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DOES INNOVATION LEAD TO GROWTH? AN SDG FOR COMPANIES IN THE BLACK SEA MARKETS BEFORE AND AFTER COVID-19

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Abstract
Based on the agenda 2030 for a healthier, safer and more prosperous world, were 17 sustainable development goals (SDGs) were proposed pertinent to economic, social and environmental aspects. One of these goals, namely number 8, is about "promoting sustained, inclusive and sustainable economic growth". One of the factors promoting economic growth is innovation for the economy as a whole and for individual corporations. During the last decades, the economy in most of the developed countries has been transformed from a production to a knowledge economy. Expenditure for research and development (R&D) and company intangible assets serve as a proxy for innovation for the companies considered. Therefore, the existence of intangible assets in a company indicates that it pursues a level of innovation; furthermore, the higher the innovation, the more competitive advantages for the company and the higher its potential for survival and growth in future globalized markets. Our objective in this paper is to examine the research question, i.e., whether the existence of more innovation proxied by intangible assets or/and by R&D investment undertaken by a company leads to increasing market value, better performance, and future growth in the years before and after the COVID-19 pandemic. This study focuses on companies of Black Sea countries: Bulgaria, Georgia, Romania, Russia, Turkey, and Ukraine. From a preliminary examination of data obtained from the Thomson EIKON database, we found that research and development expenses are not reported in the case of most Bulgarian and Russian companies and only very few of Romanian and Turkish companies prepare such reports, while there are no data at all for the listed companies of the Georgian and Ukrainian markets. Hence, we limit our investigation to the three out of the six markets, specifically to the Balkan area countries, i.e., the companies listed in the stock markets of Bulgaria, Romania, and Turkey. For the examination of testable hypotheses, we use correlation and regression analysis. Results will shed more light on this issue and will help practitioners plan their strategy, accordingly; moreover, scholars will learn more about this intricate relationship, especially in the framework of developing economies.

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Keywords: R&D Investment, Firm Performance, Value, Growth

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1. Introduction

Based on the agenda 2030 for a healthier, 17 sustainable development goals (SDGs) with economic, social, and environmental aspects for a safer and more prosperous world, were proposed. One of these goals, namely, number 8, is about "promoting sustained, inclusive and sustainable economic growth". One of the factors promoting economic growth is innovation for the economy, as a whole, and for individual corporations.

During the last decades, the economy in most of the developed countries has been transformed from a production to a knowledge economy. Griliches (1984), Sher and Yang (2005) and Cho and Pucik (2005) that have undertaken some of the studies using expenditure in research and development (R&D) and the intangible assets as a proxy for innovation for the companies studied. Intangible assets are immaterial assets not reported in balance sheet in the past, which are now reported and provide knowledge and information and inspire creativity and inventions comprising the intellectual or knowledge capital of the company.

Idris (2003) stated that intellectual property assets are a "power tool" for economic growth not yet exploited to its maximum limit. There are several definitions for intellectual property or intellectual capital in pertinent literature [Sitar and Vasic (2004)]. In general, the two terms are used interchangeably. Therefore, the existence of intangible assets in a company indicates that it pursues a level of innovation. Hence, the higher the innovation of a company, the more its competitive advantages and the higher its potential for survival and growth in future globalized markets. As firms use and exploit their knowledge resources and their intellectual capital, they build strong competitive advantages (Stewart, 1997; Teece *et al.* 1997; Teece, 2006).

Mauboussin and Kawaja (1999) found that the value of a company is the present value of all future free cash flows it will generate. Therefore, if a company has more innovation, this implies that it has more intangible assets and R&D investment (expenditure), which should bring higher company value and higher future cash flows.

Our objective in this paper is to examine the research question, i.e., whether the existence of more innovation proxied by intangible assets or/and by R&D investment in a company leads to increasing market value, better performance, and future growth in the years before and after the COVID-19 pandemic. This study focuses on companies of Black Sea countries, namely: Bulgaria, Georgia, Romania, Russia, Turkey, and Ukraine. From a preliminary examination of data which is from the Thomson EIKON database, we found that research and development expenses are not reported by most Bulgarian and Russian companies and are reported by very few Romanian and Turkish ones; furthermore, there are no data at all for companies listed in the Georgian and Ukrainian markets. Hence, we limit our investigation to the three out of the six markets, specifically to the Balkan Black Sea countries, i.e., companies listed in the stock markets of Bulgaria, Romania, and Turkey. For the

examination of the testable hypotheses, we use correlation and regression analyses. Results will shed more light on this issue and will help managers of these companies interested in innovation to plan their strategies accordingly and scholars to learn more about this intricate relationship, especially in the framework of developing economies.

The rest of the study is organized as follows: the next section briefly presents some pertinent tax and accounting laws and the relevant literature review. The third section contains the data, the methodology and the testable hypotheses. The fourth section depicts and analyses our empirical results, and the final section contains a summary and offers future research ideas.

2. Tax and Accounting Laws Regarding R&D Expenditure Literature Review

The concept of research and development (R&D) contains the various activities a company is involved realized so as to a) create new products, processes or services products comprise formulas, inventions, pilot models, computer software and techniques; b) discover solutions for problems and/or c) improve existing products or services [OECD (2002)]. Intangible assets can be defined as business assets that have no physical form and are distinguished in two types: those purchased and those internally generated. If a company has its own R&D department, it incurs relevant expenses and, if research results concerning specific products/solutions lead to intellectual property or intellectual capital, such as patents or copyrights, etc., future probable economic benefits will be created for the enterprise. There are national and international laws stipulating different accounting for R&D expenses and intangibles, such as the International Financial Reporting Standards (IFRS) and the US-GAAP. Purchased intangibles are treated similarly to tangible assets, whereby the purchase price is capitalized. On the other hand, internally generated intangibles are treated differently from country to country. R&D expenditure in some countries is treated similar to intangible assets generated internally. There are national laws on the accounting of R&D expenses as well as the international Financial Reporting Standards (IFRS) and the US-GAAP.

There is a wealth of literature concerning innovation as expressed by investment in R&D and by intangible assets related to firm value and firm performance. Most studies have revealed a positive correlation between innovation and performance. However, some researchers found that there is no linear relationship between the variables mentioned above and some studies have indicated a negative relationship.

We examine this relation as early as 1984, when Grilishes and Mairesse (1984), using a sample of 133 large U.S. firms for the period 1966 to 1977, analyzed the relationship between output, employment, and physical and R&D capital. They found a strong positive relationship between firm productivity and the level of its R&D investment. Johnson and Pazderka (1993), studying a sample of Canadian

companies listed in Toronto stock exchange, showed a positive, statistically significant relationship between R&D expenditure and firm market value. These results implied that "investment in R&D is a rational allocation of resources".

Mairesse and Hall (1996) compared the contribution of R&D expenses to a firm's productivity for the French and US manufacturing companies in the 1980s and found that the contribution of R&D expenses to sales productivity growth declined during the 1980s, and this decline was higher for US firms than for French ones. Lev and Sougiannis (1996) found a positive relation between US company R&D capital and stock returns. This implied that either R&D-intensive firms were systematically mispriced by the market, or investors required compensation for the extra-market risk associated with R&D investment. Later, Ho, Keh, and Ong (2005), studying a sample of USA companies, examined the relationship between firm performance and the intensity of their investment in R&D and advertising expenses for 40 years from 1962 to 2001. These researchers found that investment in R&D had a positive effect on the one-year stock market performance for manufacturing companies but not for non-manufacturing ones. Lin and Chen (2005), focusing on 78 US technology companies, found that large firms have more advantages for technological innovation due to better exploitation of synergy effects of their technology portfolios, compared to smaller companies. Warusawitharana (2015), investigating a sample of non-financial USA companies, found that R&D expenditure had an economically and statistically significant impact on profits and firm value. VanderPal (2015) investigated the R&D impact on company value for a sample of 103 US listed companies for the 1979 to 2013 period. His results indicated a positive relationship between R&D expenses and equity; he also found a positive relationship between revenue and ~~the~~ ROA and a negative relationship between revenue and ROE.

Abrahams and Sidhu (1998), studying a sample of Australian companies, indicated that capitalized R&D on balance sheets had a significant positive information effect on firms' value (stock prices).

In Asia, Sher and Yang (2005), looking into the Taiwanese integrated circuit (IC) industry, found that higher R&D intensity and higher R&D manpower were positively related to firm performance, as measured by the return-on-assets ratio (ROA). Zhu and Huang (2012), focusing on the Chinese listed information technology (IT) companies, found that R&D expenditure had a positive effect on the firm's performance, but lagged for one year. Ghaffar and Khan (2014), investigating the pharmaceutical industry companies of Pakistan, found the relationship between research and development and firm performance to be positive. Jaisinghani (2016), reporting on a sample of Indian companies in the pharmaceutical sector for the period 2005-2014, found that there was a positive relationship between R&D intensity and performance, with performance being proxied by two measures of profitability, namely, the ratios return-on-assets and return-on-sales. Wang *et al.* (2017) found that R&D investments create additional value for

companies under study when there are interactions with IT investment in several industry sectors for China. Chen *et al*. (2019) examined this matter in relation to Taiwanese semiconductor industry companies and found that R&D investment had a positive and one-year lagged effect on companies' performance. Firm size was also significant in that it positively affected business performance. More recently, Tung *et al*. (2021), studying listed companies of the developing economy of Vietnam for the 2010-2018 period, found that R&D expenditure/investment had positive effects on revenues, profits, return on assets (ROA) and return on equity (ROE). In addition, their results suggested that companies with high R&D investment outperform those with low R&D, in terms of profit, revenue and ROA.

In Europe, Greenhalgh and Rogers (2006) found that companies filing for patents with the European patent office had, on average, higher R&D expenditure and this led to higher company value compared to cases filed with the UK patent office. Harhoff (2006) found that, since the early 1980s, patent rights as a type of innovation have become important resources for companies to build and maintain their value. Beld (2014), looking into a sample of publicly listed firms in Belgium, Luxembourg, and the Netherlands, found that return on assets (ROA) was positively affected by research and development (R&D) expenditure. Regarding the European markets, Almeida *et al*. (2019), based on the EU Industrial R&D Investment Scoreboard for the 2003–2013 period, found that R&D investment positively influenced a firm's performance measured by sales and operating profit. Dimitropoulos (2020) examined the impact of intangibles on financial performance by examining the impact of R&D investment on the profitability of Greek firms, especially during the sovereign debt crisis for the 2003-2016 period. He used panel regression analysis and results indicated that R&D investment and expenses negatively affected sample firmprofitability before the crisis, while, during the crisis from 2011 to 2016, the companies that managed to sustain or increase their R&D investments improved their profitability. This finding is important because it indicated that during a period of scarcity of external financing and financial uncertainty, R&D investment could be a vital tool for the sustainability and growth of companies.

Regarding the market of Turkey, Bouaziz (2016), studying the BIST technology index companies in Istanbul Stock Exchange, examined the impact of R&D expenses on firm performance for the 2010-2014 period. The author employed the/a pooled regression model and the/a cross-sectional time series analysis technique and concluded that there is no correlation between R&D expenses and firm performance. Yildirim (2020), looking into a sample of 138 companies listed in the Istanbul Stock Exchange during the 2007 to 2018 period, examined the impact of R&D investment on firm value in different groups of firms. These groups were classified according to their R&D investment level, company size and risk. His results revealed that R&D investment had a positive effect on firm value. However, the effect of R&D investment was significant and positive in the group of companies

of a high R&D investment level, while for the group of companies with a low level of R&D investment there was no meaningful relationship. In terms of size, results showed that the impact of R&D investment on firm value for small firms was positive, while it was negative for large firms. In terms of riskiness for the subsample of low-risk companies, R&D investment affected firm value positively, while for high-risk companies there was no significant effect on firm value.

Regarding the market of Romania, Diaconu (2018) showed that the main weaknesses in business innovation in Romania over time consisted of the extremely low share of innovative firms, a low level of business innovation expenditure and high volatility of innovation performance based on creative effort resulting from R&D activities still concentrated in a few industries.

Fábio de Oliveira and Ferreira da Silva (2018) investigated whether internal and external R&D expenses had any impact on innovation development and whether the latter had any effect on the financial performance of a sample of European manufacturing firms. Among the countries selected were Bulgaria and Romania, forming one group out of the seven examined. The authors' results indicated that R&D that affected innovation performance did not influence financial performance for the Balkan countries of Bulgaria and Romania, while it had a positive impact on financial performance for Portugal and Spain (group 3), as well as for Estonia and Lithuania (group 4).

Regarding the market of Bulgaria, Georgieva (2019) indicated that, when national accounting standards are applied, Bulgarian innovative enterprises do not publish any R&D information. She revealed that Bulgarian enterprises do not develop high technological innovations but mainly focus on developing incremental products and processes. So, under the current global technological development, if innovative enterprises do not disclose mandatory R&D information, the accuracy of the data reported in their financial statements might be questioned. This cannot be interpreted as a good and positive sign by investors and could lead to bigger lack of investment, which, as noted, is an essential part of budgets for research and development by Bulgarian companies.

Therefore, since there are few studies on Bulgaria and Romania regarding this issue and a few more for Turkey, this study that examines these three markets will shed more light on the matter.

3. Data, Testable Hypotheses and Methodology

3.1 Data and Variables

This study focuses on firms in the three Black Sea countries of the Balkan peninsula. Turkey is a growing emerging economy, while Bulgaria and Romania are former communistic economies or transition economies and, therefore, moderate or modest innovators in Europe and globally.

Our sample comprises all companies listed in the stock markets of Turkey (the Borsa Istanbul in Istanbul), Bulgaria (the Bulgarian Stock Exchange in Sofia), and Romania (the Bucharest Stock Exchange (BVB) in Bucharest). The initial sample consisted of 398 firms in Turkey, 261 firms in Bulgaria and 354 firms in Romania; in other words, there were a total of 1013 companies in the initial sample. All data were collected from the Thomson EIKON database. The period examined extends from 2000 to 2020. The year 2020 is the year of the global health crisis of the COVID-19 pandemic, which has caused a severe negative economic impact to all markets and companies around the world. Therefore, we tested our hypotheses three times. Once for the entire time period; the second time we excluded the year 2020, in order to avoid contamination of our results by this crisis. Hence, we examined the same hypotheses for two subperiods: the first one from 2000 to 2019 (before the COVID-19 crisis) and for the year 2020 (the COVID-19 year). We did not have the necessary financial statement information for all the years for all the companies, so some cases/companies with missing data were excluded. The final sample consists of 377 Turkish firms, 221 Bulgarian firms and 147 Romanian firms. Hence, there were a total of 746 firms in the final sample.

We used the market value of equity as a proxy for firm value based on Warusawitharana (2015); the R&D expenses following VanderPal (2015) and Dimitropoulos (2020) and the ratio of R&D divided by sales for size adjustment according to Ho *et al*. (2005) and Jaisinghani (2016) as the first proxy for firm innovation investment; intangible assets and the ratio of intangible assets divided by total assets as the second proxy for firm innovation investment according to Bolek and Lyroudi (2017); return on assets (ROA) and return on equity (ROE) as the two proxies for company performance according to VanderPal (2015). Finally, as a control variable, we used company size as measured by the logarithm of total assets, following Richard *et al*. (1991) and Kumar and Warne (2009), since size is commonly used in empirical corporate finance research testing for a "size effect" [Rajan and Zingales (1995); Frank and Goyal (2003); Moeller, Schlingemann, and Stulz (2004); Klapper and Love (2004); Shubita and Alsawalhah (2012); Vijh and Yang (2013); Dang *et al*. (2013); Gabaix, Landier, and Sauvagnat (2014)]. Hence, we also tried to test for a "size effect". Based on Asimakopoulos *et al*. (2009) and Lee (2009) and others, larger companies perform better because they have access to more financial resources, incur lower financial costs and make better bargain deals, being able to take advantage of scale economies.

Regarding the profitability ratios that measure company performance, we follow the terms/stipulations of Jose *et al*. (1996), since we have companies from different countries and different taxation systems. Therefore, instead of earnings after taxes in the numerator for both ratios as is the classical approach, we use the ratio of earnings before interest and taxes (EBIT) to total assets for ROA and the ratio of earnings before taxes (EBT) to equity capital for ROE.

3.2 Testable Hypotheses

Based on the relevant literature discussed above in order to achieve our objectives, we test the following hypotheses:

Some researchers, such as Sougiannis (1994), Abrahams and Sidhu (1998), Toivanen *et al*. (2002), Greenhalgh and Rogers (2006), Pindado *et al*. (2010), Duqi *et al*. (2011) and Wang *et al*. (2017) highlight that R&D expenditure or investment enhances corporate value. Hence, we have formulated our first testable hypothesis:
H1: *R&D expenditure and intangible assets as proxies of innovation in a company are expected to increase the value of the company studied.*

Based on Sher and Yang (2005), Beld (2014), Warusawitharana (2015), VanderPal (2015) and Jaisinghani (2016), who found that R&D expenses were positively related to firm performance as measured by return on assets (ROA), we have formulated our second testable hypothesis:
H2: *R&D expenditure and intangible assets as proxies of innovation in a company are expected to increase the performance of the company studied, as measured by the ROA and ROE indicators.*

Lin and Chen (2005), focusing on US technology companies, found a size effect, since large firms had more advantages for technological innovation compared to smaller ones. Pindado *et al*. (2010) reported a positive relationship between size and market response to R&D investment. Schimke and Brenner (2014), looking into 1000 European companies, found that the positive effect of R&D activities on turnover growth strongly depended on firm size and industry sector. The same result was found by Chen *et al*. (2019) for Taiwanese semiconductor companies, since the larger the company, the greater its exposure to R&D and the more innovative the products and services it produced. This can lead to gaining a wider market share and more firm growth. In this aspect regarding innovation, the size variability should be considered. Hence, based on these studies, we have formulated our third testable hypothesis:
H3: *The size of a company is expected to positively affect innovation impact (resulting from R&D expenses and Intangible assets) on firm value and performance.*

Fábio de Oliveira and Ferreira da Silva (2018) investigated whether internal and external R&D had any impact on innovation development and whether the latter had any effect on the financial performance of a sample of European manufacturing firms. They found that the impact of innovation on financial performance was different for different groups of European companies. Banerjee and Gupta (2021), focusing on 42 countries in the 1981–2013 period, examined the extent to which firm, industry and country-level factors could explain firm-level R&D expenditure. They found that firm and industry-level determinants had higher explanatory power than country-level determinants. Thus, since in some cases, the country factor is significant and in some others not for the R&D relation to performance, it is interesting to investigate this for our sample companies; therefore, we formed our fourth hypothesis:

H4: *The country of a company is expected to significantly affect the innovation impact (resulting from R&D expenses and Intangible assets) on firm value and performance.*

3.3 Methodology

To investigate our testable hypotheses, we apply correlation analysis with the Pearson correlation coefficient and regression analysis, using the following models cross-sectionally for all the years as a whole:

$$\text{Value of firm}_{it} = a_1 + b_1 RD_{it} + b_2 Size_{it} + b_3 Country_{it} + e_{it} \quad (1)$$

$$\text{Value of firm}_{it} = a_1 + \gamma_1 Intangibles_{it} + \gamma_2 Size_{it} + \gamma_3 Country_{it} + e_{it} \quad (2)$$

$$\text{Performance of firm}_{it} = a_1 + b_1 RD_{it} + b_2 Size_{it} + b_3 Country_{it} + e_{it} \quad (3)$$

$$\text{Performance of firm}_{it} = a_1 + \gamma_1 Intangibles_{it} + \gamma_2 Size_{t} + \gamma_3 Country_{it} + e_{it} \quad (4)$$

Models 3 and 4 that examine the effect of explanatory variables on company performance are run twice, one whereby the performance is proxied by return on assets, (ROA) and the other whereby the performance is proxied by return on equity (ROE).

The four models above are run three times each for three different time periods as we have specified in the paragraphs above.

4. Empirical Results

Table 1 presents the descriptive statistics of our variables for the entire period examined. Table 2 depicts the Pearson correlation coefficients between our selected variables for the entire period examined.

Based on the Pearson correlation coefficients in Table 2, the R&D and Intangibles variables are positively correlated to market value. Neither R&D nor Intangibles are correlated to return on assets (ROA) or return on equity (ROE). On the other hand, the variables of size and country are significantly related to R&D expenses, the market value of the company, its intangible assets, and ROA. For more in-depth analysis, we perform regression analysis to investigate the explanatory power of independent variables and test our hypotheses.

Table 1. Descriptive Statistics (for the entire period)

	Minimum	Maximum	Mean		Std. Deviation
			Statistic	Std. Error	Statistic
MV	,000000	235672499999,999	896407541,910	44084213,406	4814876092,99
R&D	-1578460	615484000	10721942,99	844820,914	37210501,340
RDS	-,03	,63	,0129	,00094	,04142
Intangibles	-54438000	27675815000	134707120,52	13123528,235	1088145477,00
INTANGTA	-7,26	166,61	,1267	,02570	2,09914
ROA	-411,81	3243,65	1,6549	,36067	38,57780
ROE	109,00	212,55	,0528	,02856	3,11841
Size	5,94	26,75	17,5437	0,02314	2,48845

Table 2. Pearson Correlation Coefficients (for the entire period)

	MV	R & D	RDS	Intangibles	INTANGA	ROA	ROE	country	Size
MV	1	,550**	-,044	,265**	,011	-,005	,006	,081**	,283**
		,000	,051	,000	,355	,576	,513	,000	,000
R&D	,550**	1	-,004	,306**	-,006	-,010	,017	-,389**	,399**
	,000		,869	,000	,844	,675	,465	,000	,000
RDS	-,044	-,004	1	-,045	,386**	,027	,009	,024	-,297**
	,051	,869		,150	,000	,234	,697	,288	,000
Intangibles	,265**	,306**	-,045	1	,060**	-,003	,003	,119**	,244**
	,000	,000	,150		,000	,823	,778	,000	,000
INTANGA	,011	-,006	,386**	,060**	1	,013	-,001	,059**	-,044**
	,355	,844	,000	,000		,291	,966	,000	,000
ROA	-,005	-,010	,027	-,003	,013	1	,005	,039**	-,112**
	,576	,675	,234	,823	,291		,569	,000	,000
ROE	,006	,017	,009	,003	-,001	,005	1	,022*	,022*
	,513	,465	,697	,778	,966	,569		,015	,018

count	,081**	-,389**	,024	,119**	,059**	,039**	,022*	1	,170**
	,000	,000	,288	,000	,000	,000	,015		,000
Size	,283**	,399**	-,297**	,244**	-,044**	-,112**	,022*	,170**	1
	,000	,000	,000	,000	,000	,000	,018	,000	

Source: Authors' results based on ~~the~~ statistical analysis.
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

4.1 Effect of Innovation (resulting from R&D and Intangibles) on Firm Value

In Table 3 we reported only the empirical results of the OLS regression analyses of the models that had the best explanatory power regarding the influence of the R&D expenses variable, in two forms, namely, as (R&D) and as a ratio of R&D to sales (RDS). We also reported the influence of intangible assets, along with the other explanatory variables, namely (size) and (country), on the company's market value (MV). We checked for autocorrelation and, in all models reported, there was positive autocorrelation since the Durbin and Watson (DW) statistic is less than 2.

Regarding the independent variable R&D expenses for the entire period examined, results in Table 3, model 1 indicate that the coefficient of the explanatory variable (R&D) is statistically significant and positive. This implies that R&D expenditure significantly and positively affects the market value of sample firms. This result is consistent with our first hypothesis and the studies of Johnson and Pazderka (1993), Abrahams and Sidhu (1998), Ho, Keh and Ong (2005), Harhoff (2006) and VanderPal (2015). Model 2 depicts the effect of R&D expenses-to-sales ratio (RDS) on firm value and this is similar to model 1. However, the coefficient of the R&D variable as an explanatory variable, versus the R&D ratio (RDS), has stronger significance (t-value), while in model 2 Size is the best explanatory variable.

Regarding the independent variable (intangible assets) for the entire period examined, results in Table 3, model 3, indicate that the coefficient of the explanatory variable (intangible assets) is statistically significant and positive. Similar results can be seen in model 4, where the ratio of intangible assets to sales is used as a proxy for innovation. This implies that intangible assets significantly and positively affect the market value of sample firms supporting our first hypothesis. The control variable (size) is significant and positively related to the market value of the company in all 4 models, supporting our third hypothesis and consistent with Lin and Chen findings (2005). The implication of this result is that large companies have more advantages for technological innovation, since they have better access to more sources of financing to support such investment. More innovation in products and services

can lead the company studied to better competitive advantages and a larger market share, hence, more sales, more revenues and higher growth potential. All these lead to higher market value.

Regarding the third explanatory variable, (Country), our results in models 1 and 2 support our fourth hypothesis in the sense that the variable (Country) significantly affects the effect of R&D on company value. However, this effect is positive in the case of R&D expenses and negative in the case of the R&D ratio to sales (RDS). Regarding the variable (Intangible assets) (model 3) and the ratio of intangibles to total assets (model 4), as proxy variables for innovation, it is noted that the variable (Country) is not statistically significant, rejecting our fourth hypothesis. So, it can be concluded that, since we did not have many data regarding the variable (R&D expenses) in Bulgaria, because they are not obliged to report them, we cannot rely on models 1 and 2 that use this variable for innovation to make any inferences concerning the influence of the country factor to the impact of innovation on firm value. Since we had more data for the variable (Intangible assets), for all three countries, the results of models 3 and 4 are more reliable regarding this control variable. From these latter models, 3 and 4, it can be inferred that, for the three Balkan Black Sea countries, the country factor did not have any influence on the impact of innovation to firm value, rejecting our fourth hypothesis.

Table 3a depicts results regarding the influence of variable (R&D expenses) in two forms, namely, as (R&D) and as a ratio of R&D to sales (RDS) and the influence of (intangible assets), along with the other explanatory variables, (size) and (country), on the company's market value (MV) for the period before the COVID-19 pandemic crisis. We checked for autocorrelation and, in all models reported, there is positive autocorrelation since the Durbin and Watson (DW) statistic is less than 2.

Regarding the independent variable R&D expenses for the pre-COVID-19 period, results in Table 3a, models 1 and 2, indicate that the coefficients of explanatory variables (R&D) and (RDS), respectively, are statistically significant and positive, the former having stronger impact. This implies that R&D expenditure significantly and positively affects the market value of sample firms in the pre-COVID-19 period. This result is consistent with our first hypothesis and the studies of Johnson and Pazderka (1993), Abrahams and Sidhu (1998), Ho, Keh and Ong (2005), Harhoff (2006) and VanderPal (2015).

Regarding the independent variable (intangible assets) for this subperiod, results in Table 3a, model 3, indicate that the coefficient of the explanatory variable (intangible assets) is statistically significant and positive. Similar results can be seen in model 4, where the ratio of intangible assets to sales is used as a proxy for innovation. This implies that intangible assets significantly and positively affect the market value of the sub-sample firms supporting our first hypothesis. The control variable size is significant and positively related to the market value of the company in all 4 models, supporting our third hypothesis and consistent with Lin and Chen findings (2005). The implication of this result has been discussed for the entire sample and it is the same.

Table 3. Regression Analysis of Innovation Effect on Market Value for the entire period 2000-2020

Models. Dependent: **MV** Independent Variables	**Beta coef.**	**t-test**	**Sign**	**R^2**	**D-W**
1. Constant	19343422913.83			0.428	0.616
R&D	52.896*	21.163	0.000		
Size	770666052.054*	20.550	0.000		
Country	1996782802.055*	3.203	0.001		
2. Constant	-1.349E+10			0.309	0.535
RDS	1904700327*	6.243	0.000		
Size	1110297212*	27.219	0.000		
Country	-1949652142	-2.997	0.003		
3. Constant	-9734552498			0.157	0.494
Intangible Assets	1.051*	20.740	0.000		
Size	583608156.8*	21.759	0.000		
Country	-24928198.9	-0.369	0.712		
4. Constant	-1.205E+10			0.103	0.471
INTANGA	56973047.95**	2.138	0.033		
Size	710202026.6*	26.270	0.000		
Country	39291715.38	0.563	0.573		

Source: Authors' results based on statistical analysis. * Statistical significance at the 1% level. ** Statistical significance at the 5% level. *** Statistical significance at the 10% level.

Regarding the third explanatory variable, (Country), our results, in model 1, depict a non- significant relationship, while, in model 2, results support our fourth hypothesis in the sense that the variable (Country) significantly and negatively affects the effect of R&D on company value. Regarding the variable (Intangible assets) (model 3), we note that the variable (Country) is negative and statistically significant, supporting our fourth hypothesis. However, the ratio of intangibles to total assets (model 4), as

a proxy variable for innovation, has no statistically significant relationship with the control variable (Country). So, we can conclude that the country factor for the three Balkan Black Sea countries negatively affects the impact of innovation on firm value.

Table 3a. Regression Analysis of Innovation Effect on Market Value before COVID-19 (2000-2019)

Models. Dependent: **MV** Independent Variables	**Beta coef.**	**t-test**	**Sign**	**R^2**	**D-W**
1. Constant	-1.430E+10			0.407	2.007
R&D	44.155*	18.215	0.000		
Size	678124252.8*	19.890	0.000		
Country	866676265.6	1.469	0.142		
2. Constant	-7766365804			0.312	2.041
RDS	1586147220*	5.994	0.000		
Size	941309842.5*	25.716	0.000		
Country	-2857580175	-4.827	0.000		
3. Constant	-8432150584			0.146	1.949
Intangible Assets	1.149*	20.529	0.000		
Size	520124926.9*	19.686	0.000		
Country	-133259436**	-2.018	0.044		
4. Constant	-1.067E+10			0.146	1.934
INTANGA	53741617.9**	2.114	0.035		
Size	642292161.7*	24.073	0.000		
Country	-64883268	-0.950	0.342		

Source: Authors' results based on statistical analysis. * Statistical significance at the 1% level. ** Statistical significance at the 5% level. *** Statistical significance at the 10% level.

Table 3b. Regression Analysis of Innovation Effect on Market Value during COVID-19 (year 2000).

Models. Dependent: **MV** Independent Variables	**Beta coef.**	**t-test**	**Sign**	**R^2**	**D-W**
1. Constant	-5.767E+10			0.622	1.918
R&D	75.048*	6.959	0.000		
Size	226119561*	7.572	0.000		
Country	5336837071***	1.711	0.090		
2. Constant	-8.297E+10			0.484	1.673
RDS	1.239E+10**	1.985	0.049		
Size	3389985301*	10.442	0.000		
Country	6641961245***	1.825	0.071		
3. Constant	-2.501E+10			0.266	1.605
Intangible Assets	0.590*	3.925	0.000		
Size	1262397797*	7.562	0.000		
Country	1411998621*	3.241	0.001		
4. Constant	-2.849E+10			0.238	1.590
INTANGA	277164937	0.545	0.586		
Size	1452985334*	8.830	0.000		
Country	1399098469*	3.095	0.002		

Source: Authors' results based on statistical analysis. * Statistical significance at the 1% level. ** Statistical significance at the 5% level. *** Statistical significance at the 10% level.

Table 3b shows results regarding the influence of the variable (R&D expenses) in two forms, as (R&D) and as a ratio of R&D to sales (RDS) and the influence of intangible assets, along with the other explanatory variables, namely, (size) and (country) on a company's market value (MV) for the period of the year 2020 with the COVID-19 pandemic crisis and the severe hit to global economy. We checked for autocorrelation and in most models reported there is no autocorrelation or a bit

of positive autocorrelation since the Durbin and Watson (DW) statistic is close to 2. Regarding the independent variable (R&D expenses) for the year 2020, i.e., the COVID-19 period, results in Table 3b, models 1 and 2, indicate that the coefficients of the explanatory variables (R&D) and (RDS), respectively, are statistically significant and positive, the former having stronger impact. This implies that R&D expenditure significantly and positively affect the market value of sample firms during the COVID-19 period. This result is consistent with the results for previous time periods. In conclusion, regardless of the time period and the pandemic crisis R&D expenditure significantly and positively affects the market value of the companies in the Romanian and Turkish markets and some of the Bulgarian companies.

Regarding the independent variable (intangible assets), for this crucial year, results in Table 3b, model 3, indicate that the coefficient of the explanatory variable (intangible assets) is positive and statistically significant. A positive correlation is apparent in model 4, where the ratio of intangible assets to sales is used as a proxy for innovation, but it is not significant. This implies that intangible assets significantly and positively affect the market value of sample firms supporting our first hypothesis. The control variable (size) is significant and positively related to the market value of company in all 4 models, supporting our third hypothesis and consistent with Lin and Chen findings (2005).

Regarding the third explanatory variable (Country) our results, in all 4 models, support our fourth hypothesis in the sense that the variable (Country) significantly and positively affects the impact of innovation on company value, supporting our fourth hypothesis. This outcome for the year of the COVID-19 crisis differs from that of previous years, when, in the three Balkan Black Sea countries, the country factor did not have any influence on the impact of innovation on firm value, rejecting our fourth hypothesis.

*4.2 Effect of Innovation (resulting from R&D and Intangibles) on Firm Performanc*e

Tables 4 and 5 refer to the 2000-2020 period and depict only empirical results of the OLS regression analyses of the models with the best explanatory power, regarding the influence of the variable (R&D expenses) in two forms, as (R&D) and as a ratio of R&D to sales (RDS), and the influence of intangible assets, along with the explanatory variables (size) and (country) on a company's performance, measured by return on assets (ROA) and return on equity (ROE), respectively. We checked for autocorrelation and in most models reported there is no autocorrelation since the Durbin and Watson (DW) statistic is close or equal to 2.

Regarding the independent variable (R&D expenses) for the entire period examined, results in Table 4, model 1, indicate that the coefficient of the explanatory variable (R&D) is positive and statistically significant. In model 2, where the ratio of R&D expenses to sales is used as a proxy for innovation, the coefficient of this

explanatory variable is negative but not statistically significant. This implies that R&D expenditure significantly and positively affects performance as measured by profitability ratio ROA for sample firms. This result is consistent with our second hypothesis and the studies of Sher and Yang (2005), Ozdemir *et al*. (2012), Beld (2014), VanderPal (2015), Warusawitharana (2015) and Jaisinghani (2016).

Regarding the independent variable (intangible assets) for the entire period examined, results in Table 4, model 3, indicate that the coefficient of the explanatory variable (intangible assets) is positive and statistically significant. However, in model 4, results indicate that the coefficient of the explanatory variable (intangible assets) to sales ratio is negative but not statistically significant.

This implies that intangible assets significantly and positively affect performance as measured by profitability ratio ROA of sample firms, consistent with our second hypothesis.

The control variable (size) is significant and negatively related to the performance of a company as measured by return on assets ratio (ROA) in all 4 models, contrary to the third hypothesis. The control variable (Country) is positive and significant only in models 3 and 4. As already stated when analyzing results in Table 3, the results in these two models are more reliable since we have data from all three countries. This implies that impact of innovation, as measured by intangible assets, on firm profitability, as measured by ROA, is affected by the country variable, which is consistent with our fourth hypothesis.

Tables 4a and 4b refer to the 2000-2019 period, i.e., before COVID-19 and the COVID-19 period, namely, year 2020, respectively; they depict only empirical results of the OLS regression analyses of the models with the best explanatory power regarding the influence of the variable (R&D expenses) in two forms, as (R&D) and as a ratio of R&D to sales (RDS) and the influence of intangible assets, along with the explanatory variables (size) and (country) on a company's performance, measured by return on assets (ROA) and return on equity (ROE), respectively. We checked for autocorrelation and in most models reported there is no autocorrelation since the Durbin and Watson (DW) statistic is close or equal to 2.

Regarding the independent variable (R&D expenses) for the pre-COVID-19 period, results in Table 4a, models 1 and 2, indicate that the coefficients of the explanatory variable (R&D) and the ratio of R&D expenses to sales, respectively, as proxies for innovation, are not statistically significant. This implies that R&D expenditure does not affect the performance of sample firms as measured by profitability ratio ROA. This result is inconsistent with our second hypothesis and the studies of Sher and Yang (2005), Ozdemir *et al*. (2012), Beld (2014), VanderPal (2015), Warusawitharana (2015) and Jaisinghani (2016).

Table 4. Regression Analysis of Innovation Effect on Performance-ROA

Models. Dependent: **ROA** Independent Variables	**Beta coef.**	**t-test**	**Sign**	**R^2**	**D-W**
1. Constant	57.380			0.020	1.969
R&D	4.255E-8***	1.747	0.081		
Size	-2.286*	-6.259	0.000		
Country	-4.498	-0.741	0.459		
2. Constant	66.076			0.019	1.970
RDS	-1,777	-0.656	0.512		
Size	-2.147*	5.932	0.000		
Country	-8.107	-1.404	0.160		
3. Constant	5.345			0.039	1.718
Intangible Assets	9.550E-11**	2.095	0.036		
Size	-0.356*	-14.211	0.000		
Country	0.735	11.975	0.000		
4. Constant	5.133			0.039	1.718
INTANGA	-0.007	-0.317	0.751		
Size	-0.344*	-14.094	0.000		
Country	0.742	12.066	0.000		

Source: Authors' results based on statistical analysis. * Statistical significance at the 1% level. ** Statistical significance at the 5% level. *** Statistical significance at the 10% level.

Regarding the independent variable (intangible assets) for the entire period examined, results in Table 4a, model 3, indicate that the coefficient of the explanatory variable (intangible assets) is negative and statistically significant. However, in model 4, results indicate that the coefficient of the explanatory variable (intangible assets) to sales ratio is negative but not statistically significant.

This implies that intangible assets significantly and negatively affect performance, as measured by profitability ratio ROA of sample firms, contrary to our second

hypothesis for the pre- COVID-19 period. This result differs from the equivalent one of the entire 2000-2020 time period.

The control variable (size) is significantly negative in relation to the performance of a company, as measured by the return on assets for all 4 models, contrary to the third hypothesis. The control variable (Country) is significantly positive only in models 3 and 4. As we stated before, when analyzing results in Table 4, the results in these two models are more reliable since we have data from all three countries. This result implies that impact of innovation, as measured by intangible assets, on firm profitability, as measured by ROA, is affected by the country variable, consistent with our fourth hypothesis.

Table 4a. Regression Analysis of Innovation Effect on Performance-ROA for the 2000-2019, pre-COVID-19 period.

Models. Dependent: **ROA** Independent Variables	**Beta coef.**	**t-test**	**Sign**	**R^2**	**D-W**
1. Constant	59.973			0.021	1.994
R&D	4.523E-8***	1.633	0.103		
Size	-2.412*	-6.192	0.000		
Country	-4.620	-0.685	0.493		
2. Constant	71.337			0.020	1.996
RDS	-2,032	-0.723	0.470		
Size	-2.297*	-5.913	0.000		
Country	-8.960	-1.426	0.154		
3. Constant	5.021			0.036	1.984
Intangible Assets	-9.825E-11***	1.866	0.062		
Size	-0.335*	-12.953	0.000		
Country	0.687*	10.962	0.000		
4. Constant	4.827			0.035	1.985
INTANGA	-0.006	-0.252	0.801		
Size	-0.324*	-12.853	0.000		
Country	0.694*	11.053	0.000		

Source: Authors' results based on statistical analysis. * Statistical significance at the 1% level. ** Statistical significance at the 5% level. *** Statistical significance at the 10% level.

Table 4b depicts results for the COVID-19 period. Models 1 and 2 indicate that the coefficients of the explanatory variable (R&D) and the ratio of R&D expenses to sales, respectively, used as proxies for innovation, are positive and statistically significant. This implies that R&D expenditure affects the performance of sample firms as measured by profitability ratio ROA. This result is consistent with our second hypothesis and the studies of Sher and Yang (2005), Ozdemir *et al.* (2012), Beld (2014), VanderPal (2015), Warusawitharana (2015) and Jaisinghani (2016).

Table 4b. Regression Analysis of Innovation Effect on Performance-ROA for the period 2020, the COVID-19 period.

Models. Dependent: **ROA** Independent Variables	**Beta coef.**	**t-test**	**Sign**	**R^2**	**D-W**
1. Constant	3.092			0.165	2.029
R&D	3.663E-9*	3.223	0.002		
Size	-0.141*	-4.481	0.000		
Country	0.039	0.119	0.906		
2. Constant	0.836			0.339	1.935
RDS	3,330*	6.648	0.000		
Size	-0.045***	-1.731	0.086		
Country	0.140	0.479	0.633		
3. Constant	13.348			0.141	1.998
Intangible Assets	1.500E-10**	1.544	0.123		
Size	-0.844*	-7.613	0.000		
Country	1.553	5.470	0.000		
4. Constant	12.550			0.137	2.015
INTANGA	-0.184	-0.570	0.569		
Size	-0.802*	-7.478	0.000		
Country	1.589	5.477	0.000		

Source: Authors' results based on the statistical analysis.* Statistical significance at the 1% level. ** Statistical significance at the 5% level. *** Statistical significance at the 10% level.

The independent variables (intangible assets) and intangible assets to sales ratio for the COVID-19 period, in Table 4b, models 3 and 4, respectively, do not influence corporate performance as measured by ROA, in contrast to results for the entire period indicating the impact was positive, and the subperiod without Covid-19, during which the impact was negative. This implies that intangible assets do not affect performance as measured by profitability ratio ROA of sample firms, contrary to our second hypothesis, for the COVID-19 period.

The control variable (size) is significantly negative in relation to the performance of a company as measured by return on assets (ROA) for all 4 models, contrary to the third hypothesis. The control variable (Country) is significantly positive only in models 3 and 4. As already stated, when analyzing results in Table 4, the results in these two models are more reliable since we have data from all three countries. This result implies that impact of innovation, as measured by intangible assets, on firm profitability, as measured by ROA, is affected by the country variable, consistent with our fourth hypothesis.

Regarding the independent variable (R&D expenses) for the entire period examined, results in Table 5, models 1and 2, indicate that the coefficient of the explanatory variable (R&D) and the ratio of R&D expenses to sales as a proxy for innovation, respectively, are not statistically significant. This implies that R&D expenditure does not affect performance as measured by profitability ratio ROE of sample firms. This result is inconsistent with our second hypothesis and the studies of Sher and Yang (2005), Ozdemir *et al*. (2012), Beld (2014), VanderPal (2015), Warusawitharana (2015) and Jaisinghani (2016).

Regarding the independent variable (intangible assets) for the entire period examined, results in Table 5, models 3 and 4, indicate that the coefficient of the explanatory variables (intangible assets) and intangible assets to sales ratio, respectively, are not statistically significant. This implies that intangible assets have no impact on company performance as measured by profitability ratio ROE, inconsistent with our second hypothesis.

The control variable (size) is not significantly related to the performance of a company as measured by return on equity ratio (ROE) in any of the 4 models, contrary to the third hypothesis. The control variable (Country) is also not significant in any of the four models. This result implies that the impact of innovation, as measured by intangible assets on firm profitability, as measured by ROE, is not affected by the country variable and is not consistent with our fourth hypothesis.

Table 5a presents the impact of innovation on profitability ratio return on equity (ROE) for the pre- COVID-19 period. None of the four models analyzed had statistically significant coefficients of the explanatory variables representing innovation, R&D expenses and Intangible assets. This result is inconsistent with our second hypothesis and the studies of Sher and Yang (2005), Ozdemir *et al*. (2012), Beld (2014), VanderPal (2015), Warusawitharana (2015) and Jaisinghani (2016), as well as with the one for the entire time period examined, whereby the innovation had a positive impact on firm performance.

The control variable (size) is positive but not significant in all four models. The control variable (Country) is not significant in all four models. This result implies that the impact of innovation, as measured by R&D, on firm profitability, as measured by ROE, is not affected by company size nor by the country variable. Thus, our results are not consistent with our third and fourth hypotheses for the 2000-2019 period.

Table 5. Regression Analysis of Innovation Effect on Performance-ROE

Models. Dependent: **ROE** Independent Variables	**Beta coef.**	**t-test**	**Sign**	**R^2**	**D-W**
1. Constant	-0.192			0.000	2.062
R&D	9.522E-10	0.599	0.549		
Size	0.005	0.216	0.829		
Country	0.050	0.427	0.549		
2. Constant	-0.163			0.000	2.062
RDS	0.098	0.553	0.589		
Size	0.014	0.585	0.559		
Country	-0.013	-0.033	0.973		
3. Constant	-0.216			0.000	1.993
Intangible Assets	-2.014E-12	-0.074	0.941		
Size	0.011	0.735	0.463		
Country	0.043	1.167	0.243		
4. Constant	-0.211			0.000	1.993
INTANGA	-0.001	-0.081	0.936		
Size	0.010	0.730	0.465		
Country	0.043	1.167	0.243		

Source: Authors' results based on the statistical analysis. * Statistical significance at the 1% level. ** Statistical significance at the 5% level. *** Statistical significance at the 10% level.

Table 5a. Regression Analysis of Innovation Effect on Performance-ROE for the period 2000-2019, pre- COVID-19 period.

Models. Dependent: **ROE** Independent Variables	**Beta coef.**	**t-test**	**Sign**	**R^2**	**D-W**
1. Constant	-0.482			0.001	2.355
R&D	7.910E-10	0.459	0.647		
Size	0.016	0.676	0.499		
Country	0.069	0.165	0.869		
2. Constant	-0.438			0.001	2.355
RDS	0.086	0.492	0.623		
Size	0.024	0.974	0.330		
Country	0.011	0.028	0.978		
3. Constant	-0.262			0.003	2.008
Intangible Assets	-3.802E-12	-0.117	0.907		
Size	0.013	0.863	0.388		
Country	0.042	1.102	0.271		
4. Constant	-0.254			0.003	2.008
INTANGA	-0.001	-0.082	0.935		
Size	0.013	0.851	0.395		
Country	0.042	1.100	0.272		

Source: Authors' results based on statistical analysis. * Statistical significance at the 1% level. ** Statistical significance at the 5% level. *** Statistical significance at the 10% level.

Table 5b presents the impact of innovation on profitability ratio return on equity (ROE) for the COVID-19 period. None of the four models analyzed had statistically significant coefficients of the explanatory variables representing innovation, R&D expenses and Intangible assets. This result is inconsistent with our second hypothesis and the studies of Sher and Yang (2005), Ozdemir *et al.* (2012), Beld (2014), VanderPal (2015), Warusawitharana (2015) and Jaisinghani (2016), similarly to that for the entire time period examined.

The control variable (size) is significantly negative only for models 1 and 2. The control variable (Country) is not significant in any of the four models. This result implies that the impact of innovation, as measured by R&D, on firm profitability as measured by ROE, is affected by company size but not by the country variable. Thus, our results are partially consistent with our third hypothesis but not with our fourth one.

Table 5b. Regression Analysis of Innovation Effect on Performance-ROE for the period 2000-2019, pre- COVID-19 period.

Models. Dependent: **ROE** Independent Variables	**Beta coef.**	**t-test**	**Sign**	**R^2**	**D-W**
1. Constant	10.092			0.065	1.969
R&D	5.251E-9	1.088	0.279		
Size	-0.381*	-2.853	0.005		
Country	-0.702	-0.503	0.616		
2. Constant	7.181			0.077	1.949
RDS	3.913	1.648	0.102		
Size	-0.257	-2.077	0.040		
Country	-0.569	-0.411	0.682		
3. Constant	0.418			0.003	2.039
Intangible Assets	1.007E-11	0.408	0.684		
Size	-0.026	-0.941	0.347		
Country	0.060	0.841	0.401		
4. Constant	0.352			0.003	2.041
INTANGA	0.019	0.236	0.813		
Size	-0.022	-0.830	0.407		
Country	0.057	0.788	0.431		

Source: Authors' results based on statistical analysis. * Statistical significance at the 1% level. ** Statistical significance at the 5% level. *** Statistical significance at the 10% level.

5. Conclusions

This study focused on firms operating in three Balkan countries that are also within the Black Sea region and set out to explore innovation effects on firm value and corporate performance. The paper found a positive correlation between innovative investment, as proxied by research and development expenses and intangible assets, with a firm's value. Results indicated a positive correlation between innovation, as proxied by research and development expenses and intangible assets with a firm's performance, as measured by return on assets (ROA). However, regarding company performance, as measured by ROE, our results rejected our hypothesis since a negative correlation was found between innovation variables and this profitability ratio as performance variable. Regarding the existence of a "size effect", firm size was found to have a positive effect on firm value and a negative one on performance measured by ROA. The control variable (Country) was found to be significant only in the case of intangibles impact on ROA. Based on our results, the COVID-19 crisis affected only the performance of companies but not their value.

Future research could concentrate on the impact of innovation on firm value and firm performance and investigate whether there are any differences among various industries regarding these matters, as more recent literature suggests based on Vrontis and Christofi (2019) and Boiko (2021). The same hypotheses can also be examined for other developed and developing countries to provide further insight to scholars, investors and policy makers concerning the significance of innovation for a company's survival and growth and of the factors affecting it, since innovation is important for companies in terms of strategy, organization, behavior and knowledge, as well as from legal, economic and business perspectives.

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