# Do direct subsidies stimulate new R&D outputs in firms? A comparison of the IMPULS, TIP and ALFA programmes

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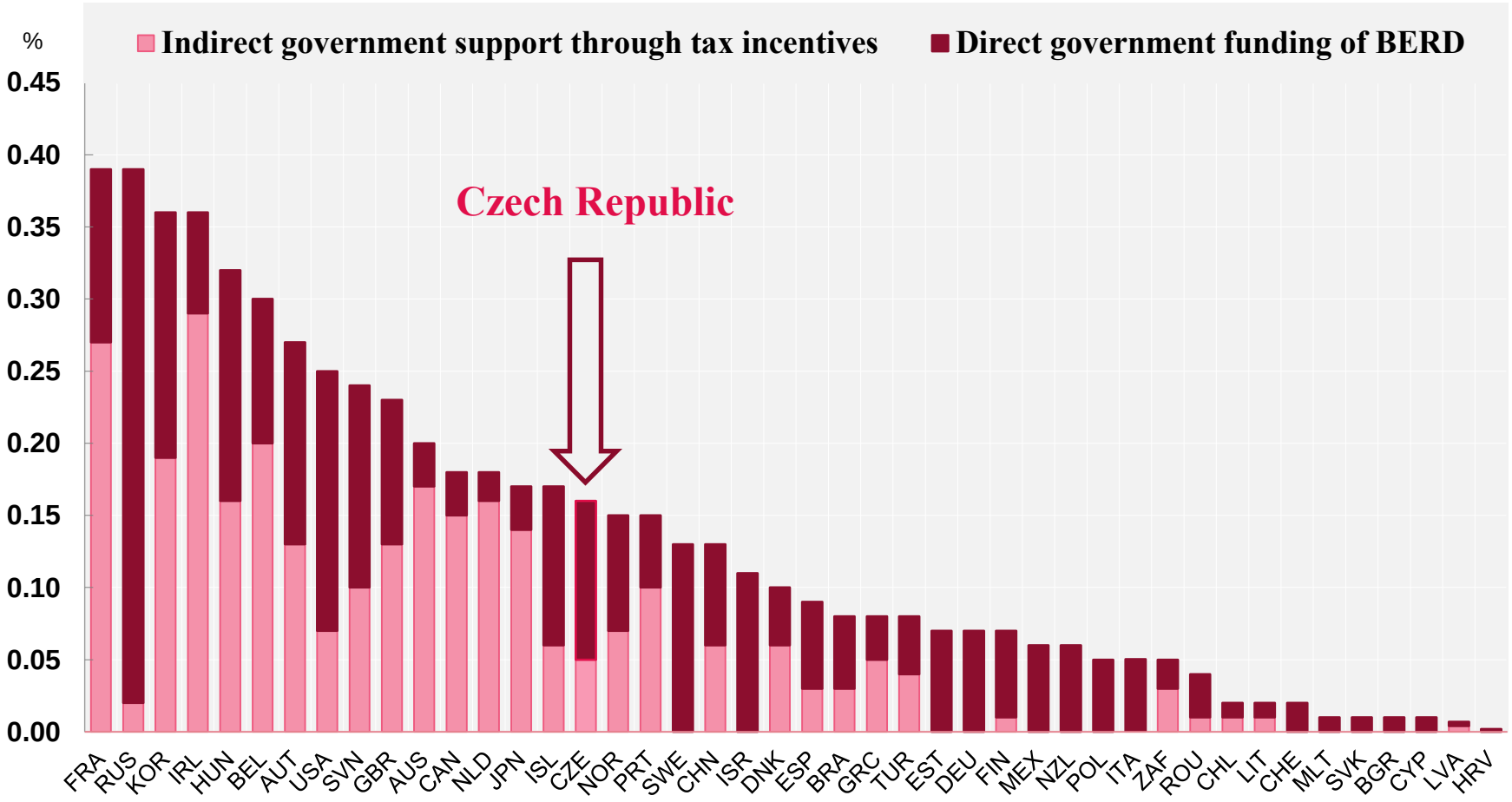
Nezávislý think tank při CERGE-EI v Praze
zaměřující se na analýzu, vyhodnocování
a vlastní návrhy veřejných politik

IDEA CERGE EI

## Main focus of this study

- Direct R&D subsidies to business enterprises
- Programmes: IMPULS, TIP, ALFA
- Timespan: 2004 – 2013
- R&D output additionality effects
- Applications for intellectual property (IP) protection
- Effects within three years after the start of funding

# Government R&D support (OECD, 2014): % of GDP



## Intellectual Property Rights (patents):

"A patent is an exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem. To get a patent, technical information about the invention must be disclosed to the public in a patent application." (WIPO, 2017)

## Protection:

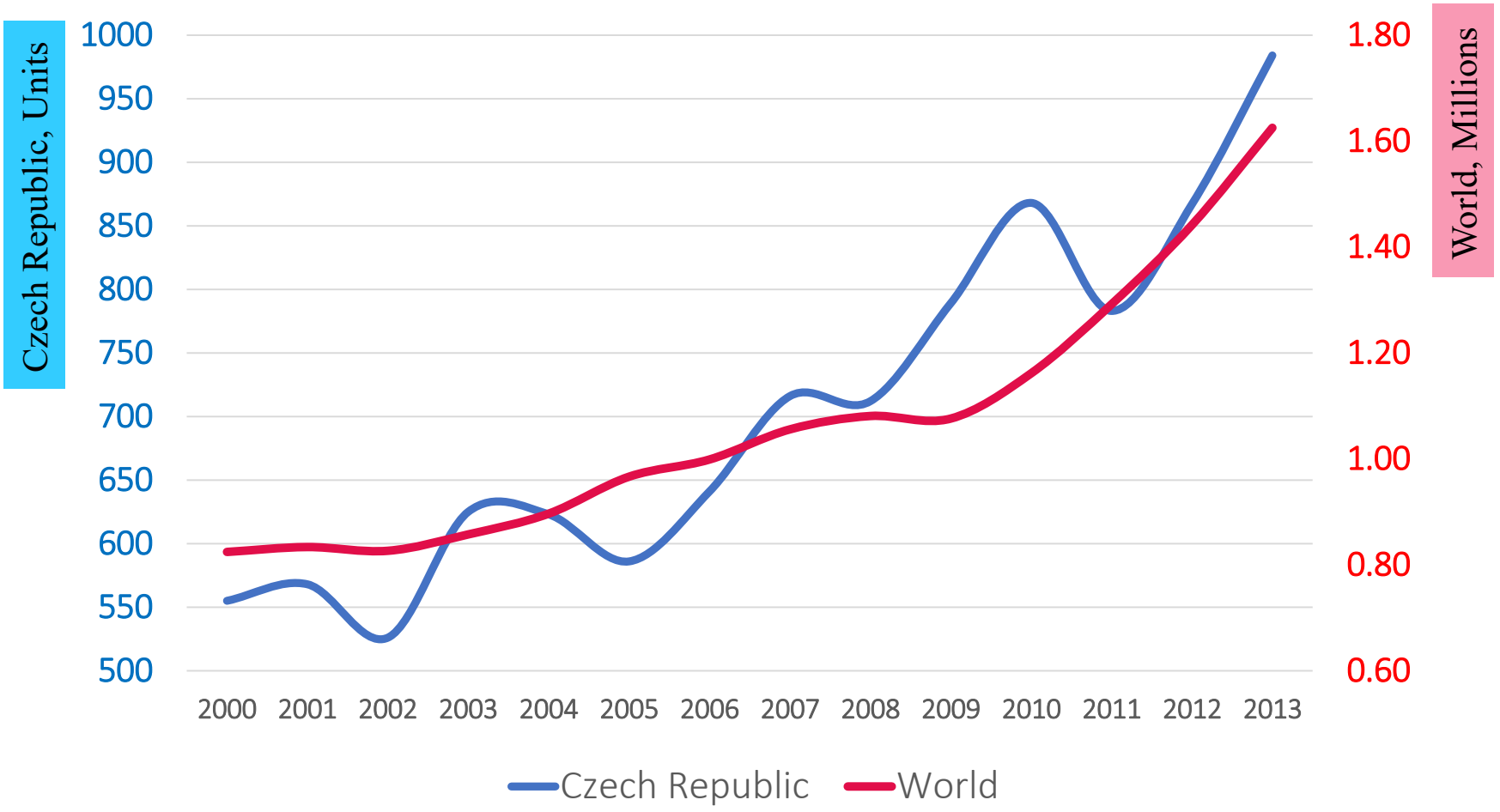
Patents prevent others from commercial exploitation of the patented invention (production, usage, distribution, selling) without the patent owner's consent.

## The types of Intellectual Property Rights (patents):

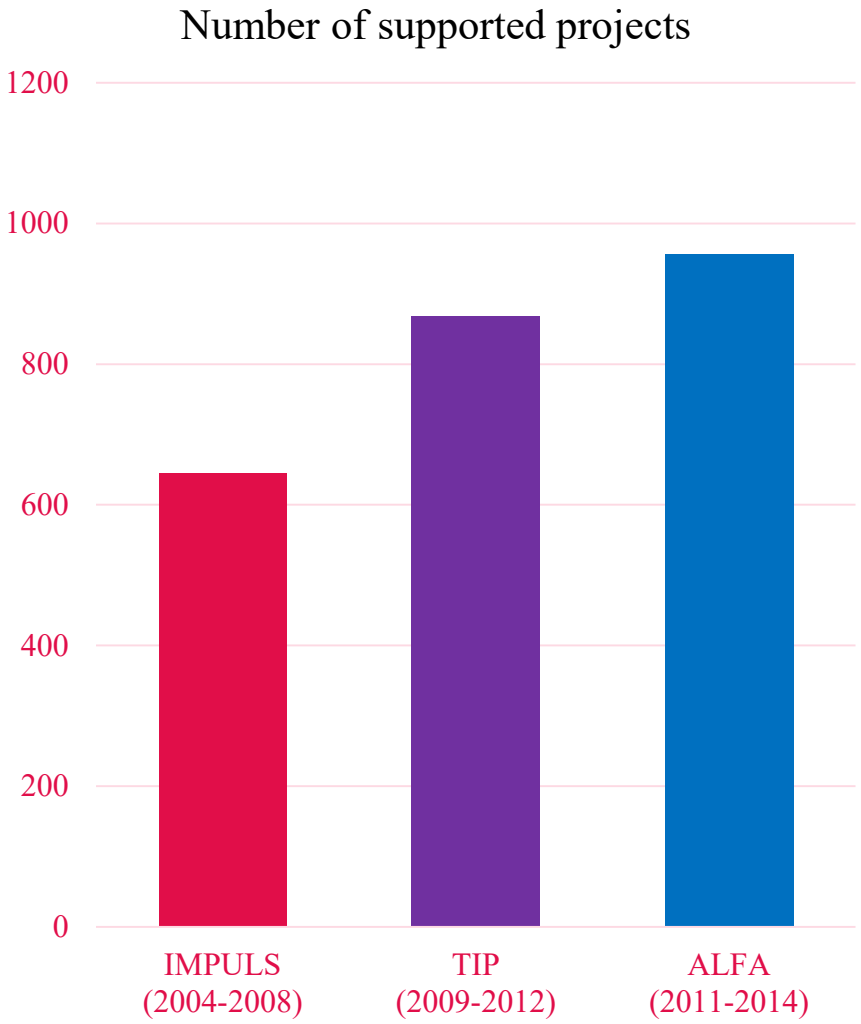
- Patents of Invention (patenty) - 20 years from the filing date of the application
- Utility Models (užitný vzory) - 10 years maximum

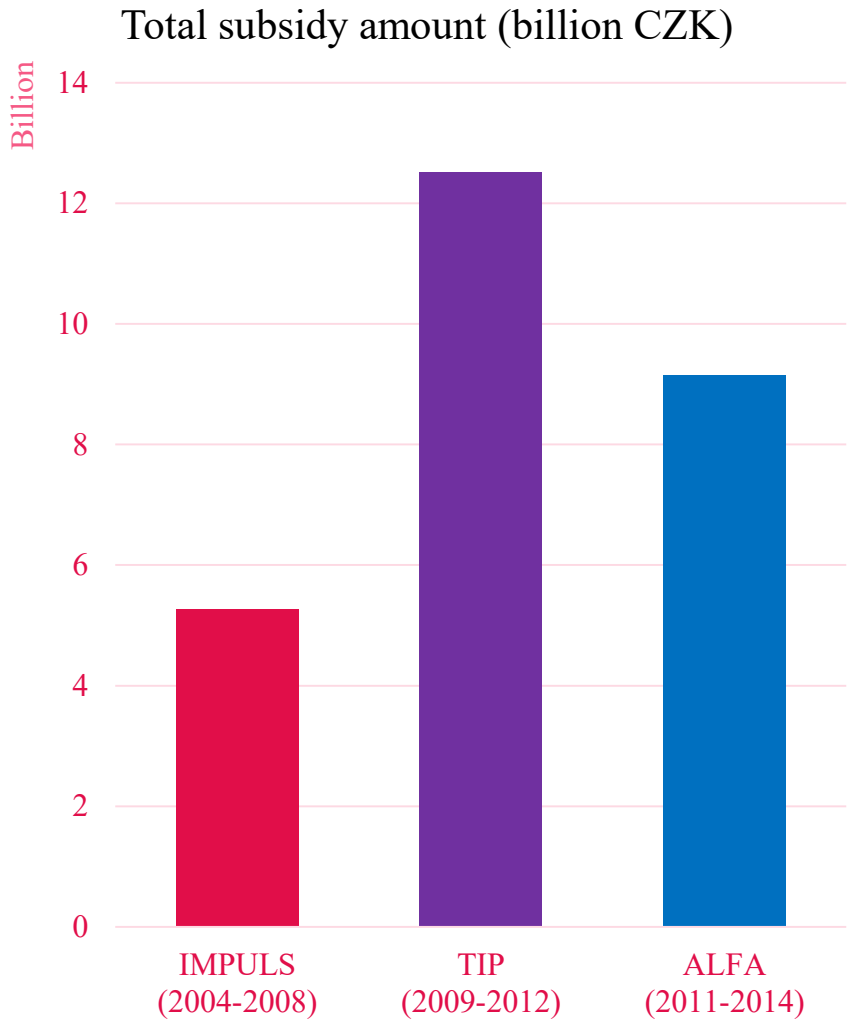
# IP protection application trends: Czech Republic vs World

Patent application through PCT or national patent offices (Source: WIPO).



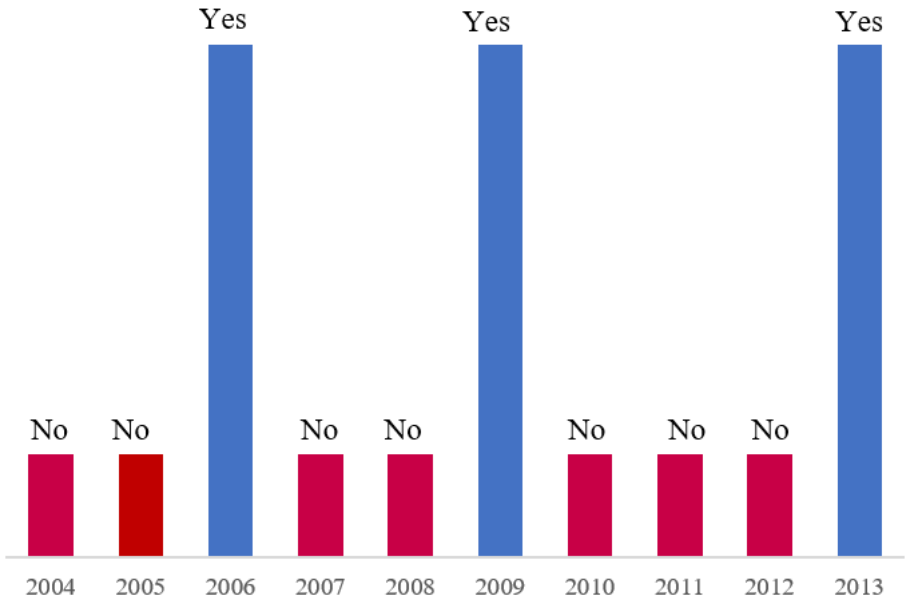
# IMPULS, TIP, ALFA programmes (calls: 2004 – 2014): projects and subsidies



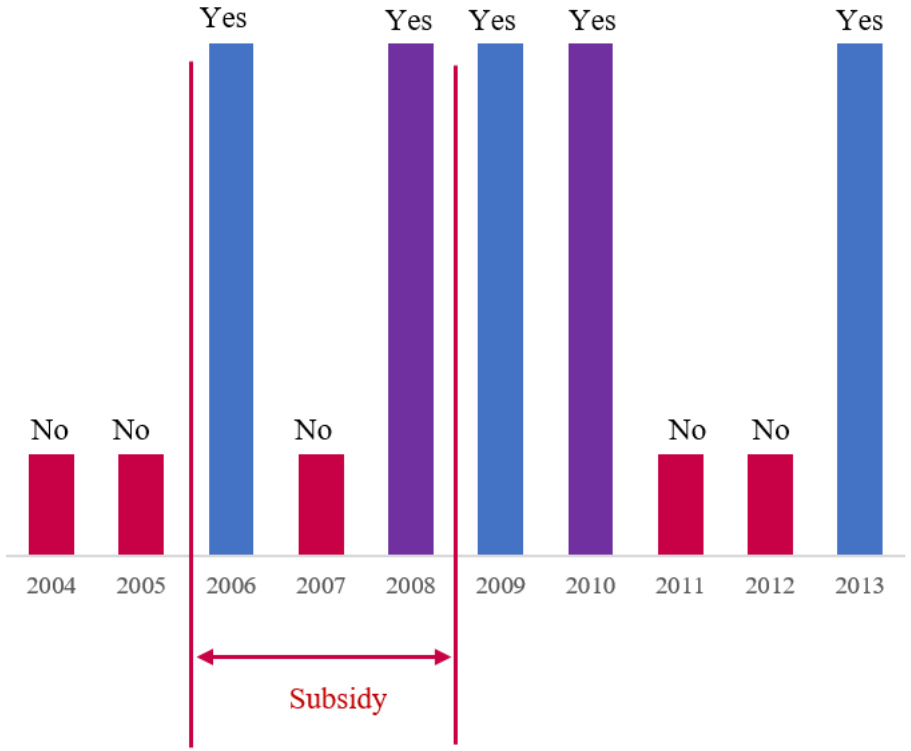



## Output additionality effects of subsidies

without R&D subsidy



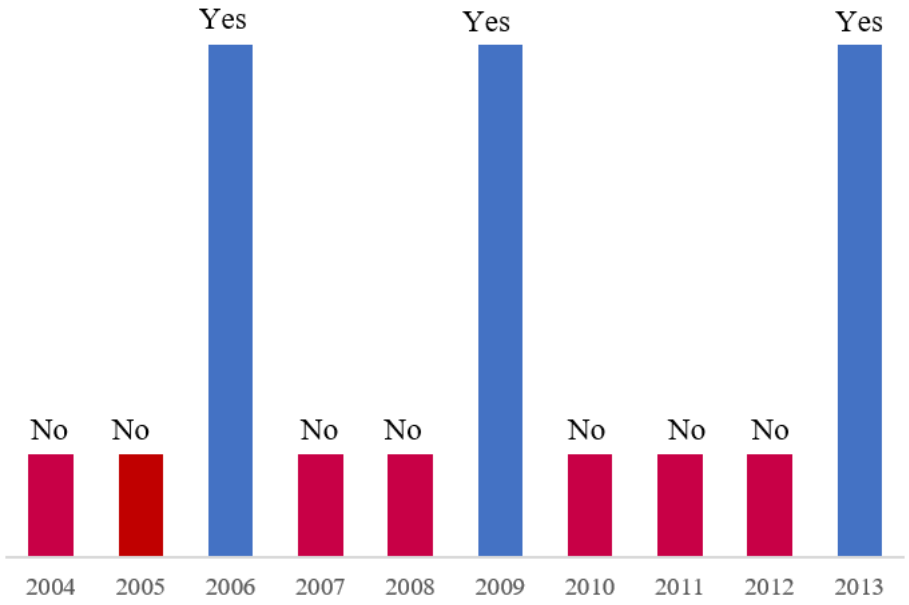

with R&D subsidies over 2006-2008



# What do we want to find?

## No effects of subsidies

without R&D subsidy

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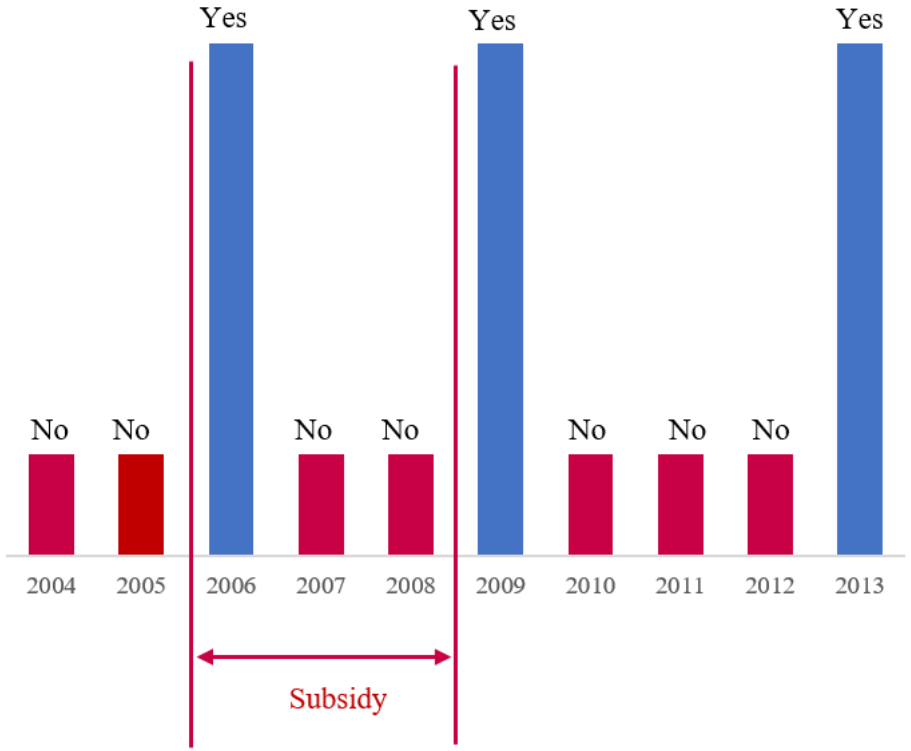


## Definition:

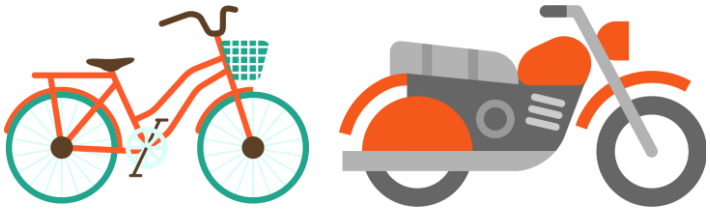
A firm is “treated” if it participates in the programme. Otherwise – “untreated”.

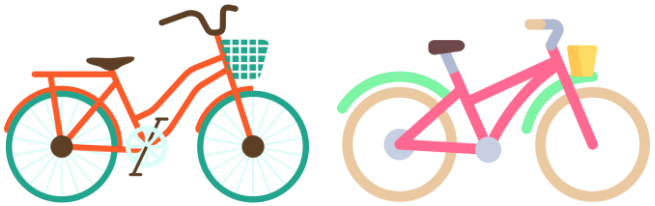
## Treated and untreated firms are different:

1. Self-selection into programme applicants
2. Evaluation committee selects winning applications (projects)

## Finding a correct group for comparison – control group:

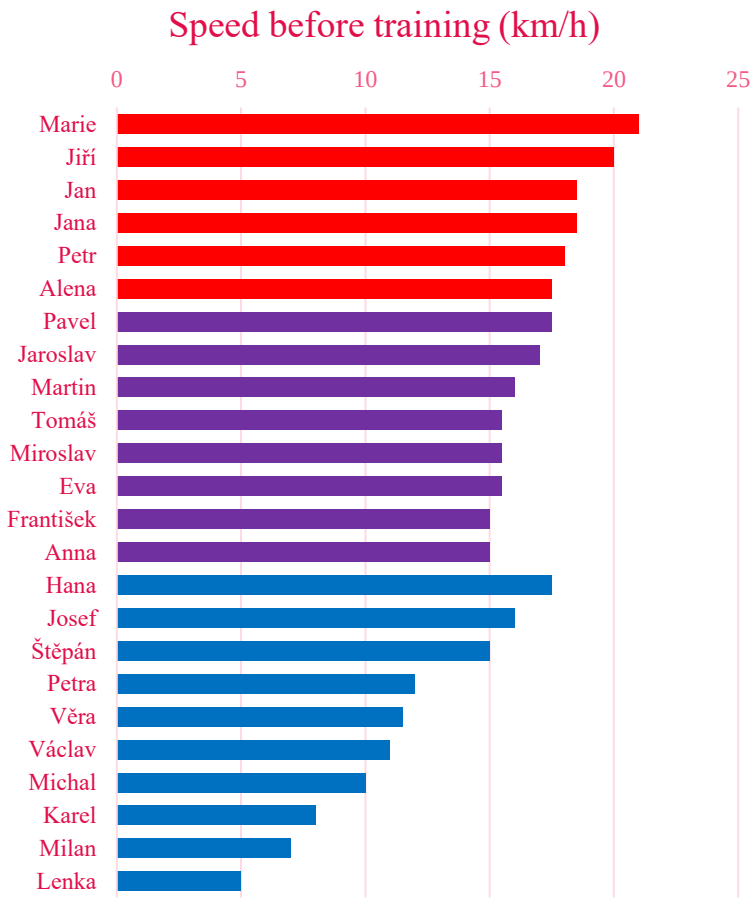
We want to compare results of firms, which received treatment, with a comparable group of firms which did not.





## Finding a correct group for comparison

Example: Speed training programme for runners



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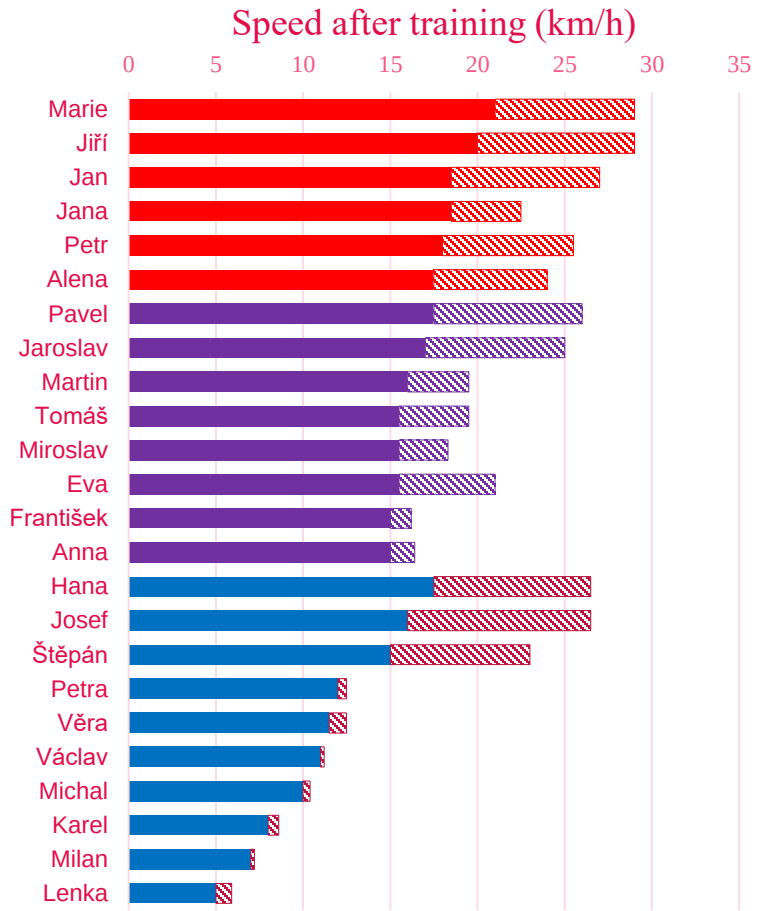
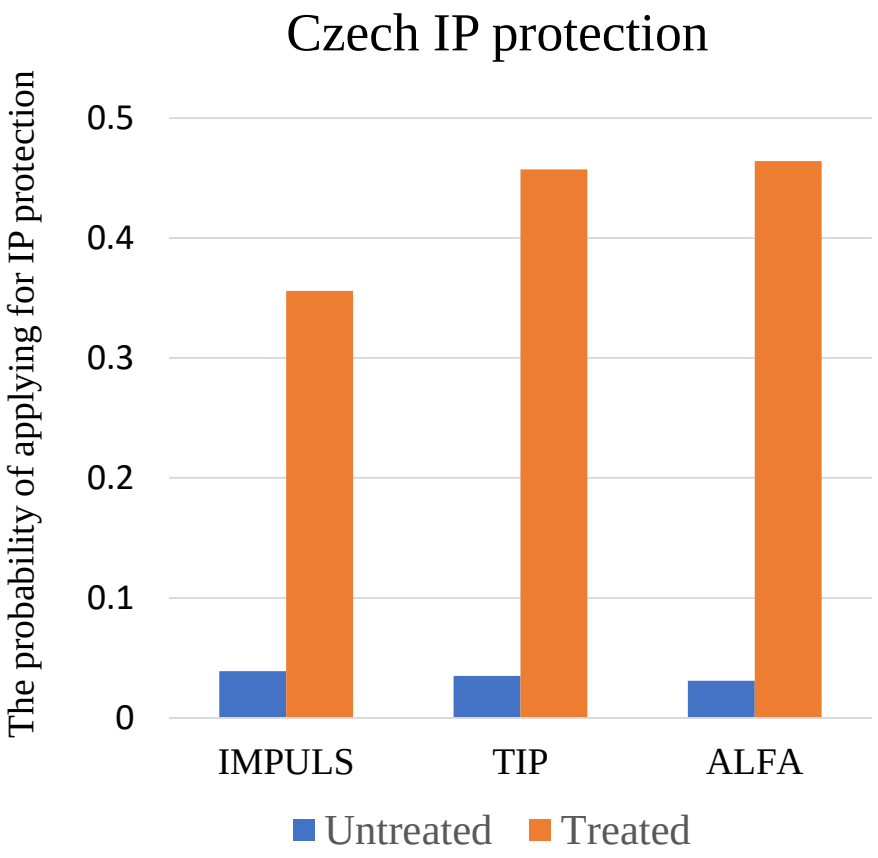
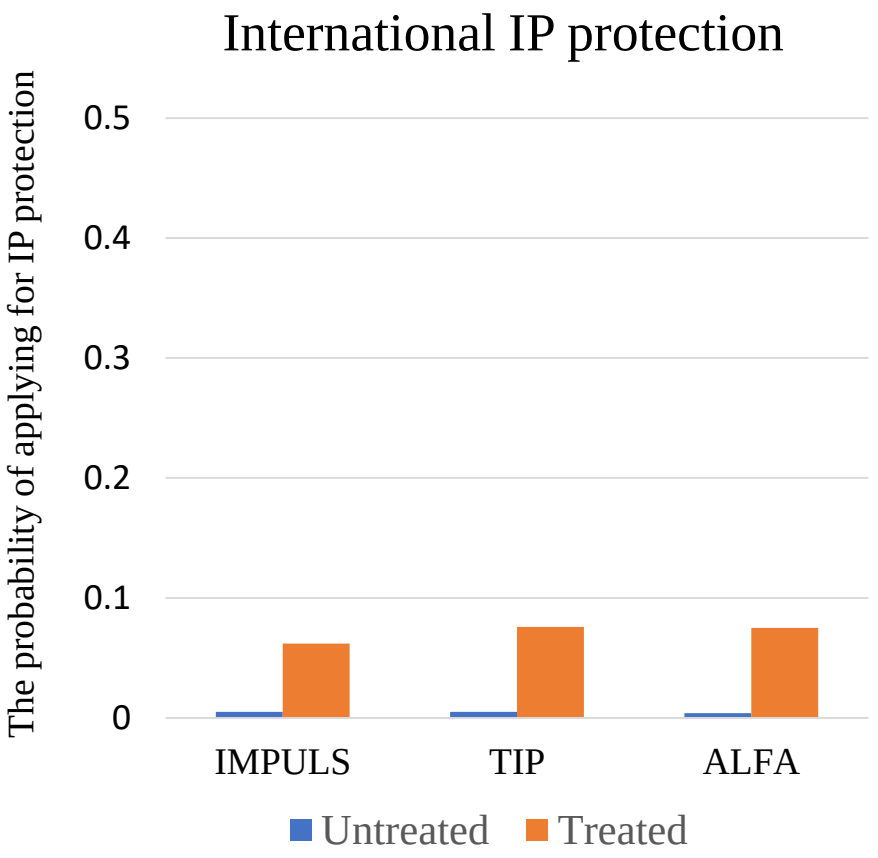


# What do we see when firms are unmatched?

Raw differences in propensities to apply for IP protection between treated and untreated enterprises one year before treatment: Selection is a problem!



## R&D subsidies are assigned non-randomly:

We have to rely on quasi-experimental techniques to eliminate the selection bias

## Principles of counterfactual evaluation in the Czech context:

Horák (2016, TA ČR) and Srholec (2016, CERGE-EI)

## Regression discontinuity design:

Srholec, M., Palguta, J. (2016, IDEA study): Additionality effects on private R&D expenditures for 3rd call for proposals in ALFA programme around ranking threshold

## Propensity score matching:

Firms, which received subsidies (treated) are matched with similar firms, which did not receive subsidies (untreated) based on observable characteristics

## ISVaV (Research, Development and Innovation Information System):

Information on R&D subsidy participants

## Amadeus database:

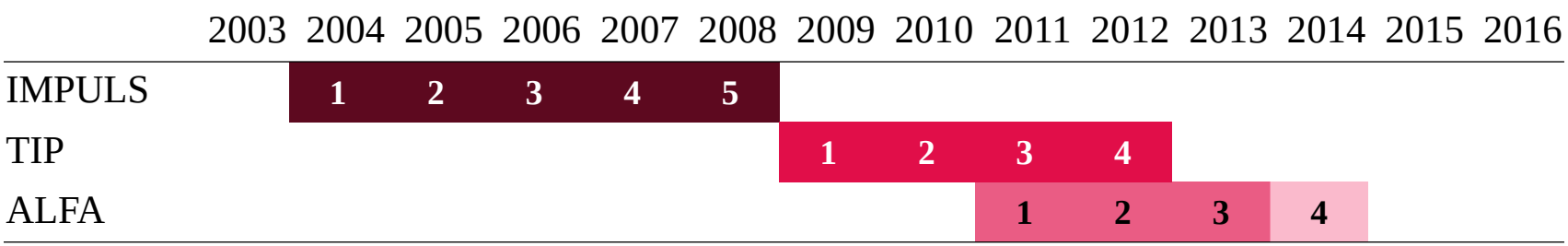
A database of comparable financial information for public and private companies.

## PATSTAT:

Worldwide patent database: 1976 – 2013 (2015*)

## Time period:

2004-2013 (2014) by individual calls



# Data Sources and Coverage

Business enterprises:

Legal form: GP, PLC, JSC, LP, Coop. (v.o.s., s.r.o., a.s., k.s., družstvo)

Sectors: Mining, Manufacturing, Electricity, Water supply, ICT, Professional activities (NACE Rev. 2: B, C, D, E, J, M)

Total treated: 2,830 observations

Business enterprises: 2,396 observations

In Amadeus: 1,530 observations (64% of business enterprises)

In sectors: 1,423 observations (59% of business enterprises)

**Final sample:** **1,267 observations** (53% of business enterprises)

**Untreated group:** **20,783 observations** (excluding treated firms)

# Estimation: Propensity Score Matching

Source for propensity score calculation: on observable firm characteristics

- Previous participation in R&D subsidies
- Previous Czech IP applications
- Previous international IP applications
- Firm's age, size, revenue, profitability, solvency indicators
- Firm's legal form, sector, year, location (region)

Matching specifications:

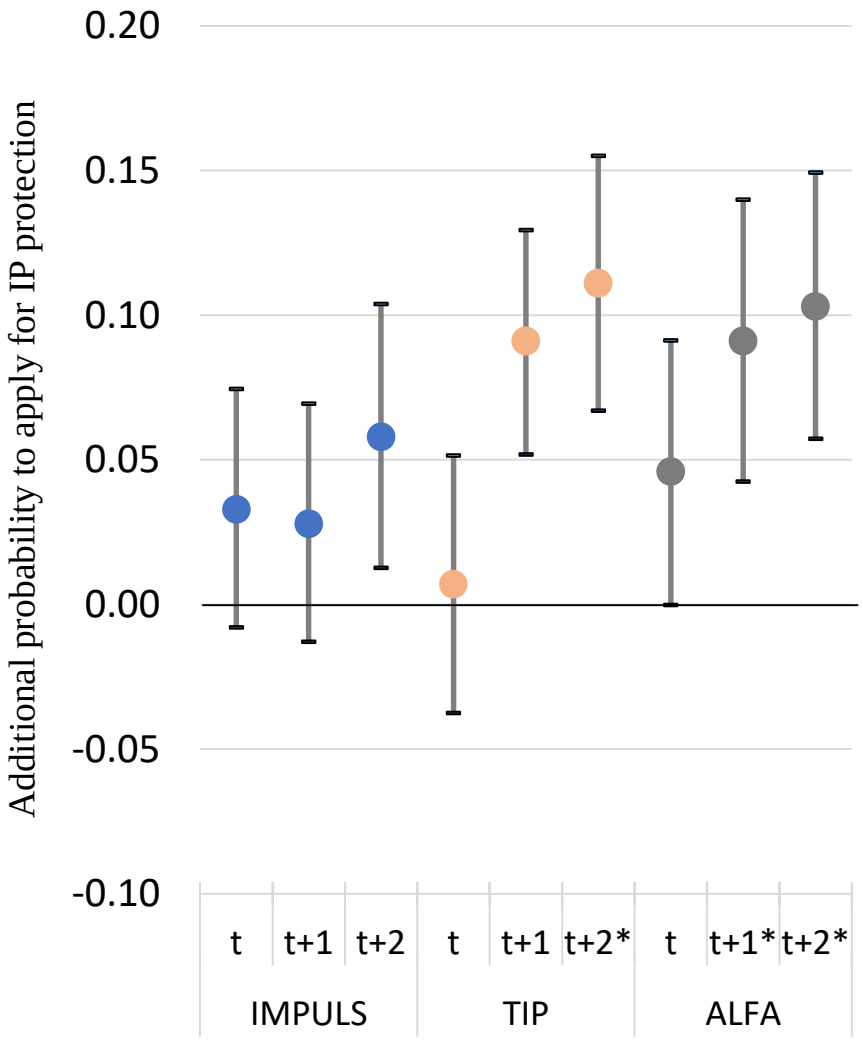
1, 3, 5 nearest neighbours, with caliper, kernel matching

Robustness check:

Propensity Score Matching + Conditional Difference-in-Differences

# Main findings: Applications for Czech IP protection

## Czech IP protection



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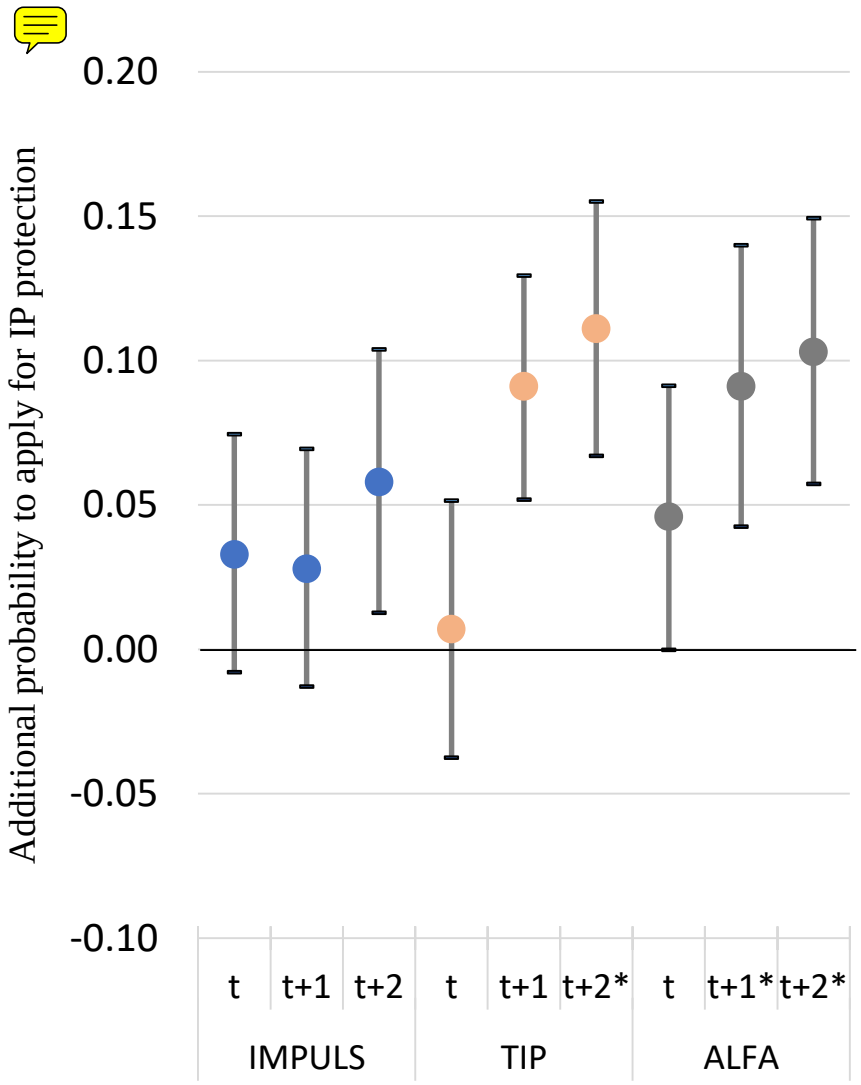
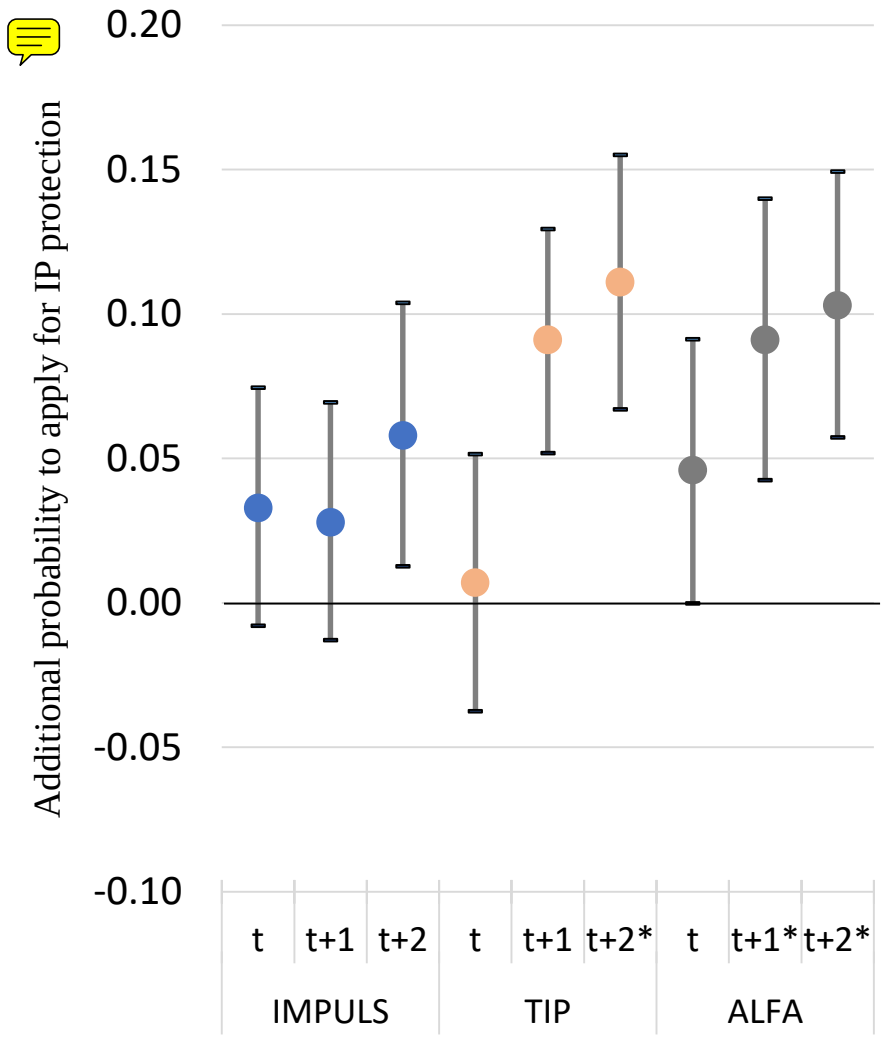



## Interpretation

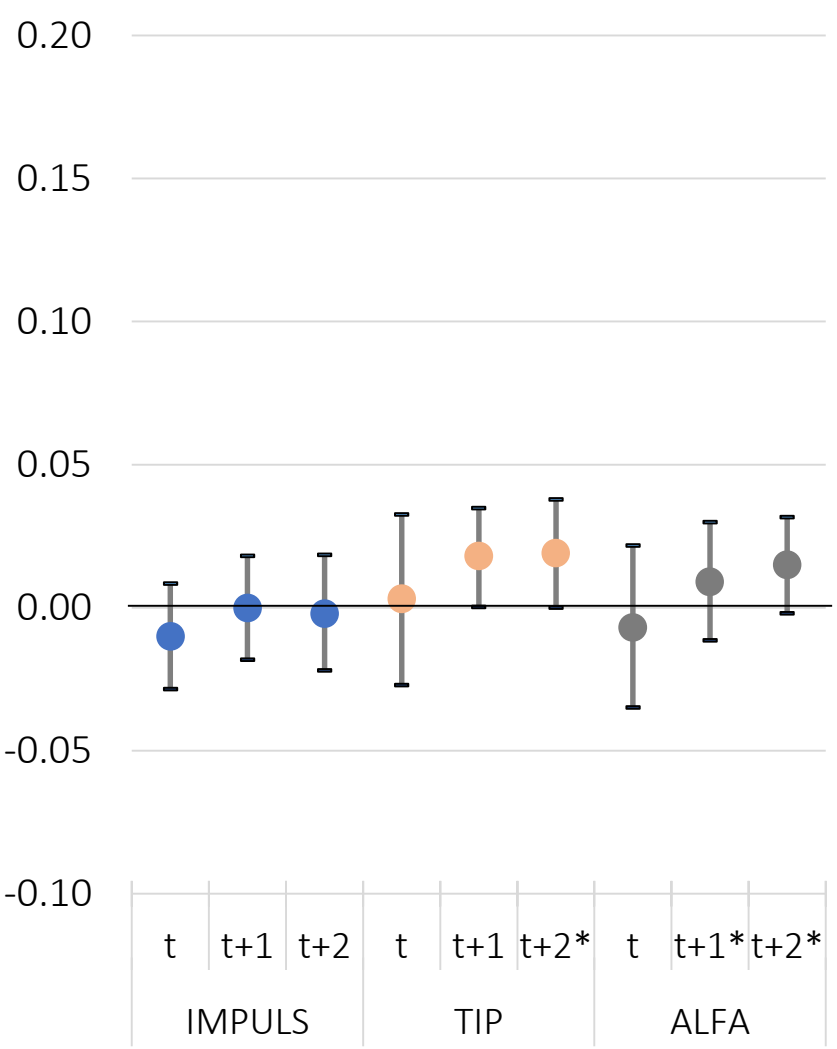
| | Year | Treated | Untreated | **Difference** |
|---|---|---|---|---|
| IMPULS | (t) | 0.185 | 0.152 | **0.033** |
| | (t+1) | 0.168 | 0.139 | **0.028** |
| | (t+2) | 0.213 | 0.154 | **0.058**** |
| TIP | (t) | 0.228 | 0.221 | **0.007** |
| | (t+1) | 0.287 | 0.196 | **0.091***** |
| | (t+2)† | 0.302 | 0.191 | **0.111***** |
| ALFA | (t) | 0.285 | 0.239 | **0.046** |
| | (t+1)† | 0.296 | 0.205 | **0.091***** |
| | (t+2)† | 0.263 | 0.159 | **0.103***** |

# Main findings: Czech vs International IP protection

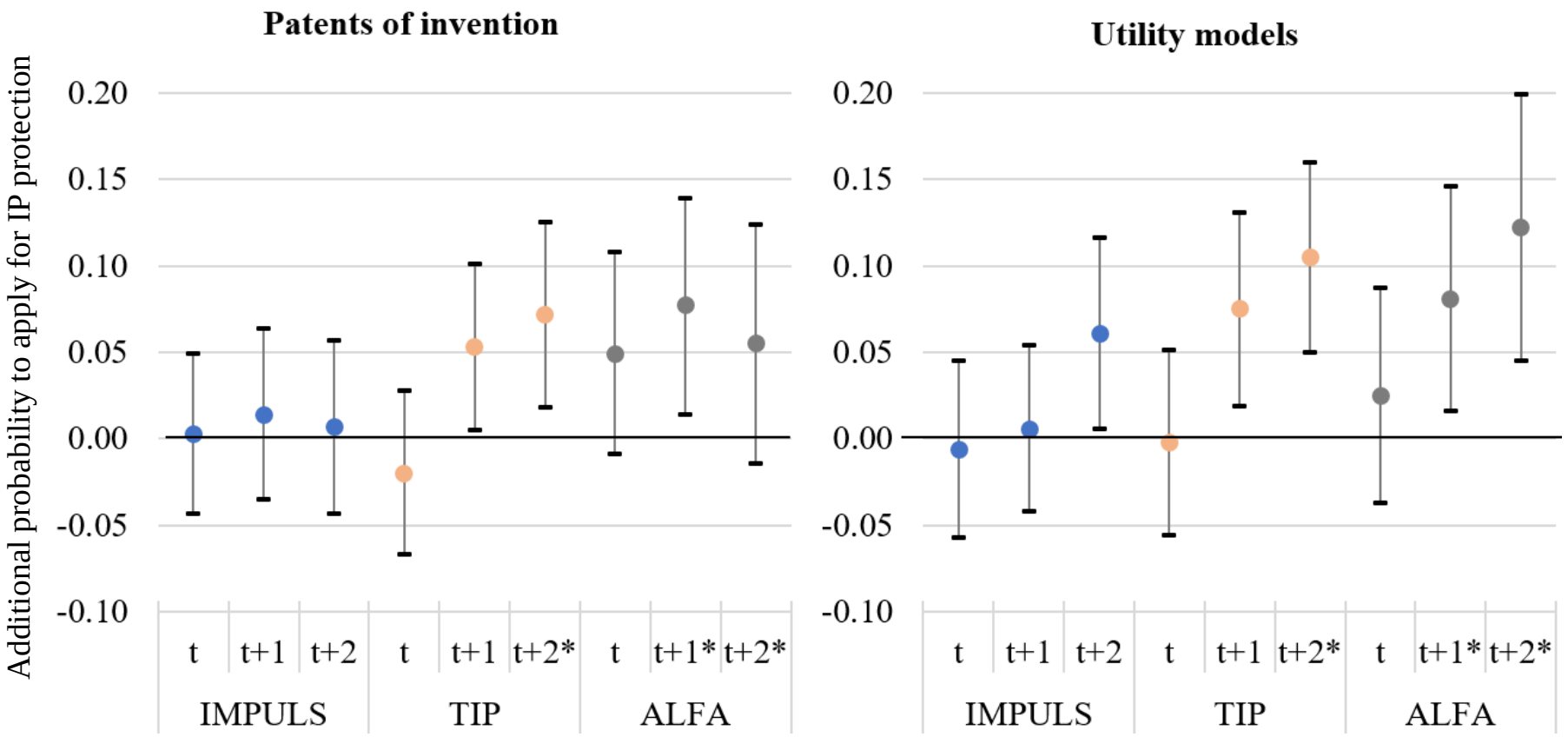
## Czech IP protection



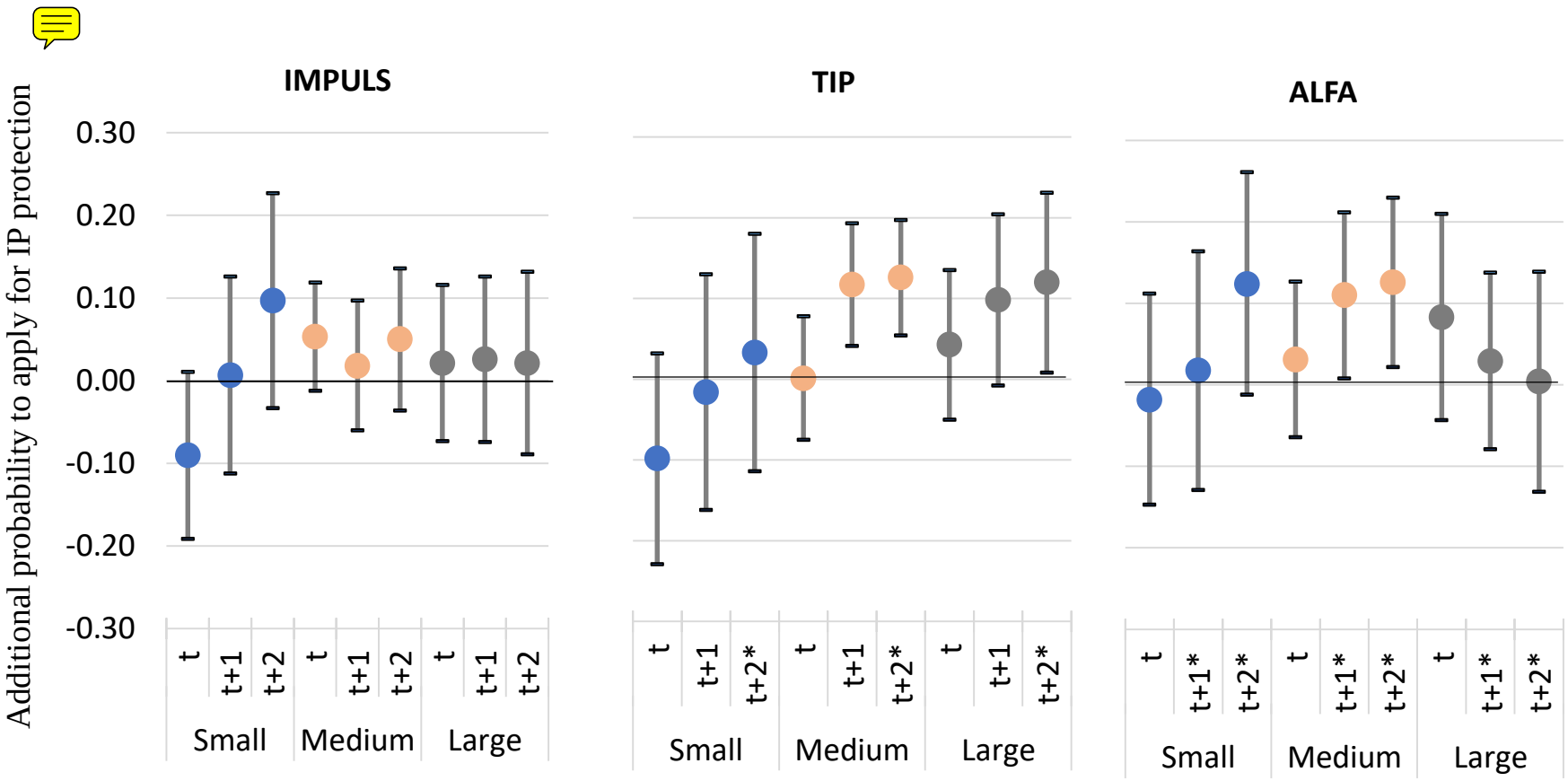

## International IP protection (PCT/WIPO, EPO, US, Japan)



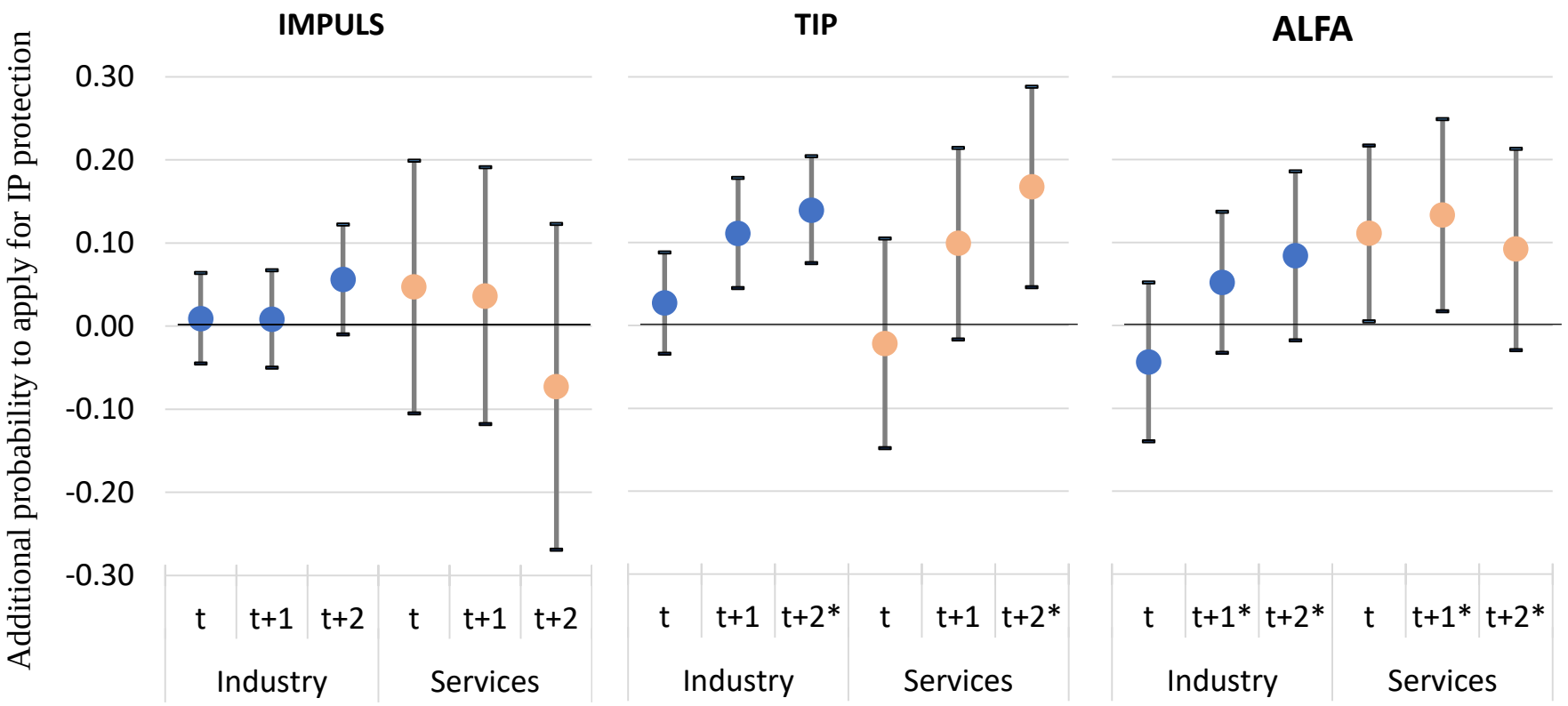
# Heterogeneity Checks: Czech IP protection by type



# Heterogeneity Checks: Czech IP protection by size of firms



# Heterogeneity Checks: Czech IP protection by sectors



# Main findings: Summary

1. Firms receiving R&D subsidies are more likely to apply for Czech IP protection, but no effect (inconclusive effect) on International IP protection applications.
2. The effects are weaker for IMPULS than TIP and ALFA, and stronger on later stages.
3. The effects are stronger for utility models than patents of invention. For both types of IP protection, the magnitude grows.
4. Insufficient output additionality effect for small businesses (<50 employees).
5. Sectoral effects by programmes are mixed, but overall stronger for industry than for services.
6. Results for ALFA and partly for TIP are preliminary!