Private Investment, R&D and European Structural and Investment Funds: Crowding-in or Crowding-out?

Roberto A. De Santis Francesca Vinci

[1]European Central Bank
[2]European Central Bank

EEA Congress 2025

Disclaimer: The views expressed are those of the authors and do not necessarily reflect those of the ECB.

Motivation

- Europe faces substantial investment needs.
- Public and private investment have a role to play: do they complement (crowding-in) or substitute (crowding-out) each other?
- **Crowding-out**: Public spending reduces private activity (e.g. competing for scarce inputs).
- **Crowding-in**: Public investment lowers costs, creates spillovers, or alleviates credit constraints.
- ***Key research question:*** *Do EU Structural and Investment (ESI) Funds stimulate or crowd out private investment and business R&D?*

ESI Funds

- ESI Funds: regional policy providing main financial instrument of the European Union to strengthen economic, social, and territorial cohesion.
- ESI funds finance projects that promote investment in research and innovation, improve infrastructure, support sustainable development, and economic convergence.
- **Four Key Funds:**
  1. **European Regional Development Fund (ERDF):** Supports regional development and innovation
  2. **European Social Fund (ESF):** Promotes employment and social inclusion
  3. **Cohesion Fund (CF):** Funds infrastructure and environmental projects in less developed regions
  4. **Youth Employment Initiative (YEI):** Assists young people not in education, employment, or training

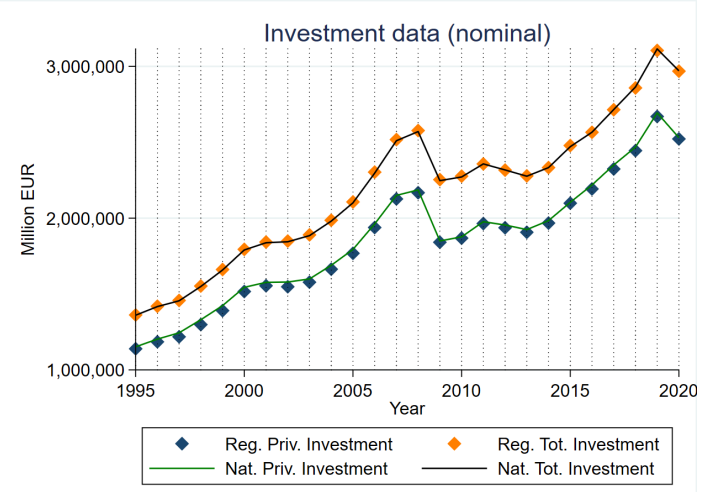
What we do in this paper

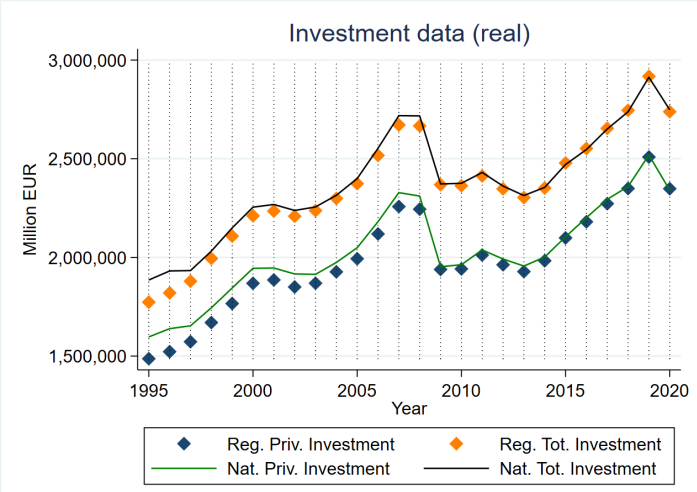
- **Analyse the effects of ESI funds on private investment and R&D: crowding-in versus crowding-out**
- **State: Degree of convergence**
  - Examine if the impact of ESI funds differs between less developed and more developed regions
- **State: Economic Cycle**
  - Determine if the effects of ESI funds vary with private debt cycles
- **Policy instrument: Fund**
  - Determine if the effects of ESI funds vary across the 4 funds

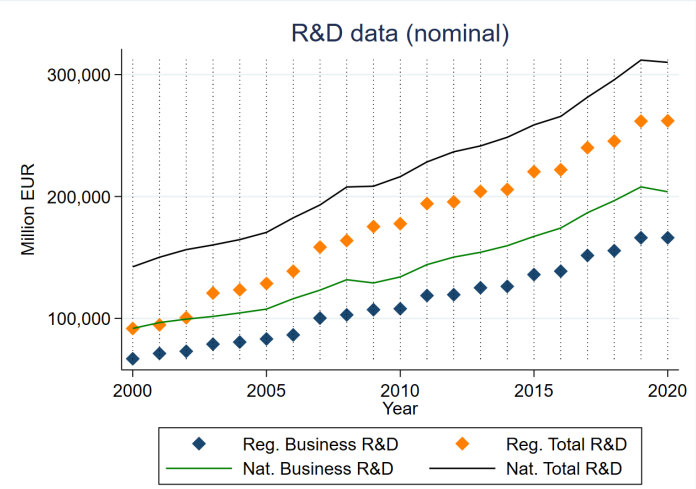
Novelty & Main Findings

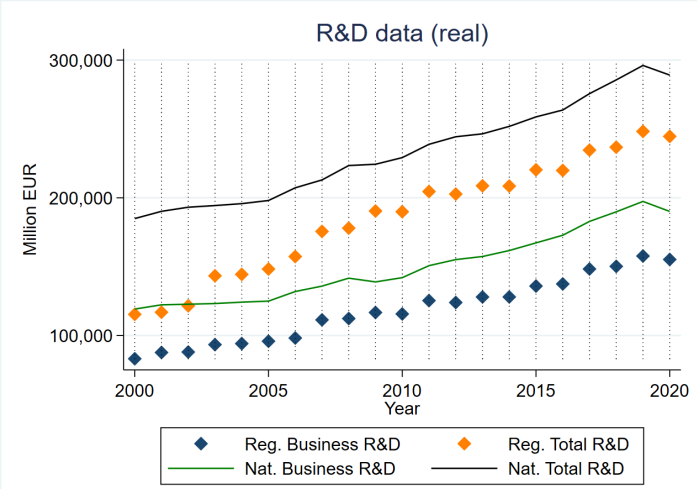
- **Novelty**
  - First to focus on crowding-in effects on private investment and business R&D
  - First to employ regional dataset on private investment & business R&D (2000–2021).
  - New instrument: employing novel historical data on ex-ante planned ESI funds at regional level.
- **Findings**
  - Strong *crowding-in*: 1 euro ESI → 1.1 euros private investment, 0.1 euros R&D (after 2 years).
  - Heterogeneous effects:
    - Developed regions: stronger on private investment.
    - Less developed: stronger on R&D.
    - High-debt regions: stronger overall.
  - By Fund: CF largest, ERDF smaller but robust, ESF/YEI weaker.

Data: Regional Private Investment and R&D





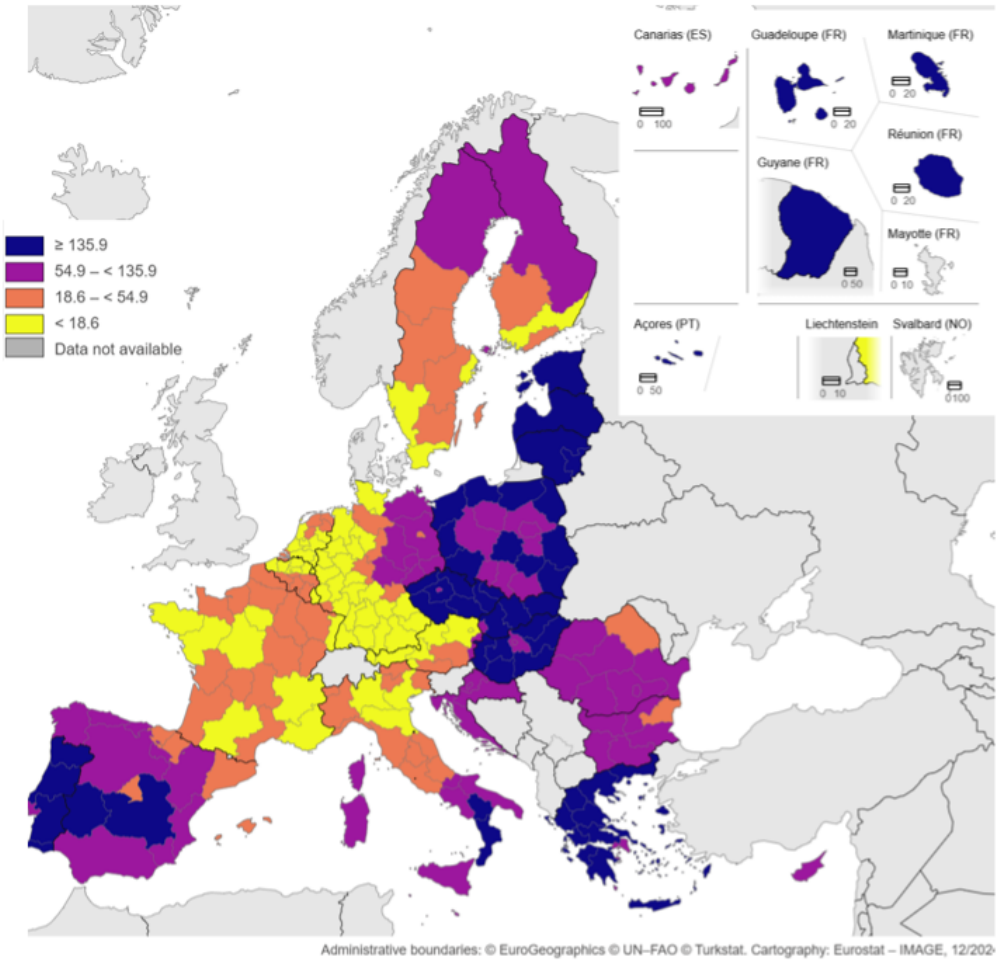




Source: Eurostat, AMECO, ARDECO.

ESI funds spent per capita (annual average)

24 countries and 226 regions



Econometric specification

We follow Bernardini et al. (2020) and Gabriel et al. (2023) and adopt Jorda (2005)'s instrumental local projection approach:

$$\tilde{y}_{r,i,t+h} = \alpha_{r,h} + \gamma_{t,h} + \beta_h \tilde{x}_{r,i,t} + \rho_h(L)' Z_{r,i,t-k} + \sigma_h W_{i,t} + \epsilon_{r,i,t+h},$$

where

- $\tilde{y}_{r,i,t+h} = \frac{Y_{r,i,t+h} - Y_{r,i,t-1}}{V_{r,i,t-1}}$ is the first difference of private investment or R&D scaled by the lagged regional real gross value added
- $\tilde{x}_{r,i,t} = \frac{X_{r,i,t} - X_{r,i,t-1}}{V_{r,i,t-1}}$ is the first difference in real ESI funds, as a fraction of $V_{r,i,t-1}$
- $Z_{r,i,t}$ include $\tilde{y}_{r,i,t-1}$, $\tilde{x}_{r,i,t-1}$ and the lagged growth rate of the regional gross value added
- $W_{i,t}$ country-time controls
- $\alpha_{r,h}$, $\gamma_{t,h}$ are region and time FE
- $\epsilon_{r,i,t+h}$ is the error term

Identification strategy

- The change in the real fund disbursement to region r of country i at time t could be influenced by regional shocks impacting public and private investment → endogeneity
- We construct an instrument exploiting:
  1. the hypothesis that regional shocks affecting regions at a similar state of development are uncorrelated across countries
  2. the positive correlation between the overall ex-ante planned ESI funds and overall ex-post disbursements for each region, the former being exogenous to subsequent private investment decisions.

Instrumental variable

- The instrument for the funds' disbursement $X_{r\in(c,i),t}$ is:

$$X^{IV}_{r\in(c,i),t} = \underbrace{P_{r\in(c,i),t\in p}}_{\text{planned cumulated}} \underbrace{\left(\frac{1}{R \in (c,j)} \sum_{r\in(c,j)=1}^{R\in(c,j)} \frac{X_{r\in(c,j),t}}{P_{r\in(c,j),t\in p}} \right)}_{\text{absorption rate in similar regions in other countries}}$$

$$\text{for } i \neq j,\ c = 3,\ p = 3, \tag{1}$$

$$\text{region } i,\ \text{country } j,\ \text{group } c \tag{2}$$

Instrument

- The approach draws from Kraay (2012, 2014) and Durand and Espinoza (2021).
- Novelty, we use:
  - the average ESI disbursement rate in "similar" NUTS2 regions **in other countries** to predict expenditure in a given region ("similarity" defined in terms of regional categorisation w.r.t. development status for each programming period)
  - the ex-ante planned real cumulative amount for region by programming period (novel data)

Instrument

On the relation between $\Delta X_{r,i,t}/V_{r,i,t-1}$ and $\Delta X^{IV}_{r\in(c,i),t}/V_{r,i,t-1}$

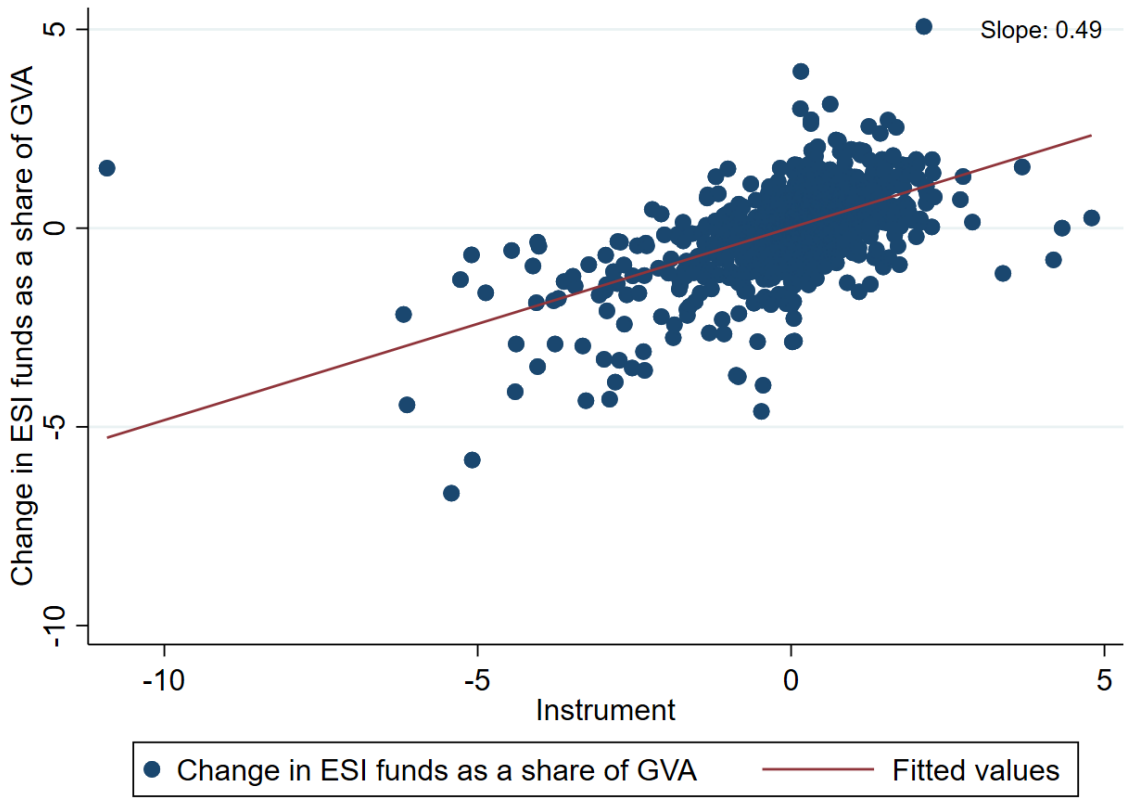


Figure: Relation between change in ESI funds and instrument.

Results: Private investment and ESI Funds

Table: Private Investment and ESI funds

	(1) h=0	(2) h=1	(3) h=2	(4) h=3	(5) h=4
ESI funds$_{r,i,t}$	0.700***	1.109***	1.107*	0.815	0.534
	(0.194)	(0.392)	(0.571)	(0.723)	(0.848)
Number of obs.	3,968	3,778	3,587	3,385	3,174
Kleibergen-Paap F-statistic	108.062	97.859	100.934	126.196	180.234

Notes: The IV specification includes controls, time fixed effects, region fixed effects, and uses Driscoll-Kray standard errors. Standard errors are provided in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The top and bottom 2% of observations for the dependent variable are winsorised. Sample period: 2000 - 2021.

Results: Business R&D and ESI Funds

Table: Business R&D and ESI funds

	(1) h=0	(2) h=1	(3) h=2	(4) h=3	(5) h=4
ESI funds$_{r,i,t}$	0.0356***	0.0579**	0.0723**	0.116**	0.105
	(0.00840)	(0.0225)	(0.0333)	(0.0530)	(0.0699)
Number of obs.	1,552	1,460	1,356	1,280	1,173
Kleibergen-Paap F-statistic	42.763	39.394	48.914	53.806	63.886

Notes: The IV specification includes controls, time fixed effects, region fixed effects, and uses Driscoll-Kray standard errors. Standard errors are provided in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The top and bottom 2% of observations for the dependent variable are winsorised. Sample period: 2000 - 2021.

Private Investment and ESI Funds
State of development

	Less Developed Regions		More Developed Regions	
	h=0	h=1	h=0	h=1
ESI funds$_{r,i,t}$	0.871	1.672	1.433***	1.791***
	(0.531)	(1.033)	(0.309)	(0.463)
Number of obs.	1,492	1,414	2,476	2,364
Kleibergen-Paap F-statistic	27.634	24.603	107.997	154.969

Notes: The IV specification includes controls, time fixed effects, region fixed effects, fixed effects and uses Driscoll-Kray standard errors. Standard errors are provided in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The top and bottom 2% of observations for the dependent variable are winsorised. Sample period: 2000 - 2021.

Business R&D and ESI Funds
State of development

	Less Developed Regions		More Developed Regions	
	h=0	h=1	h=0	h=1
ESI funds$_{r,i,t}$	0.0582***	0.117***	0.00418	-0.0683
	(0.0153)	(0.0436)	(0.0420)	(0.0605)
Number of obs.	945	882	607	578
Kleibergen-Paap F-statistic	19.092	12.586	44.406	73.049

Notes: The IV specification includes controls, time fixed effects, region fixed effects, fixed effects and uses Driscoll-Kray standard errors. Standard errors are provided in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The top and bottom 2% of observations for the dependent variable are winsorised. Sample period: 2000 - 2021.

Private Investment and ESI Funds
Private debt

Table: Private Investment and ESI funds - Private Debt

	High Debt		Low Debt	
	h=0	h=1	h=0	h=1
ESI Funds$_{r,i,t}$	0.833**	0.865**	0.387	0.407
	(0.347)	(0.429)	(0.380)	(0.330)
Number of obs.	1,443	1,359	1,477	1,371
Kleibergen-Paap F-statistic	45.513	52.301	62.611	70.277

Notes: The IV specification includes controls, time fixed effects, region fixed effects, fixed effects and uses Driscoll-Kray standard errors. Standard errors are provided in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The top and bottom 2% of observations for the dependent variable are winsorised. Sample period: 2000 - 2021.

Business R&D and ESI Funds
Private debt

Table: Business R&D and ESI funds - Private Debt

	High Debt		Low Debt	
	h=0	h=1	h=0	h=1
ESI Funds$_{r,i,t}$	0.0333**	0.0488	0.0256**	0.0302
	(0.0169)	(0.0359)	(0.0126)	(0.0213)
Number of obs.	560	533	650	583
Kleibergen-Paap F-statistic	24.428	29.383	20.637	32.006

Notes: The IV specification includes controls, time fixed effects, region fixed effects, fixed effects and uses Driscoll-Kray standard errors. Standard errors are provided in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The top and bottom 2% of observations for the dependent variable are winsorised. Sample period: 2000 - 2021.

Private Investment and ESI Funds
Analysis by Fund

Table: Dependent variable: Private Investment

	(1) (h=0) ERDF	(2) (h=1) ERDF	(3) (h=0) ESF-YEI	(4) (h=1) ESF-YEI	(5) (h=0) CF	(6) (h=1) CF
ESI funds$_{r,i,t}$	1.560***	2.089***	3.268	7.456**	1.312	3.492***
	(0.374)	(0.769)	(2.094)	(3.302)	(1.161)	(1.160)
Number of obs.	3,755	3,545	3,419	3,200	1,448	1,353
Kleibergen-Paap F	84.865	70.871	11.782	13.790	16.145	14.245

Notes: The IV specification includes controls, time fixed effects, region fixed effects, fixed effects and uses Driscoll-Kray standard errors. Standard errors are provided in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The top and bottom 2% of observations for the dependent variable are winsorised. Sample period: 2000 - 2021.

Business R&D and ESI Funds
Analysis by Fund

Table: Dependent variable: Business R&D

	(1) (h=0) ERDF	(2) (h=1) ERDF	(3) (h=0) ESF-YEI	(4) (h=1) ESF-YEI	(5) (h=0) CF	(6) (h=1) CF
ESI funds$_{r,i,t}$	0.0691***	0.106**	0.111*	0.168*	0.0841***	0.182***
	(0.0200)	(0.0457)	(0.0655)	(0.0919)	(0.0319)	(0.0686)
Number of obs.	1,441	1,345	1,344	1,239	1,062	976
Kleibergen-Paap F	19.937	17.785	6.787	7.811	20.526	16.180

Notes: The IV specification includes controls, time fixed effects, region fixed effects, fixed effects and uses Driscoll-Kray standard errors. Standard errors are provided in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The top and bottom 2% of observations for the dependent variable are winsorised. Sample period: 2000 - 2021.

Conclusions

- **Findings**
  - Strong *crowding-in*: 1 euro ESI → 1.1 euros private investment, 0.1 euros R&D (after 2 years).
  - Heterogeneous effects:
    - Developed regions: stronger on private investment.
    - Less developed: stronger on R&D.
    - High-debt regions: stronger overall
  - By fund: CF largest, ERDF smaller but robust, ESF/YEI weaker.
- **Policy implications**
  - ESI funds are effective tools for stimulating private investment and innovation.
  - Important for EUs investment needs, to support long-term growth, convergence, and green/digital transition.

Bibliography I

Bernardini, M., Schryder, S. D., and Peersman, G. (2020). Heterogeneous Government Spending Multipliers in the Era Surrounding the Great Recession. *The Review of Economics and Statistics*, 102(2):304–322.

Durand, L. and Espinoza, R. (2021). The Fiscal Multiplier of European Structural Investment Funds: Aggregate and Sectoral Effects with an Application to Slovenia. *IMF Working Papers*, 2021(118).

Gabriel, R. D., Klein, M., and Pessoa, A. S. (2023). The effects of government spending in the eurozone. *Journal of the European Economic Association*, 21(4):1397–1427.

Jorda, O. (2005). Estimation and inference of impulse responses by local projections. *American Economic Review*, 95(1):161–182.

Kraay, A. (2012). How large is the government spending multiplier? evidence from world bank lending. *The Quarterly Journal of Economics*, 127(2):829–887.

Kraay, A. (2014). Government spending multipliers in developing countries: Evidence from lending by official creditors. *American Economic Journal: Macroeconomics*, 6(4):170–208.