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Quantitative Easing and Corporate Innovation

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QE and innovation: Academic motivation

- Long-term growth depends crucially on technical change

- R&D costly, innovation hampered during down phase (Aghion et al. 2010)
  - R&D should be countercyclical (Schumpeter 1939), but it is not (Barlevy 2007)

- Can MP stimulate innovation and how (ZLB, impaired financial markets)?

- Research on TFP and conventional MP
  - Moran and Queralto (2018), Anzoategui et al. (2019), Bianchi et al. (2019)

- But nothing on unconventional MP
  - Strange – at the ZLB, all we have

QE and innovation: Academic motivation

$$Y = AK^{\alpha}(hN)^{1-\alpha}$$

- $Y =$ GDP
- $A =$ Stock of ideas
- $K =$ Physical capital
- $h =$ Human capital per person
- $N =$ Hours worked

QE and innovation: Academic motivation

$$\underbrace{\Delta y}_{Growth} \approx \underbrace{\Delta \frac{K}{Y}}_{Solow} + \underbrace{\Delta h}_{Lucas} + \underbrace{R\&D}_{Romer} + \underbrace{\Delta L}_{Jones}$$

- $Growth = 2.0\ (100\%)$
- $Solow = 0.0\ (0\%)$
- $Lucas = 0.4\ (20\%)$
- $Romer = 1.2\ (60\%)$
- $Jones = 0.4\ (20\%)$

- Source: Jones (2002), Fernald & Jones (2014)

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Practical motivation: Decline in euro productivity

QE and innovation: Main findings and implications

- QE-eligible companies increased R&D investment by around 10%
  - Matched sample, eligibility based on ratings

- Causal and remarkably robust effect
  - Not the case in non-EA countries, during pre-CSPP period
  - Robust to alternative matching, scaling, and treatment

- Heterogeneous effect within treated sample
  - Stronger for low-leverage and for already innovative companies

- To maximize aggregate effect of QE, criteria other than bond ratings needed

QE and innovation: Eligible vs. Ineligible companies

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Related literature

- Financial markets: investment, reallocation, and growth
  - Fazzarri et al (1988), Rajan & Zingales (1998), Wurgler (2000)
  - Challenge: establish causality (Lamont 1997; Rauh 2006)

- Effects of unconventional MP (CSPP, MEP, OMT, SMP, negative rates)
  - Acharya et al. (2018), Arce et al. (2021), Eser and Schwaab (2016), Ferrando et al. (2019), Foley-Fisher et al. (2016), Giannone et al. (2012), Grosse-Rueschkamp et al. (2019), Heide et al. (2018), Todorov (2020), Jorda et al. (2023)

- Finance and R&D (strong US bias, few firm-level, ambiguous effect)
  - Hall (1992), Himmelberg & Petersen (1994), Brown et al. (2009, 2012, 2013, 2017)

- MP and innovation (Ma and Zimmermann 2023)

ECB‘s QE: Institutional background

- QE (called „CSPP“) announced (activated) in March (June) 2016
  - „[…] further strengthen the pass-through of the Eurosystem‘s asset purchases to the financing conditions of the real economy.“
  - Sticking to the „principle of market neutrality“ (buying proportionate to the market)

- 6 criteria for bond eligibility
  - Euro-denominated
  - Rated at least BBB-
  - Remaining maturity between 6 months and 30 years
  - Issued by a EA-incorporated company
  - Issued by a non-bank corporation
  - Bond yield larger than ECB‘s deposit facility rate

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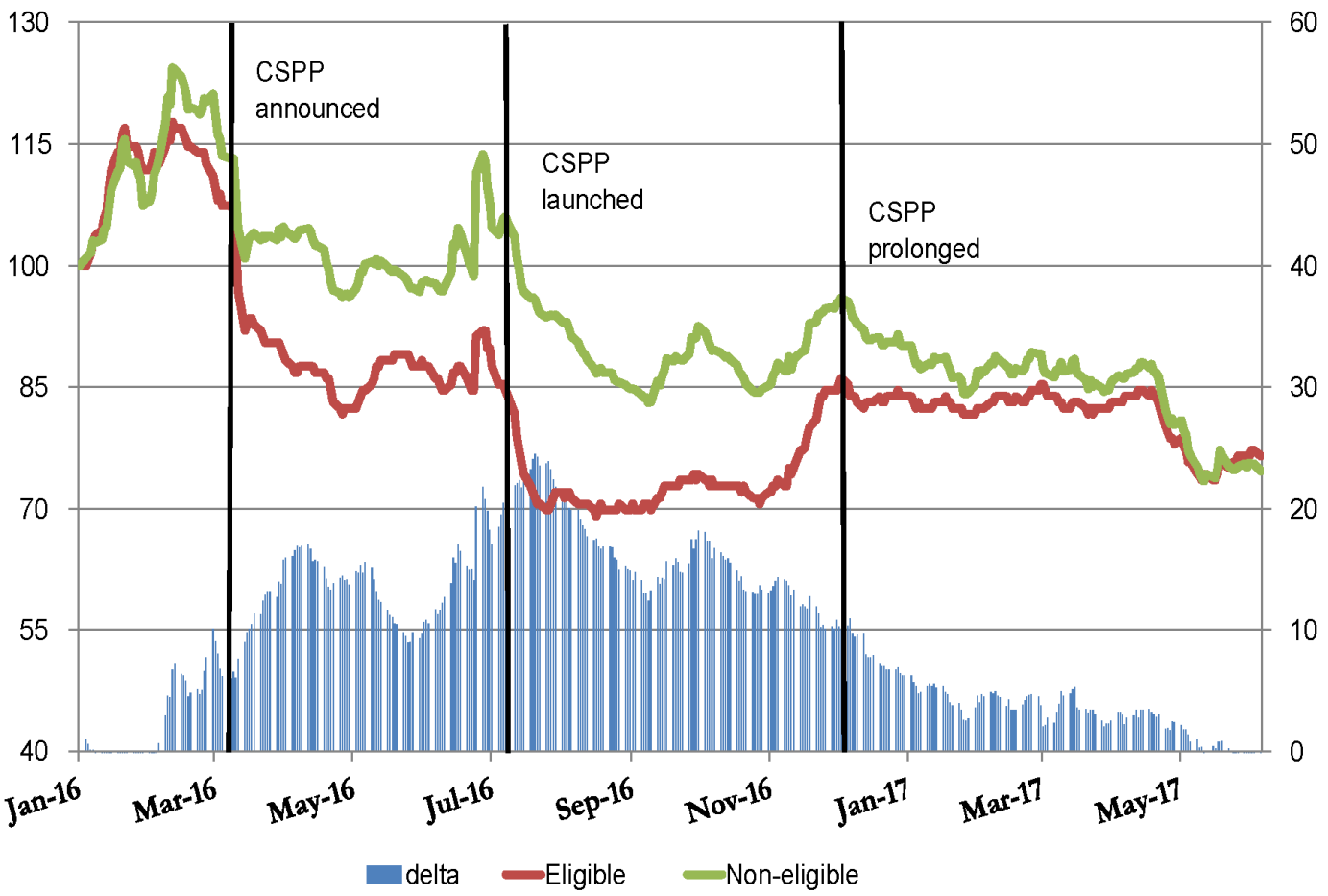
CSPP: Evolution of funding costs

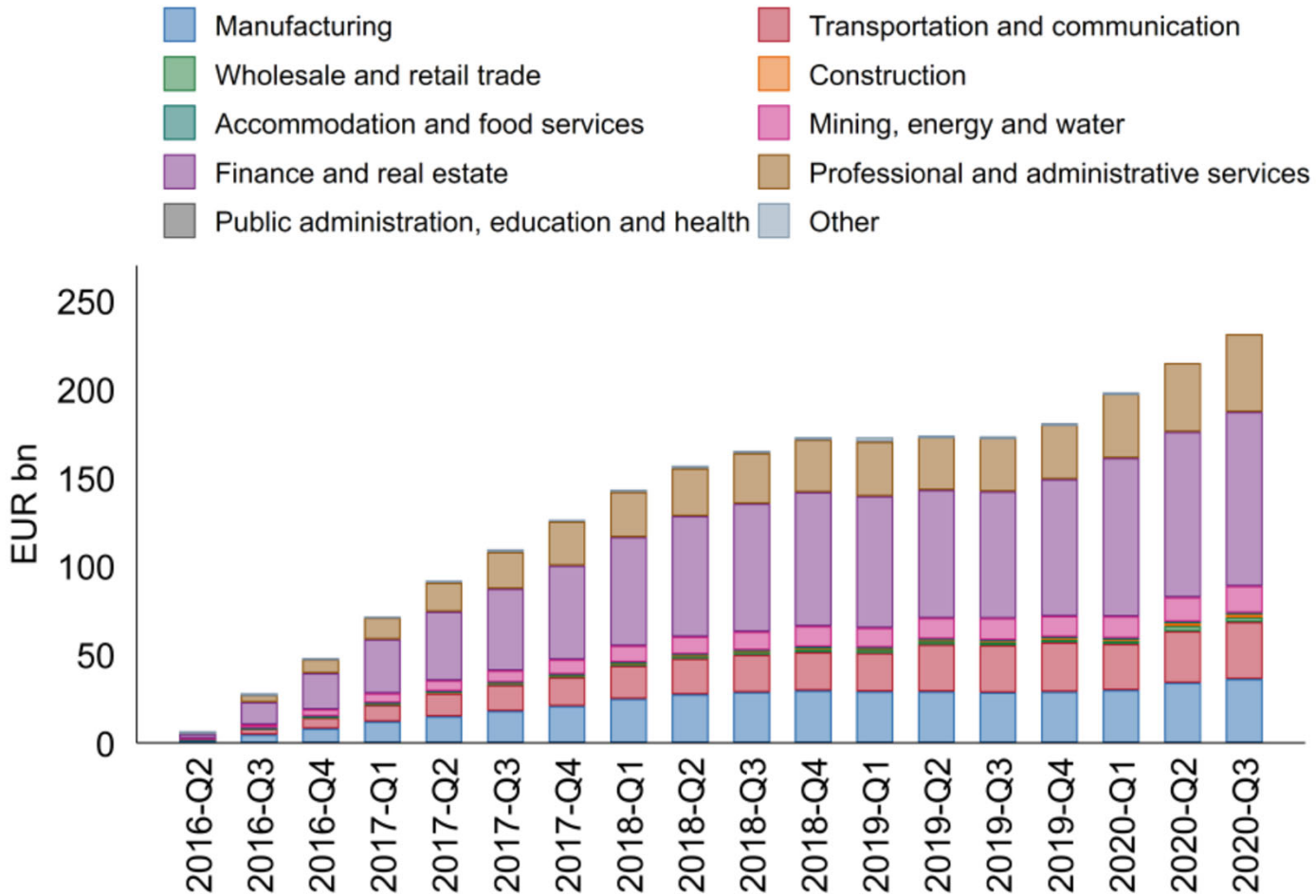


- Short-to-medium run decline in borrowing costs for CSPP-eligible companies
- Source: Zaghini (2019)

Data

- Bond-level
  - Bloomberg and SHS, hand-collect info on parent/subsidiary
- Firm-level
  - Compustat, consolidated
  - All bond-issuing companies, eligibility (BBB-) as of end-2015
  - Drop companies with no info on R&D, sales, or assets
  - Focus on manufacturing, transportation, ICT, utilities
  - Match with ineligible firms on country, sector, pre-CSPP R&D, size
- Final matched dataset: 81 pairs in AT, BE, DE, ES, FI, FR, IE, IT, NL

CSPP: Types of companies



QE and R&D: Main result

$$\frac{R\&D_{f,t}}{Sales_{f,t}} = \beta Eligible_f \times Post_t + \gamma_f + \mu_{c,t} + \phi_{s,t} + \varepsilon_{f,t},$$

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	(1) R&D/ Sales	(2) R&D / Sales	(3) R&D / Sales
Eligible X Post	0.102	0.245**	0.273***
	(0.179)	(0.094)	(0.103)
Post	0.056	0.004	
	(0.318)	(0.079)	
Eligible	0.096		
	(0.152)		
#Eligible	81	81	81
#Ineligible	81	81	81
Observations	1,176	1,176	1,176
R-squared	0.01	0.95	0.95
Company	No	Yes	Yes
Quarter X 1-Dig. Sector	No	No	Yes
Quarter X Country	No	No	Yes

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- 9.6% increase in R&D for CSPP-eligible companies
- 5% aggregate increase in aggregate R&D (eligible account for 55% of total sales) by listed companies

Falsification

- Weren't CSPP-eligible companies already increasing innovation (pre-trends)?
- Isn't this a global phenomenon?

Falsification: False announcement 3 years before

	(1) R&D / Sales	(2) R&D / Sales	(3) R&D / Sales
Eligible X Post	-0.100	-0.008	0.024
	(0.404)	(0.127)	(0.149)
Post	0.173	0.121	
	(0.349)	(0.127)	
Eligible	0.266		
	(0.264)		
#Eligible	68	68	68
#Ineligible	66	66	66
Observations	764	764	764
R-squared	0.90	0.91	0.96
Company	No	Yes	Yes
Quarter X 1-Dig. Sector	No	No	Yes
Quarter X Country	No	No	Yes

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R-squared	0.90	0.91	0.96
Company	No	Yes	Yes
Quarter X 1-Dig. Sector	No	No	Yes
Quarter X Country	No	No	Yes

- No difference in R&D trends between same firms 3 years before CSPP
- Effect specific to CSPP time period

Falsification: Placebo non-EA, Japan and USA

	(1) non-EA	(2) JP	(3) USA
Pseudo-Eligible X Post	-0.107 (0.266)	-0.009 (0.046)	0.540 (0.406)
#Pseudo-Eligible	28	29	113
#Pseudo-Ineligible	28	29	113
Observations	409	466	1,749
R-squared	0.94	0.93	0.83
Company	Yes	Yes	Yes
Quarter X 1-Dig. Sector	Yes	Yes	Yes
Quarter X Country	Yes	No	No

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#Pseudo-Ineligible	28	29	113
Observations	409	466	1,749
R-squared	0.94	0.93	0.83
Company	Yes	Yes	Yes
Quarter X 1-Dig. Sector	Yes	Yes	Yes
Quarter X Country	Yes	No	No

- No difference in R&D trends between identical non-EA groups of firms
- Effect specific to CSPP geography

CSPP and R&D: Heterogeneity

- CSPP designed to improve funding conditions
  - Improved access to finance for credit constrained firms?
  - Reduced cost of funding for high-growth-potential companies?
  - Wealth transfer to highly-rated companies?

- Explore heterogeneity within class of CSPP-eligible companies
  - Financing constraints (cash, interest coverage ratio, payout ratio)
  - Technologically innovative (sector, R&D, patents, intangibles)
  - Corporate structure (low versus high debt ratio)
  - Past growth (ROA/ROE) and risk (ROA/ROE volatility)

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QE and R&D: Role of financing constraints

	(1) *C/A*	(2) *ICR*	(3) *Payout*
Post X Eligible	0.215	0.341*	0.129
	(0.157)	(0.186)	(0.095)
Post X Financially Constrained	-0.047	-0.009	-0.469***
	(0.102)	(0.178)	(0.167)
Post X Eligible X Financially Constrained	0.241	-0.062	0.094
	(0.207)	(0.234)	(0.138)
#Eligible	81	81	81
#Ineligible	81	81	81
Observations	1,152	1,144	634
R-squared	0.95	0.95	0.95
Company	Yes	Yes	Yes
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Observations	1,152	1,144	634
R-squared	0.95	0.95	0.95
Company	Yes	Yes	Yes
Quarter X 1-Dig. Sector	Yes	Yes	Yes
Quarter X Country	Yes	Yes	Yes

- No different in elasticity across accepted proxies for financing constraints
- CSPP does not affect R&D by relaxing funding constraints

QE and R&D: Role of technology

	(1) *Patents*	(2) *R&D*	(3) *Intangibles*
Post X Eligible	-0.093	-0.102	0.255*
	(0.092)	(0.081)	(0.143)
Post X High Innovation	-0.417***	-0.469***	0.124
	(0.156)	(0.176)	(0.128)
Post X Eligible X High Innovation	0.586***	0.602***	0.038
	(0.201)	(0.226)	(0.212)
#Eligible	81	81	81
#Ineligible	81	81	81
Observations	1,174	1,176	1,176
R-squared	0.95	0.95	0.95
Company	Yes	Yes	Yes
Quarter X 1-Dig. Sector	Yes	Yes	Yes
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- Eligible firms with prior innovation increase R&D relatively more
- Growth opportunities versus assets in place

QE and R&D: Role of financial structure

	(1) D/A	(2) D/E
Post X Eligible	0.033	-0.008
	(0.086)	(0.126)
Post X Low Leverage	-0.068	-0.156
	(0.140)	(0.142)
Post X Eligible X Low Leverage	0.430**	0.489**
	(0.198)	(0.221)
#Eligible	81	81
#Ineligible	81	81
Observations	1,176	1,176
R-squared	0.95	0.95
Company	Yes	Yes
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Observations	1,176	1,176
R-squared	0.95	0.95
Company	Yes	Yes
Quarter X 1-Dig. Sector	Yes	Yes
Quarter X Country	Yes	Yes

- Eligible firms with relatively lower leverage increase R&D relatively more
- Subsidizing the cost of debt makes sense when debt can be increased

Innovation vs. dividends

	(1) *Dividends*	(2) *Dividends*	(3) *Dividends*
Post X Eligible	0.622***	1.229***	-0.152
	(0.153)	(0.460)	(0.342)
Post X High Innovation		0.853*	
		(0.439)	
Post X Eligible X High Innovation		-1.006**	
		(0.483)	
Post X Low leverage			-0.800**
			(0.385)
Post X Eligible X Low leverage			1.343**
			(0.419)
#Eligible	81	81	81
#Ineligible	81	81	81
Observations	1,174	1,176	1,176
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Post X Eligible X High Innovation		-1.006**	
		(0.483)	
Post X Low leverage			-0.800**
			(0.385)
Post X Eligible X Low leverage			1.343**
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- Eligible firms increased dividends (as in Todorov 2020)
- But, less so if more R&D-intensive and high-leverage

QE and R&D: No „one size fits all“

- CSPP does not increase R&D investment for all CSPP-eligible companies
  - Credit constrains and past growth / volatility do not matter
  - Strong effect for low-leverage and already innovating companies

- Real investment versus wealth transfer
  - Innovative companies increase innovation
  - Non-innovative companies increase dividends

- Implications for various finance-and-growth mechanisms
  - Not about relaxing credit constraints (Rajan and Zingales 1998)
  - Optimal financial structure (Jensen and Meckling 1976)
  - Assets in place versus growth opportunities (Myers 1977)

Conclusion

- Research question: Does QE have presistent / real effects and how?

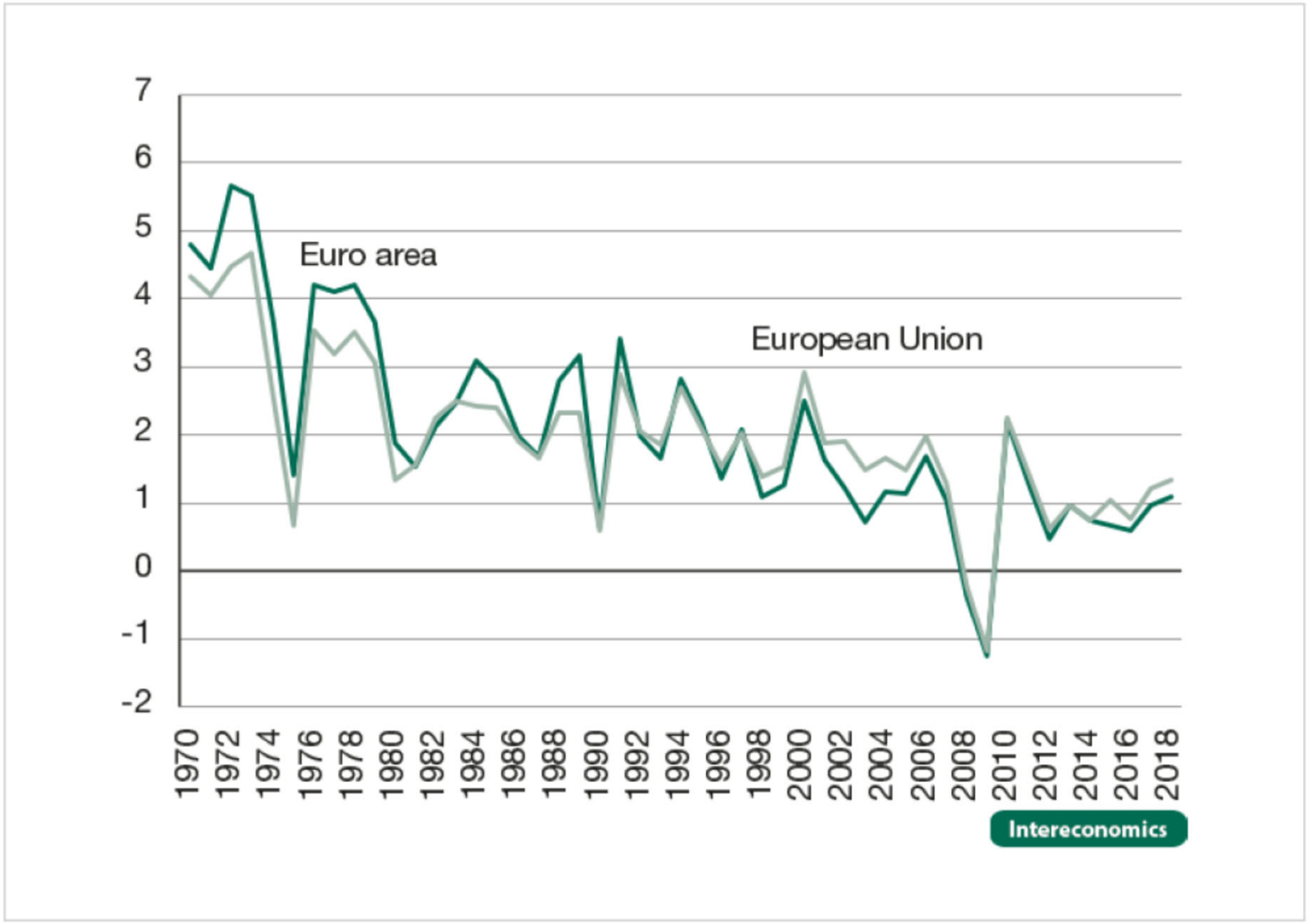
- CSPP-eligible companies increased R&D after 2016 (by about 10%)
- Significant heterogeneity in elasticity of response

- Implications for QE design:
  - Financial structure and technology matter, credit constraints do not
  - Tweak CSPP eligibility criteria for bigger real effects?
    - Policy efficiency versus pitfalls of activist industrial policy

- MP likely less powerful than structural reforms in promoting innovation
  - Eagerly awaiting Draghi‘s white paper on European economic competitiveness

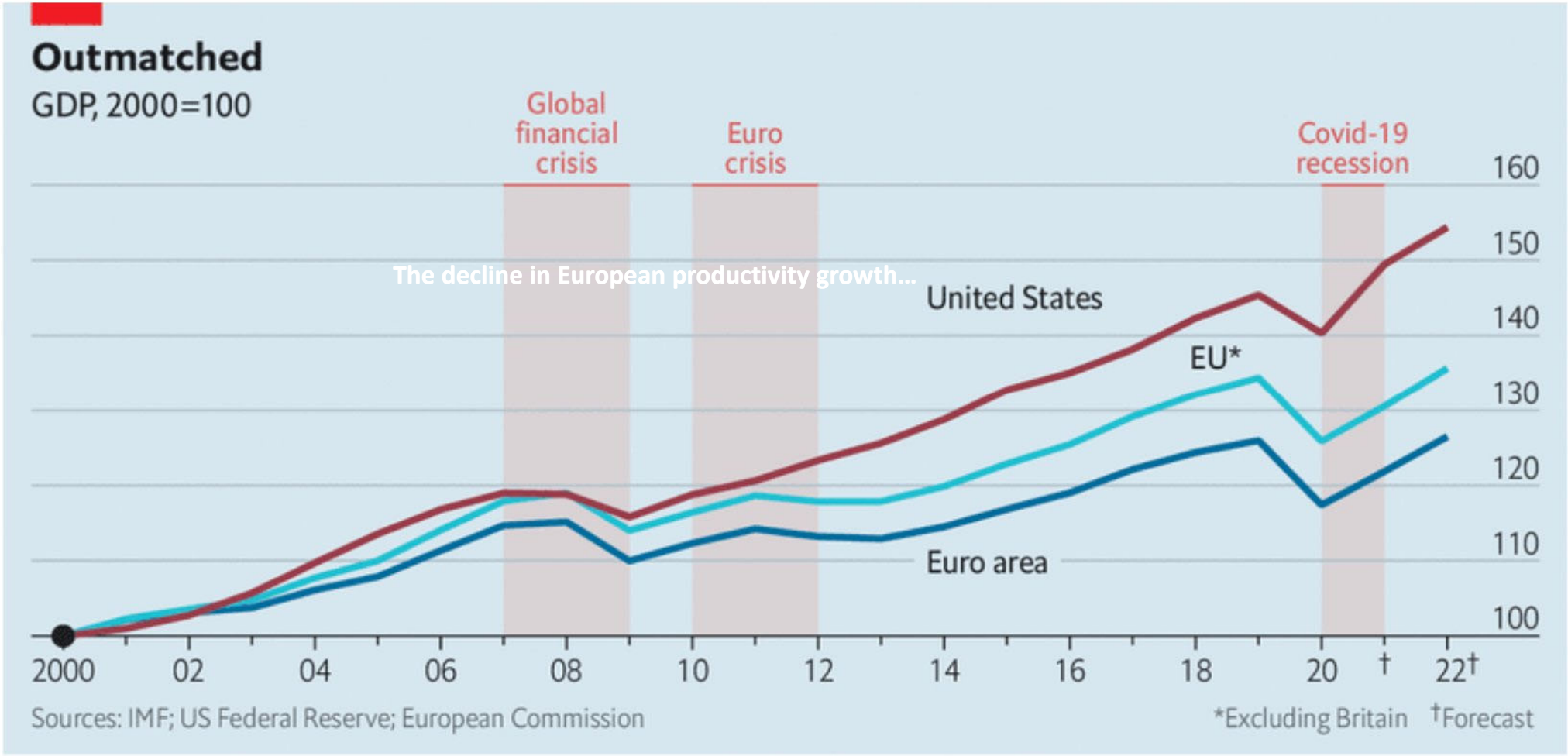
THANK YOU!

The decline in European productivity growth…



… that is specific to Europe

Motivation



Matched sample

	eligible		ineligible		
	(1) N	(2) mean	(3) N	(4) mean	(5) difference
Firm Size [log(Assets)]	81	10.03	81	7.51	***
Research Expense / Sales (%)	81	2.84	81	2.54	
Cash / Assets (%)	81	8.47	81	12.73	***
CapEx / Assets (%)	81	4.27	79	4.62	
Acquisitions / Assets (%)	54	3.04	39	3.50	
Net worth (%)	81	70.52	81	70.31	
Leverage (%)	81	29.48	81	29.69	
Sales growth (%)	81	4.06	81	1.16	
PPE / Assets (%)	81	26.65	81	24.55	
Cash flow / PPE	81	1.06	81	1.35	
Tobin's Q (%)	81	1.99	81	1.79	

CSPP and R&D: Robustness

- Alternative proxy for innovation: R&D/Assets
- Alternative sample: Including services
- Controlling for pre-treatment firm-specific factors interacted with Post
- Alternative clustering