taxation. The sensitivity of estimates to variation in the composition of the R&D investment can be consulted in the accompanying paper (González Cabral, Appelt and Hanappi, 2021^[1]).

Tax parameters

Data on the design of R&D tax incentives are collected as part of the annual OECD R&D tax incentive survey. The survey is conducted by STI in collaboration with members of the OECD R&D tax incentive network, formed by experts from the Working Party of National Experts on Science, Technology and Innovation and from the Working Party No.2 on Tax Policy and Statistics (WP2). The calculations of EATRs and the cost of capital for R&D build upon the same design features and the same modelling of R&D tax incentives as the B-Index contributed by STI. Differences arise with respect to the macroeconomic scenario chosen (see B-Index modelling notes for an extended explanation and macroeconomic parameters below) (OECD, 2021^[3]). Table A.1 at the end of this document provides a list of the expenditure-based R&D tax incentive provisions modelled.

CIT rates come from the OECD Tax Database (OECD, 2021^[4]). Baseline tax depreciation rules and rates for tangible assets and non-residential structures and other elements of the tax system such as allowances for corporate equity are obtained from the OECD Corporate Effective Tax Rates survey. This survey, conducted by the CTPA, engages experts of WP2. The tax parameters and modelling of these provisions align with that used to compute corporate effective tax rates published as part of the Corporate Tax Statistics for the categories cited above (Hanappi, 2018^[8]; OECD, 2021^[4]). For tangible assets an unweighted average is used. When countries report that accelerated depreciation is available for capital inputs used for R&D purposes, the baseline depreciation treatment captured as part of Corporate Tax Statistics is replaced with the respective accelerated depreciation scheme.

Economic parameters

A key parameter in the model for the estimation of the effect of taxation on an inframarginal investment is the pre-tax rate of return of the project, which in this case, corresponds to the private return on the R&D asset. The pre-tax return of the R&D investment is calibrated to the average rate of $p=30\%$ for the purpose of this analysis. As Hall, Mairesse and Mohnen (2009^[10]) point out, this parameter is not a 'scientific constant' but an outcome of several factors and returns to R&D may vary across sectors, countries and likely over time. See González Cabral et al. (2021^[1]) for an analysis of the sensitivity of estimates to this parameter.

Economic depreciation rates are hard to measure for intangibles. In line with previous literature, this study considers the economic depreciation rate for R&D assets to be 15% (Hall, 2007^[11]; Evers, Miller and Spengel, 2013^[12]; Lester and Warda, 2014^[13]). However, it is recognised that R&D depreciation rates might differ extensively across sectors and over time (Li and Hall, 2020^[14]).

The modelling considers a real interest rate of 3% and an inflation rate of 1% in line with the low-tax scenario considered in Corporate Tax Statistics (OECD, 2021^[4]). The B-Index assumes a different macroeconomic scenario with a nominal and real interest rate of 10%. Table 1 contains the values of the key modelling parameters used.

Table 1. Key model parameters

Parameter		Value
Pre-tax rate of return	p	30%
Economic depreciation rate	δ	15%
Real interest rate	r	3%
Inflation	π	1%

Source: OECD Secretariat.

Other modelling assumptions

- The estimation abstracts from the inclusion of personal income taxes and other related taxes such as real estate taxation.
- The investment is considered to be a domestic investment, i.e. cross-border investments are not considered at this point although the effect of these provisions could be investigated as part of future work
- For the purpose of this analysis, the investment is assumed to be financed by retained earnings for simplicity and allowance for corporate equity are accounted for where available (OECD, 2021^[3]). Note that the B-Index abstracts from the impact of financing decisions.

Annex A. Modelled expenditure-based R&D tax incentives

Table A.1 Expenditure-based R&D tax incentives modelled and notes, large firms, 2019-2020

Country	Modelled R&D tax provisions
Argentina	- No expenditure-based R&D tax incentives in 2019-2020
Australia	- R&D tax credit (volume) Modelling note: The modelling considers a firm with turnover above AUD 50 million <u>Not modelled:</u> - 175% International Premium incremental tax concession for additional investment in foreign-owner R&D (available as of 1 July 2007)
Austria	- R&D tax credit premium (volume)
Belgium	- R&D tax credit for capital expenditures (volume) - Partial exemption of payroll withholding tax (PWHTC)
Brazil	- R&D tax allowance - Accelerated depreciation for tangible assets used for R&D. <u>Not modelled:</u> - The R&D tax allowance rate may vary from 60% to 100% depending on R&D staff growth and patent/cultivar registration.
Bulgaria	No expenditure-based R&D tax incentives in 2019-2020
Canada	- Scientific Research and Experimental Development (SR&ED) tax credit (volume) <u>Not modelled:</u> - Provincial R&D tax incentives.
Chile	- Tax credit for intramural and extramural R&D (volume)
China	- R&D tax allowance (volume) - Accelerated depreciation for tangible assets used for R&D
Colombia	- R&D tax credit (volume)
Croatia	- 2019: R&D tax allowance (volume) Modelling note: The R&D tax allowance is available at a rate of 100% for basic research, 50% for industrial research, 25% for experimental development and 50% for feasibility studies. An enhanced rate of 37% is modelled, applying a common 6:30:64 distribution of business R&D expenditure (BERD) by orientation of R&D performance (basic research, applied research and experimental development) based on an average estimate for OECD countries for 2008-15 (www.oecd.org/sti/rds). - 2020: No expenditure-based R&D tax incentives in 2020
Czech Republic	- R&D tax allowance (hybrid) <u>Not modelled:</u> Extension of qualifying expenses to include external services related to R&D provided by public R&D institutions (from January 2014).
Cyprus ¹	- No expenditure-based R&D tax incentives in 2019-2020.
Denmark	- R&D tax allowance - Accelerated depreciation for tangible assets used for R&D. <u>Not modelled:</u>

¹ 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.

	- R&D tax credit (deficit-related, volume)
Estonia	No expenditure-based R&D tax incentives in 2019-2020
Finland	No expenditure-based R&D tax incentives in 2019-2020
France	<p>- Crédit d'impôt Recherche (CIR), R&D tax credit (hybrid): <u>Modelling note:</u> A tax credit rate of 30% applies to eligible R&D expenditures up to EUR 100 million (5% above this threshold). This threshold is assumed to be non-binding</p> <p>- Accelerated depreciation for tangible assets used for R&D.</p> <p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - The double deduction applicable to the wages of researchers with a PhD or equivalent degree and unlimited employment contract (young doctors) for the purposes of the R&D tax credit. - The exemption of social security contributions for young innovative enterprises (JEIs) or young university enterprises (JEU).
Germany	<p>- 2019: No expenditure-based R&D tax incentives.</p> <p>- 2020: Tax credit for R&D labour expenditures ("Forschungszulage")</p>
Greece	R&D tax allowance (volume)
Hungary	<p>- R&D tax allowance (volume)</p> <p>- Exemption of social security contributions.</p> <p><u>Modelling note:</u> The social security contribution rates amount to 20% for researchers and 9.25% and for PhD students in 2019 and to 18% and 8.25% in 2020 respectively and are weighted to account for the share of R&D expenditure attributable to each group in each year.</p> <p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - Collaboration agreements with higher education institutions, the Hungarian Academy of Sciences or research institutions established by them (300% R&D tax allowance rate). - Development tax incentive for acquisitions of intangible assets, machinery and equipment and buildings used for R&D purposes. - R&D tax credit on SSCs of R&D staff in enterprises recognized as a research facility (50%, mutually exclusive with SSC exemption), exemption and R&D tax credit in Small Business Tax (KIVA).
Iceland	R&D tax credit (volume)
Israel	No expenditure-based R&D tax incentive is currently modelled.
Ireland	<p>- R&D tax credit (volume)</p> <p>- Accelerated depreciation for tangible assets and non-residential structures used for R&D (incompatible in its use with the R&D tax credit from 2020 onwards).</p>
Italy	<p>- 2019: R&D tax credit (incremental), including the enhanced deduction on labour costs for researchers and technicians employed in R&D activity (costs related to highly qualified employees under 35 years of age with a PhD, at their first job and employed with a fixed-term contract are computed at 150 percent of the actual expenditure.</p> <p><u>Modelling note:</u> The base amount is defined to be the average R&D investment cost in the 2012 - 2014 period. In the model, the base amount is taken to be a three-year average as an approximation.</p> <p>- 2020: R&D tax credit (volume), including the enhanced deduction of 150% on labour costs for employees aged less than 35 at their first job, employed with a fixed-term contract and holding a PhD or a master's degree in technical or scientific fields.</p> <p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - 2020: Enhanced R&D tax credit rates for firms in the Southern region of Italy
Japan	<p>R&D tax credit (volume)</p> <p><u>Modelling note:</u> The volume-based rate can range from 6-14% for large firms (temporarily until March 2021, usual rate ranges from 6-10% for large firms). The range depends on the percentage change in R&D expenditures relative to the past 3-year average. A rate of 14% is modelled as an upper bound of generosity.</p> <p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - The high R&D intensity tax credit (incremental) - The Open Innovation activity-based R&D tax credit (volume) for cooperative or subcontracted R&D with national R&D institutes and universities (30%), SMEs (20%),

	applicable since 2019), R&D venture corporations (25%) or other non-public corporations (20%).
Korea	<p>- R&D tax credit for research and human resource development (hybrid)</p> <p><u>Modelling note:</u> For large firms, the volume-based component is modelled in 2019-2020.</p> <p>- Tax credit for investment in research and test facilities, training facilities and facilities for commercializing new technology</p> <p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - The position of high-potential enterprises that count with an enhanced volume-based credit rate compared to large firms. - The Growth Industry and Basic Technology tax credit (enhanced volume-based rate of 20-30% for large firms and high-potential enterprises).
Latvia	No expenditure-based R&D tax incentive in 2019-2020.
Lithuania	<p>- R&D tax allowance (volume)</p> <p>- Accelerated depreciation for tangible assets used for R&D.</p>
Luxembourg	No expenditure-based R&D tax incentive in 2019-2020.
Malta	<p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - Enhanced tax deduction for R&D - R&D tax credit, 2014-20 - Aid for Research and Development projects (R&D tax credit), 2017-19. - R&D tax credit for R&D and Innovation, 2017-19
Mexico	R&D tax credit (incremental)
Netherlands	Payroll withholding tax credit (WBSO)
New Zealand	<p>- R&D tax credit (volume)</p> <p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - R&D tax credit (deficit-related)
Norway	- R&D tax credit (volume) ("Skattefunn")
Poland	<p>- R&D tax allowance (volume)</p> <p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - The enhanced allowance rate for companies with Research and Development Centre (RDC) status.
Portugal	<p>- R&D tax credit (hybrid).</p> <p><u>Modelling note:</u> Operating expenditures qualify up to a level of 55% of R&D wage expenditure (50% of the share of other current costs is assumed to qualify for modelling purposes).</p>
Romania	- R&D tax allowance (volume)
Russian Federation	<p>- R&D tax allowance (volume)</p> <p>- Accelerated depreciation for the tangible assets and non-residential structures used for R&D.</p> <p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - Value-added tax exemptions on R&D and property tax credits for national R&D centres and organisations implementing state-approved R&D investments.
Slovak Republic	<p>- R&D tax allowance (hybrid)</p> <p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - R&D tax allowance for incentive recipients
Slovenia	R&D tax allowance (volume)
South Africa	<p>- R&D tax allowance</p> <p>- Accelerated depreciation for R&D tangible assets</p>
Spain	<p>- R&D tax credit (hybrid).</p> <p>- Accelerated depreciation for tangible assets and non-residential structures used for R&D.</p> <p><u>Not modelled:</u></p> <ul style="list-style-type: none"> - Enhanced volume-based credit rate for staff dedicated exclusively to R&D - Exemption of employer social security contributions for qualified R&D staff (only compatible for the R&D tax credit for innovative SMEs).
Sweden	Exemption of employer social security contributions.

Switzerland ²	No expenditure-based R&D tax incentives in 2019-2020.
Thailand	-2019: R&D tax allowance -2020: No details available
Turkey	- R&D tax allowance (incremental) - Exemption of employer social security contributions. - Accelerated depreciation for tangible assets used for R&D.
United Kingdom	- Research and Development Expenditure Credit (RDEC) for large enterprises - Accelerated depreciation provision for tangible assets and non-residential structures used for R&D.
United States	- Regular Research credit (RRC) - Alternative Simplified credit (ASC) <u>Modelling note:</u> A weighted average of the impact of RRC and ASC on the total value of deductions is calculated, using IRS SOI data on the credits' respective shares in total qualified R&D expenditures as a weight. The weight applicable in 2019-2020 refers to the 2013 weights as this is the latest data available at the time of this modelling exercise. The calculation accounts for RRC claims subject to the excess base (20% tax credit rate) and 50% current R&D expenditure limitation (10% tax credit rate) and the share of qualified R&D that is eligible under the ASC (14% tax credit rate). <u>Not modelled:</u> - Credit for basic research conducted in universities and certain non-profit organisations - Credit for energy research

Note: This table lists expenditure-based R&D tax provisions for large firms that were available in 2019-2020. When no year is specified, the incentive and modelling notes refer to both periods. Expenditure-based R&D tax incentives that are targeted to loss-making large firms referred to as deficit-related incentives in the table are not modelled. For a full list of expenditure-based R&D tax incentives available from the year 2000 for different firm types and profitability see the B-Index modelling notes below.

Source: OECD Secretariat adapted from the OECD R&D Tax Incentive Database, <http://oe.cd/rdtax>, July 2021.

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² Switzerland does not provide expenditure-based R&D tax incentives at the central government level, however an optional R&D tax deduction at cantonal (subnational) level was introduced in 2020.

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