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Using Approach Quantile Regression to Determine the Factors Affecting Measuring Capacity in Iraq

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Abstract

The studies relevant to taxes are so important in financial studies because of the importance of taxes of in state budget. This is on the one hand, while on the other they acquire their importance as a result of achieving their goals within their philosophy through the capacity tax for the concerned countries. It is therefore highly important to conduct studies and researches to ensure the measurement of the capacity tax in accordance with modern scientific methods because of the importance of these studies as a financial phenomenon to achieve the goals of economic and social state in addition to the financial target which is the main role in financing public expenditure . Accordingly, it has been relied on quantile regression method a statistical method to reach the scientific prediction in the measurement of capacity tax in Iraq to recognize the effect variables in their measurement.

Keywords*:* Capacity tax, Tax revenue, Quintile regression

Introduction

Taxes play an important role in the economies of most countries, regardless of their political and economic systems for they are considered a source of funding for the state budget as well as the role they play in the re-distribution of national income andachieving economic stability. Studies on taxation occupy the forefront place in the financial studies within the scope of science of public finance because of the importance of taxes in the state budget on the one hand, and because of their importance in achieving the goals of the state within its philosophy on the other hand, through the capacity tax for thosecountries.

It is important to identify the tax structure in Iraq to find out how the capacity tax ismeasured. The taxes that exist in Iraq are those which tax money, and there is no tax on individuals. The tax system in Iraq is based on a combination of direct taxes and indirect taxes. In the sense of the system's reliance on a multi-tax system and not a single tax system. The direct taxes in Iraq are those imposed on the income which are the income taxes and those on property which are the property taxes. There is only asingle tax imposed on capital which is called the real property or landstax. As for indirect taxes, on the other hand, they include both taxes on consumption and taxes on trade.

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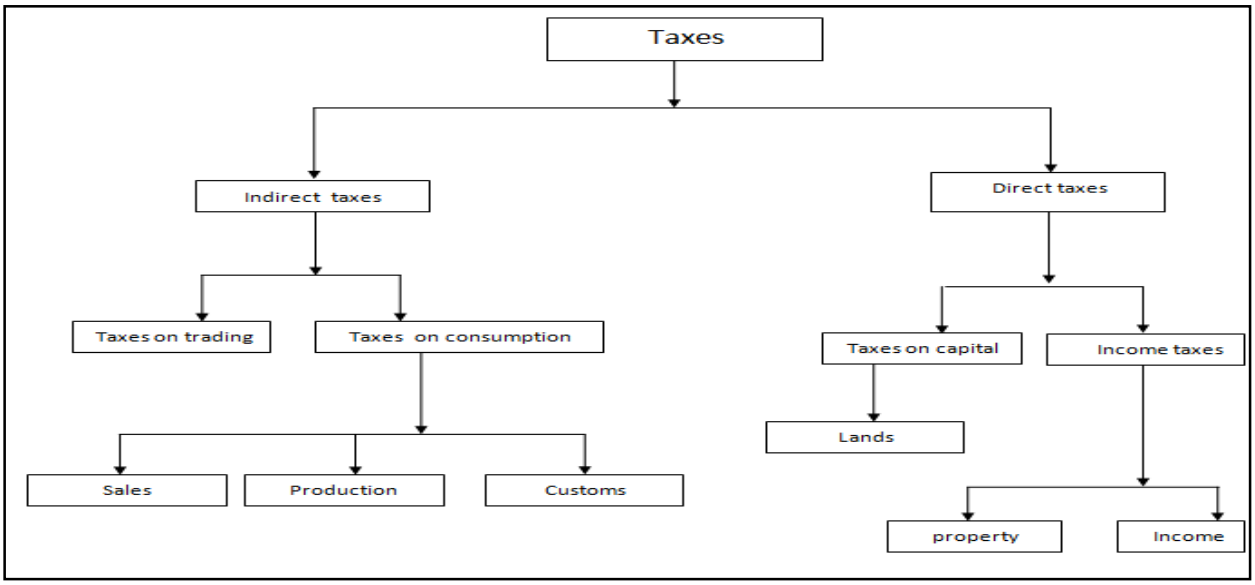
There are three types of consumption taxes which are the customs taxes, production taxes and sales taxes. Below is a flipchart diagram for the current tax structure in Iraq.

Figure (1) shown type taxes in Iraq (the shape from the work of researcher)



1.1. Capacity tax

The concept of capacity tax or as sometimes called the estimated national cost tax or the idealistic tax burden covers the ability of the GNI's ability to afford the tax, or the ability to represent the extremities of revenue that can be collected through axes, taking into account the size of the GNP and its structure, and the amount of public expenditure and the level of productivity taking into account at the same time the individual's ability to pay taxes and the government's ability to levy and collect them. As for the measuring of tax capacity , there are many attempts to set the capacity tax some of which are the attempts by the World Bank staff and others, and the most important of which are those related to the measurement of the capacity tax such as the study by Bahle and the study by Chellia and Kole.[13][18]

1.2. Tax revenue

The tax revenue is considered one of the most important components of state revenues, as they grow and increase according to the increase in the volume of economic activity of the state, and hence emerges the importance of tax revenue because it provides the state with what enable it to fulfill its basic role. The tax revenue is the outcome of manufacturing industries, trade, mining, services, monetizing, agriculture, etc. So it has become important to plan for such a revenue, and therefore, studies and researches must be conducted to ensure the measurement of capacity tax and forecasting for the subsequent years using modern scientific methods and to identify the variables affecting its measurement.

It has been relied, therefore, on the quantile regression methodwhich a statistical method is used to arrive at the scientific prediction of measuring thecapacity tax in Iraq. We will study, accordingly, the impact of six variables on the response capacity taxvariable using some regression analysis methods quantile to build models that may represent the relationship between the response variable and a set of independent variables that can provide full coverage of all sectors of the response variable tax capacity through a series of quantile regression lines and choosing the optimal quantile regression line in the analysis of the variables of the study. We will select in this research the six lines quantile regression through ratio quantile which is a specific mathematical function.

Each line of these lines represents a separate gradient initself; later on we determine the variables that directly affect the capacity tax scale in Iraq and excluding the unimportant variables. In this paper weare using the [R] programmingwhich is a free software. Through use the packages ("quantile"), contributed by Koenker. SeeKoenker [6]. This research aims to conduct a study in which the most important factors that may influence measuring the capacity tax in Iraq are determined, while a range of factors related to capacity tax have been taken alongside trying to find the variables affecting its measurement by using the quantile regression method. This paper is organized as follows. In Section 2, we illustrate method of Quantile Regression.In Section 3, we employ these quantile regression method on a sample data. In Section 4, we present a conclusion of the study.

Methods of quintile regression

In this study we will use quantile regression model,to clarify the most important variables that affect the capacity tax measure in Iraq.

2.1 Concept of quintile regression

It is well known that the main objective of the regression analysis is to evaluate the relationship between the dependent variable and a set of independent variables. Quantile regression is progressively emerging as a comprehensive approach to the statistical analysis of linear models. A number of papers have newly appeared on the application of quantile regression (see Cole and Green, 1992; Royston and Altman, 1994; Buchinsky,1998; Yu and Jones,1998; He et al.,1998;Koenker and Machado, 1999)[1][2][8][16][22].

Analysis quantile regression is a fundamental corner of the knowledge of statistics and an important method of applied statistics when studying all economic and social phenomena among variables.It is one of the statistical tools most widely used because it gives us an easy way to determine the relationship among variables. This relationship can be expressed in the equation containing the variant response variable the dependant with one or more of the explanatory variables, independent. It is also possible to define the gradient as a set of statistical methods dealing with different formulas formathematical models that describe the relationships between variables ,so that you can use models of these relationships for the purposes of prediction. It could be argued that the regression analysis quantile regression serve three main purposes which are description, control and prediction (Koenker, R. (2005).[5]).

2.2 Quintile and quintile function

Symbolizes it $Q(p)$ where define as the :

$$p = p(X \leq x_p) \qquad \text{when} \quad x_p = x$$

Then x_p is call (p-quantile) value of quantile cumulative distribution function and the quantile function is the inverse of the cumulative distribution function we can explained that as follows :

$$F(x) = Q^{-1}(x) \text{ and } Q(p) = F^{-1}(P)$$

where p isthe value of quantile proportion $0 < p < 1$.

$$0 < p_1 < p_2 < p_3 \dots \dots \dots < p_n < 1$$

Then the relationship between probability density function(p.d.f)andcumulative distribution function (c.d.f) through the equation below.

$$f(x) = \frac{\partial F(x)}{\partial x} \qquad or \qquad F(x) = \int_{-\infty}^{x} f(w)\,dw$$

The Quantile function (QF) , It possible takes abundant names relative to quantiles proportion (Qp) in population distribution where determine this proportion through as the following formula :

$$p_R = \frac{R}{q+1} \qquad R = 1,2,\dots\dots\dots q$$

Where p_R quantiles operation,and R is index of quantileand q number of quantile lines.

And also is the selection of lines quantile according to the nature of the study data for example if we study hypertension and hypotension , if We will choose the lines that pass hypertension data if we studied hypertension and if we studied hypotension then choose the lines that pass hypotension. Where this property that motivate us to choose the quantile regression model. Which is easy in study phenomenon data representation.

2.3. Mathematical model of quantile regression.

It can be described quantile regression model by the following equation:

$$y_i = \alpha_P + x_i^T \beta_P + u_{i_P} \qquad (1)$$

Wherey_i it is dependent variable and (β) they are parameters of model,
x_i^T set of independent variablesassociated with the qth quantile , and u_{i_θ}random error (where 0< P < 1) . We will get specific proportion for set of quantile regression models according to the following:

$$Q_{P_1}(y_i|x_i) = x_i^T \beta_{P_1} \quad if\ P_1 = 0.14\ the\ model\ became\ Q_{0.14}(y_i|x_i) = x_i^T \beta_{0.14}$$
$$Q_{P_2}(y_i|x_i) = x_i^T \beta_{P_2} \quad if\ P_2 = 0.28\ the\ model\ became\ Q_{0.28}(y_i|x_i) = x_i^T \beta_{0.28}$$
$$Q_{P_3}(y_i|x_i) = x_i^T \beta_{P_3} \quad if\ P_3 = 0.43\ the\ model\ became Q_{0.43}(y_i|x_i) = x_i^T \beta_{0.43}$$
$$Q_{\theta_4}(y|x_i) = x_i^T \beta_{P_4} \quad if\ P_4 = 0.57\ the\ model\ became Q_{0.57}(y_i|x_i) = x_i^T \beta_{0.57}$$
$$Q_{P_5}(y_i|x_i) = x_i^T \beta_{P_5} \quad if\ P_5 = 0.71\ the\ model\ became\ Q_{0.71}(y_i|x_i) = x_i^T \beta_{0.71}$$
$$Q_{P_6}(y_i|x_i) = x_i^T \beta_{P_1} \quad if\ P_6 = 0.85\ the\ model\ became\ Q_{0.85}(y_i|x_i) = x_i^T \beta_{0.85}$$

By use quantile regression must estimate its parameters, in case of prediction.

For the estimating the parameters of quantile regression model, It possible to through minimizing following equation.

$$\min_{\beta_P} \sum \rho_P\,|(y_i - (\alpha_P + x_i^T \beta_P)| \qquad (2)$$

Where lossfunction $\rho_P\ (u_i)$is:

$$\rho_P(u_i) = \begin{cases} (P)|(y_i - (\alpha_P + x_i^T \beta_P))| & y_i - (\alpha_P + x_i^T \beta_P) \geq 0 \\ -(1-P)|(y_i - (\alpha_P + x_i^T \beta_P))| & y_i - (\alpha_P + x_i^T \beta_P) < 0 \end{cases} \qquad (3)$$

Form equation (3) we seek to minimize weighted sum residuals$(y_i - \hat{y}_i)$ where weight (P) takes positive residuals and weight$(1-P)$takes negative residuals. We can estimate parameters quantile reg . on model through following formula:

$$\sum d_P\,(y_i, \hat{y}_i) = P \sum_{y_i \geq \alpha_P + x_i^T \beta_P} |y_i - \alpha_P + x_i^T \beta_P| + (1-P) \sum_{y_i < \alpha_P + x_i^T \beta_P} |y_i - \alpha_P + x_i^T \beta_P|$$

3. The sample of study

This study is based on data taken from statistical groups Ministry of Planning, which it is a monthly tax calculated value measure thousands of dinars and for a period of five years (2011-2015) research sample are 60 observations. For the purpose of building the proposed statistical model of capacity tax (Y = ratio of tax revenue / GDP) and as a dependent variable .This study is based on six explanatory variables (independent), which represents sectors (economic activities) involved in the calculation of GDP.
We will explain the variables as follows:

- X1 : average per capita income
- X2: Mining sector contributions in GDP (It means extract any wealth unlimited (such as oil, natural gas, etc.)
- X3:Trade sector contributions in GDP (Mediation process and to mediate between the producer and the consumer)
- X4 : Government spending sector contributions in GDP (It is a government-provided services and public expenditure)
- X5 :manufacturing sector contributions in GDP (involves the conversion of raw materials to final products)
- X6 :Monetization sector contributions in GDP(Monetization is the process of converting or establishing something into legal tender While it usually refers to the coining of currency or the printing of banknotes by central banks).

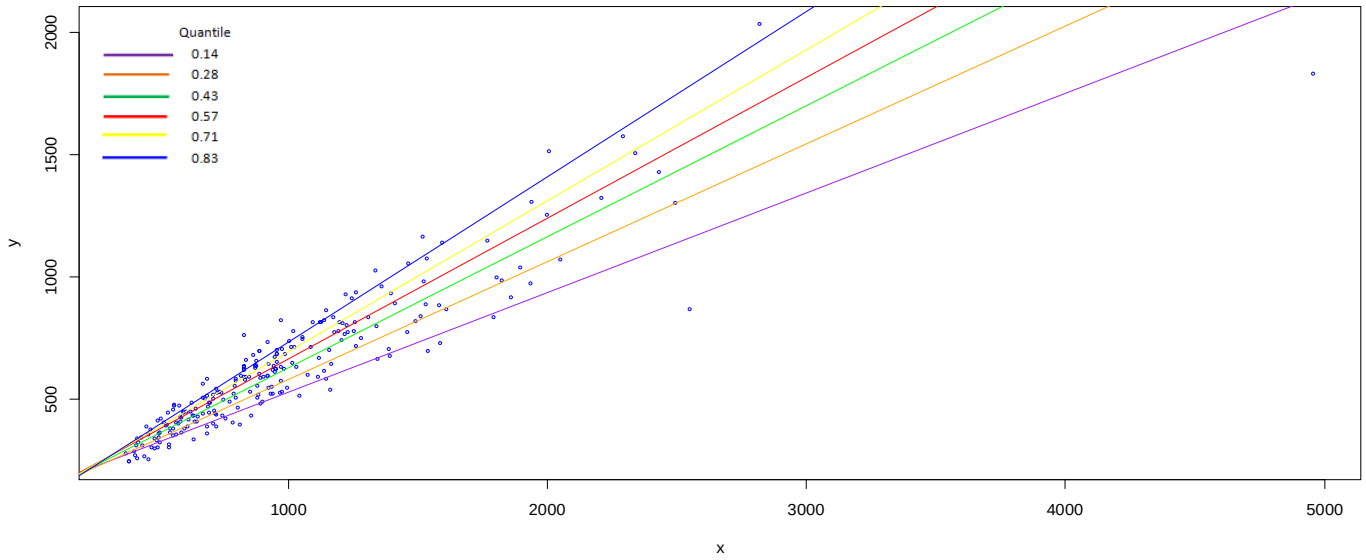
Variable	Minimum	Maximum	Mean	Std. Deviation
Y	17985	142524	60845.75	27339.11
X1	1008	54876	18608.7	12440.01
X2	53000	140000	82866.67	18875.56
X3	35000	65000	50300	10583.48
X4	12000	145000	119583.33	18193.21
X5	50000	85000	61583.33	7805.45
X6	42868	127000	64282.33	16549.33

Description Statistic

***Source: Generated by the author, using The R Project for Statistical Computing**

3.1. Analysis quintile regression model

Figure (2) shown quantile regression lines



To calculate the results quantile regression model accounted for all of the regression line separately, each regression model quantile must be accounted for independently of each other in accordance with the percentage quantile regression. We will get six lines (according to supposition the researcher) can be calculated by the following formula:

$\theta_q = \frac{q}{Q+1}$ for q = 1, … . , Q.(5)

The quantile proportion are

$P_1 = \frac{1}{Q+1} = \frac{1}{7} = 0.14$, $P_2 = \frac{2}{7} = 0.28$, $P_3 = \frac{3}{7} = 0.43$, $P_4 = \frac{4}{7} = 0.57$,

$P_5 = \frac{5}{7} = 0.71$, $P_6 = \frac{1}{7} = 0.85$

3.2. Results analysis quintile regression model

The results of the six tables represent the means we will depend on in determining the best analysis, which represent a phenomenon studied through of the value R square is represent ability of independent variables in explaining dependent variable (which is measure capacity tax in Iraq) where whenever the value R-square was high represents the best option. Through the tables above for quantile regression model we will depend on the value of The pseudo-R square, which represents ability the independent variables in explaining variation to measure capacity tax, which through we will choose the best model quantile ,which represents the highest value to pseudo-R square. For the comparison between the value of pseudo-R square in the tables, we find that the value of pseudo-R square in table (2) recorded the highest value of (pseudo-R square =0.8712446). This means that independent variables they are (average per capita income X1, mining X2 , trade X3, services X4, manufacturing X5,monetizing X6)which could explain(87.12%) (Out of the variation in the capacity tax measure which indicates the strength of the quantile regression model in the ratio of quantile (0.28) in the representation of the studied data phenomenon. If we noticed the rest of the tables we will see that the pseudo-R square are weak ratio of any unable to interpret would be very small and therefore it will be very weak quantile model.

Table (1) showsanalysis quantile regression model at quantile proportion $P_1 = (0.14)$

Variables	Coefficients	Std. Error	t value	Pr(>|t|)
Intercept	-14814.65	42545.9	-0.34820	0.72907
X1	0.38606	0.40862	0.94480	0.34905
X2	-0.10655	0.43904	-0.24269	0.80918
X3	0.35502	0.38345	0.92584	0.35872
X4	-0.36145	0.30442	-1.18737	0.24038
X5	1.76123	0.30475	5.77930	0.00000
X6	-0.06032	0.37447	-0.16109	0.87264
The pseudo-R square = 0.42430				

***Source: Produced by the author, using The R Project for Statistical Computing.**

Table (2) showsanalysis quantile regression model at quantile proportion $P_2 = (0.28)$

Variables	Coefficients	Std. Error	t value	Pr(>|t|)
Intercept	6673.75	42248.58	0.15796	0.87509
X1	-0.32859	0.34742	-0.94580	0.34854
X2	-0.04501	0.35359	-0.12728	0.89920
X3	0.64587	0.35668	1.81081	0.07584
X4	0.29187	0.30743	0.94940	0.34673
X5	1.88303	0.28207	6.32124	**0.00021**
X6	-0.25689	0.32014	-0.80243	0.42589
The pseudo-R square = 0.8712446				

***Source: Produced by the author, using The R Project for Statistical Computing**

Table (3) shows analysis quantile regression model at quantile proportion $P_3 = (0.43)$

Variables	Coefficients	Std. Error	t value	Pr(>|t|)
Intercept	-15564.16	51093.73	-0.30462	0.76185
X1	-0.01616	0.44075	-0.03667	0.97089
X2	0.03182	0.37666	0.08447	0.93300
X3	-0.39706	0.40875	-1.97139	0.33577
X4	0.31221	0.36315	0.85972	0.39382
X5	1.56503	0.30112	5.19738	**0.00000**
X6	-0.08868	0.36398	-0.24364	0.80845
The pseudo-R square = 0.3097503				

***Source: Produced by the author, using The R Project for Statistical Computing**

Table (4) shows analysis quantile regression model at quantile proportion $P_4 = (0.57)$

Variables	Coefficients	Std. Error	t value	Pr(>|t|)
Intercept	47283.60811	61288.29982	0.77149	0.44384
X1	0.19262	0.40515	0.47543	0.63644
X2	-0.05635	0.46485	-0.12121	0.90398
X3	-0.49763	0.33769	-1.47364	0.14649
X4	0.43931	0.40820	1.07621	0.28671
X5	1.58341	0.38470	4.11594	**0.00014**
X6	0.01584	0.44014	0.03598	0.97143
The pseudo-R square = 0.5480587				

***Source: Produced by the author, using The R Project for Statistical Computing**

Table (5) showsanalysis quantile regression model at quantile proportion $P_5 = (0.71)$

Variables	Coefficients	Std. Error	t value	Pr(>|t|)
Intercept	127298.59456	53404.21822	2.38368	0.02075
X1	0.13287	0.39653	0.33507	0.73889
X2	-0.46659	0.44564	-1.04702	0.29984
X3	-0.71367	0.43501	-1.64057	0.10681
X4	0.11271	0.40662	0.27718	0.78272
X5	1.59115	0.49817	3.19397	**0.00236**
X6	0.14370	0.45054	0.31894	0.75102
The pseudo-R square = 0.1946801				

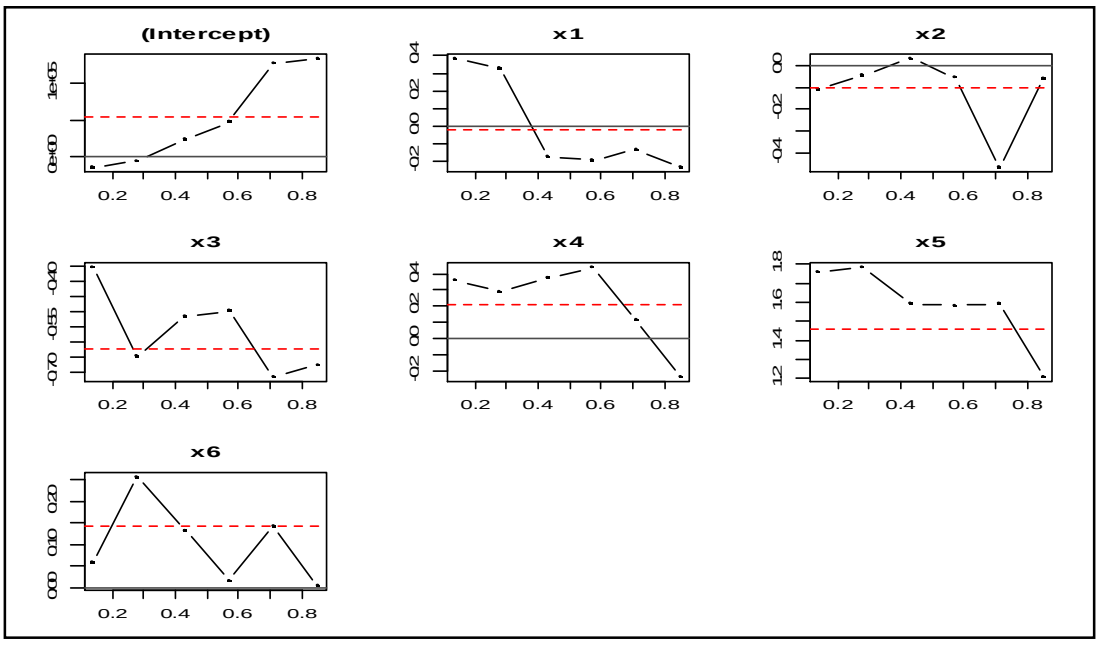
***Source: Produced by the author, using The R Project for Statistical Computing**

Table (6) showsanalysis quantile regression model at quantile proportion $P_6 = (0.85)$

Variables	Coefficients	Std. Error	t value	Pr(>|t|)
Intercept	50925.31957	60654.14952	0.83960	0.40490
X1	0.20351	0.43998	0.46254	0.64558
X2	0.08243	0.42568	0.19364	0.84720
X3	-0.49431	0.40646	-1.21615	0.22932
X4	-0.43487	0.44720	-0.97243	0.33525
X5	1.58799	0.42212	3.76193	**0.00042**
X6	-0.02202	0.45389	-0.04852	0.96148
The pseudo-R square = 0.2353987				

***Source: Produced by the author, using The R Project for Statistical Computing**

Figure(3) shows estimate of the variables coefficients



Conclusions

In this paper we studied the factors (average per capita income , Mining sector contributions in GDP ,Trade sector contributions in GDP,Government spending sector contributions in GDP, manufacturing sector contributions in GDP ,Monetization sector contributions in GDP) which affect the capacity taxes in Iraq by using quantile regression model. The results of the analytic quantile regression model have shown that the best model to represent the data from this studied phenomenon is the quantile regression model in the ratio (0.28) and this is according to the value R = 0.8712446, which shows the strength of this model in explaining the variation in measuring capacity tax through theindependent variable compared to quantile regression model in the ratio another quantile. We found that there is one variable of manufacturing X5, as an important aspect of statistics, as though the rest were of no importance.

From the results of the method, we find that the variable X5 manufacturing industry is the most important one in explaining this variation in capacity tax measurement in each ratio quantile used in this paper because of Iraq's dependence on oil export revenue source foundation to finance the development of sectors of Iraq's economy, as it depends on the prosperity of Iraq's energy sector and the oil sector represents more than 70% of GDP in Iraq. Based on the research and conclusions, we recommend using quantile regression according to its own characteristics, which is the quantile regression model representation where the full population providesthe complete picture for the observations spread through the study, to a number of quantile regression lines. We also recommend diversification in the field of employment in other areas such as agriculture or medicine.

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