The effectiveness of R&D tax incentives

Pierre Mohnen

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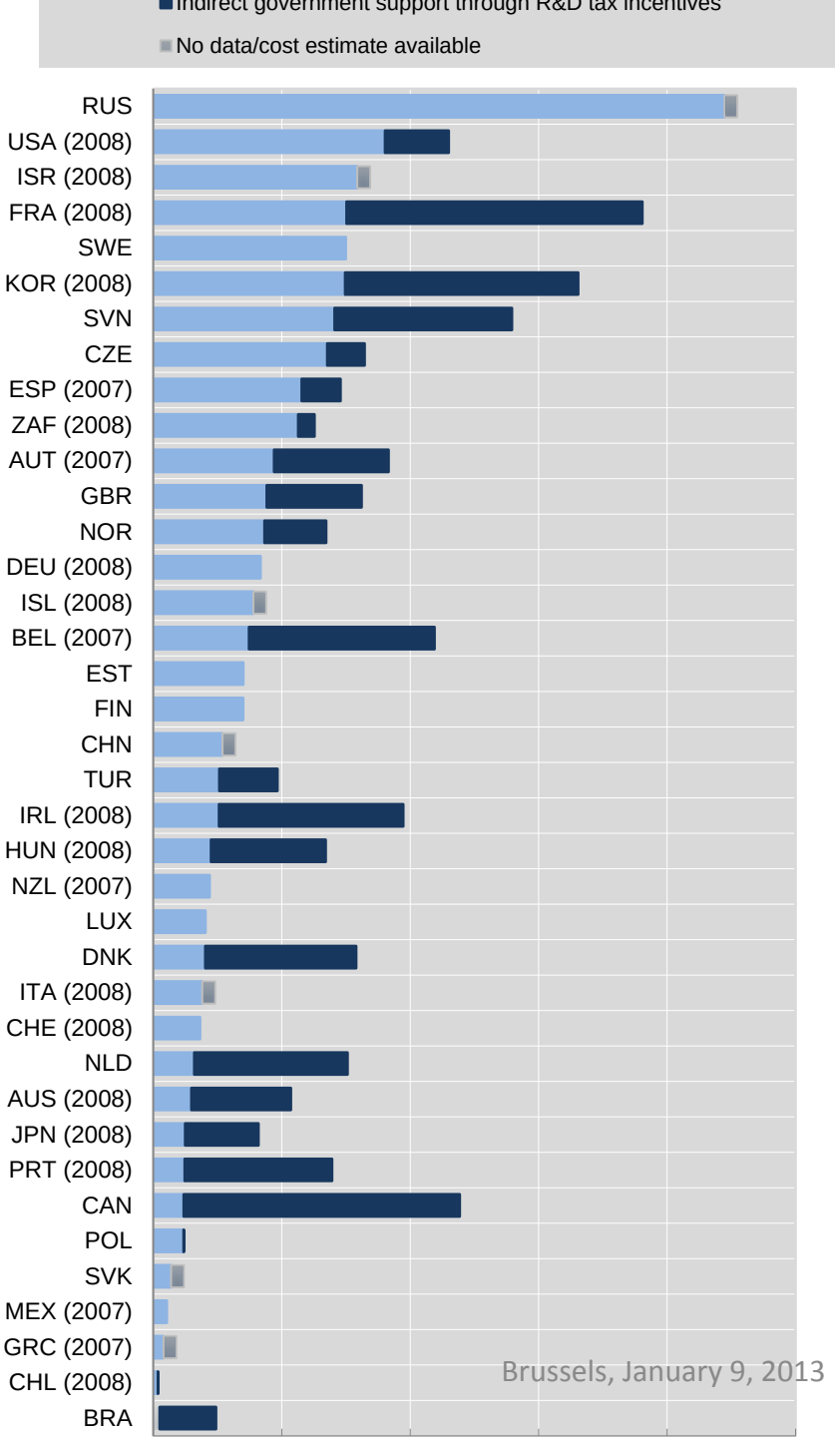


Direct government funding and R&D tax incentives in % of GDP

Source: OECD, Main Science and technology Indicators, 2011

Market failures in R&D&I

- Spillovers
  - Disincentive from imperfect appropriation
  - Social return higher than the private return
- Asymmetric information
- Uncertainty and incomplete capital markets for risky events
- Large size and indivisibility of certain projects
- Coordination problems (e.g. skills availability)

Kinds of R&D tax incentives

- In proportion to the level of the expenses
  - immediate write-off or expensing
  - tax credits proportional to the level of R&D
- In proportion to the increment of R&D
  - Definition of the base (fixed or variable, e.g. last two years)
- Measures intended to remove ceilings in the effective use of tax incentives
  - refundability of unused tax credits
  - Carry-back and carry forward of unused tax credits
  - Flow through mechanisms, i.e. transfer of unused tax credits to an eligible third party
- Focus on specific types of R&D
  - environment, health, defense, agriculture, information
  - university, small and medium enterprises (SME), regional support, R&D cooperation
- Indirect tax incentives
  - reduced corporate income taxes, exemption of capital gains taxes
  - Reduced taxes on dividends from venture capital funding
  - Reduced taxes for high-skilled immigrants

Table 1. Details of differences in R&D tax incentives schemes across selected OECD countrie 2009

Design of the R&D tax incentive scheme	*Volume base R&D tax credit*	Australia, Canada, France, Norway, Brazil, China, India
	Incremental R&D tax credit	United States
	Hybrid system of a volume and an incremental credit	Japan, Korea, Portugal, Spain
	R&D tax allowance	Denmark, Czech Republic, Austria, Hungary, UK
Payroll withholding tax credit for R&D wages		Belgium, Hungary, Netherlands, Spain
More generous R&D tax incentives for SMEs		Canada, Australia, Japan, United Kingdom, Hungary, Korea, Norway
Targeting	*Special for energy*	United States
	Special for collaboration	Italy, Hungary, Japan, Norway
	Special for new claimants	France
	Special for young firms and start-ups	France, Netherlands, Korea
Ceilings on amounts that can be claimed		Italy, Japan, United States, Austria, Netherlands
Income based R&D tax incentives		Belgium, Netherlands, Spain
No R&D tax incentives		Estonia, Finland, Germany, Luxembourg, Mexico, New Zealand, Sweden, Switzerland

Note: R&D tax allowances are tax concessions up to a certain percentage of the R&D expenditure and can be use

Price elasticity of R&D

- Netherlands: short-run -0.3, long-run -0.7
- Quebec:
  - Small firms: -0.14 in SR, -0.19 in LR
  - Large firms: -0.06 in SR, -0.10 in LR
- Comparison with other studies:
  - Bloom, Griffith, van Reenen (2002), -0.1 in SR, -1.0 in LR
  - Harris, Li, Trainor (2009), -0.53 in SR, -1.36 in LR
  - Wilson (2005), in LR -1.0 within states, but given market stealing from out-of-state, total effect -0.1
  - Mairesse-Mulkay, 0.6 after 2008, above 2 before 2008 (incremental R&D tax credit)

Not all firms apply for R&D tax credits

- Higher probability to apply if
  - Capacity for innovation (human and financial capital)
  - Stable financial position
  - Received R&D subsidies before
- SMEs incur obstacles in applying for R&D tax credits
- Corchuelo and Martinez-Ros report that in Spain around 50% of the firms in 2002 did not know about the tax incentives and only 29% of those you knew used them.

Ways to assess effectiveness of R&D

Additionality

Cost-effectiveness ratio
Incrementality ratio
Tax sensitivity ratio

Full
Cost benefit analysis

Spillovers
Administration costs
Compliance costs
Opportunity costs

General equilibrium analysis

Wage effects
Balanced budget
Open trade

Second-order effects
Third-order effects

Bang for the buck (BFTB)

- Definition:
  - changes in R&D/changes in tax expenditures

- Deadweight loss:
  - Paying for R&D levels and R&D increases that would have happened anyway

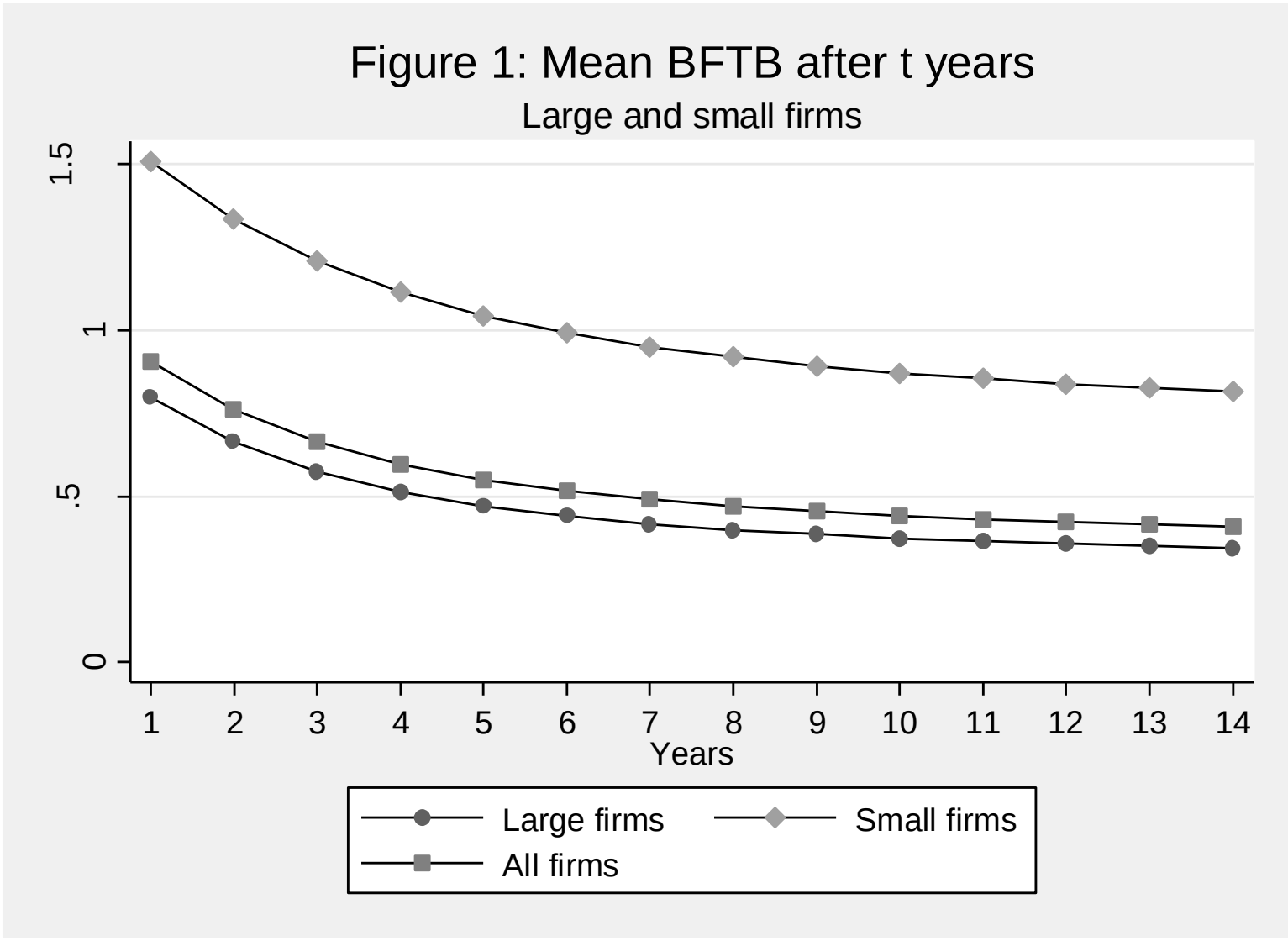
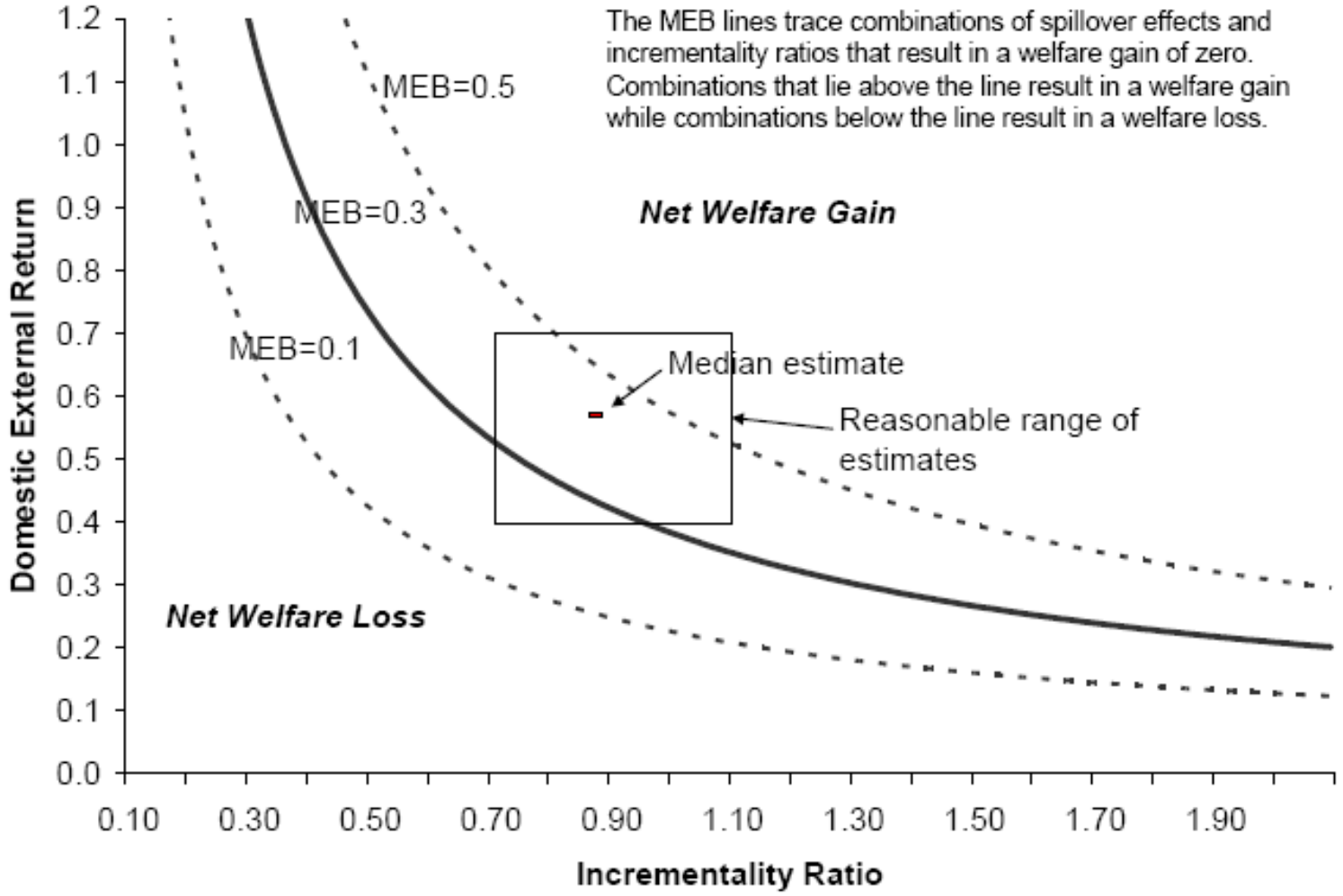


Figure 1: Mean BFTB after t years
Large and small firms
1.5
1
.5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Years
Large firms
Small firms
All firms

BFTB in Quebec

- If level-based R&D tax credit increases by 10%, for small firms, the BFTB stays above 1 after 20 years, for large firms it falls below 1
- Deadweight loss: 68% for small firms, 82% for large firms
- If increment-based R&D tax credit increases by 10%, the BFTB= 2.98 for small firms, 2.79 for large firms

Sensitivity analysis (from Parsons and Phillips, 2007)



Wage effects

- Why?
  - To stimulate researchers to apply for R&D tax credits
  - Supply constraint of R&D personnel
  - Search costs for R&D personnel
  - Negotiating power of R&D personnel

- Elasticity of the R&D wage with respect to the fraction of the wage supported by the fiscal incentives scheme is estimated at 0.1 in the short run and 0.13 in the long run.

Extensive margin

- Attract new R&D performers
- Because of sunk entry costs, give extra incentive to newcomers to cover these costs
- Because of R&D persistence, effects are long-lasting
- low deadweight loss
- 25% of manufacturing firms in Spain need subsidies to enter but not to continue R&D
- This would raise the percentage of R&D performing manufacturing firms in Spain from 20% to 30%, cost 110 million Euro but yield over 15 years 2,500 million Euro of additional R&D stock

Study by Pere Arqué-Castells and Pierre Mohnen, "Sunk costs, extensive R&D subsidies and permanent inducement effects", UNU-MERIT working paper 2012-029

Increment-based R&D tax incentives

- Pros
  - Less deadweight loss
  - Larger bang for the buck
- Cons
  - Little effect of the user cost of R&D
  - More effective with fixed base than with rolling base, although fixed base not very realistic.
  - Limit to R&D acceleration

Pros and Cons of R&D tax incentives

Pros

- Let the private sector decide on the allocation of funds and let it foot part of the bill
- Neutral, not biased towards particular projects
- Predictable, reliable
- Lower administration costs than direct subsidies

Cons

- R&D tax incentives are not terribly effective in stimulating more R&D than the amount of tax revenues foregone in the long run, except perhaps for small firms
- Deadweight loss for level-based R&D tax credits
- Tax incentives support more the big firms than the small firms even if rates are more favorable for small firms
- Tax incentives might lead to research projects with a low rate of return, unprofitable without the tax support
- Benefits partly washed out by a wage effect

Policy discussion

- Deadweight loss and effectiveness should be compared for tax credits versus direct government aid for R&D support.
- Combine R&D tax incentives with other incentives and complementary measures (e.g. creating human capital)
- Coordination of tax incentives to avoid tax competition
- Devise tax incentives or other means of support for innovation appropriate to the particular market failures (e.g. spillover, financing problems, or human capital insufficiencies)
- Keep tax laws stable