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TAX INCENTIVES FOR RESEARCH AND DEVELOPMENT IN AUSTRIA AND CROATIA: B-INDEX

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Abstract

Tax incentives for research and development represent an important tax relief within corporate income tax. B-index helps to detect differences in the influence of tax system on private sector to invest in research and development. The main objective of this paper is to present tax incentives for research and development, and calculation of B-index in Austria and Croatia. B-index results show better treatment of R&D tax incentives in Croatia than in Austria. B-index value in Croatia is 1,09 and in Austria 1,25. Fiscal policy leaders must pay attention to offer tax incentives that are stimulative enough for companies not to lose interest in their use. Otherwise, country would only have short-term revenue in the budget. In order to increase state budget, it is very important to collect sufficient revenues from the corporate income tax.

Keywords: corporate income tax, tax incentives for research and development, B-index, tax expenditure

1. INTRODUCTION

Each European Union member state independently determines its own corporate income tax rate. From the firms' point of view, that represents rather significant differences in the payment of income tax. Corporate income tax has a significant role in the investor's decision in which enterprise to invest its financial resources. State that offers more favourable terms through lower tax rates and higher tax incentives for entrepreneurs is more attractive to foreign investments. The interest of the firm's owner and board is to profit as much as possible, and pay as little tax burden as possible. Besides corporate income tax rates, there are significant differences regarding tax reliefs.

Tax incentive for research and development represents the most important tax relief of the corporate income tax. Research and development (R&D) activities have been recognised as a crucial factor of innovation activity and / or innovation capacity. The role that R&D plays in firm learning adds another dimension to the evaluation of the welfare effects of patents and similar policies (Cohen and Levinthal, 1989, p. 594). The firms have become an important source of technology and knowledge transfer. The primary issue related to R&D is the choice between internal and external R&D activities. The importance of R&D rises with complexity, risk and cost of innovation activities. The determinants of R&D activities are linked to characteristics of firms and industries. Every industrial company considers R&D to be a vital department for increasing company's business. Firms' decisions about the nature of R&D performance are mainly guided by the consideration of economic returns. A firm that does business in more than one country must know how to determine the manner of company's revenue taxation in another country. The main features of the firm's policy influenced by tax environment include decisions on investment, financing, type of enterprise and type of payment.

The main objective of this paper is to present tax incentives for research and development, and calculation of B-index in Austria and Croatia. Introductory part is followed by the literature review of all significant researches in the field of tax incentives for research and development. Section 3 discusses significant characteristics of tax incentives for research and development, as well as their advantages and disadvantages. Furthermore, it presents calculation of B-index in Austria and Croatia, including its differences in these countries.

2. LITERATURE REVIEW

According to Schumpeter, entrepreneur′s desire to constantly move boundaries and change the existing organisational form was regarded as the main driver of innovation. Later he argued that large firms operating in concentrated industries are the main source of innovative activity (Schumpeter, 1942). Schumpeterian concept of creative destruction, new knowledge and technology acts as a source of differentiation in enabling firms to enjoy temporary monopoly power over their rivals by charging lower prices or offering better quality

products. Additionally, such investment in R&D firms can result in innovations; differentiate firms from their rivals on global market, thus achieving above-average returns on their activities. Innovation activities can have a number of different results (Hsu and Hsueh, 2009). Innovations can have twofold effect on the firms' ability to compete. On one hand, innovations improve price-driven competitiveness of firms through cost-reductions (Aghion and Howitt, 1992) and through improvements in the productivity of inputs (Grossman and Helpman, 1994). On the other hand, investment in R&D improves the relative sophistication of products with beneficial effect on quality-driven competitiveness of firm (Klette and Griliches, 2000).

According to Griffit, Sandler and Van Reenen, (1995, p. 22), tax incentives are only one way how the government can affect the amount of R&D undertaken and its economic impact. As they see it, there are solid reasons to subsidise R&D. More domestic R&D could also generate employment and higher wages. These benefits are likely to affect skilled workers disproportionately. Skilled workers are generally in short supply, and it is doubtful whether increasing their demand through increased R&D is desirable without first addressing the apparent failures in the training and education systems.

Firms invest in research and development (R&D) in order to lower their costs of production or to develop new products, thereby enhancing productivity and boosting economic growth (Dahlby, 2005, p. 45).

Governments try to reallocate or attract domestic and foreign capital using tax incentives that give more favourable tax treatment to certain economic activities (Klemm and Van Parys, 2012, p. 394). Higher economic growth of a company asks for more developed research-development cooperation between institutions. Besides positive sides of cooperation, there are few negative as well. Firstly, research and development cooperatives can collectively decide to cut research and development expenses if negative pecuniary externalities prevail. Secondly, an agreement to cooperate in research and development could facilitate collusion in other stages of the production process, a harmful reduction in competition which undoubtedly leads to a loss in net total surplus. Third, research and development cooperatives can act as s barrier to entry as they can, as a consortium of firms, set standards for future application (Hinloopen 2001, p. 314). Research and development activities must be tightly connected to national industry. Science and technology are the key components in creation of foundation for innovation, productivity and economic growth. Tax treatment of R&D is becoming more lenient and it is likely that countries will increasingly turn to the tax system and away from direct grants (Hall and Van Reenen 2000, p. 466).

The effectiveness of R&D tax incentives depends on the existence of any or of sufficient taxable income to use the immediate write-off, credit and allowance associated with R&D expenditures (Bernstein, 1986, p. 441). According to Elschner et al. (2011), there are several reasons why the effectiveness of an R&D tax incentive depends on the specific firm characteristics

and the tax system it is embedded in. Firstly, the main reason for not undertaking R&D is lack of liquidity. Thus, a tax incentive should raise the cash flow in the period when R&D is undertaken by reducing the tax due in the specific period. Secondly, limitations of R&D tax incentives, such as maximum tax credit or allowances, have different effects depending on the firm's size. Thirdly, the firm specific structure of expenditures and R&D intensity are decisive in terms of to what extent the tax incentive can be used within a period. Conservative economists and policy makers prefer tax incentives based on the belief that tax policy is market neutral, in contrast to direct funding which targets particular technologies or phases of the R&D cycle (Tassey, 2007, p. 606).

According to their research, Stojčić, Hashi and Telhaj (2011) consider that in the short run firms try to improve their efficiency through the better use of the existing resources; in the long run, investment in innovation activities is the main source of such improvements. Finally, they should be acknowledged for three important findings (2011, p. 30). First, competitiveness is a dynamic phenomenon which is closely related to innovation activities which facilitate strategic restructuring. Second, the behaviour of firms in Central and Eastern European countries is still based on the same foundations as in earlier years of transition, they resemble many characteristics of price-competitive firms; in that respect, their findings are in line with the earlier transition literature. Finally, the behaviour of Croatian firms does not significantly differ from the behaviour of firms in other Central and Eastern European countries, suggesting that Croatian firms are able to catch up with the former group in the advanced stage of transition. Hashi and Stojčić (2013, p. 364) found that in the process of making decisions firms rely on knowledge accumulated from previously abandoned innovations and use resources from other members of their group or their associates and collaborators. Also, among the sources of information on innovation they found evidence of significance for internal, institutional and market sources of information in the investment stage of the innovation process.

3. TAX INCENTIVES FOR RESEARCH AND DEVELOPMENT (R&D)

Tax treatment of R&D is often quite complex and substantially across jurisdictions (McKenzie, 2008, p. 565). Research and development activity has a key role for further development of an enterprise. Development of this activity results in innovations that are crucial in achieving higher competitiveness and employment growth in an enterprise. There is a large variety in the design of R&D tax incentives in the form of reductions in the taxable base, tax credits or reduced tax rates. These measures lead to different incentives for a firm, depending on the specific economic situation in the firm and its specific characteristics (Elschner et. al., 2011, p. 234). There are three principal policy instruments for the promotion of innovative activities (European Commission, 2002, p. 8):

1. Exploitation of public research and support to the Science and Industry infrastructure: public authorities seek to assist firms without giving them funds for innovation activities.
2. Direct government funding for business-performed innovator, especially through grants, loans, subsidies and etc.
3. Fiscal incentives or tax relief measures which encourage firms to carry out innovation activities by reducing their cost.

Direct state financing and tax reliefs within income tax are the most significant instruments. Tax incentives to encourage R&D development in Austria and Croatia have been included within income tax. The OECD Frascati Manual (2002, p. 30) defines R&D as a creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications (OECD, 2002, p. 30). Increasing R&D spending can help boost total factor productivity growth. This is one reason why the government gives high priority to such spending. There are several reasons why countries encourage investments in business sector for research and development (OECD, 2010, p.1):

1. R&D is seen as a crucial investment for the long-run growth of economies
2. Maintaining jobs, especially in times of crisis
3. Contribution to national competitiveness
4. R&D investment is risky. It is very difficult for financial institutions to judge the quality of R&D investment because of its uncertain outcome and firms' reluctance to disclose all of the relevant information.
5. R&D activity generates ″public″ goods.

R&D tax incentives in Austria and Croatia are a significant element of technology and innovation policy. Direct support, especially fiscal incentives and national and the EU grants were seen as the main positive factor for the company's innovation activities. The indirect measures like cooperation policies, loans and guarantees, and cooperation and human resource exchange policies, were seen as less positive for innovation than the direct ones (European Commission, 2012, p. 6). It is difficult to finance R&D and innovative activities in competitive market place. From the perspective of investment theory, R&D has a number of characteristics differentiating it from ordinary investment. Firstly and most importantly, fifty per cent or more of R&D spending in practice includes wages and salaries of highly educated scientists and engineers. Their efforts create an intangible asset, the firm′s knowledge base, from which profits in following years will be generated (Hall and Lerner, 2009, p. 5). Important feature of R&D investment is the degree of uncertainty associated with its output. This uncertainty tends to be greatest at the beginning of a research program or project, which implies that an optimal R&D strategy has an option-like character and should not really be analyzed in a static framework. The principal instruments of public support to R&D are direct grants and tax credits. The theoretical as well as

practical difference between subsidizing R&D by tax credits and direct grants is that the former is neutral with respect to the industry or sector and the nature of the firm. The most attractive characteristic of tax credit programs related to direct grants is the fact that tax credits minimize the discretionary decisions involved in project selection for direct government grants (Czarnitzki, Hanel and Rosa, 2011, p. 219).

3.1 Advantages and Disadvantages of Tax Incentives for R&D

Tax incentives for R&D are policy instruments used by governments in Austria and Croatia to achieve national and international targets. These tax incentives have different set of advantages and disadvantages. According to the OECD (2002, p. 9) these measures generally provide a tax credit or allowance for some portion of business R&D expenditures. By reducing the cost of R&D, fiscal measures raise the net present value of prospective research projects. Fiscal measures determine the allocation of R&D investments across sectors, firms and projects. If fiscal incentives for R&D are properly designed, they can have lower administrative costs for government agencies than other types of programmes or supports. It can also be extremely costly in terms of budget expenditures. Table 1 shows some advantages and disadvantages of tax incentives.

Table 1

Advantages and disadvantages of tax incentives

ADVANTAGES	DISADVANTAGES
- Encourage an increase of R&D across the whole spectrum of firms - Private sector can decide what is the most productive way to invest - Non-discriminatory nature in terms of research, technology fields or industrial sectors - Less risk of governmental failure in ″picking winners″ (choosing the wrong R&D projects) - Encourage companies to report their profits more accurately - Avoid misappropriation of funds and rent-seeking activities by governments civil servants - Avoid an up-front budget since support is by means of forgone tax revenues - Lower administrative costs of planning, allocation and management - Least burdensome way of increasing business R&D	- Poor budget control - Greater risk of dead weight loss - Less additionality in the case of very large companies - Risk of firms relabeling other activities as R&D - Government is not more successful than the private sector in ″picking winners″ - Private firms will choose R&D projects with the highest private rates of return - Risk that the globalization of R&D may reduce local R&D spill overs to society

Source: According to Carvalho, 2011, p.15.

Every country uses both direct and indirect support instruments to promote research and development. Economic characteristics of countries provide different advantages and disadvantages for foreign-owned firms to set up promotion of R&D activities.

According to Hutschenreiter (2002, p. 74), advantages of tax incentives over direct government aid for R&D are:

1. Tax incentives for R&D are characterised by a high degree of neutrality with respect to the firm's allocation decisions. This concerns the content and character of R&D projects.
2. Relatively low barriers to access fiscal support schemes should be of advantage for small and medium-sized firms, in particular.
3. Requirements for public support are comparatively transparent.
4. Fiscal support is predictable for firms.
5. 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.
6. In the case of indirect support instruments the government need not select either firms or technologies ″qualified for support″; they are much less affected by ″rent seeking″ than targeted direct support programmes.

Whether these measures prove to be more efficient and useful for companies depends on political aims of a country and on concrete design of the particular instrument of public support and its administration.

Advantages of instruments of fiscal support for R&D are often contrasted with their potential disadvantages vis-à-vis direct support instruments (Hutschenreiter (2002, p. 74):

1. 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.
2. There is a high degree of uncertainty with respect to the effectiveness of incentives.
3. Fiscal incentives for R&D are characterised by ″inequity″.
4. Loss of tax revenue induced by tax incentives *ceteris paribus* leads to higher tax rates or, in practice, to compensatory taxation distorting the allocation of resources.
5. 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″ induced by fiscal incentives is much less subjected to public scrutiny than direct government aid explicitly listed in the budget.

Each of the above measures has its own advantages and disadvantages. For tax incentives for R&D to be efficient, appropriate mix of measures must be

adjusted to the country's conditions. These measures mostly depend on which type of R&D activities will be encouraged. Fiscal incentives tend to stimulate applied R&D characterised by sufficiently high private returns. 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 (Hutschenreiter, 2002, p. 74).

The attention on the additionality of public support to innovation activities dates back to the standard neoclassical theory rooted in the marginalist equilibrium tradition (Colander, 2000). With this approach, innovation policy is aiming at overcoming the underinvestment in innovation activities generated by the presence of market failures, such as externalities, uncertainty, indivisibilities and increasing returns (Nelson, 1959; Arrow, 1962). Beside this input additionality focused on the amount of innovation inputs, there is also output additionality which concerns the amount of innovation outputs or outcomes that would not have been reached without the public support and behavioural additionality focused on the strategic and behavioural changes directly induced by the policy. Cerulli (2010) considers that output additionality emerges in cases where the additional R&D investment activated by the policy is higher than the subsidy received.

In the case of R&D tax incentives, it is important whether the tax revenues forgone have created additional R&D investments which otherwise wouldn't have been undertaken in the economy. This refers to the theoretical concept of additionality. In the case of Croatia, the concept of the additionality requires that for each Kuna of tax forgone by the government the firms invest more than 1 Kuna in R&D activity. In their research Aralica, Botrić and Švaljek (2011) determined that additionality in Croatia exists on the overall level. Their first obtained indicator was the ratio of additional R&D to the amount of tax incentives for the year 2009, which was approximately 0,24. The ratio of additional R&D to the taxes forgone for all the respondents was 1,19. Their conclusion was that the current measures for tax incentives for R&D in Croatia were efficient.

Streicher, Schibany and Gretzmacher (2004, p.17) found that in Austria one additional Euro of funding leads to an increase in total R&D expenditures of 1,40 Euros. Additionally, the leverage estimates for firms which perform R&D in Austria only occasionally are higher than regular R&D performers.

3.2. Methodology for Measuring Investment in R&D: B-Index

A methodology that is used to compare the relative importance of R&D tax support across tax jurisdiction is called ″B-index″. The B-index model and its theoretical framework were originally published in 1983 by the Canadian Tax Foundation. It shows the impact of a tax system on private sector decisions to

invest in R&D. B-index is calculated as the present value of before-tax income that firms need 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 is, the greater is the incentive for a firm to invest in R&D (Warda, 2001, p. 204).

The value of the B-index depends on the tax treatment of R&D in a country and is based on the before-tax income required to break-even on a $ 1 R&D outlay. The more favourable its tax treatment of R&D, the lower is a country′s B-index and the greater the amount of research that will be conducted by its corporate residents. Corporate income tax rates play an important role in determining the after-tax cost of R&D and are important to the calculation of the B-index. The higher the corporate income tax rates the lower is the after-tax cost of R&D (OECD, 1996).

The first step in calculating the B-index is to determine the present value of the after-tax cost (ATC) of a one-dollar expenditure on R&D. The next step is to determine the present value of the before-tax income required to cover the present value of a one-dollar outlay on R&D expenditures and to pay the applicable taxes.

The generic formula for the B-index is as follows (Warda, 2001, p. 204):

$$\text{B-index} = (1 - uz)/(1 - u) \quad (1)$$

Where:

$(1 - uz)$ = after-tax cost per dollar of R&D expenditure

z = present value of deductible R&D expenditures

u = corporate income tax rate

R&D expenditures are divided into current and capital expenditures. Current expenditures include wages and salaries of research personnel and the cost of materials used, while capital expenditures include cost of equipment and facilities. Capital expenditures are typically depreciated over the useful life of an asset according to two methods: declining balance or straight line (Warda, 2001, p.188). Croatian corporate income tax act uses straight line depreciation method while Austria uses declining balance method.

The formulas used for calculating the present value of the accelerated depreciation, *z*, according to each of these methods are (Warda, 2001, p. 188):

The formulas assume that assets are depreciated at the beginning of the period.

Declining balance: $z = d\,(1+r)/\,(d+r)$

Straight line: $z = 1/T\,(1- (1/(1+r))^{T})\,(1+r)/r$

Where:

d = rate of depreciation

r = discount rate or rate of interest

T = the number of years over which asset is to be written off.

However, in some countries there are special allowances on R&D expenditures that allow firms conducting R&D to deduct more from their taxable income than they actually spend on R&D. The first allows a firm spending one dollar on R&D to deduct $ (1 + w) (where w > 0) from its taxable income for the year in which the expenditure occurs. This implies a tax saving of $ (1 + w)u and an after-tax R&D cost of $ (1- (1+w)u), where *u* is the corporate income tax rate.

A second type of special allowance is based on the increase in R&D expenditures over some prior base period (this is, an incremental allowance). In this case, a firm is allowed to deduct its R&D expenditures and some fraction, w, of the increase, if any, in its R&D expenditures over a specified base period. For example, for a one-dollar expenditure that also involves a one-dollar increase over the base period, there is a tax saving of $ (1+w) u and an after tax R&D cost of $ (1-(1+w) u) (Warda, 2001, p. 189). General R&D tax allowance was 25 percent in Austria in 2002, while in Croatia there is tax allowance of 100 percent of eligible costs for development research.

4. TAX INCENTIVES FOR RESEARCH AND DEVELOPMENT IN AUSTRIA AND CROATIA AND B-INDEX

Companies invest in research and development in order to create knowledge that can be applied to develop new products, lower production, costs, or can be licensed or sold to others with the aim of maximizing profits for their shareholders (Palazzi, 2011, p. 9). In economies of these countries both direct and indirect (fiscal) support instruments are used to promote research and development. The effectiveness of a particular instrument depends on the intensity of the use. These tax incentives are important for stimulating research in small and medium-sized companies as well as larger companies. Research and development enable technological advancement, which enhances economic growth and better standard. Expenditures for research and development generate a tax shield which reduces the firms′ tax base (Ernst and Spengel, 2011, 4). In the bellow chapters this paper will discuss the extent to which both countries use tax incentives for research and development.

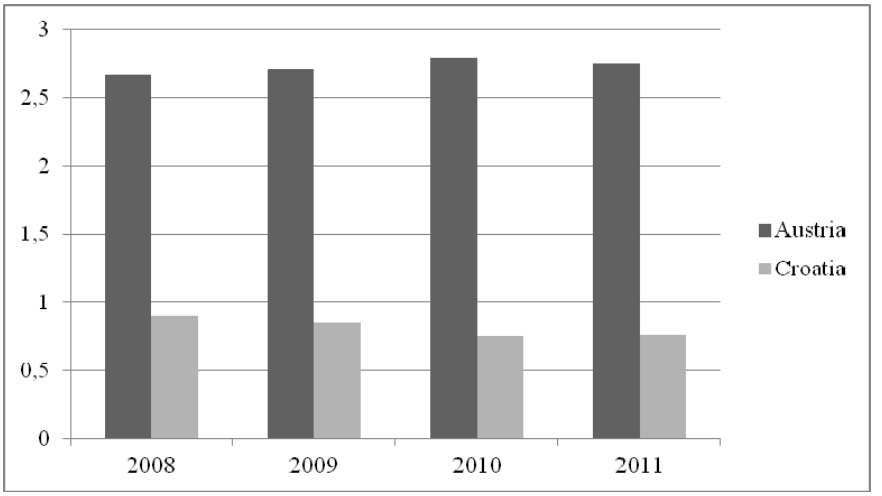
4.1 Tax Incentives for Research and Development in Both Countries

R&D tax incentives in Austria and Croatia are a significant element of technology and innovation policy. Research and development expenditures include all expenditures for R&D performed within all sectors on the national

territory during a given period, regardless of the source of funds. Figure 1 shows R&D expenditure in Austria in Croatia as % of GDP in the 2008 – 2011 period.

Figure 1

Research and development expenditure as % of GDP (2008-2011) in Austria and Croatia



Source: Research and development expenditure, Eurostat, 2013

The conclusion to be drawn from Figure 1 is that Austria has significantly higher % of GDP than Croatia. For example, in 2011 R&D expenditure as % of GDP was 28 times higher in Austria than in Croatia. The highest R&D expenditures in Austria were recorded in 2010 when they amounted to 2.79 % of total GDP, while the highest R&D expenditures in Croatia were recorded in 2008, amounting to 0.80 %. The lowest R&D expenditures as % of GDP in Austria were recorded in 2008 when they amounted to 2.67 %, while the lowest R&D expenditures in Croatia were recorded in 2010, amounting to 0.75 %. It can be concluded that R&D expenditures decreased in both countries after the economic crisis in 2008, but quick Austrian recovery also meant a significant increase of costs of investment in R&D. After the crisis, Croatia experienced a decrease of investment in R&D; however, investment in R&D has gradually increased in recent years. In line with the Europe 2020 strategy, the main objective of the European Union is to reach 3 % of investment in R&D. According to Figure 1, it can be concluded that Austria is on a very good road to meet the objective and that it puts a lot of effort into it. On the other hand, Croatia falls behind significantly.

It can be concluded that Austria, although having significantly higher R&D expenditures as % of GDP than Croatia, also has a tax incentives system for R&D that is much more complex than the one in Croatia. In Croatia, three types

of researches and their tax exemption rates can be clearly distinguished, while such distinction is not clearly clarified in Austria. Since that the economic growth is far higher in Austria than in Croatia, consequences can also be observed in R&D expenditures.

Tax incentives for research and development were not expressly stipulated in Croatian legislation until October 2003. The then Income Tax Act stipulated a possibility of accelerated or one-time only depreciation for newly purchased equipment for performance of activities, thus including the equipment for research and development projects. In 2003, the Income Tax Act stipulated incentives for the investment in research and development for the first time, thereby defining what is considered as research and what as development. Research is defined as the planned survey in order to obtain new scientific and technical knowledge. Development applies fundamental and applied research with practical experience, aiming at the creation of new technologies, processes and products. That Income Tax Act, that stipulated tax incentives for R&D, was not in line with the EU regulations on state aids so those incentives were later on used within the State Aid Act.

The Croatian State Aid Act (Official Gazette, 140/05, 49/11) established specific rules for certain types of horizontal state aids, including incentives for research and development. State aid for entrepreneurs that are obliged to pay income tax is provided through additional decrease of income tax base for costs of the projects of scientific and development researches.

State fiscal support is provided to the income tax payers through additional decrease of tax base for eligible costs of the projects of scientific and development researches as follows (IBFD Tax Research Platform 2013; Official Gazette of Republic of Croatia, 116/07):

1. 150 % of eligible costs for fundamental research
2. 125 % of eligible costs for applied research, and
3. 100 % of eligible costs for development research.

The amount of state applied and development research might be increased for (Official Gazette of Republic of Croatia, 116/07):

1. 20 % of the amount of eligible project costs for small entrepreneurs, and
2. 10 % of the amount of eligible project costs for medium entrepreneurs.

The amount of state support for studies on technical feasibility of conducting applied research can be awarded in total amount of up to 75 % of eligible costs for small and medium entrepreneurs, and up to 65 % of eligible costs for big entrepreneurs. For studies of technical feasibility of conducting development research state support may be awarded in total amount of up to 50 % of eligible costs for small and medium entrepreneurs, and up to 40 % of eligible costs for big entrepreneurs.

According to the Rule book on the state aid help for research and development projects (Official Gazette, 116/07), eligible research costs include salaries and reimbursements for employees directly participating in researches, material research costs, costs for services used during research, depreciation costs for property, facility and equipment, depreciation costs for obtained patents and licences, and general costs necessary for the conducted researches.

The total amount of state aid that beneficiary can obtain on all bases can be granted only to the amount prescribed by the Article 111(a) of the State Aid Act (Official Gazette of Republic of Croatia, 116/07):

1. for fundamental researches up to 100% of the project's eligible costs
2. for applied research up to 50% of the project's eligible costs
3. for development research up to 25% of the project's eligible costs.

Data on eligible costs of researches are recorded separately for each project and are calculated separately for each tax period.

In Austria tax treatment of R&D expenditures was introduced as early as 1980. From that time it has been continuously designed and refined. Increasing emphasis on tax instruments to promote R&D is very much in line with recent trends in other European Union member states. Since 1980 an allowance of up to 5 percent could be claimed on such expenditures. In 1985 the allowance rate rose up to 12 percent. The most important instrument of fiscal support to R&D is the R&D allowance. It was redesigned with the Tax Reform Act 2000 and the most recent reform in 2002. The definitions of qualified expenditure and the allowance rate are stated in the Income Tax Act. According to the Income Tax Act, immediate deduction as operating expenditure – expenditures for the development or improvement of „inventions valuable to the economy" qualify for the R&D allowance.

R&D allowance prior to the tax reform 2000 was characterised by the following main features (Hutschenreiter, 2002, p. 78):

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 (Hutschenreiter, 2002, p. 78):

1. The R&D tax allowance was increased to (up to) 25 percent of R&D expenditures, in general.
2. „Incremental" R&D expenditures 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.

This R&D allowance in Austria represents a combination of a „volume-based" and an „incremental" incentive. The establishment of this special incentive for incremental R&D expenditure (general R&D tax allowance of 25 percent, and 35 percent for incremental R&D expenditure) indicates the intention to give preferential treatment to new R&D firms. An invention premium of 10% of the expenses for research and development can also be claimed. The amount of expenses is limited to EUR 1 million per year. If the R&D allowance is claimed for one research project, then the invention premium cannot be claimed for other research projects. Major disadvantage of this system presents the fact that the system becomes increasingly complicated, thus causing an increase in administration and compliance costs. Cooperation between science and industry has intensified significantly in Austria over the last decade. The federal government′s objective is to make Austria a worldwide leader in technology and innovation. To do this, the internal R&D capacities of the business enterprise sector must be expanded, and the science sector must take on a stronger role as a driver of technology (Austrian Research and Technology Report, 2012, p. 123).

Example 1. illustrates calculation of the tax advantage generated by R&D allowance in both countries.

Assuming that a company realises profits before tax equal to EUR 1 million and that its R&D investment comes up to EUR 200,000. R&D expenditures are eligible for a 25 percent allowance in Austria. In Croatia, R&D expenditures are eligible for 125 % of eligible costs for applied research. The tax benefit generated by R&D allowance is calculated as follows:

The tax allowance reduces the tax base by 25 percent of the eligible EUR 200,000 R&D expenditures, i.e. by EUR 50,000 in Austria, and EUR 250,000 with 125% of eligible costs in Croatia.

The new corporate income tax base is thus EUR 1 million minus EUR 50,000 = EUR 950,000 in Austria, and EUR 1 million minus EUR 250,000 = EUR 750,000 in Croatia.

Without the R&D allowance, a company in Austria currently pays 25 percent corporate income tax on its profits, and 20 percent in Croatia, i.e. a company would pay EUR 250,000 in corporate income tax in Austria and EUR 200,000 in Croatia. By claiming the R&D allowance, a company in Austria pays only 25 percent corporate income tax on the reduced tax base of EUR 950,000, and 20 percent corporate income tax of EUR 750,000 in Croatia, i.e. a company in Austria pay only EUR 237,500, while it pays EUR 150,000 in Croatia. The R&D tax allowance thus creates a tax benefit equal to EUR 12,500 of the qualifying R&D expenditures in Austria, and EUR 50,000 in Croatia.

The conclusion to be drawn from the example is that Croatia has four times greater tax benefit than Austria. Some of the downfalls stopping foreign

investors from investing in Croatia include lack of transparency, absence of tax planning in firms, high taxpayers' expenses and weak economic growth. Austrian firms are much safer to invest in because they offer business stability and transparency to foreign investors.

4.2. B-index for Austria and Croatia

In order to calculate B-index, one first must have a thorough knowledge of the corporate income tax system of countries to be compared. Corporate profits in Austria as well as in Croatia are subject to corporate income tax. The rate of the corporate income tax is 25 % in Austria and 20 % in Croatia. The B-index model measures the relative attractiveness of R&D tax treatment in the country (in example 2, Austria and Croatia). For comparison, the model measures country B-index under uniform assumptions. These assumptions for both countries include:

1. Rate of depreciation

For Croatia were used real estate depreciation allowances of 5% and the number of years over which the asset is to be written off is 20 years.

For Austria were used real estate depreciation allowances of 3%.

2. Discount rate at 10%

Since the formula B-index = (1 – uz) / (1 – u) is known, *z* must be calculated. Croatian corporate income tax act uses straight line depreciation method while Austrian uses declining balance method.

The formulas used for calculating the present value of the accelerated depreciation, *z*, according to each of these methods are (Warda, 2001, p. 188):

The formulas assume that assets are depreciated at the beginning of the period.

Declining balance: $z = d\,(1+r)/\,(d+r)$

Straight line: $z = 1/T\,(1-\,(1/(1+r))^{T}\,)\,(1+r)/r$

Where:

d = rate of depreciation

r = discount rate or rate of interest

T = the number of years over which asset is to be written off.

z for Austria is as follows:

$z = 0{,}03\,(1+0{,}1) / (0{,}03 + 0{,}1) = 0{,}25$

z for Croatia is as follows:

$$z = 1/20\ (1- (1/1+0,05))^{20}\ )\ (1+0,05)/0,05 = 0,65$$

Now, in Austria, where *u* is corporate income tax of 25 % B-index is calculated as follows:

$$B\text{-}index_{Austria} = (1 - 0,25 \times 0,25) / (1 - 0,25) = 1,25$$

Calculation for Croatia, where *u* is corporate income tax of 20 %, is:

$$B\text{-}index_{Croatia} = (1 - 0,20 \times 0,65) / (1 - 0,20) = 1,09$$

The above example allows for the conclusion that tax treatment of R&D in Croatia is more profitable and favourable for a firm than the one in Austria. This is because B-index is lower in Croatia than in Austria. Difference between B-index in Austria and Croatia is 0.16.

The B-index methodology has multiple benefits, such as (Warda, 2001, p. 195):

1. By measuring the relative generosity of R&D tax treatment, it makes international comparison possible
2. As a synthetic measure, it allows tracking if tax trends and policy change over time.
3. The index can be applied in econometric analysis to inform policy makers.
4. It can be used as a dependent variable in analysis of tax effectiveness.
5. The index can be extended to include direct support instruments such as grants and contracts in order to produce a comprehensive picture of the overall level of generosity of government support to private sector R&D.
6. Using macro data on business-funded R&D, it can be used to estimate the value of taxes foregone due to R&D tax incentives.

The negative side of this methodology is the fact that it is limited to factors affecting corporate income taxation. It can help in generating various incentive mix scenarios and effectiveness simulations. As a synthetic measure, it allows tracking of tax trends and policy changes in each country. It also encourages better use of tax incentives and direct measures in the firm's business sector for R&D.

To conclude the above said; with the regard to B-index, Croatia have better tax incentives for research and development than Austria. The main disadvantage of Croatia is the fact that it does not invest sufficient resources into research and development, which can be seen from Figure 1. The highest R&D expenditures in Austria were recorded in 2010 when the amounted to 2.79 % of total GDP, while the highest R&D expenditures in Croatia were recorded in 2008, amounting to 0.80 % of total GDP. To encourage future discussions, the effectiveness of tax incentives for research and development in Croatia and Austria should be measured, and then, together with B-index, states in countries should be compared.

5. CONCLUSION

This paper has presented tax incentives for research and development, and calculation of B-index in Austria and Croatia. Research and development activity is an important factor when it comes to increasing economic efficiency and reaching long-term economic growth. One of the reasons why policy makers, especially in Austria, invest huge efforts to stimulate R&D expenditure and innovation activities of firms is to provide their citizens with better standard of living. R&D is a key factor in innovative performance and productivity. Tax incentives for R&D are the most prominent within corporate income tax. R&D tax incentives have an important task in the development of the firm itself. The firm development and introduction of new products in the market create firm's income. R&D influence innovation output which in turn has impact on the productivity, growth, employment or any other dimension of firm performance. Use of B-index in this paper shows that it is cheaper for foreign investor to invest in firms whose seat is in Croatia than in those whose seat is in Austria. B-index value in Croatia is 1,16 and in Austria 1,25. The more favourable its tax treatment of R&D, the lower is a country's B-index and the greater the amount of research that will be conducted by its corporate residents.

Croatia has lower corporate income tax rate than Austria, which makes it more attractive for foreign investments. Most of the downfalls stopping foreign investors from investing in Croatia include lack of transparency, absence of tax planning in firms, high taxpayer's expenses and weak economic growth. Austrian firms are much safer to invest in because they offer business stability and transparency to foreign investors. Fiscal system and entrepreneurs are the key elements that coordinate firm's functioning and allow detection of new manners of production and technologies. The system of incentives for new research activity within a firm that reduces tax base encourages new investment and employment, thus increasing profitability and competitiveness of the business itself.

The most common decisions on how to encourage the implementation and efficiency of tax incentives for R&D in Croatia and Austria mostly depend on political and economic system. Each country should encourage more investments in research and development through either direct government funding or tax incentives. Therefore, recommendation for both countries is the same: to reform fiscal support for tax incentives for R&D by adding new instruments. This new fiscal system in the area of tax incentives for R&D needs to be transparent, simple and easily understandable for all firms in Austria and Croatia. Recommendation for both countries would also be to increase R&D intensity within the business sector with a special effort paid to small and medium-sized enterprises. Consolidated knowledge of Croatia and Austria in the field of research and development would add to the accumulation of knowledge, which would, in turn, significantly influence on the increase of factor productivity and innovative processes in all economic entities. It would also influence the overall economic growth and employment. With that regard, Croatia should invest additional efforts in order to achieve Austria's investments in research and development.

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POREZNI POTICAJI ZA ISTRAŽIVANJE I RAZVOJ U AUSTRIJI I HRVATSKOJ: B-INDEKS

Sažetak

Porezni poticaji za istraživanje i razvoj predstavljaju važnu poreznu olakšicu u porezu na dobit. B-indeks pomaže otkriti razlike u utjecaju poreznog sustava na investiranje privatnog sektora u istraživanje i razvoj. Glavni cilj rada je predstaviti porezne poticaje za istraživanje i razvoj, kao i izračun B-indeksa u Austriji i Hrvatskoj. Rezultati B-indeksa pokazuju bolje postupanje s poticajima za istraživanje i razvoj u Hrvatskoj, nego u Austriji. Vrijednost B-indeksa u Hrvatskoj je 1,09, a u Austriji 1,25. Voditelji fiskalne politike moraju obratiti pozornost na ponudu poreznih poticaja, koji su dovoljno stimulativni kako tvrtke ne bi izgubile zanimanje za njih. U suprotnom, država bi imala samo kratkoročni prihod u proračunu. Kako bi se povećao državni proračun važno je osigurati dovoljnu količinu prihoda od poreza na dobit.

Ključne riječi: porez na dobit, porezni poticaji za istraživanje i razvoj, B-indeks, porezni izdaci

JEL klasifikacija: H25, O32, O38, O4