

# Technology equalizers: How digital platforms level the playing field for small firms\*

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# Outline

1. Motivation
2. Transaction costs: coordination costs and motivation costs
3. Data: EIB Investment Survey (EIBIS) and Orbis
4. Results
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## Motivation (1/2)

- ▶ Digital platforms facilitate interactions and exchanges between different types of users (Rochet and Tirole, 2003)
  - ▶ buyers and sellers
  - ▶ businesses finding suppliers
  - ▶ workers seeking employment and firms searching for candidates
- ▶ Platforms have existed in the physical world for centuries, for example medieval trade fairs (Fishman and Sullivan, 2006)
- ▶ But digital platforms make market interactions possible without having to travel to a central location
- ▶ They reduce transaction costs, coordination costs and information asymmetry (Garicano and Kaplan, 2001)

## Motivation (2/2)

- ▶ Digital platforms offer efficiency gains
- ▶ But not all firms adopt them, nor do they all benefit equally from using them (Brynjolfsson et al., 2006)
- ▶ Use of standardized solutions provided by platforms involves a trade-off between fixed and variable costs (Loertscher and Riordan, 2019)
  - ▶ some firms can develop customized solutions through investments in physical and human capital
  - ▶ but others (typically small firms) do not have the resources
- ▶ Digital platforms allow firms to replace high fixed cost, low variable cost technologies by low fixed cost, high variable cost technologies (outsourcing)

# What we do in the paper

- ▶ We estimate the effect of the use of platforms on firm productivity using data of the EIB Investment Survey (EIBIS)
- ▶ We show that the effects differ between small and large firms: small firms experience a higher increase in firm productivity
- ▶ We also find that platforms allow firms to better adapt to sudden changes in demand
- ▶ We argue that - while the large physical and human capital requirements of IT investment favor large firms and lead to industry concentration (Hsieh and Rossi-Hansberg, 2023; De Ridder, 2024; Lashkari et al., 2024) - digital platforms can level the playing field by facilitating access of small firms to similar technologies

# Preview of main results (1/3) - small firms experience a higher increase in firm productivity

Table 1: Effect of platform on productivity as a function of firm size

Dependent variable: log TFP (EIBIS)	
Platform	0.255 (0.066)
<b>Platform × log of fixed assets</b>	<b>-0.016</b> <b>(0.005)</b>
Log of fixed assets	-0.009 (0.004)
Young firm: less than 10 years old	-0.103 (0.017)
Small (10–49 employees)	0.138 (0.015)
Medium (50–249 employees)	0.210 (0.018)
Large (250+ employees)	0.017 (0.025)
Sample size	26,043
$R^2$	0.314

Note: OLS regression. The regression includes controls for firm size categories, firm age, management practices, the interactions of country and sector as well as year fixed effects. Robust standard errors in parentheses.

## Preview of main results (2/3)

**Table 2:** Effect of platform on productivity at different values of the distribution of fixed assets. Magnitude of the effects

Dependent variable: log TFP (EIBIS)	
Average fixed assets	0.042 (0.011)
Small: 1st quartile of fixed assets	0.068 (0.015)
Medium: median fixed assets	0.044 (0.012)
Large: 3rd quartile of fixed assets	0.012 (0.013)

Note: The table shows the magnitude of platform use on firm productivity for firms at different values of the distribution of fixed assets, using the empirical specification of Table 1. The regression includes controls for firm size categories, firm age, management practices, the interactions of country and sector as well as year fixed effects. Robust standard errors in parentheses.

# Preview of main results (3/3) - platforms allow firms to better adapt to sudden changes in demand

**Table 3:** Effect of platform on productivity as a function of firm size and index of sales variability in the sector

Dependent variable: Log TFP (EIBIS)	
Platform	0.158 (0.065)
Platform $\times$ log of fixed assets	-0.014 (0.004)
<b>Platform <math>\times</math> index of sales variability in the sector</b>	<b>0.036</b> <b>(0.009)</b>
Log of fixed assets	-0.010 (0.004)
Index of sales variability in the sector	-0.079 (0.038)
Sample size	26,043
$R^2$	0.314

Note: OLS regression. The regression includes controls for firm size categories, firm age, management practices, the interactions of country and sector as well as year fixed effects. Robust standard errors in parentheses.

## Previous literature

- ▶ Large literature on potential abuses of dominant position - but not our focus here
  - ▶ economies of scale and demand-side externalities benefit larger firms in 'winner-takes-most' markets (Rochet and Tirole, 2003; Parker and Van Alstyne, 2005)
  - ▶ large firms have significant advantages due to network effects (Farrell and Saloner, 1986; Katz and Shapiro, 1985)
  - ▶ power asymmetry exists between platform leaders and smaller complementors (Zhu and Liu, 2018; Miric et al., 2019)
- ▶ Literature on content - with a similar focus
  - ▶ platform adoption can boost productivity for smaller firms, leveling the playing field (Waldfoegel, 2017; Brynjolfsson et al., 2006; Oberholzer-Gee and Strumpf, 200)
  - ▶ although effects ambiguous: e.g. platform dominance can increase concentration among most successful complements; recommendation systems can lead to concentration (Meyer et al., 2024; Fleder and Hosanagar, 2009)

# Coordination costs - process improvements

- ▶ Transaction costs: coordination costs and motivation costs
- ▶ Coordination costs: costs of processing information and of connecting different agents
  - ▶ customer relationship management (CRM) services (e.g. Salesforce) streamline customer interactions, automate repetitive tasks, provide data analytics, include payment systems - improving sales, marketing and customer services
  - ▶ cloud services (e.g. AWS, Azure) reduce IT infrastructure costs (by converting them into variable costs) and offer advanced AI tools - particularly significant for small firms

## Coordination costs - marketplace benefits

- ▶ e-commerce platforms (e.g. Amazon, eBay) increase reach and improve matching (Hortacsu et al., 2009)
- ▶ They facilitate procurement and standardization, by enabling access to a global marketplace of suppliers – lower impact of distance on trade (Lendle et al., 2016)
- ▶ Firms can hire workers outside of their local markets to find specialized skill (Balgova, 2024)
- ▶ Algorithms improve matching: lower vacancy rates in rental units markets (Kroft and Pope, 2014)
- ▶ Digitization increases the number of new products that are created and made available to consumers (Waldfogel, 2017)
- ▶ Platforms like App Store and Google Play can foster innovation and competition among small developers (Cennamo and Santalo, 2013)

# Motivation costs - reductions in asymmetric information

- ▶ Motivation costs: asymmetric information and commitment cost
- ▶ Asymmetric information: platforms perform the functions of regulator of the marketplace and manage incentives
  - ▶ medieval trade fairs, with the count of Champagne as market designer “inviting the right sorts of participants (and more importantly, keeping the wrong sorts away), setting the rules, and punishing transgressors, ensuring a safe and reliable place that was much valued by merchants in a medieval Europe that was fraught with perils” (Fishman and Sullivan, 2016)
  - ▶ digital platforms convey information to potential clients, with ratings and user reviews (Chevalier and Mayzlin, 2006; Che and Hörner, 2018)

## Motivation costs - reductions in commitment and contracting costs

- ▶ Commitment costs: platforms typically enforce standardized contracts, terms of service and dispute resolution mechanisms (Constantinides et al., 2018)
- ▶ Small firms can rely on the platform for compliance with local regulations, reducing the risk and cost of legal issues
- ▶ Platforms may also offer guarantees or insurance that protect against non-performance or contract breaches (e.g. Airbnb)

## Data: EIB Investment Survey (EIBIS)

- ▶ Since 2016, annual survey of about 12,000 firms covering all 27 EU countries (and, since 2019, 800 firms in the US)
  - ▶ non-financial enterprises with 5+ employees
  - ▶ NACE categories C to J: manufacturing, utilities, construction and services
  - ▶ sample size ranges from 180 enterprises in Cyprus, Malta and Luxembourg to 600 in France, Germany, Italy and Spain
- ▶ Interviews of senior persons with responsibility for investment decisions and how they are financed (owner, CEO or CFO)
- ▶ Information on firm characteristics and performance, past investment activities and future plans, sources of finance, and challenges that businesses face
- ▶ Since 2019, EIBIS includes questions on the adoption of advanced digital technologies, including digital platforms

## EIBIS - sampling strategy

- ▶ EIBIS waves 4-9 conducted in 2019-2024: phone interviews between March and July (between May and August in 2020)
- ▶ Sampling frame: Moody's Orbis dataset, with detailed information on balance sheet and profit and loss accounts
- ▶ EIBIS sample stratified disproportionately by country, industry group (sector) and firm size classes, and stratified proportionally by region within each country
- ▶ Brutscher et al. (2020) provide evidence that EIBIS is representative of business population in Eurostat Structural Business Statistics (SBS)

## EIBIS - question on digital platforms

- ▶ To what extent, if at all, are digital platform technologies used within your business?
  1. Not used in the business
  2. Used in parts of the business
  3. Entire business is organised around this technology
- ▶ Digital platform technologies defined in EIBIS questionnaire as “active use of platforms such as Amazon, Alibaba, eBay to interact with customers, create digital communities, sell products/services”
- ▶ Question asked to firms in services (wholesale and retail trade, accommodation and food services) and ICT

# Descriptive statistics in 2024

Table 4: Firm characteristics in 2024, by platform usage

Platform usage:	Not used	Used	All firms
Turnover (EUR)	7,730,134	16,615,604	11,882,561
Fixed assets (EUR)	2,250,792	2,954,242	2,579,534
Number of employees	20.55	26.45	23.30
Firm age (years)	26.49	27.32	26.88
Young firm: less than 10 years old	15.6%	16.0%	15.8%
Strategic business monitoring system	22.3%	33.7%	27.6%
Exporter	27.5%	35.8%	31.4%
Sample size	2,505	2,087	4,592

Table 5: Average firm size, by platform intensity

Platform intensity	Log of fixed assets	Number of employees	Sample size
Not used in the business	12.45	20.55	2505
Used in parts of the business	12.96	27.21	1535
Business fully organized around platform	12.57	23.98	552
All firms	12.64	23.30	4592

## Empirical model

$$y_i = \alpha_{jc} + \alpha_t + \beta Platform_i + \gamma Size_i + \sigma(Platform_i \times Size_i) + \lambda X_i + \varepsilon_i$$

where dependent variable  $y_i$ : total factor productivity of firm  $i$

$Platform_i$ : binary variable for use of digital platforms

$Size_i$ : firm size (proxied by log of fixed assets)

$Platform_i \times Size_i$ : interaction term

$X_i$ : control variables, including firm age, management practices, exporter status

$\alpha_{jc}$  and  $\alpha_t$ : industry  $\times$  sector and year fixed effects

$\varepsilon_i$ : random disturbance term

# Results (1/5) - small firms experience a higher increase in firm productivity

Table 6: Effect of platform on productivity as a function of firm size (EIBIS data)

Dependent variable: log TFP (EIBIS)	(1)	(2)
Platform	0.334 (0.066)	0.255 (0.066)
<b>Platform × log of fixed assets</b>	<b>-0.021</b> <b>(0.005)</b>	<b>-0.016</b> <b>(0.005)</b>
Log of fixed assets	0.002 (0.003)	-0.009 (0.004)
Young firm: less than 10 years old		-0.103 (0.017)
Small (10–49 employees)		0.138 (0.015)
Medium (50–249 employees)		0.210 (0.018)
Large (250+ employees)		0.017 (0.025)
Sample size	26,043	26,043
$R^2$	0.306	0.314

Note: OLS regressions. All regressions include controls for management practices, the interactions of country and sector as well as year fixed effects. Robust standard errors in parentheses.

## Results (2/5) - magnitude of the effects

**Table 7:** Effect of platform on productivity at different values of the distribution of fixed assets (EIBIS data)

Dependent variable: log TFP (EIBIS)	(1)	(2)
Average fixed assets	0.045 (0.012)	0.042 (0.011)
Small: 1st quartile of fixed assets	0.081 (0.015)	0.068 (0.015)
Medium: median fixed assets	0.047 (0.012)	0.044 (0.012)
Large: 3rd quartile of fixed assets	0.005 (0.013)	0.012 (0.013)

Note: The table shows the magnitude of platform use on firm productivity for firms at different values of the distribution of fixed assets, using the empirical specification of Table 6. Specification (1) includes the use of business monitoring system; specification (2) adds firm size categories based on the number of employees and firm age. All regressions include controls for management practices, the interactions of country and sector as well as year fixed effects. Robust standard errors in parentheses.

## Results (3/5) - robustness using Orbis data

Table 8: Effect of platform on productivity as a function of firm size (Orbis data)

Dependent variable: log TFP (Orbis)	(1)	(2)
Platform	0.338 (0.080)	0.229 (0.079)
<b>Platform × log of fixed assets</b>	<b>-0.021</b> <b>(0.006)</b>	<b>-0.011</b> <b>(0.006)</b>
Log of fixed assets	0.040 (0.004)	0.099 (0.006)
Firm age: less than 10 years old		0.036 (0.036)
Small (10–49 employees)		-0.065 (0.020)
Medium (50–249 employees)		-0.319 (0.027)
Large (250+ employees)		-0.726 (0.038)
Sample size	9,993	9,990
$R^2$	0.543	0.570

Note: OLS regressions. All regressions include controls for management practices, the interactions of country and sector as well as year fixed effects. Robust standard errors in parentheses.

## Results (4/5) - magnitude of the effects using Orbis data

**Table 9:** Effect of platform on productivity at different values of the distribution of fixed assets (Orbis data)

Dependent variable: log TFP (EIBIS)	(1)	(2)
Average fixed assets	0.058 (0.014)	0.078 (0.014)
Small: 1st quartile of fixed assets	0.094 (0.018)	0.098 (0.018)
Medium: median fixed assets	0.059 (0.014)	0.079 (0.014)
Large: 3rd quartile of fixed assets	0.022 (0.018)	0.059 (0.016)

Note: The table shows the magnitude of platform use on firm productivity for firms at different values of the distribution of fixed assets, using the empirical specification of Table 8. Specification (1) includes the use of business monitoring system; specification (2) adds firm size categories based on the number of employees and firm age. All regressions include controls for management practices, the interactions of country and sector as well as year fixed effects. Robust standard errors in parentheses.

# Results (5/5) - platforms allow firms to better adapt to sudden changes in demand

**Table 10:** Effect of platform on productivity as a function of firm size and index of sales variability in the sector

Dependent variable: Log TFP (EIBIS)	
Platform	0.158 (0.065)
Platform $\times$ log of fixed assets	-0.014 (0.004)
<b>Platform <math>\times</math> index of sales variability in the sector</b>	<b>0.036</b> <b>(0.009)</b>
Log of fixed assets	-0.010 (0.004)
Index of sales variability in the sector	-0.079 (0.038)
Sample size	26,043
$R^2$	0.314

Note: OLS regression. The regression includes controls for firm size categories, firm age, management practices, the interactions of country and sector as well as year fixed effects. Robust standard errors in parentheses.

# Conclusion

- ▶ Platform technologies are associated with higher productivity, especially for smaller firms
- ▶ Digital platforms reduce transaction costs: coordination costs and motivation costs
- ▶ Broader picture: while large IT investments favor big firms, platforms level the playing field for small firms
  - ▶ providing access to advanced technologies
  - ▶ replacing high fixed cost, low variable cost technologies by low fixed cost, high variable cost technologies (outsourcing)
- ▶ ...and allow firms to better adapt to sudden changes in demand