

Crisis and Public R&D Investment

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Motivation

- Public R&D represents a large part of government's intangible investment
- R&D during crisis
 - Government grant (additional) R&D subsidies to the private sector in order to stabilize private sector R&D investments
 - Extend R&D spending of the public sector (universities, public sector research facilities)
- But:
 - Counter-cyclical policies might conflict with fiscal consolidation especially as tax income will also drop
 - More easier to cut R&D compared e.g. with social security
 - Discretionary R&D spending (like subsidies) easier to cut than e.g. institutional funding for universities, research institutes or research infrastructures

Research Questions

- ❖ How do economic crises influence the overall level and growth of public R&D spending?
- ❖ Do economic crises lead to shifts in the composition of public R&D expenditures across different thematic areas?
- ❖ Are there any business cycle induced redistributions across different recipients of public R&D expenditure?

Findings

- ❖ Strong pro-cyclical effect on public R&D investments
 - An increase in GDP by 1 percent leads to a subsequent increase in public R&D spending (GBAORD) by 0.15 to 0.2 percent
 - Growth rate of GBAORD is significantly lower in recession
 - Countries react differently to recessions: EU innovation leaders and non-EU countries pursue a counter-cyclical strategies; Countries with lower R&D investment level tend to pro-cyclical investments
- ❖ Government budget surplus/deficit and government debt levels affect public R&D spending significantly.
- ❖ Economic crises do not systematically affect the composition of GBAORD spending along different thematic areas
- ❖ No evidence for a business cycle induced redistribution of public R&D expenditures across recipients

Literatur

❖ Private R&D spending

- Majority of studies find pro-cyclical behaviour of private R&D
- Despite: opportunity cost of R&D favours counter-cyclical behaviour

❖ Public R&D

(less attention but increasingly since recent recession)

- Public R&D spending as Keynesian approach to fight recession
- Tax incentives
- Additional R&D subsidies
- Complementarity between private and public R&D crucial parameter
- Cyclical pattern of basic research vs. applied research or institutional funding vs. project-based (public) funding
- Target groups of R&D subsidies in the private sector & crisis
- Early vs. later stage of crisis (initial anti-crisis programme vs. consolidation needs dominating in later stages)

Data Sources

- ❖ **Government R&D spending** for 26 OECD countries for the period 1995-2015 (OECD MSTI & EUROSTAT)
 - Total public R&D funding broken down by recipients: business enterprise sector, higher education sector, government sector
 - Total government appropriations or outlays for R&D, broken down by thematic focus, distinguishing defence, health/environment, space, education/society, economic development, non-oriented R&D, and general university funds.
- ❖ **Business cycle fluctuations:** annual change in GDP
- ❖ **Fiscal consolidation needs:** Government budget surplus/deficit & level of government debt

Measuring Public R&D

- ❖ **GBAORD** (= government budget appropriations and outlays for R&D):
 - Derived from budget data (reliable & up-to-date)
 - Breakdown available by thematic areas (e.g. health, environment, economic development, etc.)
 - Closely mirrors government intentions
 - But: Regional government level's is not fully covered

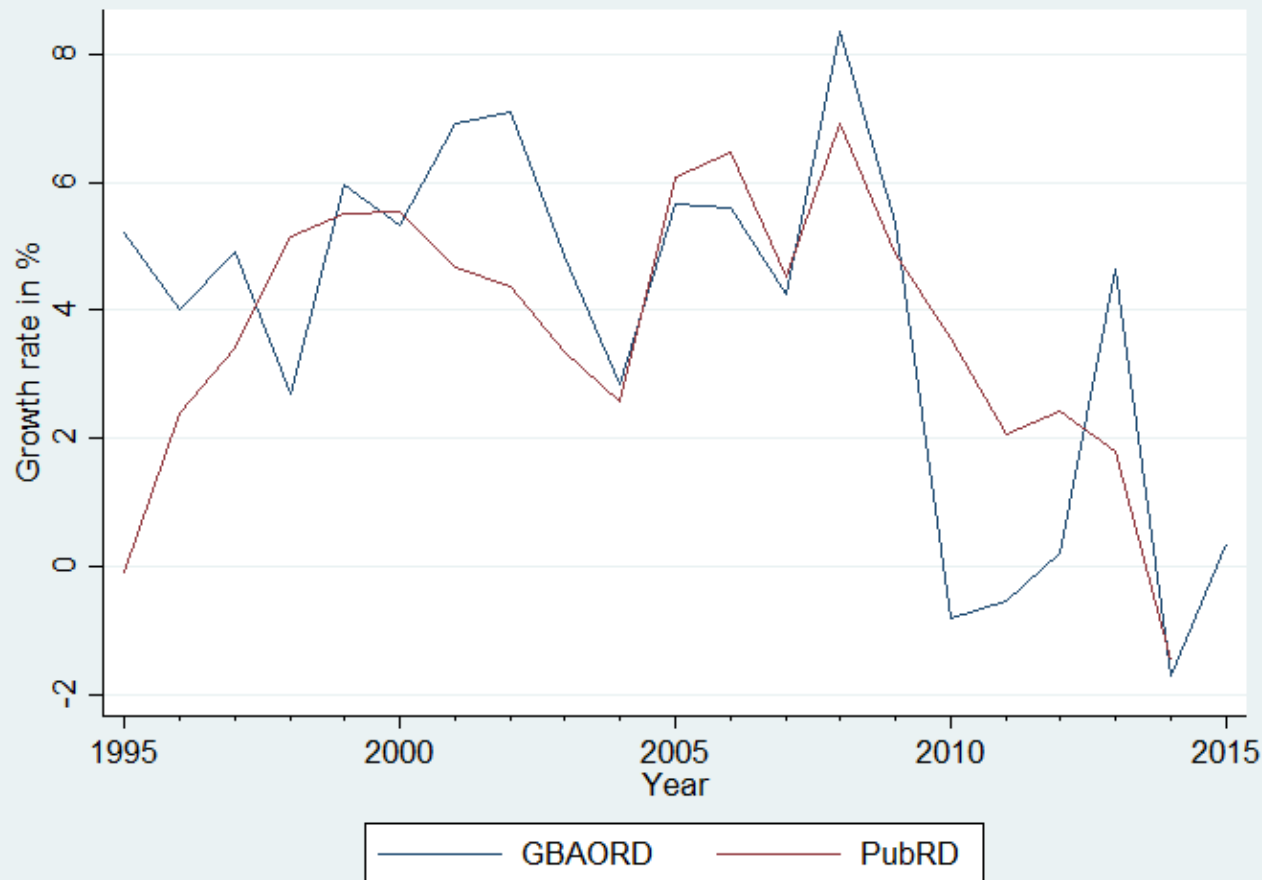
- ❖ **PubRD = HERD** (High education R&D)
+ **GOVERD** (government R&D = public research labs)
excluding HERD & GOVERD financed by private sector

Basic Empirical Model

$$\begin{aligned} GovRD_{it} = & \gamma GovRD_{it-1} + \beta_1 GDP_{t-1} + \beta_2 SURPLUS_{t-1} + \beta_3 DEBT_{t-1} + \beta_4 RECESSION_{t-1} + \beta_5 IR_t \\ & + Controls + \alpha_i + \varepsilon_{it} \end{aligned}$$

- Levels & Growth rates
- Variation of measurement of public investment
- Composition of public R&D with respect to thematic areas and with respect to beneficiaries
- Variation with regard to definition of cycle
- System GMM for levels
- Fixed Effects for growth rates

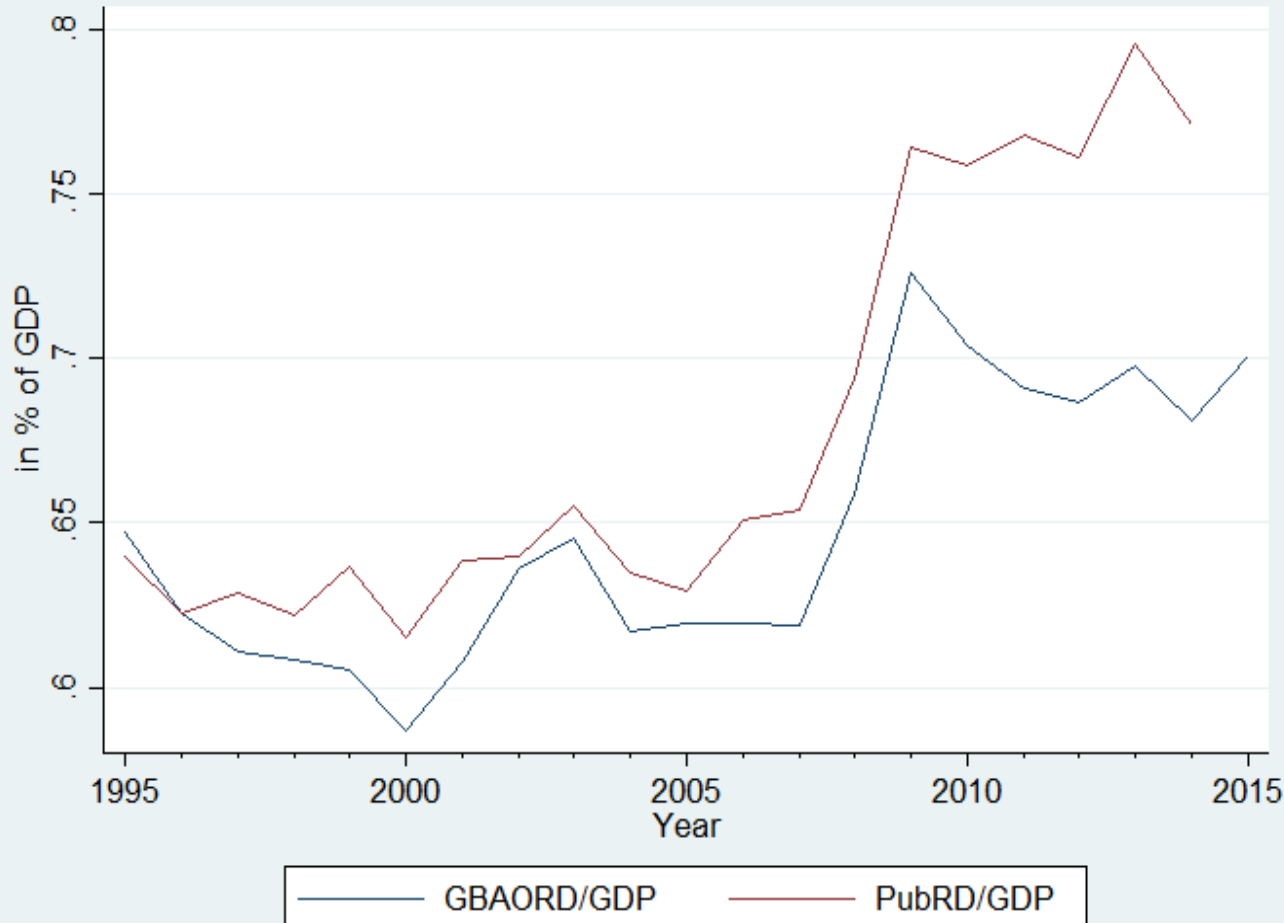
Descriptives I



Average
annual R&D
across all
countries

Descriptives II

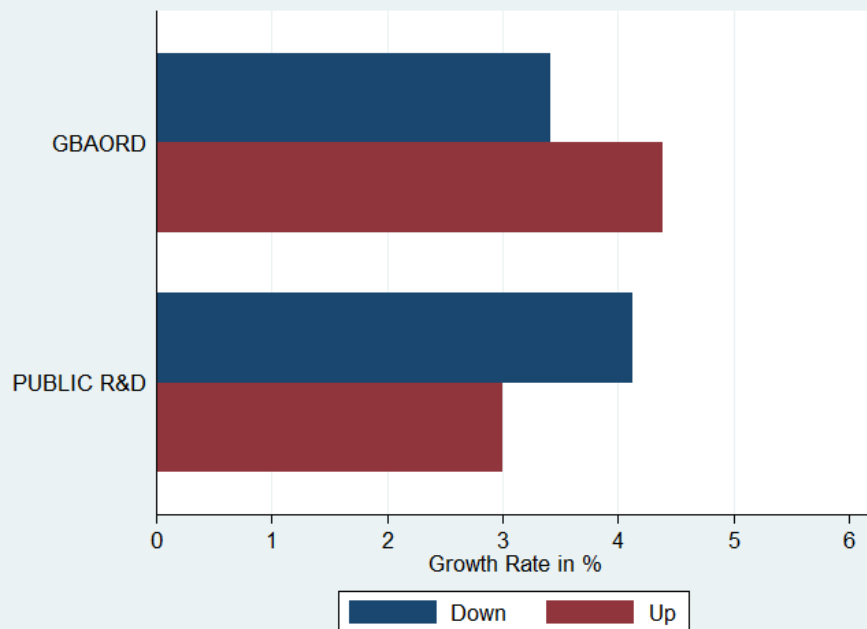
GBOARD &
PubRD
in % of GDP



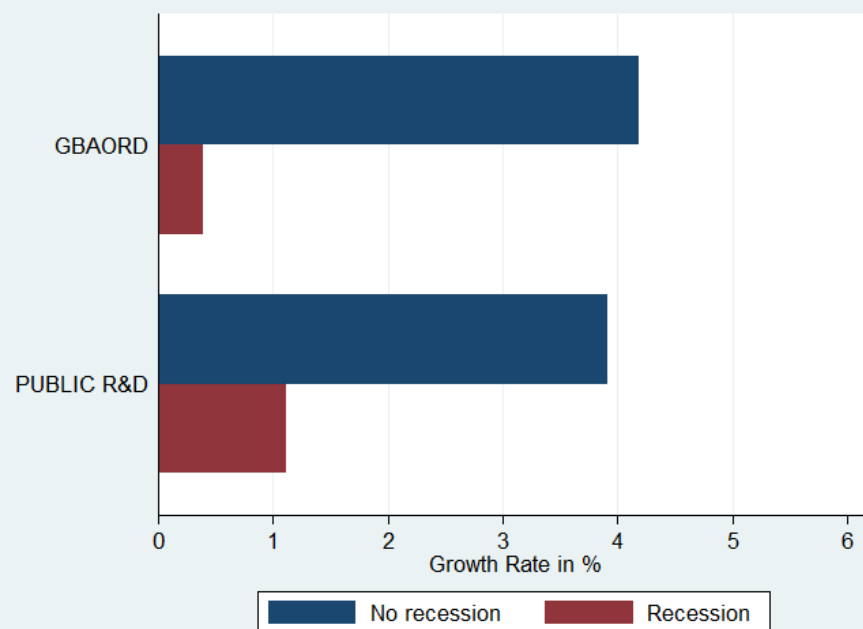
Descriptives III

Average Annual Growth Rate
by Country-specific Business Cycle Phases, 1995-2015

Down vs. Upturn



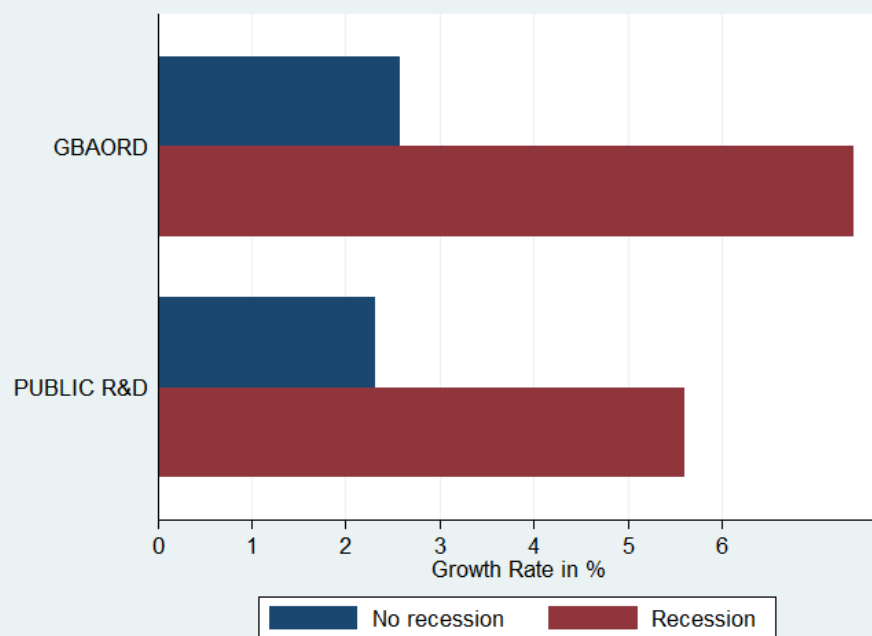
Recession vs. Non-Recession



Descriptives IV

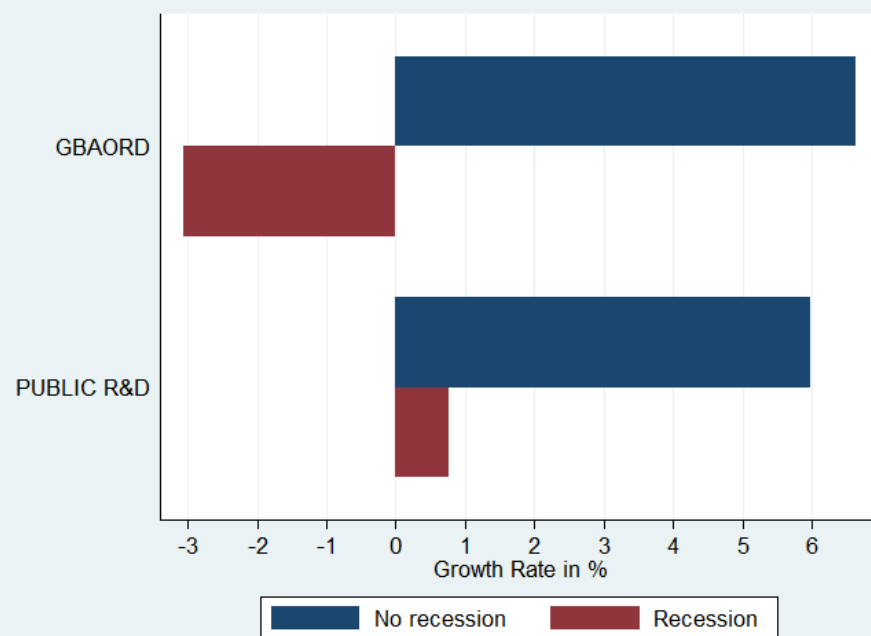
Average Annual Growth Rate
by Country-specific Business Cycle Phases, 1995-2015

EU Innovation Leaders



Germany, Denmark, Finland, Sweden

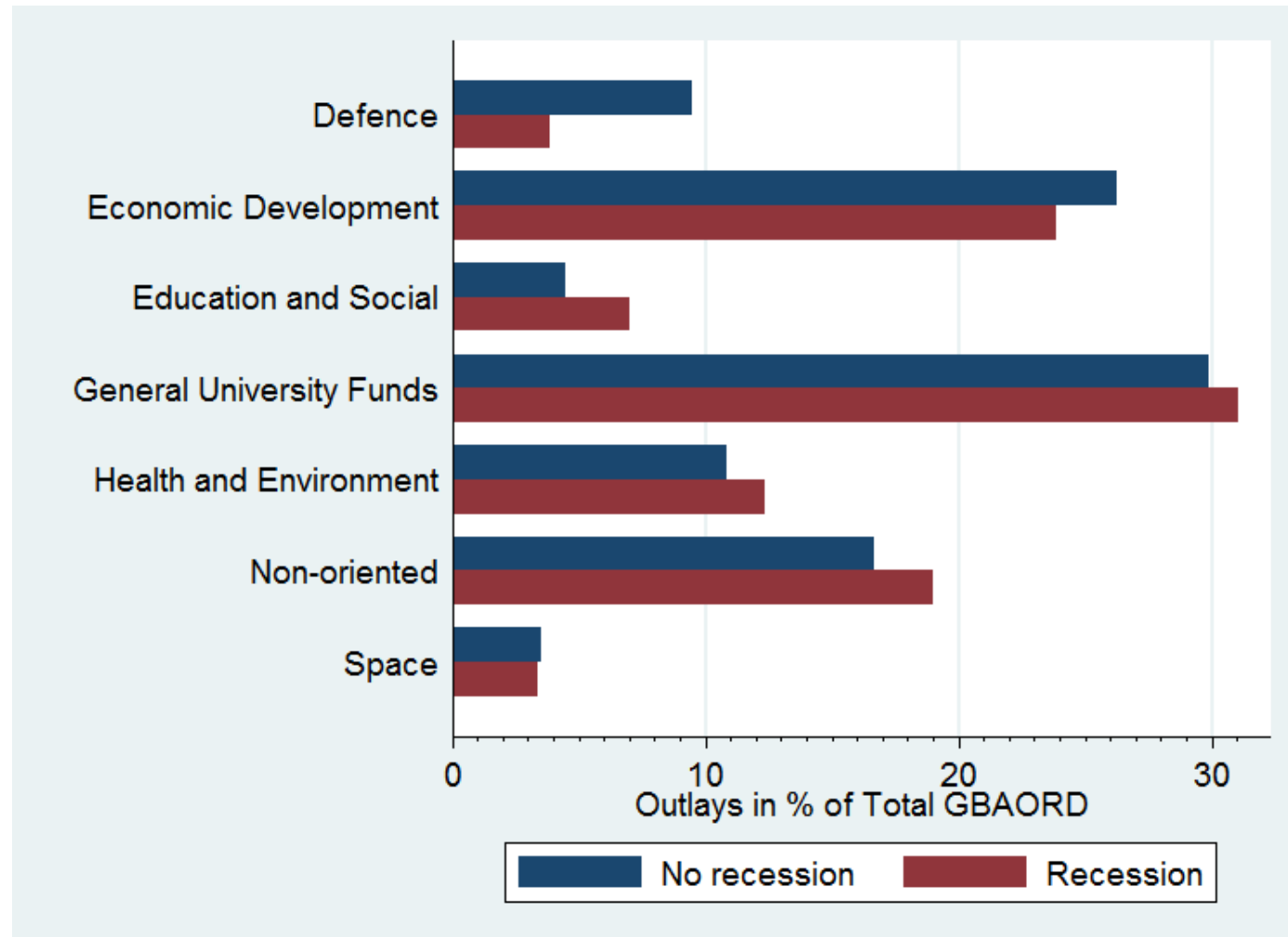
EU: Moderate Innovators



*Czech R., Estonia, Greece, Hungary,
Italy, Lithuania, Poland, Portugal, Spain*

Descriptives V

Composition of GBAORD in Recession vs. Non-Recession



Impact of Business Cycle Indicators on Government R&D Expenditures (GBAORD)

[illegible]

Impact of Business Cycle Indicators on Government R&D Expenditures (GBAORD)

VARIABLES	Pooled OLS	System GMM	Pooled OLS	System GMM endog.	System GMM exog.	System GMM exog.	System GMM exog.
In GBAORD (t-1)	0.920*** (0.013)	0.869*** (0.051)	0.910*** (0.017)	0.889*** (0.118)	0.830*** (0.067)	0.993*** (0.022)	0.815*** (0.075)
In GDP (t-1)	0.080*** (0.014)	0.144** (0.065)	0.092*** (0.020)	0.170 (0.177)	0.181*** (0.064)		0.202** (0.079)
SURPLUS (t-1)	0.007*** (0.001)	0.008*** (0.002)	0.006*** (0.001)	0.007*** (0.003)	0.006*** (0.002)	0.005*** (0.002)	0.006*** (0.002)
DEBT (t-1)			-0.0002 (0.0001)	-0.0005 (0.0004)	-0.0003* (0.0002)	-0.000 (0.000)	-0.0004** (0.0002)
IR (t)			-0.002 (0.002)	-0.000 (0.003)	-0.004 (0.004)	0.001 (0.005)	-0.003 (0.004)
RECESSION (t-1)						-0.018 (0.024)	0.002 (0.015)

Summarizing Results I

$$\begin{aligned} GovRD_{it} = & \gamma GovRD_{it-1} + \beta_1 GDP_{t-1} + \beta_2 SURPLUS_{t-1} + \beta_3 DEBT_{t-1} + \beta_4 RECESSION_{t-1} + \beta_5 IR_t \\ & + Controls + \alpha_i + \varepsilon_{it} \end{aligned}$$

- High degree state dependence (incl. Country Fixed Effects) – gradual adjustment
- GDP highly significant; strong effect of business cycle (1%GDP=>0.15%GBOARD)
- In the short run additional deficit increase public R&D (1%pointSurplus=>0.6%GBOARD)
- In the long-run a drop in debt increase public R&D (1%pointDebt=>0.03% public R&D)
- In recessions: short-run positive impact of a small government deficit or low level of debt is especially pronounced
- Interest rate never plays a significant role for public R&D expenditures

Summarizing Results II

- The composition of public R&D is quite robust against changes of the business cycle
- Only with regard to Expenditure for Economic Development existing government surplus and government debt show negative impacts on the development of this type of R/D investment
- Especially, R&D for university research seems to be especially robust against the cycle
- R&D rich country show a counter-cyclical pattern of R&D with regard to the business cycle where has public R&D is pro-cyclical of countries with a moderate or low R&D intensity (overall R&D intensity)
- Debt- / deficit financed increase in public R&D might only work for one year. However, the impact on next years public R&D is negative and even more the long-run negative impact