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The effects of innovation and digitalisation on business dynamism: an empirical study from Italian regions

Alessandra, Patti[1*]; Valeria, Schifilliti[2]

[1]Department of Economics and Business, University of Catania, Corso Italia 52, Catania, Italy
[2]Department of Economics, University of Messina, Via dei Verdi 7, Messina, Italy
*Corresponding author: alessandra.patti@unict.it

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ABSTRACT

The fast pace of innovation and digitalisation has recently changed economic equilibria that need attention from scholars and policymakers. To this end, this paper empirically investigates the relationship between innovation and digitalisation on the churn rate of Italian businesses in industries, constructions, and services from 2010 to 2019. The main findings suggest that, on average, innovation and current and past territorial development of Information and Communication Technologies (ICTs) positively influence the churn rate of businesses in all Italian regions. However, the effects of innovation are remarkable on the business churn rate of northern regions only, evidencing the existence of a "business dynamism divide" between the North and South of Italy.

Keywords: business value, digitalisation, innovation, panel model, Italy

1. INTRODUCTION

Digitalisation and innovation have gained enormous momentum because they have recently transformed businesses' operations. The rapid expansion of new Information and Communication Technology (ICT) and its creation have appreciable effects on the economy and society globally (De Wilton, 2011; Habibi and Zabardast, 2020; Lin et al., 2020 Myovella et al., 2020). Both phenomena promote the development of a dynamic set-up where growth is encouraged continuously (Bresciani et al., 2018; Truant et al., 2018). Several researchers have conducted cross-national studies to analyse digitalisation's effects on the economic growth of developed and developing countries (Molinari and Torres, 2018; Habibi and Zabardast, 2020; Myovella et al., 2020). Different studies examined the effects of digitalisation and entrepreneurship on firms' performances with firm-level analysis (Moshiri and Simpson, 2011; Stephens et al., 2013), while scanty literature has investigated the effects of digitalisation and innovation on the business dynamism at disaggregated territorial units (i.e., regions). Even fewer studies do not offer clear evidence about the benefits of digitalisation and innovation on the business dynamism of a country: some studies report a weak role (Lee et al., 2022: Liang et al., 2010), while others claim that the business dynamism is affected by digitalisation only (Eller et al., 2020; Li et al., 2020), in contrast to others' thesis that innovation plays a primary role uniquely (Gu, 2020). In this scenario, we aimed to measure, in a preliminary way, the effects of digitalisation and innovation on the Italian business churn rate of industry, construction and services sectors (excluding banking and insurance sectors) by conducting an empirical analysis with robust system-GMM. This study has never been performed with panel data on business churn rates aggregated at Italian regional levels. To this end, we contribute to filling the gap in the existing literature, which focuses on how digitalisation affects the growth of businesses at cross-country levels of analysis solely. Our hypotheses test whether the effects of digitalisation and innovation are positive and significant on the business churn rate of primary sectors in Italian regions (H1) and if both phenomena are distributed heterogeneously within regions of the North and the South of Italy (H2). The reason to focus on Italy relies on two critical aspects. First, although it is a developed country, Italy presents modest digitalisation and innovation related to EU countries. As reported by the European Commission, Italy ranks 18th out of 27 EU states in the 2022 edition of the Digital Economy and Society Index (DESI) . Even if Italy is catching up to EUs, there are still gaps in digital transformation, such as the digital culture shortage and poor connectivity in the coverage of Very High-Capacity Networks. Also, as stated by the European Innovation Scoreboard (EIS) 2022, Italy is considered a "modest

innovator" with a performance of 91.6%, almost above the average of the EU Moderate Innovators (89.7%) , but still far from catching up with the EU Innovators Leaders (134.4 %) .

Secondly, Italy's growth has stagnated since the middle of the 1990s (Calligaris et al., 2016; Bugamelli et al., 2018); although the competitive environment has changed radically, Italian businesses are still facing difficulties in adapting to the current set-up (Cirillo et al., 2021). Thus, understanding the roles played by these factors is essential to design policies that enhance investments in innovation, ICTs', and digital culture to garner talent and productivity in Italy and to reduce the likely occurrence of the North-South digital divide (see Figure 1 in the Appendix).

The paper is structured as follows: Section 2 presents the data, Section 3 describes the methods, Section 4 reports the main results, while Section 5 concludes.

2. DATA

A panel dataset of 20 Italian regions (N) (NUTS-2), where territorial churn rate is observed from 2010 to 2019 (T), was used. We obtained data on the churn rate of Italian businesses in the industry, constructions and services, the number of patents applied to EPO, and the number of those employed in the Science and Technology as a percentage of the total population from the publicly available database of the European Bureau of Statistics (EUROSTAT). The dataset for the territorial diffusion of broadband infrastructure, population, and the gross domestic product was extracted from the database of the Italian Bureau of Statistics (ISTAT). Data on corruption, regulatory quality, voice and accountability were taken from Società Italiana di Economia e Industria Politica (SIEPI) from the Institutional Quality Index (IQI) database by Nifo and Vecchione (2014) . We do not consider data before 2010 due to the incompleteness of the variables of broadband diffusion and patents.

Table 1 describes the variables utilised, Table 2 presents descriptive statistics and Table 3 reports the correlation matrix. The explanatory variables are the two-year lagged churn rate, broadband diffusion and its one-year lagged term, patents, HRST, population per 1,000 inhabitants per km2, GDP per capita in euro per inhabitant, corruption, voice accountability, and regulatory quality. The dependent variable is the regional churn rate (churn_rate) of Italian businesses in primary sectors, defined as birth plus death rates of enterprises over the total enterprises placed in each region. The churn rate reflects the capacity for creative destruction of local firms that, in turn, affects productivity and growth. The leading independent variables of our interest are territorial broadband development, its one-year lagged value, and the number of patents filed to the European Patent Office (EPO) as a proxy of digitalisation and innovation, respectively. We expect that both values have positive signs and are statistically significant over the churn rate of local businesses because i) well-developed broadband infrastructures should facilitate communications and strategic operations, and ii) patents permit to preserve value by offsetting losses derived from concurrent business breakthroughs and stimulating businesses' dynamism continuously. The mean value of patent applications (patents) is higher than that of broadband infrastructure (broadband) in Italian regions, 7.01 percent against 2.68 percent, respectively. Before ICTs progress, innovation plays a pivotal role in grounding a dynamic set-up promoting digitalisation.

Table 1. Definition of variables

Variable name	Definition	Source
churn_rate	Birth + death rate of Italian enterprises for industries, construction and services (%)	ESTAT
churn_lag (2)	2 years lagged value of churn rate	ESTAT
broadband	territorial broadband per 1,000 inhabitants	ISTAT
broad_lag (1)	1 year lagged value of broadband	ISTAT
patents	patents to EPO per 1,000 inhabitants	ESTAT
HRST	persons employed in Tech (%)	ESTAT
population	population per 1,000 inhabitant km2	ISTAT
per capita GDP	gross domestic product (euro per inhabitant)	ISTAT
corruption	crimes committed against Italian PA	SIEPI
voice account.	participation rate of citizens in public liveliness	SIEPI
regulatory q.	degree of openness of the local business	SIEPI
Dnorth	dummy for North = 1, 0 otherwise	ISTAT
Dcentre	dummy for Centre = 1, 0 otherwise	ISTAT
Dsouth	dummy for South = 1, 0 otherwise	ISTAT

Table 2. Descriptive Statistics

Variable	N	Mean	SD	Min	Max
churn rate	200	14.862	2.59	10.63	22.41
churn_lag	200	13.353	5.091	0	22.41
broadband	200	2.688	3.613	.043	16.415
broade_lag	200	2.645	3.641	0	16.415
patents	200	7.011	8.013	0	51.695
HRST	200	34.622	8.639	25.7	71.6
population	200	12.907	.825	10.95	15.287
gdppc	200	28899	13512	1610	86700
corruption	200	.777	.196	.214	.99
voice acc	200	.595	.207	.118	.979
regq	200	.531	.191	.087	.916
Dnorth	200	.4	.491	0	1
Dcentre	200	.2	.401	0	1
Dsouth	200	.4	.491	0	1

Table 3 Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) churn_rate	1.000										
(2) churn_lag	0.525	1.000									
(3) broadband	0.039	0.546	1.000								
(4) broad_lag	0.070	0.059	0.471	1.000							
(5) patents	0.232	0.141	0.005	0.018	1.000						
(6) HRST	0.372	0.218	0.186	0.195	0.228	1.000					
(7) population	0.199	0.106	-0.042	0.042	-0.121	0.032	1.000				
(8) gdppc	0.231	0.124	0.203	0.207	0.396	0.949	-0.019	1.000			
(9) corruption	-0.449	-0.301	0.037	0.088	0.418	0.385	-0.063	0.492	1.000		
(10) voice_acc	-0.474	-0.201	0.174	0.132	0.423	0.454	-0.133	0.531	0.730	1.000	
(11) regq	-0.441	-0.170	0.167	0.157	0.520	0.412	-0.084	0.523	0.716	0.814	1.000

3. MODEL

The econometric model used is the linear methods of moment estimator (GMM) of Arellano and Bover (1995) and Blundell and Bond (1997), which is suitable for panel data with few periods but a large number of observations (Roodman, 2006). The adoption of the one-step system GMM aims to respond to endogeneity concerns, namely that business dynamism and technological progress are endogenous. This paper addresses this reverse causality problem by using advanced GMM techniques. Also, traditional Pooled OLS, random effect (RE), and fixed effect (FE) are used to compare results (Table 2 in the Appendix). To justify the choice of the dynamic GMM, we perform the Breusch-Pagan test, the Hausman test, and the Wooldridge test. Results are reported by the following Table 1:

Table 1. Models' choice test

	Statistics	p-value	H_0
Breusch-Pagan Test *H0: σδ=0*	104.74	0.000	Rejected
Hausman Test *H0: Cov(δ,X)=0*	43.47	0.000	Rejected
Wooldridge Test	11.904	0.002	Rejected

***, ** and * denote coefficients are significant at 1%, 5% and 10% respectively

The Breusch-Pagan test investigates the null hypothesis that the cross-sectional variance is zero. Since the null hypothesis is rejected, Pooled OLS is not a consistent estimator, turning to RE.

RE requires that time-invariant effects are uncorrelated with the regressors, or FE is preferred. That is what the Hausman test indicates, as the null hypothesis of no difference between FE and RE is rejected, FE is adopted. However, the Wooldridge test rejects the null of the absence of serial correlation in the error term and suggests that the dynamic model is preferred.

The dynamic framework, which was built upon Barro et al. (1991) and Levine and Renelt (1992), is estimated using the econometric specification as follows:

$$Churn\ rate_{i,t} = \alpha Churn\ rate_{i,t-1} + \beta (X_{i,t}) + \delta_i + \eta_t + \varepsilon_{i,t} \quad (1)$$

Where i =1…20, t = 2010…2019, and Xi,t includes *(broadbandit, broadbandi,t-1, patentsit, HRSTit, corruptionit, regulatory_qualityit, voice_accountabilityit)*. Fixed effects for regions and years are included. We assume that the error term is independently and identically distributed (i.i.d)

Broadband and its lagged one-year term (broadbandi,t-1) measure connectivity per 1,000 inhabitants, while patents denote the number of patent applications to the EPO. Both values are expected to have positive signs and to be statistically significant on the dependent variable.

HRST is inserted as a proxy of the territorial endowment of digital culture that may positively influence the effectiveness of ICTs and patents on the (local) businesses' churn rate.

Corruption indicates the number of criminal cases against the Italian Public Administration (PA) (misuse of public funds, embezzlements, bribery). It is inserted as a control value denoting the quality of institutions and is expected to negatively affect the business' churn rate because of poor quality of institution incentive stagnation. Voice and accountability indicate the percentage of participants in public and cultural liveliness. It is used as a proxy of transparency and is expected to negatively influence the businesses' churn rate because a rise in transparency makes the necessary enlargement of bureaucratic burdens that, in turn, may limit businesses' dynamism. Regulatory quality indicates the degree of openness of the local market. This value harms businesses' churn rate because the open market creates competition that may determine more deaths than births, limiting businesses' creation or renewal phases.

4. RESULT

Preliminary results with a one-step system GMM are reported in Table 2 from column 1, the baseline regression, to column 4, specifications enriched by additional explanatory variables.

Table 3 reports the results with the robust GMM and uses the territorial constraint to denote the regions that belong to the

Centre-North and the South of Italy, columns 1 and 2, respectively.

The bottom of Tables 2 and 3 present the diagnostic statistics to assess the appropriateness of the GMM model. The Arellano-Bond test for no serial correlation under the null hypothesis is rejected (AR 1 test). However, there is no evidence for serial correlation of order 2 in the residuals (AR 2 test). Also, all estimates satisfy the requirement that the number of instruments (#instruments) does not exceed the number of regions (#groups), and the Hansen test suggests that the instruments are valid because they are uncorrelated with the error term.

The two-year lagged value of the Italian business churn rate (lagged churn rate) of industry construction and services has the expected positive sign and is statistically significant at 1 percent (Table 2, 1-4, Table 3, 1-2). Hence, the current business dynamism of the Italian region is positively affected by its past as business breakthroughs leave space for new by renewing traditions to survive to challenges posed by the modern market. The effect seems homogenous along the northern and southern regions of Italy.

The regional development of the broadband infrastructure and its one-year lagged value (lagged broadband) exhibit the expected positive signs and are statistically significant at 5 percent and 10 percent, respectively (Table 2, 1-4). The broadband variables maintain positive signs and statistical significance at 10 and 5 percent for the center-northern and southern Italian regions (Table 3, 1-2). This result denotes that ICTs infrastructures are equally developed in Italy's northern and southern regions. Efficient connectivity incentive productivity because of the ability to pivot rapidly and keep up with the changing habits (H1 satisfied).

Patents show the expected positive sign and are statistically significant at 5 and 1 percent (Table 2, 1-4). Patents play a crucial role in the birth-death cycle of businesses because they create and preserve value, maintaining businesses alive and still productive (H1 satisfied). However, the effectiveness of patents changes when looking at businesses' churn rates in the northern and southern regions. Patents have positive signs but are statistically significant at 1 and 5 percent (Table 3, 1-2) on the business' churn rate of the northern Italian regions while are not statistically meaningful on the business' churn rate of southern Italian regions.

Innovation, differently from digitalisation, appears to be not evenly distributed across the Italian regions, with patents mainly exploited in the North rather than in the southern areas (H2 satisfied). Population is inserted as a control variable for scale effect, and it shows the expected positive sign but is not statistically significant (Table 2, 1-4, Table 3, 1-2). Also, GDP per capita is used as a control variable for the wealth effects. It has the expected positive sign and is statistically significant from 1 to 10 percent (Table 2, 1-4) and 5 percent in the centre-northern Italian regions only (Table 3, 1). Wealthier Italian regions experience higher business dynamism than poorer ones, and the former are mainly located in the Centre-North macro area of the country.

Corruption, voice and accountability, and regulatory quality are added as control values (Table 2, 3-4 and Table 3, 1-2).

Corruption has the expected negative sign but is not statistically significant for all specifications. High corruption tends to elicit monitoring activities, favouring a steady state. Voice and accountability present negative signs and is statistically significant at 5 percent (Table 2, 3-4) and 1 percent in the southern regions only (Table 3, 2). This value reveals that an increase in transparency leads to the rise of administrative burdens, which, in turn, diminishes the capacity to change in the market environment quickly. Southern regions suffer from a business dynamism gap with respect to the northern areas.

Regulatory quality has the expected negative signs for all specifications but is only statistically significant at 10 percent in northern regions (Table 3, 1). Even if we deal with regional business churn rate, openness plays a vital role in overcoming business stagnation locally. Even this feature highlights current differences between the northern and southern macro areas.

HRST has the attended positive sign and is statistically significant at 1 percent (Table 2, 3). Not only efficient technological devices but also digital culture plays an essential role in a well-functioning business environment, which indicates that the supply of individuals with digital skills should be trained to deal with the dynamic business environment. No meaningful differences, instead, emerge when digital culture is analysed considering northern and southern regions specifically (Table 3, 1-2).

Table 3. Main Results with one-step System GMM for all Italian regions

business churn rate	**Model 1**	**Model 2**	**Model 3**	**Model 4**
1-year lag churn rate	.8689***	.4975***	.4213***	.4123***
	{0.041}	{0.052}	{0.058}	{0.063}
2-year lag churn rate		.4227***	.3832***	.3712***
		{0.046}	{0.044}	{0.044}
broadband	.02258	.0365	.07126**	.06702*
	{0.025}	{0.027}	{0.032}	{0.033}
1-year lag broadband	.08043**	.06031*	.1016*	.09643*
	{0.034}	{0.033}	{0.052}	{0.053}
patents	.02267**	.01996***	.02255***	.0246***
	{0.008}	{0.006}	{0.006}	{0.007}
population	.00000740	.0000327	.0000131	.0000256
	{0.000}	{0.000}	{0.000}	{0.000}

GDP per capita	.0000298***	.0000231**	.0000458***	.0000315*
	{0.000}	{0.000}	{0.000}	{0.000}
corruption			-.6677	-.5586
			{0.585}	{0.566}
voice accountability			-.95**	-1.223**
			{0.444}	{0.528}
regulatory quality			-.9983	-.8156
			{0.659}	{0.665}
HRST			.1335***	
			{0.044}	
Regional FE	YES	YES	YES	YES
Years	YES	YES	YES	YES
N	180	180	180	180
A-B test(1)	0.000	0.001	0.002	0.001
A-B test(2)	0.010	0.573	0.410	0.264
Hansen (p-value)	0.107	0.129	0.152	0.173
# instruments	9	9	9	9
# groups	20	20	20	20

Notes: The lagged variables, churn_rate(t-1), churn_rate (t-2), and broadband (t-1), are treated as predetermined variables (GMM-style option of xtabond2), while the other independent variables are treated as exogenous (IV-style option of xtabond2). A maximum of six lags is used as an instrument for the GMM endogenous variable. Standard errors reported in parenthesis are heteroskedasticity-robust. ***, ** and * denote coefficients significant at 1%, 5% and 10%, respectively. Results are in **b/se.**

Table 4. Main results with territorial constraints (Centre-North and South of Italy)

business churn rate	**Model 1**	**Model 2**
	Centre-North	South
1-year lag churn rate	.518***	.5143***
	{0.096}	{0.120}
2-year lag churn rate	.4009***	.2114**
	{0.088}	{0.076}
broadband	.05457*	.07056*
	{0.028}	{0.039}
1-year lag broadband	.02998**	.06475*
	{0.014}	{0.033}
patents	.0179**	.01439
	{0.006}	{0.031}
population	-.0000108	-.0000541
	{0.000}	{0.000}
GDP per capita	.0000229**	.0000111
	{0.000}	{0.000}
corruption	-.2357	-.1073
	{0.094}	{0.239}
voice accountability	-.3148	-2.413***
	{0.373}	{0.515}
regulatory quality	-1.058*	-.239
	{0.505}	{0.719}
HRST	.04851	.09318
	{0.064}	{0.058}
Regional FE	YES	YES
Year	YES	YES
Centre North Dummy	YES	NO
South Dummy	NO	YES
N	180	180
A-B test(1)	0.030	0.038
A-B test(2)	0.280	0.258
Hansen (p-value)	0.585	0.389
# instruments	9	9
# groups	20	20

Notes: The lagged variables, churn_rate(t-1), churn_rate (t-2) and broadband (t-1), are treated as predetermined variables (GMM-style option of xtabond2), while the other independent variables are treated as exogenous (IV-style option of xtabond2). A maximum of six lags is used as an instrument for the GMM endogenous variable. Standard errors reported in parenthesis are heteroskedasticity-robust. ***, ** and * denote coefficients significant at 1%, 5% and 10%, respectively. Results are in b/se.

5. CONCLUSION

This paper represents a preliminary attempt to study the effects of innovation and digitalisation on the Italian business dynamism of industry, construction and services, with data aggregated at the Italian regional levels for ten years. Even if provisional, the final results are remarkable.

First, territorial digitalisation, proxied by the diffusion of broadband infrastructure and innovation, measured by the number of regional patents applied to EPO, has a positive and significant influence over business' churn rate, which, in turn, favours Italian regional growth.

When we distinguish regions located in the Centre-North and South of Italy, differences in digitalisation and innovation processes on the business churn rate are stark: digitalisation maintains a uniform and positive influence on northern and southern regions, while innovation strongly influences the business churn rate of the North of Italian regions only. It highlights the intrinsic features of digitalisation and innovation: the former facilitates communication and operations to keep up with the challenges of the business environment uniformly, while the latter promotes the creation and preservation of value for entities that can afford it. So, digitalisation promotes an equal distribution of value than innovation does. In this regard, policymakers should incentive a policy framework that eases accessibility to innovation uniformly, and it would reduce disparities for territories where innovation is not affordable.

However, future research agenda should consider the limits of this study to overcome: i) the development of variables related to robotics and Artificial Intelligence (AI), and ii) the creation of a firm-level index to detect digital aspects that promote businesses' profitability. Finally, it would be useful to reproduce a comparative analysis for countries with similar regional features of Italy, like the Mediterranean countries of Spain and

innovation influence the local businesses' dynamism heterogeneously or not and compare it with the regional territories of the northern European countries.

REFERENCE

Arellano and Bover, (1995) "Another look components models," Journal of Econometrics, 68:1, 29-51

Barro, R., Sala-I-Martin, X., Blanchard, O., & Hall, R. (1991). Convergence across states and regions. Brookings Papers on Economic Activity, 1991(1), 107 https://doi.org/10.2307/2534639.

Berlingieri, G., et al. (2018), "Sulla produttività pesa la dimensione di impresa", www.lavoce.info

Blundell and Bond, 1998 "Initial conditions and moment restrictions in dynamic panel data models," Journal of Econometrics, 81:1, 115-143

Barro, R., Sala-I-Martin, X., Blanchard, O., & Hall, R. (1991). Convergence across states and regions. Brookings Papers on Economic Activity, 1991 (1), 107. https://doi.org/10.2307/2534639.

Bresciani, S., Ferraris, A. and Del Giudice, M. (2018) 'The management of organisational ambidexterity through alliances in a new context of analysis: Internet of Things (IoT) smart city projects, Technological Forecasting and Social Change. North-Holland, 136, pp. 331–338. DOI: 10.1016/J.TECHFORE.2017.03.002.

Bugamelli, M., et al. (2018), "Productivity Growth in Italy: A Tale of a Slow-Motion Change," Bank of Italy Occasional Paper, No. 422, Bank of Italy, Rome, https://www.bancaditalia.it/pubblicazioni/qef

Calligaris, S., et al. (2016), "Italy's Productivity Conundrum. A Study on Resource Misallocation in Italy", Discussion Paper, No. 2015-030, Directorate General, Economic and Financial Affairs (DG ECFIN), European Commission, Brussels, http://publications.europa.eu/resource/cellar/a67d8d51 -4405-11e6-9c64- 01aa75ed71a1.0001.03/DOC_2.

Cirillo, V. et al. (2021) "Digitalization, routineness, and employment: An exploration on Italian task-based data", Research Policy, Elsevier, 50(7), p. 104079. DOI: 10.1016/j.respol.2020.104079.

Decker, R., et al. (2016). "Declinin business dynamism: What we know and the way forward," American Economic Review, Vol. 106, No. 5, pp. 203-07.

De Wilton, A., 2011, "Patent Value: A Business Perspective for Technology Startups," Technology Innovation Management Review, 5-11.

Eller, R., Alford, P., Kallmünzer, A., Peters, M., (2020) 'Antecedents, consequences, and challenges of small and medium-sized enterprise digitalisation,' Journal of Business Research, Volume 112, pp. 119-127, ISSN 0148-2963.

Gu, W. (2020) 'Frontier Firms, Productivity Dispersion and Aggregate Productivity Growth in Canada,' Analytical Studies Branch Research Paper Series, (11).

Habibi, F., Zarbadast, M., A., 2020, "Digitalization, education and economic growth: A comparative analysis of the Middle East and OECD countries," Technology in Society, 63, 101370

Lee, KL. et al., (2022) 'The effect of digital supply chain on organisational performance: An empirical study in Malaysia manufacturing industry, Uncertain Supply Chain Management,10, pp. 495–510

Levine, R., & Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. American Economic Review, 82, 942–963.

Li, Y., Dai, J., & Cui, L. (2020). The impact of digital technologies on economic and environmental performance in the context of industry 4.0: A moderated mediation model. International Journal of Production Economics, 229, [107777]. https://doi.org/10.1016/j.ijpe.2020.107777

Liang, T., You, J. and Liu, C. (2010), "A resource-based perspective on information technology and firm performance: a meta-analysis," Industrial Management & Data Systems, Vol. 110 No. 8, pp. 1138-1158. https://doi.org/10.1108/02635571011077807

Lin, W., Yip, N., Ho, J., A., Sambasivan, M., 2020, "The adoption of technological innovations in a B2B context and its impact on firm performance: An ethical leadership perspective", Industrial Marketing Management, 89, 61-71

Myovella, G., Karacuka, M., Haucap, J., 2020 , "Digitalization and economic growth: A comparative analysis of Sub-Saharan Africa and OECD economies," Telecommunications Policy, 44, 101856

Molinari, B. and Torres, J. L. (2018) 'Technological sources of economic growth in Europe and the US, Technological and Economic Development of Economy. Vilnius Gediminas Technical University, 24(3), pp. 1178–1199. DOI: 10.3846/20294913.2017.1280557.

Moshiri, S., Simpson W., (2011)' Information technology and the changing workplace in Canada: firm-level evidence, Industrial and Corporate Change},20, pp.1601-1636

Nifo A., Vecchione, G., (2014), "Do Institutions Play a Role in Skilled Migration? The Case of Italy", Regional Studies, Volume 48, Issue 10, 2014, pages 1628-1649. DOI: 10.1080/00343404.2013.835799.

Roodman, D. (2006). How to do Xtabond2: An introduction to difference and system GMM in Stata. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.982943.

Stephens, H. M., Partridge, M. D. and Faggian, A. (2013) 'Innovation, entrepreneurship and economic growth in lagging regions", Journal of Regional Science. John Wiley & Sons, Ltd, 53(5), pp. 778–812. DOI: 10.1111/JORS.12019.

Truant, E., Broccardo, L. and Dana, L. P. (2021) 'Digitalisation boosts company performance: an overview of Italian listed companies, Technological Forecasting and Social Change, 173 (May). DOI: 10.1016/j.techfore.2021.121173.

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The present manuscript has not been previously published in its current form or a substantially similar form and is not currently under review by another journal.

Conflict of Interest
The authors declare no conflict of interests.

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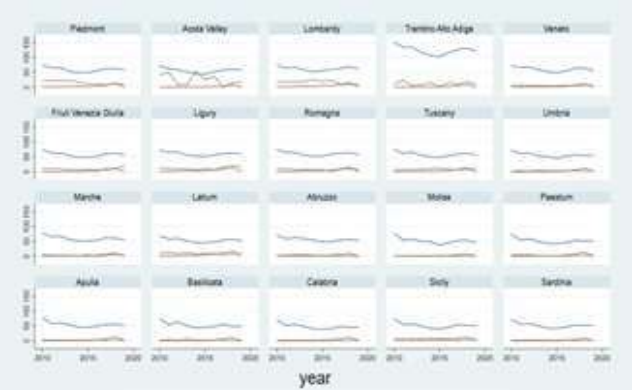
Authors Declaration
The present manuscript is original, and the software Plagiarism Checker verified originality.

APPENDIX

Figure 1. Business churn rate, broadband and patents in Italian regio



Note: Authors elaborate on data taken from ISTAT and EUROSTAT and processed on STATA. The blue line represents the business' churn rate, the green line denotes the number of patent applications, and the red line depicts the development of territorial diffusion of broadband. The business churn rate line is steeper for northern regions and flat for southern ones. The line denotes broadband development is flatter for all Italian regions, while the line representing patents is steeper for northern regions but relatively flat for southern areas.

Table 1. List of Italian Regions (NUTS-2 ISTAT

Region	Area
Piedmont	North
Aosta Valley	North
Lombardy	North
Trentino-Alto Adige	North
Veneto	North
Friuli-Venezia Giulia	North
Liguria	North
Romagna	North
Tuscany	Centre
Umbria	Centre
Marche	Centre
Latium	Centre
Abruzzo	South
Molise	South
Paestum	South
Apulia	South
Basilicata	South
Calabria	South
Sicily	South
Sardinia	South

Table 2. Preliminary results with static models

	Model 1 Pooled-OLS	Model 2 Fixed Effect	Model 3 Random Effect
population	.0003276***	-.0000576	.0000192
	{0.000}	{0.000}	{0.000}
GDP per capita	.0001034***	.000093	.000106***
	{0.000}	{0.000}	{0.000}
broadband	.252***	.01992	.04855
	{0.084}	{0.034}	{0.048}
1-year lag broadband	.239***	.02369	.03293
	{0.068}	{0.042}	{0.051}
patents	.04822**	.01465***	.02005***
	{0.017}	{0.005}	{0.006}
HRST	.1335***	.04851	.09318
	{0.044}	{0.064}	{0.058}
corruption	-2.28***	.4178	-.55
	{0.680}	{0.940}	{0.687}
voice accountability	-3.607**	.1904	-1.345**
	{1.378}	{0.615}	{0.681}
regulatory quality	-3.467**	.1463	-1.657*
	{1.514}	{0.727}	{0.976}
Regional FE	YES	YES	
Years	YES	YES	YES
N	180	180	180

***, ** and * denote coefficients are significant at 1%, 5% and 10%, respectively