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BRIEF REPORT ON DIRECT AND TAX INCENTIVES FOR R&D INVESTMENT IN SPAIN (*)

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I. INTRODUCTION

Technology policy underwent important changes in the 1990s derived from the approval of the so called Science Act in 1986. However, although R&D expenditure increased considerably with respect to GDP from the mid-1980s to the mid-1990s, there was a noticeable deceleration in the second half of the last decade, which was then reversed in 2000. Nevertheless, the gap between the Spanish economy and the other developed economies in terms of R&D spending is still considerable: approximately one percentage point of GDP. The second issue which must be highlighted is the relative weight of business R&D expenditure in relation to total R&D expenditure. Thus, half of Spanish R&D expenditure is corporate, whereas this percentage is about 65% in the developed countries as a whole.

This situation suggests that the technology policy is very important in Spain and even more necessary than in other countries. One of its main objectives, which may be inferred from what has been stated, must consist of encouraging business R&D&I in a very intensive way as there has not been much effort in this respect. Another necessary objective is fostering both basic and applied research outside business, for the same reason mentioned above.

To comply with these generic objectives, Spain's technology policy has been using a basic tool: National Plans. As regards technical research and technological innovation –essentially targeted at business– political, scientific and technical aims may be found in the design of such plans, and they are compiled in the PROFIT (Programa de Fomento de la Investigación Tecnológica) programme for the promotion of technological research.

The implementation of technology policy has historically been associated with the more intensive use of direct aid, basically subsidies. However tax incentives have been increasingly used in recent years, especially during the last decade, and Spain is currently the OECD country granting the highest tax relief per R&D dollar invested by large firms.

This survey is presented as follows: Section I describes Spanish direct R&D&I incentives. Section II is devoted to the description of tax incentives. We concentrate on three aspects. Firstly, the design of incentives is analysed. Secondly, differences between the different territories in relation to the design and implementation of those incentives are presented. Thirdly, we review the empirical evidence in respect of these fiscal tools. Finally, there is a section on conclusions and recommendations.

II. DIRECT INCENTIVES FOR RESEARCH, DEVELOPMENT AND INNOVATION IN SPAIN

Technology policy is developed mainly through the following financial instruments:

— Total or partial subsidies.

— Subsidies combined with credit.

— Repayable soft loans.(alternatives: reimbursable, refundable).

— Credit guarantee (in order to cover the technical risk associated with commercial credit provided by financial entities for R&D&I activities).

— Equity holding (seed capital) to encourage the establishment of new technology-based enterprises.

— Matched funds, in order to strengthen technology-based enterprises.

The application of these financial tools to the different forms of participation in the R&D&I National Plans is summarised in Table I.

TABLE I

FINANCIAL TOOLS USED IN THE NATIONAL R&D&I PLAN

Segmento especifico	Human resources	Equipment	R&D and innovation projects	Innovation and technology transfer	Special actions
Subsidy	√	√	√	√	√
Subsidy + credit	√	√	√	√	
Repayable loan		√	√	√	
Credit guarantee				√	
Equity holding				√	
Matched funds				√	

Source: CICYT.

As regards the instruments that are used to finance most technological and R&D&I activities, it must be emphasised that the main tool consists of direct subsidies which, in many cases, do not require a guarantee as they are granted to public institutions or private non-profit institutions –research institutions, foundations, etc.–

"Function 54" comprises the range of budgetary programmes containing allocations to finance science and technology policy. In 2000, more than 3000 million euros were allocated to finance actions under national technology policy. In 2000, budgetary programmes, functions and resources were transferred to the newly-created Ministry of Science and Technology (MST). This Ministry concentrates 85% of the public resources assigned to R&D. The remaining 15% is in the hands of the Ministries of Defence (MD), Health and Consumer Affairs (MHC) and Education, Culture and Sports (MECS). Table II provides a summary of funded activities, the institutions financing them –mainly the Ministry of Science and Technology– and the kind of instrument used.

TABLE II

ACTIVITIES AND TOOLS SUPPORTING R&D&I

Class of activity that is supported	Financing institution	Tool
I. R&D Projects		
National Programmes and PROFIT	MST-DGR	Subsidies up to 100% of the project cost
R&D actions in the health and biomedicine fields	MHC-ISCIII	Subsidies up to 100% of the project cost
Actions in the agricultural and food fields	MST-NIAR	Subsidies up to 100% of the project cost
II. Enhancing Human Resources		
– FPI (Training of Research Staff) Scholarships – Assigning doctors and technologists to technology enterprises and centres – Hiring support staff – Mobility of teaching staff – National awards	MST-DGR DGU-MECD	– Pre and post-doctoral scholarships – Contracts and reductions in employer social security contributions
Agricultural and food	MST-NIAR	Hiring researchers and providing scholarships
Biomedicine	MHC-ISCIII	
III. Other activities to foster R&D		
– Transfer of research results – Special actions – Support to scientific centres – Dissemination of research results – Natural resources	MST-DGR MHC-ISCIII	Subsidies up to 100% and preferential funding

Notes: DGR: Directorate General for Research. ISCIII: Instituto de Salud Carlos III (Health Institute Carlos III). NIAR: National Institute for Agriculture Research. DGU: Directorate General for Universities.

The Centre for Technological and Industrial Development (CTID), an agency of the MST, is devoted to financing different kinds of projects, programmes and activities regarding R&D&I carried out by enterprises. Its activities concentrate on financing R&D&I, supporting the creation of new technology-based companies (NEOTEC), space programmes, EU Framework programmes and EUREKA and IBEROEKA programmes, on R&D&I internationalisation and on the support for the creation of new technological-based enterprises and on the support for large facilities. We summarise CTID's activities in Table III:

TABLE III

ACTIVITIES CARRIED OUT BY THE CENTRE FOR TECHNOLOGICAL AND INDUSTRIAL DEVELOPMENT (CTID)

<table>
<tr><th colspan="6">Financing R&D&I (with Soft Credits)</th></tr>
<tr><th></th><th colspan="2">Interest rate (%)</th><th>Term (years)</th><th colspan="2">Credit as a Percentage of the Budget (%)</th></tr>
<tr><td>Technological Development Projects</td><td colspan="2">0</td><td>5</td><td colspan="2">50</td></tr>
<tr><td>Technological Innovation Projects</td><td colspan="2">0</td><td>5</td><td colspan="2">25</td></tr>
<tr><td>Projects Associated with International Programmes</td><td colspan="2">0</td><td>8</td><td colspan="2">35-60</td></tr>
<tr><td>Agreed Industrial Research Projects</td><td colspan="2">0</td><td>6-8</td><td colspan="2">60</td></tr>
<tr><td>Bank Financing Line CTID-ICO</td><td colspan="2">Euribor less 0.82</td><td>5-7</td><td colspan="2">70</td></tr>
<tr><th colspan="6">EU Framework Programme (3,000 - 18,000 Euros)</th></tr>
<tr><th>Maximum Reimbursable Aid (in Thousand Euros)</th><th colspan="3">Participation of the Spanish enterprise in the budget of the proposal</th><th colspan="2">Total Budget of the Proposal</th></tr>
<tr><td>12</td><td colspan="3" rowspan="2">≤ 25%</td><td colspan="2" rowspan="2">≤ 3</td></tr>
<tr><td>9</td></tr>
<tr><td>9</td><td colspan="3" rowspan="2">≤ 25%</td><td colspan="2" rowspan="2">≤ 3</td></tr>
<tr><td>From 3 to 6</td></tr>
<tr><td>6</td><td colspan="5">For additional leadership</td></tr>
<tr><th colspan="6">EUREKA (Subsidy)</th></tr>
<tr><th>General Requirements</th><th colspan="2">Definition phase</th><th colspan="3">Development phase</th></tr>
<tr><td>Government contribution must not exceed 70% of total budget</td><td colspan="2">Up to 75% of the subsidy granted through PROFIT</td><td colspan="3">Up to 60% financed with credits from the CTID to be reimbursed within 8 years and up to 25% (35% if they are SME's) through subsidies from PROFIT</td></tr>
<tr><th colspan="6">IBEROEKA (Preferential credit)</th></tr>
<tr><th>Interest Rate</th><th colspan="2">Repayment period (Years)</th><th colspan="3">% of budget eligible(alternative: liable to be financed)</th></tr>
<tr><td>0</td><td colspan="2">8</td><td colspan="3">60%</td></tr>
<tr><th colspan="6">Internationalisation of Research, Development and Innovation (preferential credit and information support)</th></tr>
<tr><th>Interest Rate</th><th colspan="2">% of Expenditure eligible</th><th colspan="3">Information</th></tr>
<tr><td>0</td><td colspan="2">60</td><td colspan="3">– International network of the CTID and Catalogue of technologies being promoted internationally</td></tr>
<tr><th colspan="6">Large Facilities (European Organisation for Nuclear Research and European Synchrotron Radiation Facility) (Soft Credits)</th></tr>
<tr><th>Liable to be Financed</th><th>Interest Rate</th><th colspan="2">Refundable</th><th colspan="2">Amount Which May be Financed</th></tr>
<tr><td>Preparation of supply bids to the EONR and ESRF with a budget of more than 120.000 euros</td><td>0</td><td colspan="2">Only if the enterprise signs a contract with those entities</td><td colspan="2">3,000 - 18,000 euros</td></tr>
</table>

It is worth highlighting that the Autonomous Communities have technological innovation plans of a regional scope and also support regional research, development and innovation plans, unilaterally or jointly with the State Administration or with the EU programmes. The financial instruments which are used are generally similar to those described above, and there are many alternatives. Perhaps the most noteworthy feature in this connection is the development of regional risk-capital companies.

III. TAX INCENTIVES FOR R&D INVESTMENT IN SPAIN

The description of existing tax incentives to invest on R&D in Spain requires that we consider two dimensions: the territorial scope and the calendar. In terms of territorial scope, the tax regime in Spain is not uniform in all Autonomous Communities. The tax regimes are as follows:

— A tax regime for the Common Territory, which includes all of Spain except the Basque Country, Navarre and the Canary Islands.

— The Basque Country and Navarre each have a specific tax regime. Both have authority regarding corporation tax regulation and collection; in practice, this means that there are different tax incentives from the Common Territory.

— The Economic and Tax Regime of the Canary Islands. This region has a particular regime on grounds of its insularity.

From a time perspective, it is interesting to review the development of tax incentives, particularly under the tax regime in force in the Common Territory, where matters have improved in recent years (see below).

The design of a tax credit for R&D investment under the Tax Regime in force in the Common Territory

As shown in Table IV, until 1992, the R&D investment tax credit was implemented as a single percentage on the total amount of investment. Since 1993, the tax incentive is in two tiers. Nowadays, a h percentage is set for investment B_t in fiscal year t as regards operating expenses. In addition, a h^* percentage is fixed for investment B_t^* over the average investment in the last two fiscal years. So, the tax saving obtained due to the investment credit $\hat{h}$ may be defined as follows:

$$\hat{h} = B_t h + \theta B_t^* h^* \qquad [1]$$

And:

$$B_t^* = B_t - \frac{1}{2}\sum_{i=1}^{2} B_{t-i} \qquad [2]$$

With the following restrictions:

$$\theta \begin{cases} \theta = 0 & \text{si} \quad B_t^* \leq 0 \\ \theta = 1 & \text{si} \quad B_t^* > 0 \end{cases} \qquad [3]$$

The average saving per additional unit of R&D investment is given by the following expression:

$$\bar{h} = \frac{1}{B_t + B_t^*}\left[hB_t + h^* B_t^*\right] \qquad [4]$$

The use of a percentage $h^* > h$ for an investment exceeding the average investment of the two previous tax years is intended to foster sustainable growth in this kind of investment. Accordingly, percentages h and h^* are 30% and 50%, respectively, of current expenditure in fiscal year 2002.

Nonetheless, the law does not consider the incremental base for tangible fixed assets and intangible assets allocated to R&D or for research personnel expenses, since it allows only 10% tax credit on these expenses.

Outlook for tax treatment of R&D investment in the Common Territory

The R&D investment tax credit has been maintained in the structure of the corporation tax since 1978 (Act 61/1978). During this period it has undergone a number of amendments, including the 1995 tax reform (Act 48/1995). R&D investment by enterprises without a legal personality which are liable to personal income tax benefits from the tax treatment provided under corporation tax.

A retrospective analysis of the structure of the tax credit enables us to identify several characteristics in its legal development. Firstly, we observe that there has been a large number of changes in response to circumstances. This has given rise to a lack of co-ordination in the regulation of these incentives[1] during some taxable years. Finally, legal changes have in general tended to enhance the incentivating power of this fiscal tool supporting investment, as shown in the legal review provided in Table III. A review of how R&D investment has been treated in corporation tax since 1979 allows us to identify the following phases:

1st phase: 1979-1982. Tax credit applicable to total R&D expenditure –new products or industrial procedures– without no distinction between current expenses and investment. The percentages and tax deduction limits were 10% and 20% respectively (25% in 1982). The credit could be carried forward for two years if there had been a null tax liability.

2nd phase: 1983-1992. In 1983 the tax relief rate was raised to 15%. In addition a technological innovation incentive was introduced (not compatible with the existing one), with 15% tax relief for intangible expenditure and 30% relief for the purchase of fixed assets[2]. Both incentives were unified in 1992. The maximum tax relief fluctuated during the period, from 20% in the earlier years to 25% in the final years. It must be highlighted that, in 1992, the aforementioned limit was established for all tax relief obtained by a company. The carry-forward period was changed to 4 years in 1984 and 5 years in 1988.

3rd phase: 1993-1995. The kind of tax credit applicable depended on whether it was for intangible expenditure or fixed assets. For the former, the rate was 15%, or 30% if the expenditure exceeded the average of the last two fiscal years. For the latter, the percentage was 30% and 45%, respectively. The carry-forward period when there had been a null tax liability was 5 years. The tax credit/tax liability ratio increased from 25% in 1993 to 35% in 1995.

4th phase: 1996-1999. The regulations made no distinction between expenditure on intangibles and fixed assets, so that the percentage tax credit rate was established on total expenditure. There were no distinction as to percentage rates, so the general tax relief was 20%, or 40% on the

[1] For example, between 1983 and 1998, there was a tax incentive for new products or procedures and another for technological innovation. There was a degree of overlap between the two, although the subsidies for technological innovation were more favourable.

[2] Albi y Ariznavarreta, 1990, page 410.

amount exceeding the average expenditure of the last two years. The carry-forward period changed from 5 to 10 years and the value of the tax credit cap remained at 35% of the tax liability(alternative: en lugar de decir “credit cap” the tax credit/tax liability ratio did not change) since 1995.

5th phase: 2000-2002. The computation base is still total R&D expenditure. The percentage rate is 30%, and 50% on the expenditure in excess of the average expenditure in the last two years. In addition, 10% tax relief was introduced for the expenses of qualified personnel assigned to research. An additional tax deduction is introduced for intangible and tangible fixed assets, buildings and land being excluded. The carry-forward period is maintained at 10 years.[3]

TABLE IV

R&D INVESTMENT TAX INCENTIVES IN THE PERIOD 1979-2002
TAX REGIME IN THE COMMON TERRITORY

Year	R&D Investment Tax Credit within the Corporation Tax			Other Tax Measures In force in the Corporation Tax
	Tax Relief Percentage Rates	Carry forward Period Due to a Null Tax Liability	Maximum Tax Credit as a Percentage of Tax Liability	
1979	⇒ New Products or Procedures: 10% on R&D Expenditure	2 Subsequent Tax Years	20%	NO
1980	⇒ New Products or Procedures: 10% on R&D Expenditure	2 Subsequent Tax Years	20%	NO
1981	⇒ New Products or Procedures: 10% on R&D Expenditure	2 Subsequent Tax Years	20%	NO
1982	⇒ New Products or Procedures: 15% on R&D Expenditure	2 Subsequent Tax Years	25%	NO
1983	⇒ New Products or Procedures: 10% on R&D Expenditure ⇒ Technological Innovation: 15% on Intangible Expenditure 30% on Fixed Assets Expenditure	2 Subsequent Tax Years	20%	⇒ Technological Innovation: Sinking Instalment Chosen by the Enterprise: i) 5 Years for Investment: – Machinery and Capital Goods – Intangibles ii) 7 Years for Buildings
1984	⇒ New Products or Procedures: 15% on R&D Expenditure ⇒ Technological Innovation: 15% on Intangible Expenditure 30% on Fixed Assets Expenditure	4 Subsequent Tax Years	25%	NO
1985	⇒ New Products or Procedures: 15% on R&D Expenditure ⇒ Technological Innovation: 15% on Intangible Expenditure 30% on Fixed Assets Expenditure	4 Subsequent Tax Years	25%	NO
1986	⇒ New Products or Procedures: 15% on R&D Expenditure ⇒ Technological Innovation: 15% on Intangible Expenditure 30% on Fixed Assets Expenditure	4 Subsequent Tax Years	25%	NO
1987	⇒ New Products or Procedures: 15% on R&D Expenditure ⇒ Technological Innovation: 15% on Intangible Expenditure 30% on Fixed Assets Expenditure	4 Subsequent Tax Years	25%	NO

(*Sigue*)

[3] Since fiscal year 2000, a technological-innovation tax deduction different from the R&D tax deduction may be included. This new tax deduction will depend on the kind of expenditure.

(*Continuación*)

Year	R&D Investment Tax Credit within the Corporation Tax			Other Tax Measures In force in the Corporation Tax
	Tax Relief Percentage Rates	**Carry forward Period Due to a Null Tax Liability**	**Maximum Tax Credit as a Percentage of Tax Liability**	
1988	⇒ New Products or Procedures: 10% on R&D Expenditure ⇒ Technological Innovation: 15% on Intangible Expenditure 30% on Fixed Assets Expenditure	5 Subsequent Tax Years	20%	NO
1989	15% on Intangible Expenditure 30% on Fixed Assets Expenditure	5 Subsequent Tax Years	20%	NO
1990	15% on Intangible Expenditure 30% on Fixed Assets Expenditure	5 Subsequent Tax Years	25%	NO
1991	15% on Intangible Expenditure 30% on Fixed Assets Expenditure	5 Subsequent Tax Years	25%	NO
1992	15% on Intangible Expenditure 30% on Fixed Assets Expenditure	5 Subsequent Tax Years	25%	NO
1993	⇒ Σ R&D Expenditure < Average Expenditure of the Last Two Years ⇒ 15% on Intangibles - 30% on Fixed Assets ⇒ Expenditure Amount Exceeding the Average Expenditure of the Last Two Years: 30 % on Intangibles - 45% on Fixed Assets	5 Subsequent Tax Years	25%	NO
1994	⇒ Σ R&D Expenditure < Average Expenditure of the Last Two Years ⇒ 15% on Intangibles - 30% on Fixed Assets ⇒ Expenditure Amount Exceeding the Average Expenditure of the Last Two Years: 30 % on Intangibles - 45% on Fixed Assets	5 Subsequent Tax Years	25%	NO
1995	⇒ Σ R&D Expenditure < Average Expenditure of the Last Two Years ⇒ 15% on Intangibles - 30% on Fixed Assets ⇒ Expenditure Amount Exceeding the Average Expenditure of the Last Two Years: 30 % on Intangibles - 45% on Fixed Assets	5 Subsequent Tax Years	35%	NO
1996	⇒ 20% on Total Expenditure ⇒ Expenditure Amount Exceeding the Average Expenditure of the Las two years: 40%	5 Subsequent Tax Years	35%	NO
1997	⇒ 20% on Total Expenditure ⇒ Expenditure Amount Exceeding the Average Expenditure of the Las two years: 40%	5 Subsequent Tax Years	35%	NO
1998	⇒ 20% on Total Expenditure ⇒ Expenditure Amount Exceeding the Average Expenditure of the Las two years: 40%	5 Subsequent Tax Years	35%	NO

(*Sigue*)

(*Continuación*)

Year	R&D Investment Tax Credit within the Corporation Tax			Other Tax Measures In force in the Corporation Tax
	Tax Relief Percentage Rates	**Carry forward Period Due to a Null Tax Liability**	**Maximum Tax Credit as a Percentage of Tax Liability**	
1999	⇒ 20% on Total Expenditure ⇒ Expenditure Amount Exceeding the Average Expenditure of the Las two years: 40%	5 Subsequent Tax Years	35%	NO
2000	⇒ 30% on Expenditure and 50% on the Expenditure Amount Exceeding the Average Expenditure of the Last Two Years ⇒ In Addition another 10% on Staff Expenditure, Project Expenditure Paid to Research Institutions	10 Subsequent Tax Years	35% - 45%	NO
2001	⇒ 30% on Expenditure and 50% on the Expenditure Amount Exceeding the Average Expenditure of the Last Two Years ⇒ In Addition another 10% on Staff Expenditure, Project Expenditure Paid to Research Institutions	10 Subsequent Tax Years	35% - 45%	NO
2002	⇒ 30% on Expenditure and 50% on the Expenditure Amount Exceeding the Average Expenditure of the Last Two Years ⇒ 10% on Intangible and Tangible Fixed Assets, Buildings and Land Excluded ⇒ In Addition another 10% on Staff Expenditure, Project Expenditure Paid to Research Institutions	10 Subsequent Tax Years	35% - 45%	NO

Source: table designed by the authors.

The design of R&D tax credit in the Canary Islands, the Basque Country and Navarre

R&D investment in the Canary Islands is treated in a similar way to that under the Tax Regime in the Common Territory, except in relation to the level of deduction rates and the maximum tax credit as shown in Table V. In both cases percentages will be 80% higher than those in force in the Common territory.

The Foral regulations for corporation tax in the Foral Territory of the Basque country treat tax relief for R&D activities in a very similar way to the existing one in the Tax Regime in force in the Common Territory[4], both in terms of the structure and the definition of this class of activities. Thus, tax deduction is set at 30% on R&D expenditure and 50% on expenditures exceeding the average of the two last fiscal years. In addition, 10% tax deduction is accepted for the purchase of intangible and tangible assets assigned to R&D activities and 10% tax deduction for personnel expenditure and project contracts with research entities.

Finally, such incentives in the Foral Territory of Navarre accept 30% tax deduction for all this kind of expenditure including the purchase of capital goods and current expenditure. In contrast to the situation in the Foral territory of the Basque country, there is not a higher tax credit percentage rate which could reward the investment effort compared to the average investment of the previous fiscal years.

[4] The Canarian special regime and the Foral regulations of the Basque Country consider an investment reserve but the former requires that such funds be assigned to the development of an economic enterprise.

TABLE V

R&D INVESTMENT TAX INCENTIVES IN THE FORAL TERRITORIES OF THE BASQUE COUNTRY AND NAVARRE AND IN THE CANARY ISLANDS

Territory	R&D Investment Tax Credit on Corporation Tax			Other measures in force in the Corporation Tax
	Tax Deduction Percentage	Carry-forward period Due to a Null Tax Liability	Maximum Tax Credit as a Percentage of Tax Liability	
Canary Islands	**R&D Activities** 80% Higher than those under the Tax Regime in force in the Common Territory (the minimum difference being 20% between both tax regimes)	The same as under the Tax Regime in force in the Common Territory	80% higher than those in the Tax Regime in force in the Common Territory, with a minimum difference of 35 per cent	NO
Basque Country	**R&D Activities** ⇒ 30 % of expenditure and 50% on the expenditure amount exceeding the average expenditure of the last two years ⇒ 10% of tangible fixed assets and intangible asset, buildings and land being excluded ⇒ In addition, 10% tax deduction from personnel expenses and projects expenses paid to research entities	15 subsequent tax years	45%	Compatible with accelerate depreciation and free choice for applying (alt: depreciation free choice when fixing number and calendar of repayment periods)
Navarre	**R&D Activities** ⇒ 30 % of expenditure new fixed assets and current expenses	5 subsequent tax years	35%	NO

The effectiveness of tax incentives for R&D investment: an international comparison

Business investment on research and development is intended to achieve improvements in the production process either as cost decreases or improved quality. This type of investment is endowed with the characteristics of a public good, which produces externalities with a social rate of return higher than the private one obtained by businesses that develop projects. These facts, together with their effects of a microeconomic nature (such as quality of goods, competitiveness) or macroeconomic (such as economic growth, comparative advantages, etc.) have helped foster this kind of activity by different tools. Thus, basic science is encouraged mainly through the direct participation of the government in research projects, while business R & D expenditure is stimulated by tax incentives or direct grants (subsidies) according to a market point of view (González et al, 1999).

Analysis of the effectiveness of tax incentives for R & D has generally been undertaken using neo-classical models. Romero (2001) and López and Romero (2001) have recently carried out a wide revision on the international background of investment, on fixed assets and on R&D.

Studies have shown quite contradictory results as far as elasticities are concerned. Some authors such as Eisner et al (1984), Bernstein and Nadiri (1989) find that price elasticities take on low values for the US and Nadiri obtains the same results for Canada. On the contrary, Mamuneas and Nadiri (1996) find elasticities close to one for the period 1956-1988 in the US while Hines (1991) finds elasticities between 1.2 and 1.6 in the period 1984-1989. In line with these results Bloom et al (1997) find there are large differences in capital cost among OECD members for the period 1979-1994, elasticities fluctuating between 0.6 in the short term and 1.1 in the long term.

We must emphasise some important aspects in relation to the results mentioned above. In the first place, differences in the value of elasticities may result from including total business-

financed R & D expenditure, as in Hines (1991) and Mamuneas and Nadiri (1996). In the second place, tax incentives favour investment through cost decreases in purchased goods and services, bearing in mind that such tax incentives are responsible for cost decreases and that those goods and services are bought for this reason. However, the incentive effects could be reduced if some of the fiscal benefits were transferred, through a price increase, from buyers to sellers or to the entities financing business investment projects. Empirical analysis on this issue has provided conflicting results. For instance, Goolsbee (1997) has estimated that a 10% tax credit will rise the price of investment goods from 3.5% to 7.0% in the US; conversely, results obtained by Hasset and Hubbard (1998) suggest that tax incentives have a very slight effect on capital goods. In the third place, in empirical work building the price of capital goods is determined using nominal values whereas real values are seldom taken so that actual fiscal situations specifically faced by the company are not considered. This undoubtedly gives rise to more or less important biases regarding the value of elasticities obtained.

Available evidence from surveys or investment models, highlights some characteristics worth while emphasising:

Firstly, it does not seem that investment incentives for R & D, as well as for physical capital will stabilise long term investment; on the contrary, they could help bring forward the investment period (Mansfield, 1985 for the US; Mansfield and Suitzer, 1985 for Canada). In other words, time planning in investment could be altered because of fiscal requisites, which will mean a loss of tax neutrality. Secondly, it seems that the decrease in –or removal of– incentives could reduce the quality of projects but would not necessary lead to their abandonment (Mansfield, 1985 and Swenson, 1992 for the US, Mansfield and Suitzer, 1985 for Canada). This would imply that incentives do not basically change decisions on R & D investment made by those companies which normally make this kind of investment because of the activities they carry out and the sector where they operate. This result is in line with the studies of Eisner et al (1984) for the US and Romero (2000) for Spain, where a high concentration of beneficiaries of this kind of expenditure and incentives is observed. However, we know very little of how the removal or reduction of tax incentives affects companies which occasionally make R & D investments, particularly those which need a greater encouragement to implement this class of activities, such as small and medium-sized and newly-created companies. Nevertheless, tax incentives help at the margin companies usually investing to undertake more challenging research projects. These incentives provide additional resources needed to reach a minimum profitability threshold, below which the quality of the project is not sufficient for marginal profits to cover expenditures required for these activities. Finally, there is an evidence showing that physical capital and R & D are highly substitutive at least when dealing with companies which are low-intensive in R & D expenditures (Mamuneas and Nadiri, 1996).

In other words, tax incentives on physical capital may give rise to important side effects on R & D expenditures. However, price cross- elasticities computed by Mamuneas and Nadiri (1996) show that a price change in the R & D expenditure financed by business affects physical capital relatively less than effects of prices changes in fixed assets on R & D expenditure .

Results from cost-benefit analyses, as well as the literature reviewed above, show that elasticities are very wide-ranging. For instance, Hall (1992) obtains a value of 2.0 for the 80's in comparison with 0.95 computed by Mamuneas and Nadiri (1996) for the period 1956-1988 for the same country: the US. Using this method different cross-country comparisons have been made, for example, Mansfield (1986) obtains values ranging from 0.3 to 0.4 for Canada, Sweden and US. These results are lower than the value of approximately 0.8 obtained by Bernstein for Canada and the ones mentioned above for the US. McFetridge and Warda design an index for determining a minimum cost-benefit value below which it is not advisable to undertake investment projects on R & D. In this international comparison the country which offers the best tax treatment to investment is Singapore, followed by Canada, Spain and the US whereas Brazil, Norway and Germany are ranked worst.

Finally, it must noted that this kind of studies has not attract much attention in Spain, most studies being referred to investment on fixed assets (Romero, 2001; López and Romero, 2001). Nevertheless, the Spanish Institute for Fiscal Studies is presently developing several lines of research associated with the effectiveness of tax incentives in relation to R&D investment, with the role of financial variables when financing R&D investment and with the effects of this kind of expenditure on productivity.

FINAL CONCLUSIONS AND RECOMENDATIONS

This survey shows the main current mechanisms for supporting R&D investment in Spain: on one hand, direct aid granted through the National R&D&I Plan (for research, development and innovation) and on the other, tax incentives included in corporation tax.

Tax incentives included in the structure of corporation tax basically focus on tax credit. This tool has some specific characteristics in the Spanish case. Firstly, the fact that there are several tax regimes (the Common Territory, the Foral Territory of the Basque Country, the Foral Territory of Navarre and the Fiscal and Economic Regime of the Canary Islands) introduces differential territorial tax treatments for this kind of investment. Secondly, in all these territories but Navarre, an incremental base is used when dealing with R&D expenditure. This involves the existence of two tax deduction percentage rates, one for investment expenditure lower than the average of the two previous fiscal years and another higher percentage rate for investment expenditure exceeding the average.

The design of R&D tax credit must consider that fiscal saving obtained through tax credit requires previous investment. Evidence suggests that this design is not the most adequate for several reasons. Some characteristics of specific companies –i.e. small size, being newly created or forming part of a high-technology sector- increase the degree of financial restrictions and the possibilities of obtaining adequate financing –in terms of amount, terms and instalments– for this type of project (a review for the Spanish case may be found in Romero (2001)). Therefore, tax credit plays a secondary role in enterprises subject to different degrees of financial restriction (Romero, 2001; Romero and Ruiz-Huerta, 2002). Another way to ease the issue of asymmetric information is to establish an investment reserve. Thus, enterprises allocate a percentage of their tax-free profits to a fund earmarked for R&D. Such measures are currently applied when dealing with investment on fixed assets under the Economic and Fiscal Regime of the Canary Islands.

REFERENCES

ALBI, E., y ARIZNAVARRETA, J. L. (varios años), *Sistema Fiscal Español*, Madrid: Editorial Ariel.

BERNSTEIN, J. I., y NADIRI, M. .I. (1989), "Rates of return on phisycal and R&D capital and Structure of production process", en RAJ, B., (ed.), *Advances in Econometric and modelling*, Dordrecht, The Netherlands: Kluwer Academic Press, 169-187.

BLOOM, N.; CHENNELS, L.; GRIFFITH, R., y VAN REENEN, J. (1997), "How has tax affected the changin cost of R&D? Evidence from eight countries", *Institute for Fiscal Studies Working Paper*, 97/3.

EISNER, R.; ALBERT, S., y SULLIVAN, M. (1984), "The New Incremental Tax Credit for R&D: Incentive or Desicentive", *National Tax Journal*, 37, 171-183.

GOOLSBEE, A. (1997), "Investment Tax Incentives, Prices, and the Supply of Capital Goods", *Quaterly Journal of Economics*, 1 , 121-148.

HALL, B. H. (1992), "R&D Tax Policy During the Eighties: Sucess of Failure", *Paper prepared for the NBER Tax Policy Conference*, Washington.

HASSETT, K. A., y HUBBARD, R. G. (1998), "Are investment incentives blunted by changes in prices of capital goods?", *NBER Working Paper*, núm. 6676.

HINES, J. R. (1991), "On the Sensitivity of R&D to Delicate Tax Changes: The Behavior of U.S. Multinationals in the 1980s", *NBER Working Paper*, núm. 3930.

LÓPEZ, D., y ROMERO, D. (2001). "Eficacia de los incentivos fiscales a la inversión: aspectos teóricos y aplicados". *Hacienda Pública Española*, Monografía 2001, 207-249.

MAMUNEAS, T. P., y NADIRI, M. I. (1996), "Public R&D Policies and Cost Behavior of the US Manufacturing Industries", *Journal of Public Economics*, 63, 57-81.

MANSFIELD, E. (1985), "Public Policy Toward Industrial Innovation: An international Study of Direct Tax Incentives for R&D", en HAYES *et al.*, (eds.), *The Uneasy Alliance: Managing the Productivity-Technology Dilemma*, Boston: Harvard Business School.

– (1986), "The R&D Tax Credit and Other Technology Policy Issues", *American Economic Review*, núm. 76 (2), pp. 190-194.

MANSFIELD, E., y SWITZER, L. (1985), "The Effects of R&D Tax Credits Allowances in Canada", *Research Policy*, núm. 14, pp. 97-107.

McFETRIDGE, D. G., y WARDA, J. P. (1983), "Canadian R&D Incentives: Their Adequacy and Impact", *Canadian Tax Paper*, núm. 70, Canadian Tax Foundation.

ROMERO, D. (2000), "El ahorro fiscal por crédito a la inversión y al empleo en el Impuesto sobre Sociedades: un análisis con microdatos tributarios de la empresa manufacturera española para el período 1991-1994", *Hacienda Pública Española*, 154, 171-207.

– (2001), *El crédito fiscal al a inversión en presencia de restricciones financieras: análisis de su impacto a partir de microdatos tributarios*, Tesis doctoral presentada en la Universidad Complutense de Madrid, publicada en la Colección *Investigaciones* del Instituto de Estudios Fiscales, núm. 3.

ROMERO, D., y RUIZ-HUERTA, J. (2001), "Crédito fiscal, costes financieros e inversión empresarial: evidencia para España con un panel de microdatos tributarios", *Hacienda Pública Española*, 158, 154-196.

SWENSON, C. W. (1992), "Some test of the incentive effects of the research and experimentation tax credit", *Journal of Public Economics*, 49, 203-218.

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