

Innovation, Employment, Firm growth and Job creation

Discussion

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Impact of industrial research and innovation on job creation

The study provides

- A theoretical discussion of the topic
- Survey of empirical studies
- Two empirical tests of hypotheses on R&D, investment and job creation
- Annex with additional evidence at firm and sectoral level

We learn that

- The literature provides evidence for a positive relationship between R&D and employment (confirmed by the study)
- ... and a negative or neutral relationship between process innovation and employment (confirmed by the study)
- The relationship between employment and innovation is manifold and shaped by different, opposing effects

Overall, the message of the study is positive

- There may be negative effects from process innovation, but also mechanisms that compensate negative effects
- The compensation effects seem to be stronger
- So, the economic literature seems to be optimistic about technology and employment
- I have the impression that there is a fundamentally different perception of the topic in public discussions

The public recognition is clearly negative

- New technologies are destroying jobs
- Just ask Google about robots and employment...



New studies on ICT and employment

- There are a number of recent studies from an labour economics background which come to a more pessimistic view on the relationship of technology and innovation
- These studies focus on the impact of information and communication technologies (ICTs), and often refer to trends such as:
 - Digitalisation in production
 - Machine learning, autonomous decision making, artificial intelligence
 - New production technologies, 3D printing, etc.
 - Robotics

Studies on the impact of ICTs on employment

Source	Result	Forecast	Remarks
Frey and Osborne (2013)	-47%	10 - 20 years	USA, all sectors
Bowles (2014)	-47 to -60%	10 - 20 years	All EU member states; follows the approach of Frey/Osborne 2013
Bonin et al. (2015)	-12%		DE, all sectors
Boston Consulting Group (2015)	+6%	10 years	DE, manufacturing
Wolter et al. (2015)	less than 1%	25 years	DE, manufacturing, considers also economy- wide compensation effects
Arntz et al. (2016)	-12% to -6%		OECD countries, follows the approach of Bonin et al. 2015

The study of Frey und Osborne (2013)

- with around 450 citations in Google Scholar since 2013 and 445,000 search results on Google, this is one of the most discussed pieces of research these days.
- Frey and Osborne identify occupations with the highest content of routine tasks
- They estimate on this basis how many jobs could be replaced by robots, algorithmic decision-making and other applications of ICT.
- The authors find that about 47 percent of total US employment is at risk of being substituted within the next 20 years.
- Bowles (2014) repeats the study for the European Union
 - Between 47% (for Sweden - similar to the US) and up to well over 60% (Romania) of the EU work force will lose their job due to ICT

Critique of Frey und Osborne (2013)

- Bonin et al. (2015) focus on **tasks within occupations** rather than occupations itself.
 - Occupations include various tasks, routine and non-routine, and require a set of different skills.
 - Persons apply their skills to deliver various tasks (Autor 2013).
 - It is therefore unlikely that ICT makes complete occupations obsolete, which the assumption of Frey and Osborne who estimate how 'computerisable' different jobs are.

- Studies that follow the task approach come to much lower displacement numbers
 - Bonin et al. (2015) from the ZEW expect for Germany a reduction of 12%.
 - Melanie Arntz et al. (2016) estimate 12% for Germany and Austria, and 6-7% in Estonia, Finland and Belgium

Critique on the robots-and-employment literature based on the study by Marco Vivarelli

- In Marco Vivarelli's terminology, these studies only talk about the displacement effect of process innovation, but not about the **compensation effects**:
- Compensation mechanism "via new investments"
 - New production technologies => new investment => new jobs
- The compensation mechanism "via decrease in prices"
 - decreasing cost => decreasing prices => new demand => new jobs
- The compensation mechanism via new products
 - new products => new demand => higher productivity => new jobs

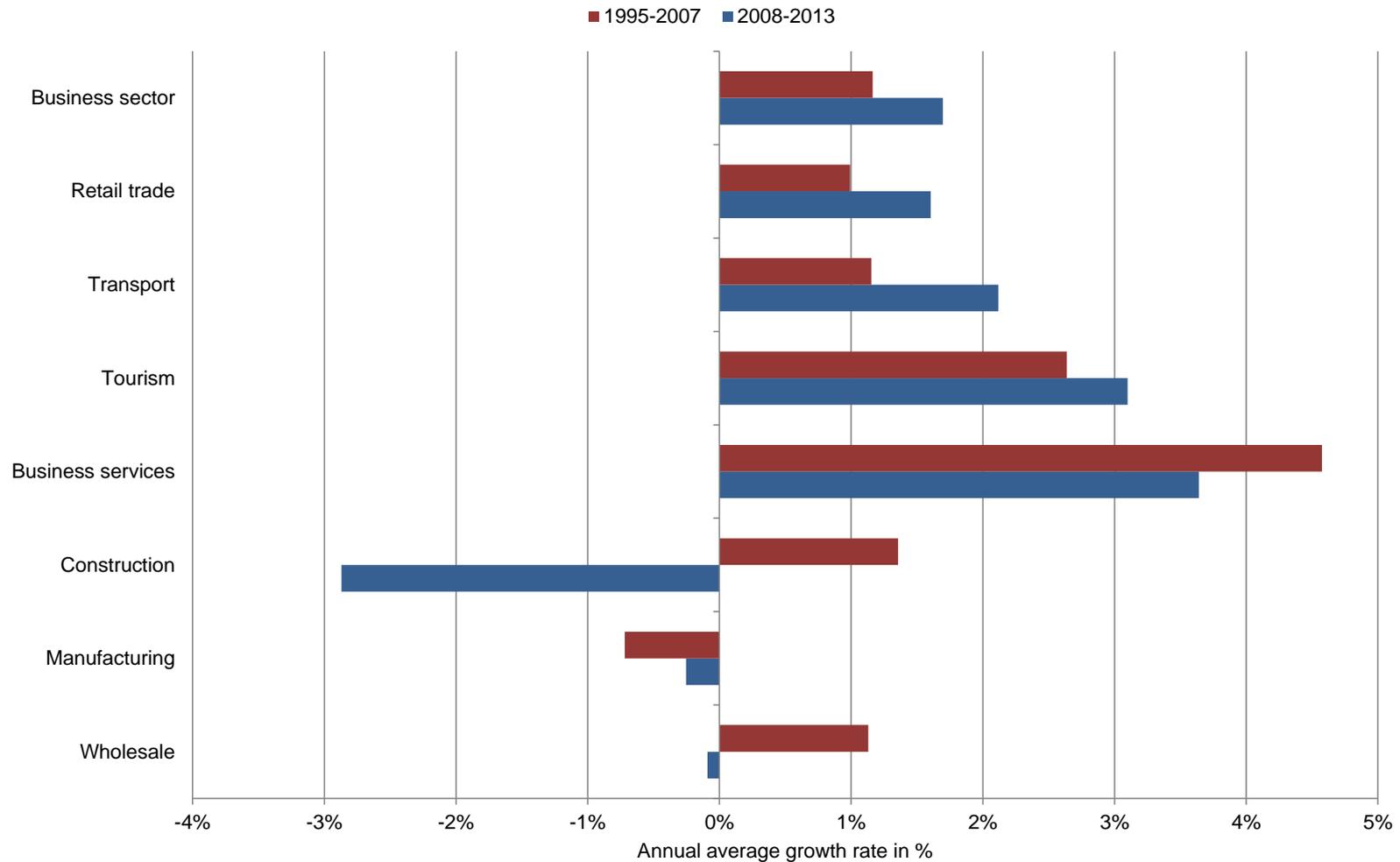
What can we learn from the robots-and-employment literature for innovation economics?

- Focus on services
 - The aforementioned studies find the main displacement effects not in manufacturing, but in the service sector!
 - White-collar, middle income, routine jobs are in danger of being replaced by machines

- The manufacturing sector may also not be the best place to look at the employment growth effects of innovation, because employment in manufacturing is shrinking.

Are we looking in the wrong place for employment effects?

Annual average growth of persons employed

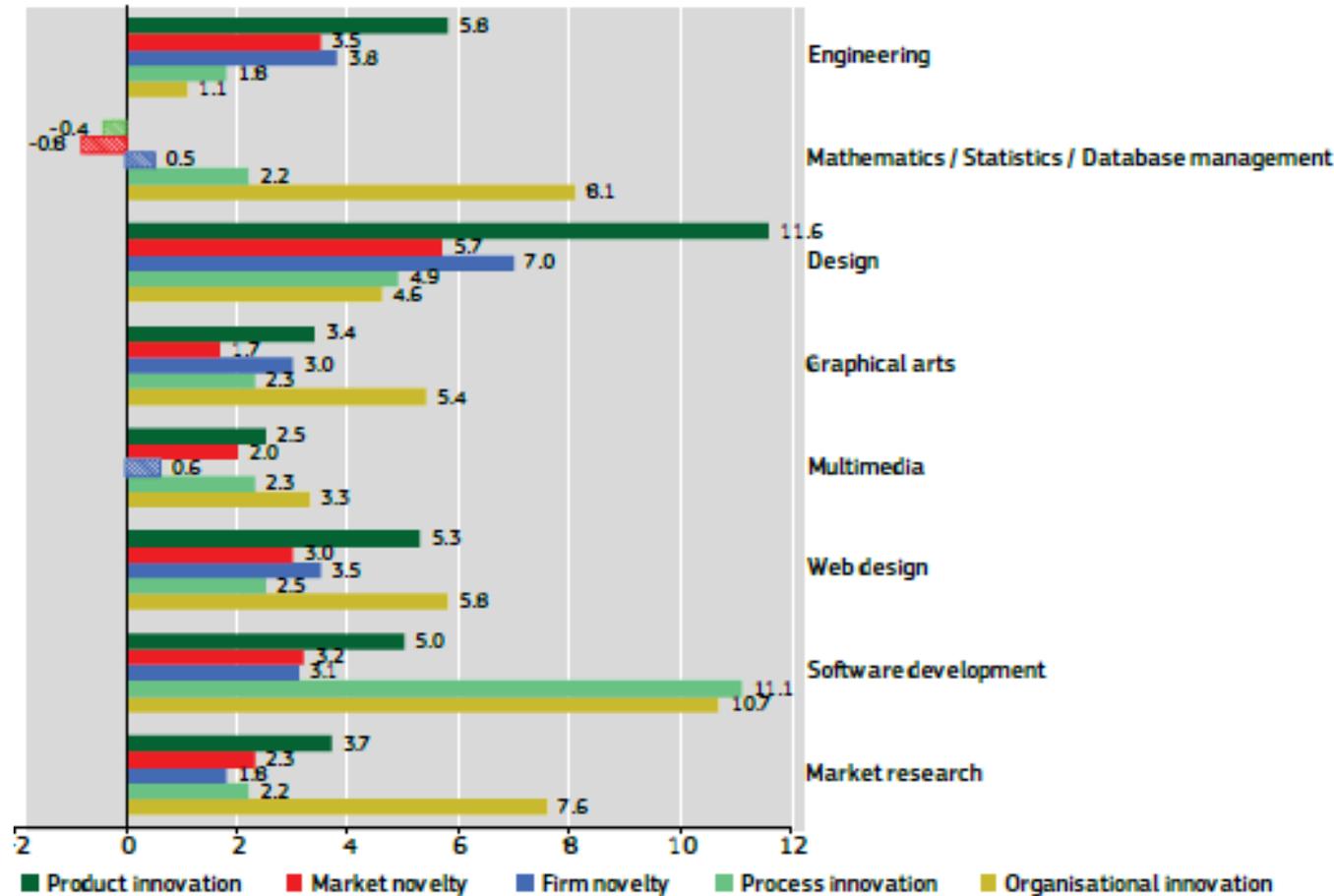


What can we learn from the robots-and-employment literature for innovation economics?

- Focus on diffusion and skills
 - Innovation-employment studies still largely lack the metrics to measure technology diffusion and its effects properly (best example is the CIS!)
 - Focus of the literature is still on R&D, rather than on the effects of existing skills in firms on innovation and employment
 - Two recent papers from Bettina Peters (2016) and Luca Marcolin et al. (2016) go in the skills direction

Are we looking at the wrong indicators?

Marginal effect of the usage of a particular skill on the likelihood of innovation



Peters (2016)

Science, Innovation and Research Performance of the EU

To sum up

- Based on the existing literature and experiences with past ‘technological revolutions’ we can be optimistic about future developments
 - Altogether, R&D, innovation and technology creates more employment than it destroys
 - This is, in my opinion, also the key message of Marco Vivarelli’s paper

- With respect to the employment effects of new ICTs we can easily calculate the displacement effects, but have only very little information about the compensation effects
 - These compensation effects may emerge in fields totally unknown today
 - We can only say from past experience that there will be compensation effects!