



# **Performance and growth of innovative firms: IRIMA recent evidence and planned work**

First IRIMA workshop

**Industrial Research and Innovation Monitoring and Analysis**

*Identifying policy-makers and business community needs*

*Brussels, 4 December 2012*

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# Presentation's outline

## ***Recent IRMA/IRIMA results. A selection***

- A. Relevance and evidence of firms performance & growth*
- B. R&I and Productivity gains*
- C. R&I and Employment growth*

## ***Planned work***

- *R&D and firms' growth*
- *R&D and firms' productivity*
- *Policy aspects in innovative firm's performance and growth*





## **A. Relevance and evidence of firms' performance and growth**

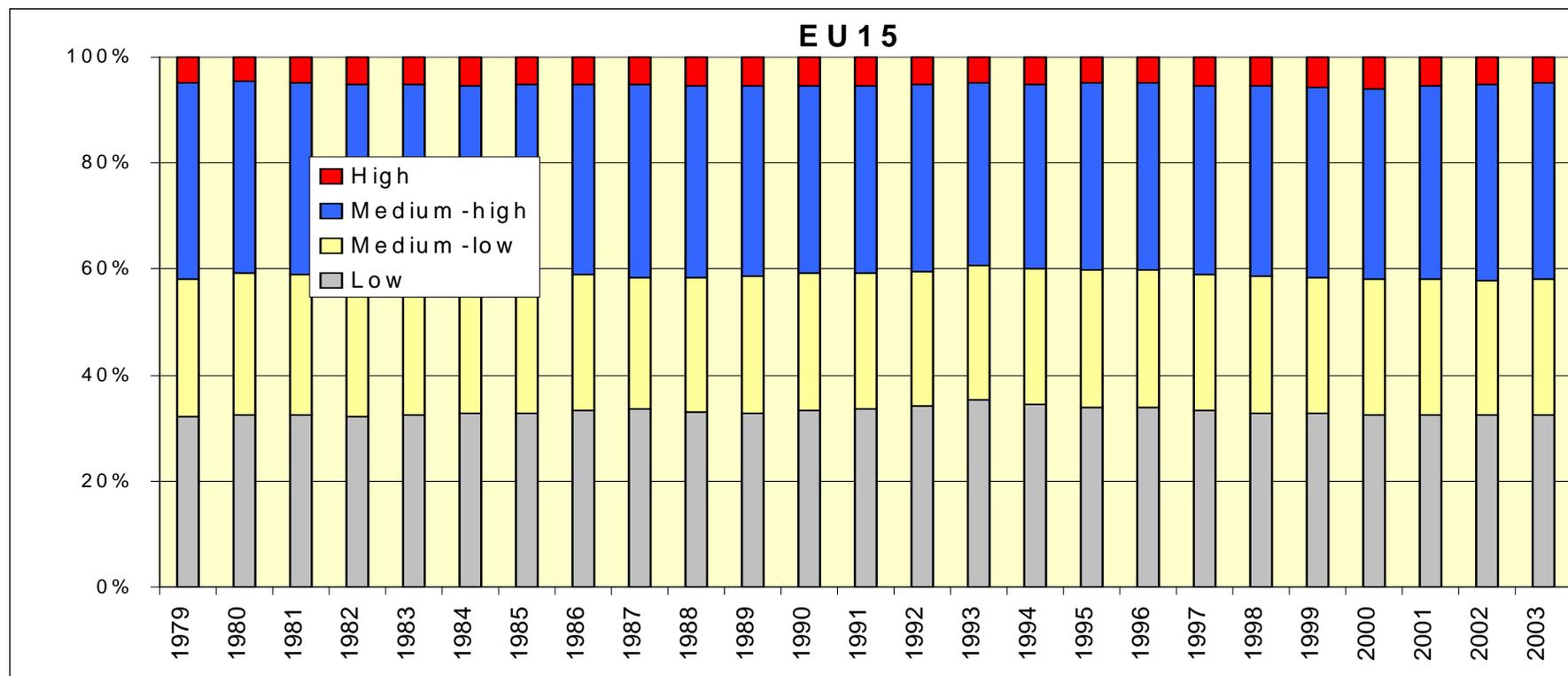
### *1. Structural changes of the economies and the relevance of young/smaller innovative firms*

#### **Diagnosis:**

**Structural changes in EU occur at a modest pace and the EU misses the growth of smaller/young and innovative firms to speed up a positive structural dynamism**



## Sectors' dynamics: Contribution to value added; manufacturing



Data: Groningen's 60-Industry Database 2006

Source: European Commission, JRC-IPTS / DG RTD - Moncada-Paternò-Castello (*Science and Public Policy*, 2010)

=> The contribution of the high and medium-high tech manufacturing sectors to value added in the EU has hardly changed in the past decades

=> **Aggregate statistics often lack relevant characterizations**

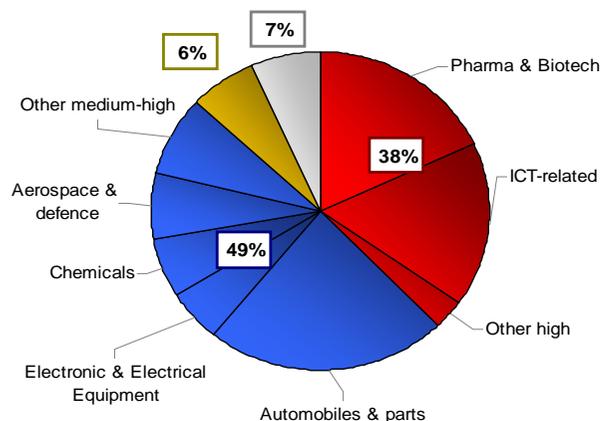


European Commission

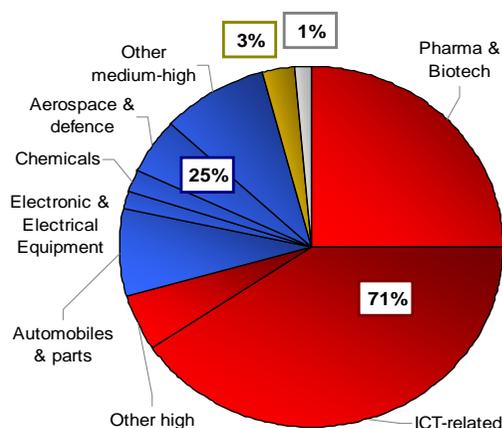
# EU vs. USA - Why there is a corporate R&D investment gap?

## → Big difference in sector mix of the two economies

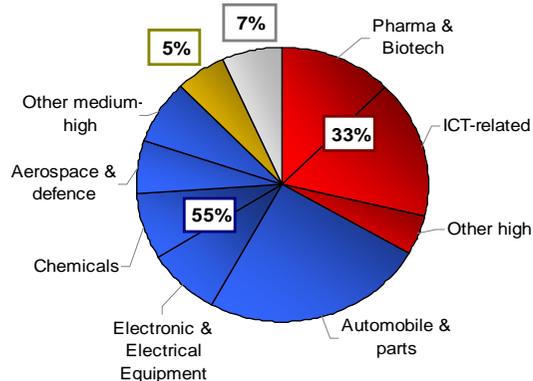
EU 2011



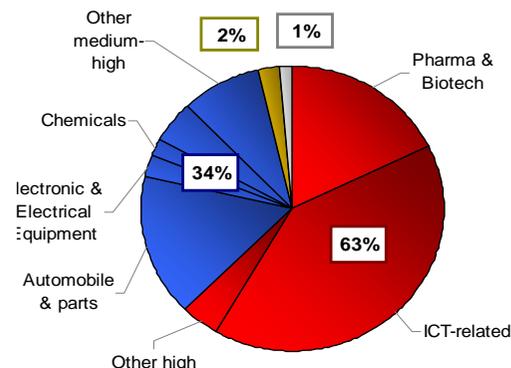
US 2011



EU 2002



US 2002



■ High ■ Medium-High ■ Medium-Low ■ Low R&D intensity

The EU is specialised in the medium-high and US companies in the high R&D intensity sectors.

... and the gap is increasing



## Literature / JRC-IPTS findings

- **Modest speed of industrial structure change in Europe**
- **The greatest structural changes in industrial R&D have occurred - in the last decades - in a set of *new industries and services* in the **US**.**
- **This country is clearly more specialised than others in the world, but also is *more able to shift, maintain and reinforce its specialisation over time*.**
- **Fundamental role of smaller/younger firms - though their R&D-lead growth and performance - in this positive dynamics**

*Ref.: Gambardella et al. (2007), Mowery (2009), Foray and Lhuillery (2010), Karlsruhe Univ. and Bocconi Univ. (2010) and JRC-IPTS-DGR&I studies (2009-12)*



## *2. Innovative small firms in the EU*

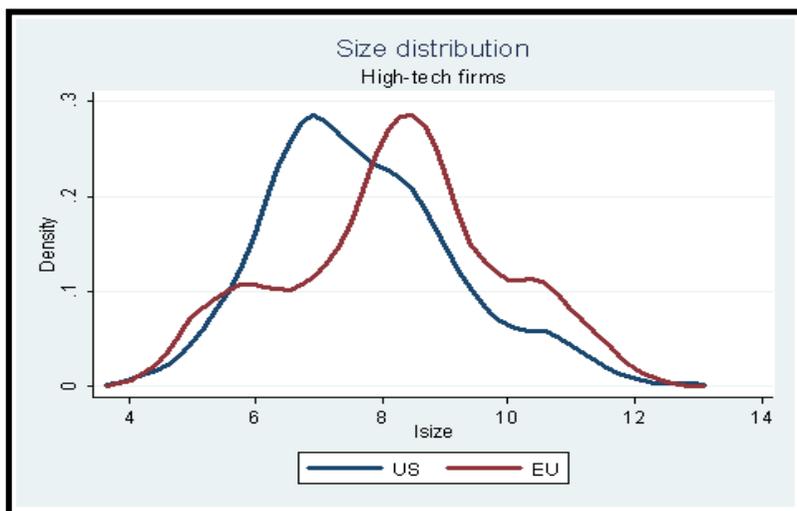
### **Diagnosis:**

**Smaller companies** active in R&D are fewer in the EU than in the US

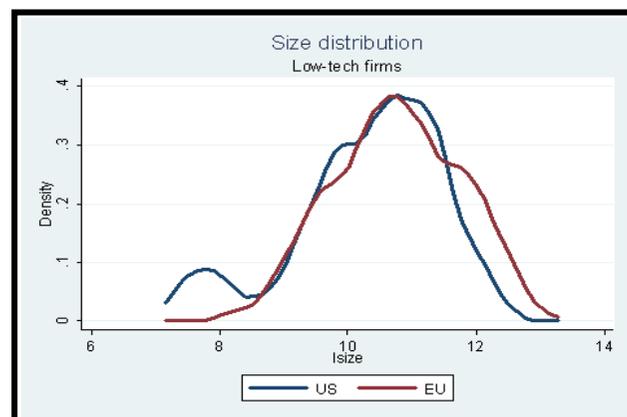
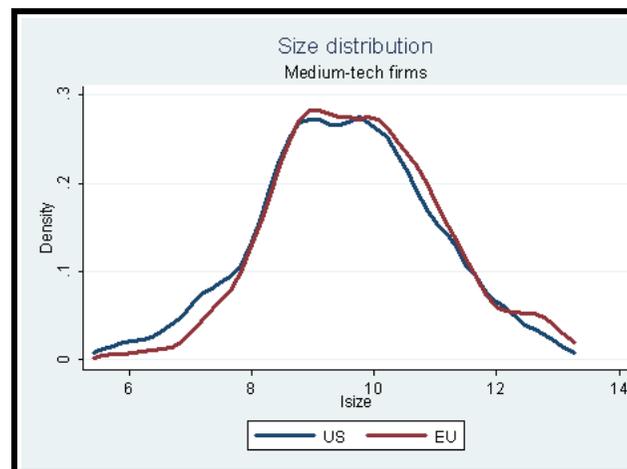


## The size (employees) of top R&D investing firms by groups of R&D intensity

**There are US-EU differences in the size of high R&D intensity firms**



**These differences disappear at lower R&D intensity levels**



Data: EU Industrial R&D Investment Scoreboard, 2006  
Source: European Commission, JRC-IPTS / DG RTD – Ortega-Argilés and Brandsma (*Science and Public Policy*, 2010) ■ □



### *3. Young leading innovative firms in the EU*

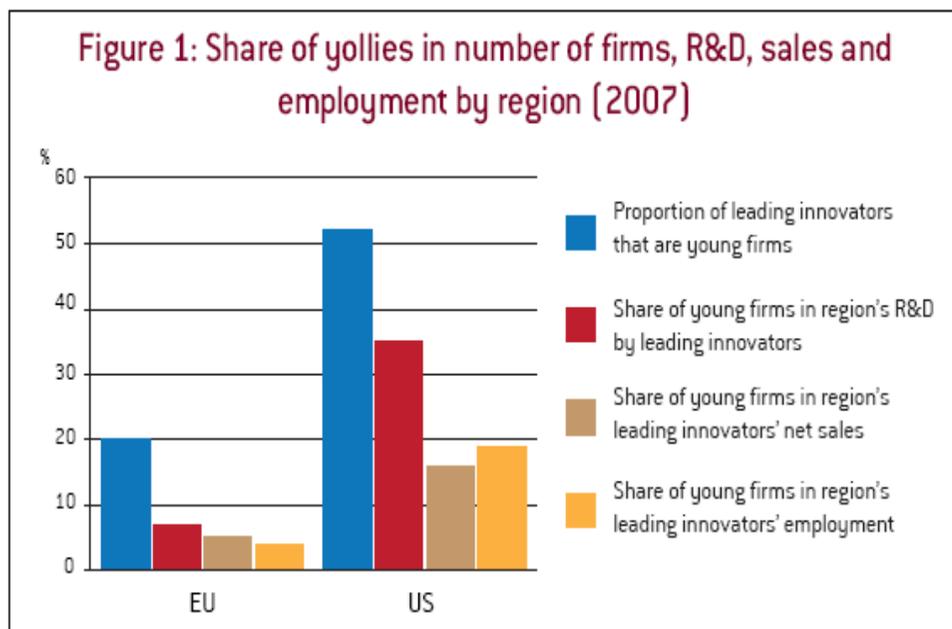
#### **Diagnosis:**

**Young** companies investing strongly in R&D are fewer in the EU than in the US



## EU is lacking firms among young leading innovators

Figure 1: Share of young firms in number of firms, R&D, sales and employment by region (2007)



Among the largest R&D investors, Leading Innovators are defined both by the R&D expenditures and age:  
 Young (YLI) =  $\geq 1975$  of firm creation  
 Old (OLI) =  $< 1975$  of firm creation

### Annual average Net Sales growth (2004-2007) of YLIs and OLIs by region (in %)

Net Sales	EU	US
<b>Total Growth</b>	<b>8</b>	<b>8</b>
<i>Growth YLI</i>	<i>12</i>	<i>13</i>
<b>Growth OLI</b>	<b>8</b>	<b>7</b>
<i>Contribution from YLI to total</i>	<i>6</i>	<i>23</i>

YLI have a higher sales growth than OLIs

**The higher contribution of YLIs to sales growth in the US is therefore due to having more YLIs**

Data: EU Industrial R&D Investment Scoreboard, 2007;

Source: European Commission, JRC-IPTS / DG RTD - Cincera and Veugelers (2010)



## *4. Simulating the growth of R&D intensive firms:*

*Can fast growing R&D-intensive SMEs affect the economic structure of the EU economy?*

*- A projection to the year 2020 -*

### **Diagnosis:**

EU needs the R&D-lead growth of *more* new/smaller firms to revitalize the EU economy *within the next decade(s)*

# Scenario results

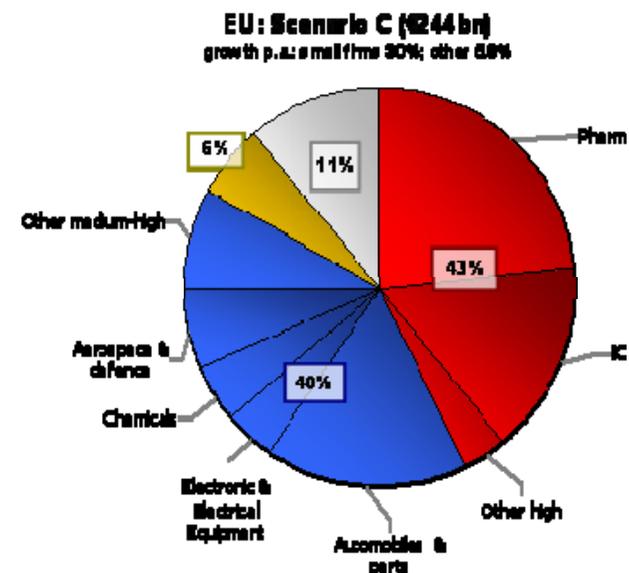
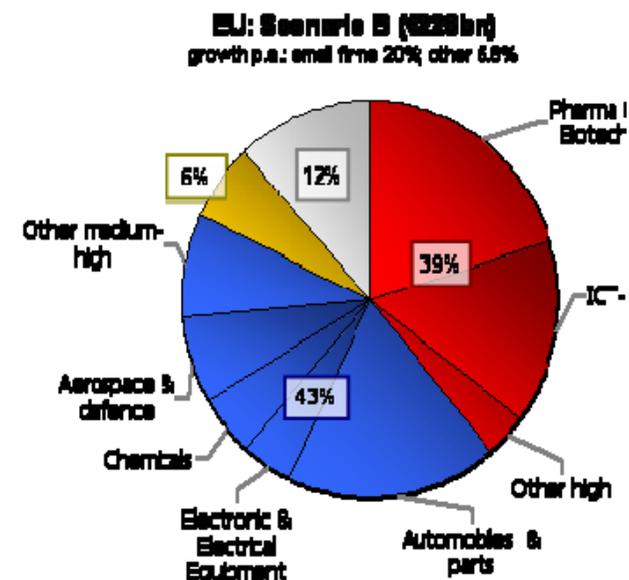
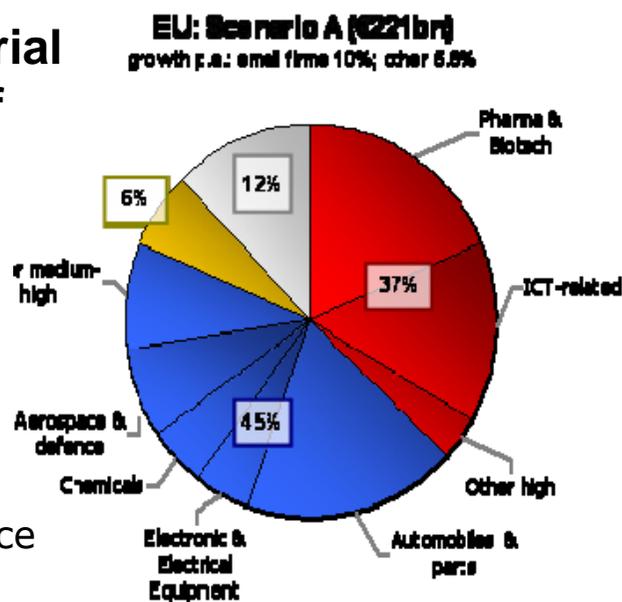
## Simulated EU Industrial R&D Scoreboard of year 2020

### Main assumptions:

- SMEs found in 2002-09 will grow at a faster pace
- Large size companies continue to grow as before

A results appear similar to Reference Scenario B and C: medium-tech sectors tend to decrease, while high-tech sectors increase

*Data: based on the EU R&D Scoreboard 2010*



## Analysis of results

- *The structural gap (EU vs. US) in terms of R&D investment is hardly expected to close until 2020, if it is assumed to be driven by the growth of present 'R&D-intensive firms SMEs'*
- *To close the gap: either a significant longer time horizon of the assumed fast growth track than the simulated 10 years or SMEs' growth figures even exceeding the assumed 30% annually.*
- *It derives that facilitating also the presence of a higher number of new 'small' fast growing R&D-intensive firms together with the R&D-lead growth of large firms could be more promising options.*



## **B. Corporate R&D and firm's productivity**





# Evidence from Europe's top R&D investors

## ***Data:***

Top EU private R&D investors. Unbalanced longitudinal database of micro-data consisting of 577 European companies over the period 2000-05

## ***Methodological approach:***

Econometric test; Stochastic frontier analysis

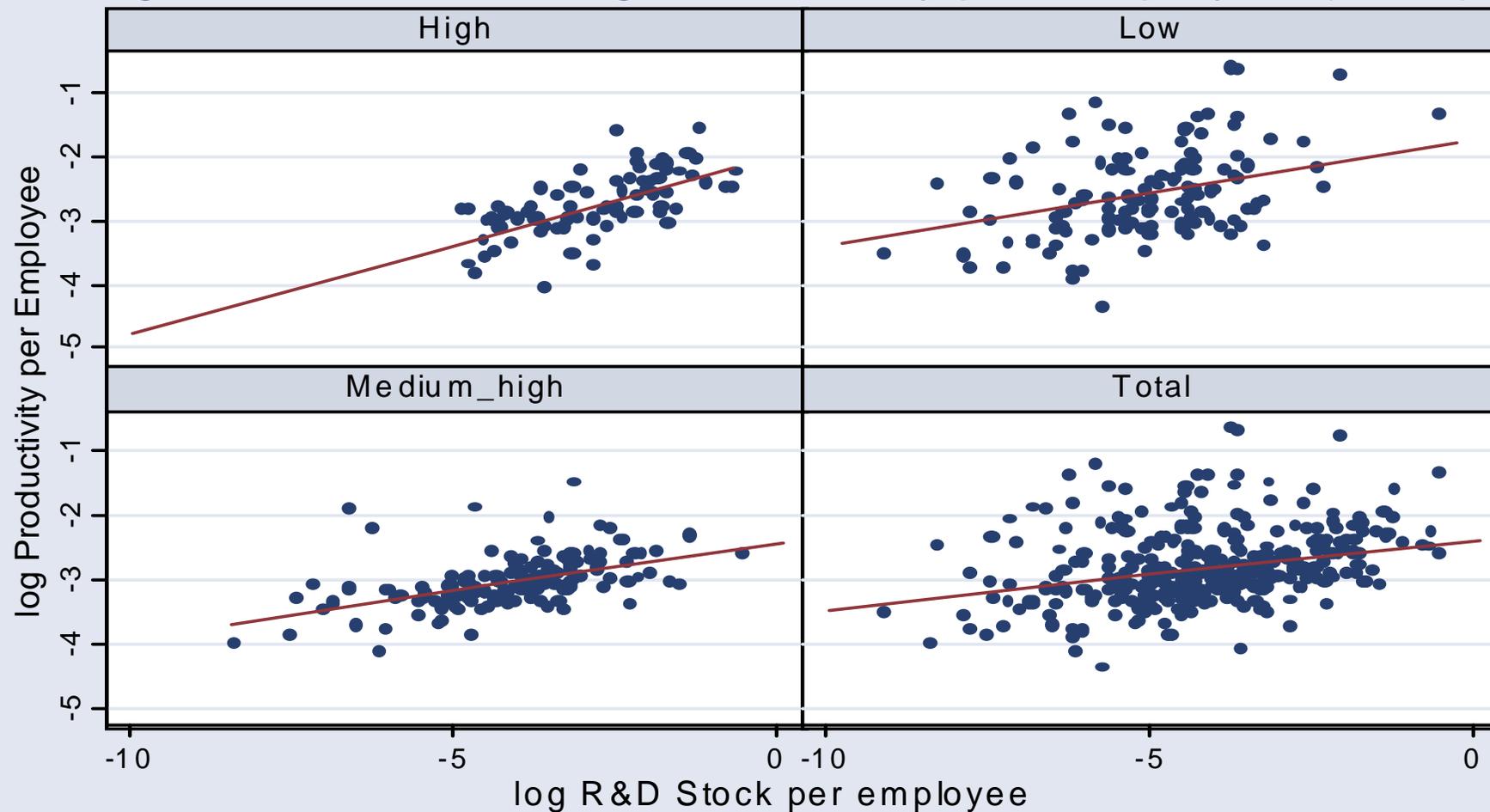
## ***Main findings:***

- 1) Link between R&D and productivity in the high-tech sectors, to a lesser extent in the medium-tech industries
- 2) Stability of the coefficients linking R&D and productivity over time
- 3) Role of physical capital in generating productivity gains

## ***Main analytical results / messages:***

- Investment in physical capital stock results in higher productivity returns in low-tech and service sectors than R&D investment
- R&D investment results in higher productivity returns to firms in high-tech sectors (see graph in next slide).

## Log R&D Stock vs. Log Productivity per Employee (2005)



Graphs by R&D Intensity sector groups



## **C. Research/Innovation and employment**

*(i) Impact of corporate R&D investment on employment*





## The evidence from several studies:

- (1) *Analysis of **OECD** data at industry level from 15 European countries, covering 25 manufacturing and service sectors for the years 1996-2005 (JRC-IPTS / DGRTD - Bogliacino and Vivarelli, 2010)*
- (2) *An investigation which uses innovation surveys (**CIS**), representative at the national level and covering 23 EU countries for the period 1998-2000, nineteen countries for 2002-2004 and eighteen countries for 2004-2006 (JRC-IPTS / DGRTD - Bogliacino and Garcia Torres, 2011)*
- (3) *A paper which assesses the job creation effect of R&D expenditures, using a unique longitudinal database (**EU R&D SB**) of 677 European companies over the period 1990-2008 (JRC-IPTS / DGRTD - Bogliacino, Piva and Vivarelli - 2012).*





# Results and implications

## **Results:**

- In all the works the positive **impact comes out robustly and a conservative estimate of the elasticity can be identified into 0.15**
- This positive significant effect corresponds to the **high-tech sector and services**, but it is not significant for traditional manufacturing sectors.

## **Policy implications:**

- (1) Relevance of framework conditions / policy mix to favour the matching of supply of skills with the demand generated by R&D investment
- (2) Importance of supporting firms' competitiveness, as innovation is also related with market power
- (3) The results support the policy agenda of promoting structural changes in European economies.





## *(ii) Innovation & employment: Country-specific evidence*

# **Does size or age of innovative companies affect their growth persistence?**

**Evidence from a Spanish panel of innovative firms**

Source:

European Commission, JRC-IPTS / DGRI - Ciriaci, Moncada-Paternò-Castello and Voigt (2012)





## Research questions

- Do Spanish innovative and non-innovative firms show different employment growth patterns?
- Are there systematic differences in the persistence of the jobs created by innovating vs. non-innovating firms?

## Dataset

**Eight** waves (2002-2009) of the **annual** Spanish Community Innovation Survey (Encuesta Sobre Innovación en las Empresas) – balanced panel of **3,178** firms (25,426 observations).

## Methodology:

Serial correlation; quantile regression





## Results

### Innovative firms:

- High employment growth episodes are more likely
- Stable employment creation over time

### Smaller and/or younger firms (innov. + non-innov.)

- Are more likely to experience high employment growth

### Young Innovative Companies (YICs):

- When growing, do not necessarily grow faster in employment than **non-YICs** companies
- When declining, decline slower in employment than **non-YICs**.



# Employment growth results

	Q10	Q25	Q50	Q75	Q90
<b>SIZE (t-1)</b>	<b>0.0070***</b> (0.00228)	0.00157 (0.00112)	0.000557 (0.000585)	<b>-0.00429***</b> (0.00116)	<b>-0.00939***</b> (0.00206)
<b>Innovative; Growth (t-1)</b>	-0.0881 (0.0741)	-0.0225 (0.0294)	0.0183 (0.0221)	<b>0.0434*</b> (0.0211)	<b>0.0672**</b> (0.0381)
<b>Non-innovative; Growth (t-1)</b>	0.0708 (0.0687)	0.0343 (0.0316)	-0.000732 (0.0209)	-0.0169 (0.0197)	<b>-0.0864***</b> (0.0303)
<b>Innovative; Growth (t-2)</b>	-0.0143 (0.0342)	-0.0101 (0.0227)	0.0132 (0.0164)	-0.00169 (0.0218)	-0.00423 (0.0503)
<b>Non-innovative; Growth (t-2)</b>	0.0319 (0.0354)	0.0394* (0.0216)	0.0178 (0.0162)	0.0333 (0.0215)	0.0208 (0.0491)
Dummy innovative firms	<b>0.0559***</b> (0.00919)	<b>0.0222***</b> (0.00277)	<b>0.009***</b> (0.00226)	<b>0.0143***</b> (0.00446)	<b>0.0215***</b> (0.00708)
<b>YICs</b>	<b>0.317***</b> (0.0488)	<b>0.208***</b> (0.0422)	<b>0.153***</b> (0.0389)	0.0758 (0.0496)	-0.00535 (0.0557)
<b>AGE</b>	<b>0.030***</b> (0.00627)	<b>0.007***</b> (0.00223)	<b>-0.0025***</b> (0.00107)	<b>-0.019***</b> (0.00186)	<b>-0.0428***</b> (0.00435)

**Quantile 10: Declining firms**

**Quantile 90: High growth firms**



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# Planned work





# ***R&D AND FIRM GROWTH***

## ***Objectives***

- To study how the variations in R&D investment and the differences in size, age, and sectors of top R&D investing firms affect their employment and sales growth over time
- To assess the impact of both geographic and industrial diversification of economic activities on employment and the business performance of top R&D-investing companies

## ***Data***

- A unique balanced panel of micro-data of ~ 1,600 firms with a longitudinal coverage of years (2002-2012), built from the EU R&D Scoreboard
- To complement the above information with data from commercial sources , e.g. AMADEUS, COMPUSTAT, Dun & Bradstreet, ORBIS.

## ***Methodological approach***

Literature review, qualitative, and quantitative (descriptive statistical and econometric) analysis methods.





# ***R&D AND FIRM PRODUCTIVITY***

## **Objectives**

- To investigate whether significant differences emerge in the connection between R&D and efficiency in the US vs. the EU (transatlantic efficiency gap)
- To see whether (and how much) the intensity of the R&D/efficiency link is affected by the sectoral composition and the institutional context characterising the different European countries
- To check whether R&D is clearly and significantly linked to efficiency in IT sectors, while a weaker impact emerge in the other sectors of the economy.

## **Data**

EU R&D Scoreboards data complemented by Compustat Global dataset (Standard & Poor's). Unbalanced panel with ~1,800 companies, covering 1990-2008 years

## **Methodological approach**

Standard parametric econometric approach and exploration recent of semiparametric approach techniques; Efficiency decomposition (Oaxaca).





# ***POLICY ASPECTS OF CORPORATE R&D***

## **Objectives**

- To study what are the implications for research and innovation policy following the results of the aforementioned research tasks (performance/growth)
- To explore to what extent policy initiatives have determined firms' R&D investment
- To investigate the most appropriate policy instruments that guarantee the fair growth stability of innovative firms' employment and business performances.

## **Data**

- Information on public policies & instruments from public available sources, e.g. Innovation Union Observatory; FP7 SIMPATIC project
- Company information on the influence of public policies on firms' R&D investment: EU R&D Scoreboard + surveys (IRI/Innobarometer/*ad hoc*), or interviews

## **Methodological approach**

Literature review, qualitative, and quantitative (descriptive statistical and econometric, e.g. input additionally of policy impact on R&D investment).





# Thank you for your attention

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