

Impact of Public SME Policy on SME's Innovation Activity: Experiences From Germany

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Chances in Industrial Landscape and
the Future of Service Economy

Session 1: How to Nurture Strong SMEs

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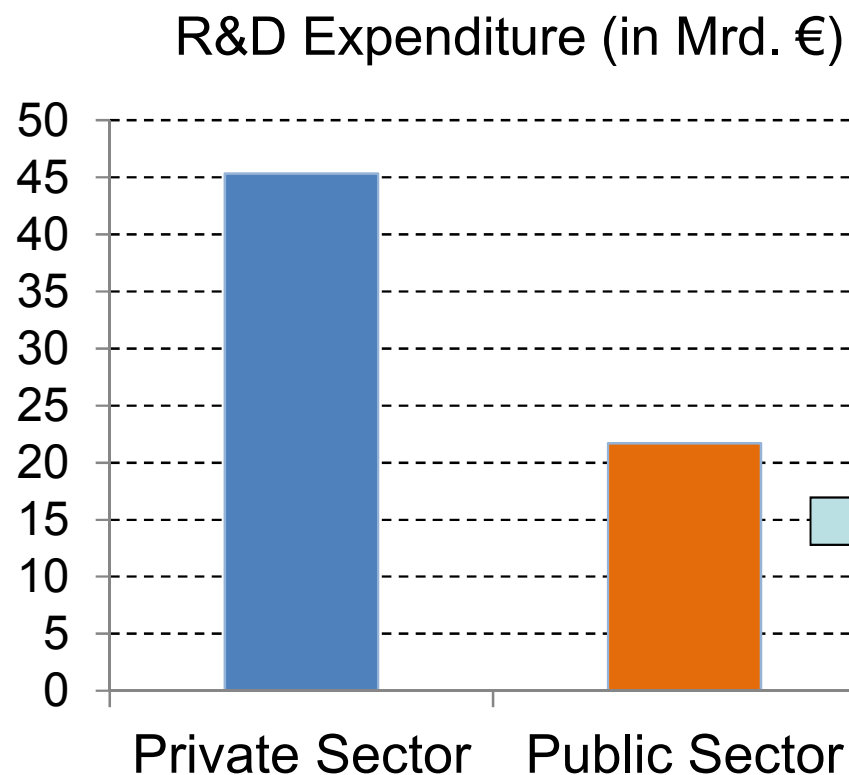
Background

- A period of reforms of the welfare state in Germany
 - Most pronounced: Reforming the German Labour Market
- Federal Governments **Hightech-Strategy I (2005)**
 - Improving coordination of policies between different ministries
 - Coordination between Federal and Provincial („Laender“) governments
 - Significant increase in government R&D spending (along with the EU vision of 3% R&D/BIP by 2010)
 - New approaches to horizontal R&D and innovation policies instruments

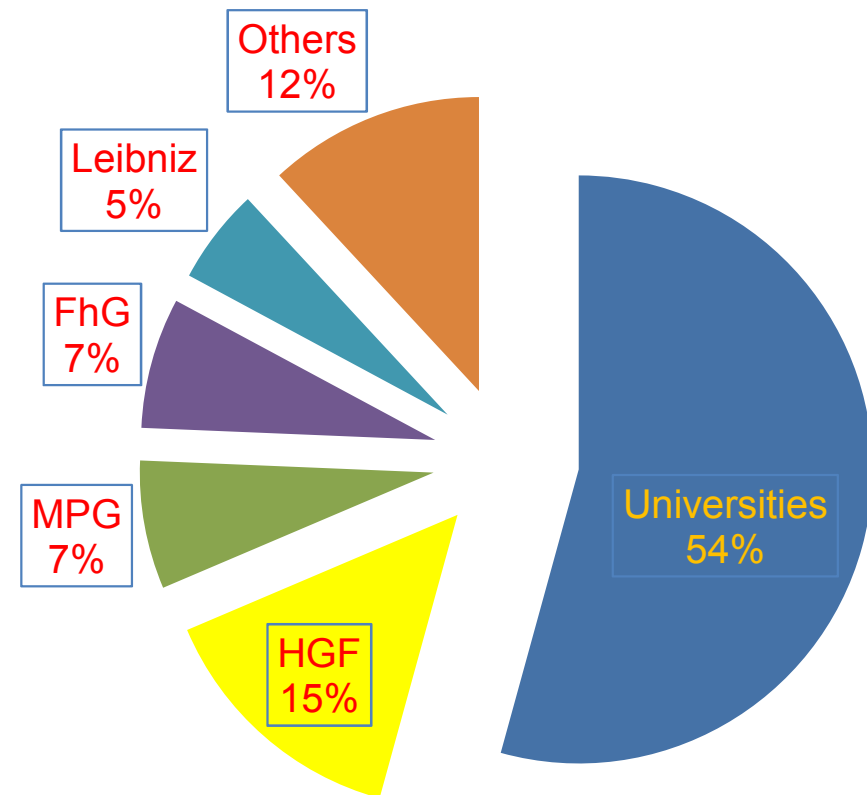
Elements of Hightech Strategy

- R&D in universities & public research institutes (PROs)
 - Excellence Initiative (Competition between university for significant additional federal funding)
 - Research and Innovation Pact for PROs
 - Increase competition between universities and between PROs
- Public funding for private R&D and Innovation
 - Cluster policies: Cutting Edge Cluster Competition
 - Increase support for SMEs (ZIM, KMU innovativ) & Decrease of barriers for participation of SME in public technology programs
 - Starting a new public venture (seed) fund: „Hightech Startup Fund“
 - New program on „Validation of public R&D outcomes“ (Proof of concept programme)
- Hightech Strategy II (2010): Mission-oriented R&D Policy

R&D Expenditure in Germany by Performer

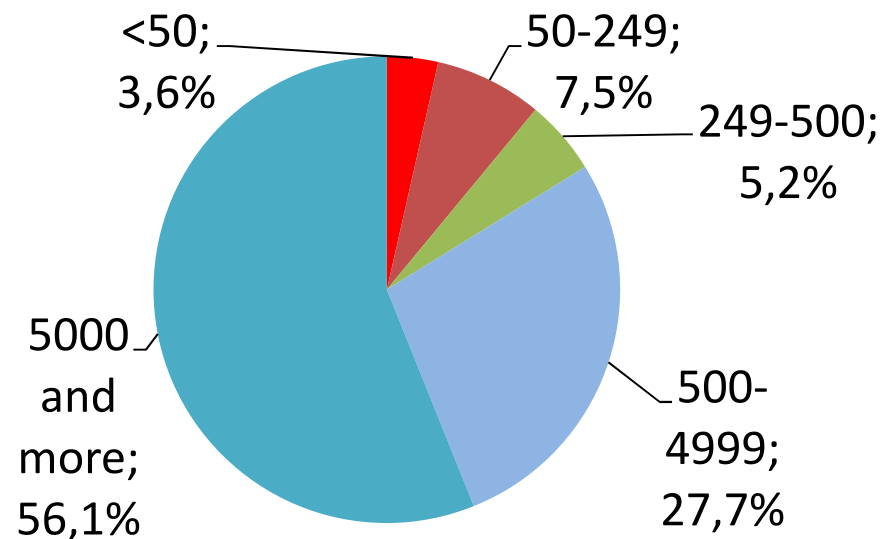


Distribution of Public R&D

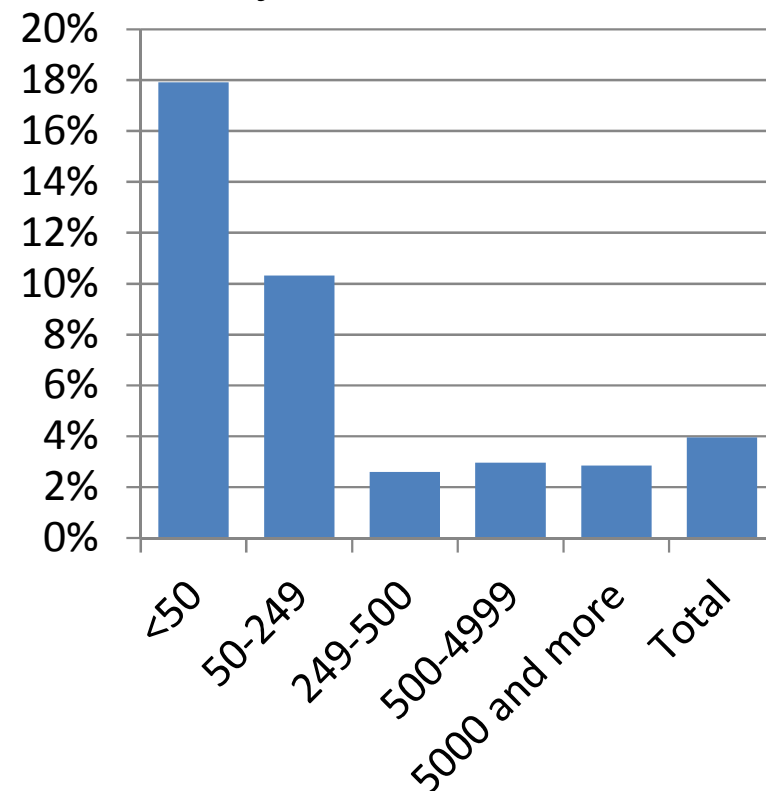


R&D Expenditure of the Private Sector - by Firm Size -

R&D Expenditure by Size Class
- Number of Employees -



Share of Public Support
by Size Class



Source: Stifterverband: 2012 German R&D Survey

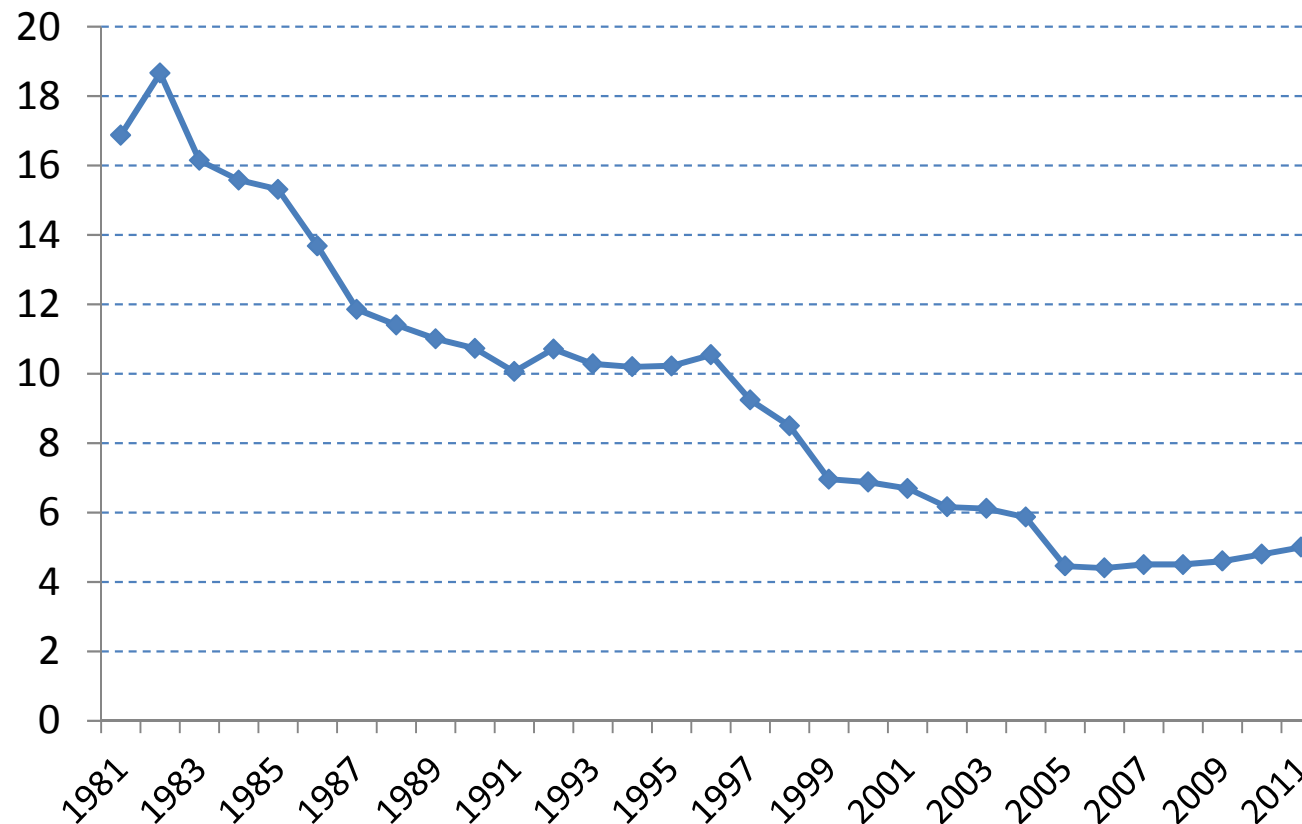
Aid Intensities within EU State Aid Rules

Share of Public Funding in Total Project Costs

	Small enterprise	Medium-sized enterprise	Large enterprise
<i>Fundamental research</i>	100%	100%	100%
<i>Industrial research</i>	65%	60%	50%
<ul style="list-style-type: none"> - collaboration between undertakings; for large undertakings: crossborder or with at least one SME - collaboration of an undertaking with a public research organisation - dissemination of results 	80%	75%	65%
<i>Experimental development</i>	40%	35%	25%
<ul style="list-style-type: none"> - collaboration between undertakings; for large undertakings, with cross-border or at least one SME - collaboration of an undertaking with a public research organisation 	55%	50%	40%

Public Funding for Private R&D

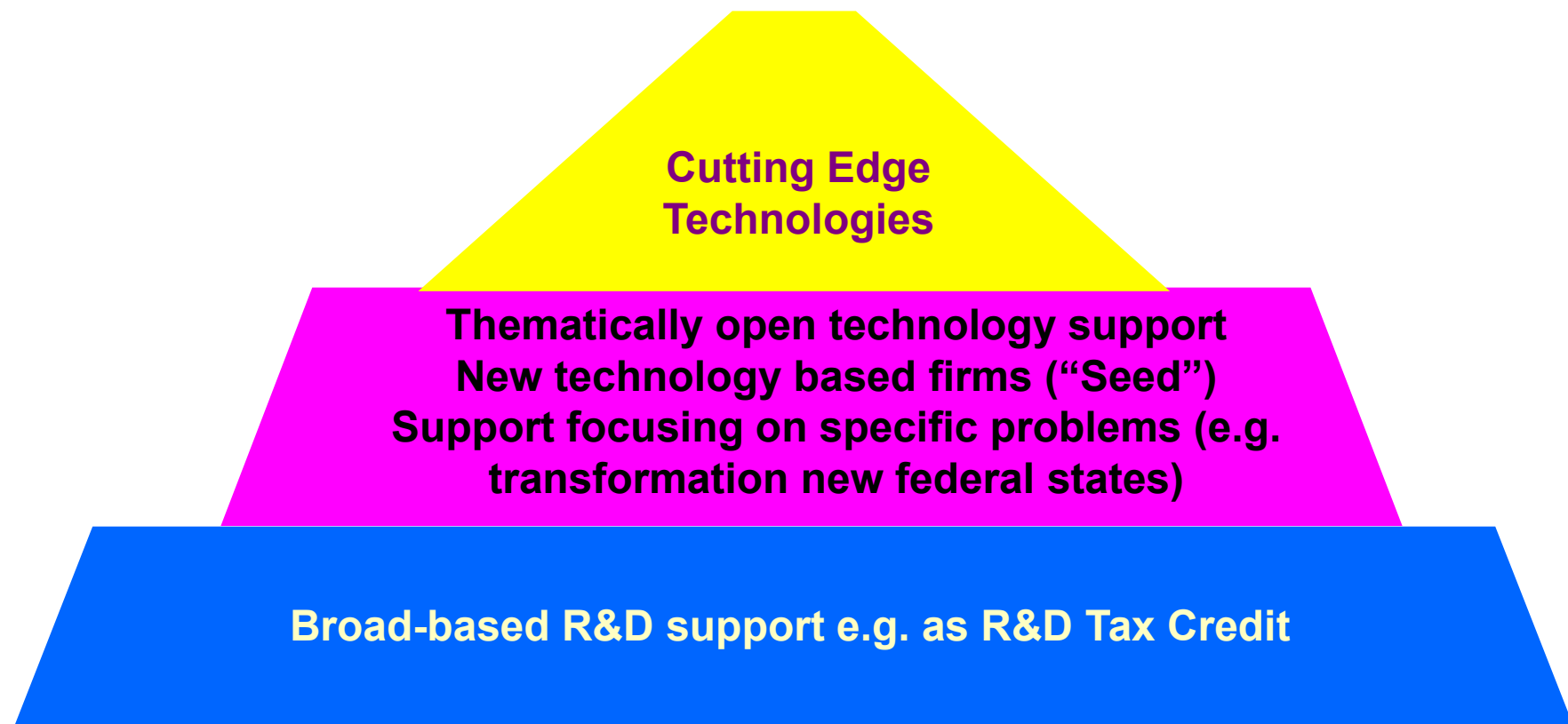
Share of Public Funding of Business Enterprise R&D (in %)



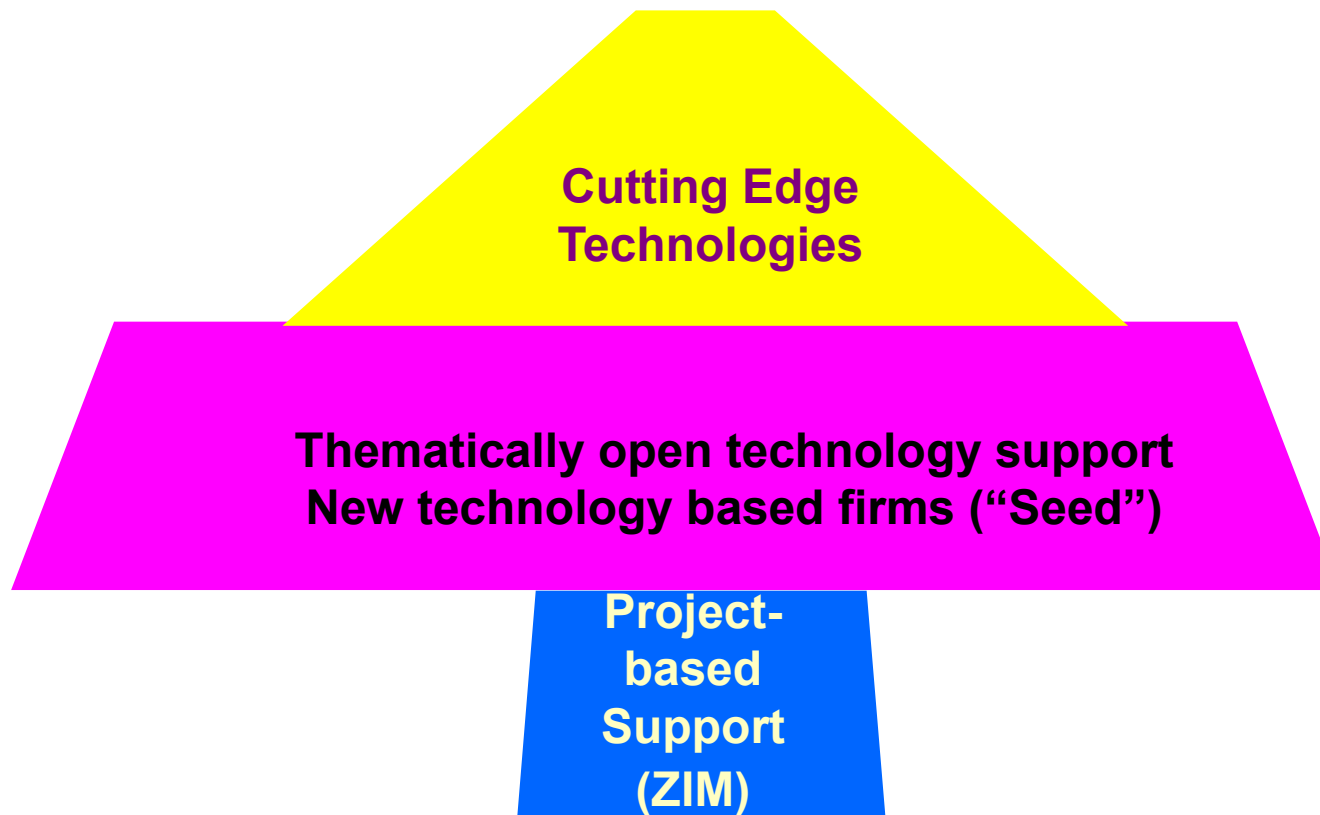
The increase since 2005 is primarily due to R&D support for SMEs

Source: OECD MSTI 1981-2009; 2010/2011 estimates based on national sources

An Optimal Structure for Public Funding for Private R&D

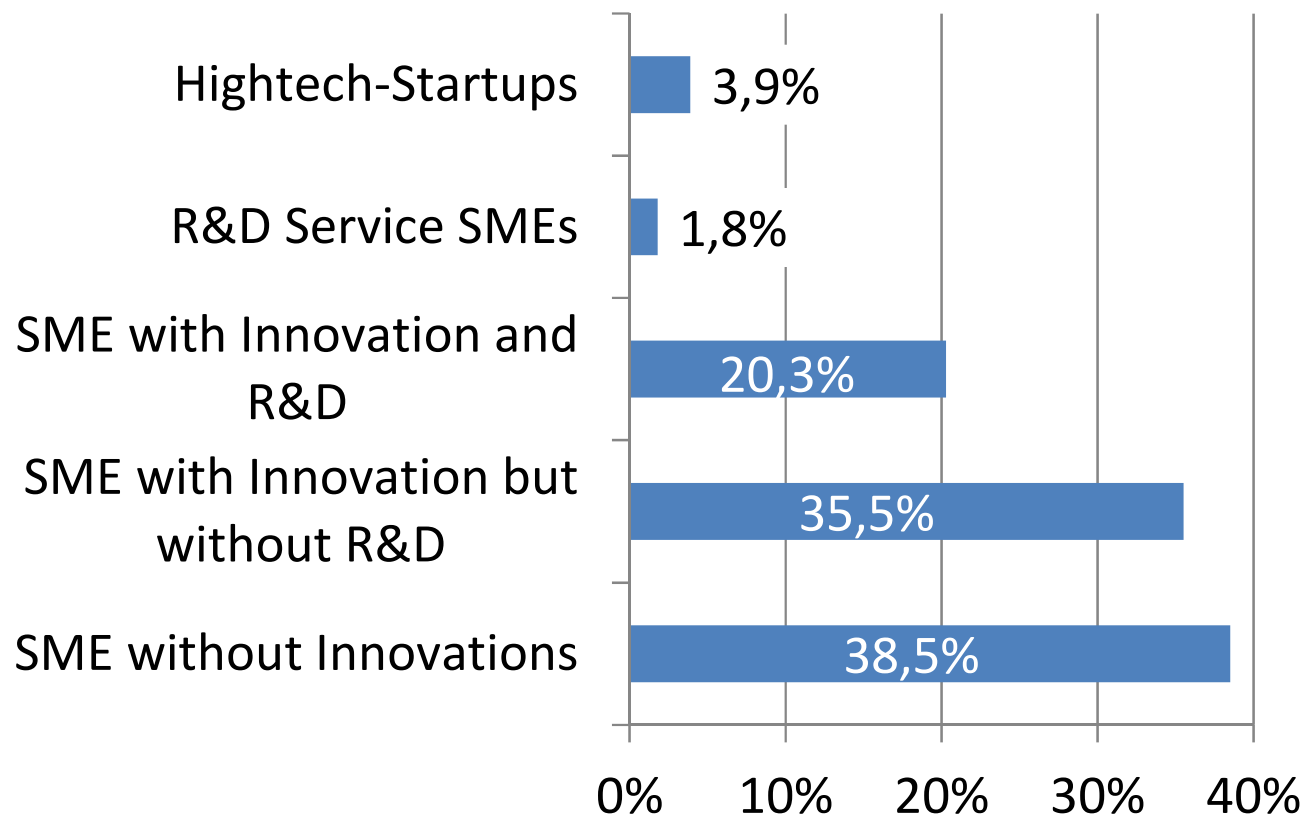


The R&D support system in Germany



A Simple Typology of SMEs in Germany

- Manufacturing and Knowledge-intensive Business Services -



Source: ZEW: Mannheim Innovation Panel; (d.i. the German contribution to CIS)

Evaluation of Impact of Technology Programs in East- and West-Germany

- ❖ Technology programs are the standard form of supporting innovation in the private sector
- ❖ Technology-specific calls launched by the federal ministry of education and research (BMBF)
- ❖ Firms suggest specific-projects to government; Government select based on technological merit
- ❖ Evaluation is based on first-come first-served basis; Hence, not direct competition between projects
- ❖ Government support amounts to max. 50% of total costs of project

Research Questions

- ❖ Do public funds really stimulate private R&D and innovation?
- ❖ If yes: Does the additional R&D lead to increased innovation output?
- ❖ Is the impact of public R&D support larger during transition?

See for details:

Dirk Czarnitzki and Georg Licht (2006), Additionality of Public R&D Grants in a Transition Economy: the Case of Eastern Germany, *The Economics of Transition*, 14(1):101-131

Econometric Approach: Input additionality

Problem to solve: R&D expenses of a subsidized firm in case this firm had not received a subsidy?

Solving the counterfactual problem by nearest neighbour matching with additional restrictions

$$E\left(Y^0 \mid P = X \tilde{\beta}, D = 1\right) = E\left(Y^0 \mid P = X \beta, D = 0\right)$$

Hence, the treatment effect is given by:

$$\alpha_{ATT} = \frac{1}{N^1} \sum_{i=1}^{N^1} \left(Y_i^1 - \hat{Y}_i^0 \right)$$

Working with multiple control groups

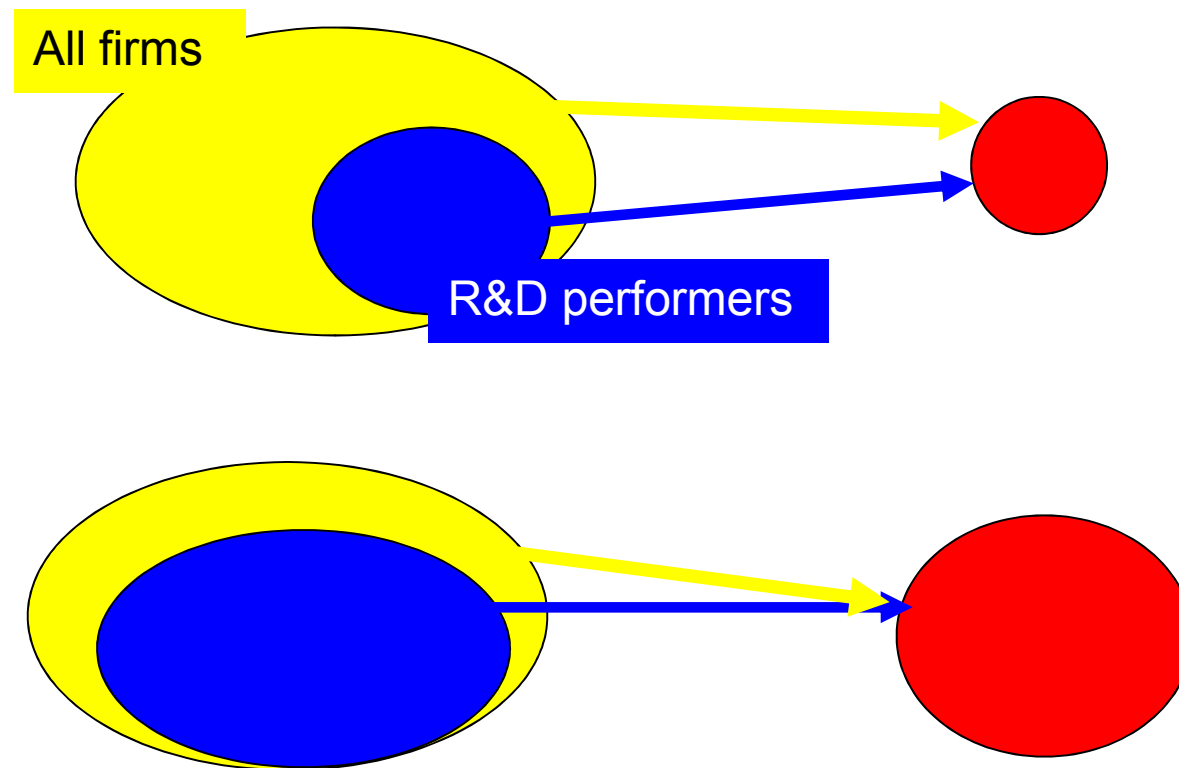
Non-subsidized firms

Subsidized firms

Western
Germany



Eastern
Germany



Econometric Approach: Output additionality

Invention production function
to estimate marginal R&D productivities ($\frac{\partial O}{\partial Y^j}$)

$$O_i = f(Y_i^{\text{public}}, Y_i^{\text{private}}, Z_i) + \mu_i$$

O_i = Innovation output

Y_i^{private} = R&D spending in case of no subsidy

Y_i^{public} = R&D spending in case of no subsidy

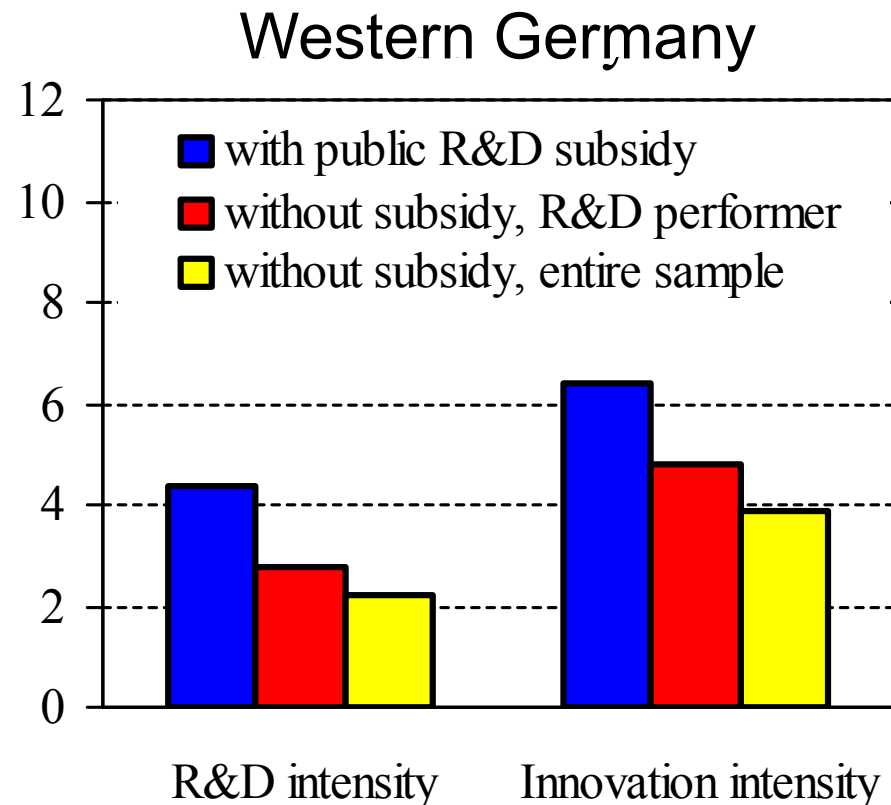
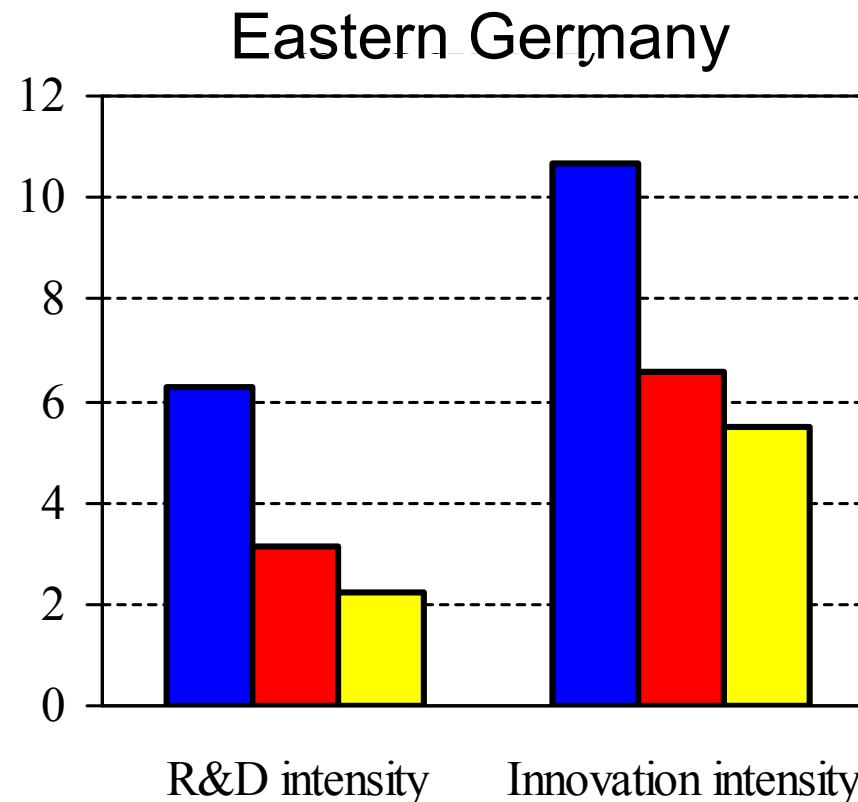
Z_i = Vektor of additional controls

Data Sources

- (1) Mannheim Innovation Panel (CIS type survey)
1994, 1996, 1998 and 2000
- (2) Patent application data from the files of the German
Patent Office 1980-2001
- (3) Credit Rating Information taken from ZEW's
Mannheim Enterprise Panel

Data are matched at the firm level using computer assist merging algorithms and additional casewise manual checks

Input Additionality of Public R&D Subsidies



R&D intensity = R&D expenditure / turnover

Innovation intensity = Innovation expenditure / turnover

Conclusions for Public Technology Programs in Germany

- ❖ Public R&D subsidies from government technology programs stimulate private R&D
- ❖ The degree of input additionality depends not only during on the size of public support but also depends on situation of in which firms act (e.g. credit constraints were more significant in Eastern Germany after unification)
- ❖ Public subsidies induce additional R&D output
- ❖ However: Marginal R&D productivity seems to be larger in Western Germany than in Eastern Germany (e.g. access to markets, established networks, advantages in innovation / IP management)

Evaluation of a Family of Programs to Support Young Biotech Firms

Situation of Biotech industry after 2000

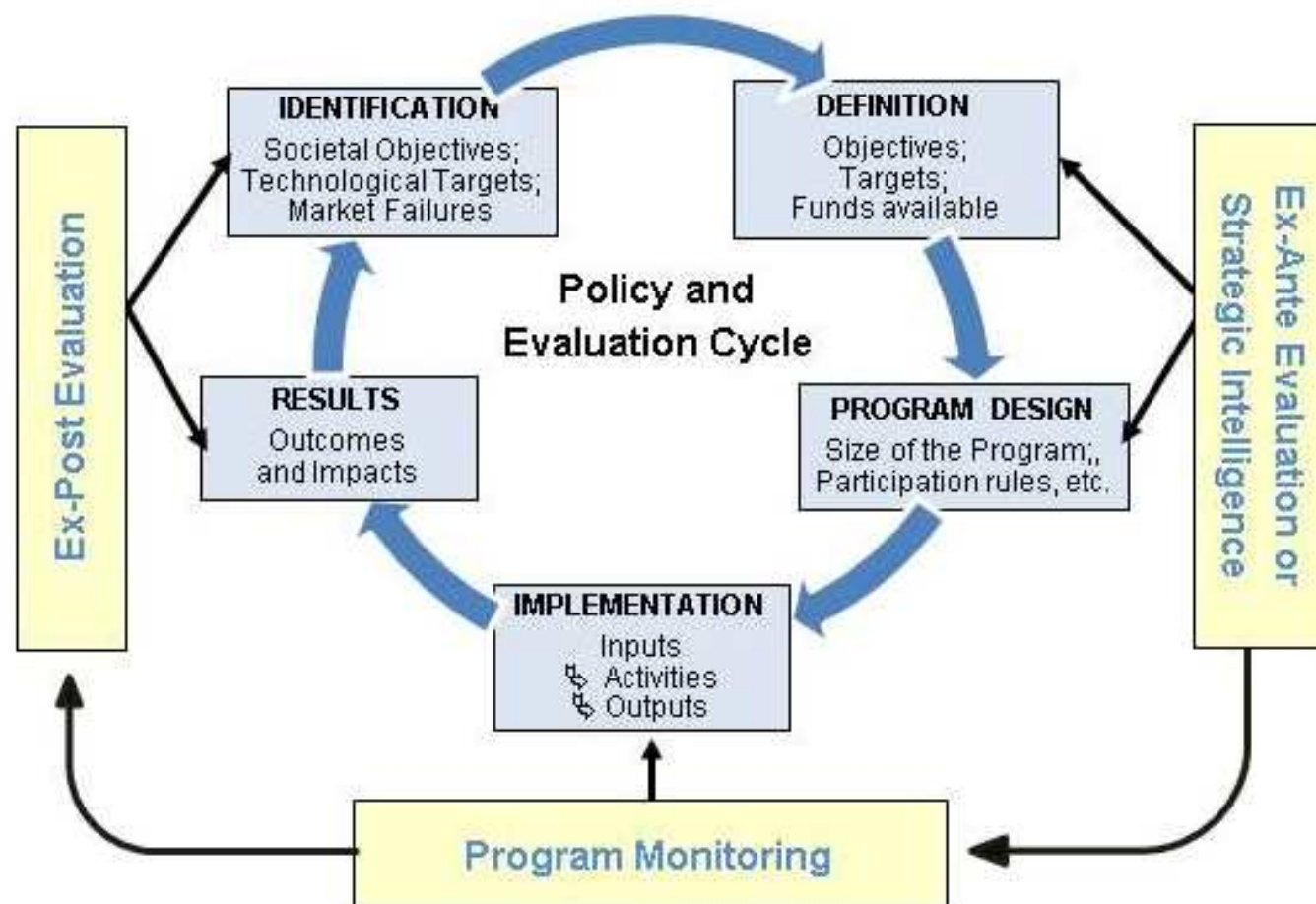
- ❖ Significant number of startups in 1998-2002
- ❖ Venture Capital Market (one of the main sources of finance for Biotech startups) broke down in 2002
- ❖ Significant slow down in the number of new biotech firms in 2002
- ❖ Supporting R&D to prevent an industry shake out and/or change of business model from biotech R&D firm to pure biotech service firms
- ❖ Introduction of a new funding mechanism which was adjusted over time to take into account learning about the program

Evaluation Approach

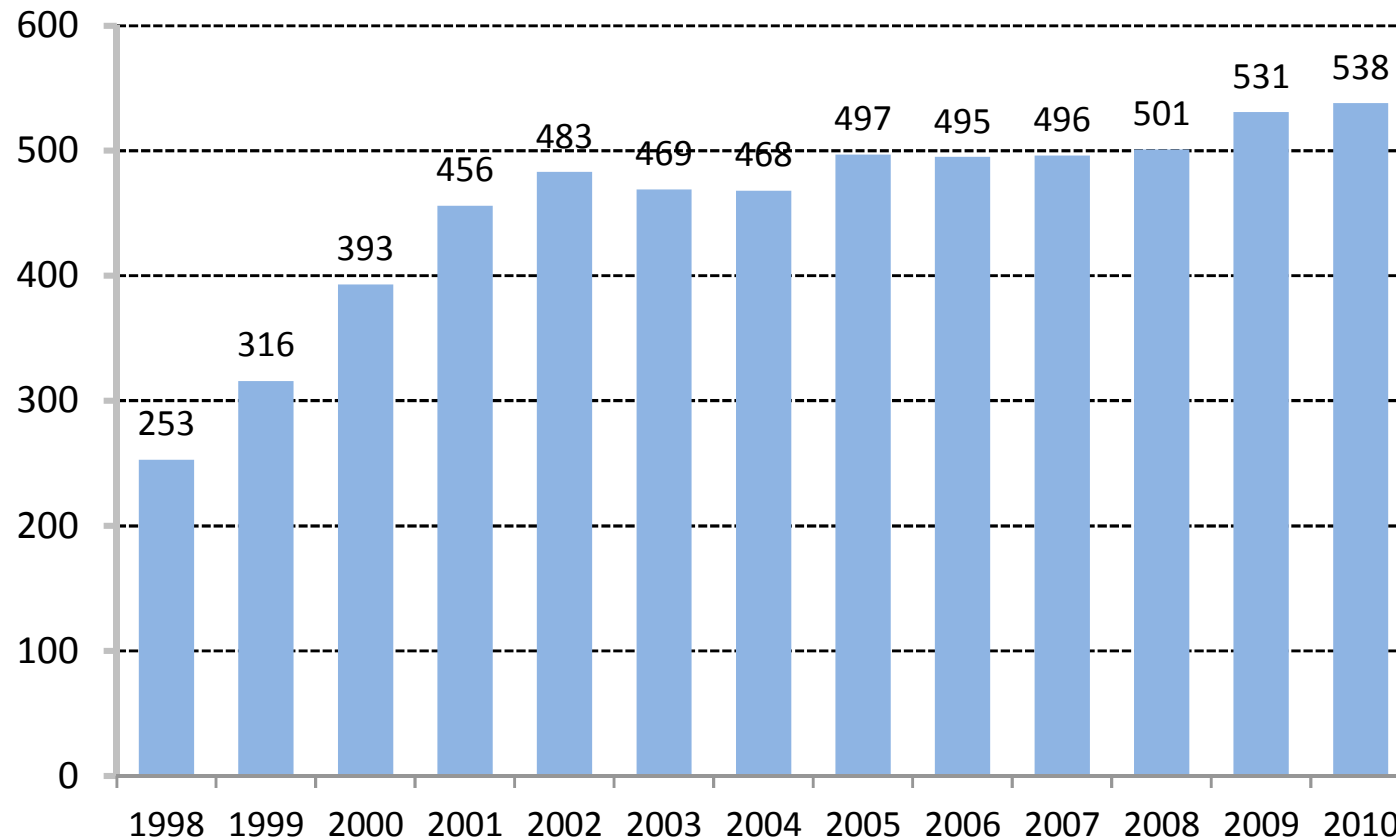
- ❖ Ex-post evaluation for BioChance + BioChancePlus resp. Monitoring Evaluation for KMU-Innovativ: Biotechnology
- ❖ Combination of qualitative and quantitative Methods
 - Establish a panel data set comprising data from the annual biotech industry survey, funding data, patent application data & data from Mannheim Enterprise Panel
 - Specific survey of applicants and program participants
 - 20 Case studies for funded and non-funded firms
 - Structured interviews with about 35 stakeholders of the program, ministries, cluster managers, program managing agency, evaluators
 - Monitoring selection committee and evaluating administrative records of individual projects

Georg Licht et al. (2012):
Begleit- und Wirkungsforschung zur Hightech-Strategie:
Ex-post-Evaluierung der Fördermaßnahmen BioChance und
BioChancePlus im Rahmen der Systemevaluierung „KMU-
innovativ“,
Mannheim, February 2012 (in German only)
(available at www.zew.de)

Evaluations and the Policy Cycle

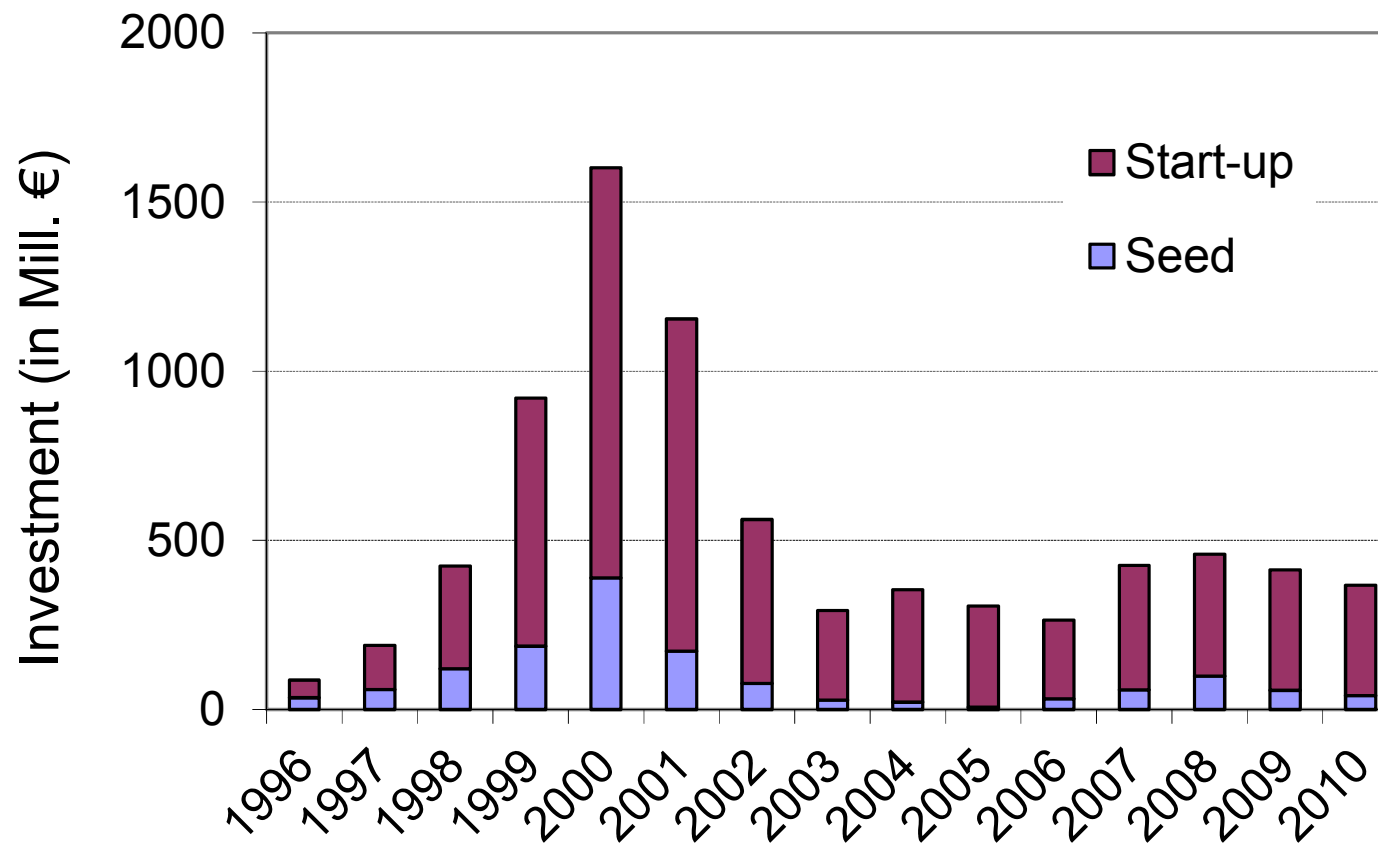


Number of Dedicated Biotechnology SMEs - by year -



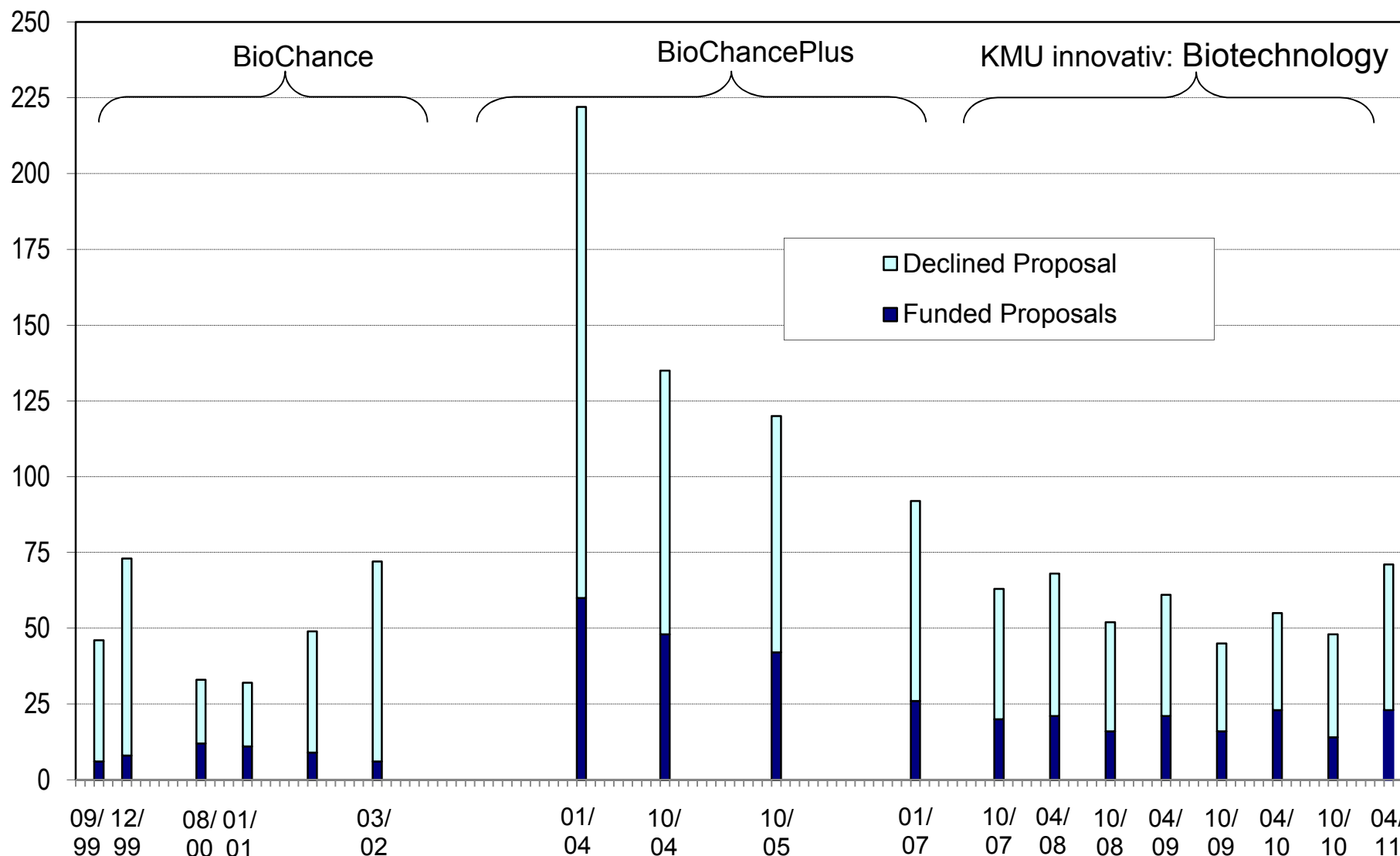
Source: BIOCOM: Results of the annual survey of biotech companies (various years)

Evolution of Venture Capital Market (seed and start-up) in Germany

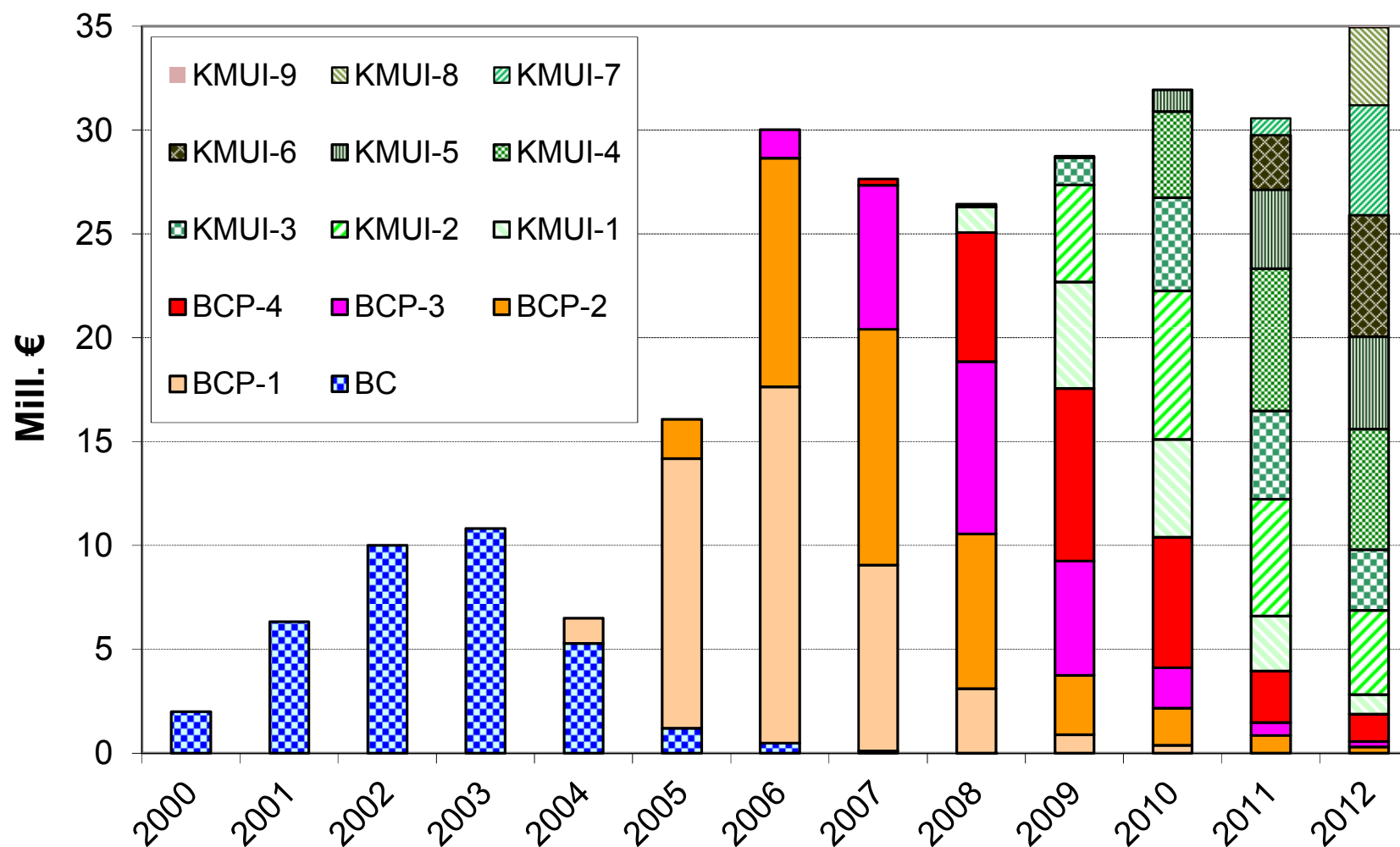


Source: BVK (German Venture Capital Association): Annual Statistics (various years)

Evolution of Biotech-SME Programs

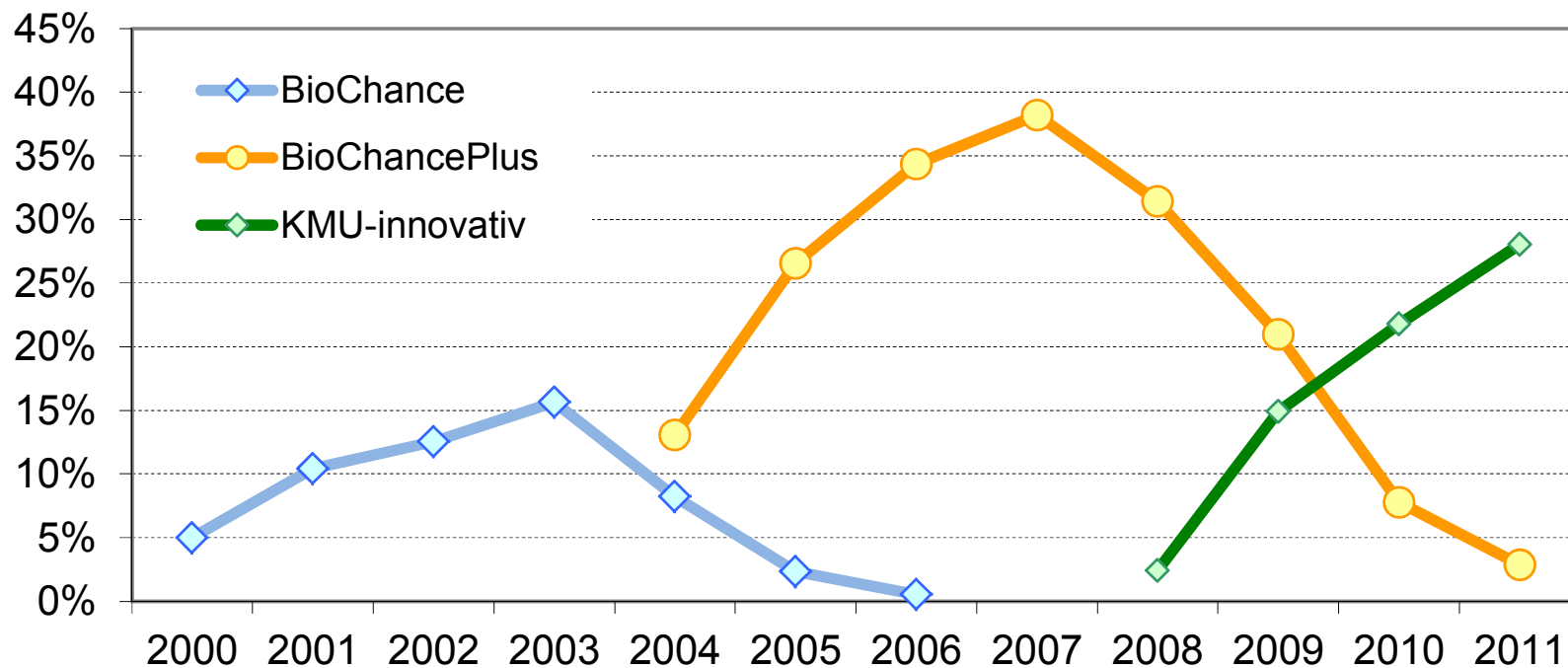


Government Support for Biotech SMEs for different wave of the program



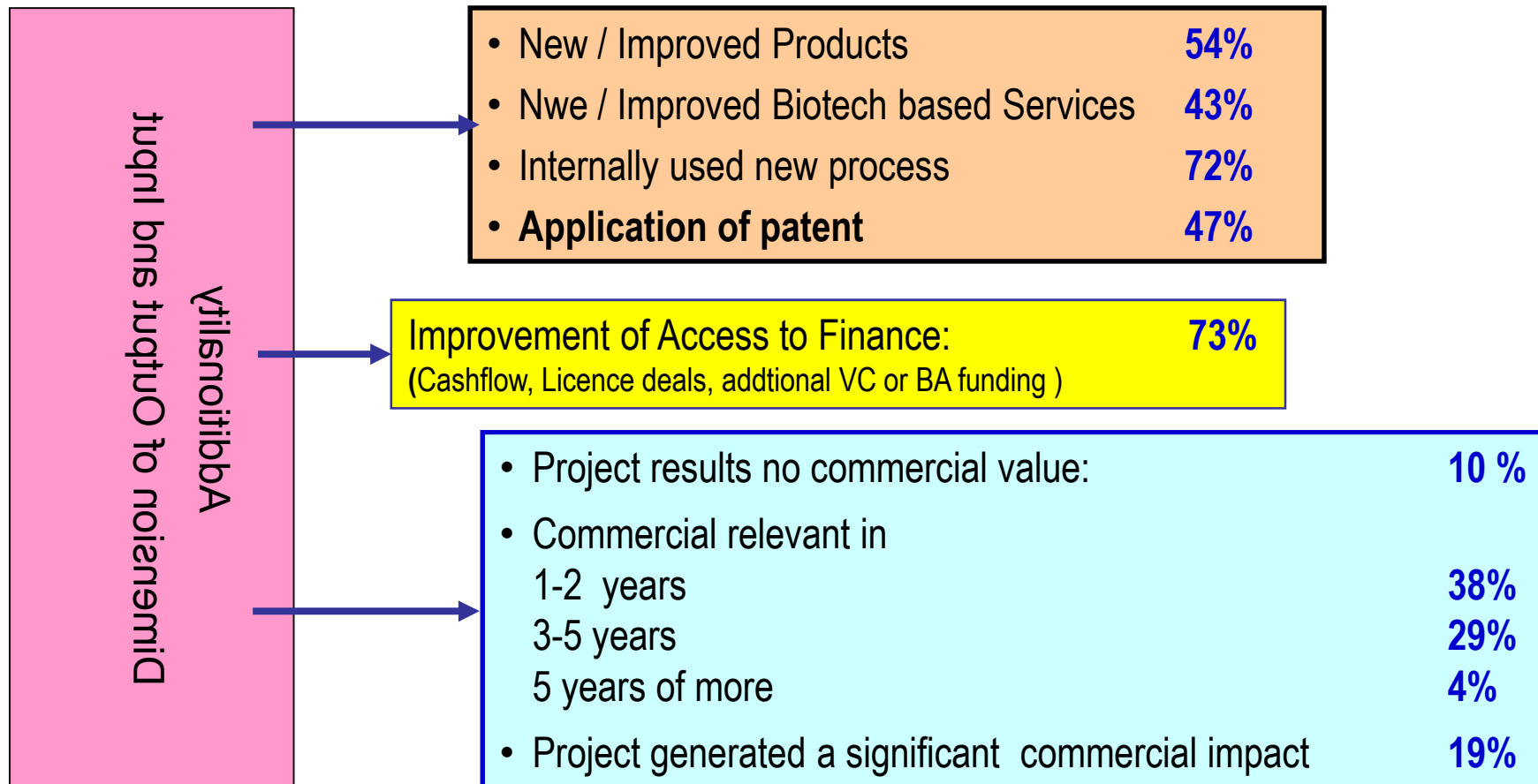
Source: BMBF: Funding Database Profi (2012 edition; February)

Share of Dedicated Biotech SMEs which Received funding by year



About 30% of biotech companies receive support

Impact of the Programs



Per cent figures refer to the share of projects which fulfill the dimension

Input Additionality Based on Matching Approach

	Funded Firms	Control group	Difference	Standard error
R&D spending (in T€)	800	465	335	20,4
R&D spending per employee (in T€)	41,9	32,6	9,3	1,1
R&D / Sales	0,67	0,35	0,32	0,13
Employment growth	0,14	0,05	0,09	0,10
No. Of Collaborative Links to universities or other biotech firms	6,7	3,9	2,8	1,9

R&D support from BioChance or BioChancePlus yield a bang-for-buck ratio of about 2,4. Firms increased the R&D budget as response to funding. Hence, program helped firm to raise additional money

Critical Features of the Program

- ❖ Competitive Evaluation of Proposals
- ❖ Thematically open calls within broad technology fields (to enable competitive evaluation)
- ❖ Use of external project selection committee comprising technological, scientific, financing (VCs) and market expertise
- ❖ Two step application procedure
- ❖ Calls in regular intervals
- ❖ BUT: Limits of project based support in case of drug development projects / firms; Equity-based funding (e.g. specialised public VC) is preferred over a subsidy based funding



Thank You For Your Attention

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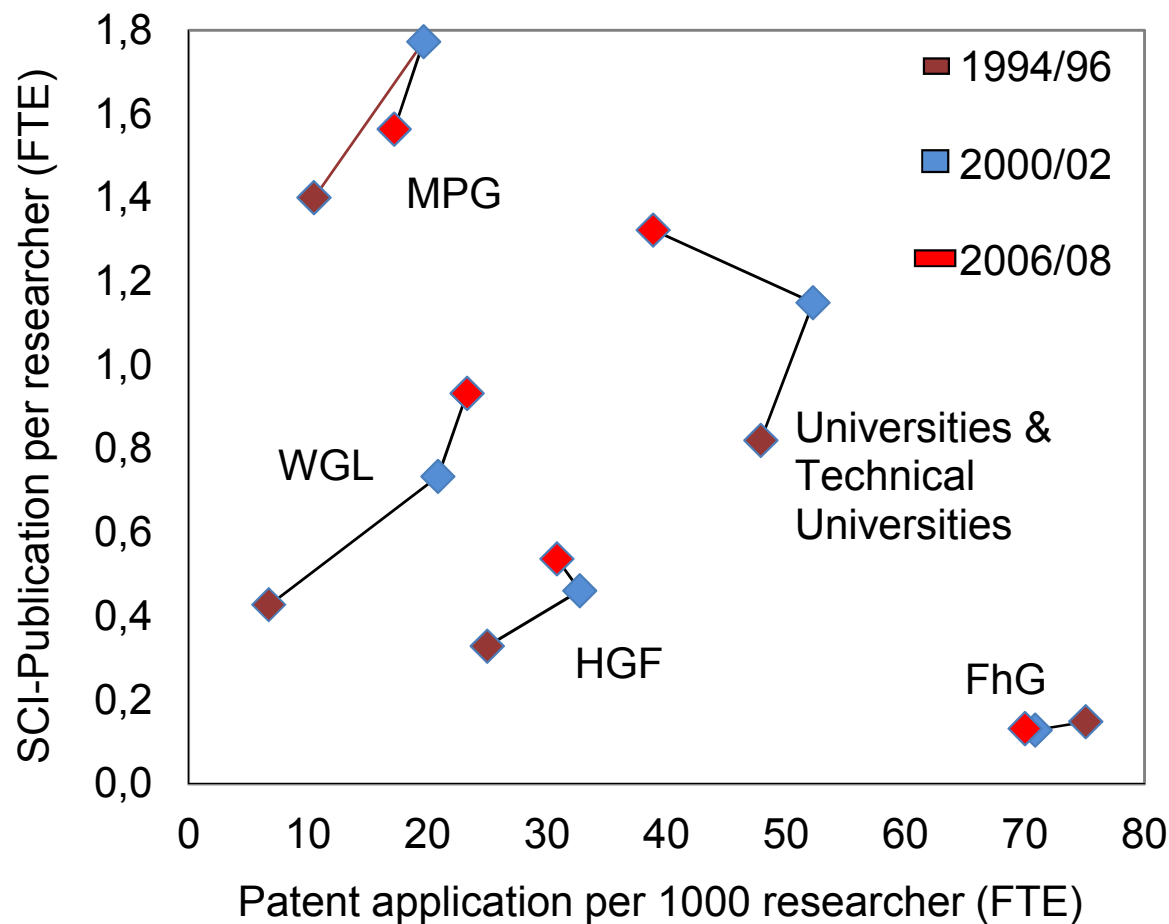
ZEW: Centre for European Economic Research

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German Public Research Institutions in the Publication vs. Patent Domain



Selected descriptive statistics

Means values for firms receiving R&D subsidies, without public R&D subsidies but R&D, without public R&D subsidies not conditioned on R&D

	East-Germany			West-Germany		
	With subsidy	Without (R&D)	Without (ALL)	With subsidy	Without (R&D)	Without (ALL)
R&D / Turnover	6.4%	2.6%	0.6%	4.4%	2.4%	1.1%
Innovation expenditure / turnover	10.8%	6.4%	2.5%	6.4%	4.6%	2.6%
At least one patent	36%	15%	14%	71%	58%	38%
Share of exporting firms	78%	68%	46%	97%	91%	79%
Firm size (No. of employees)	144	147	95	645	379	260

Source: ZEW Mannheim Innovation Panel

Probit estimates of R&D funding probability

Table 1: *Probit Regression for Programme Participation; All Firms*

Dependent Variable: <i>PF</i> Exogenous variable	Eastern Germany		Western Germany	
	Coeff.	Std. error	Coeff.	Std. error
<i>lnEMP</i>	0.94***	0.174	0.05	0.106
$(\ln EMP)^2$	-0.09***	0.020	0.02**	0.010
<i>RDDEPT</i>	1.46***	0.081	/	
<i>lnPAT</i>	/		0.10***	0.022
<i>NoPat</i>	-0.37***	0.088	-0.54***	0.176
<i>LnAGE</i>	-0.18**	0.077	/	
<i>DEXP</i>	0.44***	0.076	0.55***	0.106
<i>FOREIGN</i>	-0.63***	0.166	-0.21***	0.080
<i>WGROUPE</i>	-0.32***	0.098	/	
<i>lnHHI</i>	/		0.05*	0.028
<i>lnCR</i>	/		0.29***	0.105
Constants	-2.26***	0.834	-4.10***	0.693
<i>incl. industry and year dummies</i>				
Log-likelihood	-863.98		-1,533.92	
McFadden Pseudo R ²	0.337		0.165	
Number of observations	1,967		4,495	

*** (**, *) denotes significance at the of 1% (5%, 10%) level

Mean Comparison for Matched Samples

Means values for firms receiving R&D subsidies, without public R&D subsidies but R&D, without public R&D subsidies not conditioned on R&D

	East-Germany			West-Germany		
	With subsidy	Without (R&D)	Without (ALL)	With subsidy	Without (R&D)	Without (ALL)
R&D / Turnover	6.2%	3.1%	2.2%	4.4%	2.8%	2.2%
Innovation expenditure / turnover	10.6%	6.6%	5.5%	6.4%	4.8%	3.9%
At least one patent	31%	33%	33%	71%	71%	71%
Share of exporting firms	77%	77%	79%	97%	97%	97%
Firm size (No. of employees)	135	149	144	629	593	585

Source: ZEW Mannheim Innovation Panel

Output Additionality of Public R&D Subsidies

Probability of Patent Application: Probit-Regression

	East-Germany		West-Germany	
	Coeff	Std. Err.	Coeff	Std. Err.
R&D sponsored by government FuE	0,32***	0,09	0,15***	0,026
R&D financed by firm's own funds	0,45***	0,12	0,18***	0,027
Incl. export-, Incl. industry and time dummies				

No. of Patent Applications: Negativ-Binomial Regression

	East-Germany		West-Germany	
	Coeff	Std. Err.	Coeff	Std. Err.
R&D sponsored by government FuE	0,78***	0,21	0,30***	0,038
R&D financed by firm's own funds	0,91***	0,23	0,40***	0,043
Incl. export-, Incl. industry and time dummies				