

The Effect of R& D on Firms' Performance: Europe Vs. GCC Countries

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Main Points

An Overview

R&D firms' performance

Research methodology

Empirical Model and the results

Analysis and conclusion

An Overview

- A firm/ company invests in R&D in order to innovate new product or service which enhances its competitive advantages.
- Further, innovations are the basic impetus that starts and keeps the capitalist engine running (Schumpeter, 1950).
- Moreover, they help manufacturers to satisfy the diverse and rapidly changing consumer demands in the current global climate of increased competition and enable firms to maintain their competitive advantage in the dynamic market.

An Overview

- The results of the European Innovation Scoreboard 2021 indicated that the top EU countries in innovation performance are Sweden, Finland, Denmark and Belgium.
- Further the EU performs better than its competitors such as China, Brazil, South Africa, Russia and India, while South Korea, Canada, Australia, the United States and Japan have a performance advantage over the EU.

An Overview: R&D in EU and GCC

Research and development expenditure (% of GDP)									
Country Name	2012	2013	2014	2015	2016	2017	2018	2019	2020
Kuwait	0.10	0.30	0.43	0.10	0.08	0.08	0.06	0.19	0.19
Qatar	0.48	..	..	0.52	..	..	0.53	..	..
Bahrain	..	..	0.10	..	..	..	..	..	..
Saudi Arabia	0.88	0.82	..	..	..	..	..	..	0.52
United Arab Emirates	..	..	0.69	0.90	0.96	..	1.28	1.31	1.45
Oman	0.21	0.17	0.21	0.25	0.26	0.23	0.22	0.31	0.37
Belgium	2.28	2.33	2.37	2.43	2.52	2.67	2.86	3.16	3.48
Denmark	2.98	2.97	2.91	3.05	3.09	2.93	2.97	2.89	2.96
Finland	3.40	3.27	3.15	2.87	2.72	2.73	2.76	2.80	2.94
Sweden	3.23	3.26	3.10	3.22	3.25	3.36	3.32	3.39	3.53

An Overview: Research issue and objectives

Research Question:

What is the impact of firms' R&D expenditures on their performance in EU and GCC?

Research Objectives

- To review the scholarly research on the relation between R&D expenditures and firms' performance
- To test the relation between R&D expenditures and firm's performance in selected European countries and GCC
- To compare the results and provide specific recommendations

An Overview: Research issue and objectives

Research Methodology

- We are going to use quantitative research methods through developing an econometric model to assess the impact of firms' R&D expenditures on their performance.
- We are going to use panel data analysis (pooled data model) for two groups of firms, European firms and GCC firms.

Literature Review

- Various studies have conducted for the past decades to investigate the relationship between R&D expenditure and firm performance and values. However, it remains unclear whether R&D can fulfil companies' positive expectations as the process involves numerous influencing factors.
- Existing studies established different relationships between R&D intensity and firm performance in various countries.
- They can be broadly summarised into studies which examine the long-term effects of R&D input on business performance and studies which test the correlation between R&D expenditures and business performance in the short term (Chen et al., 2005).

Literature Review: Positive Impact of R&D

- The existing literature established positive relationship between firms' R&D expenditure and their operational performance, values and innovation (Anagnostopoulou and Levis, 2008; Tubbs (2007; 2008); Jaisinghani, 2016; Morbey, 1988; and Iovino and Rizzo, 2008).
- Spending on R&D activities has a positive and significant impact on the growth of firm's productivity (Wakelin, 2001) and long-term performance (J. Diéguez-Soto, et al., 2019).
- Majority of these studies provide empirical evidence to support the positive impact of investing in R&D activities on firms' ability to innovate that in turn leads to greater productivity (Leung & Sharma, 2021; Sher & Yang, 2005; Chen et al., 2005).

Literature Review: Negative Impact of R&D

- There are also studies established a negative or no relationship between firms' R&D expenditures and their performance (Lin et al., 2006; Vithessonthi and Racela, 2016; Chao and Kavadias, 2013; Wang et al., 2011. Lin et al, (2006) studied 258 American firms based on data on the patents and financial information and revealed no apparent correlation between R&D and company performance.
- On the other hand, Vithessonthi and Racela (2016) found that investment on R&D is negatively correlated with company performance in the short run, whereas positively correlated with corporate values in the long run.
- Further, R&D investment has a negative influence on the return from the sales of companies with high R&D intensity, but no significant effect was found in companies with low R&D intensity (Chen et al., 2005).

Literature Review

A recent study by Ravselj and Aristovink (2020) on the relation between R&D expenditures and company performance in Slovenia find out that R&D is ineffective in the short run but it brings certain benefits in the long run.

They use a number of indicators as proxies of a company performance including:

- Return on Sales = net operating profit/ net sales

Price to sales ratio = market capitalization/ net sales

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Empirical study

- A company/ firm's performance is often reflected in its profitability and its market value. Thus, the relation between Research & Development (R&D) expenditures and company's performance is going to be assessed through using two proxies for company performance which are (1) Return on sales (ROS) and (2) Price to sale ratio (PSR) and their relation with R&D.
- We are going to use panel data analysis (pooled OLS) to test the relationship and compare between two sets of countries, European Union countries (Belgium, Denmark, Finland and Sweden) and GCC countries (Saudi Arabia and UAE)

Empirical study

- We are going to test two hypotheses,
 - 1st hypothesis: H_0 : the company's expenditure on R&D has a positive impact on ROS
 - 2nd hypothesis: H_0 : the company's expenditure on R&D has a positive impact on PSR

Empirical study

- **Dependent variables**

Company performance can be measured through the following:

- ROS: Return on sales = net operating profit/ net sales
- PSR: Price to sale ratio = market capitalism/ net sales

1. Independent Variables is the R&D intensity = R&D expenditure/ net sales

The 1st Econometric Model

- The 1st model (static model) uses ROS as a proxy for company performance

- $Y_{it} = B_0 + B_1 X_{1,it} + V_{it}$

where:

- Y_{it} : is ROS of Company (i) in year t (dependent variable)
- B_0 : is the intercept
- B_1 : is the coefficient of the independent variable
- $X_{1,it}$: is the R&D intensity of company (i) in year t (independent variable)
- V_{it} : is the error term related to the company i in year t

The 2nd Econometric Model

- The 2nd model (static model) uses PRS as a proxy for company performance
- $Y_{it} = B_0 + B_1 X_{1,it} + V_{it}$
- where:
- Y_{it} : is PRS of Company (i) in year t (dependent variable)
- B_0 : is the intercept
- B_1 : is the coefficient of the independent variable
- $X_{1,it}$: is the R&D intensity of company (i) in year t (independent variable)
- V_{it} : is the error term related to the company i in year t

The 3rd Econometric Model

The 3rd model (Dynamic model) uses ROS as a proxy of company performance

- $Y_{it} = B_0 + B_1 X_{1,it} + Y_{it-1} + V_{it}$
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- Where:
- Y_{it} : is ROS of Company (i) in year t (dependent variable)
- B_0 : is the intercept
- B_1 : is the coefficient of the independent variable
- $X_{1, it}$: is the R&D intensity of company (i) in year t (independent variable)
- Y_{it-1} : is the instrumental variable
- V_{it} : is the error term correlated to a company i in year t

Data and Analysis

We used the financial data obtained through Orbis database for companies in selected EU and GCC countries

YEAR	Belgium	Denmark	Finland	Sweden	Saudi Arabia	UAE	Qatar	Oman	Bahrain	Kuwait
2014	15	25	22	42	2	0	0	0	0	0
2015	14	29	19	40	2	0	0	0	0	0
2016	15	26	19	36	2	0	0	0	0	0
2017	16	30	18	36	2	1	0	0	0	0
2018	12	30	17	33	3	1	0	0	0	0
2019	14	32	16	32	2	1	0	0	0	0

Data and Analysis

- After filtering the data, we tested the models as follows

We used the data from 2016-2019

There are 85 firms from those European Countries

There are 4 firms from GCC countries

Results and Analysis: 1st Model

Pooled Panel Data Model (OLS) of selected Eu countries

Parameter Estimates							
Dependent Variable: [ROS] (%)							
Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	950.983	96.255	9.880	<.001	761.343	1140.624	0.295
R&D intensity	-1.084	.035	-30.673	<.001	-1.154	-1.015	0.802

The overall model is statistically significant at 99%.

R-square is 91.3%, meaning that the R&D intensity (%) explains 91.3% of the total changes in the ROS

There is a negative relationship between R&D and ROS.

Results and Analysis: 1st Model

- Pooled Panel Data Model (OLS) of selected GCC countries

Dependent Variable: Profitability (%) (ROS)

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	26.211	8.310	3.154	.025	4.849	47.573	.666
R_and_D_Intensity	-7.556	7.589	-.996	.365	-27.063	11.951	.165

The overall model is statistical significance at 99%.

R-square is 94.3%, meaning that the R&D intensity (%) explains 94.3% of the total changes in the ROS.

Results and Analysis: 2nd Model

2.1 Pooled Panel Data Model of Selected EU countries

Parameter Estimates							
Dependent Variable: PSR							
Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	19.892	6.728	2.957	.003	6.629	33.154	.040
R&D intensity	0.054	.002	22.022	<.001	.050	.059	.697

The overall model is statistically significant at 99%.

R-square is 93.8%, meaning that the R&D intensity (%) explains 93.8% of the total changes in the PSR

Results and Analysis: 2nd Model

2.2 Pooled Panel Data Model of Selected GCC countries

Dependent Variable: PSR (Market Cap./N, Sales)

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	2.536	.297	8.547	.001	1.712	3.360	.948
R_and_D_Intensity	-0.467	.271	-1.722	.160	-1.219	.286	.426

The overall model is statistically significant at 99%.

R-square is 97.4%, meaning that the R&D intensity (%) explains 97.4% of the total changes in the PSR.

Results and Analysis: 3rd Model

3.1 Dynamic Panel Data of Selected EU countries

Parameter Estimates

Dependent Variable: [ROS] (%)

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	960.48	98.416	9.759	<.001	766.573	1154.389	.292
R_and_D_intensity	-1.088	.036	-30.123	<.001	-1.159	-1.016	.797
lag_ROS	-.016	.031	-.507	.613	-.077	.045	.001

The overall model is statistical significance at 99%.

R-square is 91.3%, meaning that the R&D intensity (%) and Lag ROS explain 91.3% of the total changes in the ROS.

Results and Analysis: 3rd Model

3.2 Dynamic Pooled Panel Data Model of Selected GCC countries

Parameter Estimates							
Dependent Variable: PSR (Market Cap./N, Sales)							
Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	2.320	.407	5.698	.029	.568	4.071	.942
R_and_D_Intensity	-.152	.674	-.226	.842	-3.054	2.749	.025
Lag_ROS	-.004	.015	-.237	.835	-.070	.063	.027

The overall model is statistical significance at 99%.

R-square is 98.2%, meaning that the R&D intensity (%) and Lag ROS explain 98.2% of the total changes in the ROS.

Concluding Remarks

- For the 1st Model: there is a negative relation between R&D intensity and firms' performance in terms of return on sales in both groups of countries
- For the 2nd Model: there is a positive relation between R&D intensity and firms' performance in terms of PSR of EU countries and negative in case of GCC countries.
- For the 3rd Model (dynamic panel data) : there is a negative relation between R&D intensity and firms' performance in terms of return on sales in both groups of countries

Thank you for your attention