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# *Ex post evaluation of the impact of the EU funds under the 2007–2013 financial perspective on main innovation and R&D indicators*

preliminary results of macroeconomic modelling

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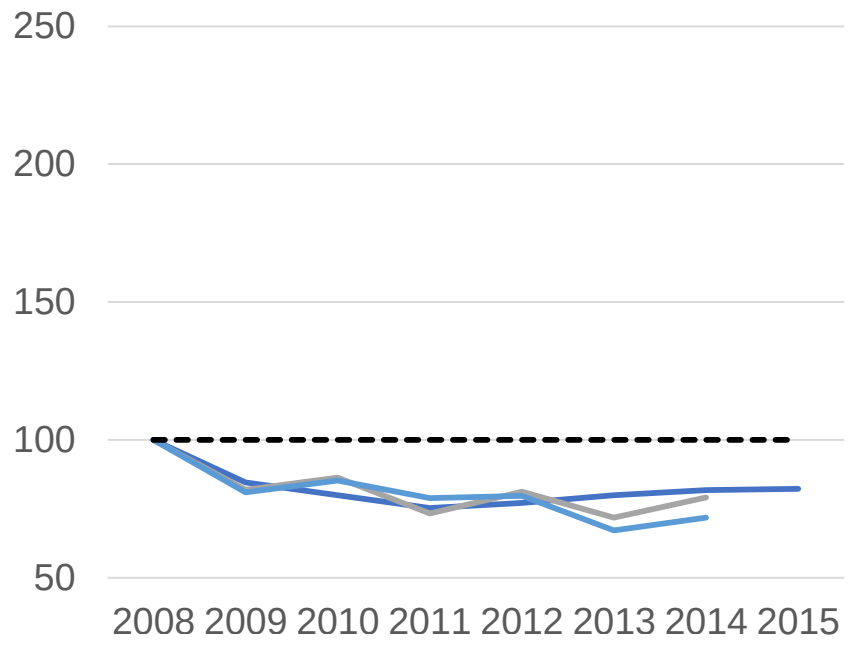
# scope of evaluation

# Innovation and R&D activity (dynamics since 2008)

## scale of innovation activity

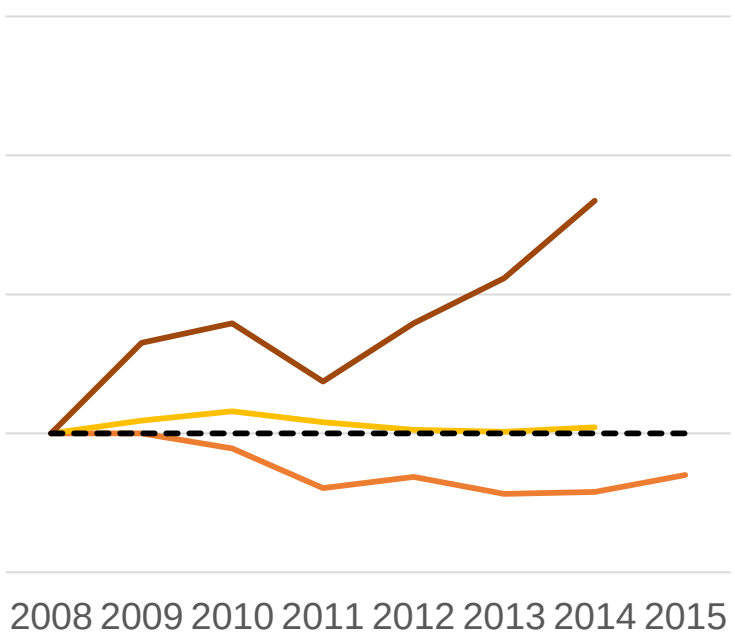



Share of innovative enterprises (industry) [%]

Innovation expenditure in enterprises [% of GDP]

Share of enterprises which cooperated in the area of innovation [%]

## sales of innovative products

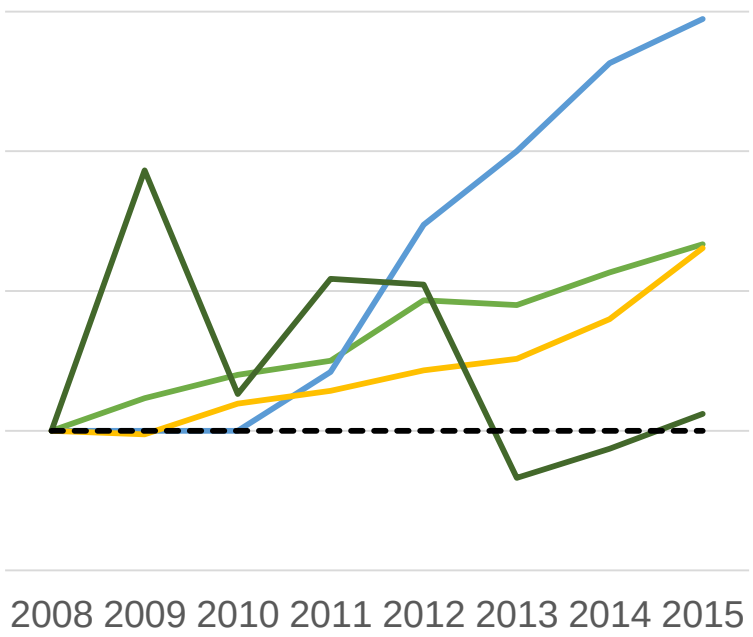



Share of sales of new and significantly improved products (industrial companies) [%]

Share of high and high-low technology products in output [%]

Export of high technology products in total exports [%]

## R&D activity




R&D expenditure in relation to GDP [%]

R&D expenditure of the enterprise sector in relation to GDP [%]

Employment in R&D [thousands of FTE]

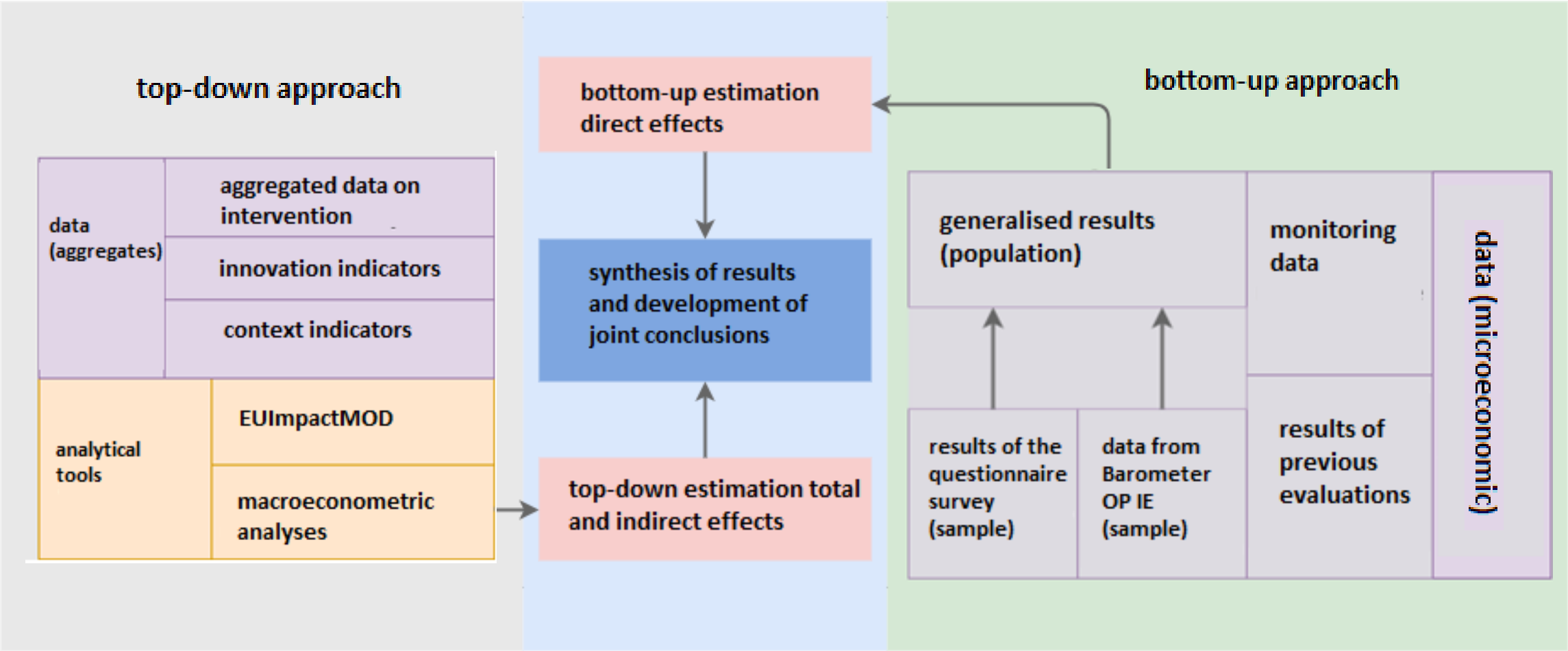
Employment in R&D in the enterprise sector [thousands of persons]

# Preliminary analysis of indicators



- The scale of innovation activity decreased, and in 2015 it is still below the level recorded in 2008. The dynamics should be analysed in the context of:
  - The reality after the greatest crisis in the post-war period and the related uncertainty which contributes to a decrease in capital expenditure, including expenditure on innovation;
  - Growing expenditure on innovation under cohesion policy;
  - Changes in the methodology of data collection;
  - An increase of total R&D expenditure, particularly in the enterprise sector.
- What is the reason for the increase in exports of high technology products? Which ones contribute more to the increase of the indicator, national enterprises or enterprises formed under FDI?
- Substantial annual changes in employment at enterprises of the R&D sector are problematic.

# Top-down and bottom-up approach



# What does the micro research show so far?

**Net effects estimated as part of counterfactual evaluations**

| Variable | | Regional operational programmes[1] | OP IE Priority 4[1] | OP IE large companies[2] |
|---|---|---|---|---|
| **Indicators relating to innovation and productivity** | Share of innovation companies (0-1) | +(?) (at the limit of statistical significance) | + | |
| | R&D expenditure | | + | |
| | TFP | | | + |

[1] Central Statistical Office (2015)
[2] PAG Uniconsult (2014)

- Subsidies **under OP IE Priority 4** translate into:
  - higher **share of innovation companies**;
  - higher level of **R&D expenditure**.
- Less unambiguous estimations for regional operational programmes.
- Relatively little is known about the scale of deadweight effect / crowding out of the national funds.

→ The results of existing counterfactual studies, **complemented with the survey study results** (pending), ultimately **will be used in the modelling analysis**.

# Indicators relating to innovation and R&D

# Methodology of indicator calculation



## Share of innovative companies – in the total number of industrial enterprises

| | |
|---|---|
| Source of data | • Community Innovation Survey<br>• Public statistics research programme on subjects 1.43.02 – Innovation in industry (PNT-02) |
| Method of data collection | • Full evaluation – enterprises with 50+ employees<br>• Representative study – enterprises with 10-49 employees |
| Enterprises included in the indicator | • small<br>• medium-sized<br>• large |
| Sectors covered by the indicator | • Only industrial enterprises |

# Could intervention have an impact on indicators at all?



## Share of innovative companies – in the total number of industrial enterprises

| | |
|---|---|
| **YES**, in the case of support: | |
| Project scope | • Product innovation<br>• Process innovation<br>• R&D |
| Type of beneficiary | • Small, medium-sized and large enterprises |
| 54% | • Share of small, medium-sized and large enterprises among all enterprises |
| **NO**, in the case of support: | |
| Project scope | • Organisational innovation<br>• Marketing innovation<br>• Other support |
| Type of beneficiary | • Microenterprise |
| 46% | • Share of microenterprises among all enterprises |

# Summary of problems with the analysis of indicators



- The study should in particular verify whether a given intervention financed under the cohesion policy had any chance of exerting an impact on a given indicator at all.
- In the case of the indicator measuring the share of innovative enterprises, a large part of innovation activity, in particular relating to marketing and organisational innovations at microenterprises, is not included in the indicator.
- It should be verified whether there are similar problems with respect to other indicators covered by the study.

# Modelling of research and development and innovation

# Review of literature (1)



- Arrow (1962): Leaving R&D to market alone leads to non-optimal resource allocation. Three reasons for market failure: indivisibility, inappropriability and uncertainty of R7D. State participation is necessary.

- David, Hall and Toole (2000): Public and private R7D spending is complementary (complementing each other and not crowding out). A lot of literature confirming that public support for R&D increases private R&D expenditure.

- Griffith, Redding and Van Reenen (2004): Two faces of R&D: a direct source of numerous innovations (mainly the countries at the technological frontier), but also conducive to absorption of innovation and technology transfer (mainly the catching-up countries).

- Griliches (1979; 1990): Significant impact of R&D expenditure on patent activity in the USA. Jasiński (2011): Positive verification of the Grilliches model for Poland (on data for 1989-2007)

# Review of literature (2)



- Branstetter and Sakakibara (2002): Research consortia subsidized from public funds increase patent activity of Japanese companies participating in the consortia.
- Czarnitzki, Hansel and Ross (2011): R&D tax credits have a positive impact on the number of new products placed on the market by their beneficiaries in Canada.
- Bronzini and Piselli (2016): Evaluation of the impact of a local R&D support programme in one of the Italian regions – a significant positive impact on the number of patent applications, in particular in the case of small firms.
- Jaffe and Le (2017): R&D grants in New Zealand significantly increase the likelihood of a company applying for a patent and/or introducing new products or services.

# EUimpactMOD



- Macroeconomic DSGE (Dynamic Stochastic General Equilibrium) model
- Description of the behaviour of companies, employees and consumers
- Publications: *Sustainability* (2016), *International Journal of Manpower* (2017)
- Systematic development of the model: i.a. the grant from the National Science Centre (NCN)

# Innovations in EUimpactMOD (1)



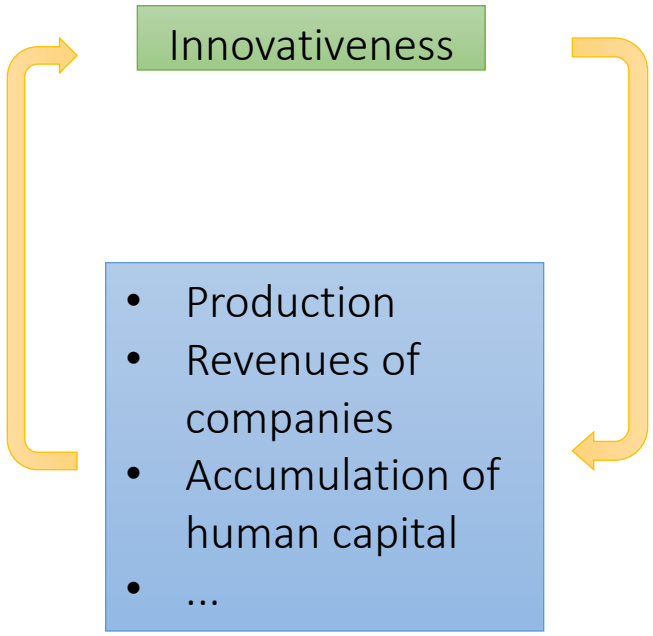
- Assumptions of the model (Romer 1989, Young 1998, Jones 1994):
  - A new product is a source of additional profit for companies
  - Innovations require investments
  - The cost of innovation is low, if the number of innovations in a given sector in the past was high (spillover effect)

# Innovations in EUimpactMOD (2)

I. Innovation expenditure depends on revenues of companies in a given sector and on subsidies

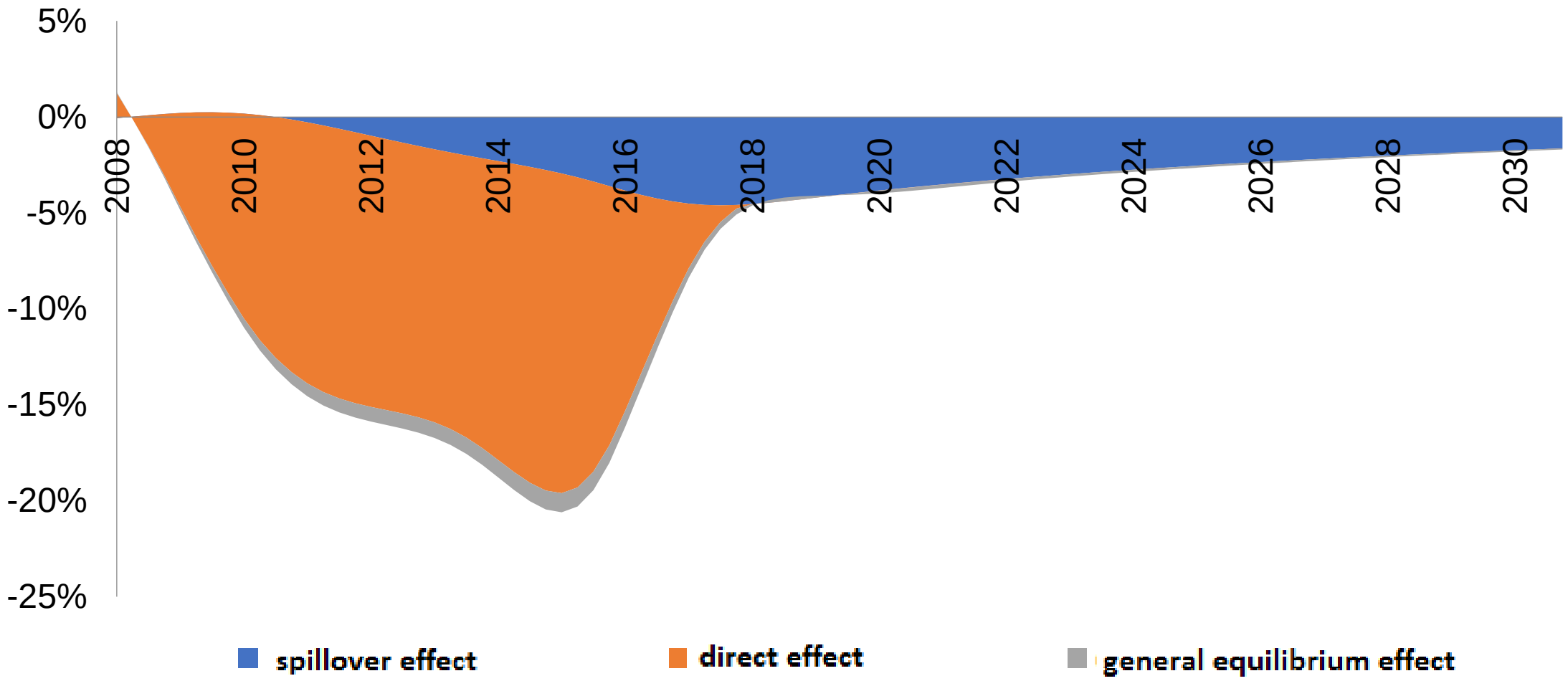
II. Innovations lead to the growth of TFP and revenues

- One-off increase in innovativeness leads to the growth of TFP and innovation expenditure for many years

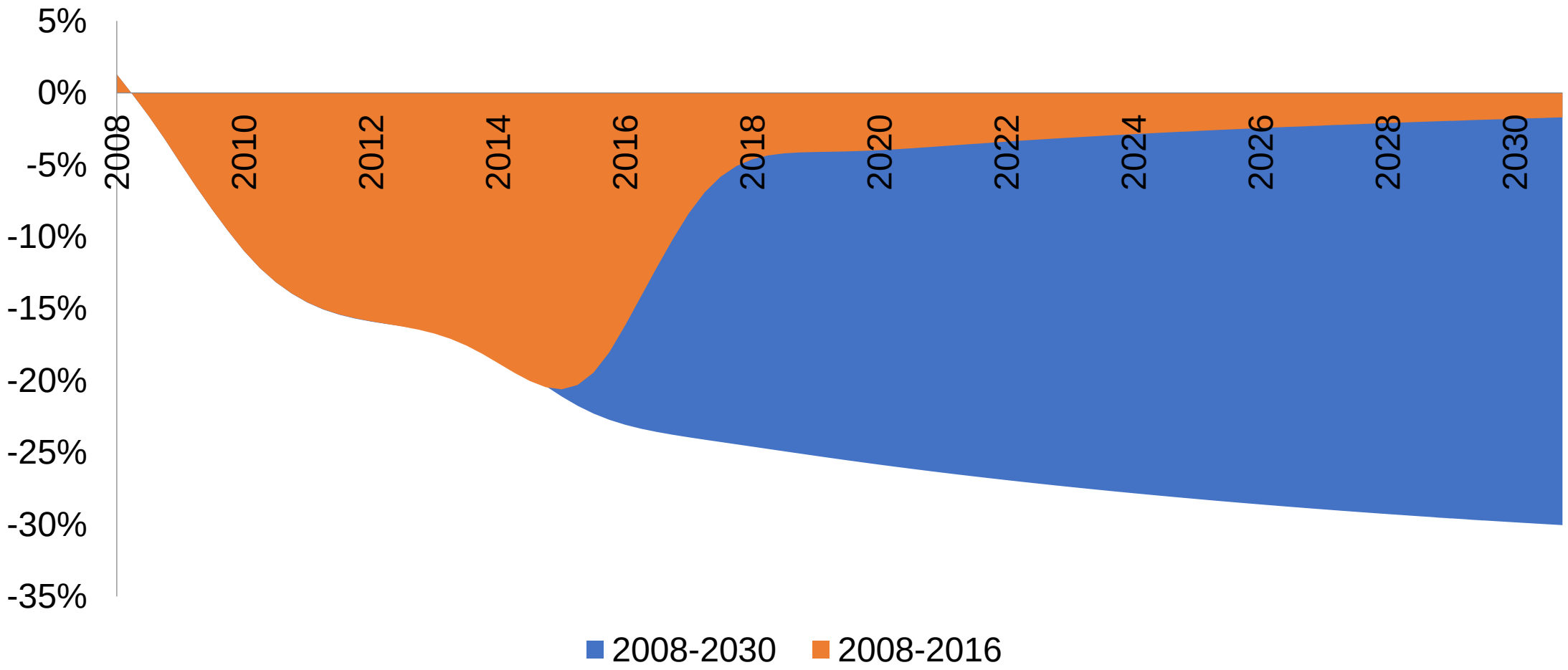


# Preliminary results of analyses

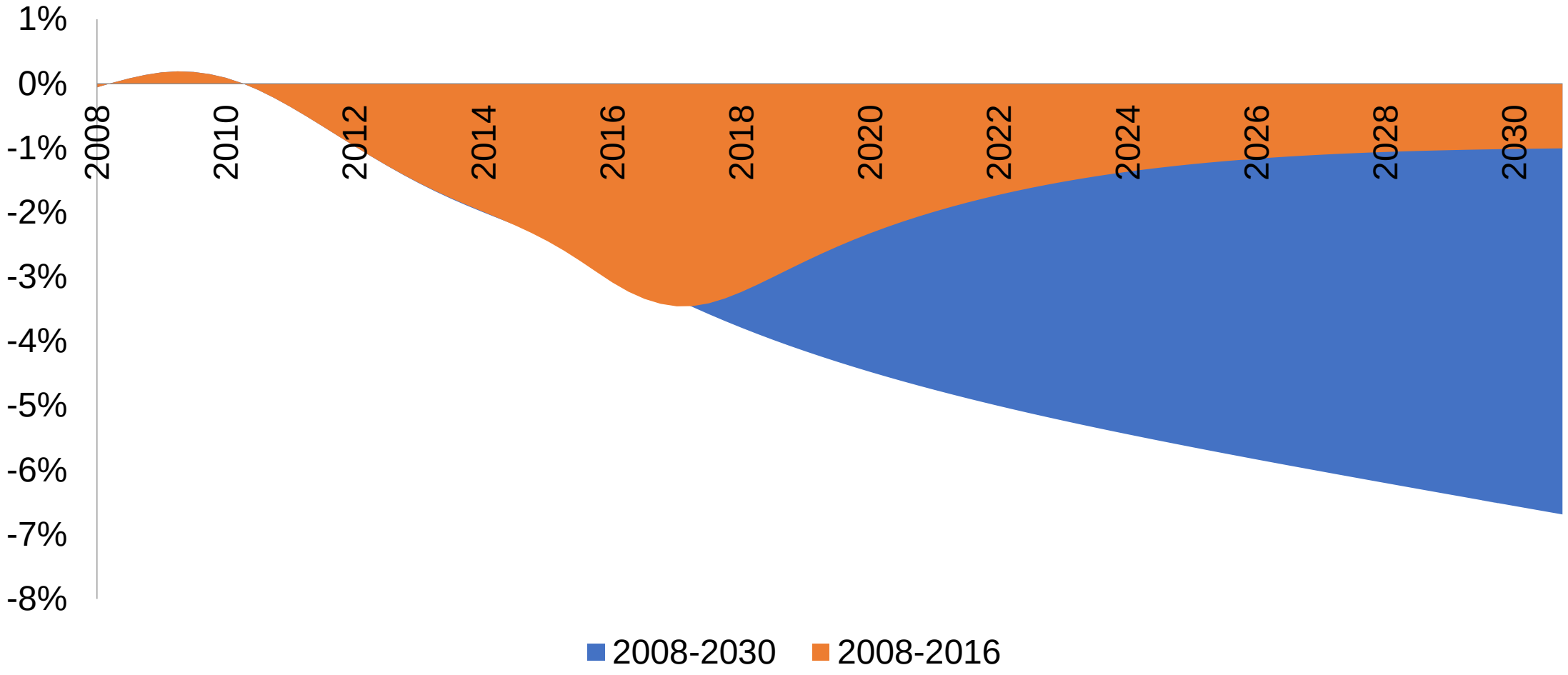
# Impact on innovation expenditure (I)



# Impact on innovation expenditure (II)



# Impact on GDP



# Preliminary results of analyses – commentary (I)



- We present the impact of intervention on innovation expenditure and Gross Domestic Product.
- The results are presented as a percentage deviation from the path defined by historical data and values forecast until 2030.
- With intervention at up to 0.50% of GDP and innovation expenditure of approximately 2% of GDP, we predict that if not for the cohesion policy, the expenditure would have been lower by around 15% in the top year 2015.
- The major part of the change may be attributed to the direct effect equal to the amount of funds reduced by the estimated crowding out effect;
- while in the long-term the spillover effect is the most important.
- The general equilibrium effect related to the general improvement of the economic situation is relatively small.

# Preliminary results of analyses – commentary (II)



- In the second simulation, the maintenance of support from 2015 was assumed.
- To retain the positive effects, it is of key importance to continue spending from the cohesion policy for innovation.
- It is important not only due to the direct effect, but also for further accumulation of innovations which leads to their constant growth thanks to the spillover effect.
- The impact of intervention on GDP at the end of the first financial perspective amounts to almost 4% of GDP (in terms of its level), which translates into an additional growth of approx. 0.3 percentage point.

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*Thank you!*

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