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WHAT DRIVES PROFITABILITY IN THE ROMANIAN ICT SECTOR?

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Abstract
Identifying the major driving factors behind variations in profitability across firms is a question addressed by many researchers, at industry, economic sector, country level, or through regional and international comparisons. Empirical approaches have shown that profitability variation across firms and industries, is the norm, rather the exception. The paper investigates the factors underlying the profitability of Romanian companies in the ICT sector within the company-industry-localization framework, applying the variance components methodology and using aggregate profitability (ROA – Return on assets) as a measure of profitability. The ICT sector in Romania, one of the most dynamic in the last decade and the "winning sector" of the pandemic, operates with different levels of profitability depending on its two main components, Production and Services. At the same time, other disparities resulting from the characteristics of the business – size, personnel costs, productivity – are present. Our results show the high heterogeneity of profitability between firms in the ICT sector, but also the greater importance of the factors intrinsic to the firm compared to that of industry or location factors, which raises the question of whether this sector has incorporated into profitability the tax advantages it enjoys and how sustainable its performance will be once these advantages will diminish.

Keywords: Aggregate profitability (ROA), ICT sector, the firm-industry-localization triad, variance components methodology, Romania

JEL Classification: L23, L25, L86

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Introduction

Even before the pandemic, technological advances led to changes in production methods and employment patterns, which enhanced the ICT sector role as driver of competitiveness, particularly for knowledge-based economies. But the coronavirus crisis has brought into light the ubiquitous role that technology has nowadays in our lives and has provided societies with the opportunity of using Internet to connect and work at levels not seen before. The consequence at firm level is that businesses in the ICT sector have seen their activities increasing in importance, which transformed the sector into a "winner" of the pandemic, by evolution of the turnover, particularly when we contrast it against other sectors such as manufacturing, transportation, or HoReCa.

The ICT sector, which includes 11 industries at 3-digits NACE Rev.2, of which 5 come from Manufacturing and 6 from Services, had a share of 3.7% in the European Union's GDP at the end of 2018, for a total value added of over 479 billion euro and on a rise after 2009. An important feature of the ICT sector is the unequal contribution of its two main components to GDP and employment, accompanied by significant differences in firms' performance measured by labour productivity or profitability. Based on Eurostat data, firms in the manufacturing industries had a gross operating rate of 7% in 2018 compared to 16.5% for firms on the services industries, and their aggregate labour productivity was 17.3 thousand euros against 33.9 thousand euros (authors' calculations). This is a proof of overall movement of the global economy from products to services and nowhere is this more evident than in the ICT sector. On the other hand, we expect labour productivity to stall or grow slower or even stop growing, as marginal productivity in the long run tends to near zero.

In Romania, the ICT sector share in GDP increased from 3.12% in 2009 to 3.74% in 2018, but its share in employment was smaller (2.52% in 2018), although growing after 2009 (Eurostat). ICT sector's share in GDP placed Romania on the second to last position in CEE at the end of 2018 (after Poland), but before countries such as Italy, Spain, or Austria. A 2020 McKinsey report positioned Romania's digital economy growth between 2017 and 2019 on a higher level compared to the overall CEE countries' growth (11% per year against 8%) and estimated its size at 16.6 billion euros at the end of 2019 (Filip, et al., 2020). In the context, it is worth mentioning that a significant stimulus for the development of the ICT sector in Romania were the specific exemptions from salary taxes and certain social security contributions between 2011 and 2019, which were applied by almost 25% of the ICT sector, based on the number of employees.

Nonetheless, the ICT sector in Romania is still to reach its nadir. In this framework, our research proposes an investigation of the factors behind the profitability of Romanian firms in the ICT sector in the firm-industry-location nexus by the application of the variance components methodology.

The purpose of this research is to determine the relative importance of firm effects versus industry effects for describing the variation in profitability for non-diversified Romanian companies that activate in the ICT sector of the economy. Specifically, we aim at examining the relative importance of these two factors in the Romanian framework, but we complement this analysis by the introduction of the location factor as the development region in Romania where the firm is headquartered, which brings an additional element of originality to our research. Such an investigation is interesting and useful because there are significant

differences between the regions of Romania from the perspective of their level of development, which are prerequisites for differentiating the performance of companies coming from different regions. We consider both industry and location factors as potentially significant for profitability variation across firms since the ICT sector has benefited from fiscal support that aided its progress (applicable across the country, no differentiation), on the one hand, and, on the other hand, the unequal level of development of Romanian regions, also reflected in average wages, may represent an encouraging or, on the contrary, a hindering factor for profitability. Moreover, we add to this research structure the business size (scale) as a relevant discriminator for the firm-industry-location nexus. Like in any industry, early entrants earn a comparative advantage over subsequent entrants, due mostly to scale.

The paper is structured as follows: we present in the next section the main research directions relevant for the current study, then we formulate the research questions, followed by the description of methodology and data used. Further, we present the most important results and conclude, inclusively by extracting implications for business decisions and outlining directions for further research.

1. Literature review

Although the standard neoclassical model of perfect competition maintains that over- or under-profitability is quickly eroded by competitive actions, empirical approaches have shown that profit and profitability variation across firms across different industries, but even in the same industry, is the norm, rather the exception. Schmalensee (1985) and Rumelt (1991) are the two founding contributions that supported the research on firms' diversity in terms of profitability using the variance components methodology that we also adopt in this paper. They have opened the door to empirical analyses attempting to provide an answer to the driving factors behind differences in performance among firms competing in the same industry or sector, but also amid companies operating in different industries or sectors.

There are two main research directions that influenced the development of the literature in the field: the industrial organization framework and the resource-based view of the firm. The first path considers the industry structure as the main driver of firm profitability (Scherer and Ross, 1990; Porter, 1981; Porter, 1983), seeing product differentiation, entry barriers or competition as leading to companies' dissimilar performance, while the second direction focuses on the internal features of firms such that sustain its competitive advantages as profitability discriminators (Barney, 2001; Colbert, 2004; Acedo, Barroso and Galan, 2006). Over time, many contributions have supported this direction of research development by analyzing the multiple facets of the industrial structure at national or regional level. Cubbin (2013) made in his paper a very good presentation of the link between market structure and performance, as well as of the empirical evidence supporting this relationship, and, more recently, Drucker (2015) and Ellickson (2013) showed that the competitive structure of industries is very important for understanding the level and changes in employment rate, economic performance and industrial development, on the one hand, but also for the formulation of effective antitrust economic policies and the development of international trade. The second direction of research focuses on the internal characteristics of firms, which supports their competitive advantages as discriminators for

profitability (Barney, 2001; Colbert, 2004; Acedo, Barroso and Galan, 2006). Moreover, Wang and Ahmed (2007), along with Ambrosini and Bowman (2009) expanded the company's resource-focused vision and reinforced the concept of firm's "dynamic capabilities" as elements that complement this vision. These dynamic capabilities consider ways in which firms can permanently modify their resources over time to maintain their competitive advantages. In recent years, in the category of these dynamic capacities were introduced the R&D activity (Leiponen and Helfat, 2010), acquisitions (Karim and Mitchell, 2000), corporate social responsibility (Zhao et al., 2019) or absorption capacity (Senivongse et al., 2019).

Kessides (1990) proposes a reconciliation of the two approaches, in which both external conditions, such as the industrial structure, and the internal ones of the firm, are seen as influencing performance and differences in profitability between companies. Subsequently, the existing literature has shown that both industry-related and firm-related characteristics are significant differentiators for firms' performance, generally with a greater contribution of firm-specific effects (McGahan and Porter, 2002; Ruefli and Wiggins, 2003; Chaddad and Mondelli, 2013; Hirsch, 2018). Furthermore, the company attributes generally identified to make a greater contribution to performance variability (Claver et al., 2002; Chaddad and Mondelli, 2013; Hirsch and Schiefer, 2016; Perveen et al., 2020) seem to play an even greater role in times of adversity, such as recessions and economic crises (Garcia-Sanchez et al., 2014; Bamiatzi et al., 2016; Spitsin et al., 2020). On the other hand, the relative importance of of firm versus industry characteristics changes depending on the way the industry is defined, narrower or wider – Claver et al. (2002) shows that the ratio of firm to industry effect decreases as the definition of industry is narrowed, a result subsequently confirmed by Goddard et al. (2009), Nanda and Panda (2018) or Fernandez et al. (2019), to mention just a few studies. Also, the size of the firm also plays a role from the perspective of the relative influence of the effects of firm versus industry on performance, the studies that have addressed this feature demonstrating, in general, that profitability is positively correlated with the size of the firm, but also with other characteristics of the board of directors (Lee, 2009; Müller et al., 2014; Isik et al., 2017; Fernández et al., 2019; Hemza, 2020).

Certainly, the performance of a company is influenced by many attributes, and the global economy and the expansion of the value chains of multinational companies have brought to the fore the importance of the country and / or the region in which firms operate. Thus, an interesting addition to the industry-firm model is represented by the effects of the country or region, in the form of institutional design, legal differences or economic structure, which can influence the strategies and profitability of firms (Tong et al., 2008; Ma et al., 2013; Tartavulea, 2015; Li et al., 2018). Thus, countries with more imperfect markets would offer firms greater opportunities to make high profits, even at the expense of the economic development of those countries (Goldszmidt et al., 2011). On the other hand, Ghemawat (2003) supports the idea of firms' dependences on the economic environment of the country of origin, and not of the host ones, if we refer to the subsidiaries of multinational companies, and emphasizes that the phenomenon of globalization does not have a major impact on national borders in terms of business performance. However, although weakened by globalization, these localization-related effects will remain significant as factors of variation in profitability between firms, especially when comparing economies at different stages of development (Peng et al., 2008). This result is confirmed by Makris et al. (2021) which study the attributes behind the performance and growth of listed companies in France in a period of recession and shows that their internationalization based on the

exploitation of host countries characteristics has played a crucial role in their increased profitability, jointly with their size and financial health.

To our knowledge, Romania has received little attention in the literature investigating the differentiators of firms' profitability - among the exceptions are the studies of Stavropoulos and Skuras (2016) on 410,000 companies in 15 EU Member States, of Botoc and Anton (2017) linking profitability to the management of working capital, of Lazarus (2016) who addresses the performance of publicly traded companies using panel methodology, or Salah (2018) which explores the variability of ROA for 4095 publicly traded companies in 54 countries between 2014 and 2016. Our research is the pioneer of this methodological approach, analyzing a small area of the Romanian economic environment, namely companies in the ICT sector, but offering a valuable perspective on the profitability of a very dynamic sector in the last decade, whose potential for progress in the post-pandemic world is significant. In this context, it is worth mentioning a recent report by McKinsey, which estimated the growth of the digital economy in Central and Eastern Europe at 14% in the first half of 2020, which represents 78% of the growth for the entire year 2019, respectively 5.3 billion euro (Izkowska, 2020). Moreover, another McKinsey report in 2020 positioned the growth of Romania's digital economy between 2017 and 2019 at a higher level compared to the global growth of CEE countries (11% per year compared to 8%) and estimated its size at 16.6 billion euros at the end of 2019 (Filip et. al., 2020).

2. Research Methods

Our analysis is based on the variance components methodology, which uses the ANCOVA analysis (covariance analysis), a combination of traditional ANOVA (variance analysis) and regression that tests, in the case of a linear model, the effect of one or more independent and categorical variables on a continuous dependent variable, independent of the effect of other continuous variables. Thus, this methodology estimates the importance of the variance that can be attributed to the main effect of a categorical variable, but also the importance attributed to the interactions of that variable with other categorical variables.

Starting from the analysis of the literature and the study of the profitability evolution of companies in the ICT sector in recent years, we have formulated three hypotheses that have been tested in our research, as follows:

- H1: Firm, industry and location effects are significant factors for profitability in the Romanian ICT sector;
- H2: Firm effects are more important than industry and location effects in explaining profitability variance in the ICT sector;
- H3: Firm size is relevant for the contribution of firm, industry and location effects to profitability variance in the ICT sector.

To test these assumptions, we estimated a business profitability model that includes both continuous variables (firm effects) and categorical variables (industry and region effects). Therefore, we estimated the following model:

$$Y_{i,t} = \alpha_0 + \beta_1 R_{i,t0..t-1} + \beta_2 I_i + \beta_3 L_i + \beta_2 I_i L_i + \varepsilon_i \quad (1)$$

where $Y_{i,t}$ is ROA in 2019 for company *i*, I_i is a categorical variable that designates the industry where the firm operates and takes values between 1 to 4 (1-digit), 1 to 7 (2-digit), 1 to 13 (3-digit) and 1 to 21 (4-digit), and L_i is another categorical variable that represents the region where company i has its headquarters (values from 1 to 8). $R_{i,t0..t-1}$ is the cumulative ROA over the 2011-2018 period, calculated in a similar manner to a holding period return over the timeframe:

$$R_{i,t0..t-1} = (1 + R_{i,t0})(1 + R_{i,t1})(1 + R_{i,t-1}) - 1 \quad (2)$$

In terms of regions, we have used the eight Romanian development regions or divisions created in 1998 with the aim of an improved coordination of the country's regional development, as follows: Bucharest-Ilfov, North-West, West, South-Muntenia, North-East, Centre, South-West, and South-East. I_iL_i is the interaction between industry and region or location effects, and ε_i is the error term. The coefficients have been estimated using an ANCOVA model with type III sum of squares, where the independent variables are the cumulative ROA between 2011 and 2018 that is considered a covariate and average industry and region ROA between 2011 and 2018 as fixed effects. Our model and methodology do not identify causal relationships between the variables included in the model, but the relative importance of each effect in the total ROA variance at firm level, which shows what is the variability in ROA determined by that specific effect. The model assumes that effects are independent from each other, therefore the variance in ROA equals the sum of the variances of each factor or effect (to the right of Equation 1).

Besides the base-case model, we also estimate ROA variance components by varying the number of digits in the NACE codes, thus testing the sensitivity of the estimates to how the industry is defined (more largely versus more restrictive). Moreover, we also make assessments on variance components depending on firm size, after dividing firms in three main categories – large, medium and small – considering their mean turnover between 2011 and 2019.

Data on Romanian companies in the ICT sector was collected from the ORBIS – TP Catalyst database with annual frequency between 2011 and 2019 (9 years). For each company we obtained information on ROA, as profitability measure, like other research (Claver, Molina and Tarí, 2002; Eriksen and Knudsen, 2003; Yazdanfar, 2013), as well as on its NACE code (from 2 to 4-digit) and postal address, which was used to assign the company to one of the eight development regions in the country. The companies included in the ICT sector are originating, according to the European Commission and Eurostat, from the following 11 industries (defined at 2 or 3-digits NACE Rev.2 codes): Manufacture of electronic components and boards (26.1), Manufacture of computers and peripheral equipment (26.2), Manufacture of communication equipment (26.3), Manufacture of consumer electronics (26.4), and Manufacture of magnetic and optical media (26.8); and ICT Services – which includes 6 industry codes (2 or 3-digits NACE Rev.2): Wholesale of information and communication equipment (46.5), Software publishing (58.2), Telecommunications (61), Computer programming, consultancy and related activities (62), Data processing, hosting and related activities; web portals (63.1), and Repair of computers and communication equipment (95.1). Of these, industries 26.1, 26.2, 26.3, 26.4 and 26.8 are included in Manufacturing and the others are part of the Services domain. The companies included in the sample are very large, large and medium in terms of number of employees.

The initial selection included 1971 companies, but after restricting the sample to full data requirements between 2011 and 2019 the final sample consisted of 1,086 companies and 9.774 observations – see Table 1. By reference to the number of companies in the ICT sector indicated by the National Institute of Statistics (NIS) in the Tempo Online database for 2019, namely 2,917 (companies with an average number of employees of at least 10), our sample represents 37.23%. In the case of turnover, our sample represents 71.7% of the turnover of companies in the ICT sector indicated by the NIS for companies with at least 10 employees in 2019 – for the calculation of the percentage we used the average exchange rate of the National Bank of Romania of 4.7452 lei / euro, considering the need to convert the turnover from euro, from the Orbis database, into lei). Specifically, the turnover of the companies in our sample was of 60,538 million lei, while the total turnover of the companies in the ICT sector identified by NIS was 84,403 million lei. As for the distribution of the sample on the two major sectors, Manufacturing and Services, it represents 60.8% of the number of companies in Manufacturing and 36.0% in Services, as well as 89.18% of the turnover in Manufacturing and 69.59% in Services.

Table no. 1. Sample description

Number of industries (NACE)	2-digit		3-digit		4-digit	
	7		13		21	
ROA 2011-2019 (%)	Mean	Minimum	Maximum	Standard deviation	Skewness	Kurtosis
	17.195	-31.570	78.621	15.939	0.977	1.352

3. Results and discussion

Aggregate profitability or Return on assets (ROA) has been chosen as a profitability measure in our study due to its cumulative consideration of both operational profitability and assets use efficiency, as evidenced in the DuPont model (Mangiero, 2004). The mean and standard deviation of ROA for each year and for cumulative ROA between 2011 and 2019, jointly with correlation coefficients between them, are shown in Table 2.

Table no. 2. Sample descriptive statistics

Variable	Median	S.D.	Correlations									
			ROA 2011-2019	ROA 2011	ROA 2012	ROA 2013	ROA 2014	ROA 2015	ROA 2016	ROA 2017	ROA 2018	ROA 2019
ROA 2011-2019	197.28	1686.51	1.00									
ROA 2011	12.20	25.10	0.46	1.00								
ROA 2012	11.63	23.62	0.55	0.53	1.00							
ROA 2013	10.23	22.04	0.60	0.35	0.53	1.00						
ROA 2014	11.91	22.15	0.59	0.33	0.49	0.60	1.00					
ROA 2015	13.72	22.39	0.59	0.32	0.42	0.47	0.52	1.00				
ROA 2016	12.95	24.29	0.60	0.28	0.33	0.41	0.45	0.62	1.00			
ROA 2017	12.80	22.82	0.57	0.27	0.29	0.37	0.42	0.51	0.67	1.00		
ROA 2018	14.17	21.23	0.50	0.26	0.25	0.32	0.35	0.47	0.54	0.65	1.00	
ROA 2019	13.09	21.43	0.47	0.23	0.29	0.35	0.34	0.42	0.50	0.59	0.65	1.00

Note: All correlations are statistically significant at 5% level.

Median ROA between 2011 and 2019 shows a somewhat growing trend, albeit marked by fluctuations from one year to another. At the same time, cumulative ROA has increased

every year, indicating that companies in the ICT sector have enjoyed solid returns over time, driven by higher demand and, undoubtfully, fiscal facilities. The higher standard deviation of cumulative ROA between 2011 and 2019 compared to annual ROA additionally shows a decline in the systematic effect, as this cumulative effect considers many years. Correlations between annual ROA and cumulative ROA are all positive, ranging between 0.26 and 0.67, which suggests the presence of a systematic effect for the differences in individual firms' performance, that is stable over time. Correlations tend to decrease when they span over a higher number of years, but they remain at quite high levels, which supports the presence of a lasting effect in ROA variation across individual firms.

The presence of this systematic or permanent effect is also illustrated by the upward trend of the simple moving averages of ROA between 2011-2019. Figure 1 shows these moving averages with different periods (2 and 3 years) compared to simple ROA. The ROA trend in the Romanian ICT sector is observable both in the case of the 2-years moving average, and especially in the case of the one with a period of 3 years.

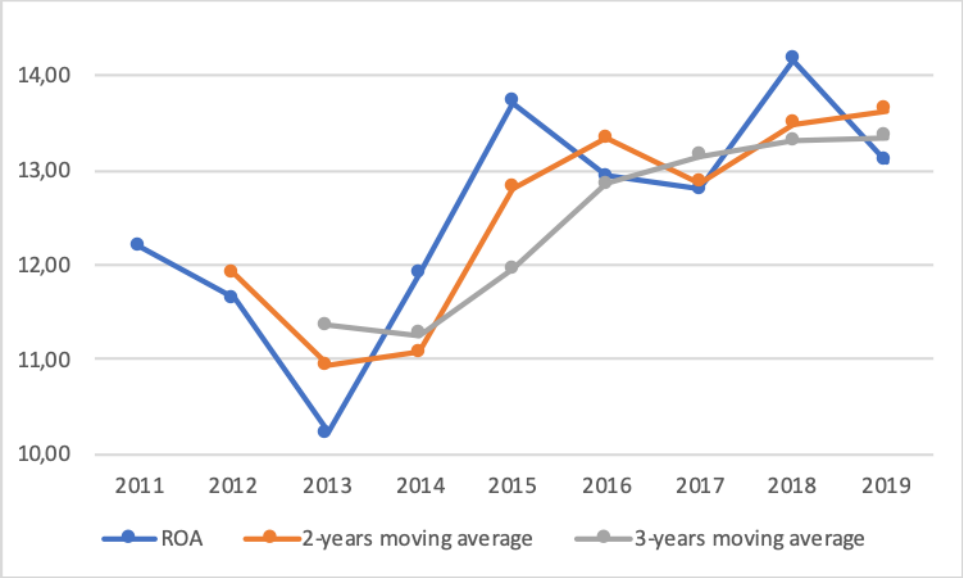

Figure no. 1. Trends in ROA evolution, 2011-2019

Table 3 presents the 1,086 firms in our sample distributed according to their NACE 2-digit industry (left side) and development region (right side) and the corresponding ROA for 2019. Mean ROA varied between 6.68% in C26 - Manufacture of computer, electronic and optical products – and 22.65% – Computer programming, consultancy and related activities-, and between 13.96% in South-Muntenia and North-East, and 25.63% in North-West regions. All mean ROA are higher than median ROA, thus suggesting the presence of companies with significantly better performance in each industry and region. ROA means are statistically significantly difference between themselves at 5% level for all NACE industry definitions and regions (ANOVA).

Table no. 3. Firms' distribution in industries and regions based on ROA, 2019

NACE 2-digit	Mean	Median	SD	Number	Region	Mean	Median	SD	Number
J61	10.249	5.867	18.527	120	Bucharest-Ilfov	16.320	12.062	21.492	531
G46	13.478	10.926	12.480	191	North-West	25.631	22.056	21.303	158
C26	6.681	6.003	19.116	87	West	13.956	12.483	16.413	93
J62	22.655	17.342	22.748	514	South-Muntenia	13.956	7.926	24.888	43
J58	18.235	15.687	21.958	70	North-East	20.973	15.623	20.961	80
J63	20.153	20.141	28.188	61	Centre	15.008	11.972	20.618	111
S95	13.165	12.096	19.344	43	South-West	13.033	10.559	23.941	40
All	17.589	13.088	21.435	1086	South-East	20.777	17.832	20.480	30
					All	17.589	13.088	21.435	1086

The results of the variance components analysis are reported in Table 4, for different levels of industry definition – from 2-digit to 4-digit, which allows us to see whether the latter is relevant for variance components.

Table no. 4. Variance components results

	NACE 2-digit		NACE-3 digit		NACE 4-digit	
Variable	**Estimate**	**Percent**	**Estimate**	**Percent**	**Estimate**	**Percent**
Firm	64069.9*	12.85	62178.0*	12.47	55116.2*	11.06
Industry	7927.4*	1.59	10780.2*	2.16	11351.5*	2.28
Region	7445.3*	1.49	4985.4	1.00	6960.1*	1.40
Industry x Region	13105.8	2.63	18454.6	3.70	33021.5	6.62
Error	373366.4	74.90	366419.9	73.50	345096.9	69.23
Total	498504.1	100.00	498504.1	100.00	498504.1	100.00
Ratios						
Firm - Industry		8.08		5.77		4.86
Firm - Region		8.61		12.47		7.92
Industry - Region		1.06		2.16		1.63

Note: * denotes statistical significance at 5% level.

Although the largest part of ROA variance is due to error terms (or disturbances that need to be further explored), firm effects are the most important regardless of the industry definition, and statistically significant at 5% level. The ratio between firm effect and industry effect is 8.08 for 3-digit NACE, but only 5.77 for 3-digit and 4.86 for 4-digit NACE, suggesting an increased importance of the industry effect over the firm effect when the industry is defined in a narrower manner. Moreover, the industry effect is statistically significant for all industry definitions and, although its importance is smaller compared to firm effect, our results point towards the presence of advantages generated for individual firms belonging to market niches. *Thus, we validate the H1 and H2 hypotheses regarding the importance of firms, industry and location effects for the variation of profitability among ICT companies in Romania, but also regarding the higher relevance of firm effects compared to industry effects. Moreover, our research confirms the previous results of McGahan and Porter (2002), Ruefli and Wiggins (2003), Chaddad and Mondelli (2013) or Fernández et al. (2019).*

In the case of location or region effects, they are statistically significant in the 2-digit and 4-digit NACE industry definition, indicating that the region where the company operates may contribute to business returns and performance. Certainly, the region-related variance

component is small, but not very far from the industry component, which advises that, for Romanian ICT companies, both industry and region are important for returns. The presence of regional or location effects revealed by our findings comes as a minor surprise, given than Goldszmidt, Brito and de Vasconcelos (2011) argued that country effects had greater impact on firm performance in emerging markets compared to the case of developed economies. However, specific research has been less undertaken on the importance of within-country regions for firm performance; hence, our paper fills a significant research gap from this perspective.

Furthermore, the high number of companies included in our sample form the basis of a study on how firm, industry and region effects interact depending on firm size. We divided firms in three equal categories based on mean turnover between 2011-2019, as follows: large firms had turnover between 2,695 and 1,067,714 thousand euros, medium firms had turnover between 972 and 2,691 thousand euros, and small firms had turnover between 4.3 and 971 thousand euros. Table 5 shows the ROA variance components for 4-digit NACE depending on firm size.

Table no. 5. Variance components results by firm size

Variable	Large firms		Medium firms		Small firms	
	Estimate	**Percent**	**Estimate**	**Percent**	**Estimate**	**Percent**
Firm	7359.7*	7.07%	22976.0*	14.42%	14716.7*	6.72%
Industry	5370.6	5.16%	8851.0	5.56%	14357.0	6.55%
Region	3934.4*	3.78%	2448.8	1.54%	5671.6	2.59%
Industry x Region	18853.7*	18.11%	19535.2	12.26%	27707.1	12.64%
Error	55810.6	53.61%	88004.4	55.25%	136226.5	62.17%
Total	104097.1	100.00%	159294.1	100.00%	219121.3	100.00%
Ratios						
Firm - Industry		1.37		2.60		1.03
Firm - Region		1.87		9.38		2.59
Industry - Region		1.37		3.61		2.53

Note: * denotes statistical significance at 5% level.

Although we report here only the results for this industry definition, they are very similar when the other two definitions are considered. Again, as for the overall sample, the firm effect is statistically significant and larger than the industry or region effects, but once size is considered the relative importance of these effects changes dramatically. Thus, for large companies the ratio between firm and industry effects is only 1.37, for medium firms is 2.60 and for small firms is 1.03, compared to 4.86 at sample level. Similar results are found for the firm to region ratios. *These findings support the importance of firm size when investigating the effects of the firm, industry and location, and confirm the H3 hypothesis regarding the relevance of the firm's size for the contribution of firm, industry and localization effects to the variation of profitability in the ICT sector in Romania. Thus, we confirm the results obtained by Bamiatzi et al. (2016), Fernández et al. (2019), or López-López et al. (2021).* Another interesting result is the lack of statistical significance of industry effects, regardless of firm size, but the statistically significant region effect and of the interaction between industry and region for large companies. From here we may imply that industry effects may act as catalysers for region effect in the case of large companies, thus substantiating ROA variance. This may be evidence of "clusterisation" of the ICT industry. Without meaning to exaggerate, the "Silicon Valley effect" might just work at a

smaller scale when looking at the region effect in case of large companies. Incumbents attract new entrants where a labour market has already been created thus providing a competitive advantage in terms of workforce.

Conclusions

Our study analyzed the factors that can explain the differences in performance, more specifically profitability, in the ICT sector in Romania and hypothesized that, in addition to the factors specific to the company, there are significant effects of the industry on ROA at company level. This was confirmed by ANCOVA methodology by which we analysed ROA statistically significant differences based on industry segment (NACE code 2-digit, 3-digit and 4-digit respectively). Thus, our research has shown that, although the ratio of firm and industry effects varies between 4.86 and 8.08 depending on its broader or narrower definition, industry effects are statistically significant in terms of their influence on the variation in the profitability of firms in the ICT sector. Therefore, the market niche in which firms operate influences their profitability and will continue to do so as firms in the ICT industry in Romania, at least in the service sector, appear to be far from the near-zero marginal growth which characterises the services industry worldwide. With an estimated increased turnover in the ICT industry in 2020, in a pandemic year, at a relatively constant short-term cost base, we expect the conclusions of our study to hold true, albeit with (perhaps significantly so) higher ROA levels. The later implication is driven by the position gained by the ICT sector as a "pandemic winner", which we expect to be consolidated in the next years.

The second large inference of our study is that there appears to be a "regionalisation" in the ICT industry, in the sense that large firms set-up within certain regions appear to be faring well above the average industry ROA, and the location effects are indicated as statistically significant by our methodology, along with those of the industry, and even close in value – the ratio between them varies between 1.06 and 2.16 depending on the definition of the industry, with an edge for the effects of industry. This may be the effect of two converging factors: (i) Clustering - according to this logic, there may be a small Silicon Valley in each country; in particular, in Romania, there seem to be regions where the current advantage attracts other competitors, who can benefit from the already existing knowledge and specialization of employees, such as the North-West region and its main city, Cluj-Napoca, but also the Bucharest-Ilfov region and, growing in importance, the Central region (Brasov and Sibiu as important cities), West region (with Timisoara as the main center) and North-East region (with Iasi as a central point); (ii) Scale effect – large companies in the ICT sector show above average ROA compared to medium sized and small sized companies (authors' classification). Large companies also compound better the benefits of the fiscal incentives over the period 2011-2019. We expect these factors to have compound effects for the industry in 2020, where demand for ICT products and services increased significantly, but this could be the subject of a follow-up study.

Other factors may also explain differences between profitability of companies based on regions (e.g., availability of graduate workforce, export-intensity etc.), which may be subject to further refinement of this research. The analysis of the services sector of the ICT industry based on indicators other than ROA, to mirror the low-capital intensity of the sector may also be subject to adjacent research.

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