

Examining the relationships between Entrepreneurship, Intrapreneurship, and e-Commerce. Evidence from Iberian and Scandinavian Countries

Exploración das relacións entre o espírito empresarial, o intraemprendemento e o comercio electrónico. Datos dos países ibéricos e escandinavos

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Abstract

Digitisation is a phenomenon that inevitably affects companies and economies. Consequently, the virtual market seems an excellent alternative for aspiring entrepreneurs. Recent statistics precisely point to accelerated growth of e-commerce. Indeed, this and entrepreneurship are business tools that allow a new dynamic in the market. However, recent research has barely explored the relationship between entrepreneurship and e-commerce, so this study contributes to the literature by filling the gap.

In light of the above, this study has used several indicators from two groups of countries, namely Scandinavia, in broad terms (Denmark, Sweden, Norway and Finland), and Iberia (Portugal and Spain) from the years 2012 to 2020. The Panel Corrected Standard Errors models have been used for the econometric treatment of the data. The findings confirm the bidirectional causality between entrepreneurship and e-commerce. In addition, from a widerperspective of entrepreneurship, the paper also reveals that intrapreneurship based on Research and Development (R&D) is an e-commerce driver. Therefore, this study opens up a new discussion and provides relevant support for the theoretical framework and a valuable contribution to the scarce literature on the relationship between entrepreneurship and e-commerce.

Keywords: Entrepreneurship; Intrapreneurship; e-commerce; Iberian region; Scandinavian region; Panel Corrected Standard Errors models.

Resumo

A dixitalización é un fenómeno que afecta inevitablemente as empresas e as economías. En consecuencia, o mercado virtual parece unha excelente alternativa para os aspirantes a empresarios. As estatísticas recentes apuntan precisamente a un crecemento acelerado do comercio electrónico. De feito, este e o espírito empresarial son ferramentas de negocio que permiten unha nova dinámica no mercado. Con todo, a investigación recente apenas explorou a relación entre o espírito empresarial e o comercio electrónico, polo que este estudo contribúe á literatura enchendo ese baleiro.

Tendo en conta o anterior, este estudo utilizou varios indicadores de dous grupos de países, a saber, Escandinavia, en termos xerais (Dinamarca, Suecia, Noruega e Finlandia), e a Península Ibérica (Portugal e España) dos anos 2012 a 2020. Para o tratamento econométrico dos datos utilizáronse os modelos de Erros Estándar Corrixidos para Panel. Os resultados confirman a causalidade bidireccional entre o espírito empresarial e o comercio electrónico. Ademais, desde unha perspectiva máis ampla do emprendemento, o traballo tamén revela que o intraemprendemento baseado en Investigación e Desenvolvemento (I+D) é un impulsor do comercio electrónico. Por tanto, este estudo abre un novo debate e proporciona un apoio relevante ao marco teórico e unha valiosa contribución á escasa bibliografía sobre a relación entre o espírito empresarial e o comercio electrónico.

Palabras chave: Espírito empresarial; Intraemprendemento; Comercio electrónico; Rexión ibérica; Rexión escandinava; Modelos de erros estándar corrixidos para paneis.

JEL: M10; M14; M15; M21; M30.

1. INTRODUCTION

E-commerce is currently at its pinnacle, spurred by recent events such as the COVID-19 pandemic (Beckers et al., 2021). Nevertheless, more challenges will come; for instance, the Russia-Ukraine conflict will reshape international trade and force global value chains to be reconsidered (Estrada & Koutronas, 2022). Implementing the 5G Internet of Things will clearly provide opportunities and changes (Zhu et al., 2021), what with more and more users connecting and spending longer online (Kross et al., 2021), indicating that the current virtual environment offers several business opportunities and challenges.

In this respect, e-commerce, which consists of commercial transactions performed electronically on the Internet (Barkatullah & Djumadi, 2018), is a relevant field of research for the economy and companies. In general, the latter are aware of its importance in contemporary business, as it is a sales channel open 24 hours a day, 7 days a week without any geographical limitations (Witek-Hajduk et al., 2022). Therefore, the Internet offers consumers a great deal of information at lower prices, facilitating their purchases. At the same time, suppliers have many more opportunities to benefit from economies of scale to reduce production costs (Duch-Brown et al., 2017), with indicators confirming this combination of interests. Thus, according to the Statistical Office of the European Union [Eurostat] (2022), from 2011 to 2020, the percentage of companies that performed e-sales in this region increased (from 16% in 2011 to 22% in 2020). Likewise, business turnover generated from e-sales rose, in this case by 6 percentage points (from 14% in 2011 to 20% in 2020). Hence, e-commerce has a net market expansion effect (Duch-Brown et al., 2017).

However, despite the rapid growth of digital market, studies on drivers of e-commerce remain limited (Saridakis et al., 2018) and so do those focusing on the link between entrepreneurship and digital (Steininger, 2019) in spite of the fact that e-commerce is considered to be a source of resilience in the context of entrepreneurship (Organization for Economic Co-operation and Development, [OECD], 2021). Hence, there is a need for knowledge of the relationship between entrepreneurship and e-commerce to be broadened. Taking this into consideration, this paper aims to create a new talking point and improve upon existing knowledge, examining the causal relationships between e-commerce and entrepreneurship, including intrapreneurship, one of its sub-concepts.

From a pragmatic perspective, entrepreneurship is the ability to create, develop and manage a new venture (Parker, 2011). However, entrepreneurial production can arise in a broad range of contexts as events that create value in a stream of changing circumstances (Gaddefors & Anderson, 2017). In other words, value creation is the basic principle of entrepreneurship (Liguori & Bendickson, 2020). Intrapreneurship, in contrast, is a driver or an internal force that searches for opportunities to innovate and develop entrepreneurship within organisations (Audretsch et al., 2021; Nassuna et al., 2022). Specifically, it refers to the company's ability to react quickly and innovatively to internal and external changes (Klofsten et al., 2021), for instance, by way of new business ventures innovativeness, the development of new products or services, the renewal of key ideas and proactiveness (Skarmeas et al., 2016).

Therefore, entrepreneurship and digital have dominated economic development recently and will continue to play an important role for years to come (Ghauri et al., 2022). Intrapreneurship is a driver of change in companies (Bogatyreva et al., 2022), which can lead to their becoming involved in e-commerce.. Moreover, intrapreneurial capabilities are important to an organisation's success, especially during turbulent periods of uncertainty (Klofsten et al., 2021), as was the case when the analysis of this study was performed. This

paper zooms in on two European regions, Scandinavia, in its broad sense (Denmark, Sweden, Norway and Finland) and Iberia (Portugal and Spain) between 2012 and 2020. These regions are culturally diverse (Hofstede, 2022) and have different perspectives on e-commerce growth. According to e-commerceDB (2022), an annual global average growth rate of 6% for e-commerce is predicted between 2021-2025. For Scandinavia, a growth equal to or greater than the global average of 6% is expected, with Finland and Sweden seeing annual growth forecasts of 7% and Norway with rates similar to the aforementioned global average, while Denmark will be at 5%, i.e., below the global average. For the Iberian region, it is predicted to be equal to or less than the 6% global average, with Spain being at said rate while in Portugal it will more likely be 5%.

There is a lack of general understanding regarding these factors (entrepreneurship, intrapreneurship) in e-commerce in recent literature, but this study aims to fill the gap. In particular, it intends to explore whether e-commerce influences entrepreneurial activities or vice versa. In addition, this dynamic between entrepreneurship and e-commerce raises the possibility of analysing whether the relationship between these two quantities is bidirectional.

2. LITERATURE REVIEW

2.1. The relationship between entrepreneurship and e-commerce

Business managers consider e-commerce a source of competitive advantage because it provides a cost-effective way to access any customer globally and compete internationally (Khan et al., 2016). It also allows small and medium-sized companies to compete in a similar fashion to large ones (Khan et al., 2016; Tolstoy et al., 2021). As start-ups naturally face many challenges, e-commerce can be a competitive force (Mishra & Gupta, 2020), the digitalisation of products or services helping new ventures create value, for instance (Rachinger et al., 2019). Entrepreneurs can use e-commerce tools, take risks, look for new business opportunities and create new products or services, responding effectively to business challenges in a constantly changing world in real time as a consequence (Abebe, 2014). Therefore, the digitisation of products and services can increase the potential for ventures to be rapidly scaled (Proksch et al., 2021). In practice, digital works for entrepreneurs as a facilitator and mediator of their business operations, providing tools and channels, mediated by digital technology in order to access customers, as e-commerce does (Steininger, 2019). Entrepreneurial companies use e-commerce to increase operational efficiency in terms of sales growth (Saridakis et al., 2018). This means that e-commerce is growing exponentially and attracting more and more entrepreneurs (Cuellar-Fernández et al., 2021) who are familiar with the potential benefits of this business tool.

To perform this study, “enterprises with e-commerce sales of at least 1% turnover” is the e-commerce indicator from Eurostat which has been adopted. To enrich the analysis, the two entrepreneurship indicators from Eurostat, namely “Birth rate of companies” and “Survival rate 3 of companies,” have also been included. For entrepreneurship, the relationship between emerging and surviving companies is an important detail to consider in e-commerce because entrepreneurial persistence affects its performance (Chen et al., 2021). Generally, it is considered a robust strategy by newly created ventures to adopt e-commerce as it helps them beat their competitors and generate profits (Mishra & Gupta, 2020). The entrepreneur's journey unfolds via various ventures and stages of development, with failures and restarts

(Petrucci & Milanese, 2022). Thus, the strategic timing of e-commerce adoption is critical because it can affect performance measures (Fuller et al., 2022).

With this in mind, the discussion of the literature suggests that entrepreneurship can influence e-commerce, awakening the following hypotheses:

H1. Entrepreneurship based on the creation of new ventures positively influences the adoption of e-commerce.

H2. Entrepreneurship based on surviving ventures positively influences the adoption of e-commerce.

The aforementioned literature suggests that e-commerce is an output, but some studies also point to its being a driver of entrepreneurship. Indeed, the Internet promotes entrepreneurship mainly because it eases entrepreneurs' access to information (Tan & Li, 2022). Likewise, the development of e-commerce significantly increases the number of new start-ups entering the market while the number of companies exiting is reduced (Huang et al., 2018). The prosperity of e-commerce has created multiple opportunities for aspiring entrepreneurs to seize (Modgil et al., 2022), among which are the fact that it has no geographical limitations, the operational and implementation costs are significantly lower and more precise segmentation can be made (Taher, 2021). Therefore, e-commerce simplifies new business development, positively affecting the annual rate of business evolution for SMEs and micro businesses (Yacob et al., 2021), alluring micro-entrepreneurs.

The discussion of the literature also suggests that e-commerce can influence entrepreneurship, leading to the following hypotheses:

H3. The adoption of e-commerce positively influences entrepreneurship based on the creation of new ventures.

H4. The adoption of e-commerce positively influences entrepreneurship based on surviving ventures.

2.2. The relationship between intrapreneurship and e-commerce

Intrapreneurial initiatives can promote digital transformation (Ambos & Tatarinov, 2022; Blanka et al., 2022) because these actions can contribute to generating organisational newness if said automated technology is taken advantage of (Vassilakopoulou & Grisot, 2020). Similarly, Tolstoy et al. (2021) have highlighted the importance of taking risks and developing certain capabilities (intrapreneurial behaviour) related to e-commerce; digitisation has allowed for new intrapreneurship opportunities (Pinchot & Soltanifar, 2021) with the development of e-commerce businesses.

Therefore, the study has used the R&D indicator and Global Innovation Index for intrapreneurship. It is argued that knowledge derived from R&D investments is, in practice, an internal force that searches for opportunities to innovate and develop internet entrepreneurship. The field of intrapreneurship is generally related to R&D functions (Menzel et al., 2007) and innovation is a natural factor of intrapreneurship for organisations (Skarmeas et al., 2016).

Taking all of the above into account, the discussion of the literature suggests that intrapreneurship can influence e-commerce, allowing the formulation of the following hypotheses:

H5. Intrapreneurship based on R&D positively influences the adoption of e-commerce.

H6. Intrapreneurship based on innovation positively influences the adoption of e-commerce.

3. METHODOLOGY

3.1. Data and variables

The main objective of this study is to analyse entrepreneurship and intrapreneurship as antecedents of e-commerce, so e-commerce will be the dependent variable. However, a bidirectional analysis between e-commerce and entrepreneurship will also be applied in the study.

As presented in the literature review, the explanatory variables related to entrepreneurship are (i) Birth rate and (ii) Survival rate 3 of companies. The explanatory variables related to intrapreneurship are (iii) R&D expenditure and (iv) Global Innovation Index. The descriptions of the variables, their acronyms, their units of measurement and their sources are shown in [Table 1](#).

Table 1. Data and definition of variables

Variable	Acronym	Definition	Source
e-commerce	ECOM	Enterprises with e-commerce sales of at least 1% turnover. All enterprises without financial sector (10 or more employees and self-employed workers)	Eurostat
Entrepreneurship based on the creation of new ventures	ENV	The number of enterprise births in reference period (t) divided by the number of enterprises active in t.	Eurostat
Entrepreneurship based on surviving ventures	ESV	The number of enterprises in reference period (t) newly born in t-3 having survived to t, divided by the number of enterprise births in t-3.	Eurostat
Intrapreneurship based on R&D	IR&D	Research and experimental development (R&D) comprises creative work undertaken on a systematic basis to increase the stock of knowledge, including that of humans, culture and society, and the use of this stock of knowledge to devise new applications. R&D expenditure includes all expenditure for R&D performed in the business enterprise sector (BERD) in the national territory during a given period, regardless of the source of funds. R&D expenditure in BERD is shown as a percentage of GDP (R&D intensity).	Eurostat
Intrapreneurship based on innovation	IINOV	The index comprises around 80 indicators, including measures on each economy's political environment, education, infrastructure and knowledge creation.	Wipo

This paper focuses on two European regions, Scandinavia in broad terms (Denmark, Sweden, Norway, and Finland) and Iberia (Portugal and Spain). Therefore, the study has collected data for each indicator for the years 2012 to 2020 for the the abovementioned countries.

To analyse the hypotheses proposed in the literature review, the following equations have been applied:

$$EC_{it} = \beta_0 + \sum_{k=1}^k \beta_k X_{kit} + \mu_{it} \quad (1)$$

where EC_{it} is e-commerce, X_{kit} is the vector of the k explanatory variables (Birth rate; Survival rate 3 of companies; R&D expenditure; Global Innovation Index) and μ_{it} is the error term, i representing a specific country and t indicating the year.

However, the literature review also suggests that there is bidirectionality in the relationship between e-commerce and entrepreneurship, based on Survival rate 3 of companies and Birth rate of companies. Thus, the study includes two models represented by Equations 2 and 3:

$$BR_{it} = \beta_0 + \sum_{k=1}^k \beta_k \chi_{kit} + \mu_{it} \quad (2)$$

where BR_{it} is Birth rate of companies, X_{kit} is the vector of the k explanatory variables (e-commerce; Survival rate 3 of companies; R&D expenditure; Global Innovation Index) and μ_{it} is the error term, i representing a specific country and t referring to the year.

$$SV_{it} = \beta_0 + \sum_{k=1}^k \beta_k \chi_{kit} + \mu_{it} \quad (3)$$

where SV_{it} is Survival rate 3 of companies, X_{kit} is the vector of the k explanatory variables (e-commerce, Birth rate of companies; R&D expenditure; Global Innovation Index) and μ_{it} is the error term, i referring to a specific country and t indicating the year.

3.2. Econometric approach

This study has used Panel Corrected Standard Errors (PCSE) models. However, to justify these econometric models to the detriment of conventional and/or robust models of fixed and random effects, it is essential to check for the presence of what are known as cross-dependence, heteroscedasticity and autocorrelation problems. Consequently, [Frees \(1995\)](#) and [Pesaran \(2004\)](#) tests have been used to assess the presence of sectional dependence. To check for the existence of heteroscedasticity problems, this study has used the Modified Waldtest ([Baum, 2001](#)). As for whether there is autocorrelation, the [Wooldridge \(2002\)](#) test has been employed.

After conducting diagnostic tests for the existence of autocorrelation, heteroscedasticity and contemporary correlation problems, these can be solved by using PCSE models, among others. In this study, econometrically, to estimate equations (1), (2) and (3), we have used the PCSE models developed by [Beck and Katz \(1995\)](#). Namely, Feasible Generalized Least Squares (FGLS); a contemporaneous correlation PCSE model [CORR(IND)]; a PCSE estimator with the option for first-order serial correlation (AR1); Parks (PSAR), a first-order autocorrelation with a coefficient of the AR(1) process specific to each panel; Hetonly (ar1) (HET-AR1), a PCSE estimator with the options for both heteroscedasticity and first-order serial correlation; finally, we have used Hetonly (HET), a PCSE estimator, which specifies that the disturbances are assumed to be heteroscedastic.

The PCSE estimator is suitable for short-sized panels because it considers finite sample bias while producing panel-corrected standard errors, allowing for heteroscedasticity and correlation within analysis panels (Bailey & Katz, 2011). Recent empirical studies have used the PCSE estimator because it offers a good fit and very robust estimates for studies with similar characteristics to this one (Le & Park, 2021; Lu et al., 2020; Pais-Magalhães et al., 2022).

The three models, or equations, have been estimated using statistical software for data science (known as Stata) where the PCSE estimators have been calculated with the econometric methods and estimators associated by CORR(IND), FGLS, PSAR, HET-AR1 and HET, thus allowing the robustness of the regression results to be tested.

The CORR (IND) estimation specifies that there is no autocorrelation, while the FGLS estimator is conditioned to any autocorrelation of the estimated parameters. AR1 states that there is no autocorrelation between the panels and adds that the coefficients of the AR1 process are common to all panels with the same coefficient for all countries. PSAR (1) is similar to AR1 but considers that the coefficients of the first-order autocorrelation process are particular to each panel. HET-AR1 regards the errors as heteroscedastic and the coefficients of the first-order autocorrelation process as common for all countries. At the same time, the HET estimator assumes a perturbation variance common to all observations (STATA, 2022).

4. EMPIRICAL RESULTS

In the first stage, we have performed diagnostic tests whose results are presented in Table 2, and relate them to the estimation of fixed effects, since the observations of the sample of this study refer to a specific set of countries. There is significant statistical evidence for the existence of the cross-section dependence problem but only from the Frees test and Equations 1 and 2. Next, heteroscedasticity has been shown to predominate in the three equations proposed, while the first-order autocorrelation problem only appears in the estimation of Equation 2.

Table 2. Diagnostic tests

	Pesaran Test	Frees Test	Modified Wald Test (χ^2)	Wooldridge Test	Statistical and significant evidence
1 st equation	Null hypothesis not rejected	Null hypothesis rejected	Null hypothesis rejected	Null hypothesis not rejected	Cross-Section dependency Heteroscedasticity
2 nd equation	Null hypothesis not rejected	Null hypothesis rejected	Null hypothesis rejected	Null hypothesis rejected	Cross-Section dependency Heteroscedasticity Autocorrelation (AR 1)
3 rd equation	Null hypothesis not rejected	Null hypothesis not rejected	Null hypothesis rejected	Null hypothesis not rejected	Heteroscedasticity

According to the results presented in Table 2, the diagnostic tests report that they must be selected for the interpretation of the estimation results of the 1st proposed econometric relation and only the contemporaneous correlation estimator (CORR (IND)) and the estimator with the option for heteroscedasticity (HET). Table 3, below, presents the PCSE regression estimates, considering e-commerce to be a dependent variable whose coefficients have identical values and signals.

Table 3. PCSE results for 1st equation

DEPENDENT VARIABLE	E-COMMERCE				
	CORR (IND)	FGLS	PSAR	HET-AR1	HET
Entrepreneurship based on the creation of new ventures	0.3972971	0.2691969**	0.5303297	0.7641218*	0.3972971
Entrepreneurship based on surviving ventures	0.6725205***	0.5309511***	0.5186054***	0.4782816***	0.6725205***
Intrapreneurship based on R&D	0.1374575**	0.1272493***	0.2975227***	0.2761219**	0.1374575**
Intrapreneurship based on innovation	-0.7169127	0.462933	0.8999118	0.9280401	-0.7169127
Constant	-21.74833*	-13.73156***	-25.24183**	-23.85123**	-21.74833*
R ²	0.4667		0.5236	0.5720	0.4667
Observations	60	60	60	60	60

Note: *, ** and *** represent the values being statistically significant at 90%, 95% and 99% respectively. FGLS - Feasible Generalized Least Squares; CORR(IND) – Contemporaneous correlation PCSE model; AR1 - PCSE estimator with the option for first-order serial correlation; PSAR1 - first-order autocorrelation with a coefficient of the AR1 process specific to each panel; HET-AR1 - PCSE estimator with the options for both heteroscedasticity and first-order serial correlation.

The grey columns represent the values of the estimators considered in the empirical analysis. The other estimators are presented only from an informal perspective.

The results shown in [Table 3](#), from the CORR (IND) and HET models, reveal that the explanatory variable Entrepreneurship based on surviving ventures has a positive and statistically significant effect on e-commerce with a 1% level of significance and the variable Intrapreneurship based on R&D has a positive and statistically significant effect on e-commerce with a 5% level of significance. However, the variables Entrepreneurship based on the creation of new ventures and Intrapreneurship based on innovation do not significantly influence e-commerce. Therefore, H2 and H5 are statistically supported whereas H1 and H6 are not.

[Table 4](#) presents the PCSE regression estimates considering Birth rate of companies as a dependent variable. The main explanatory variables are e-Commerce, Survival rate 3 of companies, R&D expenditure and Global Innovation Index. In Entrepreneurship, Survival rate 3 of companies has a negative and significant influence on Birth rate of companies in all methods selected according to the results of diagnostic tests, where the study finds the problems of cross-section dependency, heteroscedasticity and autocorrelation first order. Moreover, the variable Intrapreneurship based on R&D shows a negative and significant effect according to results of FGLS and HET estimators at a 1% level of significance. Nonetheless, Intrapreneurship based on innovation has a negative and significant effect on Entrepreneurship based on Birth rate of companies only with the FGLS estimator. e-Commerce shows a positive and statistically significant impact on Entrepreneurship based on Birth rate of companies at a 1% and a 5% level of significance, according to FGLS, PSAR and HET-AR1 estimators. Comparing the results presented in [Tables 3](#) and [4](#) and recognising that there is consensus on the estimation results PCSE under Estimator with the options for heteroscedasticity (HET-AR1), the results show that there is a bidirectional sense between the variables Entrepreneurship based on Birth rate of companies and e-Commerce. Therefore, it can be said that H3 is supported. Moreover, with H1+H3 supported statistically at the estimator level (HET-AR1), it raises a hypothesis of bidirectionality between H1 and H3.

Table 4. PCSE results for 2nd Equation

DEPENDENT VARIABLE	ENTREPRENEURSHIP BASED ON BIRTH RATE OF COMPANIES				
INDEPENDENT VARIABLES	CORR (IND)	FGLS	PSAR	HET-AR1	HET
Entrepreneurship based on surviving ventures	-0.2001396***	-0.2006392***	-0.1113756**	-0.1374425***	-0.2001396**
Intrapreneurship based on R&D	-0.1493402***	-0.1452031***	-0.0621713	-0.0451342	-0.1493402***
Intrapreneurship based on innovation	0.471561	0.3812352**	-0.014056	-0.9186213	0.471561
e-Commerce	0.0643778	0.069592***	0.0882707**	0.0722575**	0.0643778
Constant	26.59717***	26.36188***	16.43217***	18.88665***	26.59717***
R ²	0.5773		0.8060	0.6593	0.5773
Observations	60	60	60	60	60

Note: *, ** and *** represent the values being statistically significant at 90%, 95% and 99% respectively.

The grey columns represent the values of the estimators considered in the empirical analysis. The other estimator is presented only in an informal perspective.

Table 5 presents the PCSE regression estimates considering Survival rate 3 of companies as a dependent variable. For entrepreneurship, Birth rate of companies has a negative and significant influence on Survival rate 3 of companies in all methods. Regarding intrapreneurship, R&D expenditure as an influence on Survival rate 3 of companies is not significant in any of the methods. According to diagnostic tests, the Global Innovation Index emerges as a significant driver of Survival rate 3 of companies with significance in both methods.

Comparing the results presented in Tables 3 and 5, it has been taken into consideration that there is consensus on the estimation results PCSE under estimator with the options for the Contemporaneous correlation CORR (IND) and heteroscedasticity (HET) PCSE estimators. The scores show that significant statistical bidirectional causality exists at the 1 % level of significance for both variables and the relationship proposed is confirmed, so e-Commerce also influences Survival rate 3 of companies and vice versa. Therefore, it can be said that H4 is supported. Moreover, with H2+H4 supported statistically, it raises a hypothesis of bidirectionality between H2 and H4.

Table 5. PCSE results for 3rd Equation

DEPENDENT VARIABLE	ENTREPRENEURSHIP BASED ON SURVIVAL RATE 3 OF COMPANIES				
INDEPENDENT VARIABLES	CORR (IND)	FGLS	PSAR	HET-AR1	HET
ENV	-0.487117***	-0.5039063***	-0.7125641***	-0.6570531**	-0.487117***
IR&D	0.0240619	0.0232215	-0.0220903	-0.0032314	0.0240619
IINOV	5.390891***	5.537408***	4.818595***	4.368772***	5.390891***
ECOM	0.2652322***	0.2399772***	0.3042625***	0.3240187***	0.2652322***
Constant	43.10689***	44.23486***	47.59907***	45.92557***	43.10689***
R ²	0.7979		0.9595	0.8428	0.7979

DEPENDENT VARIABLE	ENTREPRENEURSHIP BASED ON SURVIVAL RATE 3 OF COMPANIES				
INDEPENDENT VARIABLES	CORR (IND)	FGLS	PSAR	HET-AR1	HET
Observations	60	60	60	60	60

Note: *, ** and *** represent the values being statistically significant at 90%, 95% and 99% respectively.

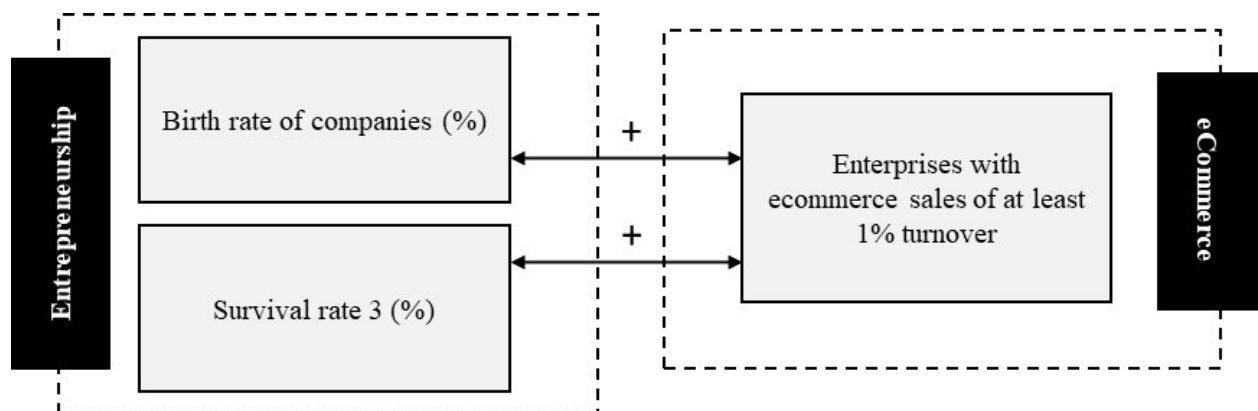
The grey columns represent the values of the estimators considered in the empirical analysis. The other estimators are presented only from an informal perspective.

5. DISCUSSION AND CONCLUDING REMARKS

Some challenges arise after analysing and validating the research hypotheses by applying the three econometric relations proposed, when e-commerce, entrepreneurship based on the creation of new ventures and entrepreneurship based on surviving ventures are considered for Scandinavia (Denmark, Sweden, Norway, and Finland) and Iberia (Portugal and Spain). The findings show bidirectionality and unidirectionality between these same quantities, as shown in Figure 1.

Therefore, the results reveal a mutual influence between e-commerce and entrepreneurship. One upside of the former is that it can be a competitive force for entrepreneurs (Mishra & Gupta, 2020). Given that entrepreneurial processes see failures and restarts (Petrucci & Milanese, 2022), e-commerce adoption is critical for entrepreneurial performance (Fuller et al., 2022), which can be done by entering new markets for instance (Duch-Brown et al., 2017). In addition, it promotes entrepreneurship because it facilitates entrepreneurs' access to information (Tan & Li, 2022) and generates multiple opportunities that potential entrepreneurs can seize (Modgil et al., 2022).

Figure 1. Bidirectionality of Entrepreneurship and eCommerce



In terms of intrapreneurship, the results highlight its role based on R&D as an e-commerce driver, which paves the way for future investigations. R&D will probably be an efficient intrapreneurial process to generate organisational newness if it takes advantage of digital technology (Vassilakopoulou & Grisot, 2020). R&D helps to understand the internal and external environment and create solutions. Among the benefits is the possibility of reducing errors and creating effective strategies.

The results on the bidirectionality between e-commerce and entrepreneurship partially corroborate findings on e-commerce that state that it is a competitive and value-creating output for entrepreneurs (Khan et al., 2016; Mishra & Gupta, 2020; Rachinger et al., 2019),

while at the same time said results agree with studies that propose that e-commerce is an input or entrepreneurial source and generator of opportunity for new ventures (Tan & Li, 2022; Huang et al., 2018; Modgil et al., 2022). Therefore, this paper offers a complementary link between different views present in the literature on the relationship between entrepreneurship and e-commerce. The findings that e-commerce influences Survival rate 3 of companies and vice versa also highlight the results of other studies (Chen et al., 2021; Mishra & Gupta, 2020; OECD, 2021) that suggest e-commerce as a source of resilience for entrepreneurs; entrepreneurship is not a single act but a process marked by successes, failures and beginnings (Petrucci & Milanesi, 2022). Bearing this in mind, e-commerce can work as a tool to combat the volatility and adversities of the entrepreneurial process. Finally, R&D-based intrapreneurship as a driver of e-commerce also backs up the intrinsic relationship between R&D functions and intrapreneurship (Menzel et al., 2007). Studies highlight intrapreneurial initiatives as drivers of digital transformation (Ambos & Tatarinov, 2022; Blanka et al., 2022), thus opening up new opportunities for intrapreneurship (Pinchot & Soltanifar, 2021).

However, the most relevant aspect of the study is that it opens up the debate about the effects on the directional sense between entrepreneurship and e-commerce. The bidirectional evidence found should be studied more in depth with a larger number of European countries and in more recent periods which cover the COVID-19 pandemic. During this time, the digital transition processes in e-commerce have implied changes and adjustments in entrepreneurial behaviour, representing an important step forward in research on this topic.

Hence, entrepreneurial styles of working increasingly gain recognition as fundamental vehicles in order for the entire value-added chain to be fostered, as well as the sustainable development of e-commerce via the technological changes of the digital transition process for all economic activities. Consequently, there are knowledge gains in technological innovation and digitalisation in e-commerce, with potential gains in digital transition periods, particularly for Europe.

Based on the results, this study recommends that public policies promote professional knowledge in entrepreneurship and e-commerce at the same time as creating legal, social and economic conditions for organisations to explore the opportunities generated by the combination of entrepreneurship and e-commerce; one advantage of following this advice is that it strengthens digital technology, making broadband access more efficient, and creates the logistical infrastructure to support entrepreneurship and e-commerce, as well as lines of financing and consultancy services to support venture activities. This is in addition to the specific legal requirements that promote e-commerce in a fair and agile way.

A new decade has already started, marked by digitalisation, where there are new challenges to undertake and opportunities for growth. Small entrepreneurial projects in a digital era could become economically viable with high growth potential. Those who do not adapt will miss out on more and more opportunities than ever. Seeking to keep up-to-date will be fundamental in the dynamic field of entrepreneurship and e-commerce.

6. LIMITATIONS AND FUTURE RESEARCH

This study has used an e-commerce indicator that only comprises omnichannel businesses (enterprises with e-commerce sales of at least 1% turnover). Thus, it would be interesting for a comparative study between e-commerce and brick-and-mortar companies to be performed. This paper generates insights into the significant effect of entrepreneurship on

sustainability and digitalisation in e-commerce, particularly in Iberian and Scandinavian countries.

As for limitations, the following aspects have been identified: firstly, the drivers of the impact of e-commerce on entrepreneurship and vice versa in other European countries have not been tested, meaning that potential differences in terms of the levels of the above-mentioned business tools in and between the nation states are unknown, having solely focused on the Iberian and Northeastern countries; secondly, the number of years covered in the sample is rather limited.

Regarding future research, it may be of interest to consider the significant increase in the number of observations, namely the panel with a range of countries and the notable rise in the number of years. There could be other estimation options for the relationships proposed in this study, such as the application of dynamic models that may make a contribution and show other statistical evidence between the quantities and other types of results, including higher levels of reliability. Finally, according to more recent studies of entrepreneurship, digital transition and e-commerce, the inclusion of other variables is recommended, employing the models and equations proposed in this study. Such examples may be (i) the number of Internet users in a particular country per 100 inhabitants, (ii) the percentage of total early-stage entrepreneurial activity (TEA) businesses that are active in technology sectors (high and medium), (iii) the percentage of TEA businesses founded because of incentives for start-ups, (iv) the percentage of TEA businesses using new technology that are less than 5 years old on average, and (v) innovation capability, normalised to 0-100 (higher capability), among others.

Author contribution

Conceptualization PMS, A.P.; Data Curation PMS, VFM; Methodology PMS, VFM; Visualization PMS, VFM, AP; Software PMS, VFM; Formal analysis PMS; Validation VFM, AP; Writing Original Draft PMS; Writing- Reviewing and Editing VFN, AP

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