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Promoting Digitalization through Information Dissemination

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Motivation

- Increased use of digital technologies with possible positive effects on growth and productivity.
  - However, slower adoption pace among SMEs. Why?
- Typically, lack of capital primary friction for efficient investment decisions.
- However, for investments in digital technologies (*digitalization*), major barrier seems to be:

  - Lack of awareness of new technologies, and lack of digital skills (e.g., OECD, 2021a).
  - More prevalent among managers of SMEs.

What we do

- Examine impact of improving SMEs *managerial awareness of digital technologies* and *training in digital skills* on investments in such technologies and firm performance.
- Exploit U.K. government initiative, Small Business Digital Capacity Program Challenge Fund (*Challenge Fund*) in 2014.
  - Provided funding on competitive basis to local enterprise public-private partnerships (LEPs) in England.
  - Objective: support LEPs' projects that aim at improving local SMEs' *awareness of digital technologies* and *transfer of digital skills* to enable them to trade and grow online.
    - Examples: launch events for networking, face-to-face advice, workshops with IT experts.

Research Design

- Exploit geographical variation of allocation of funds.
- Focus on SMEs without internet presence prior to program:
  - In LEPs that received funding (***Treated***).
  - In LEPs in England and rest of Great Britain that didn't receive funding (***Control***).

Possible concerns	How we address them
Treatment assignment	Comparing treated and control areas prior the program on internet infrastructure, business demographics, economic conditions, political affinity.
LEP self-selection	Comparing SMEs vs. non-SMEs within treated LEPs.
Firm composition	PSM based on size, age, financial constraints, growth opportunities, employment, and industry.

Main Regression (PSM-DID)

$$Y_{i,t} = \beta(Post_t \times Treated_i) + \mathbf{Z_{i,t,j,g}} + \epsilon_{i,t}, \quad (1)$$

$Y_{i,t}$ = Measures of digitalization outcomes.
$Post_t$ = one (zero) during the 2015-2019 (2011-2013) period.
$Treated_i$ = one (zero) for SMEs without a website before the program and located in treated (control) areas.
$Z_{i,t,j,g}$ = matrix of fixed effects that includes firm (i), year (t), industry-by-year (j), and geographic (g) fixed effects.
Standard errors are clustered at the geographic-year level.

Data

- *FAME (Financial Analysis Made Easy)*:
  - firmographics, financial statements, and directors' data for a large sample of U.K. public and private firms over 2011-2019.
- *BuiltWith:*
  - frequent records of any new technology that a website may have adopted or dropped, and the date of the record update.
  - Technologies grouped in different *tags* based on their function.
    - *Web:* dummy equal to one if a firm has a website in a given year;
    - *G-score (B-Score):* sum of general (business) technology tags for each firm each year; *GB-Score*: sum of all tags detected each year;
    - *E-commerce:* dummy equal to one if a firm has adopted any e-commerce-related technologies in a given year;
    - *E-score:* sum of the e-commerce related technology tags for each firm each year.

Digitalization outcomes (1/2)

	Extensive Margin		
		Web	
	(1)	(2)	(3)
Post × *Treated*	0.027***	0.026***	0.025***
	(2.21)	(2.54)	(2.44)
Observations	148,645	148,645	147,096
Adjusted R^2	0.51	0.53	0.53
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry × Year FE	No	Yes	Yes
Geographic FE	No	No	Yes

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	Intensive Margin								
	Ln(BG-score)			*Ln(B-score)*			*Ln(G-score)*		
	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post × Treated	0.067***	0.065***	0.063***	0.049***	0.048***	0.046***	0.052***	0.051***	0.048***
	(2.32)	(2.66)	(2.58)	(2.39)	(2.73)	(2.67)	(2.31)	(2.64)	(2.56)
Observations	149,293	147,293	147,739	149,293	149,293	147,739	148,293	148,293	147,739
Adjusted R^2	0.52	0.53	0.53	0.50	0.52	0.52	0.51	0.53	0.53
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Geographic FE	No	No	Yes	No	No	Yes	No	No	Yes

Digitalization outcomes (2/2)

	Extensive Margin			Intensive Margin		
	E-commerce			*Ln(E-score)*		
	(1)	(2)	(3)	(4)	(5)	(6)
Post × *Treated*	0.026***	0.025***	0.025***	0.022***	0.022***	0.021***
	(2.45)	(2.75)	(2.71)	(2.39)	(2.64)	(2.62)
Observations	149,293	149,293	147,739	149,293	149,293	147,739
adjusted R^2	0.44	0.46	0.46	0.44	0.46	0.46
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	No	Yes	Yes	No	Yes	Yes
Geographic FE	No	No	Yes	No	No	Yes

- Parallel trend condition confirmed.
- Results hold within treated LEP: SMEs vs. non-SMEs.

Real outcomes

	Panel A: *Sales Growth*			Panel B: *ROA Growth*		
$Post \times Treated$	0.029**	0.027*	0.029**	0.021**	0.020**	0.021**
	(2.04)	(1.95)	(2.10)	(2.26)	(2.18)	(2.29)

	Panel A: Δ *Ln(Employees)*			Panel B: Δ *Ln(Employees)*		
$Post \times Treated$	0.020***	0.020***	0.020***	0.051**	0.055***	0.057***
	(5.02)	(4.98)	(5.01)	(2.43)	(2.62)	(2.71)

- Parallel trend condition confirmed.
- Also find increase in both IT workers and IT expenses.

Robustness Tests

- Parallel trend condition.
- Placebo tests.
- Barriers to digitalization:
  - Subsamples by financial constraints.
  - Subsamples by directors ages.
  - Subsamples by spatial divide.

All robustness tests support our main conclusions.

Conclusion

- We investigate whether *increased awareness* of digital technologies *and training in digital skills* spur digitalization among SMEs and whether digitalization has real effects.
- Using novel measures of digitalization, we show that treated SMEs are more likely to set up a business website, adopt significantly more types of digital technologies, and are more likely to invest in e-commerce technologies.
- Increased digitalization has positive effects on revenue and profitability, and employment growth and labor productivity.

Lack of knowledge about digital technologies represents an important barrier for SMEs to become more digitalized.