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## The Impact of Research & Development, Advertising Expenses on the Growth and Value of the Petrochemical Companies in Iraq

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### Abstract

This study aims to identify the effect of research and development (R&D) and advertising expenses on the growth and value of petrochemical companies listed in Iraq Stock Exchange. The data are collected from the financial reports of the three Iraqi petrochemical companies. The researcher adopts descriptive and analytical approaches because they were relevant to the nature of the study. Arithmetical means, standard deviations, unit root test and multiple linear regression analysis are used. The study sample consists of two petrochemical companies. The results show that there is a statistically significant effect of research and development expenses on the value of petrochemical companies listed in Iraq Stock Exchange at the significance level ( $\alpha \leq 0.05$ ). The study recommends that the focus should be on R&D and advertising in order to increase the value of companies, which increases the perceived quality ratio of the products provided by advertising.

**Keywords:** Research and Development (R & D) Expenses, Advertising Expenses, Growth and Value of Companies.

### Introduction

The aim of establishing any institution or economic unit is to achieve a set of goals. These institutions use all available tools to sustain and improve their activity. They try to enhance performance and work by developing all useable methods, tools and means, enhancing creative capabilities, promoting thinking, and creating a climate that helps to study and analyze all data, identify weaknesses and strengths, identify opportunities and cope with challenges. Therefore, expenses on research and development (R & D) activities is a priority for senior administration on the one hand, to enhance its capacities and on the other hand, to maximize profits and achieve competitive advantages. In addition, planning for advertising is a main element for improving sales and helps companies continue their work and open new prospects. Thus, the index of expenses on R & D and advertising is one of the work priorities to fulfil the goals of different companies.

Furthermore, appropriate training programs should be prepared continuously to increase the efficiency and performance of employees. These programs should include the concepts of competitiveness and self-development. It is necessary to develop company's productivity through the optimal exploitation of modern management techniques that link all stages of the production process in terms of administration and information. Regarding production methods, the value of the ability to stand out and excel in competition in relation to production methods and techniques is evident when the company is able to reduce expenses and costs through the use of one of the production strategies that improve the use of strengths as economies of scale or growth, or when the company can achieve the desired goal, i.e., largely increasing the production rate as well as flexibility and quality control in the total quality management process. Most competitive companies around the world are able to produce products or provide outstanding services that are valuable to customers.

With huge expenses on R & D and advertising of their products, industrial companies in general and petrochemical companies in particular try to make their products distinct by improving quality and creating specifications and characteristics that are not available in competitive products. Increasing the allocation of expenses on R & D and the establishment of research centers within companies has become necessary to dominate the markets, in addition to paying attention to expenses on advertising. Companies seek to implement this on the ground in spite of all the difficulties, challenges, competition or conflicts in the market. The economic importance of advertising is reflected in achieving the economic growth of companies by focusing on monitoring current or new commodity or pursuing services (Rahman & Aziz, 2015).

Interest in expenses on R & D and advertising has become important and necessary to promote activities and increase the effectiveness of all economic activities, particularly for-profit ones, especially within the competitive environment and the difficulties faced by companies, where corporate activity and growth are constantly affected by R & D expenditure, which in turn reflects on revenues, which will necessarily increase the company's market share and achieve competitive advantages.

The business environment and the nature and size of the business of companies also play an important role in identifying the type and size of expenses. It should be noted that the variations of expenses correspond to the objectives and available opportunities, as well as the expected or planned amount of revenues and profits.

This, in turn, leads to a variance in the amount of expenses, whether on scientific research or on the relevant costly advertising expenditure or both. This may be due to the different amounts of money spent on R & D, advertising or both (Abboud & Mohammed, 2020).

The petrochemical sector is one of the important industrial sectors that play a prominent role in improving the national economy in Iraq. Therefore, the research problem lies, in general, in the extent to which both R & D expenses and advertising expenses affect the company's level of performance and size in general, especially on the growth and value of petrochemical companies in the financial market in Iraq.

There is no doubt that the size and longevity of the company in the labor market requires allocation of more expenses on the field of R & D. Compared to the newly established companies, the company, due to the experience factor, assumes greater responsibility in the field of scientific research in order to deal with various successive and accelerated technological variables, or as a result of its need to achieve better performance.

Hence, this requires increased interest in R & D, as this process plays an important role in the company's continuity and progress.

Economically, R & D activity reflects the desire of companies to give up part of their profits to improve their future capabilities and potential, by allocating part of the revenue and employing it in the R & D process in the hope that this process will achieve the desired results in the short and long term (Al-Anzi & Ali, 2017).

### **Literature Review**

Advertising and research and development (R & D) are the two key elements that companies should use if they want to increase profits and improve competitiveness. This study developed a system of equations to identify general correlations between R & D, advertising and financial performance across corporate sizes. The data was collected from Korean listed companies during the period 2012-2016. The results showed that

- R & D and advertising support and complement each other in South Korea.
- There is a significant positive correlation between advertising and financial performance of large companies, and there is no effect of R&D expenses.

The aim of this study was to assess the impact of advertising on the company's sales and profitability. The Statistical Package for the Social Sciences (SPSS) was used to ensure that the data collected for this study was appropriate. To analyze data, regression analysis was used to test the hypothesis of the variables included in this study. The results of the study showed that there is an important correlation between marketing expenses and the company's profitability. It also showed that there is an important and significant correlation between business size and marketing expenses.

The study recommended that the company should maintain a cost-effective advertising system, where highly experienced employees are an essential component. The advertising system should be controlled using a mechanism that enhances an excellent reputation of the company and its products (Johnson & Adalakun, 2019).

Treatment of research and development is discussed in terms of generally accepted accounting principles in the United States, which include accounting principles to be followed and adhered to by United States-based companies. In addition, research and development treatment methods in international financial reporting standards have been explained. Also, previous studies on the treatment of research and development in financial statements have been reviewed, and studies that addressed the impact of research and development costs on the company's growth and profitability. There is no consensus on whether or not research and development spending will be capitalized. On the other hand, there is a clear consensus that there is a positive effect of research and development on the company's growth. However, opinions differed on profitability, but most studies suggest that research and development spending should increase the company's profitability. The data used in the study were derived from the Computer database. The final sample consisted of 675 companies and 8100 observations for one year from 2005-2016 (Leskinen, 2018).

### **Hypotheses of the Study**

Based on the objectives and problem of the study, the following hypotheses are set alternatively at a statistical significance level of 0.05:

- 1- There is a statistically significant effect of research and development (R & D) expenses on the value of petrochemical companies listed in Iraq Stock Exchange.

- 2- There is a statistically significant effect of R & D expenses on the growth of petrochemical companies listed in Iraq Stock Exchange.
- 3- There is a statistically significant effect of advertising expenses on the value of petrochemical companies listed in Iraq Stock Exchange.
- 4- There is a statistically significant effect of advertising expenses on the growth of petrochemical companies listed in Iraq Stock Exchange.
- 5- There is a statistically significant effect of R & D and advertising expenses together on the value of petrochemical companies listed in Iraq Stock Exchange.
- 6- There is a statistically significant effect of R & D and advertising expenses together on the growth of petrochemical companies listed in Iraq Stock Exchange.

### Methods of Data Collection

The study data consist of

Data of theoretical literature, collected from previous studies, references, books and publications that address the variables of the study model. Data of financial statements, collected directly from published annual financial statements, and during the study period (2010-2020).

### Statistical Methods

Views software is used to process and treat raw data. The following statistical measures and tests used

Percentages, iterations, arithmetic means and standard deviations are used to describe the variables of the study Linear correlation factor and variance inflation factor are used to test multicollinearity. Unit root test is used to identify the stability of the time series. Multilinear regression analysis is used to test the extent to which there is an effect of independent variables on the dependent variable (testing of hypotheses).

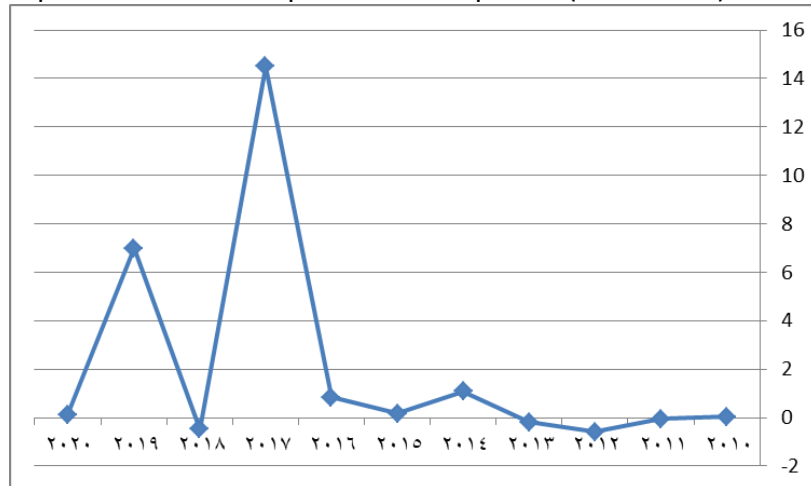
### Growth of petrochemical companies:

Table (1- 1)

*Descriptive statistics of the growth of petrochemical companies during the period (2010-2020)*

Year	Mean	Standard deviation
2010	0.030	0.016
2011	-0.057	0.031
2012	-0.580	0.063
2013	-0.188	0.087
2014	1.073	0.886
2015	0.158	1.592
2016	0.837	1.242
2017	14.491	20.195
2018	-0.479	0.628
2019	6.990	9.786
2020	0.108	0.049
The whole period	2.035	6.692

Table (1-1) shows that the overall arithmetic mean of the growth of petrochemical companies for the period (2010-2020) is (2,035). The standard deviation is (6.692). The largest value is (14,491), whereas the smallest value is (-0.580). This result indicates a fluctuation in the company's growth values during the study period. The values are stable at the beginning of the study period between 2010 and 2016. Then, there is a clear increase during the year (2017), but the values decline during the year (2018) then increases again in 2019. This result can be attributed to economic and political instability. Figure (1-1) shows the change in the growth values of petrochemical companies for the period (2010-2020).



**Figure (1-1)**  
Change in growth values of petrochemical companies during the period (2010-2020)

- **The value of petrochemical companies**

Table (1-2)

*Descriptive analysis of the value of petrochemical companies during the period (2010- 2020)*

Year	Mean*	Standard deviation
2010	8053.97	989.52
2011	6545.22	176.82
2012	5359.78	159.04
2013	5292.71	350.09
2014	4376.59	178.24
2015	3638.05	95.60
2016	4443.37	254.35
2017	4233.05	91.20
2018	3472.45	321.05
2019	3323.55	41.72
2020	2740.30	148.49
<b>The whole period</b>	<b>4679.91</b>	<b>1539.75</b>

\* The value is rounded to the nearest million.

Table (1- 2) shows that the overall arithmetic mean of the value of petrochemical companies for the period (2010-2020) is (4679.91). The standard deviation is (1539.75). The largest value is (8053.97), while the smallest value is (2740.30). This result indicates that there is a relative decline in corporate values during the study period. This result can be attributed to the inability of companies to improve their market value as a result of the decline in trading volume in the financial market. Figure (1- 2) shows the change in the value of petrochemical companies for the period (2010-2020).

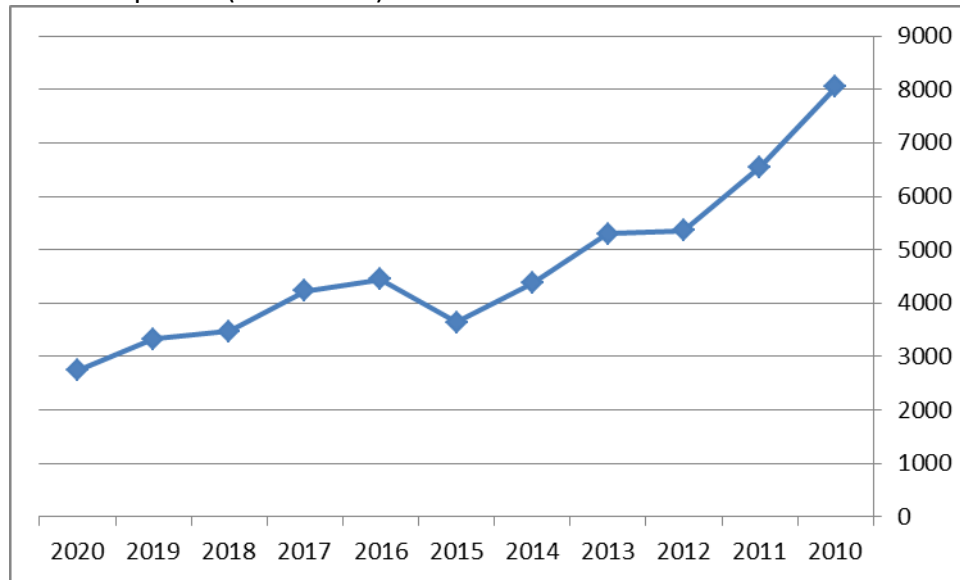


Figure (1- 2)  
Change in petrochemical company values during the period (2010-2020)

**Second: Independent variables**

The following tables describe the independent variables: research and development expenses, advertising expenses, as follows

- **Research and development expenses**

Table (1- 3)

*Descriptive statistics of research and development expenses during the period (2010-2020)*

Year	Mean*	Standard deviation
2010	572.57	154.43
2011	563.26	128.54
2012	549.48	131.67
2013	537.81	115.21
2014	548.52	87.89
2015	538.98	102.66
2016	471.64	70.54
2017	437.11	161.85
2018	504.59	59.32
2019	466.73	77.90
2020	497.71	118.88
<b>The whole period</b>	<b>517.13</b>	<b>93.48</b>

\* The value is rounded to the nearest million.

Table (1-3) shows that the overall arithmetic mean of R & D expenses during the period (2010-2020) is (517.13). The standard deviation is (93.48). The largest value is (572) 57, while the smallest value is (437.11). This result indicates a relative stability in the values of R & D expenses during the study period. This can be attributed to the importance of R & D for petrochemical companies. Figure (4-3) illustrates the change in the values of research and development expenses of petrochemicals companies during the period (2010-2020).

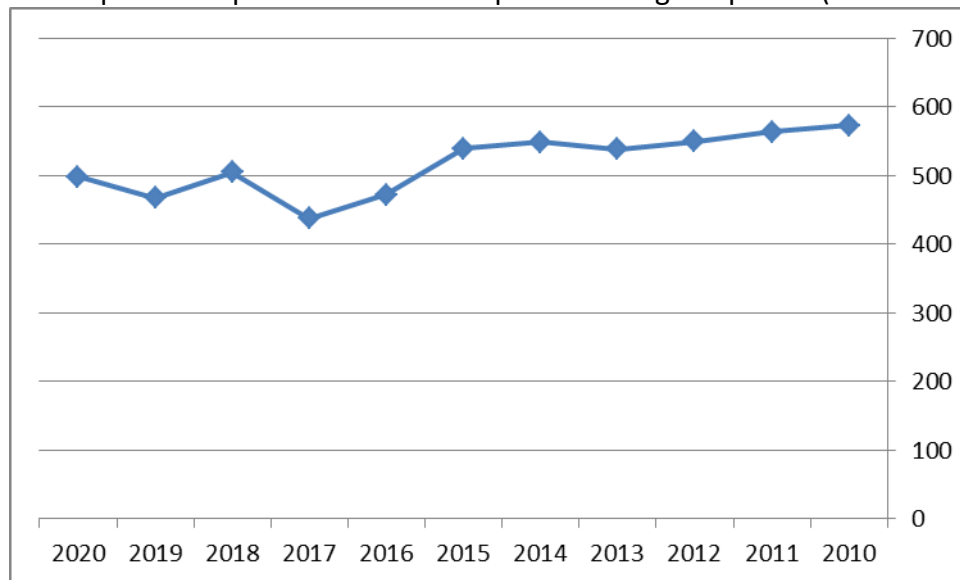


Figure (1- 3)  
Change in R & D expense values in petrochemical companies during the period (2010-2020)

\* The value is rounded to the nearest million.

- **Advertising expenses**

Table (1- 4)

*Descriptive statistics of advertising expenses during the period (2010-2020)*

Year	Mean*	Standard deviation
2010	12.50	1.47
2011	9.79	0.93
2012	8.84	1.47
2013	10.61	1.67
2014	6.91	2.84
2015	6.14	0.01
2016	5.08	5.52
2017	2.86	0.86
2018	3.73	0.07
2019	7.00	5.93
2020	2.81	0.64
<b>The whole period</b>	<b>6.93</b>	<b>3.72</b>

\* The value is rounded to the nearest million.

Table (1- 4) shows that the overall arithmetic mean of advertising expenses during the period (2010-2020) is (6.93). The standard deviation is (3.72). The largest value is (12.5 0), while the smallest value is (2.81). This result indicates a variance in the amount of advertising of the study sample, due to the diversity of promotion and marketing methods used by



companies. Figure (1- 4) illustrates the change in the values of advertising expenses in petrochemical companies during the Period (2010-2020).

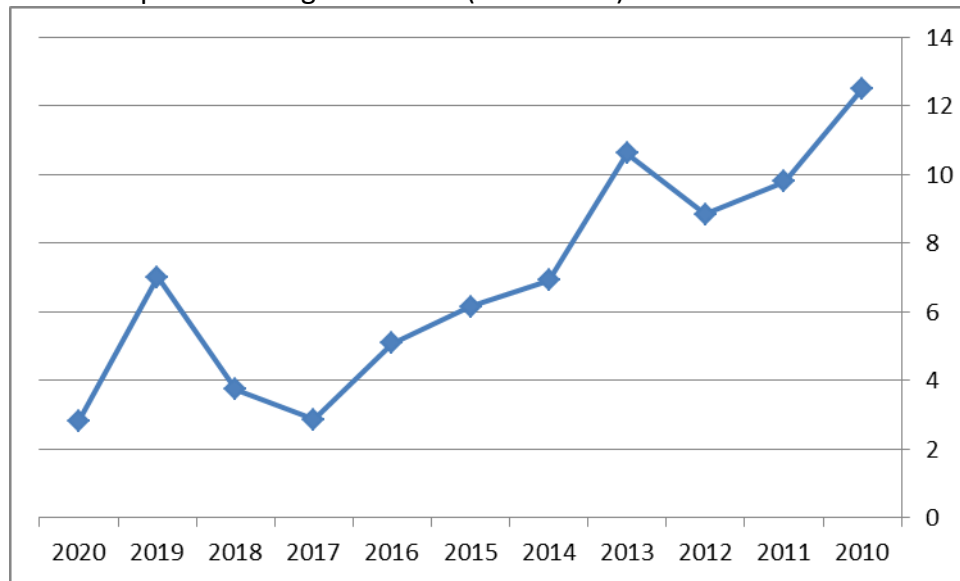


Figure (1- 4)  
Change in advertising expenses values in petrochemical companies during the period (2010-2020)

**Third: controlling variables**

The following tables describe the controlling variables: company size, company age, and as follows

**Company's size**

Table (1- 5)

*Descriptive statistics of the size of the company during the period (2010-2020)*

Year	Mean*	Standard deviation
2010	10.84	0.80
2011	10.85	0.45
2012	10.35	0.70
2013	10.70	0.44
2014	10.72	0.56
2015	10.73	0.63
2016	10.74	0.18
2017	10.74	0.12
2018	10.76	0.10
2019	10.73	0.40
2020	10.83	0.55
<b>The whole period</b>	10.73	0.20

Table (1- 5) shows that the overall arithmetic mean of company size during the period (2010-2020) is (10.73). The standard deviation is (0.20). The largest value is (10.85), while the smallest Value is (10.35). This result indicates the stability of the size variable of the company during the study period except in 2012. This may be due to the preparation of balance sheets

for these companies during the year (2012). Figure (1- 5) shows the change in the company's size values of petrochemical companies during the period (2010-2020).

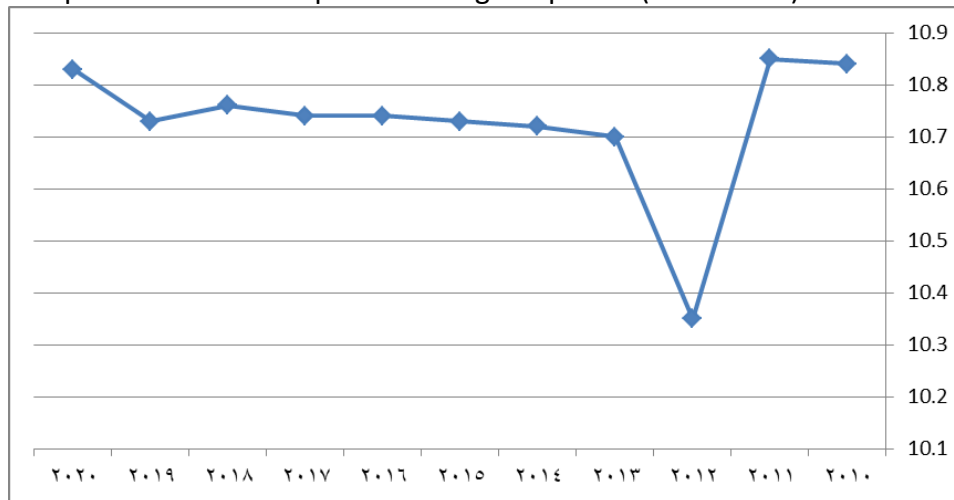


Figure (1- 5)  
Change in company size values of petrochemical companies during the period (2010-2020)

### Company's age.

Table (1- 6)

Descriptive statistics of the company's age during the period (2010-2020)

Year	Mean*	Standard deviation
2010	29.00	5.66
2011	30.00	5.66
2012	31.00	5.66
2013	32.00	5.66
2014	33.00	5.66
2015	34.00	5.66
2016	35.00	5.66
2017	36.00	5.66
2018	37.00	5.66
2019	38.00	5.66
2020	39.00	5.66
The whole period	34.00	الفترة كاملة

Table (1- 6) shows that the overall arithmetic mean of the company's age during the period (2010-2020) is (34.00). The standard deviation is (5.22). The largest value is (39.00), while the smallest value is (29.00). Figure (1- 6) shows the change in the company's lifetime values of petrochemical companies during the period (2010-2020).

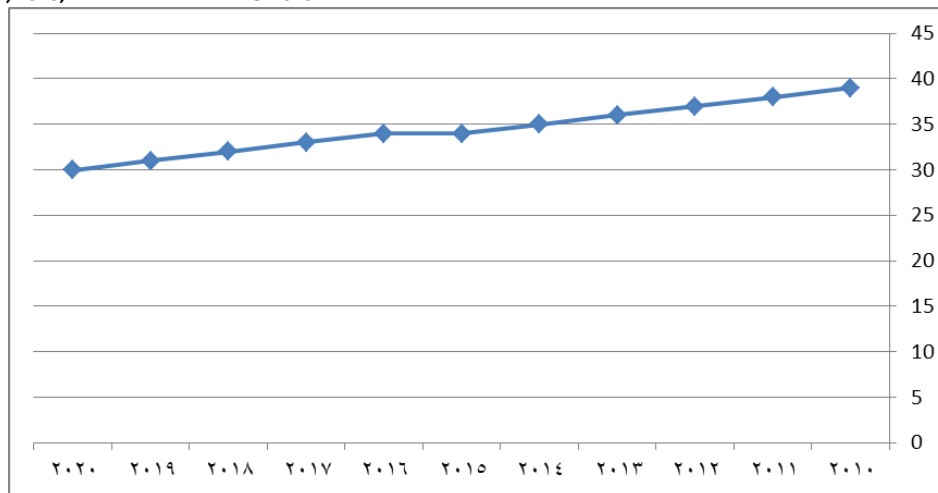


Figure (1- 6)  
Change in the company's life values for petrochemical companies during the period (2010-2020)

Table (1- 7)  
*Link matrix for independent and controlled variables*

Variable	Research and development expenses	Advertising expenses	Company size	The age of the company
Research and development expenses	1			
Advertising expenses	0.34	1		
Advertising expenses	-0.25	-0.12	1	
The age of the company	-0.36	-0.50*	0.24	1

\* significant at (0.05)

Table (1- 7) shows that the value of the correlation coefficient between all independent and controlled variables is less than (0.80). This may indicate that there is no high correlation between independent variables as linear correlation coefficient values exceeding (0.80) may be considered an indicator to multiple linear correlations. Hence, it can be said that the study sample is free of the problem of high multiple linear correlation (Guajarati, 2004).

To confirm the previous result, variance Inflation Factor (VIF) is used between independent variables to ensure that there is no multiple linear correlations between them.

Table (1- 8)  
*Results of the multi-link test between independent and controlled variables*

Variable	Variance inflation factor (VIF)
Research and development expenses	1.236
Advertising expenses	1.399
Advertising expenses	1.095
The age of the company	1.449

Table (4- 8) shows that the value of the variance inflation factor at all variables is less than (5), This emphasizes that the data are free of the phenomenon of multiple linear correlation.

Table (1-9)

*Unit root test results of study variables*

Variable	Value calculated at the level	Probability value	Result
R & D expenses	3.88399	0.000	stationary at the level
Advertising expenses	5.86712	0.000	stationary at the level
Company growth	4.33243	0.000	stationary at the level
Company value	4.08567	0.000	stationary at the level
Company size	4.65344	0.000	stationary at the level

Table (1- 9) illustrates the results of the data stability test of study variables, using Levin-Lin-Chu (LLC) test. It is clear that time series data of all study model variables are stable over time at the level, because probability values (P- Value) of the mentioned variables mentioned don't exceed the level of 5%. As a result, we reject the hypothesis that there is a unit root and these time series are stable.

Table (1- 10)

*Autocorrelation problem test*

Hypothesis	Calculated value of D- w	dl	du	Result
H 1	1.852	1.738	1.799	There is no autocorrelation
H 2	1.846	1.738	1.799	There is no autocorrelation
H 3	1.951	1.738	1.799	There is no autocorrelation
H 4	1.819	1.738	1.799	There is no autocorrelation
H 5	1.941	1.738	1.799	There is no autocorrelation
H 6	1.818	1.738	1.799	There is no autocorrelation

Table (1- 10) indicates that it can be asserted that the phenomenon of autocorrelation does not exist at all hypotheses according to the test results (Gujarati, 2004).

Table (1-11)

*Results of stationary time series test*

	Test			
	ADF-Fisher Chi-sq		PP-Fisher chi-sq	
	First difference of Prob b	Level of Pro	First difference of Prob b	Level of Pro
X1	0.0021	0.4209	0.001	0.3934
X2	0.0132	0.4838	0.042	0.5291
Y1	0.0067	0.5113	0.001	0.5101
Y3	0.033240	0.6454	0.047	0.6378
Z1	0.0372	0.5598	0.013	0.5734
Z2	0.0021	0.4209	0.001	0.3934

Source: Prepared by the researcher based on EViews outputs.

The results shown in table (1-11) indicate that the variables are not stable when conducting the ADF and PP tests. The absolute values of the estimated statistic were less than those of critical for all levels of statistical significance. As a result, the null hypothesis, pointing to the existence of the unit roots, is accepted. After taking the first difference, all variables became stable at the significance level of 5%. To ascertain whether the variables are first-class integrated or not, the researcher has tested the degree of integration of the residuals. This is illustrated in Table (1- 12).

Table (1-12)

*Results of stationary test of residuals*

	ADF	PP
Hypothesis 1	0.0000***	0.0000***
Hypothesis 2	0.0000***	0.0000***
Hypothesis 3	0.0000***	0.0000***
Hypothesis 4	0.0000***	0.0000***
Hypothesis 5	0.0000***	0.0000***
Hypothesis 6	0.0000***	0.0000***

\*, \*\*, \*\*\* indicates that variables are stable at the significance level of 1%, 5% and 10%, respectively.

Source: Prepared by the researcher based on EViews outputs.

The results shown in table (4- 12) indicate that the residuals are stable when conducting ADF and PP tests at the level. The absolute values of the estimated statistic are higher than those of critical for all levels of statistical significance. This means that we have to reject the null hypothesis which point to the existence of the unit roots. Thus, the residuals are integrated from the null point (0) I at the significance level of 1%. Based on the results and the fact that the residuals are stationary at zero (0) I, the null hypothesis cannot be rejected.

Hausman test is applied in order to know the appropriate model for estimation (fixed effects model or random effects model). Table (1-13) shows this

Table (1-13)

*Hausman Test Results*

Hypothesis	Chi-Sq. Statistic	Prob.
Hypothesis 1	0.003114	0.88
Hypothesis 2	0.00213	0.89
Hypothesis 3	0.00412	0.87
Hypothesis 4	0.00341	0.85
Hypothesis 5	0.0051	0.78
Hypothesis 6	0.00321	0.79

Source: Prepared by the researcher based on EViews outputs.

Table (1- 13) shows that the appropriate model for testing the study hypotheses is the fixed effects model, in which the goal is to know the behavior of each data set that varies from set to another, with only regression factors  $\beta_j$  remaining constant for each set of cross-sectional data. If the value of (H) is greater than the table value of  $\chi^2$  with degrees of freedom K, then  $H_0$  is rejected, that is, the fixed effects model is the appropriate model (Amer, Ghazal Abdul Aziz, 2015).

**Results Related to the Testing of Hypotheses**

The following part of the study addresses testing of hypotheses. The multiple regression equation has been applied to test hypotheses

**Results of the test of the first hypothesis (Ha1):** “There is a statistically significant effect of R & D expenses at the level ( $\alpha \leq 0.05$ ) on the value of petrochemical companies listed in Iraq Stock Exchange”.

To validate this hypothesis, the multiple regression equation is applied to study the effect of R & D expenses on the value of petrochemical companies listed in Iraq Stock Exchange, with the size and age of the company as controlled variables, this is illustrated in table (1- 14).

Table (1- 14)

*The results of the application of the multiple regression equation to study the impact of R & D expenses on the value of petrochemical companies listed in Iraq Stock Exchange, with size and age of the company as controlled variables*

Dependent variable	Coefficients				
	variable	B	Standard error	T	Sig t*
Value of listed petrochemical companies	Consistency of regression	492.485		4.503	0.000
	R & D expenses	52.622	10.516	5.004	0.000
	Company size	2.675	4.148	0.645	0.523
	Company age	0.138	0.117	1.185	0.243
Determination coefficient R <sup>2</sup>	0.398				
Correction factor AdjR <sup>2</sup>	0.350				
Calculated F value	8.373				
Sig. F*	0.000				

\*Natural logarithm is calculated.

\* The effect is statistically significant at the level ( $\alpha \leq 0.05$ )

Table (1- 14) indicates that the value of the determination factor (R<sup>2</sup>) is (0.398). This means that the independent variable with controlled variables have interpreted 39.8% of the variance in (the value of petrochemical companies), with the other factors remaining consistent. The value of (F) is (8.373) at the confidence level (Sig = 0.000). This emphasizes the significance of regression at the level ( $\alpha \leq 0.05$ ). The first hypothesis is therefore accepted in the alternative form, which provides that: there is a statistically significant effect of R & D expenses at the level ( $\alpha \leq 0.05$ ) on the value of petrochemical companies listed in Iraq Stock Exchange.

**Results of the test of the second hypothesis (Ha2):** “There is a statistically significant effect of R & D expenses at the level ( $\alpha \leq 0.05$ ) on the growth of petrochemical companies listed in Iraq Stock Exchange”.

To validate this hypothesis, the multiple regression equation is applied to study the effect of R & D expenses on the growth of petrochemical companies listed in Iraq Stock Exchange, with the size and age of the company as controlled variables. Table (4- 15) shows this.

Table (1-15)

*The results of the application of the multiple regression equation to study the effect of R & D expenses on the growth of petrochemical companies listed in Iraq Stock Exchange, with size and age of the company as controlled variables*

Dependent variable	Coefficients				
	variables	B	Standard error	T	Sig t*
Value of listed petrochemical companies	Stability of regression	6.462	2.563		0.016
	Expenses of research and development	0.303	0.246	1.229	0.226
	Company size	0.068	0.097	0.697	0.490
	Company age	0.006	0.003	2.101	0.042
Determination coefficient R <sup>2</sup>	0.167				
Correction factor AdjR <sup>2</sup>	0.102				
Calculated value F	2.548				
Sig. F*	0.07				

\*Natural logarithm is calculated.

\*\* The effect is statistically significant at the level ( $\alpha \leq 0.05$ )

Table (1- 15) indicates that the value of the determination factor (R<sup>2</sup>) is (0.167), meaning that the independent variable with controlled variables have interpreted 16.7% of the variance in (growth of petrochemical companies), with other factors remaining consistence. It also shows that the value of (F) is (2.548) at the confidence level (Sig = 0.07). This emphasizes the significance of regression at the level ( $\alpha \leq 0.05$ ). The second hypothesis is therefore accepted in the null form, which states: there is no statistically significant effect of R & D expenses at the level ( $\alpha \leq 0.05$ ) on the growth of petrochemical companies listed in Iraq Stock Exchange.

**Results of the test of the third hypothesis (Ha3):** "There is a statistically significant effect of advertising expenses at the level ( $\alpha \leq 0.05$ ) on the value of petrochemical companies listed in Iraq Stock Exchange".

To validate this hypothesis, the multiple regression equation is applied to study the effect of advertising expenses on the value of petrochemical companies listed in Iraq Stock Exchange, with the size and age of the company as controlled variables. Table (1-16) shows this.

Table (1-16)

*The results of the application of the multiple regression equation to study the effect of advertising expenses on the value of petrochemical companies listed in Iraq Stock Exchange, with size and age of the company as controlled variables*

Dependent variable	Coefficients				
	Statement	B	Standard error	T	Sig t*
Value of listed petrochemical companies	Stability of regression	36.200		0.598	0.553
	Advertising expenses	5.654	1.674	3.378	0.049
	Company size	0.456	5.085	0.090	0.929
	Company age	-0.041	0.143	-0.289	0.774
Determination coefficient R <sup>2</sup>	0.377				
Correction factor AdjR <sup>2</sup>	0.295				
Calculated F value	3.888				
Sig. F*	0.002				

\*Natural logarithms are calculated.

\* The effect is statistically significant at the level ( $\alpha \leq 0.05$ )

Table (1- 16) indicates that the value of the determination factor (R<sup>2</sup>) is (0.377), meaning that the independent and controlled variables have interpreted 37.7% of the variance in (the value of petrochemical companies), with other factors remaining consistent. It also shows that the value of (F) is (3.888) at the confidence level (Sig = 0.002). This emphasizes the significance of regression at the level ( $\alpha \leq 0.05$ ). The third hypothesis is therefore accepted in the alternative form, which states: there is a statistically significant effect of advertising expenses at the level ( $\alpha \leq 0.05$ ) on the value of petrochemical companies listed in Iraq Stock Exchange.

**4- Results of the test of the fourth hypothesis (Ha4):** “There is a statistically significant effect of advertising expenses at the level ( $\alpha \leq 0.05$ ) on the growth of petrochemical companies listed in Iraq Stock Exchange”.

To validate this hypothesis, the multiple regression equation is applied to study the effect of advertising expenses on the growth of petrochemical companies listed in Iraq Stock Exchange, with size and age of the company as controlled variables, Table (1- 17) indicates this



Table (1- 17)

*The results of the application of the multiple regression equation to study the impact of advertising expenses on the growth of petrochemical companies listed in Iraq Stock Exchange, with size and age of the company as controlled variables*

Dependent variable	Coefficients				
	Statement	B	Standard error	T	Sig t*
Value of listed petrochemical companies	Stability of regression	7.544		7.778	0.000
	Advertising expenses	0.221	0.054	4.078	0.000
	Company size	0.071	0.082	0.874	0.388
	Company age	0.005	0.002	2.082	0.044
Determination coefficient R <sup>2</sup>	0.398				
Correction factor AdjR <sup>2</sup>	0.350				
Calculated F value	8.372				
Sig. F*	0.000				

\*Natural logarithm is calculated.

\*\* The effect is statistically significant at the level ( $\alpha \leq 0.05$ )

Table (1- 17) indicates that the value of the determination factor (R<sup>2</sup>) is (0.398), meaning that the independent and controlled variables have interpreted 39.8% of the variance in (growth of petrochemical companies), with other factors remaining consistent. It also shows that the value of (F) is (8.372) at the confidence level (Sig = 0.000). This emphasizes the significance of regression at the level ( $\alpha \leq 0.05$ ). The fourth hypothesis is therefore accepted in the alternative form which provided that: there is a statistically significant effect of advertising expenses at the level ( $\alpha \leq 0.05$ ) on the growth of petrochemical companies listed in Iraq Stock Exchange.

**Results of the test of the Fifth Hypothesis (Ha5):** "There is a statistically significant effect of R & D and advertising expenses together at a level ( $\alpha \leq 0.05$ ) on the value of petrochemical companies listed in Iraq Stock Exchange".

To validate this hypothesis, the multiple regression equation is applied to study the effect of R & D and advertising together on the value of petrochemical companies listed in Iraq Stock Exchange, with size and age of the company as controlled variables, as illustrated in table (1-18) this.

Table (1- 18)

*The results of the application of multiple regression equation to study the effect of R & D and advertising expenses together on the value of petrochemical companies listed in Iraq Stock Exchange, with size and age of the company as controlled variables*

Dependent variable	Coefficients				
	Statement	B	Standard error	T	Sig t*
Value of listed petrochemical companies	Stability of regression	487.470		4.406	0.000
	Expenses of research and development	50.621	11.121	4.552	0.000
	Advertising expenses	1.719	2.874	0.598	0.553
	Company size	2.728	4.185	0.652	0.519
	Company age	0.147	0.119	1.238	0.223
Determination coefficient R <sup>2</sup>	0.404				
Correction factor AdjR <sup>2</sup>	0.339				
Calculated F value	6.263				
Sig. F*	0.001				

\*Natural logarithm is calculated.

\* The effect is statistically significant at the level ( $\alpha \leq 0.05$ )

Table (1- 18) indicates that the value of the determination factor (R<sup>2</sup>) is (0.404), meaning that independent and controlled variables have interpreted 40.4% of the variance in (The value of petrochemical companies), with other factors remaining consistent. It also shows that the value of (F) is ( $\alpha \leq 0.05$ ). The fifth hypothesis is therefore accepted in the alternative form, which states: there is a statistically significant effect of R & D and advertising expenses together at the level ( $\alpha \leq 0.05$ ) on the value of petrochemical companies listed in Iraq Stock Exchange.

**Results of the test of the sixth hypothesis (Ha6):** “There is a statistically significant effect at the level ( $\alpha \leq 0.05$ ) of R & D and advertising expenses together on the growth of petrochemical companies listed in Iraq Stock Exchange”.

To validate this hypothesis, the multiple regression equation is applied to study the effect of R & D and advertising together on the growth of petrochemical companies listed in Iraq Stock Exchange, with size and age of the company as controlled variables, Table (1- 19) explains this.

Table (1-19)

*The results of the application of multiple regression equation to study the effect of R & D and advertising together on the growth of petrochemical companies listed in Iraq Stock Exchange, with size and age of the company as controlled variables*

Dependent variable	Coefficients				
	Statement	B	Standard error	T	Sig t*
Value of listed petrochemical companies	Stability of regression	7.095		3.205	0.003
	Expenses of research and development	0.050	0.223	0.226	0.822
	Advertising expenses	0.217	0.058	3.773	0.001
	Company size	0.074	0.084	0.889	0.380
	Company age	0.005	0.002	1.973	0.056
Determination coefficient R <sup>2</sup>	0.399				
Correction factor AdjR <sup>2</sup>	0.334				
Calculated F value	6.135				
Sig. F*	0.001				

\*Natural logarithm is calculated.

\* The effect is statistically significant at the level ( $\alpha \leq 0.05$ )

Table (1- 19) indicates that the value of the determination factor (R<sup>2</sup>) is (0.399), which means that independent and controlled variables have explained (39.9%) of the variance in (growth of petrochemical companies), with other factors remaining consistent. It also shows that the value of (F) is (6.135) at the confidence level (Sig =0.001). This emphasizes the significance of regression at the level ( $\alpha \leq 0.05$ ). The six hypothesis is therefore accepted in the alternative form, which states: there is a statistically significant effect of R & D and advertising expenses together ( $\alpha \leq 0.05$ ) at the level on the growth of petrochemical companies listed in Iraq Stock Exchange.

**Summary of Hypotheses Results**

Table (1- 20)

*Summary of hypotheses results*

Hypothesis	Alternative form	null form
There is a statistically significant effect of R & D expenses on the value of petrochemical companies listed in Iraq Stock Exchange.	Accepted	rejected
There is a statistically significant effect of R & D expenses on the growth of petrochemical companies listed in Iraq Stock Exchange.	Accepted	rejected
There is a statistically significant effect of advertising expenses on the value of petrochemical companies listed in Iraq Stock Exchange.	Accepted	rejected
There is a statistically significant effect of advertising expenses on the growth of petrochemical companies listed in Iraq Stock Exchange.	Accepted	rejected
There is a statistically significant effect of R & D and advertising expenses together on the value of petrochemical companies listed in Iraq Stock Exchange.	Accepted	rejected
There is a statistically significant effect of R & D and advertising expenses together on the growth of petrochemical companies listed in Iraq Stock Exchange.	Accepted	rejected

**Conclusions and Recommendations**

Based on the results of statistical analysis and testing of hypotheses, the following concludes the following:

- There is a statistically significant effect of R & D expenses at the level ( $\alpha \leq 0.05$ ) on the value of petrochemical companies listed in Iraq Stock Exchange. The researcher suggests that this result is due to the fact that interest in R & D helps the company control over the markets and know its requirements and needs, i.e. the more interested the company in R & D, the greater its absorption of the market than the new companies as well as the ratio of its sales increases faster in in terms of developments and improvements of products. This is due to experience and competence can enter in the required developments, which positively affects the value of companies.
- There is no statistically significant effect of R & D expenses at the level ( $\alpha \leq 0.05$ ) on the growth of petrochemical companies listed in Iraq Stock Exchange, this finding can be explained by the fact that corporate spending on R & D contributes to sustainable growth in the long run because policymakers are well aware of the importance of R & D in companies. Research and development expenditures are considered to be an investment in the new technologies and knowledge base. Then, they can be converted into more efficient production methods of available resources, which is reflected in the level of corporate growth.
- There is a statistically significant effect of advertising expenses at the level ( $\alpha \leq 0.05$ ) on the value of petrochemical companies listed in Iraq Stock Exchange. The researcher explains this result through the general overview of advertising. Corporate administration sees advertising as one of the most important entities through which the level of competitiveness can be improved and the level of market share increased. The company's position in the market

indicates the efficiency of its management in general. The assessment is determined by the amount of sales achieved for a limited period compared to an earlier period, the direction of sales, what has been sold to new customers or by comparing the designed sales targets which are achieved, which reflects on the value of the company.

- There is a statistically significant effect of advertising expenses at the level ( $\alpha \leq 0.05$ ) on the growth of petrochemical companies listed in Iraq Stock Exchange. This result can be explained by the fact that advertising expenses contribute to improving the customers' mental image towards the goods or products produced by the company, which has a positive impact on the company's growth.

- There is a statistically significant effect of R & D and advertising expenses together at the level ( $\alpha \leq 0.05$ ) on the value of petrochemical companies listed in Iraq Stock Exchange. This result can be explained by the fact that companies are interested in this type of expenses because of its importance and impact on the company's income.

- There is a statistically significant effect of R & D and advertising expenses together at the level ( $\alpha \leq 0.05$ ) on the growth of petrochemical companies listed in Iraq Stock Exchange. This finding can be explained by the fact that R & D and advertising expenses are difficult to measure and see their impact clearly and directly, due to the fact that their results may appear in various forms such as an increase in sales and revenues or attracting new suppliers and consumers, encouraging them to deal with the company and benefit from its services or purchase its products through promotions and competitive prices.

Based on the above results, the study recommends the following:

- Focus on research and development expenses (R & D) and advertising, with the aim of increasing the value of companies, which increases the perceived quality of the products provided by advertising.

- Increasing corporate interest in modern technology in R & D and advertising, making them more capable of dealing with customers.

- Increasing R & D expenses and advertising to contribute to improving the mental image towards the company.

- Companies need to use different types of advertising to reach out to the largest possible number of customers.

- The researcher recommends petrochemical companies to be interested in R & D and advertising as well as the need to increase spending on them because they greatly affect their market value.

- Petrochemical companies should be more interested in R & D as an effective tool in increasing competitiveness and profitability, in addition to the need to increase R & D expenses.

- Paying attention to raising the level of awareness of the departments of petrochemical companies about the importance of measuring R & D and expenses through the preparation of courses and workshops aiming to sensitize them about the importance of measuring expenses.

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