Rethinking innovation policies for development

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IS and Innovation policies

- The general theory of innovation systems can be developed by a more detailed analysis of innovation policies
- The topic is particularly important for emerging and developing countries with a shaky and reduced set of science, technology and innovation policies
- This paper addresses the issue based on the huge literature of IS, on STI policy and on the basic idea of policy complementarity that I will insert in the presentation

Why do governments implement R&D incentives?

- Market failures: due to R&D externalities (consumer and producer benefits) private companies conduct little R&D (Arrow)
- Systemic failures: knowledge producing institutions such as universities, public labs and non-profit R&D organizations may produce little new technology (Teubal)
- In order to create new industrial sectors (Saviotti & Pyka)
- Inertia in private firms' R&D (a new routine)
- Risk and uncertainty associated to R&D

How do governments promote R&D

- Horizontal policies that cut across sectors and promote R&D in many different industries such as fiscal incentives or the US SBIR Program
- Vertical policies that concentrate on one sector, such as Canada's National Biotechnology Policy (1983) or the Technology Partnerships Program (1996-2008) replaced by the Strategic Aerospace Defence Initiative (since 2009). Also through specialised public R&D labs such as the several biotechnology institutes of the Shanghai Institutes of Biological Sciences (1999) in China or the many aerospace labs China created since 1950.

How do governments promote R&D

- Fiscal deductions to R&D activities
- Fiscal credits to R&D
- Non reimbursable grants for R&D
- Reimbursable grants for R&D
- Grants to hire scientists and engineers in industry
- Fiscal deductions for venture capital
- Public venture capital
- Public-private R&D centres
- Research grants for university-industry cooperation
- Fellowships and loans to increase the supply of Human capital

How do governments promote R&D:
creating supply and demand for human capital

- Keynes wrote *The general theory of employment, interest and money* to show, among other things, that Say's law was not true: supply does not produce its own demand
- It is equally wrong, but commonly assumed, that the supply of human capital automatically produces its own market
- In fact, in all developed and emerging countries, governments implement incentives to both increase the supply and the demand for human capital

How do governments promote R&D:
creating supply and demand for human capital

Creating supply	Creating demand
Fellowships for graduate students	Incentives for business R&D
Grant-loans for undergraduates	Incentives for quality control
Skilled immigrant programs	Public R&D laboratories
University research funding councils	Joint university – industry R&D institutes
Fiscal exemptions for foreign researchers	Meritocratic hiring in government and academic positions
Accelerated immigration for foreign graduate students	Venture capital policies
Adequate pricing of higher education	Angel capital policies
“Bribing mothers” (Becker)	Non reimbursable grants to hire engineers, managers & scientists

How do governments promote R&D

- There is no optimal policy mix: each country uses its own battery of policies
- But all OECD countries and BRIC countries apply a large set of policies
- These policies are complementary and super-modular (Mohnen and Röller)
- The most innovative firms use several incentives
- Fiscal incentives are used across the board and increasingly so in most OECD countries

How do governments...fiscal incentives

- They come in two different types:
- Fiscal deductions: R&D expenditures incurred in the year are assimilated to manufacturing costs and can be deduced from net profits
- Fiscal credits: some part of R&D expenditures can be deducted from taxes on net profits. In Canada, large companies over 2 M C$ in sales can deduct up to 20% of R&D expenditures and smaller firms under Canadian control can deduct up to 35% of R&D expenditures. Some systems are based on “volume” (i.e. Canada) and others on increments to a base year (US).

Fiscal incentives versus grants

	Fiscal incentives	Direct grants and reimbursable loans
Advantages	"Level the field" for all types of firms and all sectors Allows the growth of sectors not planned Well adapted for large and medium-size firms Promotes permanent R&D centres	Easier to assess and supervise Allows the stimulus of priority sectors Best adapted to SMEs and high-risk sectors such as aerospace
Disadvantages	May not nurture key sectors such as health, environment or defence More difficult but not impossible to evaluate	May accommodate corruption or the exchange of favours between business and politicians

Advantages of fiscal incentives

- They reduce the cost of conducting R&D for the firm
- If, like in most OECD countries, there is no maximum limit to R&D eligible expenditures and are open to foreign firms, they may attract large and permanent foreign-controlled labs
- They allow the spontaneous emergence of new local firms in unplanned sectors
- They are complementary and non-rival to other incentives
- They increase fiscal revenues because R&D intensive firms have faster growth, pay more taxes and hire more high-salary scientists and engineers

Fiscal incentives are on the rise

- In the OECD, there were 12 countries with such programs, now there are over 20; also first adopters are increasing their generosity (i.e. France, UK)
- Canada started with fiscal deductions (1942), then fiscal credits for R&D (1977) and now almost all provinces have their own programs
- The US federal government implemented in 1981 their fiscal credit program and now most US states have one
- All the four BRIC countries have their own since the 1990s.
- Yet even in strong users, fiscal incentives represent less than 20% of BERD

The use of fiscal incentives

Country	Fiscal Cost (1990s) USD Million PPP	Fiscal cost 1990s as % of BERD	Fiscal cost (2005) USD Million PPP	Fiscal cost 2005 as % of BERD
USA (1999)	2393	1.6%	5110.0	2.3%
Canada (1995)	685	13.3%	2290.4	19.5%
France (1997)	376	2.7%	1009.9	4.0%
UK	NA	NA	937.3	4.3%
Netherlands (1997)	207	6.3%	419.3	7.2%
Australia (1997)	138	4.26%	355.6	4.86%
Belgium	NA	NA	355.4	8.1%
Spain	NA	NA	343.3	4.8%
Austria (2004)*	NA	NA	300	5%
Norway	NA	NA	137.0	0.8%
Ireland	NA	NA	65.2	4.9%
Portugal	NA	NA	60.8	9.3%

USA fiscal credit

- Launched in 1981, it applies only to “increments” related to a base year (but it is not always evident what the base year may be)
- The law is not permanent but must be renew periodically adding uncertainty to industrial R&D
- According to some authors the law pushes companies to expatriate R&D to other countries
- Only applies to major innovation (but what are they)
- Yet the US incentive has made an impact on industrial R&D

US fiscal credit

Year	Fiscal cost (US$ Millions)	Number of firms
1990	1547	8699
1995	1422	7877
2000	7079	10495
2005	5110	ND
2010	7900 (forecast)	15000

NB Fiscal credits represent approximately 2% of US BERD

Canada

- Canada is the strongest adopter of such type of incentives among OECD countries
- The number of firms using it has increased from 300 in 1977 to 20000, and some 30000 firms have used the federal credit over period of 10 years
- The adoption of the incentive was slow and progressive, reflecting a learning process in business
- Also, government learned and the credit was extended and fine-tuned several times
- Revenue Canada runs the SR&ED program

Canada

- Canada's fiscal credit is permanent (while the US system is not) and has thus attracted some 600 large R&D labs of foreign firms including Alcatel, Bell Helicopter, Ericsson Canada, IBM, Merck, P&WC, Pfizer, and Sanofi Aventis (see table next slide)
- It is more generous than the US program because it is applied to volume and not to increments in R&D expenditures
- It is very easy to use both for firms and governments
- It can be carried forward for 10 years and backwards for 3 years

Canada: main industrial R&D performers, 2008

Firm	Current R&D expenditure (C$M)	% R&D on sales	Sector
Nortel (CA)	1678	15,1%	Telecom equipment
BCE (CA)	985	5,6%	Telecom services
Magna (CA)	693	2,7%	Auto parts
P&WC (US)	442	12,3%	Aircraft engines
IBM Canada (US)	397	ND	Software
RIM (CA)	384	6%	Telecom equipment
Atomic Energy (CA)	329	57%	Nuclear energy
Alcatel-Lucent (FR)	237	ND	Telecom equipment
Apotex (CA)	219	16,2%	Drugs
Sanofi-Aventis (FR)	212	37,5%	Drugs
TELUS (CA)	210	2,2%	Telecom services
Bombardier (CA)	182	1%	Aircraft

UK

- Fiscal credit was launched in 2000 for SME and in 2002 it was extended to larger firms
- SMEs can deduct 150% of their R&D expenditures and large firms deduct 125%
- There are no limits as to the number of firms or the total amount that can be deducted
- The number of firms using the stimulus has gone from less than 2000 in fiscal year 2000-1 to over 6000 in 2004-5; this year fiscal cost was 650 M £
- The rapid adoption of the incentive is probably related to the fact that many firms already conducted R&D and they new the stimulus through their foreign activities

China

- China has used a large series of incentives to stimulate industrial R&D from business incubators to science, technology and industrial parks, to government labs, and direct subsidies
- The tax credit was implemented in 1996 and it represents 150% deduction of R&D expenditures
- BERD increased from 0,25% of GDP in 1995 to 0,9% in 2005 and 1,08 in 2007
- China is now the second largest investor in R&D in the world in terms of total volume of expenditures and is attracting droves of foreign R&D labs

Latin America

- BERD is low in this region, and thus in the 1990s several governments including those of Argentina, Brazil, Chile and Mexico implemented tax credits for R&D
- Except in Brazil, where the credit was implemented in 1993 and fine-tuned in 2005 under the Lula government, one observes little coherence and continuity and flawed designs
- The funds directed to the credits are meagre, allocation methods are inefficient and incentives are not permanent

Latin American countries versus others

	BERD/GDP (2007)	% of GERD executed by Business	GERD/GDP
Argentina	0,15%	30%	0,51%
Brazil	0,38%	34%	1,11%
Chile	0,31%	46%	0,67%
Mexico	0,19%	41%	0,46%
Canada	1,05%	56%	1,88%
China	1,08%	72%	1,49%
UK	1,15%	64%	1,79%
US	1,93%	72%	2,68%

NB: in August 2010 a new calculation by INE using Frascati methods reduced Chilean figures by 50%

Argentina

- Argentina implemented its fiscal credit in 1997 (Law 23877) but it limited to US$ 20 million the total fiscal cost. The credit can cover up to 50% of R&D expenditures; credits can be used for 3 years
- The first year some 125 firms presented projects with a total potential investment of US$ 137,8 M. From that total 94 projects were approved with a total investment of US$ 58 M and a total fiscal cost of US$ 18,5 M.
- But fiscal limits require project selection. Selection rimes with corruption, and the amounts are too low to have a major impact

Argentina

- Yet the federal government found the way to reduce the stimulus, putting a limit of US$ 11 M for 2009, when it financed 126 projects of R&D but also for technological modernization (such as JIT, TQC or other) and technical counsellors.
- All in all, one Argentinean firm on 10,000 has the credit, against 2% in Canada
- The national authorities restrict the credit and the provinces have no independent fiscal capacity to implement it (different from US or Canada).

Chile

- In 2007, Chile passed the law 20241, valid for 10 years, to increase industrial R&D and strengthen links between universities, public labs and industry
- The credit amounts to 35% of payments made by firms to public labs or university research centres duly registered by CORFO. In-house R&D is not included in the law. By April 2009 there were 25 registered centres and 15 other in analysis
- No firm can deduct more than US$ 0,4 M per year
- The credit does not nurture in-house R&D
- The first year only US$ 173,000 were used
- Like in Argentina, firms must disclose their R&D activities and somebody allocates the credit.
- There are 4 stakeholders against 2 in Canada; also too much disclosed information

Mexico

- Mexico had fiscal deductions since 1976, but it created a fiscal credit in 2001 with a total maximum that increased year after year up to US$ 450 M in 2009. This year the credit was abolished after a local evaluation
- Like in Argentina and Chile the impact on BERD was very low. During its existence, many large (mostly foreign firms) used it but total BERD did barely increase which indicated little additionality
- Few SMEs used the credit

What is wrong in Latin America (and other LDC)

- Implementing adequate R&D and human capital policies requires a permanent, efficient, meritocratic government bureaucracy
- In most developing countries, LA above all, most public officers change with the governments; thus there is no learning process in the government sector
- Ex: Argentina aircraft industry, nuclear energy industry, tax credits for R&D, grant-loan program and many others, Ministry for science, technology and innovation

Conclusion

- Fiscal stimuli for industrial R&D are on the rise in OECD and BRIC, but most less developed countries are barely aware of the importance of the incentive
- In LA the incentive was badly designed, assessed and implemented: too little funds were devoted to the incentive (US$ 4 billion in Canada against US$ 11 M in Argentina or even less in Chile)
- Conversely in Canada, China, UK and US, among other countries, the tax credit has worked and reinforced the absorptive capacity of industrial firms through the adoption of in-house R&D. The credit worked best where it was permanent, easy to apply, and it was assessed and fine-tuned regularly

Conclusion

- Any incentive is easier to design and implement where public bureaucracies are permanent, highly skilled, professional and knowledgeable. In LA, like in many other developing countries, government bureaucracies change with each government, and improvisation in public policy is the rule.
- Finally the success of the fiscal credit in OECD and BRIC countries is due to the existence of other complementary policies: direct subsidies for R&D and for the hiring of scientists and engineers in industry, policies for venture capital, research grants for U-I collaboration, etc. The rapid adoption of the British fiscal credit is thus explained by its previous STI policies.
- Developing countries need to implement a series of well-designed STI policies in a short period of time. Such a requirement makes their adoption less likely

Conclusion

- In order to adequately design, implement, monitor and fine-tune these human capital and R&D policies, LDC governments need a permanent, meritocratic and highly skilled public bureaucracy, such as those adopted by the UK in the 1840s and the US in the 1880s
- One way to avoid the syndrome called “to the victor the spoils”, is to start creating a permanent national department of science, technology, innovation and economic development in order to be in charge of these policies.
- Also, like in the US or Canada, a “law of access to public information” helps keeping corruption at a low level

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