Digital transformation and implications on new firms creation in the European Union

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Presentation outline

1. Motivation and aim of research
2. Previous research
3. Methodology and data
4. Empirical results
5. Conclusions

1.Motivation (1)

- Digitalization:
- a new trend in developed and developing economies, reshaping entrepreneurial endeavours and society;
- creates not only new forms of entrepreneurship, but also has significant implications for activities at the firm level (Verhoef et al., 2021; Kraus et al., 2022);
- however, little is known about the impact of digitalization on new firm creation (Nambisan, 2017; Elia et al, 2020).

1.Aim of research

- The paper aims to analyze the impact of the digitalization tranformation (DT) on new firm creation
- European Union member states, 2015-2020
- A panel data quantile regression approach
- DT- “a change in how a firm employs digital technologies, to develop a new digital business model that helps to create and appropriate more value for the firm” (Verhoef et al., 2021, p. 889).

2.Previous research (1)

- The role of digital technologies and digital transformation in the entrepreneurial process has been largely neglected (Nambisan, 2017; Elia et al., 2020; Verhoef et al., 2021).
- Empirical evidence is very limited (Galindo-Martín et al., 2019; Zhang et al., 2022)
- There is no perfect measure for digital transformation for a large sample of countries over a long period

2.Previous research (2)

- Galindo-Martín et al. (2019):
- data from 29 European countries for only one year (2016)
- the partial least square methodology
- digital transformation (measured by digital commerce variables) has a positive impact on entrepreneurial employee activity (a measure for **intrapreneurship**)

2.Previous research (3)

- Zhang et al. (2022):
- a sample of 101 countries over the period 2001-2018 to investigate the impact of digital technologies on national entrepreneurship.
- DT: the use of digital artefacts (by “the number of mobile users per 100 inhabitants”) and digital platforms and infrastructure (by “the number of internet users per 100 inhabitants”).
- a positive and statistically significant link between DT and national entrepreneurship

2.Previous research (4)

- DT - entrepreneurial activity - **channels**:
- the digitalisation of procedures regarding business creation;
- new forms of entrepreneurship (e.g., digital entrepreneurship) or
- new business models (e.g., platforms) that allow firms to sell products to a broad range of customers (World Bank, 2016).
- new financing opportunities such as crowdfunding platforms or fintech services (Cumming & Schwienbacher, 2018; Skare et al., 2023)

2.Previous research (5)

- DT - entrepreneurial activity - **channels**:
- expanding the number of customers (World Bank, 2016; Nambisan, 2017);
- access to new niche markets (Galindo-Martín et al., 2019) and new marketing opportunities;
- lowering the labour costs by using artificial intelligence or remote work arrangements (Fossen and Sorgner, 2022);
- improved abilities and entrepreneurial mindset through easier access to online entrepreneurial education (e.g., MOOCs) (Ben Youssef et al., 2021; Fossen and Sorgner, 2022).

2.Previous research (5)

- Hypotheses:
- **H.1.**: Higher level of DT will result in higher EA.
- **H.1a.**: Higher level of connectivity will result in higher EA.
- **H.1b.**: Higher level of digital skills (human capital) will result in higher EA.
- **H.1c.**: Higher level of the use of the Internet will result in higher EA.
- **H.1d.**: Higher level of the integration of digital technology will result in higher EA.
- **H.1e.**: Higher level of digital public services will result in higher EA.

3.Methodology and data – sample selection

- Sample: 28 EU member states
  - EU represents an interesting framework to study as it has a strategy to support digitalisation + numerous funds
- Period: 2015-2020
- DESI - Digital Economy and Society Index (European Commission)
  - measures progress of EU countries towards a digital economy and society
  - it brings together a set of relevant indicators on Europe's current digital policy mix.
  - it includes 5 areas: connectivity, digital skills, use of internet, integration of digital technology, and digital public services.
- World Bank (Entrepreneurship database, World Development Indicators, International Debt Statistics, and Doing Business)

3.Methodology and data(variables)

Dependent variable	Definition	Source
NBD	New business density – "New registrations per 1,000 people ages 15-64" (World Bank, 2022a)	World Bank, Entrepreneurship database
Independent variables		
DESI_OVERALL	DESI is computed as "the weighted average of the five main dimensions: (1) Connectivity (25.0%), (2) Human Capital (25.0%), (3) Use of the Internet (15.0%), (4) Integration of Digital Technology (20.0%), and (5) Digital Public Services (15.0%)" (European Commission, 2020).	European Commission
DESI_1_CONN	1 Connectivity – "fixed broadband take-up, fixed broadband coverage, mobile broadband and broadband prices" (European Commission, 2020, p. 11)	European Commission
DESI_2_HC	2 Human capital – "Internet user skills and advanced skills" (European Commission, 2020, p. 11)	European Commission
DESI_3_UI	3 Use of Internet - "citizens' use of internet services and online transactions" (European Commission, 2020, p. 11)	European Commission
DESI_4_IDT	4 Integration of digital technology – "business digitisation and e-commerce" (European Commission, 2020, p. 11)	European Commission
DESI_5_DPS	5 Digital public services - e-Government (European Commission, 2020, p. 11)	European Commission
Control variables		
FDI	Foreign direct investments - net inflows (% of GDP)	World Bank, International Debt Statistics
EG	Economic growth - GDP per capita growth (annual %)	World Bank, World Development Indicators
UNEMP	Total unemployment - % of the total labour force	World Bank, World Development Indicators
DCPS	Access to finance – "domestic credit to the private sector (% of GDP)" (World Bank, 2022c)	World Bank, World Development Indicators
CBSP	Cost of business start-up procedures (% of GNI per capita)	World Bank, Doing Business

3. Methodology and data (Model)

$$NBD_{i,t} = \alpha_{i,j} + \beta_1 DESI_{i,t} + \beta_2 COUNTRY_{i,t} + \varepsilon_{i,t}$$

- where: $NBD_{i,t}$ is the new business density;
- $DESI_{i,t}$ represents the Digital Economy and Society Index (or one of its components) for country *i* over year *t*;
- $COUNTRY_{i,t}$ refers to country-specific variables;
- β_i represents the coefficients of the variables;
- *i* indexes the countries;
- *t* indexes time; $\varepsilon_{i,t}$ represents the error term.

3. Methodology and data (Model)

- Mean regression techniques - have never been satisfactory approaches when considering heterogeneous populations (Buchinsky 1994).
- Quantile regression (QR)
- it offers a more detailed picture of the relationship between digitalisation and new firms creation.
- it accounts for heterogeneity and non-Gaussian distributions (Barnes & Hughes, 2002; Coad & Rao, 2008).

4. Empirical results

Table 2. Descriptive statistics (2015-2020).

Variable	Mean	Std. Dev.	Min	Max	25th percentile	50th percentile	75th percentile	Skewness	Kurtosis
NBD	6.48	5.53	0.51	24.79	2.93	4.50	7.82	1.39	4.11
DESI_OVERALL	46.40	10.16	26.13	72.31	39.18	45.71	53.25	0.22	2.51
DESI_1_CONN	41.39	9.94	17.44	65.82	34.45	40.36	48.48	0.18	2.66
DESI_2_HC	46.87	11.92	27.27	78.44	36.49	45.55	55.76	0.46	2.56
DESI_3_UI	51.19	11.67	21.71	76.34	43.37	49.94	59.57	0.14	2.60
DESI_4_IDT	37.42	13.11	15.28	74.32	27.98	35.82	45.13	0.50	2.68
DESI_5_DPS	61.11	15.29	20.62	89.33	50.73	62.37	73.62	-0.39	2.41
FDI	8.09	23.84	-40.08	163.04	1.00	2.73	4.74	3.77	21.34
EG	1.59	4.01	-11.25	24.00	0.85	1.89	3.83	-0.05	9.21
UNEMP	7.52	4.10	2.01	24.90	4.96	6.55	8.68	1.92	7.19
DCPS	80.52	38.54	24.74	244.19	50.79	77.52	103.44	1.07	4.72
CBSP	3.59	3.96	0.00	14.40	0.70	1.70	5.40	1.32	3.79

Notes: NBD stands for new business density; DESI_OVERALL - Digital Economy and Society Index; DESI_1_CONN - Connectivity; DESI_2_HC - Human capital; DESI_3_UI - Use of Internet; DESI_4_IDT - Integration of digital technology; DESI_5_DPS - Digital public services; FDI - Foreign direct investments; EG - Economic growth; UNEMP - Total unemployment; DCPS - Access to finance; CBSP - Cost of business start-up procedures.

4. Empirical results – correlation matrix

Table 3. Pearson correlations (pooled sample).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) NBD	1.00											
(2) DESI_OVERALL	0.31	1.00										
(3) DESI_1_CONN	0.20	0.74	1.00									
(4) DESI_2_HC	0.33	0.88	0.47	1.00								
(5) DESI_3_UI	0.37	0.93	0.65	0.88	1.00							
(6) DESI_4_IDT	0.13	0.83	0.40	0.71	0.74	1.00						
(7) DESI_5_DPS	0.28	0.82	0.64	0.58	0.66	0.61	1.00					
(8) FDI	0.28	-0.08	-0.10	-0.07	-0.05	-0.08	-0.02	1.00				
(9) EG	0.04	-0.32	-0.43	-0.19	-0.33	-0.18	-0.25	0.15	1.00			
(10) UNEMP	-0.19	-0.37	-0.43	-0.32	-0.33	-0.22	-0.25	0.04	0.00	1.00		
(11) DCPS	0.32	0.33	0.04	0.37	0.41	0.31	0.27	0.19	-0.21	0.25	1.00	
(12) CBSP	-0.09	-0.31	-0.30	-0.29	-0.26	-0.28	-0.16	0.16	-0.02	0.06	0.07	1.00

4. Empirical results – DESI_OVERALL

Table 4. Digital transformation and entrepreneurial activity.

	(1) OLS	(2) 10th quant	(3) 25th quant	(4) 50th quant	(5) 75th quant	(6) 90th quant
DESI_OVERALL	0.0846*	0.0620***	0.0321	0.0201	0.0316	0.3987**
	(0.0510)	(0.0229)	(0.0294)	(0.0433)	(0.0849)	(0.1876)
FDI	0.0547***	0.0259*	0.0451**	0.0583*	0.0725	0.0085
	(0.0165)	(0.0155)	(0.0179)	(0.0325)	(0.0466)	(0.0508)
EG	0.1674	0.0809	0.0811	0.0597	0.1816	0.3986
	(0.1014)	(0.0712)	(0.0907)	(0.0766)	(0.1491)	(0.2747)
UNEMP	-0.2940***	0.0005	-0.1741**	-0.2909***	-0.5514***	-0.3432*
	(0.1104)	(0.0637)	(0.0738)	(0.0723)	(0.1574)	(0.2019)
DCPS	0.0445***	-0.0020	0.0431***	0.0459***	0.0717**	0.0526**
	(0.0119)	(0.0175)	(0.0143)	(0.0099)	(0.0276)	(0.0251)
CBSP	-0.1180	-0.2008*	-0.1703*	-0.0756	-0.2452	0.1300
	(0.1040)	(0.1188)	(0.0897)	(0.0750)	(0.1842)	(0.2080)
Constant	0.8654	-0.3238	0.1321	2.3293	5.6294	-8.0689
	(2.7619)	(1.0370)	(1.4622)	(2.2089)	(4.0029)	(7.9658)
R^2/Pseudo R^2	0.2695	0.1302	0.1279	0.1877	0.2275	0.2259
N. of cases	168	168	168	168	168	168

4. Empirical results – robustness checks (1)

Table 5. Connectivity and entrepreneurial activity.

	(1) OLS	(2) 10th quant	(3) 25th quant	(4) 50th quant	(5) 75th quant	(6) 90th quant
DESI_1_CONN	0.0875*	0.1017***	0.0569	0.0845*	0.0977*	0.2339
	(0.0506)	(0.0207)	(0.0379)	(0.0505)	(0.0588)	(0.1529)
FDI	0.0521***	0.0174	0.0406**	0.0612**	0.0537	0.0749
	(0.0165)	(0.0146)	(0.0205)	(0.0309)	(0.0441)	(0.0624)
EG	0.2100*	0.1733***	0.1403	0.1511	0.2170*	0.3229
	(0.1104)	(0.0625)	(0.0900)	(0.1004)	(0.1282)	(0.2562)
UNEMP	-0.2990***	0.0236	-0.1580**	-0.1982**	-0.4827***	-0.5202**
	(0.1076)	(0.0556)	(0.0776)	(0.0813)	(0.1702)	(0.2261)
DCPS	0.0523***	0.0116	0.0449***	0.0343***	0.0822***	0.1140***
	(0.0105)	(0.0167)	(0.0113)	(0.0107)	(0.0282)	(0.0291)
CBSP	-0.1214	-0.1849	-0.1945**	-0.0937	-0.2203	0.2177
	(0.1025)	(0.1303)	(0.0767)	(0.0723)	(0.2136)	(0.2841)
Constant	0.5380	-2.8023**	-1.1293	0.1230	1.7602	-4.3462
	(2.8390)	(1.0932)	(1.7851)	(2.0834)	(3.5111)	(9.1133)
R^2/Pseudo R^2	0.2706	0.1490	0.1385	0.1994	0.2357	0.1861
N. of cases	168	168	168	168	168	168

4. Empirical results – robustness checks (2)

Table 6. Human capital (digital skills) and entrepreneurial activity.

	(1) OLS	(2) 10th quant	(3) 25th quant	(4) 50th quant	(5) 75th quant	(6) 90th quant
DESI_2_HC	0.0740*	0.0408	-0.0250	-0.0005	0.0571	0.2679**
	(0.0412)	(0.0411)	(0.0247)	(0.0360)	(0.0942)	(0.1322)
FDI	0.0559***	0.0298*	0.0366**	0.0580*	0.0721*	0.0204
	(0.0166)	(0.0173)	(0.0155)	(0.0340)	(0.0432)	(0.0520)
EG	0.1367	0.0595	0.0705	0.0568	0.1829	0.1756
	(0.0975)	(0.0750)	(0.0831)	(0.0759)	(0.1350)	(0.2089)
UNEMP	-0.2978***	-0.0442	-0.2045***	-0.2991***	-0.5279***	-0.6119***
	(0.1070)	(0.0932)	(0.0618)	(0.0575)	(0.1168)	(0.1816)
DCPS	0.0428***	0.0028	0.0482***	0.0457***	0.0669***	0.0649**
	(0.0122)	(0.0254)	(0.0092)	(0.0098)	(0.0254)	(0.0322)
CBSP	-0.1209	-0.2812*	-0.2045**	-0.0963	-0.1781	0.0208
	(0.1021)	(0.1512)	(0.0891)	(0.0797)	(0.1789)	(0.3020)
Constant	1.5441	0.8114	2.8703**	3.4331**	4.4111	-0.7119
	(2.2453)	(1.5606)	(1.3841)	(1.7111)	(4.1032)	(4.8831)
R^2/Pseudo R^2	0.2716	0.1020	0.1291	0.1861	0.2332	0.2489
N. of cases	168	168	168	168	168	168

4. Empirical results – robustness checks (3)

Table 7. Use of the Internet and entrepreneurial activity.

	(1) OLS	(2) 10th quant	(3) 25th quant	(4) 50th quant	(5) 75th quant	(6) 90th quant
DESI_3_UI	0.1178***	0.0756***	0.0431	0.0377	0.0914	0.2437**
	(0.0444)	(0.0213)	(0.0306)	(0.0405)	(0.0805)	(0.1161)
FDI	0.0559***	0.0255*	0.0409**	0.0574	0.0751*	0.0259
	(0.0163)	(0.0151)	(0.0201)	(0.0360)	(0.0445)	(0.0587)
EG	0.1917*	0.0987*	0.0830	0.1336*	0.2592*	0.3188
	(0.0997)	(0.0580)	(0.0885)	(0.0737)	(0.1426)	(0.2316)
UNEMP	-0.2423**	-0.0111	-0.1657**	-0.2372***	-0.4825***	-0.5038***
	(0.1082)	(0.0644)	(0.0739)	(0.0645)	(0.1305)	(0.1560)
DCPS	0.0360***	0.0009	0.0397***	0.0425***	0.0560**	0.0398
	(0.0123)	(0.0174)	(0.0148)	(0.0099)	(0.0228)	(0.0304)
CBSP	-0.0923	-0.2657**	-0.1742*	-0.0641	-0.1667	0.1627
	(0.1008)	(0.1105)	(0.0919)	(0.0792)	(0.1697)	(0.1875)
Constant	-1.0759	-1.2110	-0.3365	1.0381	3.1863	-0.1012
	(2.5554)	(0.9269)	(1.5443)	(2.1259)	(4.6258)	(4.8005)
R^2/Pseudo R^2	0.2881	0.1383	0.1270	0.1909	0.2394	0.2564
N. of cases	168	168	168	168	168	168

4. Empirical results – robustness checks (4)

Table 8. Integration of digital technology and entrepreneurial activity.

	(1) OLS	(2) 10th quant	(3) 25th quant	(4) 50th quant	(5) 75th quant	(6) 90th quant
DESI_4_IDT	-0.0333	0.0475***	0.0432**	-0.0015	-0.0729	-0.1239*
	(0.0339)	(0.0177)	(0.0192)	(0.0342)	(0.0448)	(0.0711)
FDI	0.0509***	0.0251	0.0363*	0.0579*	0.0729*	0.0524
	(0.0166)	(0.0162)	(0.0194)	(0.0336)	(0.0429)	(0.0562)
EG	0.1099	0.0621	0.0870	0.0582	0.1238	0.2402
	(0.0981)	(0.0757)	(0.0885)	(0.0706)	(0.1155)	(0.2068)
UNEMP	-0.4221***	-0.0359	-0.1809***	-0.3014***	-0.6440***	-0.9776***
	(0.1002)	(0.0604)	(0.0612)	(0.0730)	(0.1215)	(0.1407)
DCPS	0.0585***	-0.0017	0.0418***	0.0461***	0.0794***	0.0887***
	(0.0115)	(0.0194)	(0.0115)	(0.0080)	(0.0207)	(0.0274)
CBSP	-0.2160**	-0.1928	-0.1380	-0.0979	-0.3124	-0.0276
	(0.1011)	(0.1359)	(0.0920)	(0.0776)	(0.1952)	(0.2531)
Constant	6.3396***	1.0123	0.1311	3.4696*	9.9397***	17.0594***
	(1.6815)	(0.9791)	(1.0111)	(2.0210)	(2.2474)	(5.5738)
R^2/Pseudo R^2	0.2614	0.1331	0.1383	0.1862	0.2354	0.2015
N. of cases	168	168	168	168	168	168

4. Empirical results – robustness checks (5)

Table 9. Digital public services and entrepreneurial activity.

	(1) OLS	(2) 10th quant	(3) 25th quant	(4) 50th quant	(5) 75th quant	(6) 90th quant
DESI_5_DPS	0.0532*	0.0299	0.0236	-0.0012	0.0164	0.2246**
	(0.0279)	(0.0228)	(0.0175)	(0.0222)	(0.0420)	(0.0968)
FDI	0.0531***	0.0273	0.0455***	0.0579*	0.0708	0.0194
	(0.0164)	(0.0181)	(0.0165)	(0.0343)	(0.0465)	(0.0517)
EG	0.1562	0.0759	0.0939	0.0582	0.1462	0.4148*
	(0.0988)	(0.0766)	(0.0871)	(0.0763)	(0.1379)	(0.2354)
UNEMP	-0.3261***	-0.0124	-0.1815***	-0.3012***	-0.5670***	-0.3694*
	(0.0996)	(0.0825)	(0.0555)	(0.0587)	(0.1399)	(0.2143)
DCPS	0.0471***	0.0020	0.0433***	0.0462***	0.0728***	0.0790***
	(0.0110)	(0.0209)	(0.0105)	(0.0092)	(0.0260)	(0.0266)
CBSP	-0.1520	-0.1608	-0.1921**	-0.0986	-0.2870	-0.2033
	(0.0970)	(0.1781)	(0.0775)	(0.0769)	(0.1869)	(0.2271)
Constant	1.7238	0.4386	0.1983	3.4923**	6.3231***	-3.4028
	(2.0635)	(1.4200)	(1.2977)	(1.5233)	(2.4166)	(5.3487)
R^2/Pseudo R^2	0.2735	0.1029	0.1283	0.1862	0.2260	0.2268
N. of cases	168	168	168	168	168	168

5. Conclusions(1)

- To analyze the impact of the DT on new firm creation
- A sample of EU countries over a recent period (2015-2020)
- A quantile regression approach
- Our results show that DT spurs new firm creation and
- These findings are robust for different areas of digitalization.
- However the impact is heterogenous across various quantile levels.
- These findings are interesting for (potential) entrepreneurs, policy-makers, and academics alike.

5. Conclusions(2)

- **Contributions:**
- The first effort in examining the impact of DT on entrepreneurial activity over a longer period (2015-2020)
- The paper employs a quantile regression (QR) approach
- DESI allows us to gauge the impact of various aspects (skills, connectivity, use of the Internet, integration of digital technology, and digital public services) on EA

5. Conclusions(3)

- Limitations:
- the study covers only the period 2015-2020 for the EU countries
  - the findings limited by the data on which the results are based

- Future research:
- alternative measures for entrepreneurial activity and digital transformation
- a larger sample of countries or a larger period
- moderating factors of the relationship between DT and EA

Thank you for you attention!

Q & A!

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