

# R&D & Growth

**Evidence from the scientific literature**

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- To reduce “market failures”
  - **Imperfect Appropriability**: Arrow (1962 )
    - Social Return > Private Return
  - **Uncertainty**: requires high risk premium
  - **Financial constraints**: SME’s and start-up

⇒ Business will fail to provide sufficient amount of R&D from a social point of view
- Contributing to basic knowledge and growth
- Social goals : Defence, Health, Space....

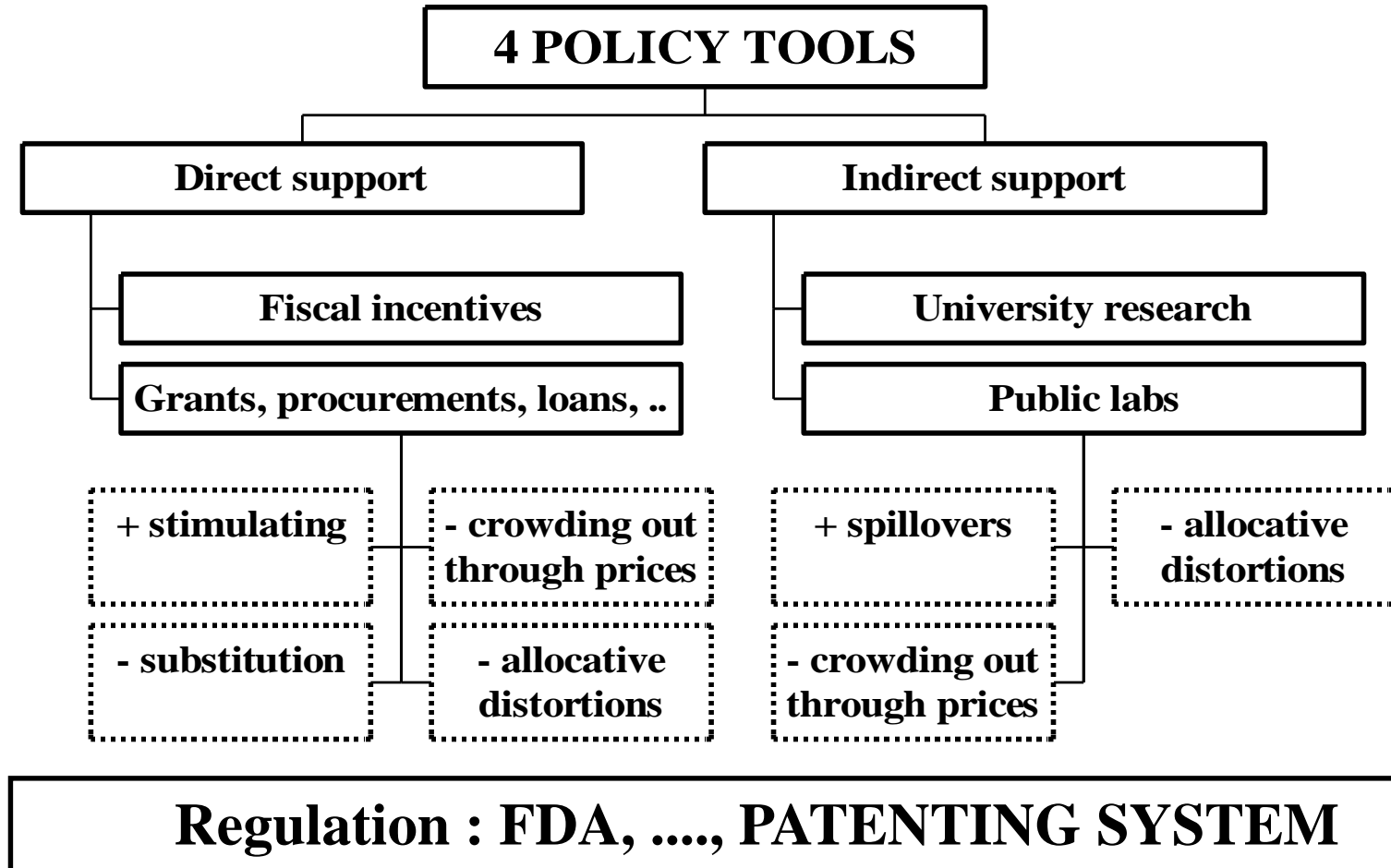
## Financial Constraints are Significant

Table AE

	All Sectors				ICT sectors			
	YICs		All other INN		YICs		All other INN	
	N	%	N	%	N	%	N	%
<i>Barriers to innovation</i>								
<b>Internal financial constraints</b>	46	91.30%	1233	66.42%	13	92,31%	205	85,00%
<b>External financial constraints</b>	46	95.65%	1237	75.75%	13	84,62%	206	67,48%
<b>Innovation costs too high</b>	45	93.33%	1237	87.71%	13	84,62%	203	89,66%
<b>Lack of information on technology</b>	46	69.57%	1231	63.20%	13	53,85%	206	65,05%
<b>Lack of information on markets</b>	46	69.57%	1233	67.56%	13	61,54%	205	69,27%
<b>Difficulty of finding cooperation partners</b>	46	67.39%	1230	53.90%	13	61,54%	205	55,12%
<b>Uncertain demand for innovative products</b>	46	89.13%	1236	74.60%	13	84,62%	206	75,73%
<b>No demand for innovation</b>	44	54.55%	1204	51.74%	13	53,85%	200	52,00%
<b>Lack of qualified personnel</b>	46	71.74%	1239	72.56%	13	61,54%	207	78,26%
<b>Regulations</b>	46	71.74%	1235	64.70%	13	69,23%	204	55,39%
<b>Resistance to change</b>	46	52.17%	1235	60.08%	13	38,46%	205	62,93%
<b>Market dominated by established firms</b>	46	65.22%	1236	62.14%	13	53,85%	206	65,53%

*Source:* On the basis of German CIS data 2004-2006, ZEW Mannheim. *Note:* Respondents were asked to give a score to each (potential) hampering factor on a scale going from zero (not relevant) to three (highly relevant). Percentages indicate the share of firms that considered this factor to be relevant (i.e. firms that scored one or more).

# S&T Instruments: the net impact on business R&D is unpredictable



Solow, Romer: for long run, **PRODUCTIVITY GROWTH**, comes from **TECHNOLOGICAL CHANGE**.

## How?

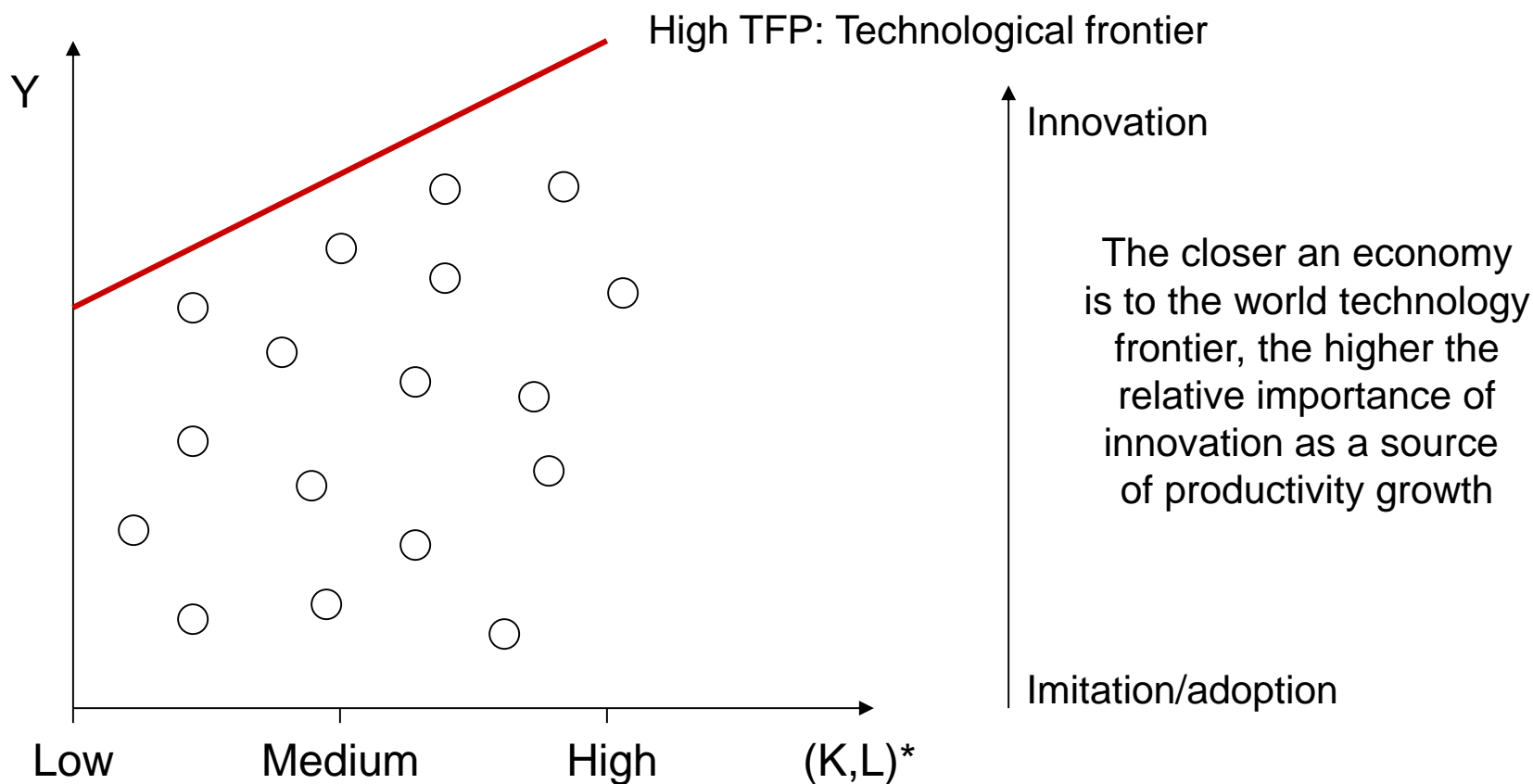
- New processes allow firms to increase output per worker/per unit of capital.
- New products contribute to improving the well-being of consumers.

## How much?

1. what are the sources of knowledge ?
2. What is their impact on technological changes on productivity growth?
3. Which policy?

- $Y = f(K,L) = A \times K^\alpha \times L^{1-\alpha}$
- « A » is TFP. It may account for more than half the growth of countries
- $A = f(\text{R\&D, Education,....})$
- Growth in A, growth in Y

## The growth engine depends on where countries stand

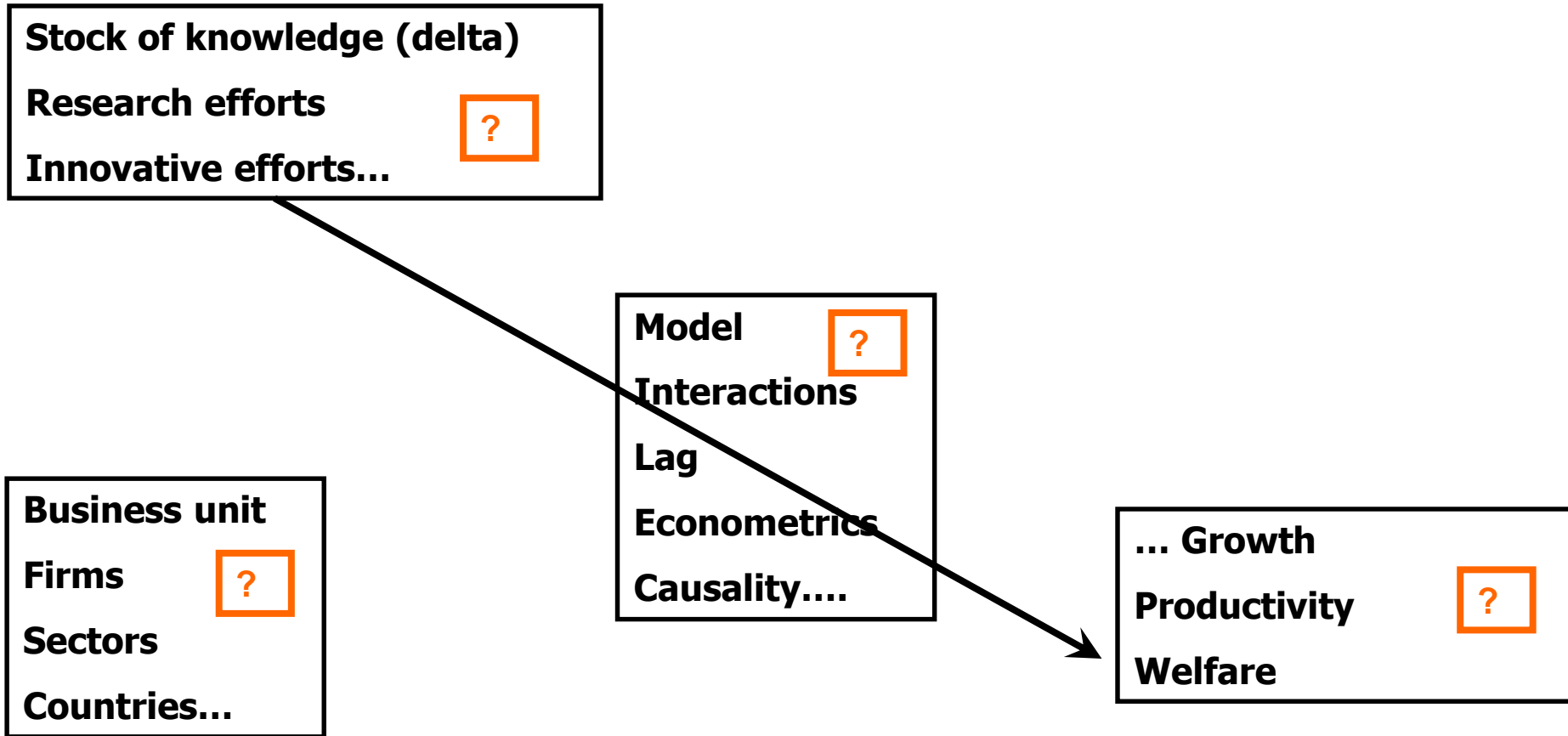


Is the residual (an approximation of the current state of technology) related to the knowledge base (Innovative efforts, innovative outputs, ...)?

The residual is the % of economic growth which is not accounted for by labour growth, and GFCF growth.

- $Y = TFP \cdot F(K, L)$
- $TFP = G(R, O)$  error term = current state of technology = Total Factor Productivity
- $R$  = accumulated R&D (or own knowledge stock)
- $O$  = other factors affecting productivity (including other knowledge stocks, education, ....)





- **Business R&D:**

1. generates new products and processes: it directly increases productivity. BUT its impact might differ according to the source of funds
2. enhance absorptive capability of outside knowledge

- **Public R&D:**

1. public missions (no *measured* effect nor *direct* effect);
2. basic research that induces new technological opportunities.

- **Foreign R&D:** new products and processes have a direct effect on productivity when implemented in the country (FDI, licences, imitation); an indirect effect through pecuniary externalities (imports, TBP...).

$$\text{LMFP}_{i,t} = \Phi_{it} + \beta \cdot \text{R\&D}_{i,t} + u_{i,t} \quad (3)$$



Empirical implementation

+ distinction between  $\neq$  sources of knowledge:

- domestic R&D (BERD)
- foreign R&D (FRD)
- public R&D (PRD)

+ time dummies ( $\varphi_t$ ) and country dummies ( $\Phi_i$ )

+ 2 control variables:

- Business-cycle effects ( $U$ ) (1- the unemployment rate)
- Dummy variable for the German reunification ( $G$ )

Conditions that potentially enhance or reduce the estimated elasticities across countries.

1. the origin of funding?
2. the absorptive capability (R&D intensity)?
3. the country size?
4. the socioeconomic objectives of public research?
5. the type of institution that performs research?

Do they explain cross-country difference? If yes, to what extent?

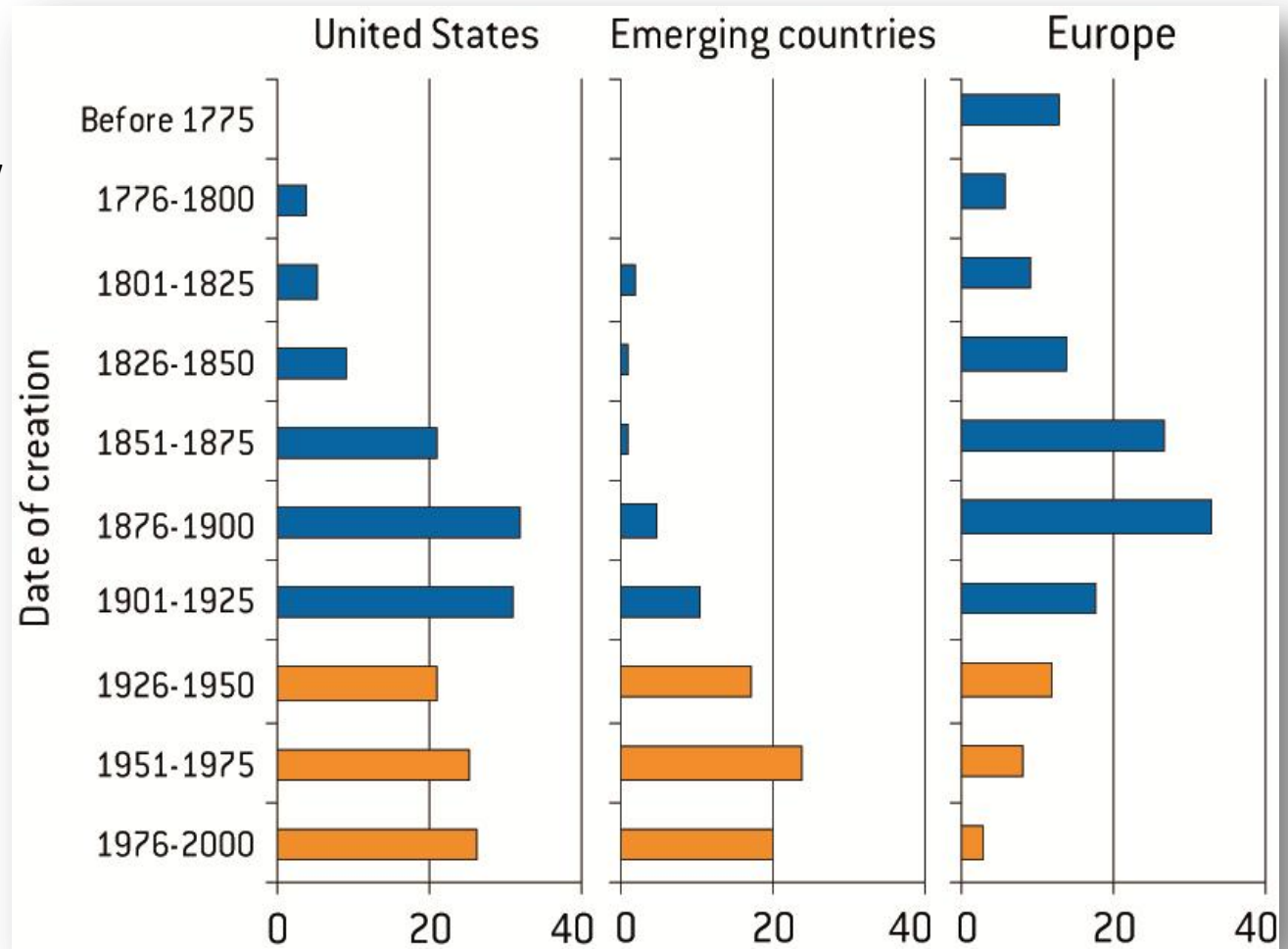
Conditions that potentially enhance or reduce the estimated impact of R&D on growth.

- Competition policy/IP policy
- Technology frontier
- Firm size/age
- Education/research education
- Academic research/research agenda setting
- Other appropriability methods

Cf. the survey and latest results in Aghion and Akcigity (2015)

1. Doing **R&D is important** for productivity and economic growth
2. Government may **review the mechanisms** through which they provide funds for R&D to firms
3. Government should **improve the reactivity** of the public research system
4. Government should **support basic research** performed in the higher education sector, and defend free research agenda
5. Government should **ensure the openness** of the economy to foreign sources of knowledge

- Europe does not generate many 'new champions'
- This mirrors lower growth rate of young companies



FT Global 500 companies in each age category, based on the end-Sep. 2007 ranking

Bruegel working paper 'The Demographics of Global Corporate Champions', July 2008, N. Veron

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