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## TAX INCENTIVES FOR RESEARCH AND DEVELOPMENT

The majority of OECD countries provide support to R&D both through direct subsidies and, increasingly, by means of tax incentives. Austria has been offering an instrument of fiscal support to R&D – the R&D tax allowance – that is rather generous by international standards. However, the R&D allowance shows some weak points. A reform designed to eliminate some of these weaknesses was passed recently.

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Over the past two decades, a number of countries have either introduced or extended fiscal incentives for research and development (R&D). Today, the majority of OECD countries employ a mix of fiscal incentives and direct subsidies for R&D. The European Commission is now paying more attention to fiscal incentives for R&D than in the past. Its aim is to increase the effectiveness and coherence of tax incentives for R&D, particularly by diffusing "good practices", as well as their co-ordinated use in order to overcome common challenges in the area of R&D and innovation.

In addition to direct public support for R&D, which is administered largely by specialised institutions, the R&D promotion funds, Austria has been offering fiscal support to R&D for a considerable period of time. Among these instruments, the Austrian R&D allowance is by far the most important: This special allowance permits a firm to deduct from its taxable income not only its actual R&D expenditure, but, in addition, a certain percentage over and above this expenditure. In order to achieve the goal set by the federal government to increase Austria's expenditure for research and development to 2.5 percent of GDP by the year 2005, additional efforts are required. A well-designed fiscal incentive for R&D may contribute to stimulate R&D investment of domestic enterprises without burdening the budget excessively.

In advanced economies, both direct and indirect (fiscal) support instruments are used to promote research and development. Today, the majority of OECD countries, albeit to varying degrees, apply both types of support enabling them to make use of their respective advantages.

Tax incentives seem to have, above all, the following advantages over direct government aid for R&D:

- Tax incentives for R&D are characterised by a high degree of "neutrality" with respect to the firm's allocation decisions. This concerns, above all, the content and character of R&D projects. A general tax incentive for R&D is, in principle, also neutral with respect to the industry the firm belongs to.
- Relatively low barriers to access fiscal support schemes should be of advantage for small and medium-sized firms, in particular.
- Requirements for public support are comparatively transparent.
- Fiscal support is predictable for firms. In this respect it differs from direct (discretionary) project-based support instruments.
- The costs of administration for government and the compliance costs for firms can be kept at a low level – there are no large costs for programme planning, programme management etc., and firms are less burdened. Some studies, however, pass a more critical judgement with respect to the overheads involved (see OECD, 2001).

### Advantages and disadvantages of tax incentives for R&D

- In the case of indirect support instruments the government need not select either firms or technologies "qualified for support" ("picking the winner"); they are much less affected by "rent seeking" (unproductive activities aimed merely at the redistribution of resources) than targeted (specific) direct support programmes (see, e.g., Cohen – Noll, 1991).

These advantages do not necessarily become effective. Whether or not they are realised, depends on the concrete design of the particular instrument of public support and its administration. It is well known that the design of an instrument of fiscal support is crucial for its effectiveness: "The detailed design of tax incentive schemes often makes the difference between efficient and wasteful fiscal support to R&D" (OECD, 1998, p. 180).

These advantages of instruments of fiscal support for R&D are often contrasted with their potential disadvantages vis-à-vis direct support instruments:

- Due to their very construction, tax incentives for private R&D tend to favour R&D activities characterised by high private returns, and not necessarily activities with high social returns.
- There is a high degree of uncertainty with respect to the effectiveness of incentives.
- Fiscal incentives for R&D are characterised by "inequity". In practice, one can observe a high degree of heterogeneity of effective "R&D prices" (i.e., the actual cost of R&D; see Hall – van Reenen, 2000). Depending on the particular design of the fiscal support instrument, this heterogeneity is caused, e.g., by the presence or lack of sufficient profit, by limits set to the amount of support and, in the case of incentives for incremental R&D expenditure, by the definition of the baseline (see below).
- Loss of tax revenue induced by tax incentives ceteris paribus leads to higher tax rates, or, in practice, also to compensatory taxation distorting the allocation of resources.
- Tax incentives undermine the control of the budget. Direct support programmes are usually endowed with fixed financial resources. The practice of fiscal policy shows that "tax expenditure" (foregone tax revenue) induced by fiscal incentives are much less subjected to public scrutiny than direct government aid explicitly listed in the budget.

For an appraisal of the pros and cons of tax incentives for R&D see Leyden – Link (1992), Harhoff (1994), Link (1996), OECD (1998, 2001), European Commission (1999A) and Hall – van Reenen (2000). Based on an analysis of the advantages and disadvantages of tax incentives for R&D, some fundamental conclusions concerning the design of such instruments can be derived. For example, as the practice in OECD countries (OECD, 1998, 2001) shows, an instrument of fiscal support may well be used – beyond the overall stimulation of R&D activities in the business sector – for pursuing more specific goals such as the promotion of small and medium-sized enterprises, or the stimulation of technology-based start-ups. However, the goals to be pursued by tax incentives should not be too specific – mainly because this would undermine the principal advantages of fiscal instruments of public support for R&D (neutrality with respect to firm's allocation decisions, low barriers of access, low costs of administration etc.). Targeted technology policy interventions should, in principle, be left to instruments of direct support.

Since both direct and fiscal support have specific advantages, an appropriate mix adjusted to national circumstances may increase the efficiency of the overall system of government aid. According to a study of the OECD (2000), based on Guellec – van Pottelsberghe (2000), estimating simultaneously the impact of various forms of public support to R&D on business enterprise R&D expenditure, both direct support and tax incentives for R&D appear to stimulate R&D performed and financed by the business enterprise sector. In fact, the difference between direct support and tax incentives for R&D is not that one is systematically more effective than the other. Rather, the two types of public support primarily differ with respect to the type of R&D activities they stimulate: Fiscal incentives tend to stimulate applied R&D characterised by sufficiently high private returns, while, in principle, direct support can – at the cost of potential "policy failure" – be targeted on the basis of a longer-term perspective, and, with a prospect of high social returns.

The effectiveness of a particular instrument of public support for R&D depends on the intensity of the use of other components of the system of public support for R&D. Direct and fiscal support to R&D seem to be substitutes: An increase in the intensity of one type of support reduces the impact of the other (OECD, 2000) which requires that the instruments of public support are co-ordinated. Well-developed fiscal support for R&D re-

*Tax incentives designed according to the international state of the art can stimulate R&D investment of business enterprises without burdening the budget unduly.*

*Direct government aid and fiscal incentives for R&D each have distinctive advantages and disadvantages. An appropriate mix adjusted to national conditions may increase the efficiency of the system of government aid.*

believes the institutions involved in direct support for R&D, giving them the opportunity to concentrate on their core competencies. This could result, e.g., in a higher "specificity" (focussing) or an increased intensity of government aid. Moreover, in a complementary way, well developed, easily accessible fiscal support for R&D could also benefit firms, which in the past had only limited access to direct support for R&D (e.g., due to otherwise meaningful minimum standards set for the size and set-up of projects). In particular this applies to small and medium-sized firms and start-up companies.

In the impact analysis of R&D support schemes, primarily the following two criteria are applied:

1. The first evaluation criterion, well established in economics, is the maximisation of "social returns". The (neo-) "classical" theoretical rationale for public support for private investment in R&D is based on the assumption that total ("social") returns on investment in research and development exceed the ("private") returns appropriable by the R&D-performing firm. In this case, R&D investment by optimising firms in a market economy is sub-optimal (see, e.g., *Hutschenreiter*, 1995). In order to achieve an overall economic optimum, and given that nondistortionary taxation is used, the government has to provide support to R&D to such an extent that the gap between private and social returns on R&D expenditure is closed.
2. The second, more frequently used evaluation criterion is "additionality". In this context it is attempted to estimate the extent to which a reduction of R&D costs caused by government support induces additional R&D expenditure of firms; this depends on the price elasticity of demand for R&D. Strictly speaking, the presence of additionality is not a sufficient economic justification for government intervention in the form of public support to R&D. However, a quantification of additionality provides a first approximation and may serve as a starting point for a more thorough impact analysis.

The first approach (maximisation of social returns) is extremely demanding, which, due to its informational requirements, is difficult to implement. Hence, based on the second approach, a simplified cost-benefit analysis is often performed. Here, a benefit-cost ratio is computed, which relates induced additional R&D expenditure of firms to foregone tax revenue. With a benefit-cost ratio less than 1, a fiscal incentive is interpreted as being ineffective, since in this case it would be better to rely on direct support for R&D (*Hall – van Reenen*, 2000).

In the past two decades a considerable number of econometric studies on the effectiveness of fiscal incentives for R&D has been performed in various countries (see *Mohnen*, 1999). The most thoroughly examined fiscal incentive for R&D is the "R&D tax credit" for "incremental" R&D expenditure – exceeding the average of the R&D expenditure of the last three years ("baseline") – introduced in the USA in 1981 ("Economic Recovery Tax Act"). Initially, it was limited until the end of 1985. It was extended several times with some modifications. The most important change was made at the end of the 1980s when the baseline which up to then was defined as a moving average of the R&D expenditure of the last three years (which in Austria was introduced in the course of the tax reform 2000) was abolished for lack of effectiveness and replaced by a fixed baseline in 1990 (*Whang*, 1998). Such studies outside the USA and Canada are rare.

Table 1 provides an overview of estimates for the elasticity (price elasticity of demand for R&D) and for the benefit-cost ratio drawn from various studies of the US R&D tax credit. Thus, the majority of econometric studies performed in the 1990s estimate the benefit-cost ratio of the US R&D tax credit (ratio of induced additional R&D expenditure to foregone tax revenue) to lie in the interval between 1.3 and 2.0. Estimates of the price elasticity are in the range of  $-1$ : Thus, a reduction of the cost of R&D by 1 percent leads to an increase in R&D expenditure by about 1 percent. Studies performed in the 1980s reported considerably lower estimates of the actual effectiveness of the R&D tax credit. Typically, estimates of the price elasticity of the demand for R&D according to these studies are in the interval between  $-0,3$  and  $-0,4$  (see, e.g., the surveys by *Cordes*, 1989, *Hall*, 1992, *Harhoff*, 1994). The benefit-cost ratio was estimated to be less than  $1 : 1$ ; i.e., induced R&D expenditure fell short of the foregone tax revenue.

## The effectiveness of tax incentives for R&D

According to more recent econometric studies of tax incentives for R&D 1 € of foregone tax revenue induces additional R&D expenditure between 1.3 € and 2.0 €.

Table 1: Empirical studies on the effectiveness of the US R&amp;D tax credit

		Data type	Estimated elasticity	Estimated benefit-cost ratio
Collins (1983), Eisner – Steven – Sullivan (1983)	1981	99 firms	Insignificant	< 1,0
Eisner – Steven – Sullivan (1983)	1981/1982	~ 600 firms for R&D 3- or 4-digit industries for taxes	Insignificant	Not available
Mansfield (1986)	1981/1983	110 firms	0.35	0.30 to 0.60
Baily – Lawrence (1987, 1992)	1981/1989	12 2-digit industries	0.75, 0.25	1.3
Hall (1992)	1981/1991	800 firms (unbalanced)	1.0 to 1.5	2
Berger (1993)	1981/1988	263 firms (balanced)	1.0 to 1.5	1.74
McCutchen (1993)	1982/1985	20 large drug firms	0.28 to 10.0	0.29 to 0.35
Hines (1993)	1984/1989	116 multinationals	1.2 to 1.6	1.3 to 2.00
Maimuneas – Nadiri (1997)	1956/1988	15 industries	0.95 to 1	

Source: Hall – Van Reenen (2000).

Today, the majority of OECD countries offer instruments of fiscal support for R&D. In most cases, they were introduced only since the early 1980s. In more recent times they have become considerably more widespread: According to a survey of the OECD (2001) the number of OECD countries which offer tax incentives increased from 12 to 16 between 1996 and 1999.

In general, the following instruments of fiscal support to R&D are used (see OECD, 1998, p. 168):

- Commonly, the possibility to fully deduct current R&D expenditure in the year it is incurred is not seen as a particularly favourable treatment. However, it constitutes a subsidy insofar as, from an economic perspective, R&D expenditure is an investment: "R&D capital" is generating income over an extended period of time.
- Accelerated depreciation of machinery and equipment for R&D and, in some cases, of buildings is a further instrument of fiscal support.
- Tax allowances permit firms to deduct more than 100 percent of their R&D expenditure, and thus reduce the tax base (taxable income).
- R&D tax credits allow firms to deduct a certain percentage of their R&D expenditure directly from their tax liabilities.
- Tax credits are granted in two forms: "volume-based" tax credits cover total R&D expenditure, "incremental" tax credits are limited to incremental (marginal) R&D expenditure exceeding a given threshold value ("baseline").

A survey compiled by the OECD (2001) shows that already 17 OECD countries offer fiscal incentives for R&D:

- Eight countries (Canada, France, Italy, Japan, Korea, the Netherlands, Spain and the USA) provide incentives for R&D in the form of tax credits. Both volume-based and incremental tax credits are applied. In two countries, a combination of these two types of incentives is offered. Moreover, Canada and the USA provide additional tax incentives for R&D at the state or provincial level.
- Seven countries have tax allowances (Australia, Austria, Belgium, Denmark, Ireland, Sweden, UK). These support instruments are volume-based, i.e., they cover total qualified R&D expenditure. The only exception is the Austrian R&D allowance, which constitutes a combination of a volume-based and an incremental instrument.
- A number of countries provide special tax incentives for R&D expenditure by small and medium-sized firms, among them Belgium, Canada, Italy, Japan, Korea, the Netherlands and the UK.

The majority of OECD countries offer incentives for both current R&D expenditure and qualified capital expenditure. Austria and the USA, with their R&D allowance and "R&D tax credit", respectively, support only current R&D expenditure. In the case of Austria this has to be seen from an historical perspective in connection with the existence of a general investment allowance ("Investitionsfreibetrag"), which has been abolished in the meantime.

## Tax incentives for R&D – an international survey

For more detailed information on the practice in EU countries see *European Commission* (1999A, 1999B, 2002). In the past years, some countries have introduced new instruments of fiscal support for R&D, among them the Netherlands ("WVA/S&O" – Wage Tax and Social Insurance Allowance Act, 1994) and the UK ("R&D tax credit", 2000). These examples may be considered as "best practices" (see *Hutschenreiter – Aiginger*, 2001). The underlying considerations and the design chosen for these support instruments show, on the one hand, original innovative features and, on the other hand, conform to the international state of knowledge about design and impacts of fiscal incentives for R&D (see, e.g., *Bloom – Griffith – Klemm*, 2001).

*The European Union is now paying more attention to tax incentives for R&D. Some countries have introduced new state-of-the-art instruments during the past years.*

For a considerable length of time, the Austrian tax system has been providing tax incentives for activities relevant to research and innovation policy (see, e.g., *Schneider*, 2000). By far the most important instrument of fiscal support to R&D is the R&D allowance. It was redesigned with the Tax Reform Act 2000; this as well as the most recent reform in 2002 must be seen in connection with the goal of the federal government to raise Austria's R&D expenditure to a level of 2.5 percent of GDP by 2005.

## Tax incentives for R&D in Austria

### The R&D allowance

The definition of qualified expenditure and the allowance rates are stated in the Income Tax Act (*Einkommensteuergesetz – EStG*). According to § 4, par. 4 EStG – in addition to their immediate deduction as operating expenditure – expenditures for the development or improvement of "inventions valuable to the economy" ("volkswirtschaftlich wertvolle Erfindungen") qualify for the R&D allowance. Administration and distribution costs as well as expenditure for capital assets are excluded. Furthermore, the Income Tax Act states that the economic value of the intended or completed invention has to be testified in a certificate by the Federal Minister of Economics and Labour. Such a certificate is not required if the invention is already protected under patent law.

*In Austria, the R&D allowance was extended and re-designed in the course of the tax reform 2000. In 2002, the introduction of new instruments complemented the system of fiscal incentives.*

Prior to the tax reform 2000, the R&D allowance was (up to) 12 percent of qualified R&D expenditures in general. An increased R&D allowance (up to 18 percent) was granted, if the invention was not utilised primarily by other persons. The R&D allowance of (up to) 12 percent was due to contracted research. The principal, however, was not permitted to claim the R&D allowance, but the general investment allowance instead (see *Doralt*, 1997, p. 267). According to available information, the lower rate of 12 percent played a minor role in practice.

All in all, the R&D allowance prior to the tax reform 2000 was characterised by the following main features:

1. Support for "inventions valuable to the economy" or inventions protected under patent law.
2. Volume-based support, i.e., support for all current R&D expenditure, not just for incremental expenditure.
3. Different levels of support according to whether the invention was utilised internally or by other persons.

The modification of the R&D allowance in the course of the tax reform 2000 consisted of the following main points:

1. The R&D tax allowance was increased to (up to) 25 percent of R&D expenditures, in general.
2. "Incremental" R&D expenditures (exceeding a baseline computed as moving average of the past three years) qualify for an R&D allowance of (up to) 35 percent.
3. The differentiation of support according to the above-mentioned criterion regarding the utilisation of inventions was abolished.

Using the terminology of the OECD, this R&D allowance represents a combination of a "volume-based" and an "incremental" incentive. Moreover, in contrast to recent international practice, a moving average was chosen for determining the baseline. An appraisal of the effectiveness of this particular combination, which is unique in the international arena, ought to be the subject of a design evaluation (see on this issue *Hutschenreiter*, 2002).

The actual use and impact of the R&D allowance lack transparency; no evaluation has been presented so far. Estimates of the loss of tax revenue attributed to § 4, par. 4 of the Income Tax Act (R&D allowance, preferential treatment of donations for science and re-

### Empirical evidence

search) are regularly published in the annual reports on government aid of the Federal Ministry of Finance. The loss of tax revenue caused by the R&D allowance represents its direct impact on the budget<sup>1</sup>. According to the most recent report on government aid ("Förderungsbericht 2000") the total loss of revenue amounted to € 72.67 million or ATS 1 billion (1998), € 79.94 million or ATS 1.1 billion (1999) and € 87.21 million or ATS 1.2 billion (2000), respectively. According to these estimates, the federal budget was affected by € 50.87 million or ATS -700 million in 1998, by € 54.50 million or ATS -750 million in 1999 and by € 58.14 million or ATS -800 million in 2000.

### The B-Index

In order to measure the generosity of tax incentives for R&D for a "representative firm", the OECD applies the "B-Index" which was constructed specifically for this purpose (on the construction of this index see OECD, 2000; for details see Warda, 1996, 2002; a related approach was chosen by Bloom – Griffith – van Reenen, 2000).

The B-Index  $B$  is defined as the relation between the after-tax cost of one unit of R&D expenditure, divided by 1 minus the corporate income tax rate  $\tau$  (at present 34 percent), i.e.,

$$B = \frac{1 - A}{1 - \tau},$$

where  $A$  represents the net present value of the tax incentive per unit of R&D expenditure. Thus, the B-Index is equal to 1 if there is no additional fiscal support for R&D expenditure beyond the possibility to fully deduct this expenditure in the year it is incurred. The more "generous" the tax incentive for R&D, the lower the B-Index.

For a purely volume-based R&D allowance (such as the one in place before the tax reform 2000) we have

$$1 - A = 1 - \tau - \tau \rho,$$

with  $\rho$  as the maximum tax allowance rate (after the tax reform 2000: 0.25). In order to represent more complex constructions, e.g., incentives for incremental expenditure or "hybrid" forms adequately adapted, more complex formulas have to be applied. For the case of the R&D allowance after the tax reform 2000 the formula according to Hutschenreiter (2002) is:

$$1 - A = 1 - \tau - \left[ \alpha \left( 1 - \frac{I_t}{R_t} \right) + \beta \frac{I_t}{R_t} \right],$$

where

$$\alpha = \tau \rho,$$

$$\beta = \tau \delta \left( 1 - \left( 1 - \frac{\rho}{\delta} \right) \left( \sum_{i=1}^3 \frac{1}{(1+r)^i} \right) \frac{1}{3} \right),$$

$$I_t = \max \{ 0, R_t - \Phi_t \},$$

$$\Phi_t = \frac{1}{3} \sum_{i=1}^3 R_{t-i}.$$

where  $R_t$  represents total qualified expenditure for R&D in year  $t$ ,  $I_t$  is qualified incremental R&D expenditure (exceeding the baseline) in year  $t$ ,  $\delta$  represents the maximum tax allowance rate for incremental R&D expenditure (after the tax reform 2000: 0.35),  $\Phi_t$  represents the baseline expenditure for research and development measured for year  $t$  (average of previous three years), and  $r$  represents the discount rate.

<sup>1</sup> The macroeconomic interdependencies are considerably more complex and the long-term total effect much higher since public support for R&D impacts on the stream of income attainable in the medium and long term and thus on tax revenues. The long-term effects can be adequately represented in R&D-based endogenous growth models (see Grossman – Helpman, 1991, survey by Aghion – Howitt, 1998). Moreover, one can observe interactions within the national tax system and – due to the allocation decisions of multinational firms – complex interactions between the national and foreign tax systems (Hall, 1992, Hines, 1994).

In order to measure the generosity of tax incentives for R&D, the OECD uses the so-called "B-Index" which was constructed for this purpose (see Box). "Specifically, the B-index is calculated as the present value of before-tax income that a firm needs to generate in order to cover the cost of an initial R&D investment and to pay the applicable income taxes. The lower the index, the greater the incentive for a firm to invest in R&D" (Warda, 2002, p. 192). The B-Index permits both a representation of the evolution of fiscal incentives over time, and international comparisons. In Austria, the B-Index has undergone four level shifts in the period between 1980 and 2000. These were caused, on the one hand, by two increases of the R&D allowance (1986, 2000) and by a reduction (1989) and a subsequent increase (1994) of the corporate income tax rate on the other hand (see, for details, Hutschenreiter – Aiginger, 2001).

*All in all, the actual use and impact of the R&D allowance lacks transparency. No evaluation has been presented so far.*

Figure 1: Generosity of the R&D allowance: B-Index 1980-2000



Source: WIFO. For a definition see Box.

Figure 1 shows a time series of the B-Index for Austria in the period between 1980 and 2000, which reflects the generosity of the R&D allowance for a "representative firm" which is liable to corporate income tax and makes sufficient profit. The discontinuities are due to changes in the corporate income tax rate and the R&D allowance itself. After the tax reform 2000 – and under the assumption of a discount rate of 5 percent – the B-Index is between 0.867 and 0.871, depending on the share of incremental R&D expenditure in total R&D expenditure of the firm. The fact that this interval is very small indicates that the differentiation of the allowance rate (25 percent in general, as compared to 35 percent for incremental R&D expenditure) leads only to a minor differentiation of the effective incentive. This is a consequence of the application of a moving average of the last three years in the calculation of incremental R&D expenditure, which dilutes the effective incentive.

*Even before the reform 2002, tax incentives for R&D in Austria have been rather generous in an international comparison. Several weaknesses of the R&D allowance were identified. Their diagnosis formed the basis for recommendations for a reform of this instrument.*

As evidenced by a ranking of countries with respect to the generosity of their fiscal support for R&D (Warda, 2002, complemented by WIFO calculations for the R&D allowance after the tax reform 2000; Table 2), Austria's fiscal incentives for R&D are quite well strong in an international comparison. Accordingly, Warda (2002, p. 199) lists Austria among the "generous incentive providers". The favourable ranking with respect to incentives for R&D in large firms is an important argument in favour of Austria as a good business location and contributes to maintain and strengthen Austria as a location of research activities. It is worth noting that according to the most recent R&D survey conducted by Statistics Austria (1998), Austria has the highest share of R&D expenditure funded from abroad among the most advanced OECD countries. Moreover, these funds from abroad largely consist of business enterprise R&D expenditure (funded by firms located abroad and performed by business enterprises in Austria).

Although tax incentives for R&D in Austria are generous by international standards, the tax allowance does show some weak points. Their diagnosis formed the basis for recommendations to reform the system of fiscal support for R&D (see *Hutschenreiter – Aiginger, 2001*).

### Weak points of the system

Table 2: Generosity of tax incentives for research and development (B-Index)

Ranking from highest to lowest, 1999-2000

	Large company		Small company	
	B-Index	Rank	B-Index	Rank
Spain	0.687	1	0.687	4
Canada	0.827	2	0.678	3
Portugal	0.850	3	0.850	6
Austria	0.867 to 0.871	4	0.867 to 0.871	7
Denmark (basic research)	0.871	5	0.871	8
Australia	0.890	6	0.890	10
The Netherlands	0.904	7	0.642	2
France	0.915	8	0.915	11
Korea	0.918	9	0.837	5
USA	0.934	10	0.934	12
Ireland	0.937	11	0.937	13
Mexico	0.969	12	0.969	15
Japan	0.981	13	0.937	14
UK	1.000	14	0.888	9
Finland	1.009	15	1.009	17
Switzerland	1.011	16	1.011	18
Belgium	1.012	17	1.008	16
Greece	1.015	18	1.015	19
Sweden	1.015	19	1.015	20
Norway	1.018	20	1.018	21
Italy	1.027	21	0.552	1
Iceland	1.028	22	1.028	22
Germany	1.041	23	1.041	23
New Zealand	1.131	24	1.131	24

Source: Warda (2002); Austria: WIFO based on *Hutschenreiter (2002)*.

In contrast to other OECD countries, Austria's R&D allowance does not offer any special support for small and medium-sized firms. As a consequence, Austria ranks fourth among the OECD countries with respect to support for large companies, while it ranks seventh with respect to incentives for smaller companies (see Table 2). Although small and medium-sized firms constitute a traditional strength of the Austrian economy, there are shortcomings in the technology-based segment, including the dynamics of start-ups. Research-intensive start-up firms are particularly exposed to market failure (e.g., by asymmetric information). Even in countries with highly developed venture capital markets only a relatively small fraction of technology-based start-up firms benefits from venture capital funding (*Lerner, 1999*). Support for R&D activities in this target group is of particular importance in countries with weakly developed venture capital markets. A more pronounced consideration of this segment is in accordance with the "best practices" identified by the *OECD (1998)*.

The introduction of a special incentive for incremental R&D expenditure (general R&D tax allowance of 25 percent, and 35 percent for incremental R&D expenditure) as part of the tax reform 2000 indicates the intention to give preferential treatment to newly R&D-performing firms such as research-intensive start-up companies. The chosen design (in particular the application of a moving average of the last three years), however, implies that the effective additional stimulus for incremental R&D expenditure is very small – much less than the difference of 10 percentage points between the two allowance rates might suggest (*Joint Committee on Taxation, 1992, Hutschenreiter, 2002*).

In order to make use of the R&D allowance, sufficient profits are required. Profit-based incentives discriminate, among others, against technology-based start-up firms, which, as a rule, do not make a profit in their initial phase. Moreover, the R&D allowance tends to be pro-cyclical, a feature that is undesirable in view of the goal to smooth R&D activities over the business cycle. Carry-forward facilities may counteract this effect, however they are not able to mitigate the liquidity problems of firms in their start-up phase.

**No special support for small firms – Insufficient support for technology-based start-up companies**

**Ineffective differentiation of the allowance rate**

**Dependence of the R&D allowance on profits**

In some conceptual and procedural aspects, the formulation of the R&D allowance still echoes the spirit of the 1950s and 1960s<sup>2</sup>. Since then the economics of technical change and innovation has made great progress and extensive practical experiences with instruments of fiscal support for R&D are available today. Based on these experiences, the OECD has derived "best practices".

As mentioned above, in order to claim the R&D allowance, a certificate of the "value" of the respective invention is required. This does not apply, if the invention is protected under patent law. However, a meaningful definition of the value of an invention in terms of welfare economics ("social returns") is inapplicable in administrative practice: Even an approximate estimation of the "social returns" of an innovation after its successful diffusion requires sophisticated economic research. If it were easy to observe the difference between private and social returns of innovations, under-investment in R&D could be accurately corrected by an optimal *direct* subsidy. However, from an economic perspective, a strong argument can be made that due to positive externalities, the R&D expenditures of firms per se qualify for public support. Moreover, firms are, in general, better informed about the prospects of success of their R&D projects than the government. Thus, it suffices to monitor whether expenditures reported to fiscal authorities are in fact R&D expenditure (i.e., qualified R&D inputs). The evaluation of R&D outputs *ex ante* exceeds by far the capabilities of administrations.

From an up-to-date perspective, the implied equivalence of "economic value" and protection under patent law is debatable, too. It was shown in the economic literature that the economic value of patents varies enormously. Moreover, the criterion of protection under patent law is discriminating insofar as in some fields of technology or industries (such as the pharmaceutical industry) intellectual property rights play a very important role, whereas in others they do not. This shows up in widely varying propensities to patent.

Capital assets are excluded from the R&D allowance. This does not necessarily constitute a weak point in the design of the R&D allowance. In other countries, too, "qualified" expenditure does not always cover all cost elements of the R&D process. In the past, expenditure for capital assets required for purposes of R&D – just as other capital expenditure – have been treated preferentially in Austria by the investment allowance. With its recent abolition the range of R&D expenditure qualifying for public support was reduced. Thus, investment in the R&D infrastructure of the business enterprise sector is treated less beneficially than previously.

The reform of fiscal support for R&D announced at the "Business Cycle Summit" of the federal government in December 2001 (*Austrian Federal Government, 2001*) is designed to eliminate some weaknesses of the R&D allowance. In March 2002, this reform was approved by the National Council as an amendment of the Income Tax Act (Federal Law Gazette 2002/7, *Federal Ministry of Finance, 2002A*).

It comprises the following key elements:

1. The R&D allowance for expenditure for "inventions valuable to the economy" (25 percent or 35 percent, respectively) is fully maintained.
2. As an option to provision 1., the entrepreneur can claim a new R&D allowance of 10 percent for all further R&D expenditure conforming to a definition based on the OECD standard.
3. As an option to 1. and 2., a research premium of 3 percent for R&D expenditure conforming to the OECD definition is granted.

The "new R&D allowance" (provision 2.) is based on a definition of R&D expenditures according to the "Frascati Manual" of the OECD (1994). This definition is broader than the definition exclusively in use so far, which is primarily based on the "valuable invention" concept. In the comments to the amendment (*Federal Ministry of Finance, 2002B, p. 3*) it is stated that the new 10 percent R&D allowance can be claimed "in parallel" to the 25 percent and 35 percent R&D allowance still in use. Of course, it is ruled out that one and the same expenditure benefits from both types of R&D allowances. Thus, it will

<sup>2</sup> As early as 1958, an amendment of the Income Tax Act 1953 (Federal Law Gazette 1958/147) provided the possibility to immediately deduct expenditure for the development, improvement or protection of "inventions valuable to the economy", whereby the economic value of the inventions had to be testified by a certificate of the then Federal Ministry of Trade and Economic Affairs (see *Schneider, 2000, p. 24*).

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**Outdated concepts: "Inventions valuable to the economy"**

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**Expenditure qualified for support**

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**The reform 2002**

be possible to claim the R&D allowance of 25 percent or 35 percent for R&D expenditure conforming to the narrower ("invention-based") definition and, in addition, to claim the new 10 percent allowance for *additional* expenditure conforming to the new (OECD) definition.

Similarly, it is precluded that the research premium is claimed for the same expenditure as the 25 percent and 35 percent R&D allowance. The new 10 percent R&D allowance on the one hand and the research premium on the other hand are mutually exclusive. If, in a given year, the new R&D allowance is claimed for one research project, the research premium cannot be claimed even for other research projects (*Federal Ministry of Finance, 2002B, p. 6*).

In the light of the above-mentioned weaknesses of the system in use until now, the introduction of a research premium, i.e., of an incentive for R&D that does not depend on the existence of profits is an important step forward. This contributes to smoothing R&D activities over the business cycle and is a significant improvement for start-up firms, which in their initial phase often do not make a profit. Likewise, the transition to a definition of R&D expenditure according to international standards for both the new R&D allowance and the research premium must be seen favourably. However, due to the perpetuation of the previous R&D allowance two definitions of R&D expenditure (expenditures for "inventions valuable to the economy", R&D expenditure according to the OECD definition) are in use now, which is unique in the international arena.

Since the reform of fiscal support for R&D consists of adding new instruments to the existing R&D allowance, no firm is worse off than before. On the other hand, the system becomes increasingly complicated and thus administration and compliance costs tend to increase.

Support of qualified R&D expenditure by the new R&D allowance and the research premium appears relatively modest in comparison to the present value of the R&D allowance in place since the tax reform 2000. Of course this is mitigated by the fact that a broader definition of R&D expenditure is applied. Firms, whose R&D activities conform to the OECD definition, but not to the traditional definition (based on the notion of a "valuable invention"), are better off than prior to the reform. Compared to firms that are able to claim the previous R&D allowance they are still at a disadvantage, however.

The chosen method has the advantage that no firm is worse off than prior to the reform. On the other hand, it has the disadvantage that the system of incentives is becoming increasingly complex after each reform. In comparison with other fiscal incentives in use throughout the EU area, the Austrian system is complicated. Additional complexity tends to increase administration costs and compliance costs for business enterprises. Also in the interest of marketing Austria as a good business location, a simple and easily understandable set of incentives would be preferable.

It is recommended that the fiscal support to R&D is made more transparent and that the new system for tax incentives for R&D is evaluated according to international standards after it has been in use for three years. In this respect, the Netherlands and the UK may serve as examples.

*The reform 2002 of fiscal support to R&D is designed to eliminate some weak points by additional measures (new R&D allowance and research premium, both for R&D expenditure according to the OECD definition).*

*The new system of tax incentives for R&D should be evaluated after three years according to international standards.*

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### *Tax Incentives for Research and Development – Summary*

Both direct government aid and fiscal incentives for research and development have distinctive advantages and disadvantages. An appropriate mix adjusted to prevailing conditions may increase the efficiency of the system of government aid. As a matter of fact, the majority of OECD countries provide support to R&D both through direct subsidies and, increasingly, by means of tax incentives. At present the EU is paying greater attention to fiscal incentives for R&D than it did in the past.

For a considerable period of time, Austria has been offering an instrument of fiscal support to R&D – the R&D tax allowance – that is rather generous by international standards. However, the R&D tax allowance shows some weaknesses. The recent reform of fiscal aid for R&D is designed to eliminate some of these weaknesses by additional measures (a new R&D allowance for R&D expenditure based on the OECD definition, a research premium for firms that do not manage to make sufficient profit). This reform of tax incentives for R&D does not leave any firm worse off than before. On the other hand, it means that the system of tax incentives is becoming increasingly complex, which in turn tends to increase the costs of administration and compliance by firms. Also, for the purpose of marketing Austria as a good business location, an easily understandable design of available tax incentives would be preferable. Until now the actual use and effects of the R&D tax allowance have not been very transparent and no evaluation has been presented so far. Therefore, it is recommended to increase the transparency of fiscal aid for R&D and to evaluate the newly designed set of instruments according to international standards after they have been in use for three years.