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The impact of digital services through ICT on business creation around the world

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ABSTRACT

We explore the effect of digital services on entrepreneurial activity in 153 countries during 2006–2019. Digital services are measured by the volume of the digital services that can be delivered over information and communication technologies (ICT) networks, including among others, sales and digital marketing. Entrepreneurship is measured by the number and density of new business registrations. Controlling for other economic, institutional, and technological factors, fixed effects regression was used to capture country heterogeneity. Our results show a significant positive association between the level of digital services and entrepreneurial activity across countries through ICT networks represented mainly by digital marketing, which is found to have a direct effect on new business opportunities. Our results remain robust after applying sensitivity tests and endogeneity analysis as well as using alternative control variables. These results have important implications for entrepreneurs and policymakers. Entrepreneurs are provided with insights about the importance of encouraging digital entrepreneurship by focusing on ICT infrastructure, mainly digital marketing. Second, governments need to pay more attention to promoting digitization policies to encourage entrepreneurship.

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Digital services; digital marketing; entrepreneurship; new business registration; worldwide

1. Introduction

Entrepreneurs are creative and innovative individuals who sense business opportunities, take risks, and create new ventures. Entrepreneurship contributes to the countries' structural change (Tiberius et al., 2020), standards of living (Khan et al., 2022), economic development and growth (Lafuente et al., 2021; Stam et al., 2009) through improving the innovative capacity small enterprises (Cubico et al., 2018). Entrepreneurial activity is determined by individual-level factors, such as psychological, behavioral, and demographic characteristics, firm-level factors, such as firm size, market size, competition; and institutional environment (Balawi & Ayoub, 2022; Smallbone & Welter, 2020). Its level varies from one country to another

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and from time to time within the same country, concluding that it is the result of multiple interactions. It could also suggest that factors other than those previously investigated are at play. The digital economy could stimulate entrepreneurship by improving efficiency and increasing productivity. This raises questions about the extent to which digitization has yet to, or will be able to, increase entrepreneurship.

The rapid development of information and communication technologies (ICT) has deeply changed the competitive environment, reshaped traditional business strategies (Bharadwaj et al., 2013), and fostered innovations (Elia et al., 2020). The use of ICT networks represented mainly by digital marketing plays a crucial role in business creation, efficiency enhancement, and business expansion. Digital technologies assume several forms, such as digital artifacts (Ekbia, 2009), digital platforms and digital services (Lyytinen et al., 2016), or Internet-enabled service innovations (Kuester et al., 2018), and can be seen as enablers of entrepreneurship activity by creating new ways of promoting interaction and leveraging on collaboration and collective intelligence (von Briel et al., 2018). More specifically, digital marketing deals with the new technology challenges of data explosion and social media on corporate strategy. It helps businesses to personalize communications and refine targeting to reach their targeted audience or clients, enabling them to build their community. It also facilitated product promotion in the primary sector of less developed countries, opening up new business opportunities (Tadesse and Bahiigwa, 2015). However, there is still limited evidence on how digital technologies affect the entrepreneurial process through ICT (Del Giudice & Straub, 2011). Our paper contributes to this line of research by examining the extent to which digital services affect entrepreneurial activity in 153 countries during 2006–2019. Our results show a significant positive association between the levels of digital services and entrepreneurial activity across countries, thereby confirming their coevolution. Our results remain robust after applying sensitivity tests and endogeneity analysis as well as using alternative control variables.

Our paper contributes to the literature in several ways. First, we stress the important role of ICT and digitization conditions in entrepreneurship research, thereby highlighting the role of an important global megatrend (von Briel et al., 2018). Digitization policies appear to exert a significant effect on digital operations and marketing thereby encouraging new entrepreneurial ventures. Second, we provide, to our knowledge, the first evidence on the digital economy's effect on entrepreneurial activity for a large number of countries and years, using credible and objective measures of the digital economy and entrepreneurial activity. It appears that the digitization effect is globally robust and reflects its manifestation across different national settings. Third, we emphasize the importance of large technological shocks for marketing activities and their implications for new business opportunities (Tadesse and Bahiigwa, 2015). Technological progress appears to be strongly associated with entrepreneurial dynamism through marketing and other operational effects. This paper is structured as follows. Section 2 presents a review of the existing literature. Section 3 discusses the data and methodology employed. Sections 4 and 5 presents the results of the analysis and robustness tests, while Section 6 concludes the study.

2. Related literature

Given the crucial role of entrepreneurship in inducing innovation, stimulating competition, improving efficiency, and driving economic growth (Pradhan et al., 2020; Rusu & Dornean, 2019) it is important to unveil the factors that stimulate or hamper entrepreneurial activity. Recent studies stress the role of economic and social freedom and the control of corruption in promoting innovativeness and thereby entrepreneurial activity (Leitão & Capucho, 2021). Moreover, entrepreneurship is intertwined with economic and technological transformation. More specifically, digital services are key drivers of such transformation that is currently sweeping the world. As soon as they set up a website, new businesses become global. The resulting digital network has redefined the global map of new business by facilitating the spread of both capital and information from high-cost to low-cost locations across the globe (Wennekers et al., 2005). The combination of digital resources and existing knowledge induces people and businesses to create ever more entrepreneurial endeavors because it provides new virtual tools for business formation and opportunity exploitation.

A persuasive definition of digital services views it as a sociotechnical process of applying digitizing techniques to broader social and institutional contexts that render digital technologies infrastructural (Tilson et al., 2010) and therefore intertwined with the economy and society. The impact of digitization is not only limited to specific segments within the business sector but influences social activity, including entrepreneurial activity. Theoretically, the resource-based view of structural transformation argues that digital activities are valuable resources, which help the firm gain a competitive advantage by capitalizing on information (Rivard et al., 2006). Digital information is the magic ingredient that inspires and often enables contemporary entrepreneurial endeavors (Del Giudice & Straub, 2011).

The influence of digitization on entrepreneurship is multifaceted and occurs through several channels. First, digital technologies are effective tools for stimulating innovation. By allowing new ways of collaborating, collecting, sharing, and organizing resources, they provide end-to-end support to innovation and consequently the entrepreneurial process (Nambisan et al., 2017). Second, digitization provides a universal platform for communication thereby improving the efficiency and effectiveness of information exchange, communication, and collaboration among entrepreneurial minds (Agarwal et al., 2009). Third, digitization reduces business transaction costs, thereby facilitating market entry, which is a crucial factor for encouraging new business registration, especially for small size establishments. Digitization also simplifies business registration and licensing procedures by facilitating access to training or professional services in financing and marketing or through intellectual property rights support (UNCTAD, 2011). Fourth, digitization shapes interactions among people and economic agents by expanding the relevant opportunities (Autio et al., 2018).

Digitization, through digital marketing, also affects entrepreneurial activity by facilitating the digital promotion of goods and services thereby opening new opportunities for business expansion. Digital marketing allows an integration between different ICT media, which facilitates the exploitation of the possibilities offered by digital technologies, thereby generating greater interaction and user participation that creates opportunities for new business ventures (Taiminen and Karjaluoto, 2015). Economies with higher levels

of digital services enable organizations to develop digital marketing plans with virtual tools that are better integrated with different media that enhance their strategic effectiveness (Estevez et al., 2017). To sum up, digitization reduces transactions costs and fosters the creation of new opportunities, which has a significant impact on the business environment in the future, opening up entrepreneurial opportunities.

Hypothesis 1: Digitization positively affects entrepreneurial activity.

3. Methodology

3.1 Data and variables

We use the World Bank's Doing Business report to collect annual data on entrepreneurship, which includes 153 countries¹ during the 2006–2019 period². We measure entrepreneurship by two variables: the number of new business registration (NEWBREG) and the new business entry density (NEWBDEN), calculated as the ratio of newly registered limited liability firms per 1000 people of working age. The first variable captures the breadth of entrepreneurial activity, whilst the second variable captures its intensity relative to the population. Our main independent variable is the log value of digital services delivered in a country (USD million, current prices) (DIGTL). These digital services include various business and knowledge processes, computer services, system design, and other services delivered over all ICT networks, mainly digital marketing (UNCTAD, 2015). A key advantage of this variable is that it covers both developing and developed countries and it measures services not well captured by other statistics, therefore representing a strategic component of digital services. To capture the role of the ecosystem's complexity in fostering entrepreneurial activity, we control for economic, institutional, and technological factors that mitigate the effect of digital services on new business formation.

Table 1 presents the average country distribution of entrepreneurial activity and the value of digital services. The table shows that Hong Kong, Cyprus, and New Zealand experience the highest number of NEWBDEN per year with 25.63, 21.79, and 18.10 respectively. Other countries like Liberia, Laos, and Congo have the lowest number of businesses registered per 1000 people per year with 0.01, 0.02, and 0.04, respectively. Regarding NEWBREG, the results show that Great Britain has the highest number (13.12), followed by Russia (12.77). However, the lowest number of new businesses registered per country is found in Kiribati (1.1), Micronesia (3.22), and Butan (3.31). Finally, the results show that Great Britain, Germany, and the Netherlands achieve the highest values of trade of digital services with 12.45, 11.93, and 11.78 respectively. The lowest values are found in Kiribati (0.82), Sap Tome and Principe (1.04), and Micronesia (1.39).

Based on prior literature, we use the following control variables. The growth rate of GDP (GDPGR) (+) creates the demand for new products and processes (Arin et al., 2015). Financial development (FINDEV) (+) widens the financing opportunities for new ventures (Hameli et al., 2021). The inflation rate (INFL) induces adjustments in the labor market with ambiguous relationships. An increase in inflation implies higher price levels of goods and

Table 1. Country trends in new business registrations and digital services.

ISO3	NEWBDEN	NEWBREG	DIGTL	ISO3	NEWBDEN	NEWBREG	DIGTL	ISO3	NEWBDEN	NEWBREG	DIGTL	ISO3	NEWBDEN	NEWBREG	DIGTL
AFG	0.19	7.94	6.03	DOM	1.21	8.94	6.18	LAO	0.02	4.42	3.64	QAT	3.93	8.76	6.55
ALB	1.18	7.72	5.90	DZA	0.26	8.74	7.59	LBR	0.01	3.41	2.20	ROU	5.50	11.20	8.85
ARE	2.23	9.63	9.20	ESP	3.18	11.48	10.62	LCA	3.30	5.95	3.59	RUS	3.61	12.77	9.84
ARG	0.21	8.61	8.63	EST	15.45	9.48	7.49	LKA	0.48	8.75	8.75	RWA	0.98	8.13	3.52
ARM	1.68	8.09	5.28	ETH	0.43	10.03	5.22	LSO	1.54	7.49	2.05	SAU	0.38	8.88	7.31
ATG	3.20	5.26	4.26	FIN	3.68	9.46	9.60	LTU	3.42	8.82	6.79	SEN	0.34	7.76	6.04
AUS	12.72	12.15	9.52	FRA	4.02	12.03	11.75	LUX	14.11	8.54	11.14	SGP	7.59	10.32	11.01
AUT	0.62	8.18	10.04	FSM	0.35	3.22	1.39	LVA	8.75	9.36	7.41	SLE	0.24	6.70	3.24
AZE	0.98	8.72	6.20	GAB	1.16	7.07	4.89	MAR	1.45	10.34	8.10	SLV	0.51	7.62	5.70
BEL	3.11	10.01	10.92	GBR	12.22	13.12	12.45	MDA	1.79	8.45	5.56	SRB	1.89	9.12	7.64
BEN	0.47	7.81	4.30	GEO	6.04	9.52	4.93	MDG	0.12	7.43	5.39	SSD	0.44	7.48	4.31
BFA	0.31	8.06	4.40	GHA	0.91	9.43	7.01	MDV	4.33	6.90	3.85	STP	2.58	5.51	1.04
BGD	0.07	8.82	6.82	GIN	0.29	7.42	3.70	MEX	0.58	10.63	8.00	SUR	1.08	5.74	4.38
BGR	8.93	10.66	7.61	GRC	0.85	8.63	8.23	MKD	4.57	8.78	5.93	SVK	4.42	9.72	7.94
BHR	1.95	7.46	8.15	GRD	2.06	4.95	3.37	MLI	0.25	7.57	5.08	SVN	3.80	8.57	7.59
BIH	1.11	7.85	5.20	GTM	0.57	8.51	6.66	MLT	9.81	7.81	8.81	SWE	6.15	10.51	10.61
BLR	0.95	8.68	7.17	HKG	25.63	11.80	10.37	MMR	0.11	7.76	6.66	SYC	5.12	5.76	4.61
BLZ	3.87	6.69	4.09	HRV	3.96	9.28	7.58	MNE	7.35	8.01	4.88	TCD	0.12	6.71	4.67
BOL	0.51	8.19	4.94	HTI	0.04	5.50	3.41	MNG	5.78	9.31	4.86	TGO	0.23	6.21	4.68
BRA	1.82	12.40	9.82	HUN	4.60	10.30	9.09	MRT	0.34	6.54	4.47	THA	0.81	10.54	9.12
BRN	1.95	6.33	3.56	IDN	0.26	10.62	8.76	MUS	8.78	8.95	6.66	TJK	0.33	7.18	2.97
BTN	0.07	3.31	1.54	IND	0.10	11.31	11.50	MWI	0.09	6.40	3.42	TLS	3.84	7.54	1.50
BWA	11.34	9.46	5.22	IRL	5.61	9.74	11.71	MYS	2.33	10.73	9.06	TON	1.76	4.58	1.98
CAF	0.05	4.55	2.65	IRN	0.42	10.07	6.55	NAM	0.81	6.91	3.87	TUN	1.46	9.28	6.29
CAN	0.16	8.29	10.81	IRQ	0.18	7.94	5.73	NER	0.08	6.70	3.83	TUR	1.23	11.07	8.21
CHE	4.30	10.05	11.23	ISL	11.17	7.76	6.86	NGA	0.76	11.10	5.37	TZA	0.27	8.77	5.83
CHL	6.07	11.09	7.97	ISR	3.21	9.66	9.97	NLD	4.63	10.80	11.78	UGA	0.78	9.47	5.52
CIV	0.47	8.54	5.71	ITA	2.37	11.42	10.72	NOR	7.16	10.03	9.70	UKR	1.11	10.45	8.32
COD	0.04	7.43	4.11	JAM	1.17	7.68	5.77	NPL	0.73	9.31	5.82	URY	1.44	8.06	7.06
COL	1.94	11.03	7.16	JOR	0.66	8.04	6.02	NZL	18.10	10.87	7.96	UZB	0.69	9.35	5.59
COM	0.16	4.36	2.84	JPN	0.18	9.35	11.27	OMN	1.79	8.41	6.30	VCT	1.99	4.94	3.46
CPV	3.42	7.01	3.83	KAZ	1.34	9.37	6.45	PAK	0.05	8.44	7.39	VNM	1.12	11.20	6.75
CRI	1.68	8.54	7.82	KEN	1.39	10.61	6.63	PAN	8.72	9.96	7.35	VUT	0.63	4.39	2.96
CYP	21.79	9.70	8.45	KGZ	1.01	8.19	4.77	PER	3.46	11.08	6.96	WSM	0.87	4.47	3.16
CZE	3.32	10.06	9.05	KHM	0.37	8.10	5.29	PHL	0.29	9.74	9.62	ZAF	7.94	12.49	8.17
DEU	1.30	11.15	11.93	KIR	0.05	1.10	0.82	POL	0.98	10.06	9.59	ZMB	1.01	8.90	4.36
DMA	5.03	5.39	3.28	KOR	1.89	11.12	10.18	PRT	4.78	10.39	8.78	ZWE	2.00	9.33	3.98
DNK	7.06	10.12	9.68	KWT	4.56	9.51	8.40	PRY	0.23	6.93	3.83	Total	3.31	8.65	6.67

Source: Country names are represented by their 3-digit ISO codes.

services (Sayed & Slimane, 2014) but at the same time increases the costs needed for starting a business (Rusu & Roman, 2017). Women's political empowerment (GENDPOL) (+) expands the range of potential people capable of undertaking entrepreneurial activities (Huis et al., 2019). The E-Government Development Index (EGOV) (+) captures the website development patterns in a country and reflects how a country is using IT to promote access and inclusion of its people. It creates a conducive business environment for entrepreneurs (Abu-Shanab & Osmani, 2019). By enhancing economic growth and technology transfer, Foreign direct investment (FDI) (+) influences opportunity-driven entrepreneurs (Nxazonke & van Wyk, 2020). Institutional factors are important too. The extent to which starting a business in a country (STARTBUS) (+) is an institutionally easy process that directly affects entrepreneurial activity (Bjørnskov & Foss, 2008). The overall level of human development (HUMDEP) (+) in a country contributes to entrepreneurial dynamism, by being both a resource and a process (Gries & Naudé, 2011). The final sample includes 1630 country-year observations. Table 2 displays the definition of the variables and the summary statistics and shows a considerable cross-country variation based on the mean values relative to their standard errors.

3.2 Model

We use a pooled OLS model with fixed effects to estimate the impact of digital services on entrepreneurial activity. The OLS method has the disadvantage that its linear estimation may result in predicted values for the outcome variable that are biased upwards. However, it has the advantage of maintaining simplicity and comparability (Agarwal et al., 2009). We measure the key outcome and independent variables in logarithms to capture non-linearities and contain outliers. We include country-fixed effects to capture the influence of external time-invariant factors. In general, our baseline estimation model is described by the following equation:

$$NEWBUS_{it} = \alpha + DIGTL_{it}\beta_1 + X_{it}\beta_2 + \varepsilon_{it} + u_{it}$$

where $NEWBUS_{it}$ is, alternatively, the new business registrations (NEWBREG) or the new business density (NEWBDEN) of country i in year t . The key independent variable $DIGTL_i$ is the log value of digital delivered services in a country. X_i is the vector of country-level control variables of country i in year i ; the term ε_{it} reflects the fixed effects and the term u_{it} is a disturbance parameter assumed to follow the normal distribution. To keep the analysis simple, we do not consider interaction effects. We calculate the F statistic to measure the overall fit of the model and the significance of the year effects. Table 3 presents the pairwise correlations between the basic control in the regression. The correlations do not show severe collinearity among them and therefore, they can all be included in the regression analysis.

4 Results

Table 4 reporting the baseline regression estimates shows that DIGTL is a significant and positive predictor of both NEWBREG and NEWBDEN in all models. Thus, countries with higher levels of digital services are associated with a higher volume and density (concentration) of new business registration. Our results

Table 2. Definition of variables and summary statistics.

Variable	Source	Mean	SD	Min	Max
Number of new businesses registered per country/year (log) (NEWBREG)	WDI	3.31	4.56	0.01	39.04
Number of new businesses registered per 1000 people, country/year (log) (NEWBDEN)	World Development Indicators (WDI)	8.65	2.18	0.69	13.41
Trade of digital services (USD million, current price) (log) (DIGTL)*	UNCTAD	6.67	2.71	4.68	6.55
Gross domestic product annual growth rate (%) (GDPGR)	WDI	3.07	4.76	-16.08	34.47
Financial development index (FINDEV)	International Monetary Fund	0.35	0.23	0.00	1.00
Inflation rate (%) (INFL)	WDI	4.73	0.33	3.88	9.92
Women's political empowerment index (GENDPOL)	Quality of Government Database	0.78	0.16	0.13	0.97
E-government index (EGOV)	United Nations statistical database	0.50	0.21	0.00	0.95
Foreign direct investment (net inflows, % GDP) (FDI)	WDI	9.31	56.74	-58.32	182.63
Starting a business index (STARTBUS)	Doing Business Report database	76.67	16.63	15.48	99.98
Human capital index (HUMCAP)	Quality of Government Database	0.73	0.21	0.00	1.00
State fragility index (GOVFRAG)	Database	7.65	6.27	0.00	24.00
Property rights index (1–7 best) (PROPRIGHT)	World Economic Forum	4.43	1.02	2.02	6.67
Prevalence of trade barriers index (1–7 best) (TRADBRR)		4.45	0.67	2.17	6.66
Patent applications (millions of pop) (PATNTAP)		30.93	68.78	0.00	135.38
Venture capital availability index (1–7 best) (VENTCAP)		2.89	0.79	1.44	5.39
Total tax rates (% of total profits) (TAX)		40.57	17.01	0.20	137.4
Quality of overall infrastructure index (1–7 best) (QUALINFR)		4.11	1.20	1.52	6.77

Note: * Digital services are the services that can be delivered over information and communication technologies (ICT) networks, and this includes, among others, sales and digital marketing.

Table 3. Correlation matrix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
NEWBDEN (1)	1.00										
NEWBREG (2)	0.35***	1.00									
DIGTL (3)	0.20***	0.40***	1.00								
GDPGR (4)	-0.07***	-0.02	-0.11***	1.00							
FINDEV (5)	0.44***	0.38***	0.28***	-0.19***	1.00						
INFL (6)	-0.07***	0.05**	-0.04**	-0.23***	-0.13***	1.00					
GENDPOL (7)	0.38***	0.31***	0.26***	-0.20***	0.39***	-0.07***	1.00				
EGOV (8)	0.36***	0.44***	0.35***	-0.20***	0.43***	-0.02	0.28***	1.00			
FDI (9)	0.01	-0.17***	0.02	-0.02	0.06***	-0.07***	0.08***	0.05**	1.00		
STARTBUS (10)	0.39***	0.28***	0.21***	-0.15***	0.36***	0.12***	0.40***	0.41***	0.07***	1.00	
HUMCAP (11)	0.38***	0.35***	0.26***	-0.14***	0.62***	-0.26***	0.43***	0.39***	0.04*	0.44***	1.00
VIF	2.14										

Note: The table reports the pairwise correlations between the independent variables in the baseline model. It also provides the VIF mean value. VIF values above 4 indicate collinearity. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

provide new global evidence in support of the early view of Wennekens et al. (2005) that business startup depends on transforming technological paradigms, as well as the view of Del Giudice and Straub (2011) regarding the coevolution of ICT networks represented mainly by digital marketing and entrepreneurship, consistent with Zhang and Li (2018). Moreover, this result supports Alderete's (2017) findings

Table 4. Baseline results.

	NEWBREG (1)	NEWBDEN (2)	NEWBREG (3)	NEWBDEN (4)
DIGTL	0.004*** (0.001)	0.018* (0.009)	0.006** (0.002)	0.023** (0.010)
GDPGR	0.012*** (0.004)	0.038** (0.015)	0.011*** (0.004)	0.038** (0.015)
FINDEV	2.094*** (0.386)	1.986 (1.908)	1.642*** (0.468)	1.762 (3.299)
INFL	0.265** (0.120)	0.115 (0.292)	0.258** (0.120)	0.228 (0.292)
GENDPOL	1.039** (0.430)	1.613* (0.874)	0.986** (0.468)	0.305 (1.190)
EGOV	0.893*** (0.263)	4.570*** (1.413)	0.746*** (0.267)	3.663*** (1.298)
FDI	0.001** (0.001)	0.007 (0.006)	0.002** (0.001)	0.006 (0.006)
STARTBUS	0.014*** (0.004)	0.004 (0.005)	0.014*** (0.004)	−0.000 (0.004)
HUMCAP	0.525** (0.261)	0.580 (0.845)	0.737*** (0.273)	1.397 (1.161)
Fixed effects	No	No	Yes	Yes
F stat			16.625	3.800
Wald Chi ²	174.268	47.280	.	.
Sigma	1.462	3.120	1.605	3.677
Rho	0.959	0.854	0.966	0.895
R ² _{all}	0.390	0.230	0.373	0.163

The table reports the baseline results for new business registration (NEWBREG) and new business density (NEWBDEN) from 2006–2019. The key independent variable is the log value of the trade in digital services (DIGTL). We use a pooled OLS estimation model with random effects (models (1) and (2)) and fixed effects (models (3) and (4)). Heteroscedasticity-robust standard errors are in parentheses. N=1297. * p<0.1, ** p<0.05, *** p<0.01.

that mobile broadband is important in the creation and development of new businesses. The digital services effect is stronger when we include fixed effects. Moreover, higher economic activity, more sophisticated financial systems and human capital levels are associated with higher entrepreneurial activity, consistent with Dutta and Meierrieks (2021). National financial systems need to be integrated into a strong institutional framework to realize the advances of financial development. Inflationary pressures could encourage entrepreneurial initiatives because of profit inflation. Gender equality increases the range of potential opportunities for women's initiatives thereby inducing more business registrations. Countries with higher levels of e-government infrastructure are also associated with higher entrepreneurial activity. Foreign direct investment exerts a small but significant effect on new business formation, consistent with Leitão and Capucho (2021). The higher the FDI, the greater is the technology transfer and the higher is the levels of entrepreneurial activity. Finally, the institutional structure underlying the conditions for new startup formation is also a significant factor for new business registration. The large Wald Chi² values show that the fixed effects are significant. The robustness of our results depends on resolving several potential econometric problems related to reverse causality, measurement error and omitted variable bias. We check for these potential problems by carrying out sensitivity testing and endogeneity analysis, which for space reasons are presented in the Online Appendix. The tests show that our results remain broadly robust and stable.

5 Further robustness checks

Other omitted economic and non-economic factors might likely affect the impact of digital services on entrepreneurial activity. Thus, we expand our analysis to consider the impact of additional economic, financial, and infrastructural conditions as well as institutional conditions. Table 5 presents the results after adding control variables representing economic conditions (models (1) and (2)) and institutional conditions (models (3) and (4)). The results show that in all control groups the level of digital services remains a robust predictor of new business registration. Moreover, venture capital availability and the quality of overall infrastructure play a significant positive impact on new business registration. The total tax rate has a positive impact on new business registration, but with a small magnitude. Remarkably, property rights exert a highly significant impact on both outcome variables. Also, patent applications have a positive impact on new business registration, but with a small magnitude. Finally, the prevalence of trade barriers has negative effects on entrepreneurial activities. Overall, our baseline results remain stable.

Table 5. Additional robustness checks.

	NEWBREG (1)	NEWBDEN (2)	NEWBREG (3)	NEWBDEN (4)
DIGTL	0.004** (0.002)	0.022** (0.010)	0.002** (0.001)	0.024*** (0.009)
GDPGR	0.007** (0.003)	0.038** (0.016)	0.009*** (0.003)	0.039** (0.016)
FINDEV	1.199*** (0.450)	1.477 (3.329)	1.006** (0.444)	1.184 (2.840)
INFL	0.479*** (0.145)	0.452 (0.440)	0.488*** (0.142)	0.532 (0.449)
GENDPOL	0.938** (0.459)	0.174 (1.188)	0.916* (0.475)	−0.129 (1.184)
EGOV	0.802*** (0.282)	3.793*** (1.343)	0.620** (0.258)	3.275*** (1.234)
FDI	0.002** (0.001)	0.006 (0.006)	0.001** (0.001)	0.005 (0.005)
STARTBUS	0.011*** (0.003)	0.002 (0.006)	0.009*** (0.003)	−0.002 (0.005)
HUMCAP	0.547** (0.269)	1.089 (1.357)	−0.443 (0.294)	−1.077 (1.323)
VENTCAP	0.075** (0.037)	0.097 (0.199)		
TAX	0.005* (0.003)	0.002 (0.016)		
QUALINFR	0.080** (0.039)	−0.208 (0.225)		
PROPRIGHT			0.160*** (0.045)	0.695*** (0.237)
TRADBRR			−0.070* (0.040)	−0.528** (0.229)
PATNTAP			0.006*** (0.002)	−0.010 (0.006)
Fixed effects	Yes	Yes	Yes	Yes
F stat	20.208	3.312	24.607	3.818
Sigma	1.529	3.815	1.594	3.825
Rho	0.970	0.899	0.973	0.902
R ² _{all}	0.386	0.148	0.211	0.139
N			1235	

Notes: The table reports the baseline results for new business registration (NEWBREG) and new business density (NEWBDEN) from 2006–2019, for different institutions and cultures. The key independent variable is the log value of the trade in digital services (DIGTL). Models (1) and (2) capture the effects of additional economic, financial and infrastructural conditions. Models (3) and (4) capture the effects of institutional conditions. We use a pooled OLS estimation model with fixed effects. Heteroscedasticity-robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

6 Conclusion

The emergence and growth of digital services is an important technological development that affects entrepreneurial activity. Digital technologies enable entrepreneurship by creating new ways of promoting interaction and leveraging collaboration and collective intelligence. However, there is little evidence on their association. Motivated to explore the entrepreneurial activities in the advent of the fourth industrial revolution, which deeply changed the competitive environment, reshaped traditional business strategies, and fostered innovations, the present study aims to measure the relationship between digital services and entrepreneurship activities using 1630 yearly observations from 153 different countries during 2006–2019. Our empirical findings based on two measures of entrepreneurship are broadly consistent with our hypothesis, supporting the positive impact of the digital services on entrepreneurial activities. Our results remain robust after applying sensitivity tests and endogeneity analysis as well as using alternative control variables. They affirm the important role of the ICT and digitization conditions in entrepreneurship research and provide the first evidence of their interaction on a global scale.

Our results encourage policymakers to pay attention to technological advances and infrastructure to leverage and enhance entrepreneurial activities, aiming to stabilize the country's economy and growth. Our study has different important implications. First, the results can be used to assess the impact of large technological shocks on marketing activities and their implications for new business opportunities. Second, it provides insights for entrepreneurs about the important implication of encouraging digital entrepreneurship by focusing on information and communication technology (ICT) infrastructure, mainly digital marketing. Third, the study highlights the need for governments to pay more attention to promoting digitization policies to encourage entrepreneurship through digital marketing and operation channels. Future research should explore alternative measures of digital services and entrepreneurship and consider more explicitly the role of institutions and policy in mitigating the effect.

Notes

1. The study includes all countries in the world with non-missing data.
2. The period was selected based on the publicly available data during the initiation of the project, while maintaining a balanced panel data.

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Disclosure statement

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